

Clean Energy Employment Preliminary Report

PREPARED FOR THE CLEAN ENERGY TECHNOLOGY
WORKFORCE ADVISORY COMMITTEE
EMPLOYMENT SECURITY DEPARTMENT

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1. Introduction

This report presents a preliminary analysis of clean energy employment in Washington State. In accordance with House Bill 1176, the Employment Security Department (ESD) was tasked with providing labor market data and analysis to the Clean Energy Technology Workforce Advisory Committee (CETWAC).

As interest and investment in clean technology has grown in recent years, attention has turned to the characteristics and needs for the future clean technology workforce. There have been several previous reports on clean energy employment in Washington State. The U.S. Department of Energy's U.S. Energy Employment Report (USEER) uses a survey of employers to measure clean energy employment that may not be captured through traditional industry definitions. The Clean Energy Transition Institute's (CETI) Net-Zero Northwest (NZNW) project uses a modeling-based approach to project direct, indirect, and induced employment in clean energy industries over time, under several different scenarios. Both these approaches are valid and capture different aspects of clean energy employment.

This report builds upon existing studies. This report presents clean energy employment and wages through the use of traditional Labor Market Information (LMI) produced by the Bureau of Labor Statistics (BLS) and ESD. Both the USEER and NZNW reports use BLS data as a basis for their analyses, and this report follows the clean energy definitions used in those reports when possible. However, by presenting traditional LMI as-is, this report can serve as a transparent, replicable baseline from which to explore clean energy employment going forward.

The remainder of the report is organized as follows: [Chapter 2](#) reviews the data and methods used in this report. [Chapter 3](#) provides an overview of clean, traditional, and mixed energy industry employment and wages over the last ten years. [Chapter 4](#) provides an overview of current employment and wages in clean energy occupations. [Chapter 5](#) covers employment projections in clean energy industries and occupations over the next ten years. [Chapter 6](#) adds additional detail and context to clean energy industries and occupations from Washington's unemployment insurance wage records. [Chapter 7](#) concludes.

2. Data and Methods

This report uses data from the following sources:

Quarterly Census of Employment and Wages (QCEW)

Industry employment and wage data comes from the Quarterly Census of Employment and wages (QCEW). This federal/state cooperative program measures employment and wages in industries covered by unemployment insurance. Data is collected from employers as part of quarterly unemployment tax forms. This allows for detailed data on employment, establishments, and wages by industry. The data are available statewide and by county. Industries are defined using the North American Industrial Classification System (NAICS).

Occupational Employment and Wage Statistics (OEWS)

Occupational employment and wage data is available from the Occupational Employment and Wage Statistics (OEWS) survey. This federal-state cooperative program produces employment and wage estimates annually for about 867 occupations. For Washington State, data are available statewide, for metropolitan statistical areas (MSAs), and for nonmetropolitan areas (NMAs). Occupational definitions use the Standard Occupational Classification (SOC) system.

Employment Projections

Employment projections are developed annually by the Employment Security Department (ESD) to aid job seekers, policy makers, and training providers in decision making. The projections show current and future estimated employment by industry and occupation, as well as expected annual growth rates. Projections are available for short (2-year), medium (5-year) and long-term (10-year) timelines. This report shows the 10-year projections in energy related industries and occupations.

North American Industrial Classification System (NAICS)

The North American Industrial Classification System (NAICS) is used for industry definitions. This standard, consisting of 6-digit codes, is used to classify business establishments for the purpose of data collection and statistical analysis. These codes are periodically updated. The current version, used in this report, is NAICS 2022.

Standard Occupational Classification System (SOC)

The Standard Occupational Classification (SOC) system is a federal statistical standard used to classify workers for the purpose of data collection and statistical analysis. The SOC system consists of 6-digit codes which categorize workers into major, minor, and detailed occupations. These codes are periodically updated. The current version, used in this report, is SOC 2018.

Selection of Clean Energy NAICS and SOC Codes

Identifying clean energy industries and occupations is a complicated task, and there is no established consensus on which NAICS or SOC codes constitute clean energy. We used several sources as guidance in this task.

- Clean energy NAICS codes come primarily from a BW Research spreadsheet shared with ESD identifying 100% clean energy, 100% fossil fuel energy, and mixed NAICS codes. BW Research conducted the analysis for both the Net Zero Northwest (NZNW) and U.S. Energy and Employment Jobs Report (USEER). ESD supplemented this list with several codes, including construction industry codes and several additional codes such as NAICS 424710 (petroleum bulk stations and terminals). These industries were categorized by ESD to align with the four main sectors in NZNW's report (electricity, buildings, transportation and fuels).
- Clean energy SOC codes were generated by ESD's research team, as previous reports from NZNW and USEER have not explored clean energy occupations. Our baseline analysis is drawn from a review of the SOC 2018 manual. The general principles of SOC 2018 occupation inclusion are: 1) top occupations in obvious (clean) energy industries, 2) specialty employment related to clean energy activities like energy efficiency, and 3) maintenance and repair occupations associated with various engines as proxies for energy-intensive transportation applications while avoiding broader service occupations.

Neither industry nor occupational analysis is meant to be an exhaustive list of clean energy jobs, and not all jobs within the identified NAICS and SOC codes are clean energy related. For instance, NAICS 541110, Offices of Lawyers, is not included in our industry analysis despite the existence of lawyers specializing in clean energy. Similarly, residential construction is included in our analysis but contains many jobs which are not energy related.

Unemployment Insurance Wage Records

A supplementary data source for this report is Washington's administrative wage records. Quarterly unemployment insurance (UI) wage records submitted by employers provide Standard Occupational Classification (SOC) codes, wages, and hours. Administrative wage records are also assigned industry codes using the North American Industry Classification System (NAICS). These administrative data are combined and aggregated across energy categories, industries, occupations, and wage statistics as quarterly snapshots. For the purposes of the clean energy technology baseline, we aggregate by industry or occupation to count individual wage records, but we avoid counting employers. This is a simplification to avoid the many disparities across employer sizes and industry staffing patterns, which

would require more detailed cross-tabulations and industry-specific considerations to adequately capture employer differences.

Administrative wage records provide data-based insights into employment and wages from exact numbers that cannot be matched by existing approaches. Survey-based sources like USEER capture a great deal of information about very hard-to-define clean energy business activities but cannot achieve detailed resolution on occupational employment and wages. Projection-based sources like OEWS and NZNW provide guidance into likely trends but lack the precision of exact numbers. So, wage records provide detailed insight and exactly computed employment and wage baselines to capture the pulse of clean energy employment.

Additionally, grouping wage record data on the basis of SOC or NAICS codes allows for easy replication in subsequent years. While these classification systems are imperfect, they are standardized and changes are well documented.

3. Industry Employment and Wage Trends

Industry employment and wage data comes from the Quarterly Census of Employment and wages (QCEW). This federal/state cooperative program measures employment and wages in industries covered by unemployment insurance. Data is collected from employers as part of quarterly unemployment tax forms. This allows for detailed data on employment, establishments, and wages by industry. The data are available statewide and by county.

Industries in QCEW use the North American Industry Classification System (NAICS). These 6-digit codes categorize businesses from major (2-digit) industry all the way down to detailed (6-digit) industry.

Clean energy industries are not well defined by the North American Industry Classification System (NAICS) This is largely because clean energy represents a shift in priorities, and technologies within existing industries. Currently, clean energy shifts are evident in a number of industries. This report defines clean energy industries within four categories following the U.S Department of Energy's United States Energy Employment Report (USEER) and Clean Energy Transition Institute's Net Zero Northwest (NZNW). For this report, we adopt the four major sectors used in the NZNW report.

- 1) **Electricity** industries are related to electric power generation, distribution, transmission and control. Also included are power and communication line and related structures construction.

- 2) **Buildings** industries include residential and nonresidential construction, specialty residential and nonresidential construction, heavy and civil engineering construction, and steam and air-conditioning supply.
- 3) **Fuels** industries include natural gas extraction, distribution, and transportation, coal mining, petroleum and petroleum product transportation, drilling oil and gas, support activities for oil and gas, and oil and gas related construction and manufacturing.
- 4) **Transportation** industries include the manufacturing of motor vehicles, motor vehicle parts, or motor vehicle body and trailers, and motor vehicle wholesalers. Also included are automotive repair and maintenance and support activities for air transportation.

Additional support in choosing NAICS codes came from BW Research Partnership, who served as the data consultants on both the USEER and NZNW reports.

This is not meant to be an exhaustive list of clean energy industries, and some industries included in this analysis contain non-clean-energy business activities. It is expected that future reports may adjust which industries are considered clean energy to meet the needs of the Clean Energy Technology Advisory Committee (CETWAC).

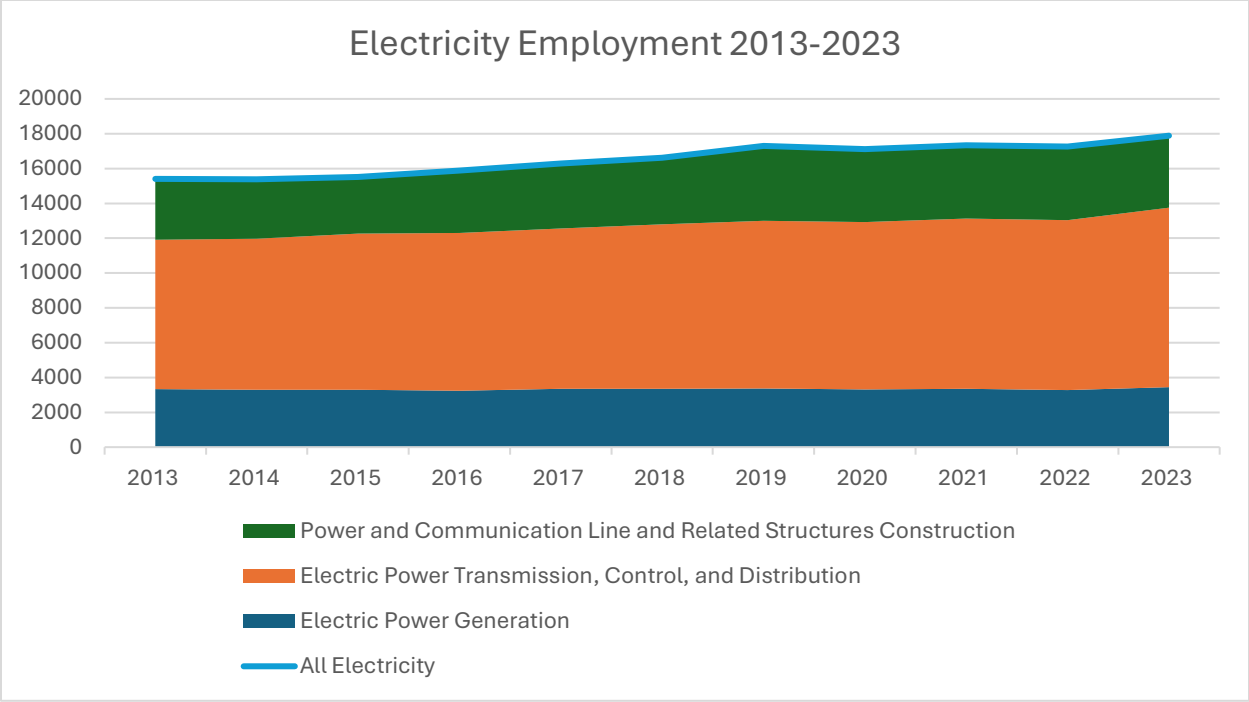
A list of all NAICS codes used in this section is at the [end of the chapter](#).

To maintain employer confidentiality, the Bureau of Labor Statistics (BLS) suppresses some data. In the tables below this is noted as not disclosed (ND). Industry totals that include missing values due to suppression are marked with an asterisk (*). For this reason, industry aggregations labeled in this section as total employment should be interpreted as total available or publishable employment, as the totals are not inclusive of non-disclosable employment.

Wage estimates are shown not adjusted for inflation.

Electricity

Electricity sector employment was 17,887 in 2023. This was up 3.6% from 17,117 in 2022 and up 16% from 15,409 in 2013. Within electricity, the largest subsector was electric power transmission, control, and distribution (10,308 in 2023), followed by power and communication line and related structures construction (4,132) and electric power generation (3,447).



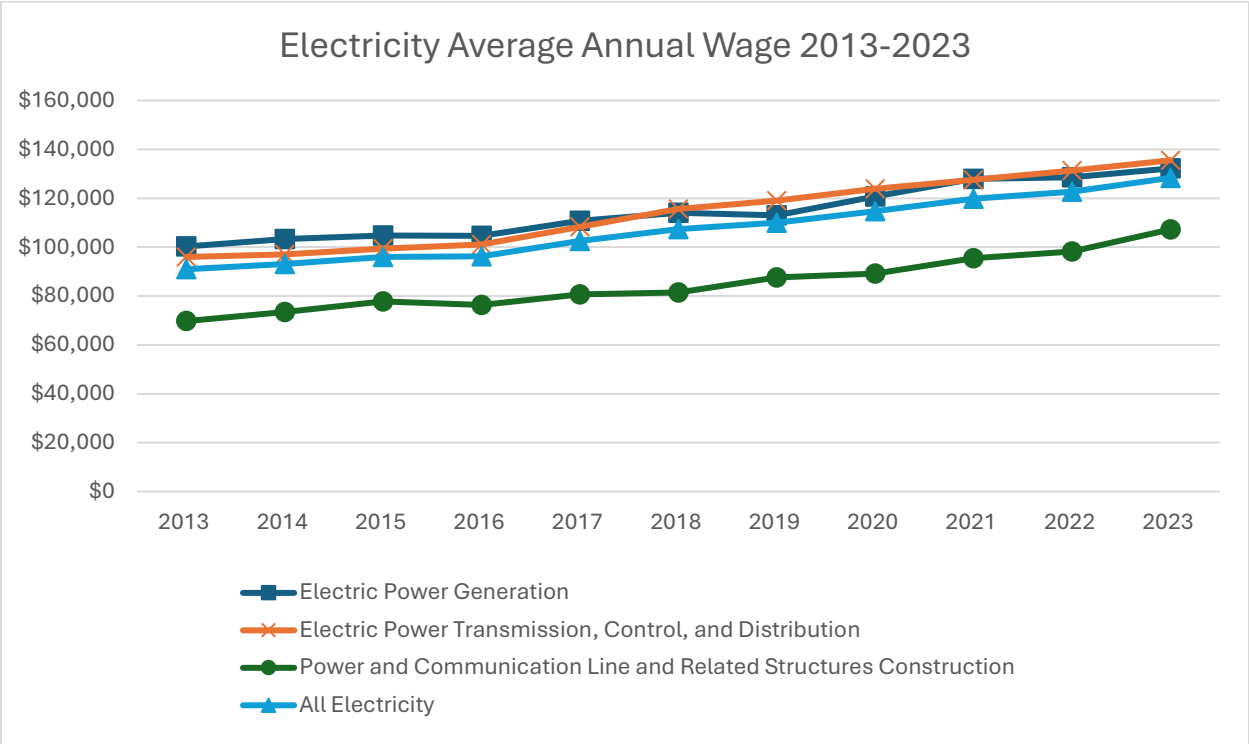
Electricity Employment, 2023 Annual Average				
	Electric Power Generation*	Electric Power Transmission, Control, and Distribution*	Power and Communication Line and Related Structures Construction	All Electricity*
2013	3,326	8,586	3,497	15,409
2014	3,300	8,671	3,412	15,383
2015	3,296	8,960	3,255	15,511
2016	3,238	9,070	3,571	15,879
2017	3,347	9,219	3,721	16,287
2018	3,350	9,451	3,826	16,627
2019	3,377	9,624	4,292	17,293
2020	3,310	9,614	4,193	17,117
2021	3,353	9,767	4,218	17,338
2022	3,277	9,759	4,223	17,259
2023	3,447	10,308	4,132	17,887

There were 436 establishments in the electricity sector in 2023. This was little changed from the previous year.

Electricity Establishments, 2023 Annual Average				
	Electric Power Generation*	Electric Power Transmission,	Power and Communication Line and Related	Total Electricity*

		Control, and Distribution*	Structures Construction	
2013	33	151	183	367
2014	35	152	206	393
2015	33	159	216	408
2016	33	162	214	409
2017	35	162	201	398
2018	38	163	192	393
2019	44	167	198	409
2020	44	167	202	413
2021	44	166	206	416
2022	39	182	216	437
2023	43	193	200	436

Average annual wages in the electricity sector were \$128,344 in 2023. This was up by 4.6% from the previous year. The highest paying subsector was electric power transmission, control and distribution (\$135,515 per year), followed by electric power generation (\$132,201) and power and communication line related structures construction (\$107,236).



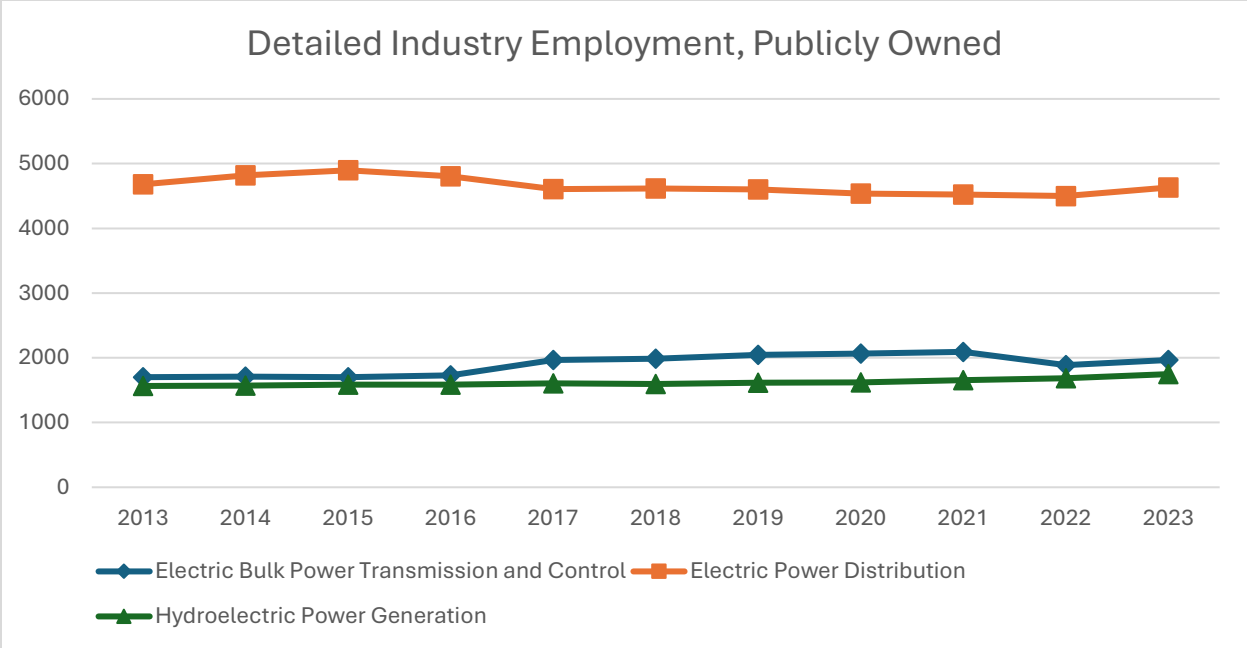
Electricity, 2023 Average Annual Wage				
	Electric Power Generation*	Electric Power Transmission,	Power and Communication Line and	All Electricity*

		Control, and Distribution*	Related Structures Construction	
2013	\$100,262	\$95,980	\$69,742	\$90,950
2014	\$103,255	\$96,969	\$73,399	\$93,090
2015	\$104,753	\$99,441	\$77,767	\$96,022
2016	\$104,633	\$101,132	\$76,318	\$96,266
2017	\$110,797	\$108,226	\$80,707	\$102,467
2018	\$113,996	\$115,553	\$81,458	\$107,394
2019	\$112,980	\$118,982	\$87,661	\$110,036
2020	\$120,665	\$123,894	\$89,145	\$114,757
2021	\$127,870	\$127,477	\$95,480	\$119,769
2022	\$128,590	\$131,280	\$98,205	\$122,676
2023	\$132,201	\$135,515	\$107,236	\$128,344

Employment and wage detail is available at the 6-digit NAICS level for some, but not all clean energy industries. Due to BLS confidentiality standards, some industries and years are excluded from QCEW data.

For publicly owned establishments, including federal and local government, detailed industry trends are available for NAICS 221111 (hydroelectric power generation), NAICS 221122 (electric power distribution), and NAICS 221121 (electric bulk power transmission and control).

Hydroelectric power is the only public sector electricity generation industry with employment available and publicly disclosed. Employment rose from 1565 jobs in 2013 to 1748 in 2023. Similar modest increases were seen in electric bulk power transmission and control and electric power distribution.

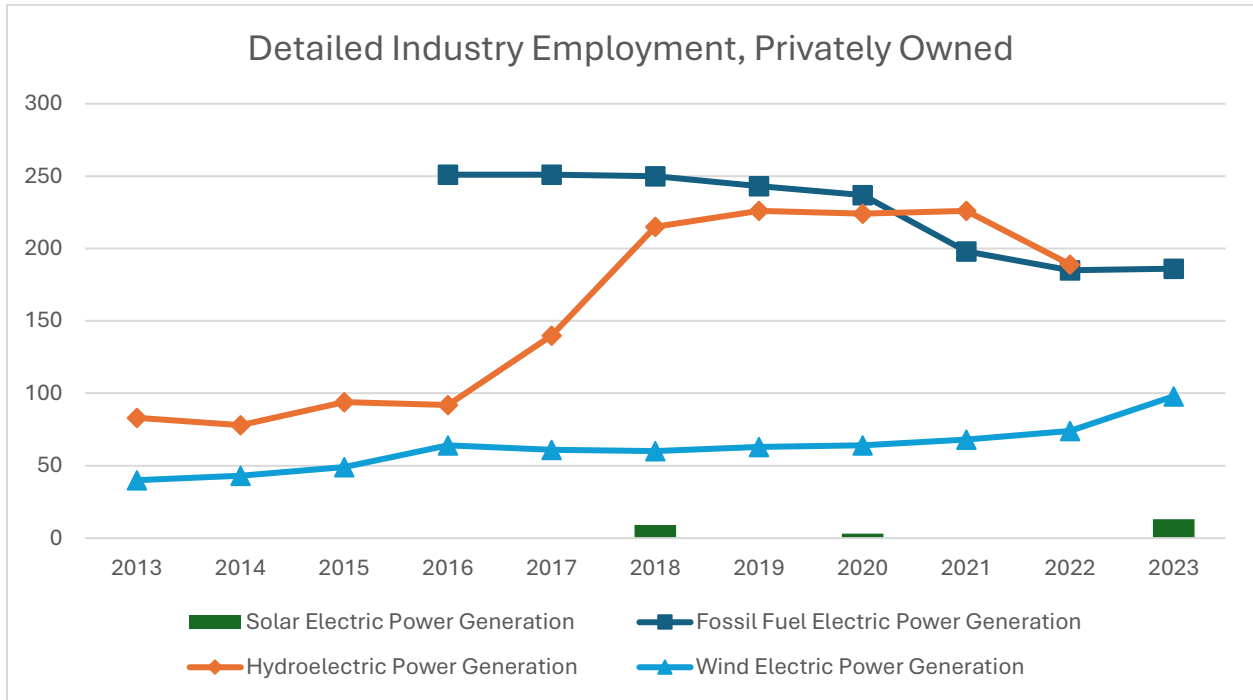


Industry Employment, Public			
	Electric Bulk Power Transmission and Control	Electric Power Distribution	Hydroelectric Power Generation
2013	1701	4682	1565
2014	1707	4818	1569
2015	1701	4897	1586
2016	1727	4802	1584
2017	1965	4607	1607
2018	1986	4615	1597
2019	2044	4602	1617
2020	2063	4539	1622
2021	2092	4521	1657
2022	1888	4500	1685
2023	1966	4630	1748

For privately owned establishments, employment trends are available for NAICS 221111 (hydroelectric power generation), NAICS 221112 (fossil fuel power generation), NAICS 221115 (wind electric power generation) and select years of NAICS 221114 (solar electric power generation).

Employment in wind electric power generation has increased in recent years, though the total employment is still small. Similarly, fossil fuel electric power employment has fallen since 2020. Privately owned hydroelectric power employment increased from 2016 to 2018

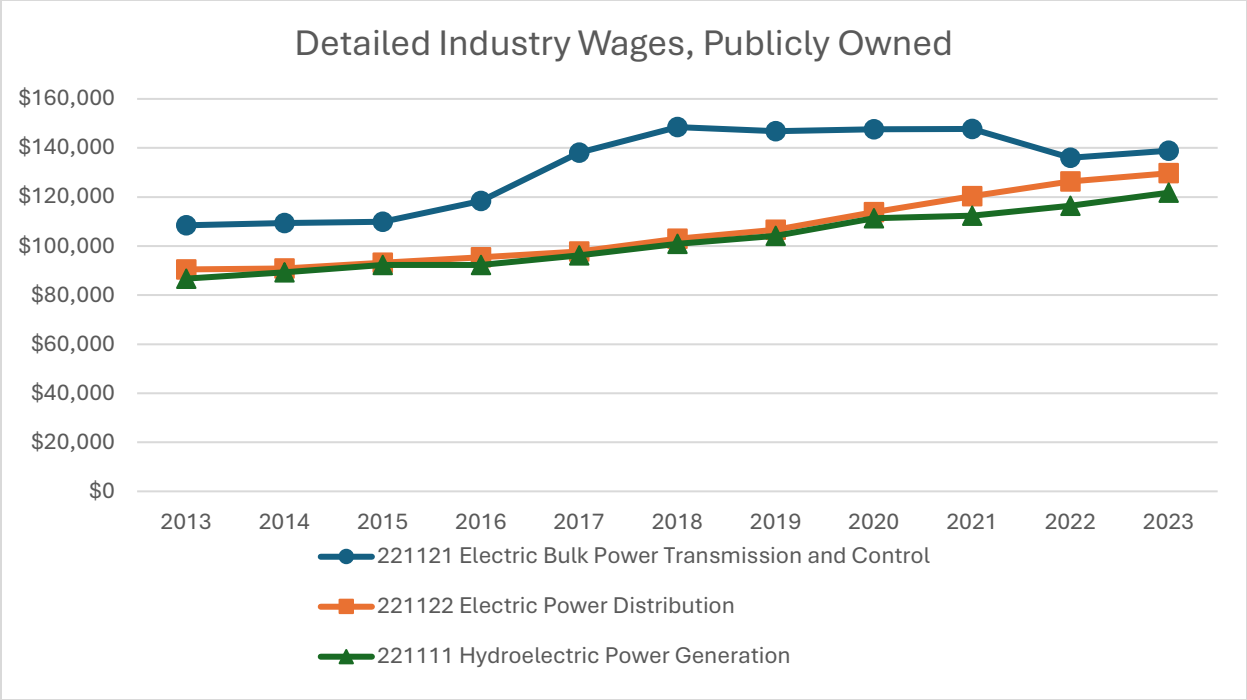
by about 100 jobs, though this number is small compared to publicly owned hydroelectric power.



Industry Employment, Private				
	Fossil Fuel Electric Power Generation	Hydroelectric Power Generation	Solar Electric Power Generation	Wind Electric Power Generation
2013	ND	83	ND	40
2014	ND	78	ND	43
2015	ND	94	ND	49
2016	251	92	ND	64
2017	251	140	ND	61
2018	250	215	9	60
2019	243	226	ND	63
2020	237	224	3	64
2021	198	226	ND	68
2022	185	189	ND	74
2023	186	ND	13	98

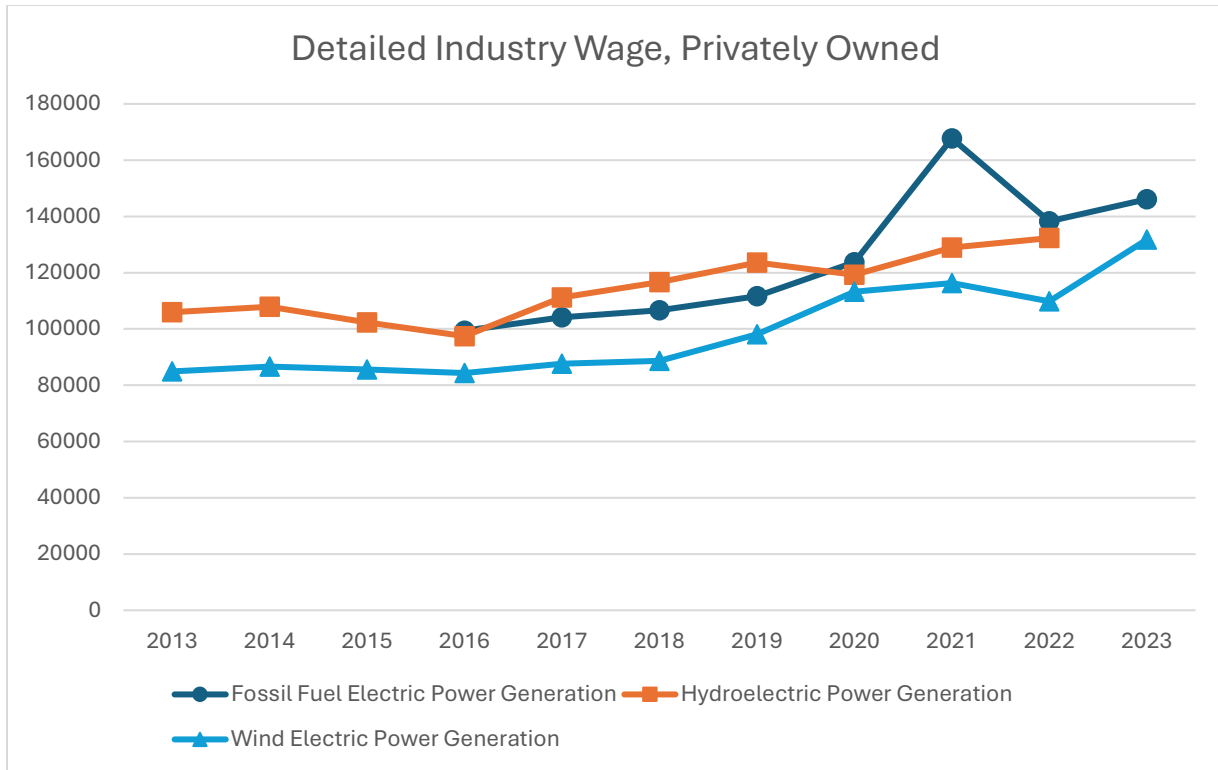
*ND = not disclosed

Wages in detailed electricity industries tend to be high. Electric power distribution and hydroelectric power generation wages have risen steadily over the past decade. Wages in electric bulk power transmission and control increased quickly from 2015 to 2018, but have changed little in recent years.



Detailed Industry Wage, Public			
	Electric Bulk Power Transmission and Control	Electric Power Distribution	Hydroelectric Power Generation
2013	\$108,470	\$90,482	\$86,728
2014	\$109,365	\$90,877	\$89,259
2015	\$109,966	\$93,210	\$92,236
2016	\$118,452	\$95,454	\$92,292
2017	\$138,069	\$97,731	\$96,169
2018	\$148,501	\$103,026	\$100,957
2019	\$146,874	\$106,674	\$104,172
2020	\$147,624	\$113,859	\$111,344
2021	\$147,802	\$120,303	\$112,442
2022	\$136,010	\$126,321	\$116,383
2023	\$138,829	\$129,684	\$121,754

Privately owned electricity industries have also seen wage growth, though the small size of these industries mean that average wages tend to have more variability.



*Not shown: solar electric power generation

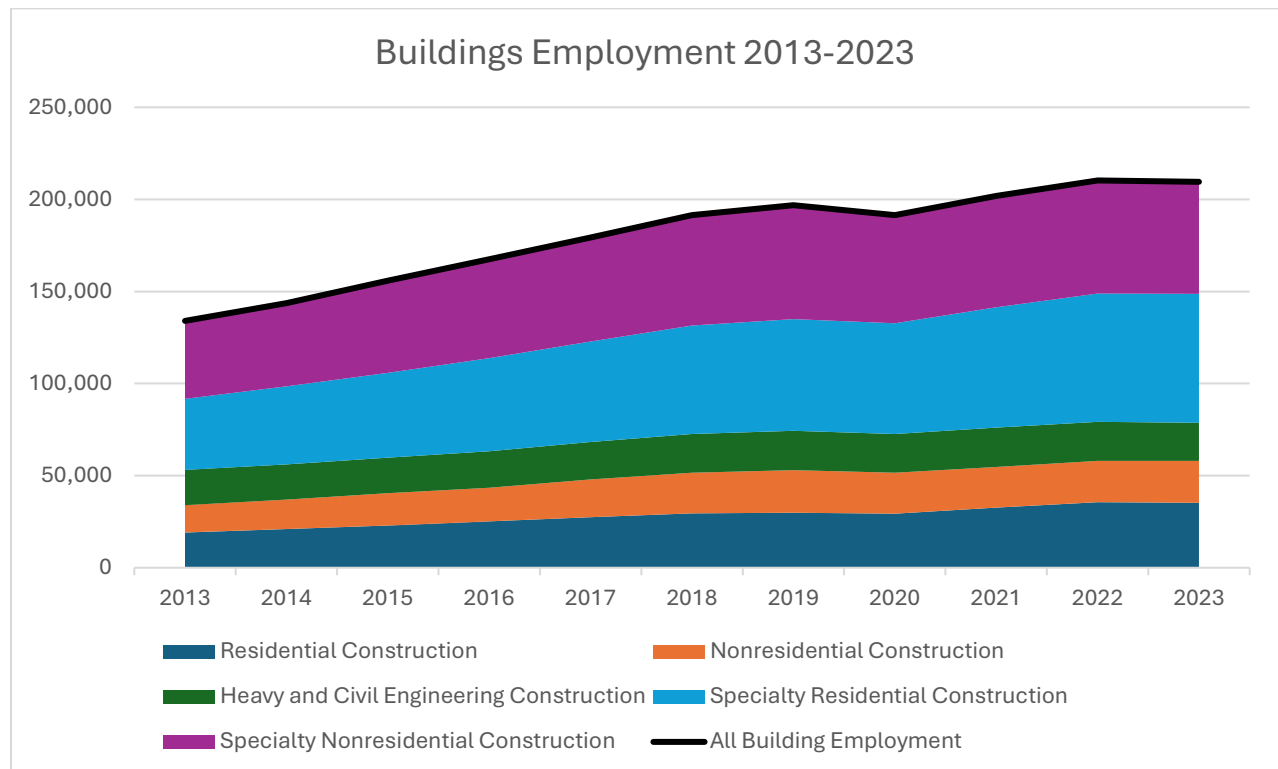
Detailed Industry Wage, Privately Owned				
	Fossil Fuel Electric Power Generation	Hydroelectric Power Generation	Solar Electric Power Generation	Wind Electric Power Generation
2013	ND	\$105,976	ND	\$84,950
2014	ND	\$107,949	ND	\$86,581
2015	ND	\$102,340	ND	\$85,633
2016	\$99,406	\$97,446	ND	\$84,328
2017	\$104,151	\$111,171	ND	\$87,639
2018	\$106,628	\$116,674	\$65,000	\$88,717
2019	\$111,617	\$123,540	ND	\$98,063
2020	\$123,650	\$119,228	\$198,333	\$113,266
2021	\$167,742	\$128,978	ND	\$116,279
2022	\$138,292	\$132,302	ND	\$109,797
2023	\$146,065	ND	\$517,077	\$131,745

*ND = not disclosed

Buildings

Employment in the buildings sector was 209,553 in 2023. This was down by 0.35% from the 2022 annual average. However, over the last ten years overall growth has been positive. Buildings employment was 56% higher in 2023 than it was in 2013.

The largest industry within the buildings sector was specialty residential construction at 70,052 jobs. This was followed by specialty nonresidential construction (60,754), residential construction (35,336), nonresidential construction (22,744) and heavy and civil engineering construction (20,667).



Buildings Employment, 2023 Annual Average							
	Steam and Air-Conditioning Supply	Residential Construction	Nonresidential Construction	Heavy and Civil Engineering Construction	Specialty Residential Construction	Specialty Nonresidential Construction	Total
2013	ND	19,162	14,802	19,125	38,619	42,320	134,028
2014	ND	20,952	16,000	19,226	42,303	45,283	143,764
2015	ND	22,959	17,477	19,331	46,092	49,947	155,806
2016	ND	25,144	18,341	19,771	50,473	53,684	167,413

2017	ND	27,487	20,417	20,380	54,504	56,572	179,360
2018	ND	29,557	22,023	21,011	58,996	59,903	191,490
2019	ND	29,928	23,046	21,359	60,583	61,963	196,879
2020	ND	29,303	22,347	20,975	60,146	58,729	191,500
2021	ND	32,661	22,050	21,302	65,343	60,567	201,923
2022	ND	35,583	22,414	21,226	69,683	61,380	210,286
2023	ND	35,336	22,744	20,667	70,052	60,754	209,553

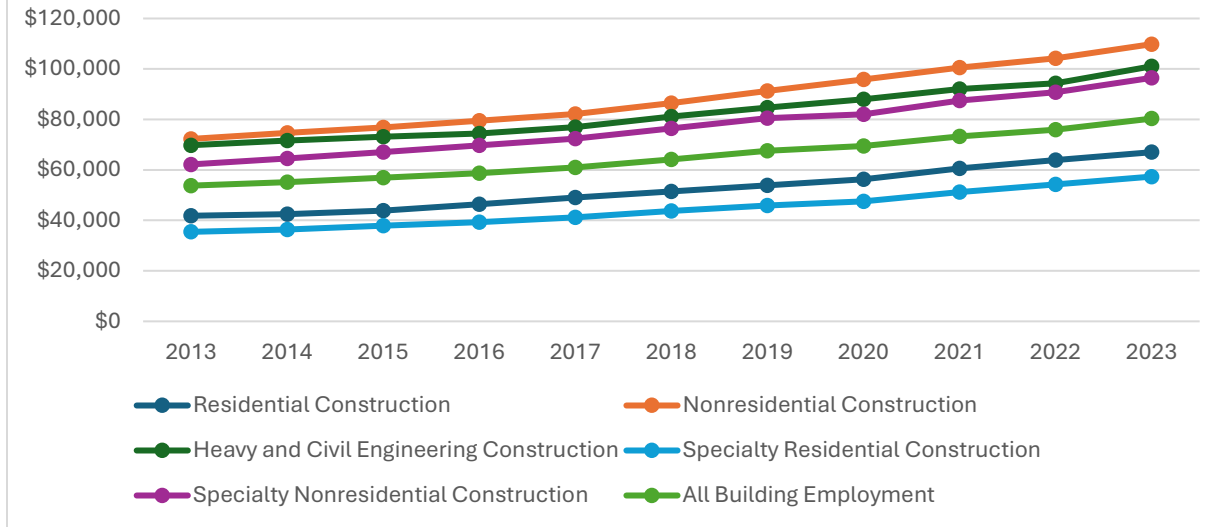
*ND = not disclosed

There were 24,649 total establishments within the buildings sector in 2023. This was down slightly from 2022, but establishment growth has been positive over the decade.

Buildings Establishments, 2023 Annual Average							
	Steam and Air-Conditioning Supply	Residential Construction	Nonresidential Construction	Heavy and Civil Engineering Construction	Specialty Residential Construction	Specialty Nonresidential Construction	Total
2013	2	5434	1115	1285	8448	2720	19002
2014	2	6212	1135	1268	9321	2859	20795
2015	3	6697	1135	1254	9733	2851	21670
2016	2	7176	1152	1229	10188	2880	22625
2017	2	7543	1171	1209	10571	2936	23430
2018	2	7862	1154	1182	10925	2967	24090
2019	2	8111	1117	1190	11132	2970	24520
2020	2	8398	1088	1172	11470	2944	25072
2021	2	9026	1082	1159	12165	2960	26392
2022	3	9177	1033	1172	12385	2924	26691
2023	2	8297	941	1105	11581	2725	24649

The average annual wage in the buildings sector was \$80,327 in 2023. This was up 5.8% from 2022, and up 49% from 2013. The highest paying industry was for nonresidential construction, at \$109,820 annually. This was followed by heavy and civil engineering construction (\$101,045), specialty nonresidential construction (\$96,475), residential construction (\$67,012) and specialty residential construction (\$57,349).

Average Annual Wage, Building Employment 2013-2023



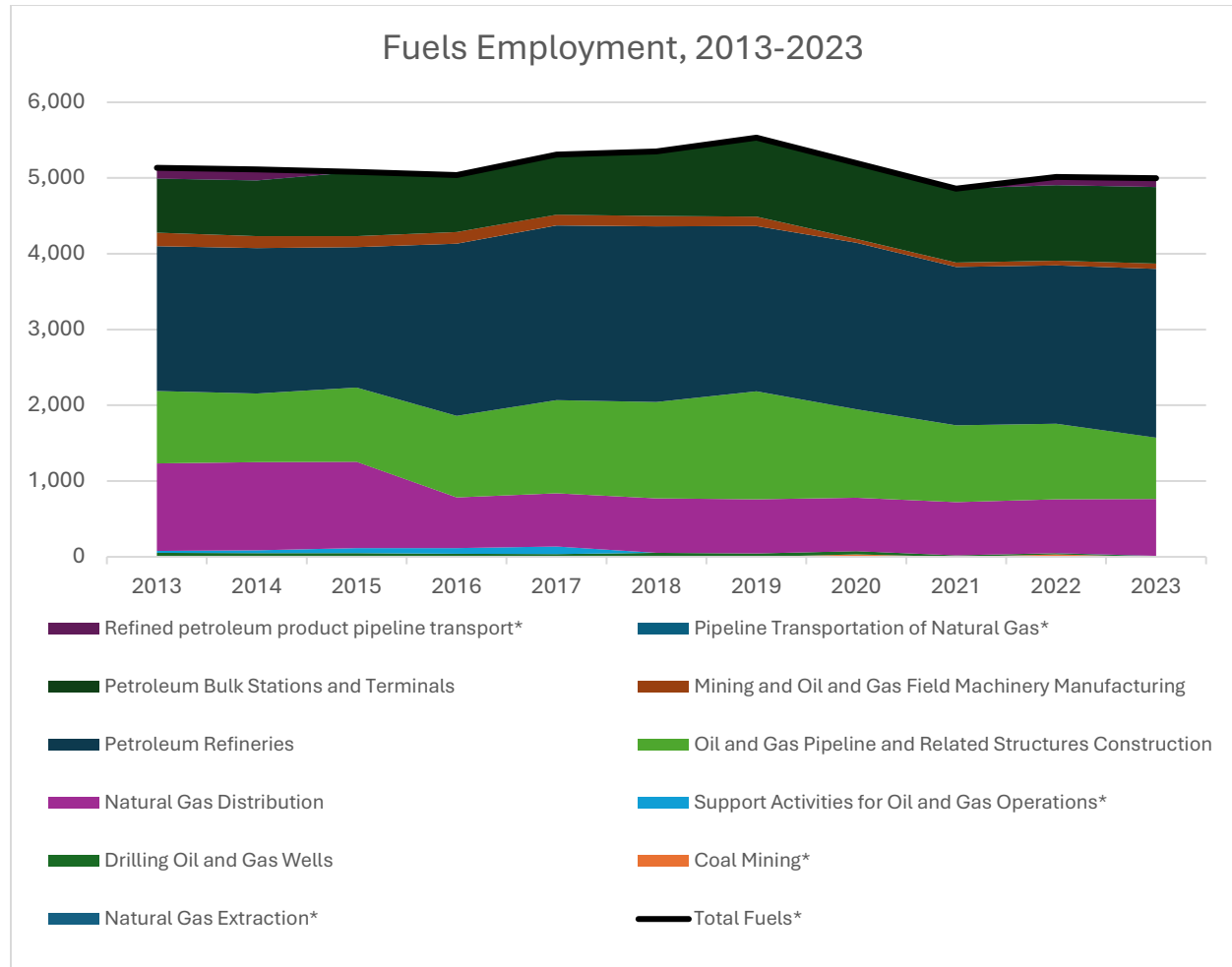
Buildings Average Annual Wage 2023

	Steam and Air-Conditioning Supply	Residential Construction	Nonresidential Construction	Heavy and Civil Engineering Construction	Specialty Residential Construction	Specialty Nonresidential Construction	All Building Employment
2013	ND	\$41,841	\$72,280	\$69,792	\$35,465	\$62,179	\$53,776
2014	ND	\$42,429	\$74,658	\$71,681	\$36,340	\$64,539	\$55,100
2015	ND	\$43,865	\$76,863	\$73,093	\$37,867	\$67,083	\$56,861
2016	ND	\$46,368	\$79,520	\$74,421	\$39,253	\$69,757	\$58,668
2017	ND	\$49,099	\$82,210	\$77,005	\$41,258	\$72,389	\$61,002
2018	ND	\$51,497	\$86,517	\$81,127	\$43,752	\$76,476	\$64,204
2019	ND	\$53,939	\$91,239	\$84,750	\$45,881	\$80,558	\$67,546
2020	ND	\$56,259	\$95,797	\$87,969	\$47,481	\$82,082	\$69,508
2021	ND	\$60,575	\$100,499	\$92,027	\$51,275	\$87,422	\$73,296
2022	ND	\$63,902	\$104,275	\$94,326	\$54,254	\$90,754	\$75,917
2023	ND	\$67,012	\$109,820	\$101,045	\$57,349	\$96,475	\$80,327

*ND = not disclosed

Fuels

Employment in fuels was 4,997 in 2023. This was down by 0.36% from 2022 and little changed from 2013. The largest industry was petroleum refineries, with 2,228 jobs, followed by petroleum bulk stations and terminals at 1,012 jobs.



Fuels Employment, 2023 Annual Average						
	Natural Gas Extraction*	Coal Mining*	Drilling Oil and Gas Wells	Support Activities for Oil and Gas Operations*	Natural Gas Distribution	Oil and Gas Pipeline and Related Structures Construction
2013	ND	ND	54	26	1155	956
2014	ND	ND	48	39	1164	905
2015	ND	ND	51	63	1142	979
2016	ND	ND	42	72	670	1077
2017	ND	ND	35	102	700	1233

2018	ND	ND	54	ND	719	1269
2019	ND	ND	43	ND	715	1425
2020	ND	33	43	ND	704	1170
2021	ND	ND	20	ND	702	1016
2022	ND	32	17	ND	710	999
2023	ND	ND	13	ND	749	811

Fuels Employment, 2023 Annual Average (Continued)						
	Petroleum Refineries	Mining and Oil and Gas Field Machinery Manufacturing	Petroleum Bulk Stations and Terminals	Pipeline Transportation of Natural Gas*	Refined petroleum product pipeline transport*	Total Fuels*
2013	1911	177	716	ND	138	5133
2014	1918	158	738	ND	146	5116
2015	1851	149	848	ND	ND	5083
2016	2274	151	755	ND	ND	5041
2017	2304	143	791	ND	ND	5308
2018	2319	140	850	ND	ND	5351
2019	2183	124	1043	ND	ND	5533
2020	2198	49	999	ND	ND	5196
2021	2089	58	975	ND	ND	4860
2022	2088	64	998	ND	107	5015
2023	2228	70	1012	ND	114	4997

*ND = not disclosed

There were 150 total establishments in the fuels sector in 2023. This was down slightly from 2022. The total number of fuels establishments has been slowly declining since 2018.

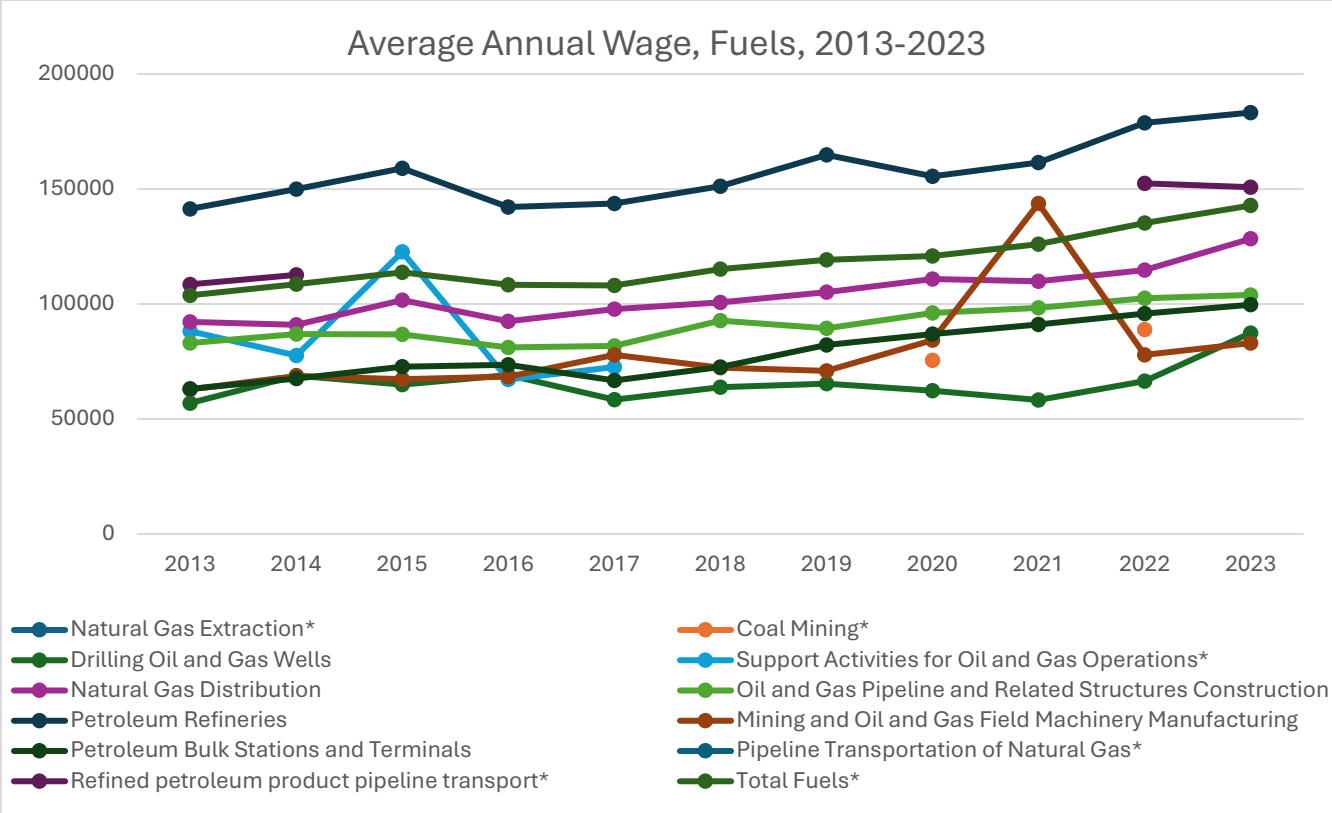
Fuels Establishments, 2023 Annual Average						
	Natural Gas Extraction*	Coal Mining*	Drilling Oil and Gas Wells	Support Activities for Oil and Gas Operations*	Natural Gas Distribution	Oil and Gas Pipeline and Related Structures Construction
2013	ND	2	13	5	25	43
2014	ND	2	14	6	24	45
2015	ND	2	13	9	24	46
2016	ND	2	15	14	23	49
2017	1	2	14	12	24	48
2018	2	2	12	11	25	47
2019	2	2	8	7	26	48
2020	2	3	9	9	27	42

2021	1	3	8	9	26	37
2022	2	5	8	10	25	36
2023	1	2	7	8	25	31

Fuels Establishments, 2023 Annual Average (Continued)						
Title	Petroleum Refineries	Mining and Oil and Gas Field Machinery Manufacturing	Petroleum Bulk Stations and Terminals	Pipeline Transportation of Natural Gas*	Refined petroleum product pipeline transport*	Total Fuels*
2013	16	6	38	2	7	157
2014	13	5	34	2	7	152
2015	12	6	39	2	2	155
2016	17	8	34	3	6	171
2017	11	9	40	3	6	170
2018	12	8	43	3	6	171
2019	12	8	46	3	6	168
2020	12	6	46	3	6	165
2021	12	7	43	2	6	154
2022	12	8	48	2	6	162
2023	12	7	46	5	6	150

*ND = not disclosed

The average annual wage in the fuels sector was \$142,831 in 2023. This was up 5.6% from 2022. The highest wages were in petroleum refineries at \$183,239 per year. The lowest wage was in drilling oil and gas wells at \$87,385.



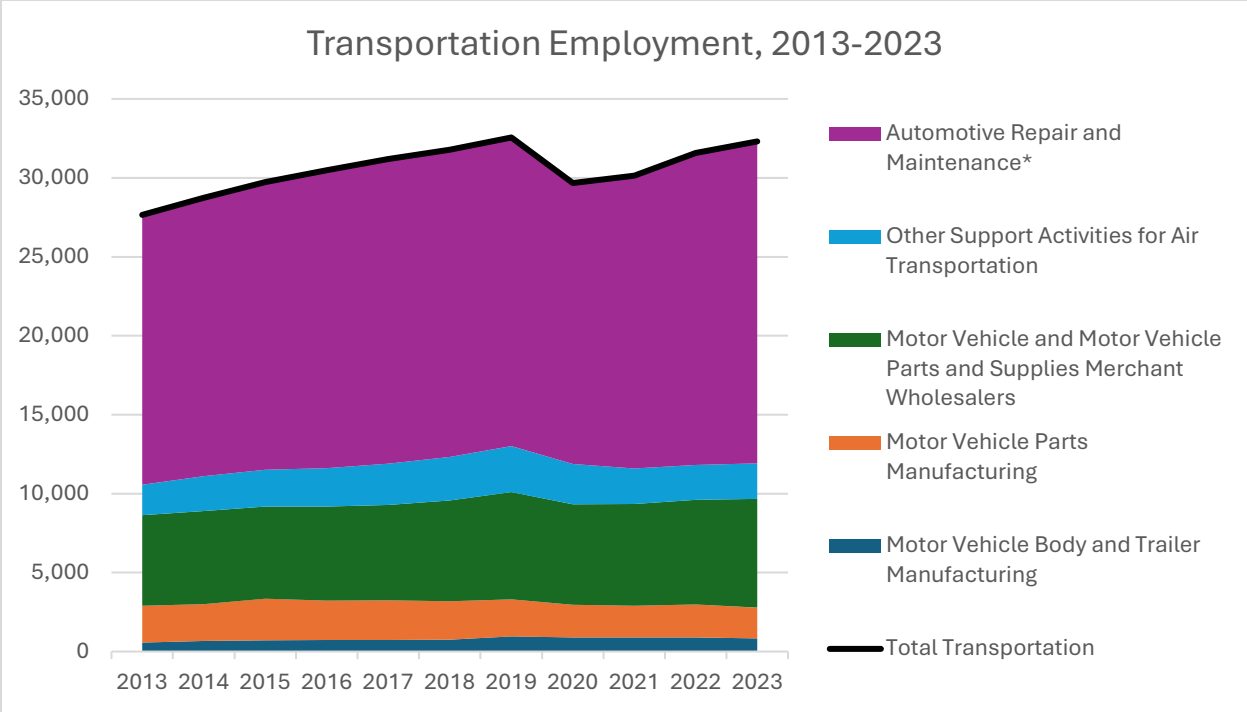
2023 Average Annual Wage, Fuels						
	Natural Gas Extraction*	Coal Mining*	Drilling Oil and Gas Wells	Support Activities for Oil and Gas Operations*	Natural Gas Distribution	Oil and Gas Pipeline and Related Structures Construction
2013	ND	ND	\$56,944	\$88,115	\$92,252	\$83,002
2014	ND	ND	\$68,875	\$77,590	\$90,956	\$86,983
2015	ND	ND	\$65,000	\$122,619	\$101,653	\$86,772
2016	ND	ND	\$69,095	\$67,181	\$92,467	\$81,133
2017	ND	ND	\$58,343	\$72,569	\$97,791	\$81,754
2018	ND	ND	\$63,796	ND	\$100,683	\$92,730
2019	ND	ND	\$65,302	ND	\$105,085	\$89,410
2020	ND	\$75,515	\$62,279	ND	\$110,824	\$96,079
2021	ND	ND	\$58,250	ND	\$109,833	\$98,360
2022	ND	\$88,813	\$66,412	ND	\$114,746	\$102,572
2023	ND		\$87,385	ND	\$128,359	\$103,945

2023 Average Annual Wage, Fuels (Continued)						
	Petroleum Refineries	Mining and Oil and Gas Field Machinery Manufacturing	Petroleum Bulk Stations and Terminals	Pipeline Transportation of Natural Gas*	Refined petroleum product pipeline transport*	Total Fuels*
2013	\$141,344	\$62,910	\$63,085	ND	\$108,543	\$103,771
2014	\$149,889	\$68,741	\$67,630	ND	\$112,644	\$108,607
2015	\$158,933	\$67,262	\$72,801	ND	ND	\$113,716
2016	\$142,171	\$68,450	\$73,636	ND	ND	\$108,371
2017	\$143,650	\$77,930	\$66,707	ND	ND	\$108,060
2018	\$151,195	\$72,329	\$72,579	ND	ND	\$115,109
2019	\$164,852	\$70,879	\$82,146	ND	ND	\$119,229
2020	\$155,492	\$84,224	\$86,916	ND	ND	\$120,926
2021	\$161,441	\$143,690	\$91,133	ND	ND	\$126,058
2022	\$178,757	\$77,859	\$95,884	ND	\$152,439	\$135,223
2023	\$183,239	\$83,086	\$99,689	ND	\$150,816	\$142,831

*ND = not disclosed

Transportation

Total employment in the transportation sector was 32,299 in 2023. This was up 2.3% from 2022, and 16.8% from 2013. The largest industry in transportation was automotive repair and maintenance at 20,380. This was followed by motor vehicle and motor vehicle parts and supplies merchant wholesalers (6,878), other support activities for air transportation (2,256) motor vehicle parts manufacturing (1,951), and motor vehicle body and trailer manufacturing (834).



Transportation Employment, 2023 Annual Averages							
	Motor Vehicle Manuf.	Motor Vehicle Body and Trailer Manuf.	Motor Vehicle Parts Manuf.	Motor Vehicle and MV Parts and Supplies Merchant Wholesalers	Other Support Activities for Air Transport	Automotive Repair and Maintenance*	Total Transport
2013	ND	567	2,335	5,735	1,927	17,091	27,655
2014	ND	670	2,340	5,885	2,209	17,636	28,740
2015	ND	720	2,632	5,826	2,341	18,219	29,738
2016	ND	725	2,508	5,959	2,417	18,874	30,483
2017	ND	737	2,509	6,046	2,614	19,280	31,186
2018	ND	747	2,446	6,367	2,769	19,443	31,772
2019	ND	962	2,343	6,797	2,908	19,547	32,557
2020	ND	895	2,059	6,375	2,543	17,799	29,671
2021	ND	895	2,010	6,431	2,253	18,553	30,142
2022	ND	900	2,075	6,624	2,223	19,747	31,569
2023	ND	834	1,951	6,878	2,256	20,380	32,299

*ND = not disclosed

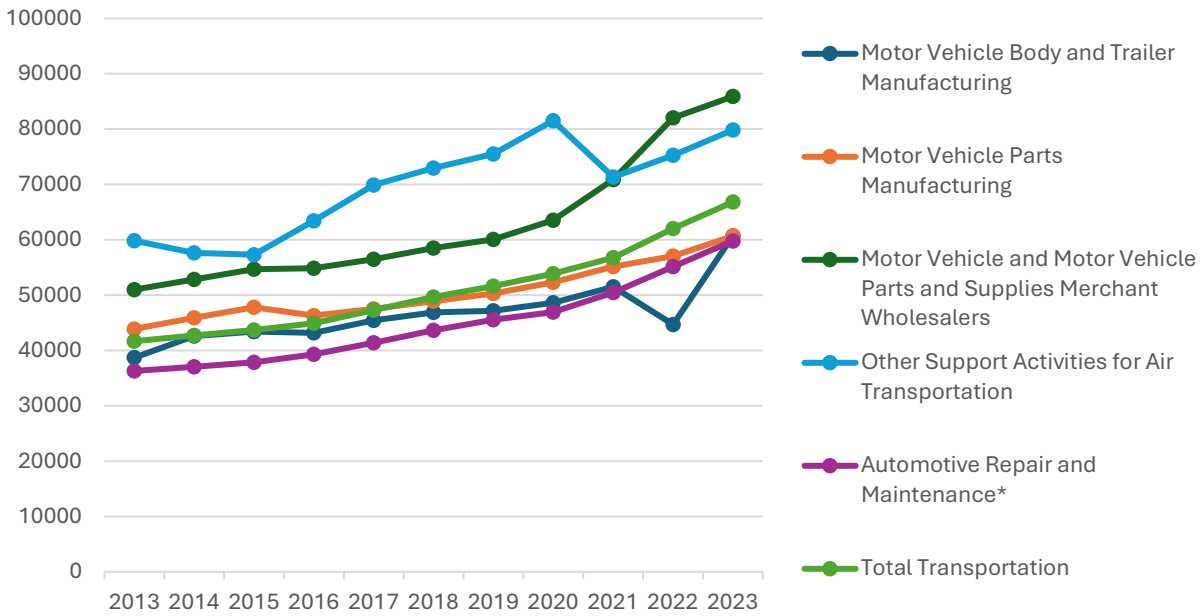
The total number of establishments in the transportation sector was 4,081. This was down slightly from 2022.

Transportation Establishments, 2023 Annual Averages							
	Motor Vehicle Manuf.	Motor Vehicle Body and Trailer Manuf.	Motor Vehicle Parts Manuf.	Motor Vehicle and MV Parts and Supplies Merchant Wholesalers	Other Support Activities for Air Transport	Automotive Repair and Maintenance*	Total Transport
2013	ND	29	84	380	129	3209	3831
2014	ND	32	83	394	141	3331	3981
2015	ND	37	81	422	142	3366	4048
2016	ND	37	76	435	136	3371	4055
2017	ND	35	75	440	133	3373	4056
2018	ND	36	76	454	139	3406	4111
2019	ND	39	77	456	144	3389	4105
2020	ND	38	73	469	150	3382	4112
2021	ND	39	72	473	154	3477	4215
2022	ND	43	74	495	160	3494	4266
2023	ND	43	71	479	157	3331	4081

*ND = not disclosed

The average annual wage for transportation jobs was \$66,829 in 2023. This was up 7.7% from 2022. The highest wage was in motor vehicle and motor vehicle parts and supplies merchant wholesalers at \$85,901. This was followed by other support activities for air transportation (\$79,828), motor vehicle body and trailer manufacturing (\$60,685), motor vehicle parts manufacturing (\$60,684) and automotive repair and maintenance (\$66,829).

Average Annual Wage, Transportation 2013-2023



Transportation Average Annual Wage 2023

	Motor Vehicle Manuf.	Motor Vehicle Body and Trailer Manuf.	Motor Vehicle Parts Manuf.	Motor Vehicle and MV Parts and Supplies Merchant Wholesalers	Other Support Activities for Air Transport	Automotive Repair and Maintenance*	Total Transport
2013	ND	\$38,704	\$43,893	\$50,998	\$59,829	\$36,297	\$41,676
2014	ND	\$42,588	\$45,875	\$52,836	\$57,660	\$37,045	\$42,711
2015	ND	\$43,407	\$47,784	\$54,669	\$57,312	\$37,884	\$43,711
2016	ND	\$43,201	\$46,297	\$54,845	\$63,398	\$39,332	\$44,938
2017	ND	\$45,418	\$47,507	\$56,499	\$69,900	\$41,398	\$47,301
2018	ND	\$46,889	\$48,908	\$58,524	\$72,965	\$43,632	\$49,655
2019	ND	\$47,147	\$50,286	\$60,095	\$75,511	\$45,527	\$51,637
2020	ND	\$48,613	\$52,333	\$63,536	\$81,521	\$46,927	\$53,887
2021	ND	\$51,507	\$55,132	\$70,906	\$71,336	\$50,497	\$56,748
2022	ND	\$44,671	\$57,083	\$82,025	\$75,296	\$55,148	\$62,034
2023	ND	\$60,685	\$60,684	\$85,901	\$79,828	\$59,793	\$66,829

*ND = not disclosed

List of NAICS Codes Used in QCEW Analysis		
NAICS	Industry	Category
22111x	Electric Power Generation (Aggregation)	Electricity
221111	Hydroelectric Power Generation	Electricity
221112	Fossil Fuel Electric Power Generation	Electricity
221113	Nuclear Electric Power Generation	Electricity
221114	Solar Electric Power Generation	Electricity
221115	Wind Electric Power Generation	Electricity
221117	Biomass Electric Power Generation	Electricity
221118	Other Electric Power Generation	Electricity
22112X	Electric Power Transmission, Control, and Distribution (Aggregation)	Electricity
221121	Electric Bulk Power Transmission and Control	Electricity
221122	Electric Power Distribution	Electricity
23713x	Power and Communication Line and Related Structures Construction	Electricity
221330	Steam and Air-Conditioning Supply	Buildings
2361xx	Residential Construction	Buildings
2362xx	Nonresidential Construction	Buildings
237xxx	Heavy and Civil Engineering Construction	Buildings
238xx1	Specialty Residential Construction	Buildings
238xx2	Specialty Nonresidential Construction	Buildings
211130	Natural Gas Extraction	Fuels
2121xx	Coal Mining	Fuels
213111	Drilling Oil and Gas Wells	Fuels
213112	Support Activities for Oil and Gas Operations	Fuels
221210	Natural Gas Distribution	Fuels
23712x	Oil and Gas Pipeline and Related Structures Construction	Fuels
324110	Petroleum Refineries	Fuels
33313x	Mining and Oil and Gas Field Machinery Manufacturing	Fuels
424710	Petroleum Bulk Stations and Terminals	Fuels
4862xx	Pipeline Transportation of Natural Gas	Fuels
486910	Refined petroleum product pipeline transport	Fuels
3361xx	Motor Vehicle Manufacturing	Transportation
3362xx	Motor Vehicle Body and Trailer Manufacturing	Transportation
3363xx	Motor Vehicle Parts Manufacturing	Transportation
4231xx	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	Transportation
488190	Other Support Activities for Air Transportation	Transportation
8111xx	Automotive Repair and Maintenance	Transportation

4. Occupational Employment and Wages

Occupational employment and wage data is available from the Occupational Employment and Wage Statistics (OEWS) survey. This federal-state cooperative program produces employment and wage estimates annually for about 867 occupations. For Washington State, data are available statewide, for metropolitan statistical areas (MSAs), and for nonmetropolitan areas (NMAs). Occupational definitions use the Standard Occupational Classification (SOC) system.

The OEWS survey uses pooled samples over three years to construct annual estimates. The most recent annual data comes from 2023. Data from the spring 2023 OEWS survey are combined with the fall 2020, spring and fall 2021, and spring and fall 2022 survey panels. Thus, OEWS is best viewed as a cross-sectional snapshot rather than an annual trend.

Previous reports on clean energy employment have not focused extensively on occupations. The U.S Department of Energy's United States Energy Employment Report (USEER) focused on energy technology and industry. The Clean Energy Transition Institute's Net Zero Northwest (NZNW) report included occupational information through industry staffing patterns, but did not directly define clean energy occupations.

This section takes an occupation-first approach by directly studying occupational employment and wages for likely clean energy occupations. Many of these occupations came from conversations or requests from CETWAC members. Others were included to align with the industry sectors in USEER and NZNW reports. The process for selecting these occupations is included in the [Data and Methods](#) section.

For ease of analysis, clean energy occupations were categorized into four groups:

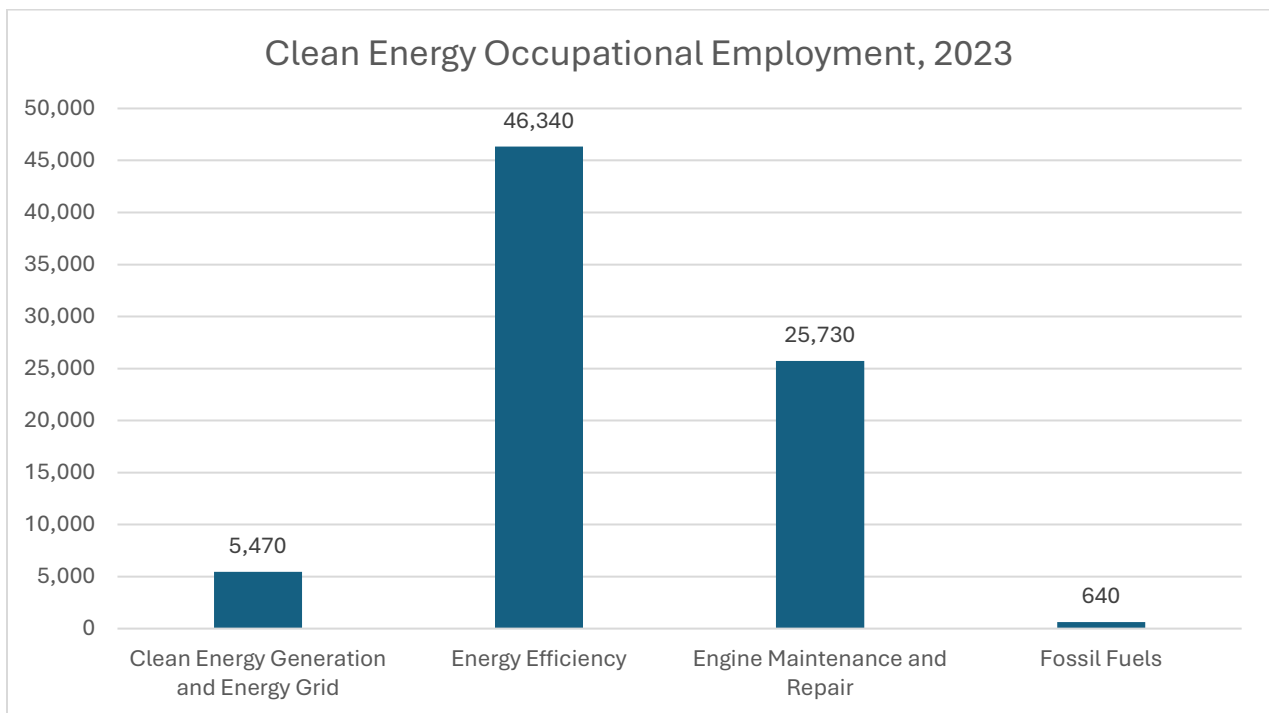
- 1) **Clean energy generation and energy grid occupations** include nuclear engineers and technicians, power plant operators, wind turbine service technicians, power distributors and dispatchers, and electrical power-line installers and repairers.
- 2) **Energy efficiency occupations** are occupations in construction trades involved with energy efficiency or weatherization. These include electricians, insulation workers, plumbers, pipefitters and steamfitters, roofers, and miscellaneous construction and related workers.
- 3) **Engine maintenance and repair occupations** include mechanics and service technicians who focus on engine-based transportation.
- 4) **Fossil fuel occupations** include petroleum engineers and petroleum pump system operators.

This is not an exhaustive list of clean energy occupations, and not all jobs within these occupations are focused on clean energy. It is expected that future versions of this report will adapt the definition of clean energy occupations to meet the needs of CETWAC.

A full list of SOC codes used in this OEWS analysis is at [the end of this chapter](#).

One limitation of the OEWS data is that, due to sample size, not all occupations can be estimated for all areas. Importantly for clean energy occupations, OEWS does not provide Washington State estimates for SOC 47-2231, solar photovoltaic installers. In such a case, supplementary data sources such as Washington’s Unemployment Insurance (UI) wage records can add detail. Because UI wage records collect data from all employers filing UI taxes, they can provide more precise estimates in small or emerging occupations. See [Chapter 6](#) for clean energy occupation analysis using UI wage records.

Due to sampling variation and the multi-year sample in OEWS, these estimates may not be directly comparable to UI wage record estimates.



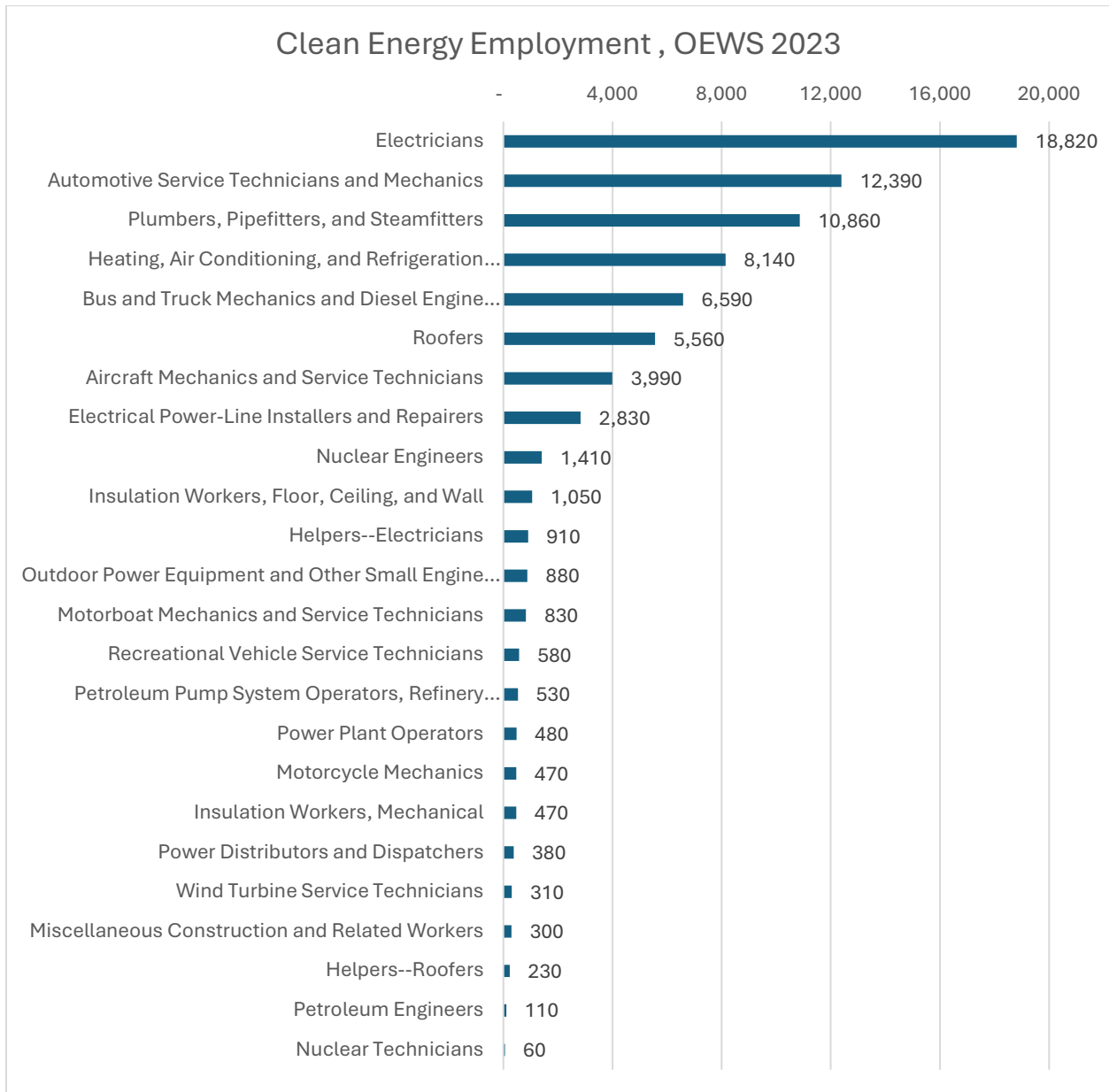
Total employment in clean energy occupations was 78,180 in the most recent (2023) OEWS survey. Of these, 46,340 were in energy efficiency occupations, 25,730 were in engine maintenance and repair, 5,470 were in clean energy generation and energy grid, and 640 were in fossil fuels.

- The largest clean energy occupation was electricians, at 18,820 jobs. This was followed by automotive service technicians and mechanics (12,390), plumbers,

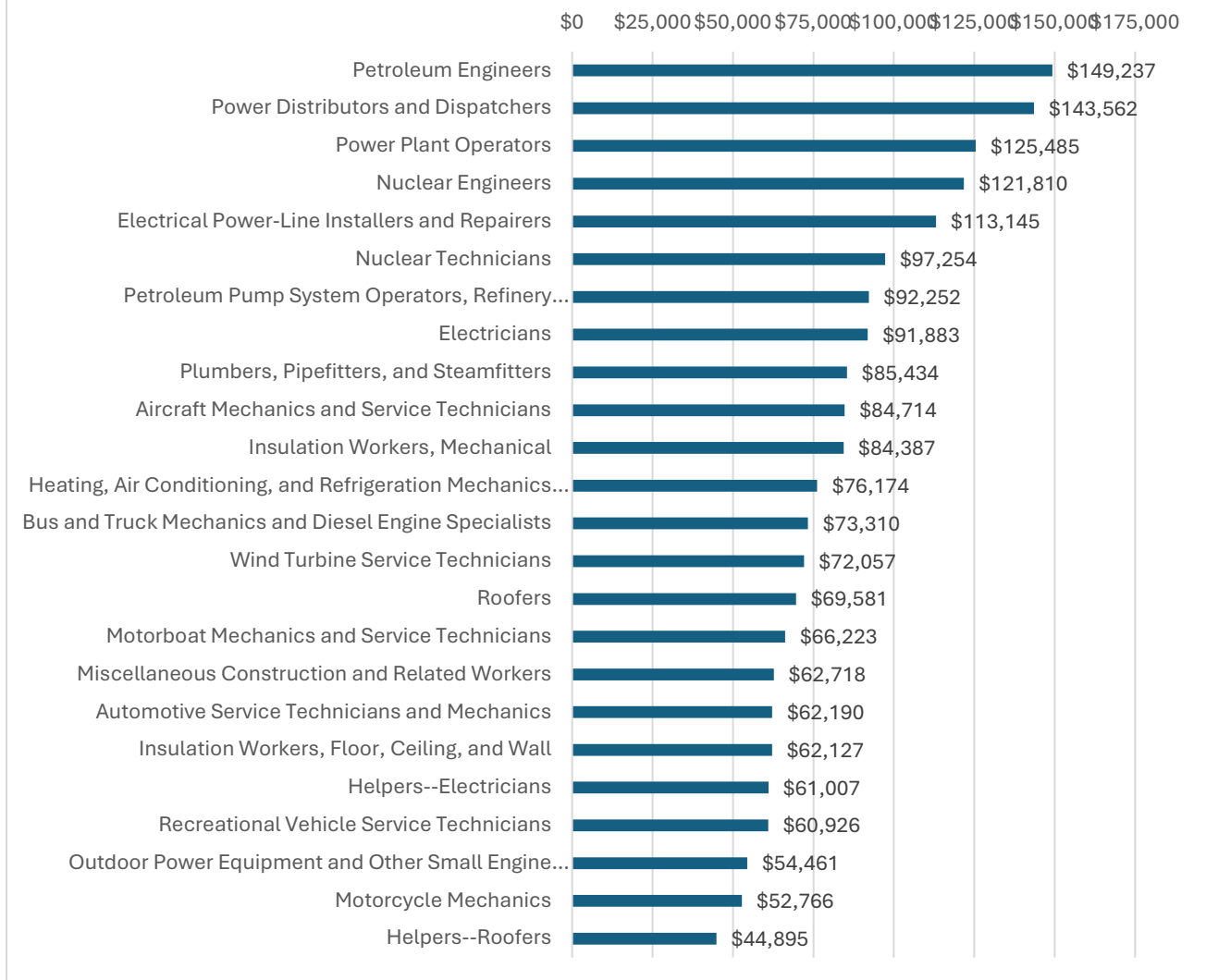
pipefitters and steamfitters (10,860), HVAC mechanics and installers (8,140), and bus and truck mechanics and diesel engine specialists (6,590).

Average annual wages varied across clean energy occupations.

- The highest average annual wage was for petroleum engineers at \$149,237 per year. This was followed by power distributors and dispatchers (\$143,562), power plant operators (\$125,485), nuclear engineers (\$121,810), and electrical power-line installers and repairers (\$113,145).



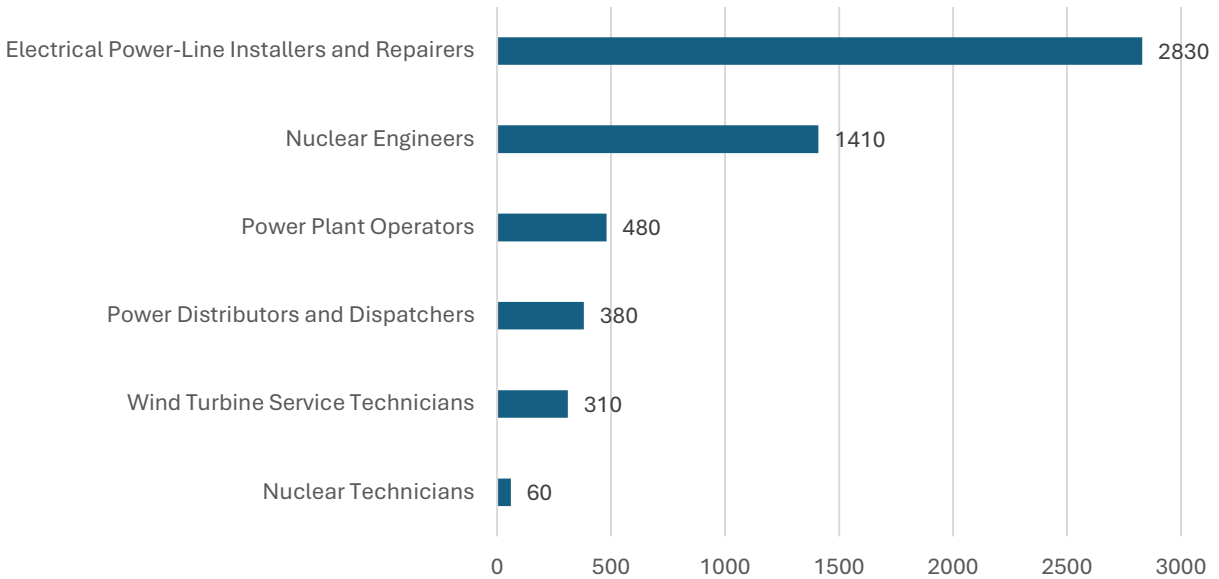
Clean Energy Occupations Average Annual Wage



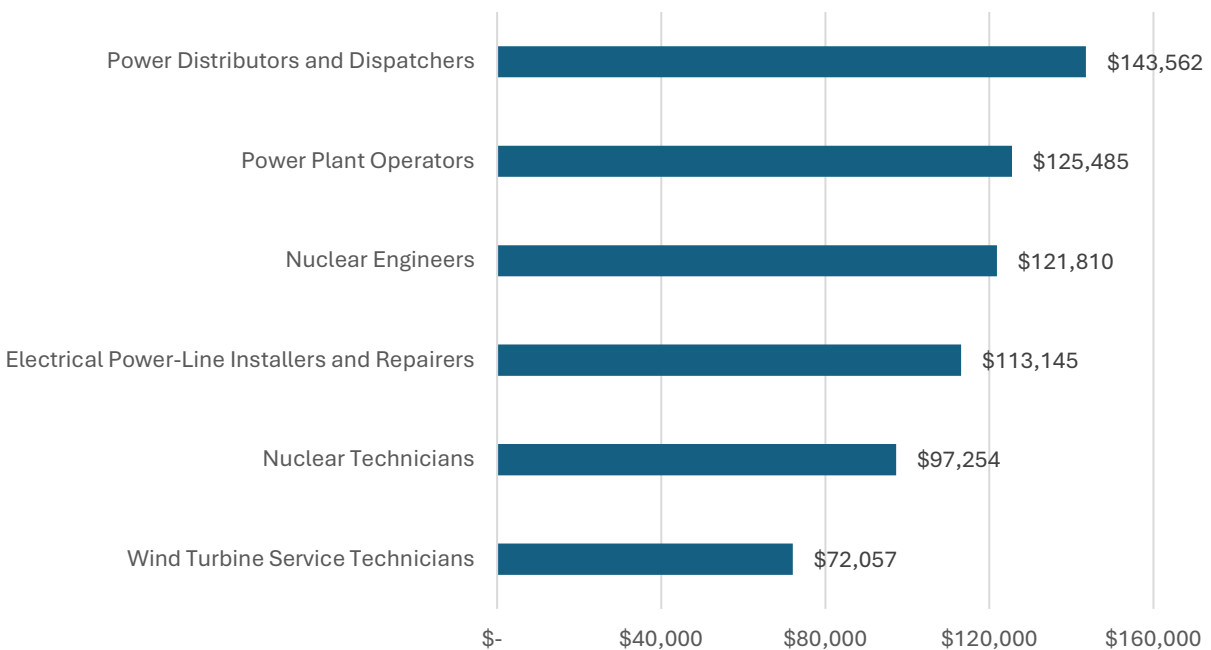
Clean Energy Generation and Energy Grid

There were 5,470 jobs in clean energy generation and energy grid occupations in OEWS 2023. The largest occupation was electrical power-line installers and repairers, at 2,830 jobs. The highest paying occupation was power distributors and dispatchers at \$143,562 per year. The lowest paying occupation was wind turbine service technicians at \$72,057 per year.

Employment, Clean Energy Generation and Energy Grid

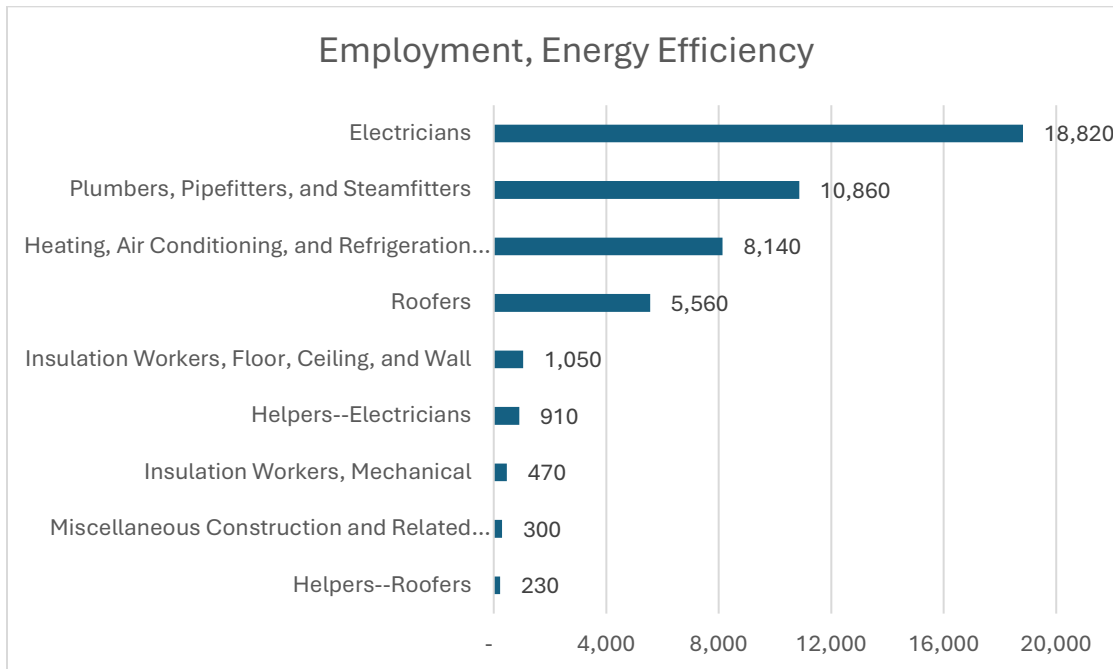


Average Annual Wages, Clean Energy Generation and Energy Grid

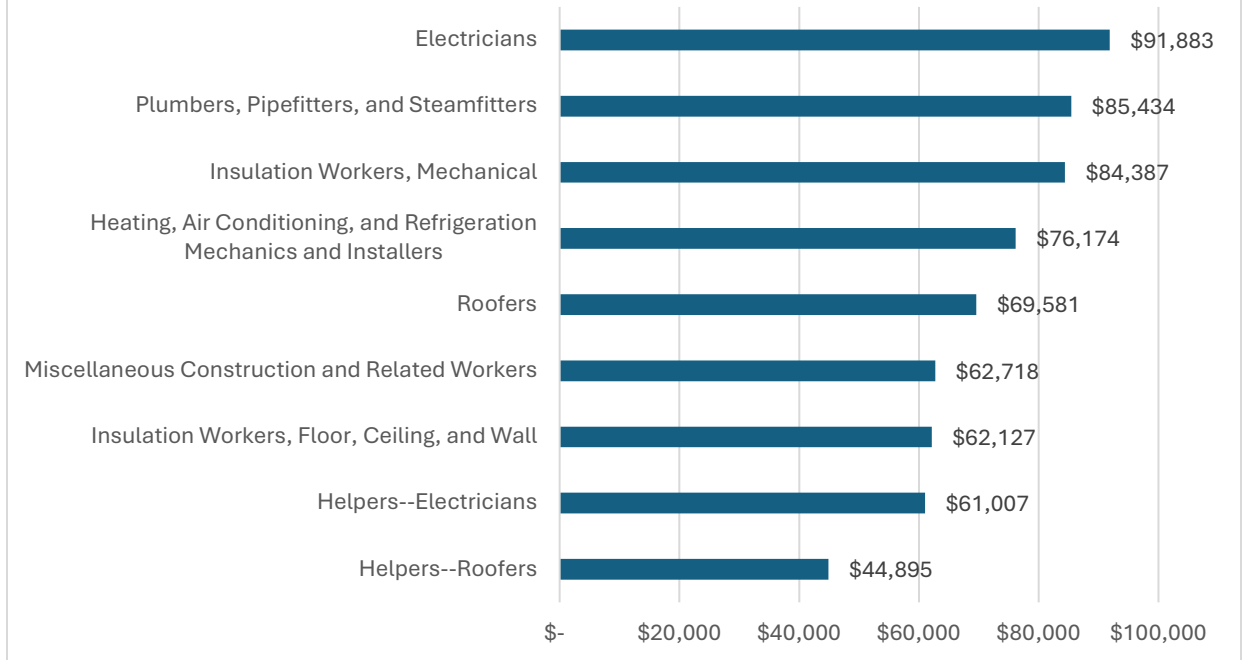


Energy Efficiency

Employment in energy efficiency occupations was 46,340 in OEWS 2023. The largest occupation was electricians, at 18,820 jobs. The highest paying occupation was electricians at \$91,883 per year. The lowest paying occupation was roofing helpers at \$44,895 per year.



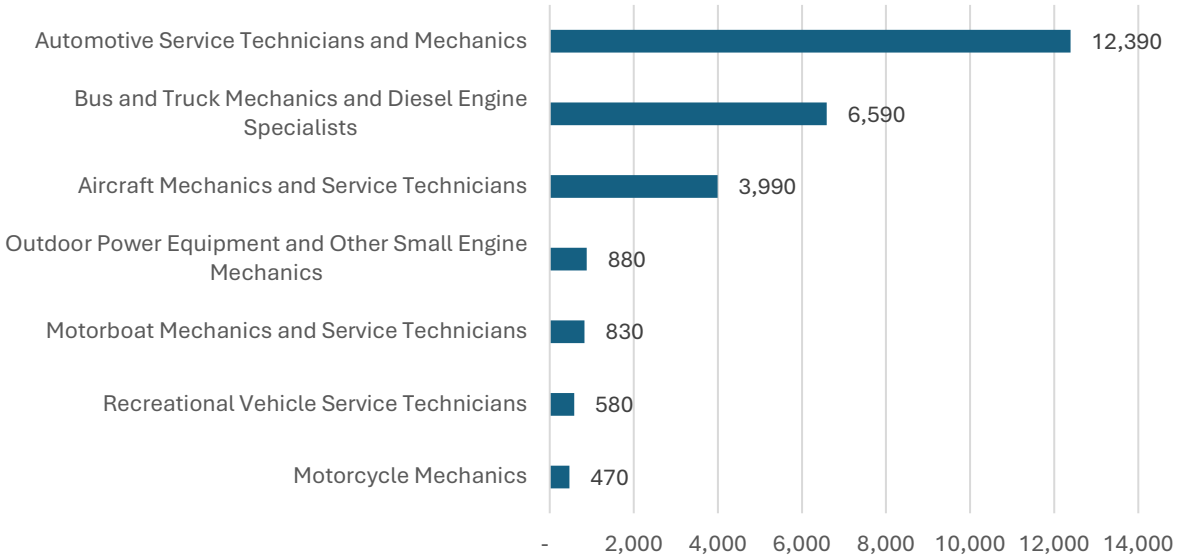
Average Annual Wages, Energy Efficiency



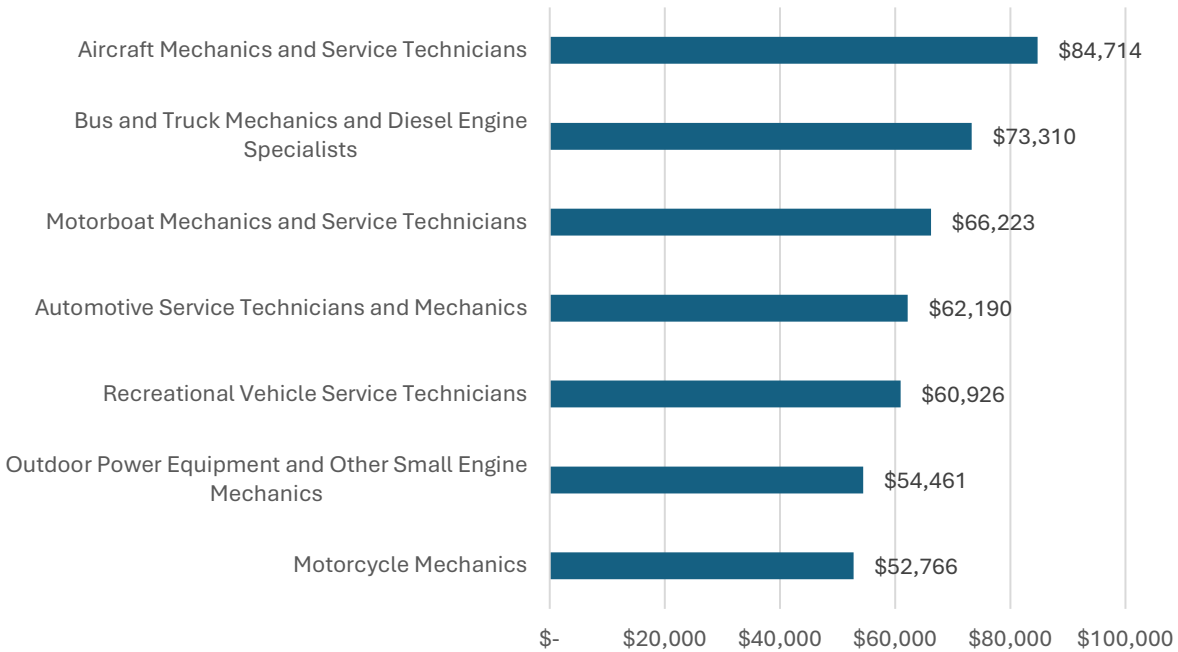
Engine Maintenance and Repair

There were 25,730 jobs in engine maintenance and repair occupations in OEWS 2023. The largest occupation was automotive service technicians and mechanics at 12,390 jobs. The highest paying occupation was aircraft mechanics and service technicians at \$84,714 per year. The lowest paying occupation was motorcycle mechanics at \$52,766 per year.

Employment, Engine Maintenance and Repair



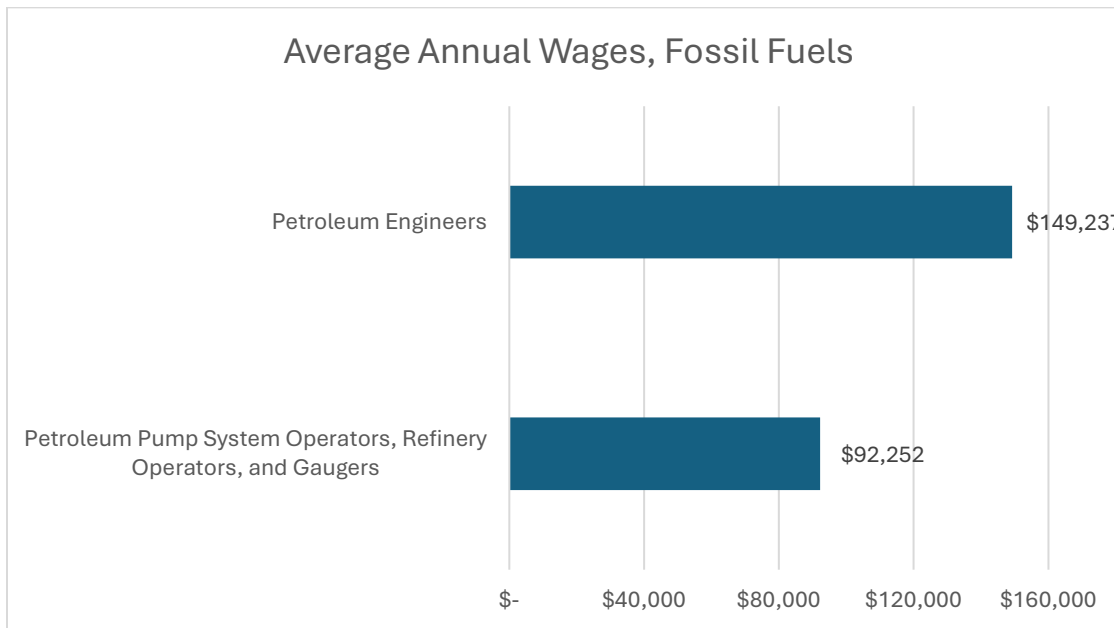
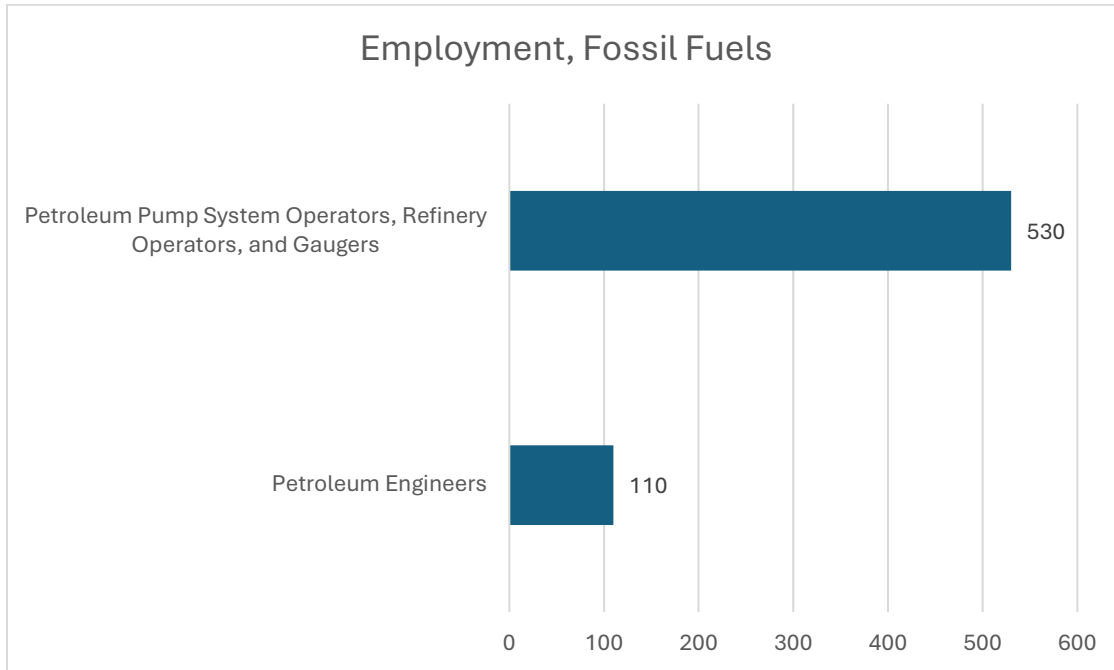
Average Annual Wages, Engine Maintenance and Repair



Fossil Fuels

Fossil fuel occupational employment was 640 in OEWS 2023. The highest paying occupation was petroleum engineers at \$149,237 per year. The lowest paying occupation

was petroleum pump system operators, refinery operators, and gaugers at \$92,252 per year.



Occupation-Industry Staffing Patterns

The Occupational Employment and Wage Statistics (OEWS) survey collects data on occupation and industry from employers. Each year, ESD takes these data and analyzes staffing patterns. A matrix of industries and occupations is constructed from OEWS survey responses which shows estimated employment by Standard Occupational Classification

(SOC) code and Industry Control Total (ICT) code for Washington State as well as Washington’s 12 Workforce Development Areas (WDAs). This occupation-industry matrix is used to convert ESD’s industry projections to occupational projections.

Staffing patterns make it possible to explore how occupations are distributed within and across industries. This can reveal previously unknown connections between industries and occupations. This is especially important for clean energy jobs, which are an emerging sector and thus not well-defined at the industry or occupational level. By exploring the staffing patterns of “known” clean energy industries, we may find occupations not previously identified as clean energy-related. Similarly, the staffing patterns of “known” clean energy occupations may reveal new clean energy industries.

As an illustrative example, below are the top ten occupations within ICT 2211, electric power generation, transmission and distribution, for Washington State.

Top 10 Occupations: Electric Power Generation, Transmission and Distribution		
SOC code	Occupational title	Estimated employment 2023 Q2
43-4051	Customer Service Representatives	539
13-1199	Business Operations Specialists, All Other	362
49-9051	Electrical Power-Line Installers and Repairers	302
17-2071	Electrical Engineers	226
51-8013	Power Plant Operators	199
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	130
13-1111	Management Analysts	117
43-1011	First-Line Supervisors of Office and Administrative Support Workers	101
15-1211	Computer Systems Analysts	97
51-8012	Power Distributors and Dispatchers	87

While some occupations are obviously clean energy related, such as electrical power-line installers and repairers, for many, the connection is less direct.

Similarly, we can look at which industries employ workers in clean energy occupations. Some occupations exist entirely or nearly entirely in one industry. Solar photovoltaic installers are entirely employed within ICT 2382, building equipment contractors, for example.

Top Industries: Solar Photovoltaic Installers

ICT code	Industry title	Estimated employment 2023 Q2
2382	Building equipment contractors	273

Others, such as electricians, are more dispersed. Below are the top ten industries for SOC 47-2111, Electricians.

Top 10 Industries: Electricians		
ICT code	Industry title	Estimated employment 2023 Q2
2382	Building equipment contractors	17786
9991	Federal government	821
9993	Local government other	746
2362	Nonresidential building construction	455
5613	Employment services	247
3364	Aerospace product and parts manufacturing	202
3366	Ship and boat building	176
6100	Education	158
3211	Sawmills and wood preservation	104
3399	Other miscellaneous manufacturing	104

While a complete analysis of these patterns is beyond the scope of this report, the occupations-industry matrix is a possible area for future work. The occupation-industry matrix can be found on [ESD's Projections site](#), along with methodology and the full projections data set.

Statistical precision is a challenge when working with occupational data because data is collected through a survey of employers. This makes, for example, tracking occupational trends difficult because with a shifting panel of employer participants, continuity is not possible. As of the fourth quarter of 2022, Washington has an additional tool for exploring occupational data. Washington is one of the first states in the U.S. to require employers to add occupational information to their quarterly Unemployment Insurance reports. As a result, it is now possible to explore occupational employment in greater detail than has been traditionally available. This report is one of the first to explore the occupational details derived from administrative records contained in the UI wage file.

Estimates using SOC codes from the UI wage record have the benefit of allowing more precise than estimates than survey-based approaches such as OEWS. As this is a new data

source and one that is unique to Washington State, it is best used as a supplementary detail to the OEWS survey, rather than a replacement. Exploring occupation-industry patterns within the UI wage record is a possible area of future work.

List of SOC Codes Used in OEWS Analysis		
SOC code	Occupational title	Category
17-2161	Nuclear Engineers	Clean Energy Generation and Energy Grid
19-4051	Nuclear Technicians	Clean Energy Generation and Energy Grid
49-9051	Electrical Power-Line Installers and Repairers	Clean Energy Generation and Energy Grid
49-9081	Wind Turbine Service Technicians	Clean Energy Generation and Energy Grid
51-8012	Power Distributors and Dispatchers	Clean Energy Generation and Energy Grid
51-8013	Power Plant Operators	Clean Energy Generation and Energy Grid
47-2111	Electricians	Energy Efficiency
47-2131	Insulation Workers, Floor, Ceiling, and Wall	Energy Efficiency
47-2132	Insulation Workers, Mechanical	Energy Efficiency
47-2152	Plumbers, Pipefitters, and Steamfitters	Energy Efficiency
47-2181	Roofers	Energy Efficiency
47-3013	Helpers--Electricians	Energy Efficiency
47-3016	Helpers--Roofers	Energy Efficiency
47-4090	Miscellaneous Construction and Related Workers	Energy Efficiency
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Energy Efficiency
49-3011	Aircraft Mechanics and Service Technicians	Engine Maintenance and Repair
49-3023	Automotive Service Technicians and Mechanics	Engine Maintenance and Repair
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	Engine Maintenance and Repair
49-3051	Motorboat Mechanics and Service Technicians	Engine Maintenance and Repair
49-3052	Motorcycle Mechanics	Engine Maintenance and Repair
49-3053	Outdoor Power Equipment and Other Small Engine Mechanics	Engine Maintenance and Repair
49-3092	Recreational Vehicle Service Technicians	Engine Maintenance and Repair
17-2171	Petroleum Engineers	Fossil Fuels
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	Fossil Fuels

5. Employment Projections

Employment projections are developed annually by the Employment Security Department (ESD) to aid job seekers, policy makers, and training providers in decision making. The projections show current and future estimated employment by industry and occupation, as well as expected annual growth rates. Projections are available for short (2-year), medium (5-year) and long-term (10-year) timelines. This report shows the 10-year projections in energy related industries and occupations.

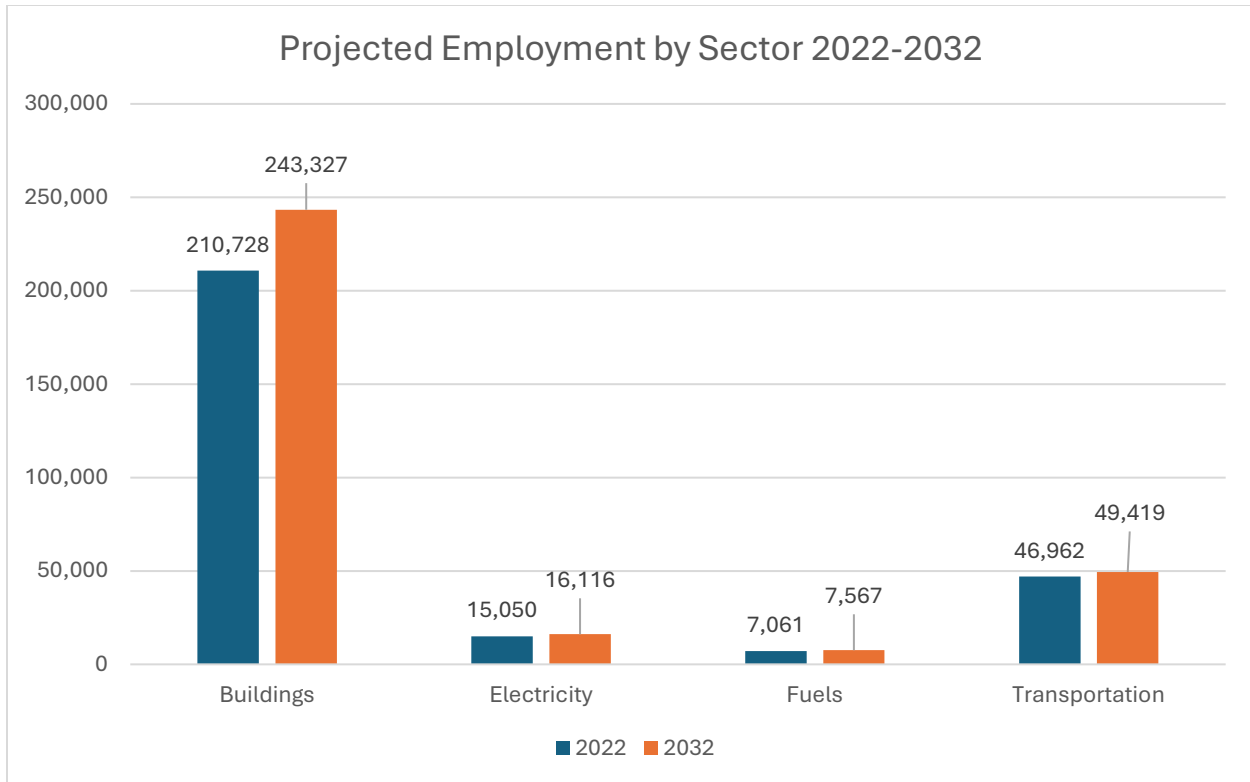
Industry Projections

Industry classification is based on Industry Control Totals (ICT), which use the North American Industry Classification System (NAICS) 4-digit level. Because ICT codes are less detailed than NAICS 6-digit codes, employment in these industries includes both energy-related and non-energy-related employment. For example, ICT 2361 contains all residential building construction.

Similarly, ICT 2211 contains all electric power generation, transmission and distribution. It is not possible within this category to distinguish between solar, wind, hydroelectric, fossil fuel, or other electricity generation, or to separate generation from transmission or distribution.

While this is a limitation, less detailed industry classification allows for more precise overall estimation. The energy industries below should be interpreted with this in mind. They are not meant to be exhaustive of or exclusive to the clean energy economy.

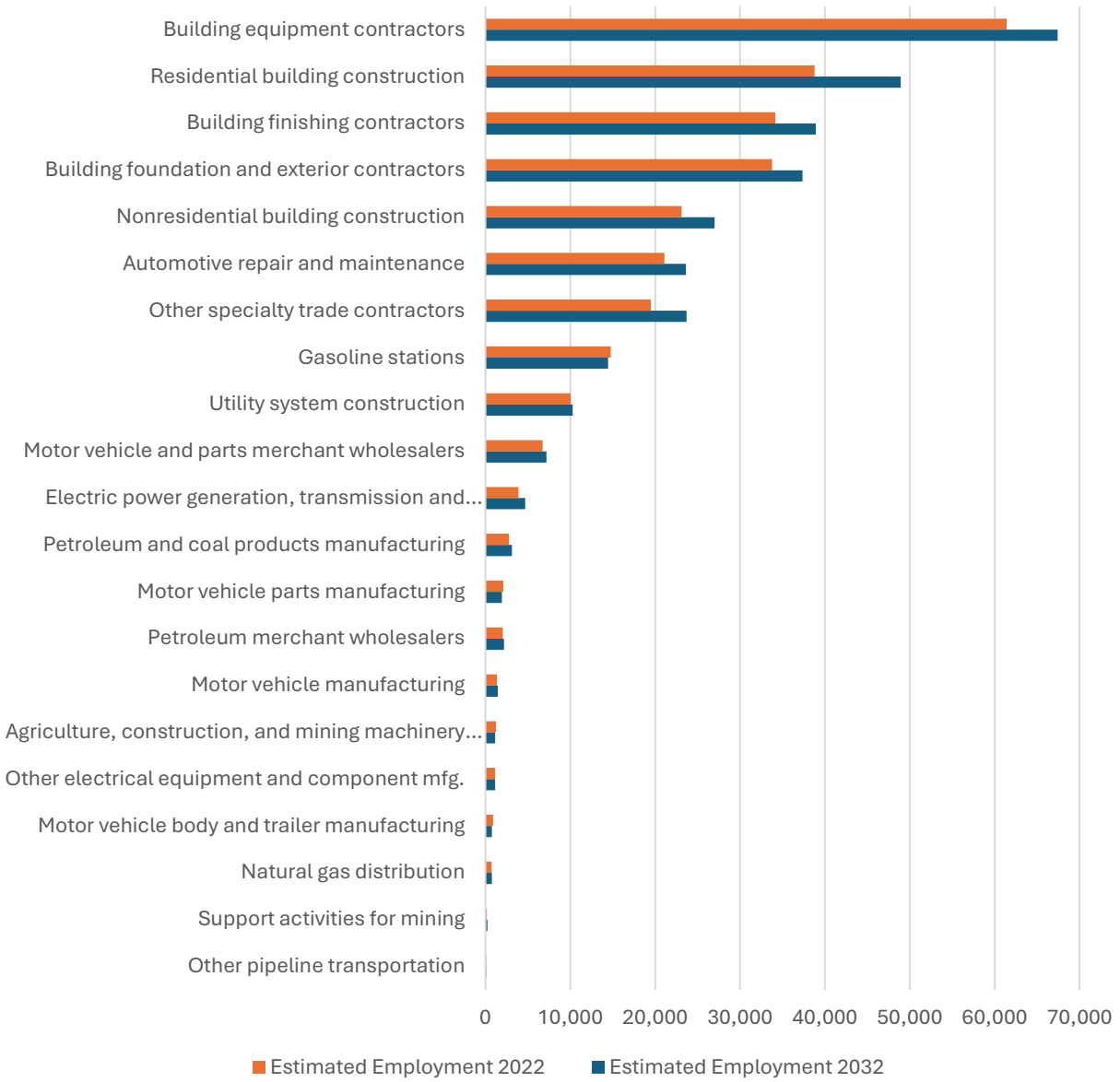
A list of ICT codes used in this section is included at the [end of this chapter](#).



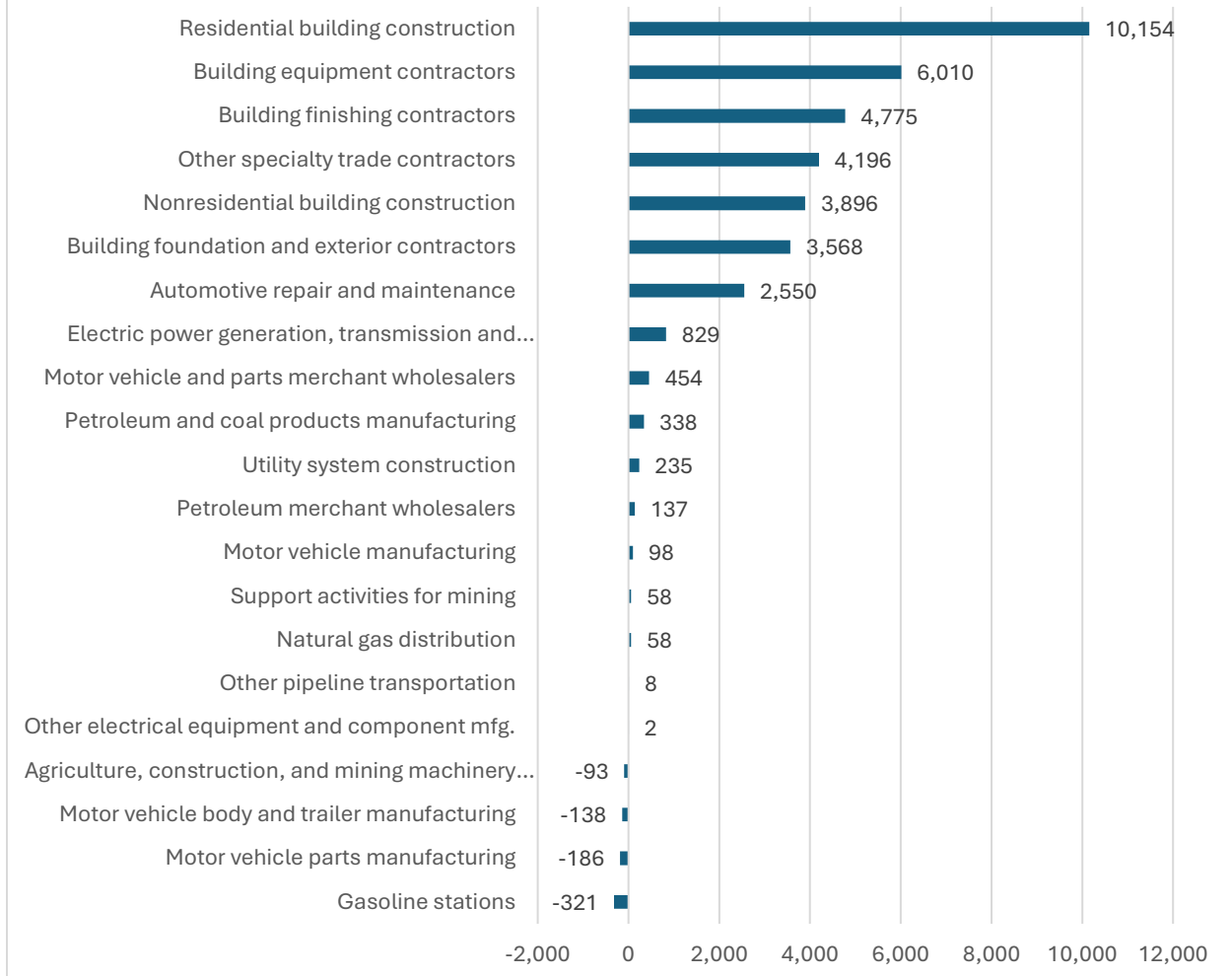
Energy related industries are expected to grow by 36,628 jobs over the 2022-2032 period. The largest industries in terms of jobs added are in the buildings sector.

- Residential building construction is expected to add 10,154 jobs over the 10-year period, the most of any industry. This is followed by building equipment contractors (6,010 jobs), building finishing contractors (4,775 jobs), other specialty trade contractors (4,196 jobs) and nonresidential building construction (3,896 jobs).
- The only non-construction industry to add more than 1000 jobs is automotive repair and maintenance, which is expected to add 2,550 jobs.
- Electric power generation, transmission, and distribution is expected to add 829 jobs.
- Four industries are expected to shrink. These include gasoline stations (-321), motor vehicle parts manufacturing (-185), motor vehicle body and trailer manufacturing (-138), and agriculture, construction, and mining machinery manufacturing (-93).
- Five industries are expected to grow but add less than 100 jobs.

Projected Energy Industry Employment 2022-2032



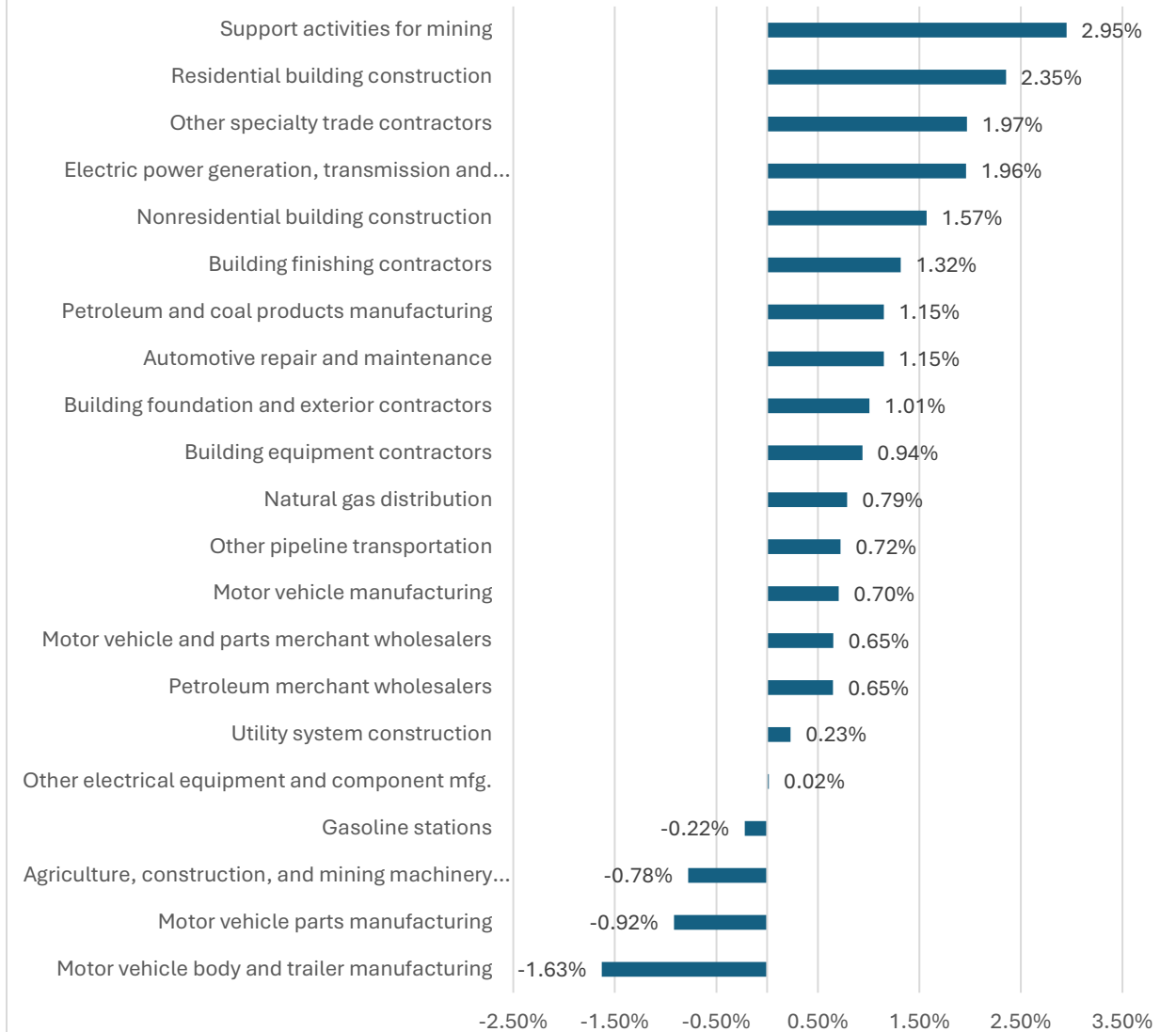
Projected Energy Industry Employment Growth 2022-2032



Average annual growth rates in energy industries are between -1.63% and 2.95% per year, with most expecting moderate growth.

- The fastest growing industries are support activities for mining (2.95%), residential building construction (2.35%), other specialty trade contractors (1.97%), electric power generation, transmission and distribution (1.96%), and nonresidential building construction (1.57%).
- The industry with the fastest contraction is motor vehicle body and trailer manufacturing, which is expected to shrink at 1.63% per year.

Projected Average Annual Growth Rate 2022-2032



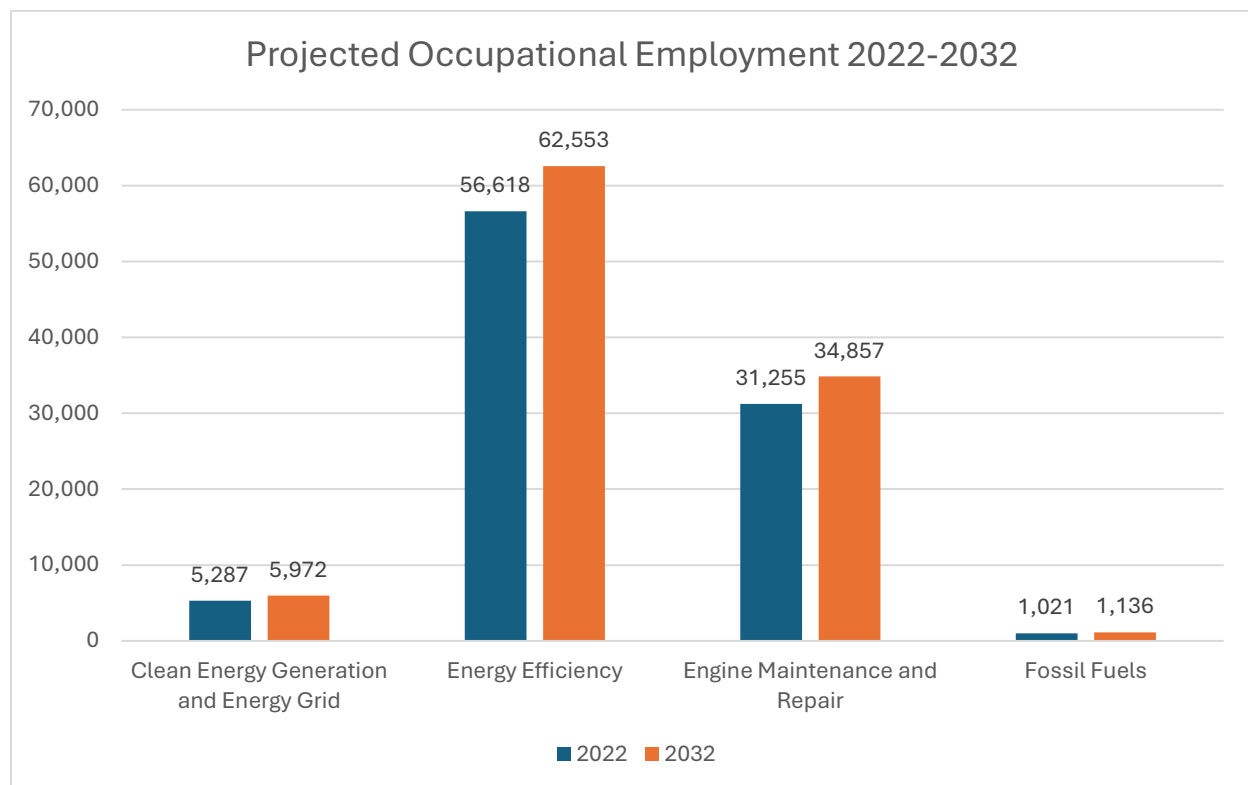
Industry Control Totals (ICTs) Used in Industry Projections		
ICT	Title	Category
2111	Oil and gas extraction	Fuels
2121	Coal mining	Fuels
2131	Support activities for mining	Fuels
2211	Electric power generation, transmission and distribution	Electricity
2212	Natural gas distribution	Fuels
2361	Residential building construction	Buildings
2362	Nonresidential building construction	Buildings

2371	Utility system construction	Electricity
2381	Building foundation and exterior contractors	Buildings
2382	Building equipment contractors	Buildings
2383	Building finishing contractors	Buildings
2389	Other specialty trade contractors	Buildings
3241	Petroleum and coal products manufacturing	Fuels
3331	Agriculture, construction, and mining machinery manufacturing	Fuels
3359	Other electrical equipment and component mfg.	Electricity
3361	Motor vehicle manufacturing	Transportation
3362	Motor vehicle body and trailer manufacturing	Transportation
3363	Motor vehicle parts manufacturing	Transportation
4231	Motor vehicle and parts merchant wholesalers	Transportation
4247	Petroleum merchant wholesalers	Fuels
4571	Gasoline stations	Transportation
4861	Pipeline transportation of crude oil	Fuels
4862	Pipeline transportation of natural gas	Fuels
4869	Other pipeline transportation	Fuels
8111	Automotive repair and maintenance	Transportation

Occupational Projections

ESD's occupational projections are created by converting industry projections to occupations using the Occupational Employment and Wage Statistics (OEWS) survey. Occupations are categorized using the Standard Occupational Classification (SOC) system at a 6-digit level. A full occupation-industry matrix can be found on [ESD's Projections site](#), along with methodology and the full projections data set.

Clean energy occupations were defined and categorized as in the [previous chapter](#). Two additional occupations were added which are suppressed in the OEWS survey: solar photovoltaic installers (SOC 47-2231) and nuclear power reactor operators (SOC 51-8011). A full list of SOC codes used in the following analysis is at the [end of this chapter](#).



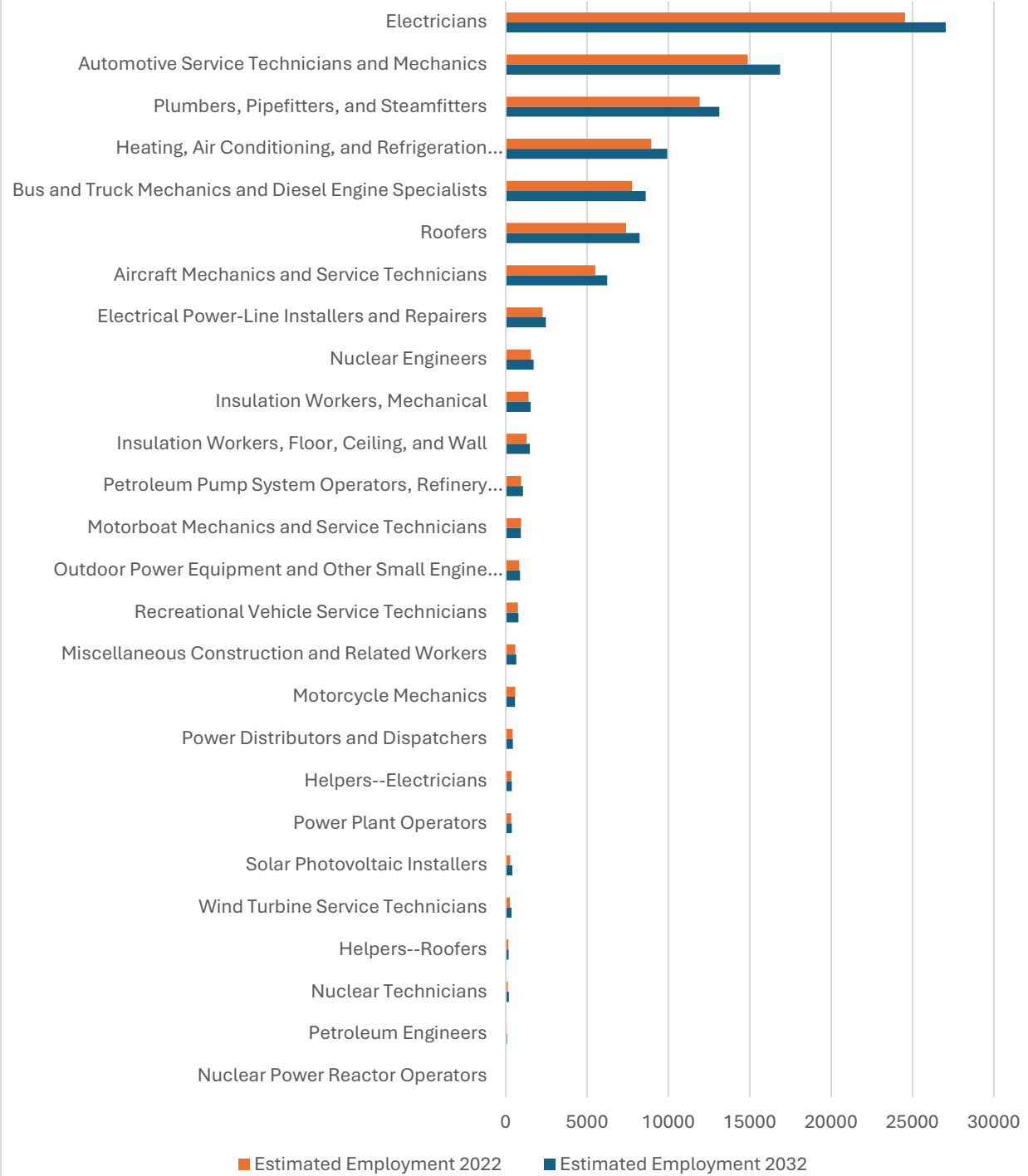
In aggregate, clean energy occupations have a projected employment growth of 10,337 over the 2022-2032 period. Energy efficiency occupations are expected to add 5,935 jobs, followed by engine maintenance and repair (3,602), clean energy generation and energy grid (685) and fossil fuel related occupations (115).

- The occupation with the highest expected job growth is electricians, which are expected to add 2,506 jobs over the decade. This is followed by automotive service technicians and mechanics (1,980), plumbers, pipe fitters, and steamfitters (1,206),

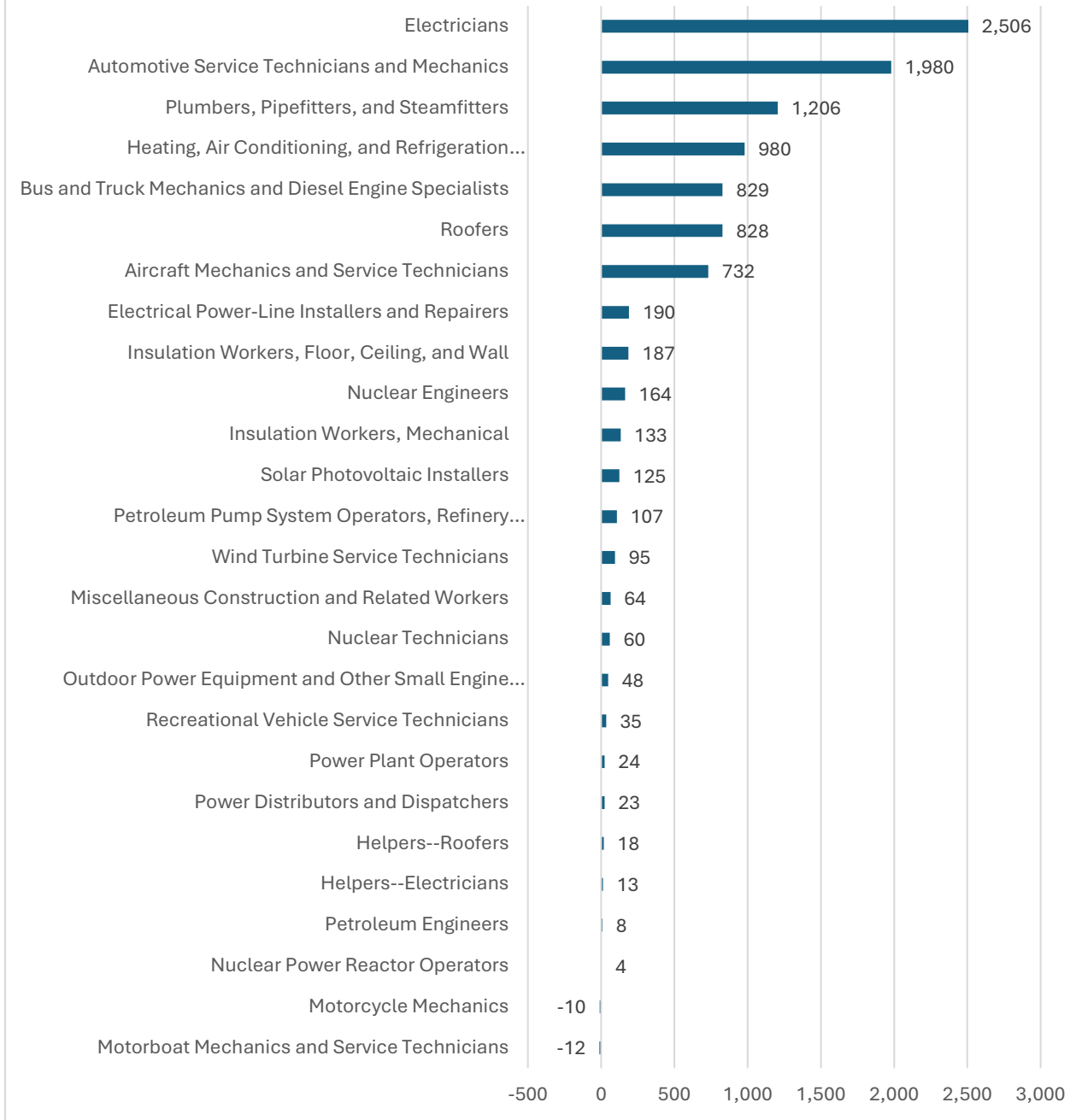
heating, air conditioning and refrigeration mechanics (980), and bus and truck mechanics and diesel engine specialists (829).

- Seven occupations expect to add more than 500 jobs over the 2022-2032 period, six occupations expect to add 100-500 jobs, eleven occupations expect to add 0-100 jobs, and two occupations expect to lose jobs.
- Occupations expecting jobs losses are motorboat mechanics and service technicians (-12) and motorcycle mechanics (-10).

Projected Occupational Employment 2022-2032



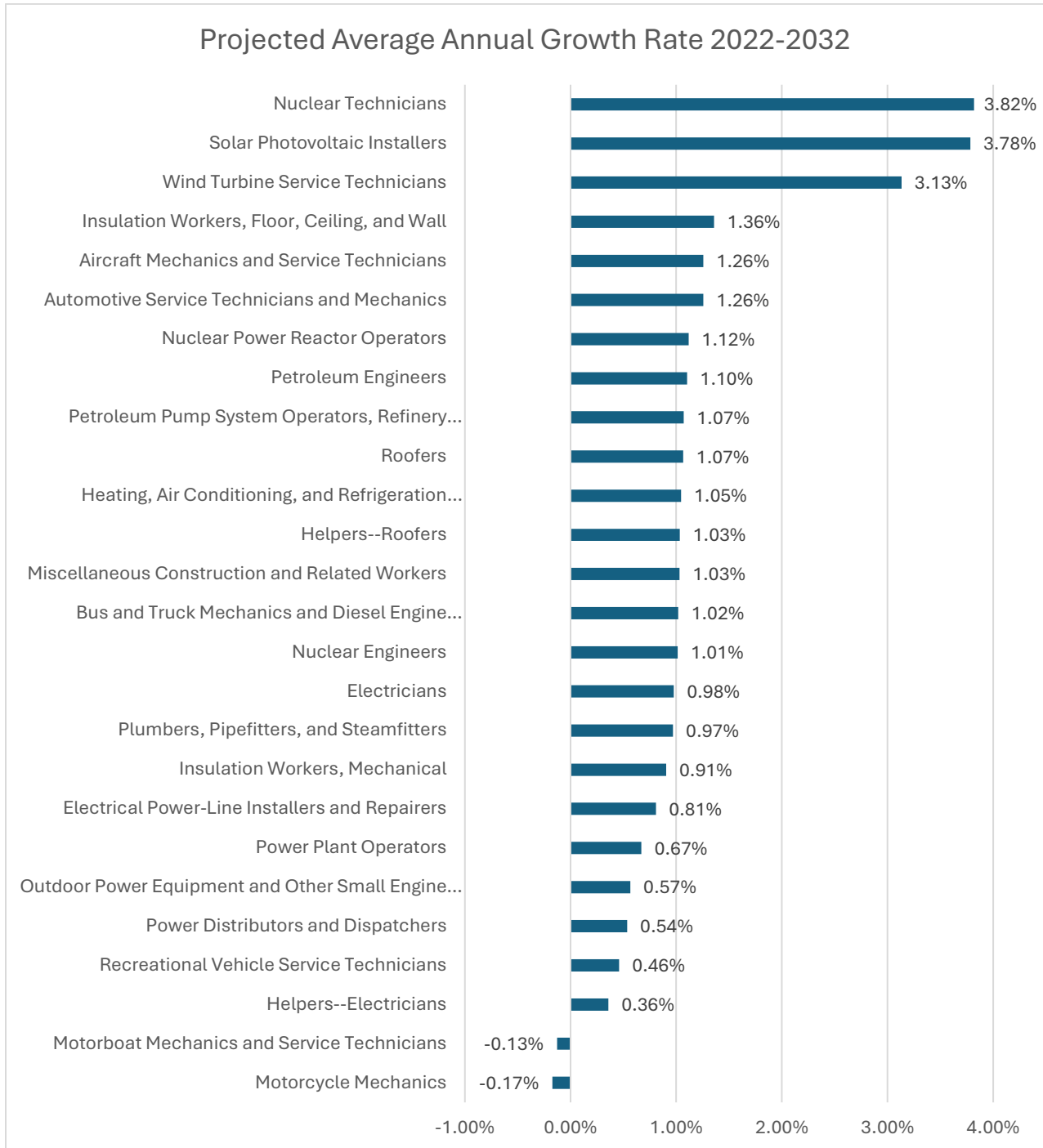
Projected Occupational Employment Growth 2022-2032



Average growth rates for clean energy occupations are between -0.17% and 3.82% per year.

- The fastest growing occupation is nuclear technicians (3.82% per year). This is followed by solar photovoltaic installers (3.78%), wind turbine service technicians

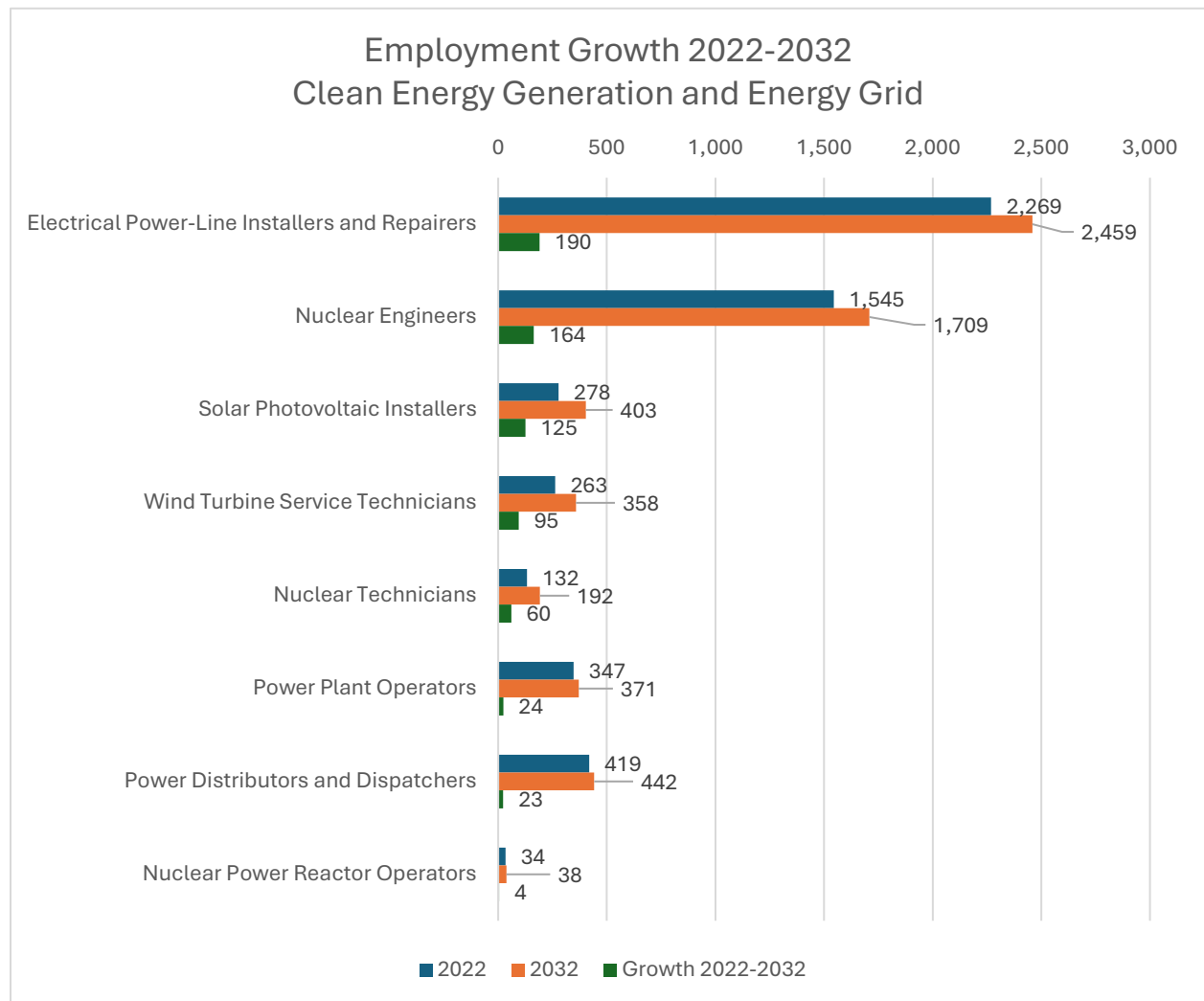
(3.13%), insulation workers for floors, ceilings, and walls (1.36%), and both aircraft and automotive mechanics and service technicians (1.26% each).



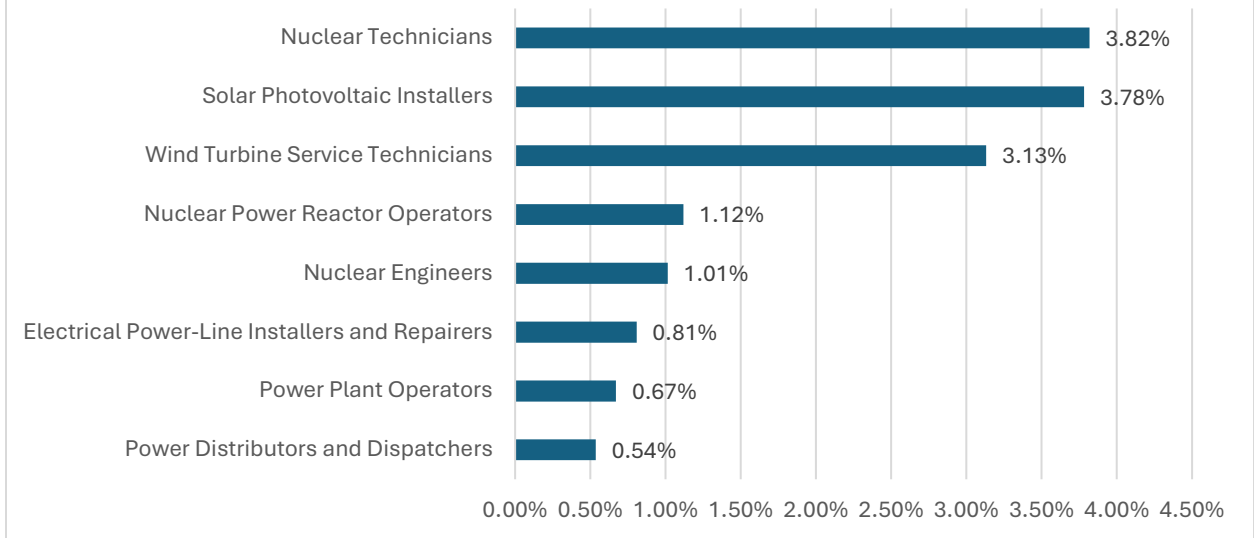
Clean Energy Generation and Energy Grid

Clean energy generation and energy grid occupations are expected to add 685 jobs over the 2022-2032 period. The top occupation in jobs added is electrical power-line installers and repairers (190 jobs), followed by nuclear engineers (164 jobs) and solar photovoltaic installers (125 jobs).

Though this occupational group is small, it contains some of the most rapidly growing occupations. Three occupations have average annual growth rates above 3%. These are nuclear technicians (3.82%), solar photovoltaic installers (3.78%) and wind turbine service technicians (3.13%).



Average Annual Growth Rate 2022-2032 Clean Energy Generation and Energy Grid

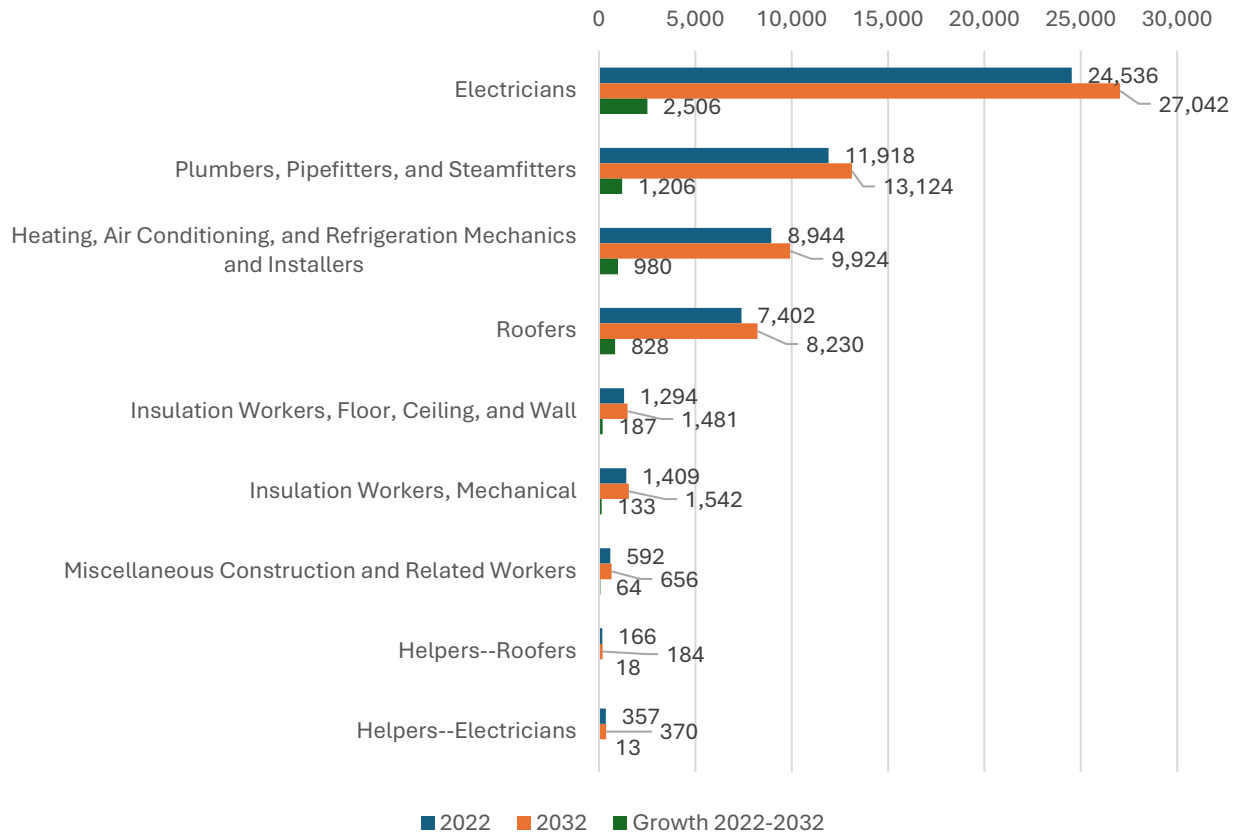


Energy Efficiency

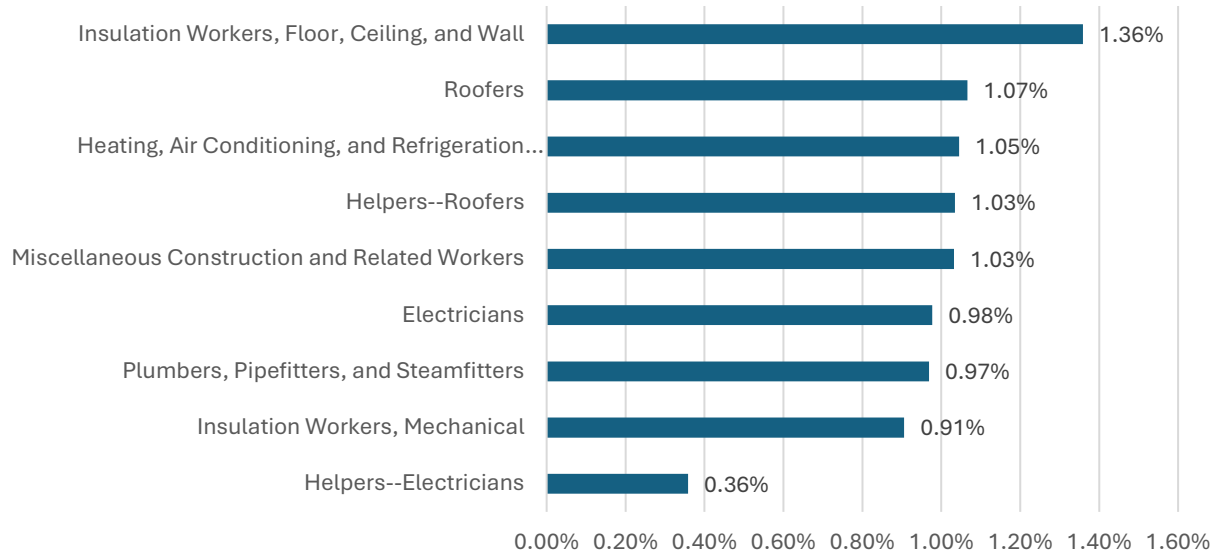
Energy efficiency occupations are expected to add 5,935 jobs over the 2022-2032 period. Electricians are expected to add the most jobs (2,506), followed by plumbers, pipefitters and steamfitters (1,206), heating, air conditioning, and refrigeration mechanics and installers (980), and roofers (828).

Growth rates are moderate, with all occupations expected to grow at average annual rates between 0.36% and 1.36%.

Employment Growth 2022-2032 Energy Efficiency Occupations



Average Annual Growth Rate 2022-2032 Energy Efficiency Occupations

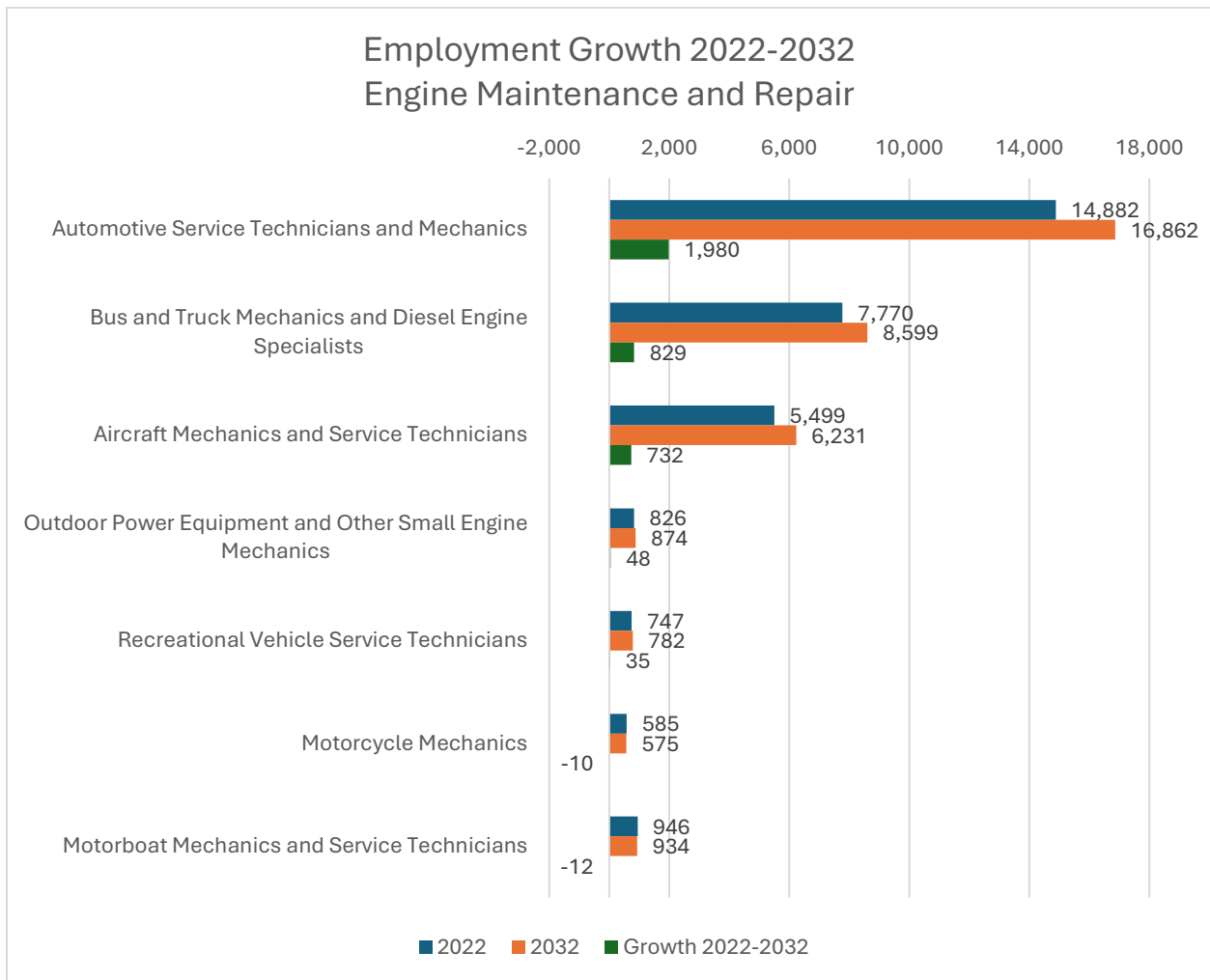


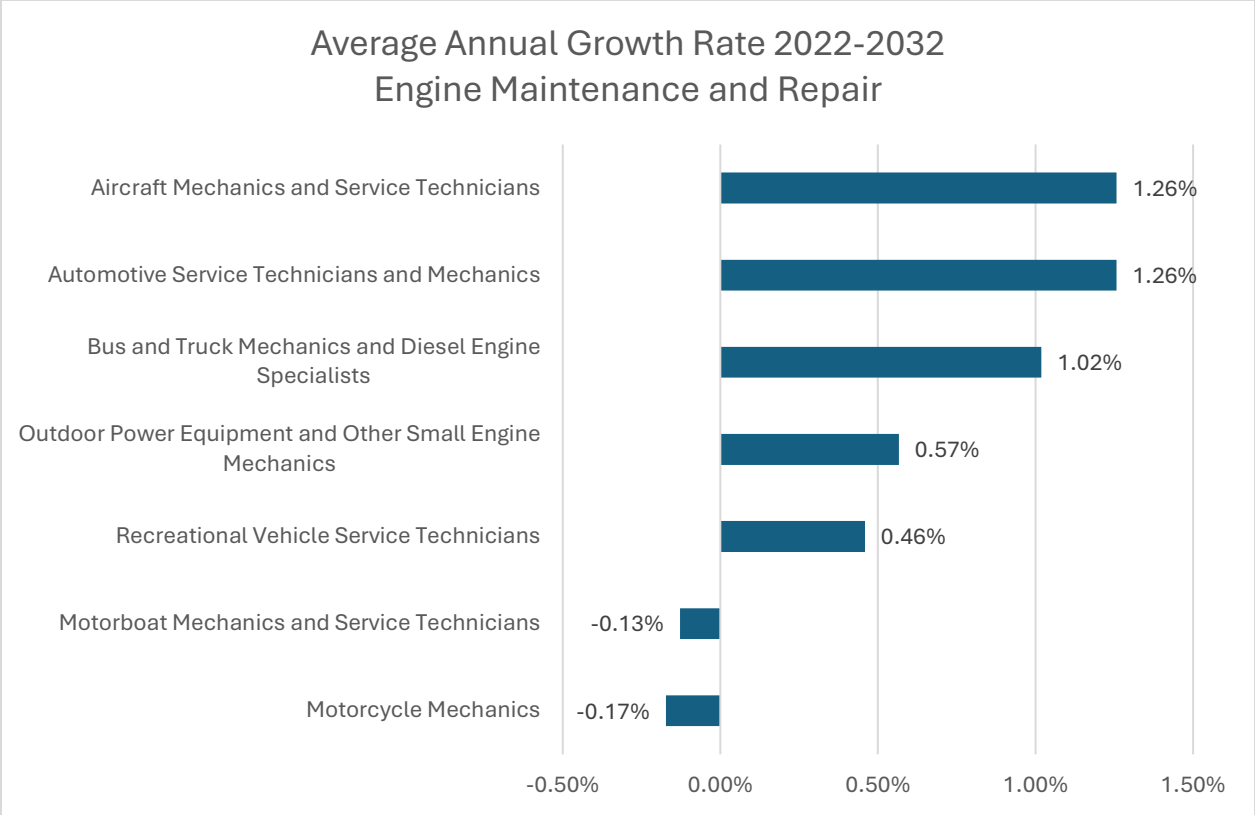
Engine Maintenance and Repair

Engine maintenance and repair occupations are expected to add a net total of 3,602 jobs over the 2022-2032 period. Five occupations are expected to grow and two are expected to shrink.

The top growth occupation is automotive service technicians and mechanics (1,980 jobs), followed by bus and truck mechanics and diesel engine specialists (829 jobs) and aircraft mechanics and service technicians (732 jobs). Motorboat mechanics and service technicians, and motorcycle mechanics are expected to lose 10 and 12 jobs respectively.

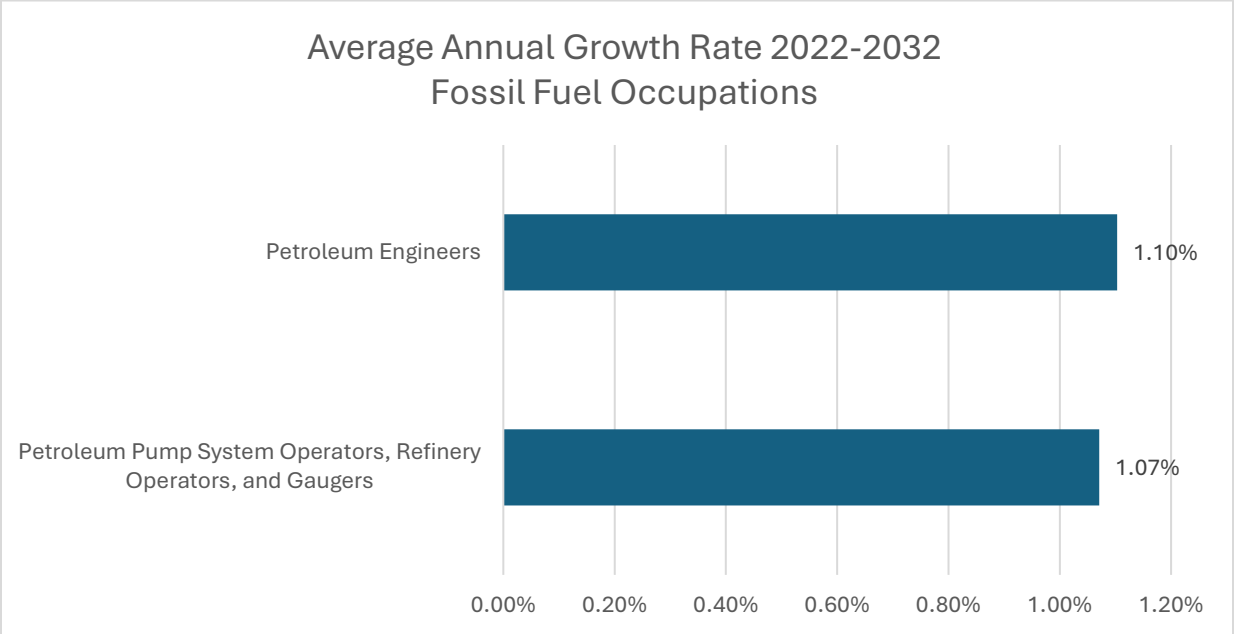
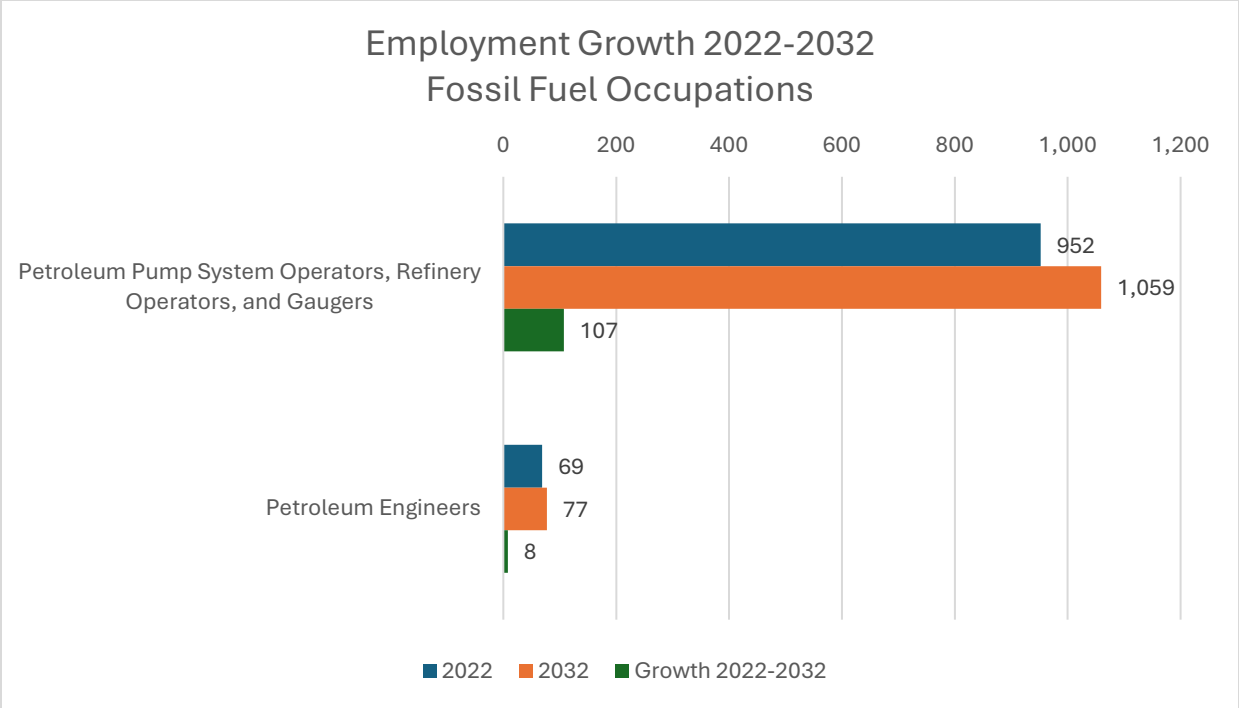
The two occupations with the highest average annual growth rates are aircraft mechanics and service technicians, and automotive service technicians and mechanics (both at 1.26% annual growth).





Fossil Fuels

Fossil fuel occupations are expected to add a modest 115 jobs over the 2022-2032 period. Petroleum pump system operators, refinery operators, and gaugers are expected to add jobs at a rate of 1.07% per year. Petroleum engineers are expected to add at a rate of 1.10% per year.



List of SOC Codes Used in Occupational Projections		
SOC code	Occupational title	Category
17-2161	Nuclear Engineers	Clean Energy Generation and Energy Grid
19-4051	Nuclear Technicians	Clean Energy Generation and Energy Grid

47-2231	Solar Photovoltaic Installers	Clean Energy Generation and Energy Grid
49-9051	Electrical Power-Line Installers and Repairers	Clean Energy Generation and Energy Grid
49-9081	Wind Turbine Service Technicians	Clean Energy Generation and Energy Grid
51-8011	Nuclear Power Reactor Operators	Clean Energy Generation and Energy Grid
51-8012	Power Distributors and Dispatchers	Clean Energy Generation and Energy Grid
51-8013	Power Plant Operators	Clean Energy Generation and Energy Grid
47-2111	Electricians	Energy Efficiency
47-2131	Insulation Workers, Floor, Ceiling, and Wall	Energy Efficiency
47-2132	Insulation Workers, Mechanical	Energy Efficiency
47-2152	Plumbers, Pipefitters, and Steamfitters	Energy Efficiency
47-2181	Roofers	Energy Efficiency
47-3013	Helpers--Electricians	Energy Efficiency
47-3016	Helpers--Roofers	Energy Efficiency
47-4090	Miscellaneous Construction and Related Workers	Energy Efficiency
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Energy Efficiency
49-3011	Aircraft Mechanics and Service Technicians	Engine Maintenance and Repair
49-3023	Automotive Service Technicians and Mechanics	Engine Maintenance and Repair
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	Engine Maintenance and Repair
49-3051	Motorboat Mechanics and Service Technicians	Engine Maintenance and Repair
49-3052	Motorcycle Mechanics	Engine Maintenance and Repair
49-3053	Outdoor Power Equipment and Other Small Engine Mechanics	Engine Maintenance and Repair
49-3092	Recreational Vehicle Service Technicians	Engine Maintenance and Repair
17-2171	Petroleum Engineers	Fossil Fuels
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	Fossil Fuels

6. Unemployment Insurance Wage Records Detail

The previous chapters of this report focused on traditional Labor Market Information (LMI) sources: the Quarterly Census of Employment and Wages (QCEW), the Occupational Employment and Wage Statistics survey (OEWS), and employment projections. Traditional LMI serves as a valuable baseline when comparing against other clean energy reports.

A supplementary tool to traditional published LMI is Washington's Unemployment Insurance (UI) wage records. This administrative dataset is collected when employers file quarterly UI taxes. The UI wage records file contains employment, hours and wages for all establishments covered under unemployment insurance. Establishments are assigned a detailed industry code using the North American Industrial Classification System (NAICS).

A key benefit of the wage records file is that quarterly hours and wages are reported for each employee. QCEW wages are aggregated across all employees in an industry regardless of hours worked. This allows for clear analysis of long-term industry trends. However, the distribution of wages across workers is difficult to quantify with QCEW data.

In examining the distribution of wages and hours for employees in various clean energy industries, the UI wage record analysis in this section adds an important layer of detail to the "big picture" of the preceding QCEW industry analysis.

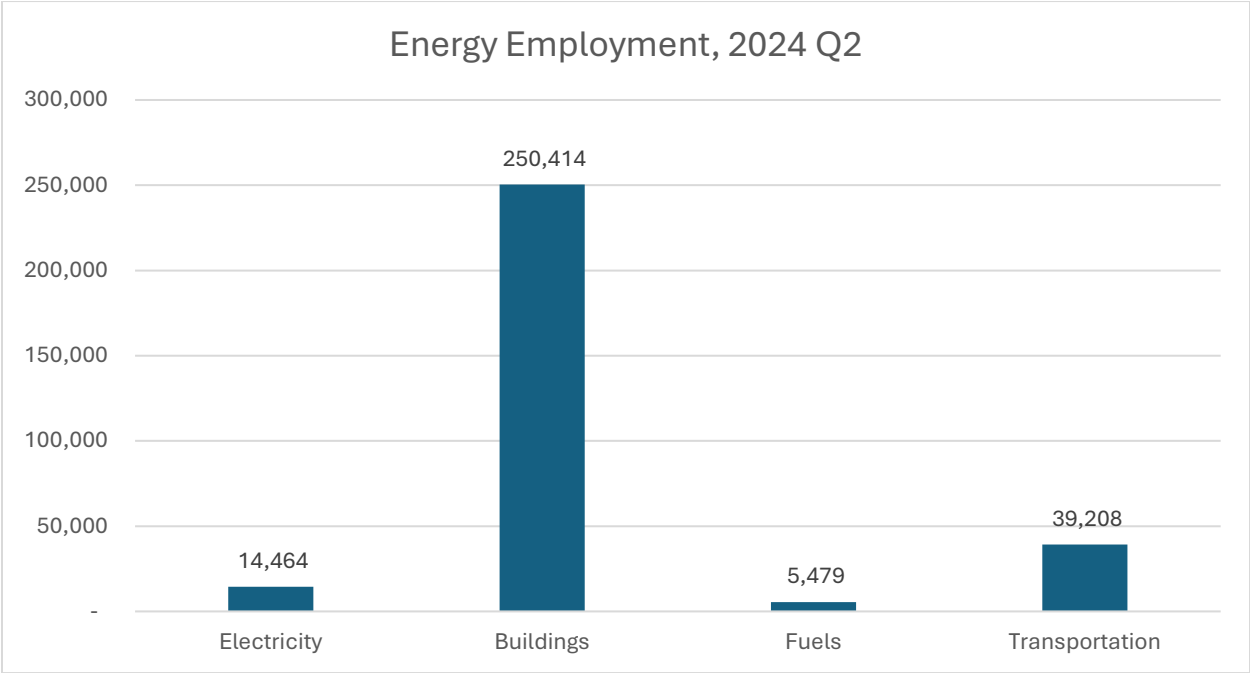
As of the fourth quarter of 2022, employers in Washington are also required to provide employee occupations using Standard Occupational Classification (SOC) codes. Washington is one of the first states in the U.S. to require employers to add occupational information to their quarterly Unemployment Insurance reports. As a result, it is now possible to explore occupational employment in greater detail than has been traditionally available. This report is one of the first to explore the occupational details derived from administrative records contained in the UI wage file.

The industries and occupations in this section follow the same organizational principles as for the previous chapters on industry and occupational employment. Clean energy NAICS and SOC codes are largely the same, with a few exceptions. Several construction occupations are included in the OEWS analysis that were not included in the wage record analysis due to time constraints.

A full list of NAICS and SOC codes used in this analysis is at the [end of this chapter](#).

Industry

Employment in energy related industries was 309,565 in 2024 Q2. The largest energy sector was in buildings (250,414), followed by transportation (39,208), electricity (14,464), and fuels (5,479).



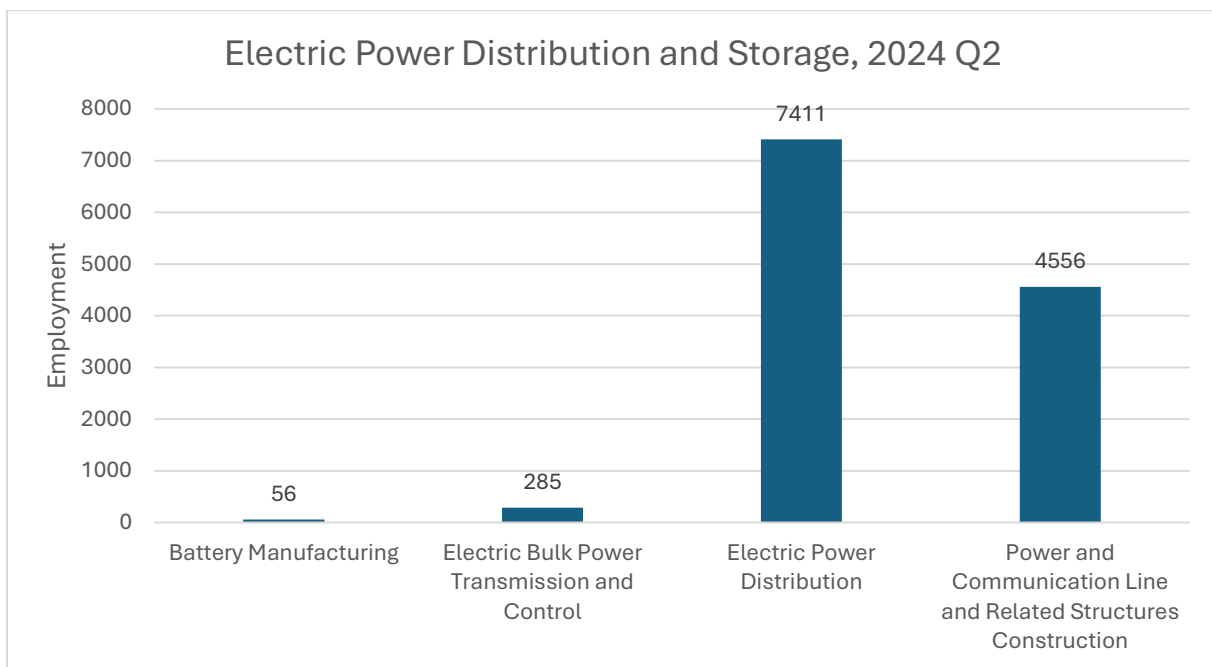
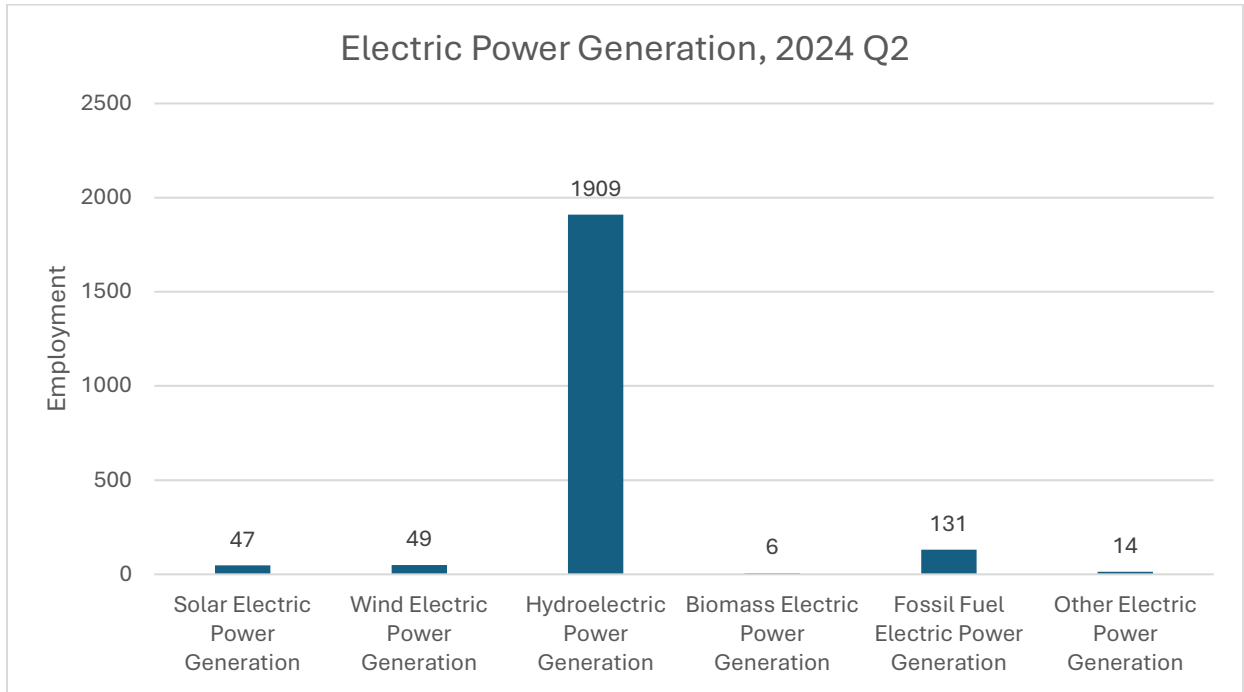
Electricity

The electricity sector is made up of two categories: electric power generation and electric power distribution and storage. Electric power generation can be decomposed into solar, wind, hydroelectric, biomass, fossil fuel, and other sources. Electric power distribution and storage involves electric power distribution, bulk power transmission and control, battery manufacturing, and power and communication line and related structures construction.

Employment Snapshot

- Employment in the electricity sector was 14,464 in 2024 Q2.
- Of these, 2,156 jobs (15%) were in electric power generation, while 12,308 (85%) were in electric power distribution and storage.
- Electric power distribution is the largest industry across all electricity employment, at 7,411 jobs. This is followed by power and communication line and related structures construction (4,556 jobs) and hydroelectric power (1,909 jobs).
- Hydroelectric was the largest source of power generation employment and comprises 89% of all power generation jobs.

- Solar and wind power generation are a relatively small part of employment, at 47 and 49 jobs respectively.
- However, the majority of electricity generation employment comes from renewable sources, with only 131 jobs (6%) in fossil fuel power generation.



Wages

Median hourly wages in the electricity sector tend to be high, with most falling in between \$50 and \$60 per hour.

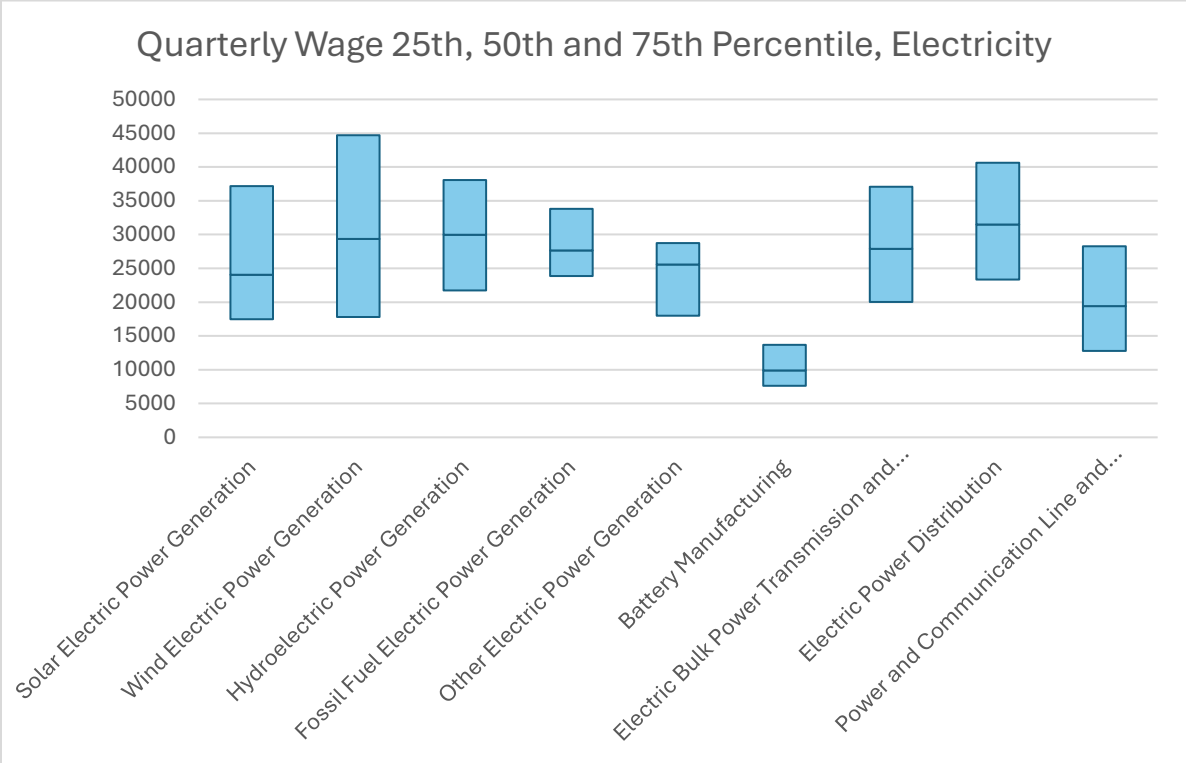
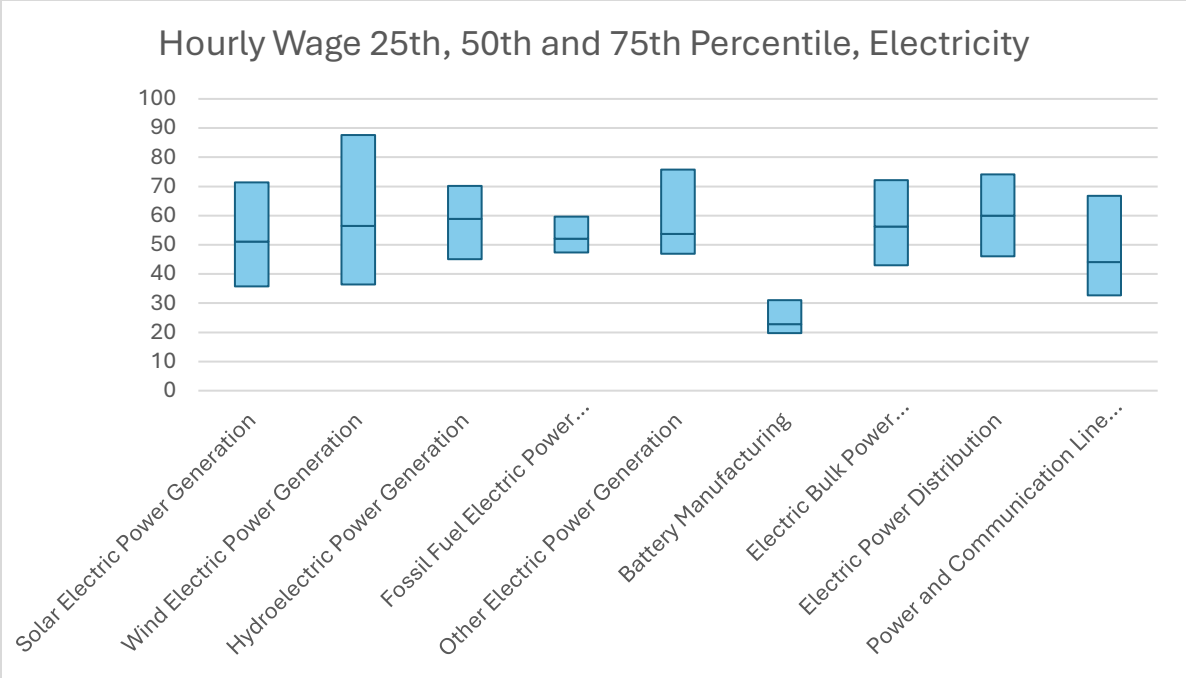
- The highest median hourly wage is in electric power distribution, at \$59.96 per hour.
- The lowest median hourly wage was in battery manufacturing, at \$22.77 per hour.
- Battery manufacturing had the lowest range of wages, with 75% of wages falling at \$31 per hour or below.
- Wages in wind and solar power generation had larger ranges than hydroelectric, fossil fuel or other electricity generation industries.

Quarterly wages can differ from hourly wage patterns because hours worked differ across jobs and industries. All but two industries had median wages between \$20,000 and \$30,000 during 2024 Q2 (\$6,667 to \$10,000 per month).

- The highest median quarterly wage in the electricity sector was in hydroelectric power generation at \$29,997 per quarter in 2024 Q2 (\$9,000 per month).
- The lowest median quarterly wage was in battery manufacturing at \$9,883 per quarter (\$3,294 per month).

Most jobs in the electricity sector are full time. Average hourly wages differ between part-time (less than 35 hours per week) and full-time (35 or more hours) workers.

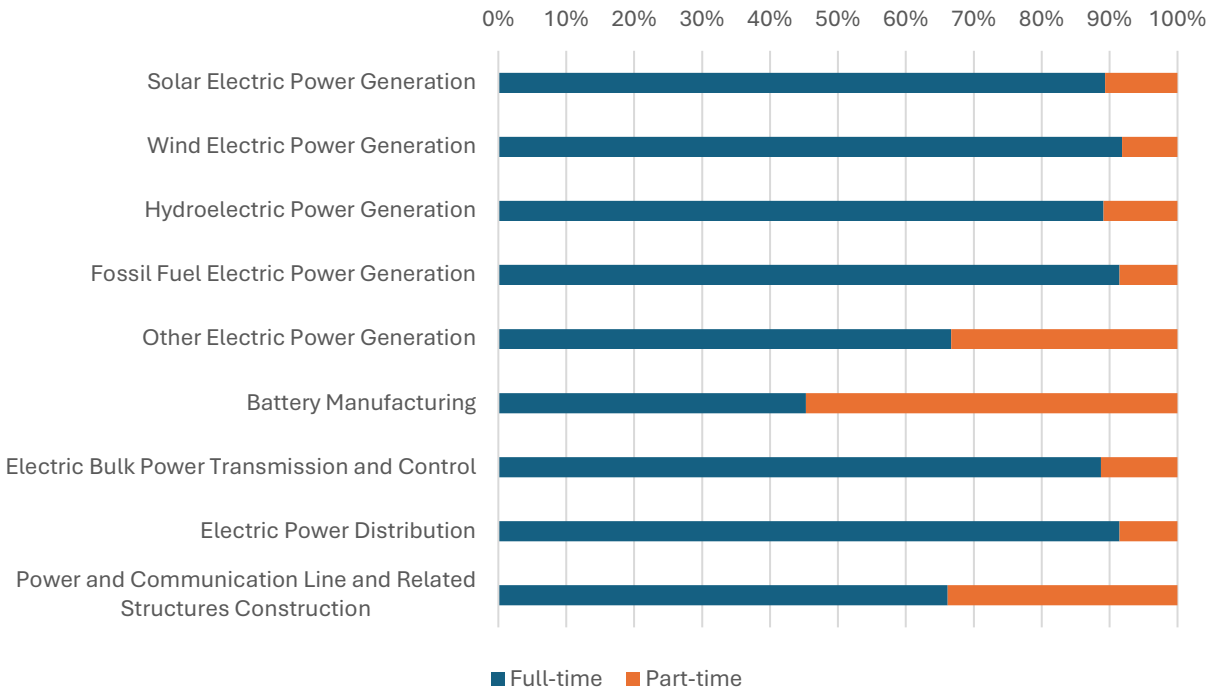
- The industries with the highest proportion of part-time workers were battery manufacturing (29 jobs, 55%), power and communication line and related structures construction (1525 jobs, 34%), and other electric power generation (4 jobs, 33%).
- The industry with the highest number of part-time jobs was power and communication structures and related construction.
- Part-time jobs had lower hourly wages than full-time jobs in six industries, and higher hourly wages than full-time jobs in three industries.
- The gap between full and part-time hourly wages ranged from \$0.74 (power and communication line and related structures construction) to \$34.17 (wind power generation).



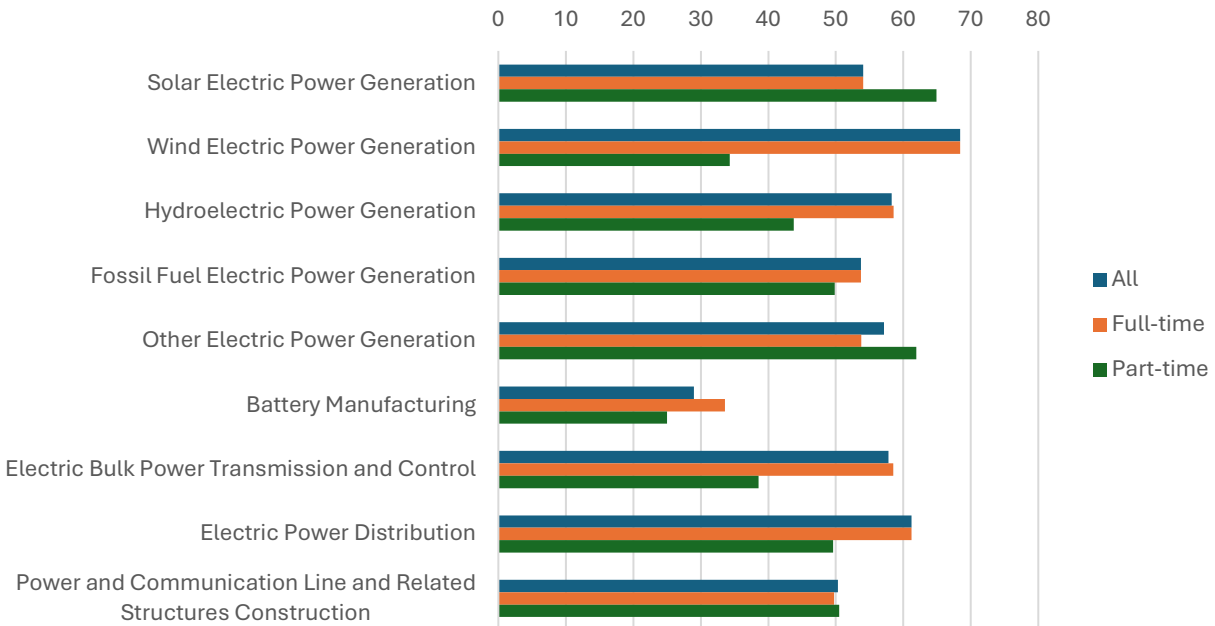
Electricity Hourly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Solar Electric Power Generation	39	54.04	35.79	51.14	71.42
Wind Electric Power Generation	37	68.44	36.36	56.45	87.63
Hydroelectric Power Generation	1659	58.26	45.08	58.85	70.23
Fossil Fuel Electric Power Generation	96	53.72	47.35	52.04	59.63
Other Electric Power Generation	11	57.12	46.96	53.77	75.76
Battery Manufacturing	47	28.97	19.78	22.77	31
Electric Bulk Power Transmission and Control	235	57.78	42.98	56.22	72.12
Electric Power Distribution	5911	61.2	46.06	59.96	74.16
Power and Communication Line and Related Structures Construction	4134	50.31	32.66	44.11	66.77

Electricity Quarterly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Solar Electric Power Generation	44	27,640	17,483	24,042	37,156
Wind Electric Power Generation	47	35,249	17,795	29,356	44,716
Hydroelectric Power Generation	1,877	29,803	21,733	29,997	38,050
Fossil Fuel Electric Power Generation	108	28,597	23,848	27,662	33,830
Other Electric Power Generation	11	25,574	17,999	25,594	28,750
Battery Manufacturing	47	10,684	7,628	9,883	13,675
Electric Bulk Power Transmission and Control	281	28,390	20,028	27,873	37,090
Electric Power Distribution	7,089	32,218	23,342	31,490	40,620
Power and Communication Line and Related Structures Construction	4,300	21,139	12,775	19,407	28,293

Full Time vs. Part Time, Electricity



Average Hourly Wage by Hours Worked, Electricity

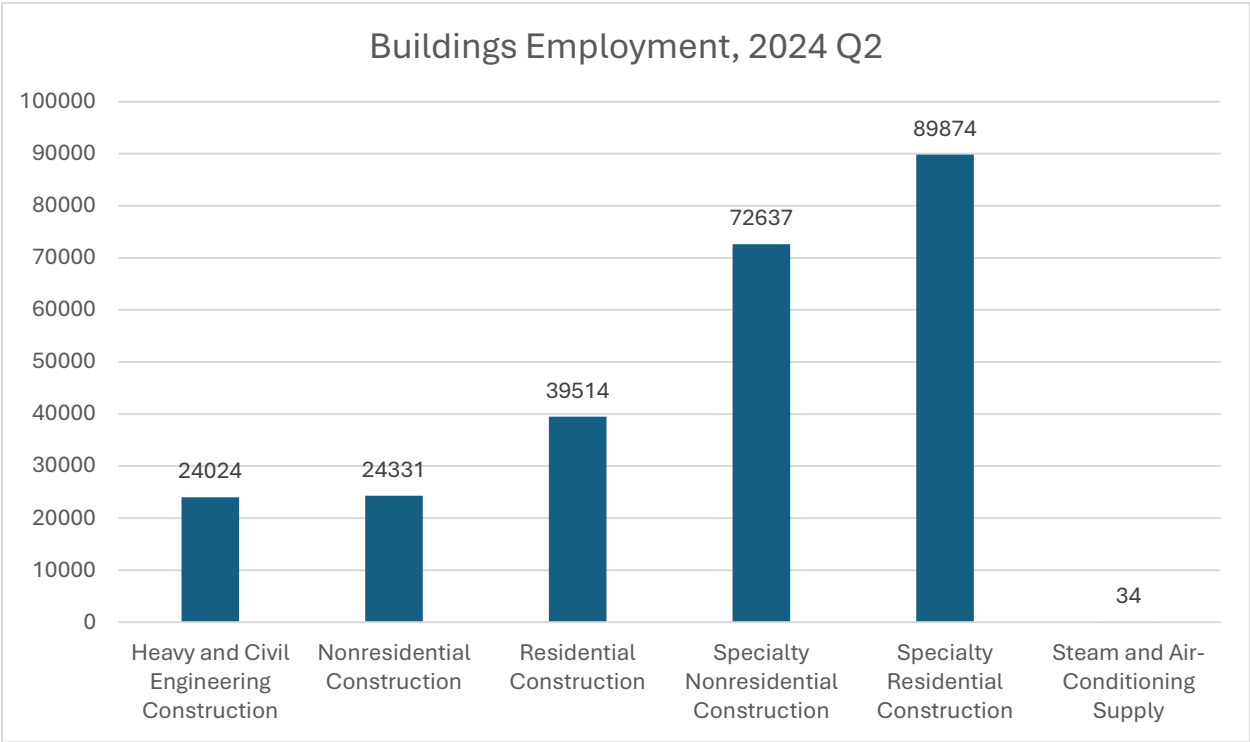


Buildings

Employment in the buildings sector consists of residential and nonresidential construction, specialty residential and nonresidential construction, heavy and civil engineering construction, and steam and air conditioning supply.

Employment Snapshot

- Employment in the buildings sector was 250,414 in 2024 Q2.
- The largest industry was specialty residential construction, at 89,874 jobs, followed by specialty nonresidential construction (72,637) and residential construction (39,514).
- Specialty construction employed more workers than traditional construction in both residential and nonresidential industries.



Wages

Median hourly wages in the buildings sector varied across industries.

- The highest median hourly wage in 2024 Q2 was \$59.62 in steam and air conditioning supply. The lowest median hourly wage was \$30.94 in specialty residential construction.

- Nonresidential construction had higher median hourly wages than residential construction in both traditional and specialty employment.
- Wage ranges were fairly consistent across all buildings industries. The gap between the 25th and 75th percentile ranged from \$15.48 (specialty residential construction) and \$28.83 (steam and air conditioning supply).
- Nonresidential construction also had higher wage ranges and higher 25th percentile wages than residential construction in both traditional and specialty employment.

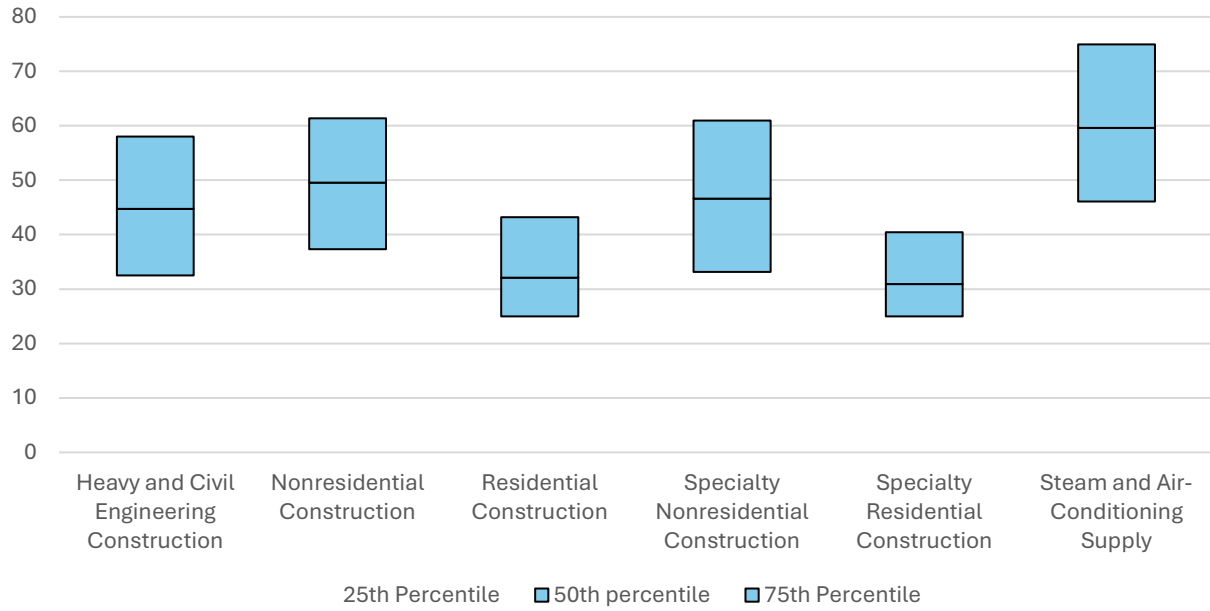
Quarterly wages showed a similar pattern to hourly wages. Residential construction had lower median wages and smaller wage ranges compared to other buildings industries.

- The highest median quarterly wage in 2024 Q2 was in steam and air conditioning supply at \$29,669 (\$9,890 per month).
- The lowest median quarterly wage was in specialty residential construction at \$12,113 (\$4,038 per month).

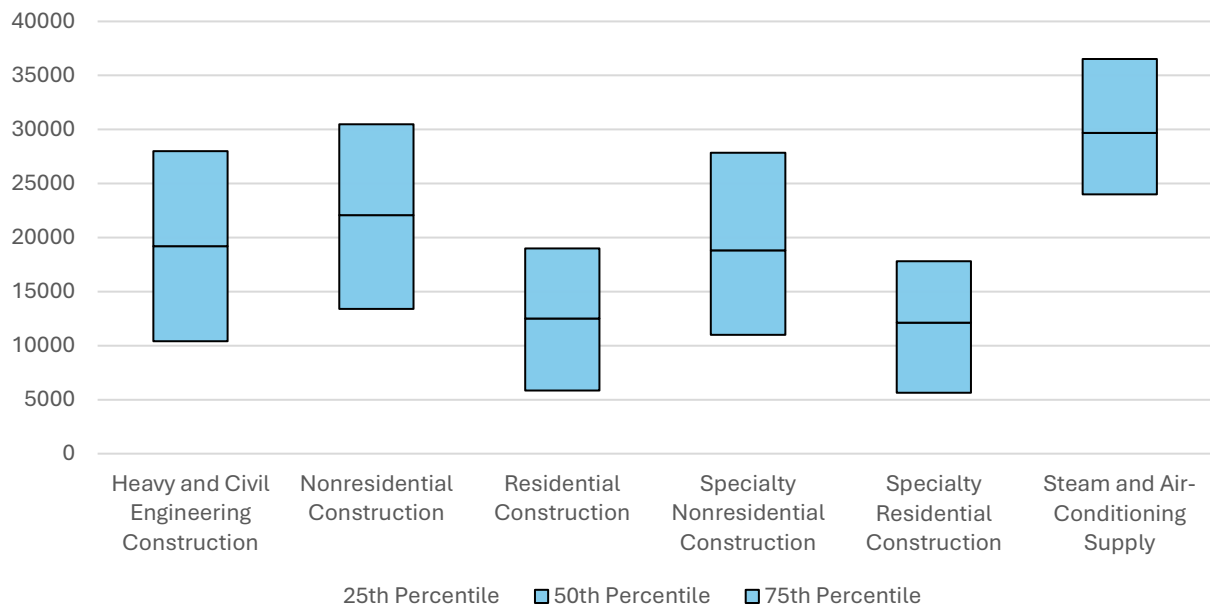
The buildings sector had a high proportion (48%) of part-time workers across all industries in 2024 Q2.

- The proportion of part-time workers ranged from 35% (nonresidential construction) to 56% (specialty residential construction).
- Average hourly wages for full-time workers were higher than for part-time workers across all buildings industries. The gap between full and part-time hourly wages ranged from \$2.79 (specialty residential construction) to \$7.38 (residential construction).

Hourly Wage 25th, 50th and 75th Percentile, Buildings



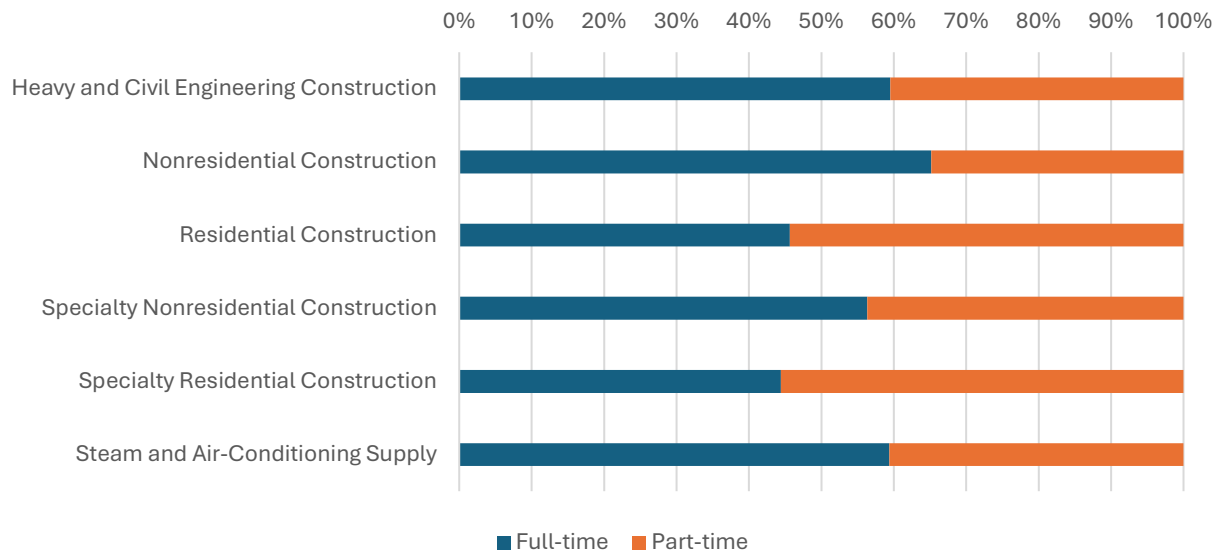
Quarterly Wage 25th, 50th and 75th Percentile, Buildings



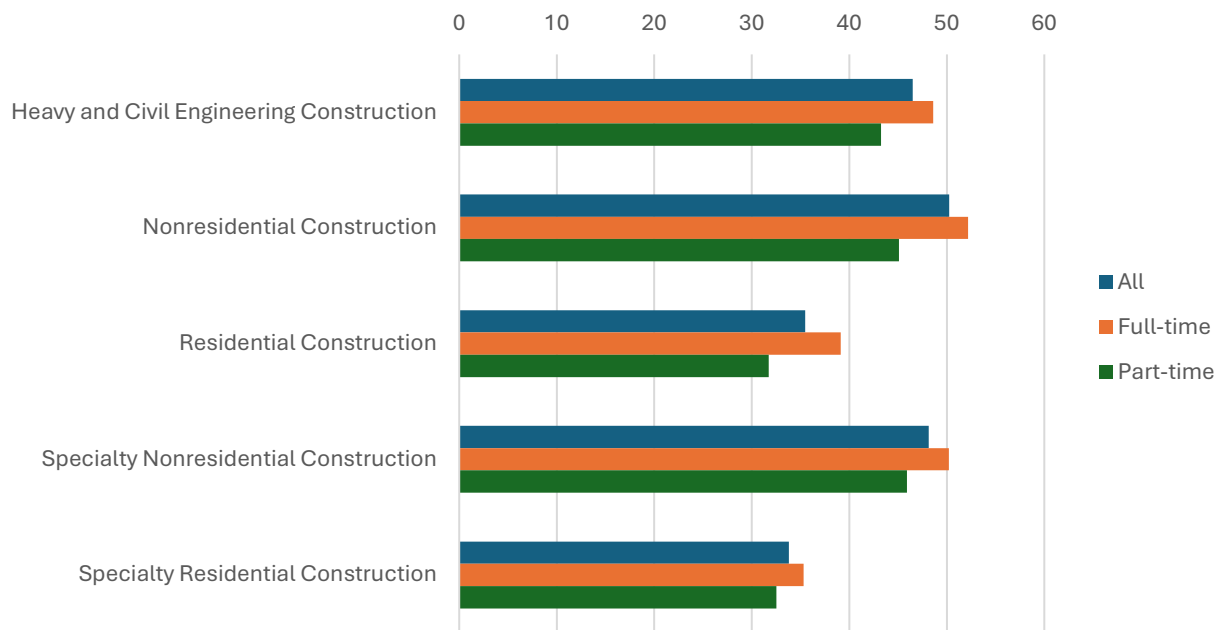
Buildings Hourly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Heavy and Civil Engineering Construction	22708	46.51	32.49	44.72	58.03
Nonresidential Construction	20863	50.23	37.31	49.58	61.34
Residential Construction	36103	35.48	25	32.1	43.23
Specialty Nonresidential Construction	70696	48.16	33.13	46.59	60.97
Specialty Residential Construction	82718	33.8	24.95	30.94	40.43
Steam and Air-Conditioning Supply	27	60.73	46.11	59.62	74.94

Buildings Quarterly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Heavy and Civil Engineering Construction	23628	19862	10410	19205	28009
Nonresidential Construction	24175	22217	13400	22076	30489
Residential Construction	38669	13382	5853	12499	18980
Specialty Nonresidential Construction	72196	19778	10990	18806	27855
Specialty Residential Construction	88156	12577	5645	12113	17816
Steam and Air-Conditioning Supply	34	29897	23997	29669	36529

Full Time vs. Part Time, Buildings



Average Hourly Wage by Hours Worked, Buildings



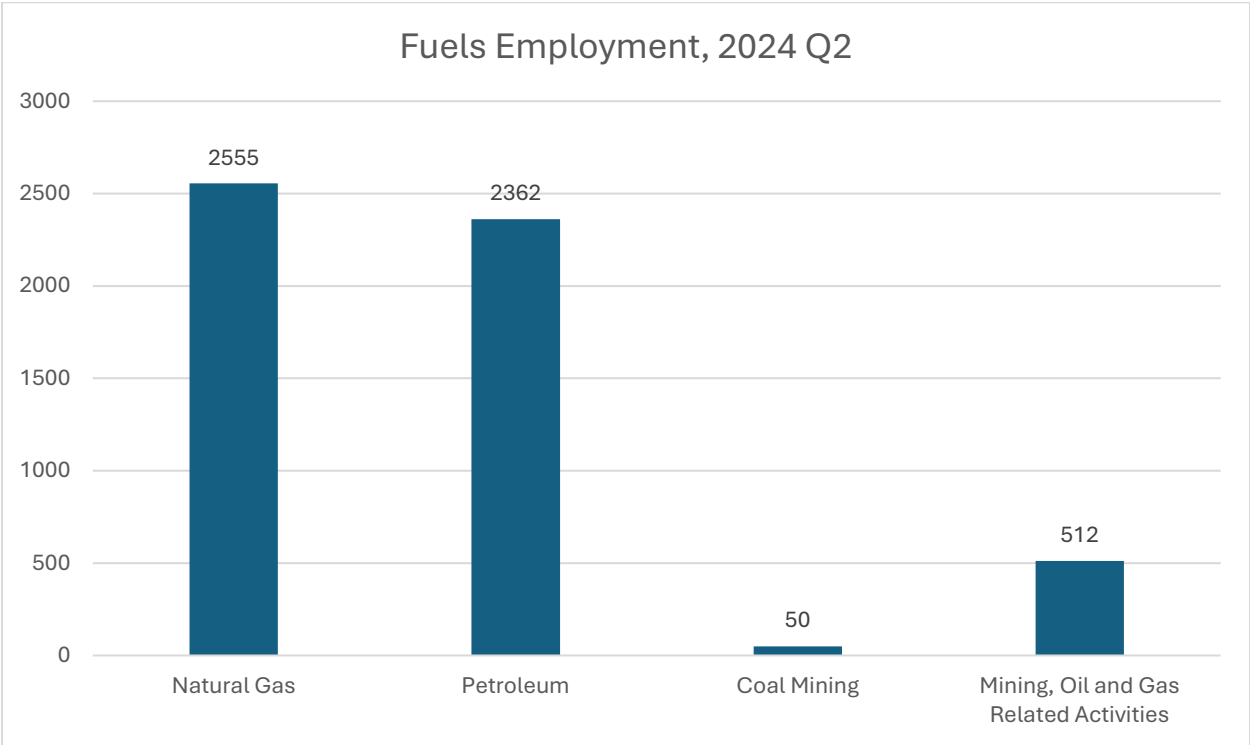
Fuels

Employment in the fuels sector is comprised of industries related to natural gas, petroleum, coal mining, and other mining or oil and gas related activities. With the exception of coal mining, each subsector contains several related industries. For example, natural gas employment contains natural gas extraction, natural gas distribution, and pipeline transport of natural gas. A full listing of detailed industries can be seen in the wage tables below.

Employment Snapshot

Employment in the fuels sector was 5,479 in 2024 Q2.

- Natural gas was the largest industry at 2555 jobs (47%), followed closely by petroleum at 2362 jobs (43%).
- Coal mining was the smallest industry at 50 jobs (1%).



Wages

Median hourly wages vary significantly by industry.

- The highest median hourly wage was in petroleum refineries, at \$67.27 per hour in 2024 Q2.

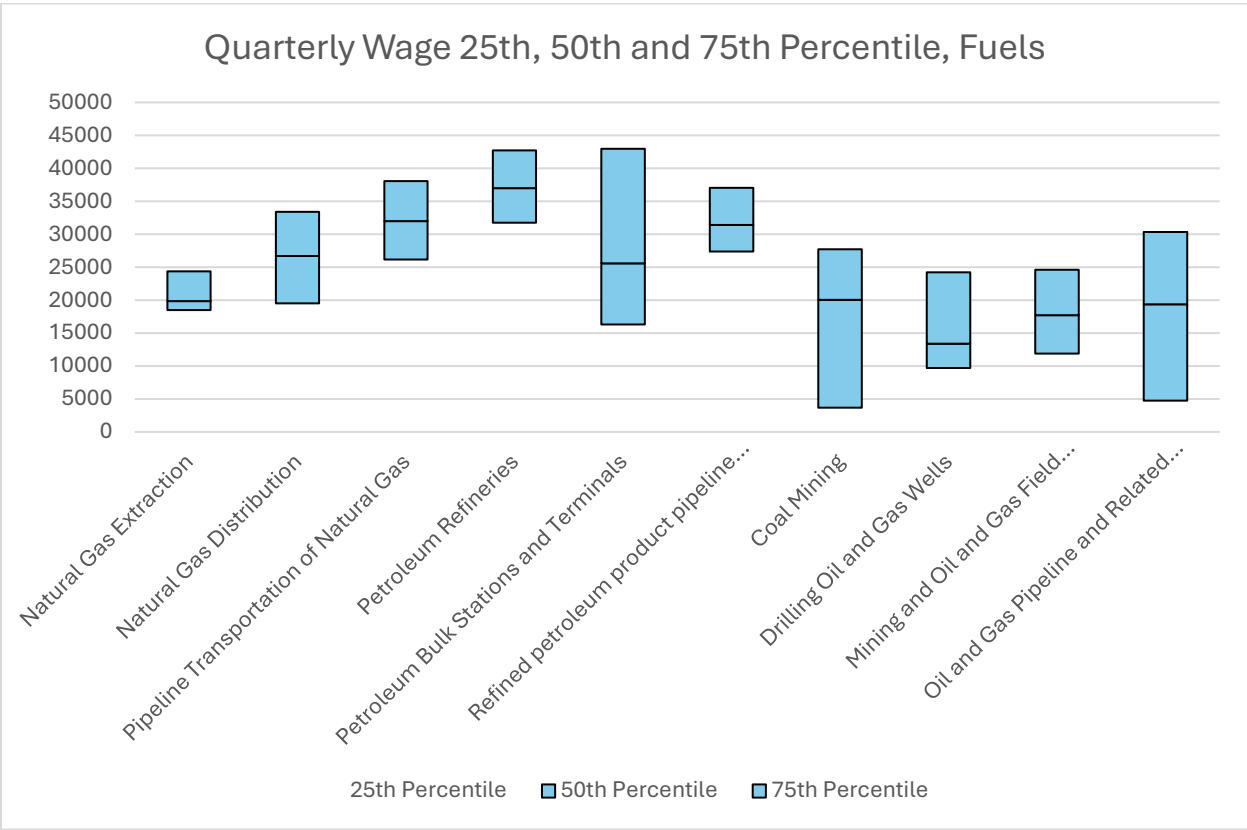
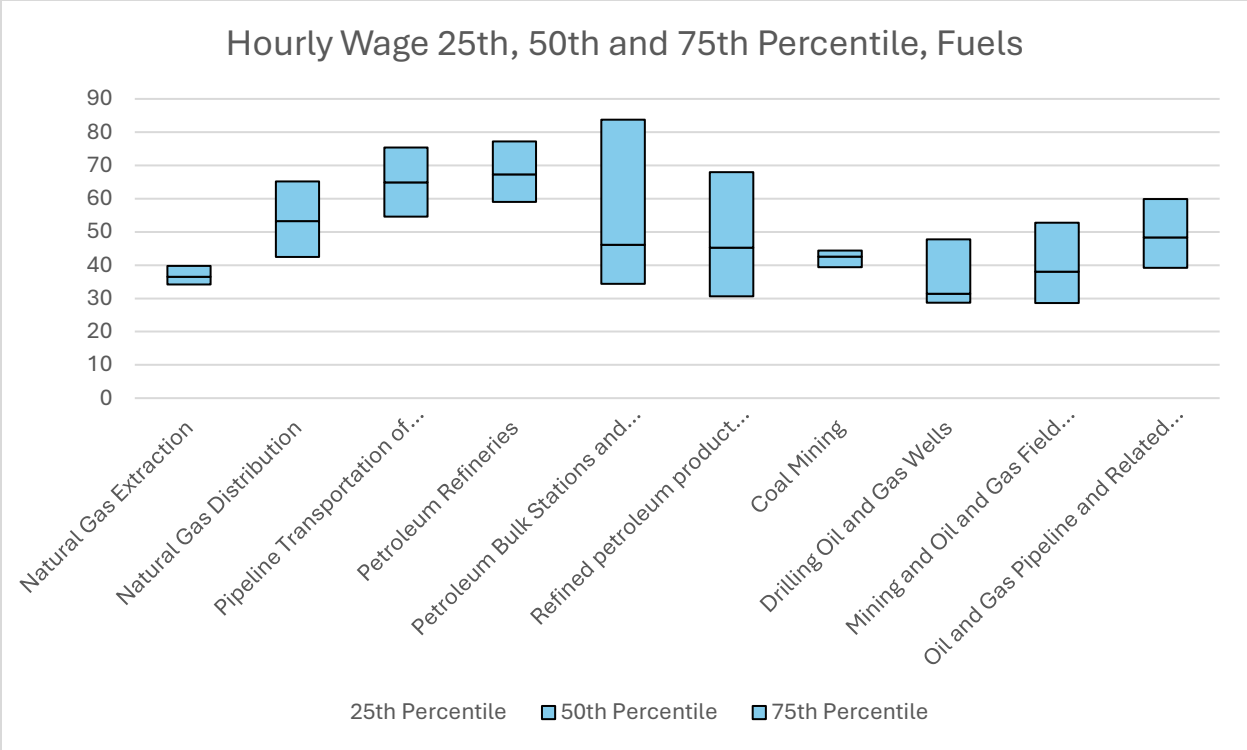
- The lowest median hourly wage was in drilling oil and gas wells, at \$31.35 per hour.
- The widest range for hourly median wages was in petroleum bulk stations and terminals, with a \$49.36 difference between the 25th and 75th percentiles.
- The narrowest range for hourly median wages was in coal mining, with a \$5.03 difference.
- Natural gas had the most wage variation across detailed industries, though the majority of employment (2,349 jobs) was in natural gas distribution.

Median quarterly wages show a similar pattern to hourly, though the range on some industries is much higher due to differences in part-time vs. full-time work.

- The highest median quarterly wage was in petroleum refineries at \$37,009 (\$12,336 per month).
- The lowest median quarterly wage was in drilling oil and gas wells at \$13,412 (\$4,471 per month).

Staffing patterns tended toward full-time employment in the natural gas and petroleum industries. Coal mining and mining, oil, and gas related activities has higher proportions of part-time employment.

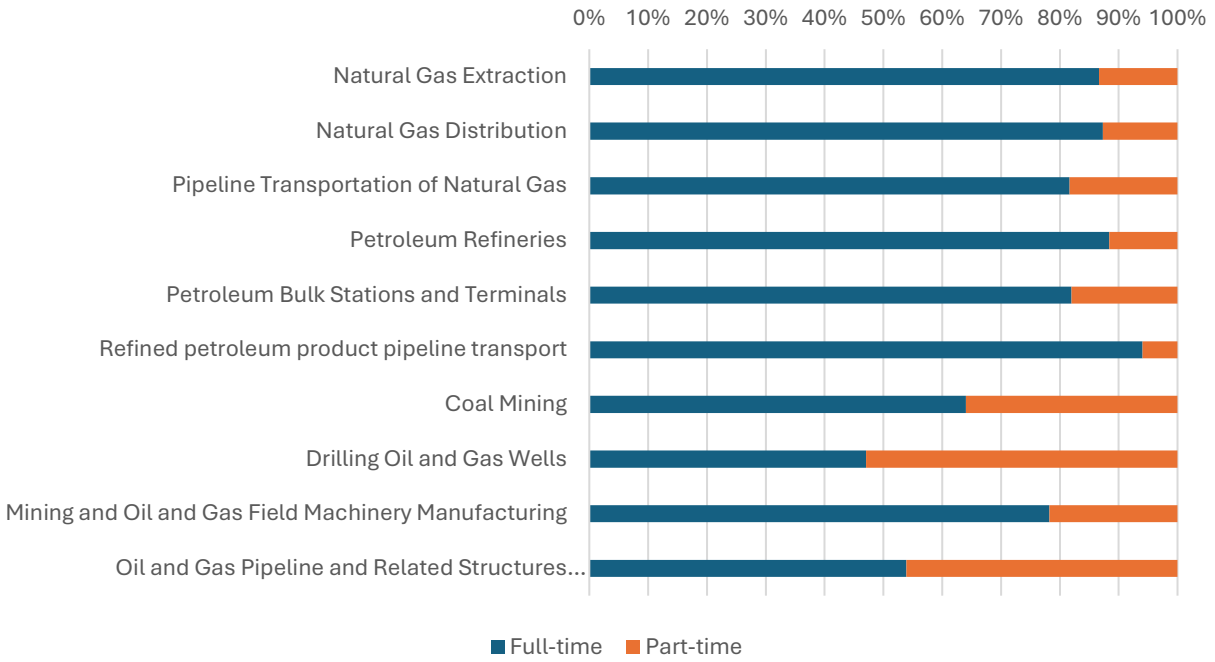
- The highest proportion of part-time jobs was in drilling oil and gas wells (53%) and oil and gas pipeline and related structures construction (46%).
- Full-time employment had higher average hourly wages than part-time in six industries, and lower wages in two. Natural gas extraction was excluded due to low part-time employment.



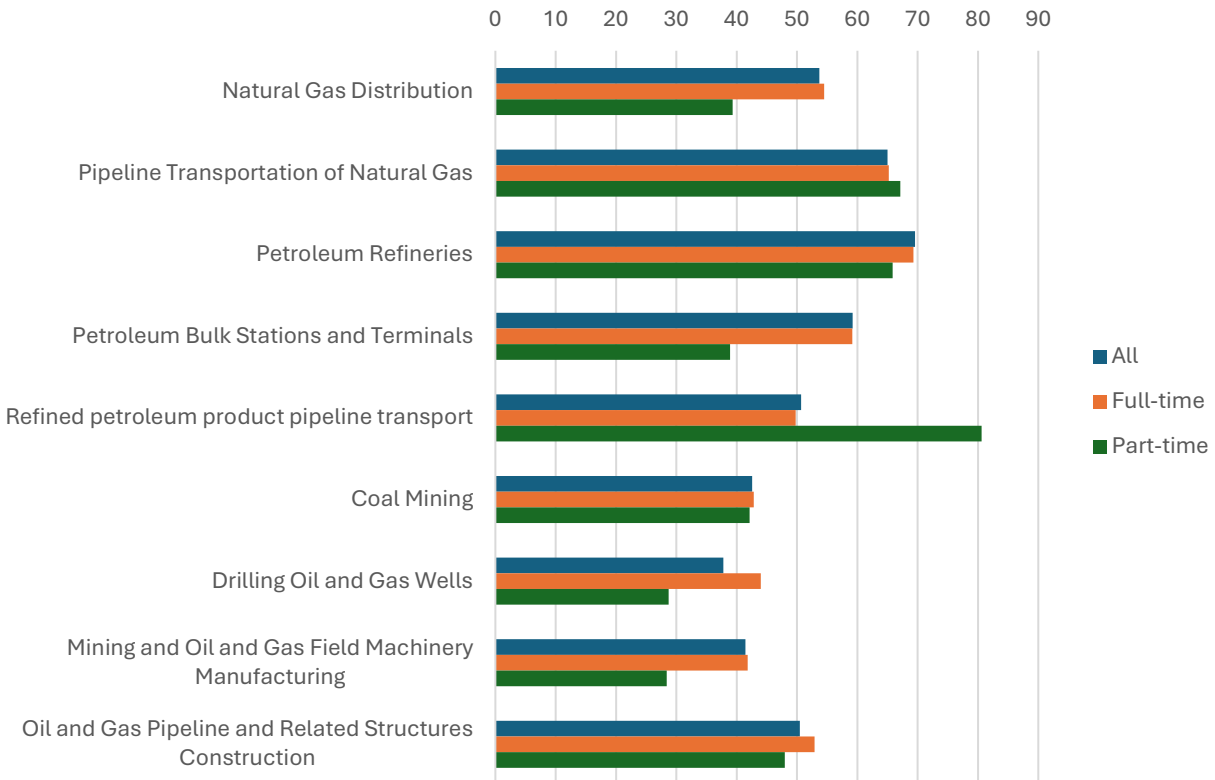
Fuels Hourly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Natural Gas Extraction	12	38.41	34.23	36.51	39.79
Natural Gas Distribution	2040	53.7	42.46	53.27	65.22
Pipeline Transportation of Natural Gas	125	64.98	54.61	64.87	75.37
Petroleum Refineries	786	69.57	58.99	67.27	77.18
Petroleum Bulk Stations and Terminals	1065	59.23	34.42	46.15	83.78
Refined petroleum product pipeline transport	116	50.67	30.63	45.28	68.01
Coal Mining	42	42.59	39.35	42.53	44.38
Drilling Oil and Gas Wells	16	37.79	28.73	31.35	47.77
Mining and Oil and Gas Field Machinery Manufacturing	62	41.46	28.56	38.06	52.76
Oil and Gas Pipeline and Related Structures Construction	392	50.49	39.17	48.34	59.92

Fuels Quarterly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Natural Gas Extraction	13	21409	18506	19828	24345
Natural Gas Distribution	2349	26220	19525	26688	33382
Pipeline Transportation of Natural Gas	147	32263	26156	31988	38035
Petroleum Refineries	843	37224	31744	37009	42734
Petroleum Bulk Stations and Terminals	1271	29790	16311	25586	42981
Refined petroleum product pipeline transport	114	31804	27359	31404	37031
Coal Mining	48	19299	3687	20045	27722
Drilling Oil and Gas Wells	16	15528	9707	13412	24225
Mining and Oil and Gas Field Machinery Manufacturing	75	18509	11894	17702	24626
Oil and Gas Pipeline and Related Structures Construction	405	20133	4723	19350	30349

Full Time vs. Part Time, Fuels



Average Hourly Wage by Hours Worked, Fuels



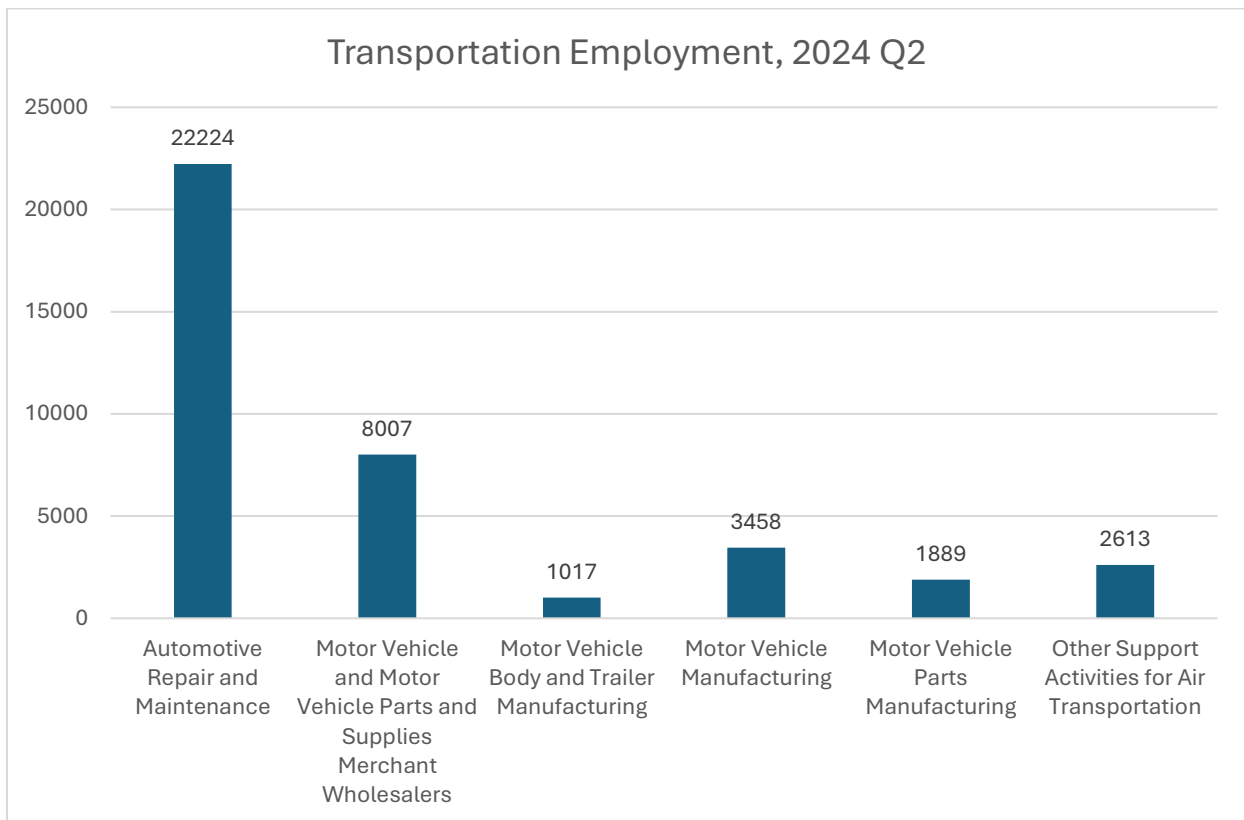
Transportation

The transportation sector consists of activities relates to motor vehicle manufacturing, motor vehicle parts, and automotive repair and maintenance. Support activities for air transport are also included. Other aspects of air transportation are excluded because they have not been a focus of previous (USEER and NZNW) reports, though this may be an area of interest in Washington state for future analysis.

Employment Snapshot

Employment in the transportation sector was 39,208 in 2024 Q2.

- The largest industry was automotive repair and maintenance (22,224 jobs, or 57%).
- The smallest industry was motor vehicle body and trailer manufacturing (1,017 jobs, or 3%).
- Employment in other support activities for air transportation was 2,613 jobs (7%).



Wages

Median hourly wages in the transportation sector were generally lower, with most wages between \$24 and \$27 per hour. All but one industry had a median hourly wage below \$31 per hour.

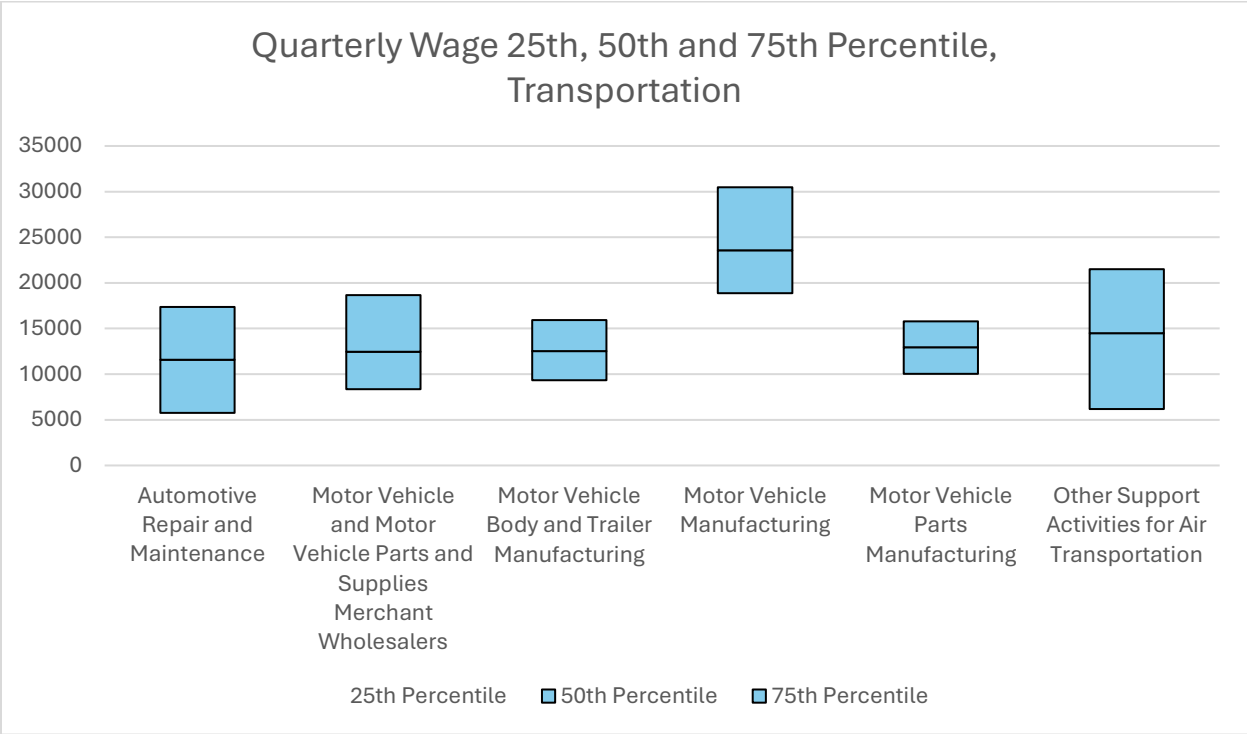
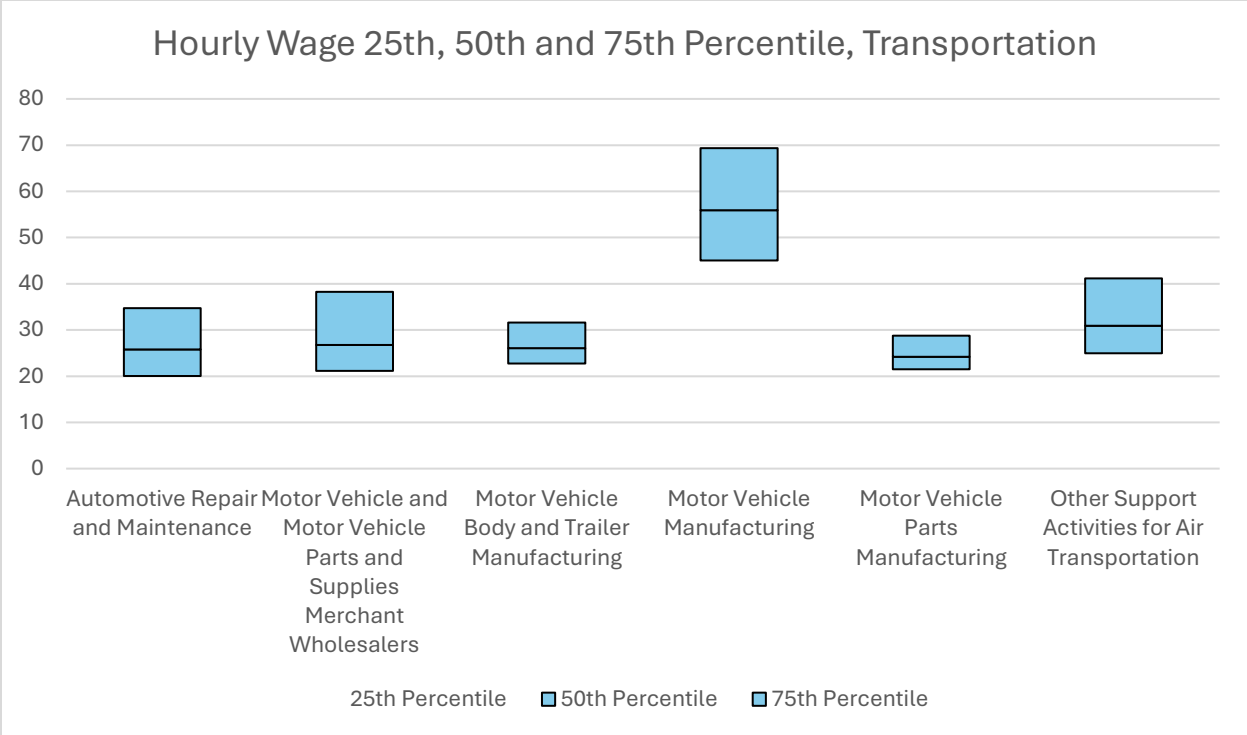
- The highest median hourly wage was in motor vehicle manufacturing, at \$55.89 per hour in 2024 Q2.
- The lowest median hourly wage was in motor vehicle parts manufacturing, at \$24.22 per hour.
- While the range of wages was similar across industries in terms of width, wages in motor vehicle manufacturing were \$25-\$30 higher in every percentile.

Quarterly median wages showed a similar pattern.

- Motor vehicle manufacturing had the highest wage in every percentile group. The median quarterly wage was \$23,571, or \$7,857 per month.
- The lowest median quarterly wage was in automotive repair and maintenance, at \$11,566 (\$3,855 per month).
- The gap between the 25th and 75th percentile ranged from \$5,731 per quarter (motor vehicle parts manufacturing) to \$15,322 (other support activities for air transportation).

Full-time status varied significantly across industries. Average hourly wages for full-time employment were higher than for part-time employment in every industry.

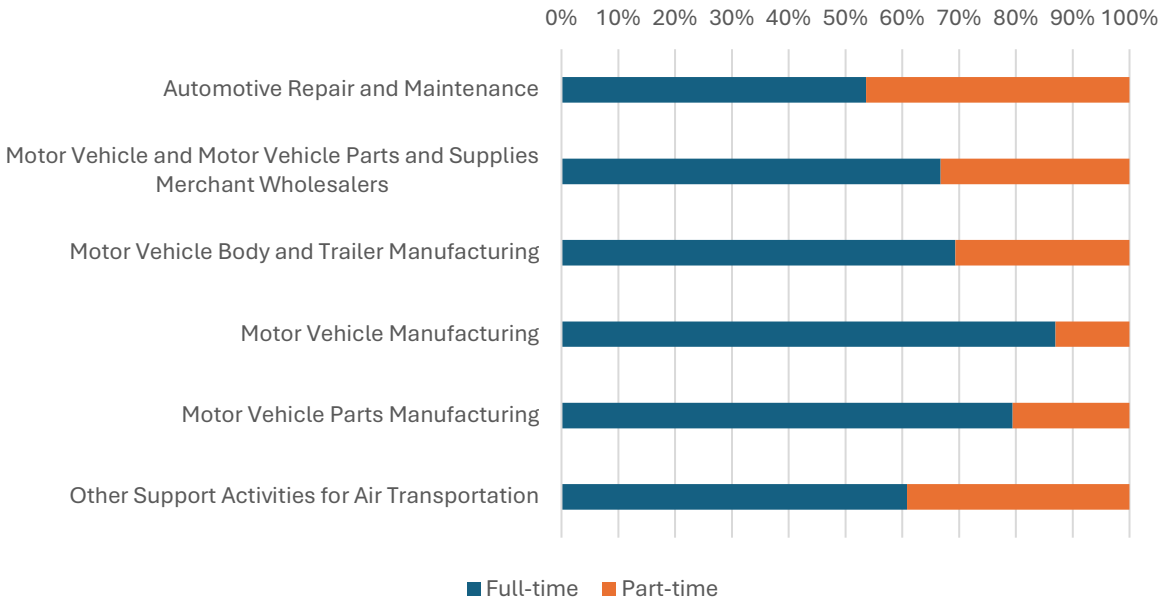
- Percentage of part time workers ranged from 13% (motor vehicle manufacturing) to 46% (automotive repair and maintenance).
- The gap in average hourly wages between full and part-time jobs ranged from \$4.80 in motor vehicle body and trailer manufacturing to \$13.61 in motor vehicle manufacturing.



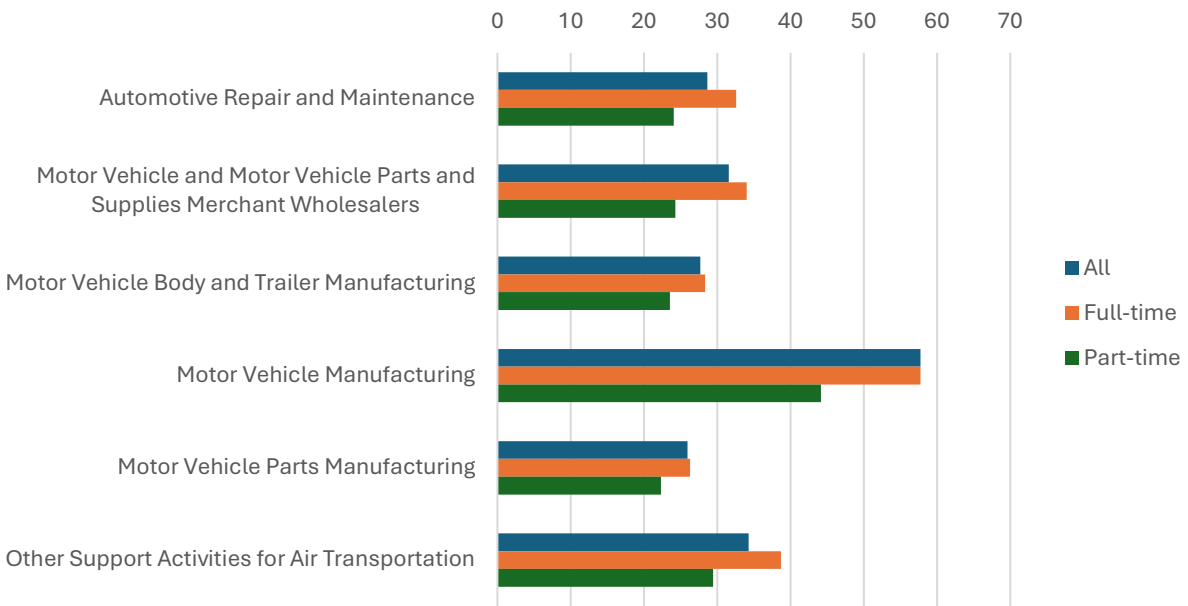
Transportation Hourly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Automotive Repair and Maintenance	19904	28.64	20.02	25.79	34.69
Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	6246	31.57	21.12	26.77	38.28
Motor Vehicle Body and Trailer Manufacturing	807	27.71	22.71	26.07	31.62
Motor Vehicle Manufacturing	2033	57.75	45.02	55.89	69.35
Motor Vehicle Parts Manufacturing	1420	25.95	21.51	24.22	28.76
Other Support Activities for Air Transportation	2338	34.29	24.98	30.91	41.13

Transportation Quarterly Wage, 2024 Q2					
Industry Title	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Automotive Repair and Maintenance	20817	12304	5764	11566	17350
Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	7318	13959	8365	12447	18663
Motor Vehicle Body and Trailer Manufacturing	957	12385	9342	12516	15917
Motor Vehicle Manufacturing	3298	24318	18890	23571	30484
Motor Vehicle Parts Manufacturing	1738	12878	10044	12959	15775
Other Support Activities for Air Transportation	2446	15220	6169	14486	21491

Full Time vs. Part Time, Transportation



Average Hourly Wage by Hours Worked, Transportation



NAICS Codes used in Wage Record Analysis			
NAICS	Title	Employees	Category
221330	Steam and Air-Conditioning Supply	34	Buildings
2361xx	Residential Construction	39514	Buildings
2362xx	Nonresidential Construction	24331	Buildings
237xxx	Heavy and Civil Engineering Construction	24024	Buildings
238xx1	Specialty Residential Construction	89874	Buildings
238xx2	Specialty Nonresidential Construction	72637	Buildings
221111	Hydroelectric Power Generation	1909	Electricity
221112	Fossil Fuel Electric Power Generation	131	Electricity
221114	Solar Electric Power Generation	47	Electricity
221115	Wind Electric Power Generation	49	Electricity
221117	Biomass Electric Power Generation	6	Electricity
221118	Other Electric Power Generation	14	Electricity
221121	Electric Bulk Power Transmission and Control	285	Electricity
221122	Electric Power Distribution	7411	Electricity
23713x	Power and Communication Line and Related Structures Construction	4556	Electricity
33591x	Battery Manufacturing	56	Electricity
211130	Natural Gas Extraction	15	Fuels
213111	Drilling Oil and Gas Wells	17	Fuels
213112	Support Activities for Oil and Gas Operations	5	Fuels
221210	Natural Gas Distribution	2382	Fuels
324110	Petroleum Refineries	922	Fuels
424710	Petroleum Bulk Stations and Terminals	1322	Fuels
486910	Refined petroleum product pipeline transport	118	Fuels
2121xx	Coal Mining	50	Fuels
23712x	Oil and Gas Pipeline and Related Structures Construction	412	Fuels
33313x	Mining and Oil and Gas Field Machinery Manufacturing	78	Fuels
4862xx	Pipeline Transportation of Natural Gas	158	Fuels
488190	Other Support Activities for Air Transportation	2613	Transportation
3361xx	Motor Vehicle Manufacturing	3458	Transportation
3362xx	Motor Vehicle Body and Trailer Manufacturing	1017	Transportation
3363xx	Motor Vehicle Parts Manufacturing	1889	Transportation
4231xx	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	8007	Transportation
8111xx	Automotive Repair and Maintenance	22224	Transportation

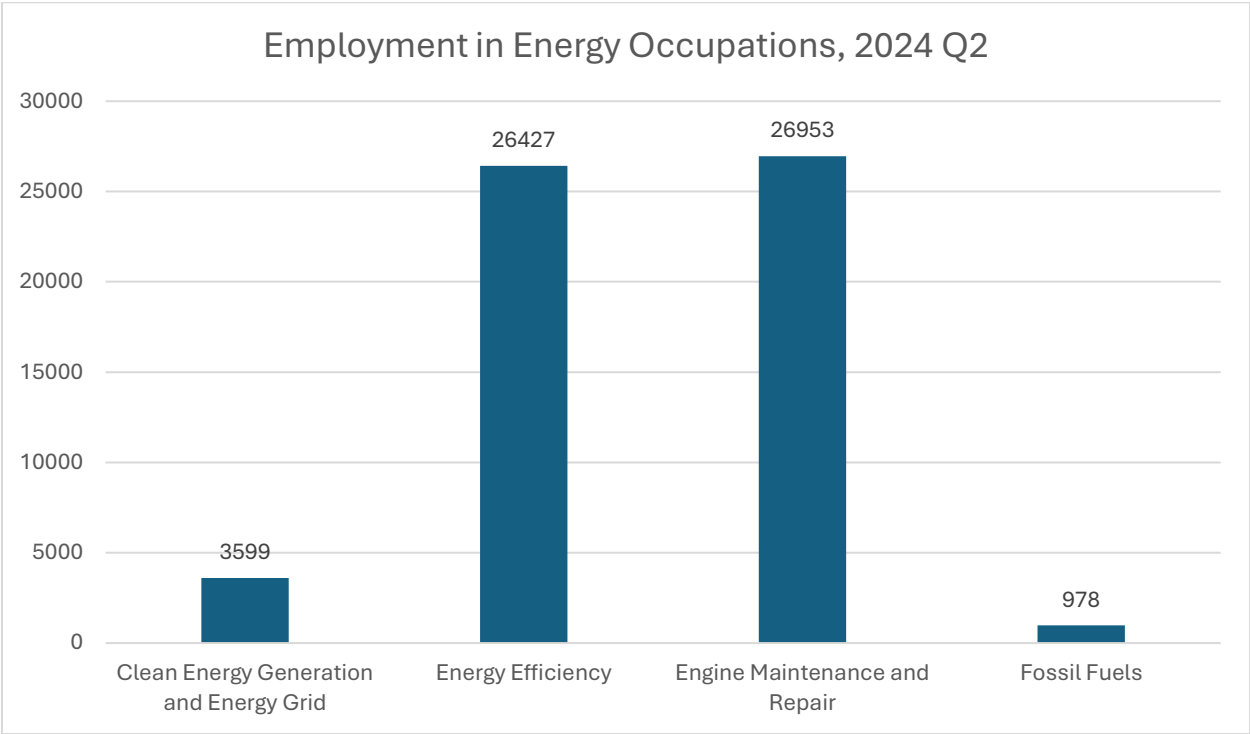
Occupational Employment and Wages

Energy related occupations consist of four main categories:

- 1) **Clean energy generation and energy grid occupations** are workers directly involved with solar, wind, or nuclear power, power generation of any kind, or power distribution and power line installation and maintenance.
- 2) **Energy efficiency occupations** consist of electricians, heating and cooling workers, and roofing or insulation workers.
- 3) **Engine maintenance and repair occupations** are workers involved in maintenance and repair of motor vehicles and other forms of engine-based transportation.
- 4) **Fossil fuel occupations** are workers involved with petroleum-based technologies.

These definitions are not exhaustive of the clean energy sector, nor do they attempt to be. Similarly, the aggregation method above is just one of many valid ways of categorizing energy employment, and thus the relative proportions should be interpreted carefully. A full list of SOC codes used in this section is at the [end of this chapter](#).

Just as clean energy industries employ many occupations, the occupations identified here span multiple industries. Some occupations have been excluded for confidentiality reasons.



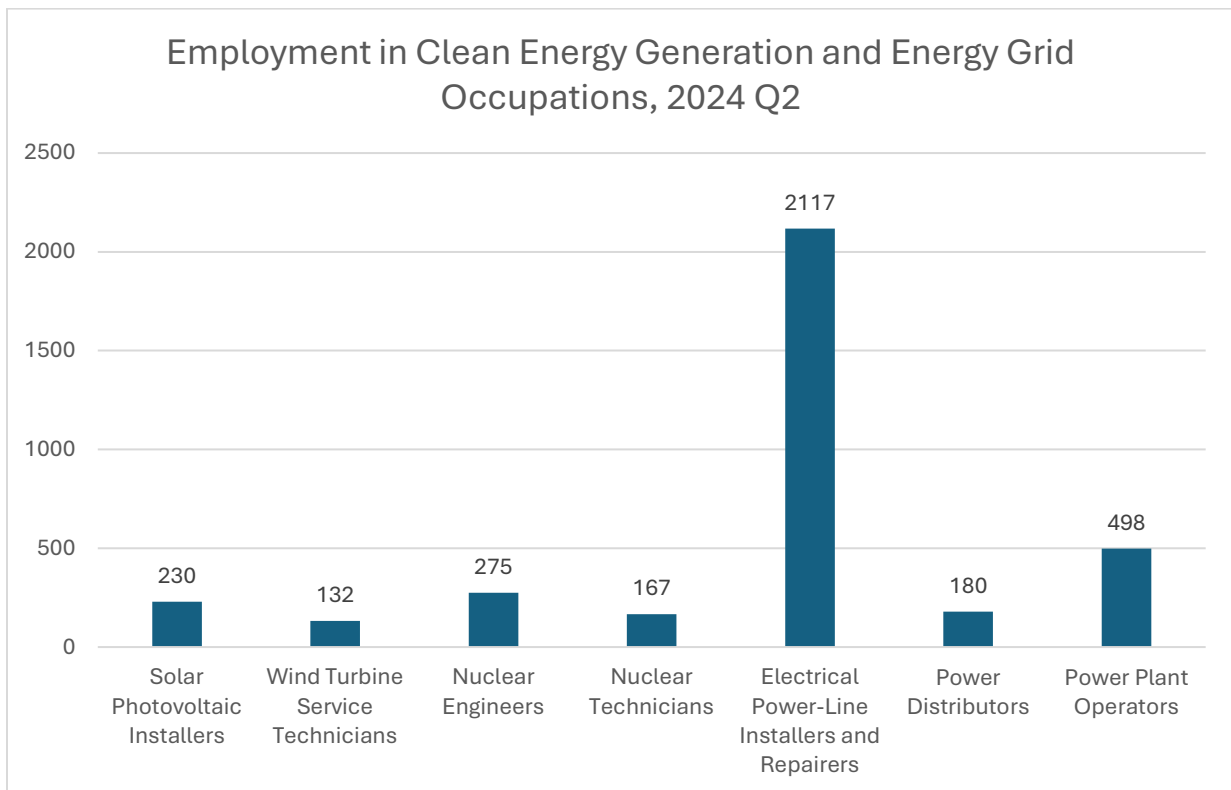
Total employment in all energy occupations was 57,957 in 2024 Q2.

- The largest occupational group was engine maintenance and repair at 26,953 jobs, followed by energy efficiency (26,427 jobs), clean energy generation and energy grid (3,599 jobs) and fossil fuels (978 jobs).

Clean Energy Generation and Energy Grid

Clean energy generation and energy grid occupations are workers directly involved with solar, wind, or nuclear power, power generation of any kind, or power distribution and power line installation and maintenance.

Employment Snapshot



Clean energy generation and energy grid occupations totaled 3,599 jobs in 2024 Q2.

- The largest occupation was electrical power-line installers and repairers at 2,117 jobs (59%).
- The smallest occupation was wind turbine service technicians at 132 jobs (4%).

Wages

Median hourly wages in clean energy vary by occupation, with solar photovoltaic installers and wind turbine service technicians having lower wages than the high-paying nuclear and energy grid occupations.

- Solar photovoltaic installers had a median wage of \$32.50 per hour, and wind turbine service technicians had a median wage of \$34.71 per hour in 2024 Q2. These wages are generally consistent with other installation and repair occupations.
- Power plant operators, power distributors, and power line installers and repairers had some of the highest median wages, at \$70.11, \$67.97 and \$70.17 per hour respectively.

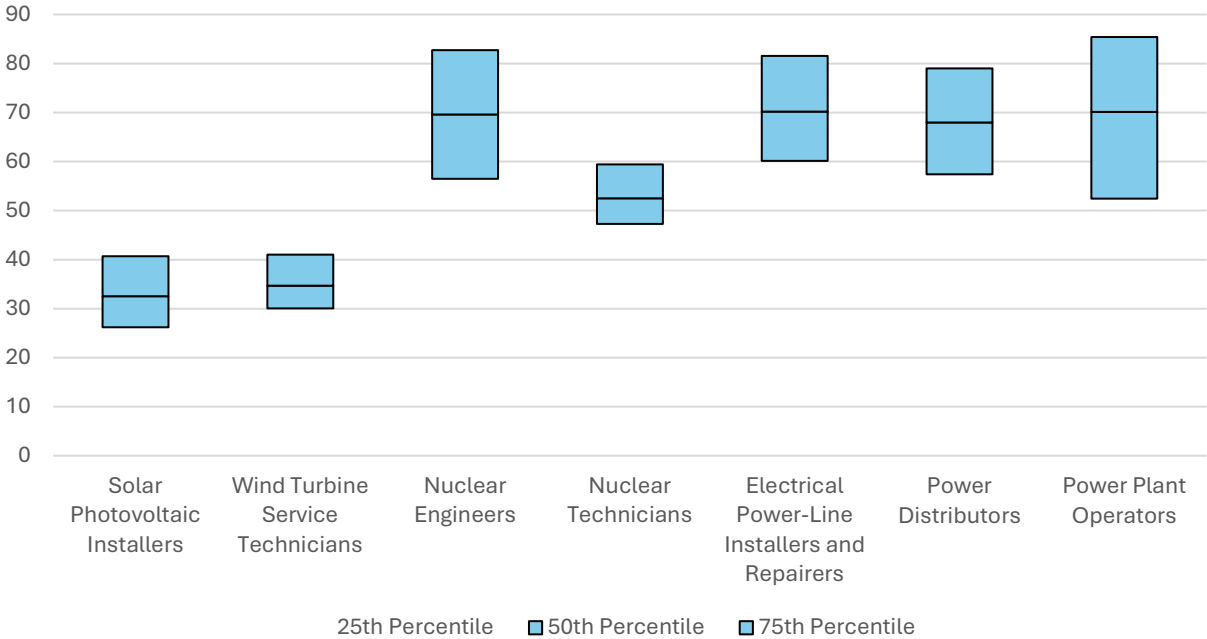
Median quarterly wages were similarly distributed except for wind turbine service technicians, which earned higher wages than solar photovoltaic installers on a quarterly basis compared to hourly.

- The median quarterly wage for solar photovoltaic installers was \$13,475 (\$4,492 per month).
- The median quarterly wage for wind turbine service technicians was \$20,331 (\$6,777 per month).
- Power plant operators, power distributors, and power line installers and repairers all had median quarterly wages around \$36,000 (\$12,000 per month).
- Nuclear engineers had quarterly higher wages than nuclear technicians, though the range of wages was similarly wide.

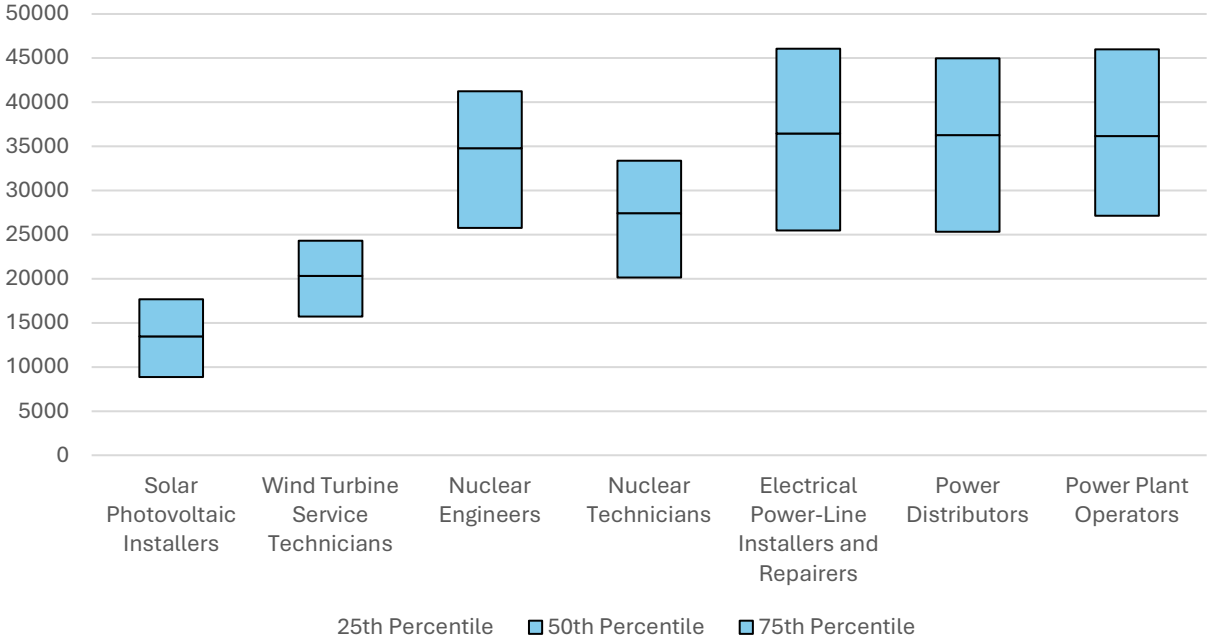
Average hourly wages can vary by employment status. Most employment in clean energy is full time except for solar photovoltaic installers, which was 57% part time.

- Part-time average hourly wages were lower than full-time wages for five occupations, higher for one, and about the same for one.
- The largest gap between average full-time and part-time wages was for power plant operators, at a \$17.62 per hour difference.

Hourly Wage 25th, 50th and 75th Percentile,
Clean Energy Generation and Energy Grid



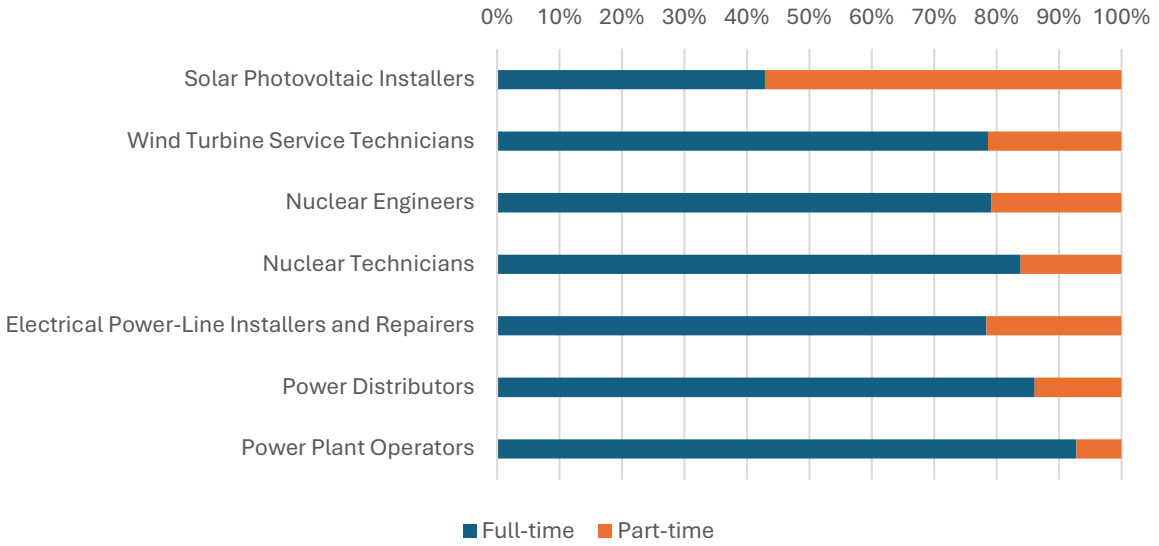
Quarterly Wage 25th, 50th and 75th Percentile,
Clean Energy Generation and Energy Grid



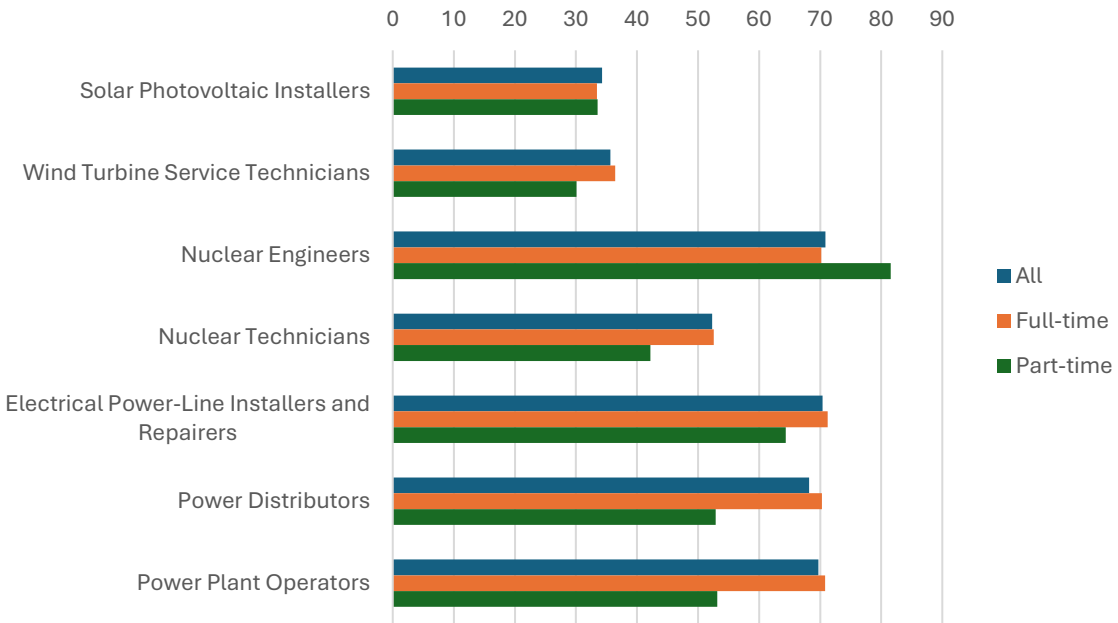
Clean Energy Generation and Energy Grid Hourly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Solar Photovoltaic Installers	198	34.28	26.22	32.54	40.72
Wind Turbine Service Technicians	117	35.64	30.02	34.71	41.01
Nuclear Engineers	223	70.88	56.46	69.63	82.75
Nuclear Technicians	138	52.33	47.29	52.52	59.45
Electrical Power-Line Installers and Repairers	1701	70.38	60.11	70.17	81.55
Power Distributors	142	68.19	57.37	67.97	78.98
Power Plant Operators	434	69.7	52.45	70.11	85.41

Clean Energy Generation and Energy Grid Quarterly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Solar Photovoltaic Installers	219	13553	8880	13475	17689
Wind Turbine Service Technicians	126	19930	15731	20331	24313
Nuclear Engineers	266	33470	25769	34772	41229
Nuclear Technicians	160	26559	20153	27421	33360
Electrical Power-Line Installers and Repairers	2027	35937	25461	36445	46065
Power Distributors	160	36005	25323	36269	44988
Power Plant Operators	473	38032	27123	36183	46009

Full Time vs. Part Time Clean Energy Generation and Energy Grid



Average Hourly Wage by Hours Worked Clean Energy Generation and Energy Grid



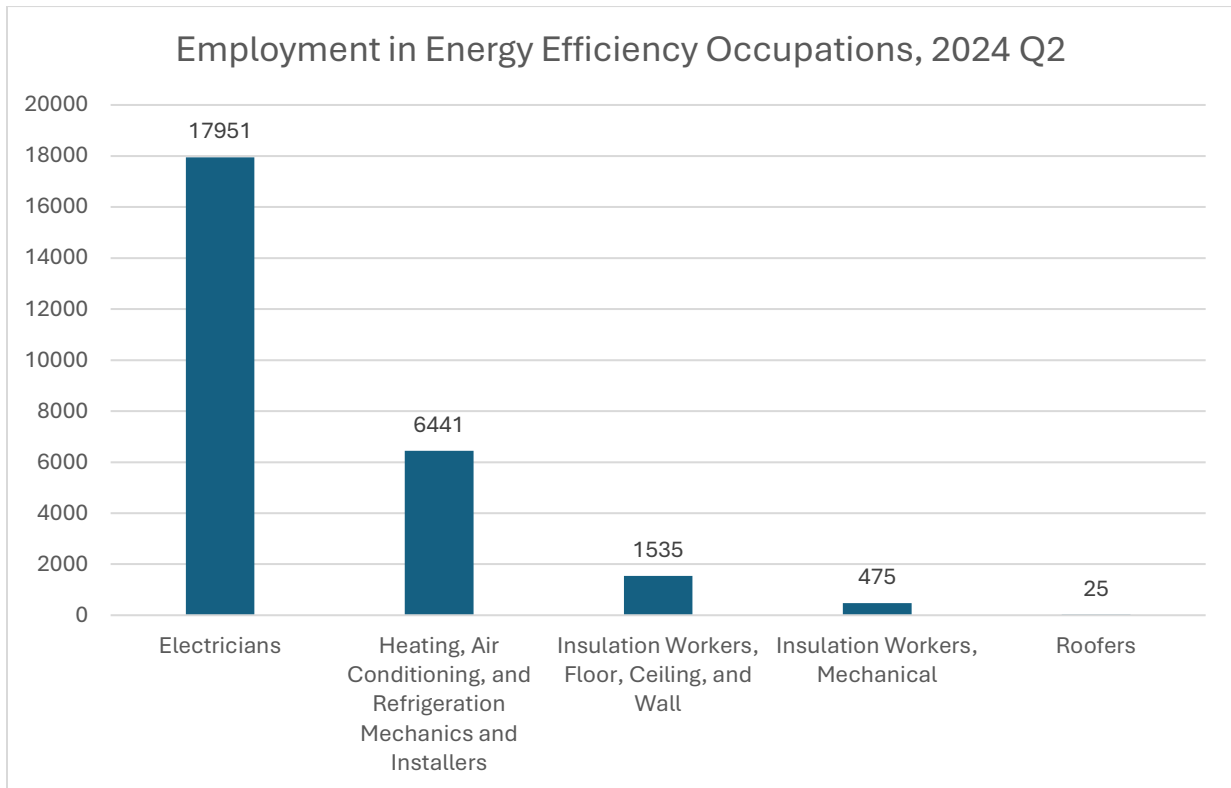
Energy Efficiency

Energy efficiency occupations consist of electricians, heating and cooling workers, and roofing or insulation workers.

Employment Snapshot

Energy efficiency employment was 26,427 in 2024 Q2.

- The largest occupation was electricians, at 17,951 jobs.
- The smallest occupation was roofers, at 25 jobs.



Wages

Median hourly wages differed somewhat by occupation.

- The highest median hourly wage in 2024 Q2 was for electricians, at \$50.82 per hour.
- The lowest median hourly wage was for roofers at \$24.17 per hour.
- The gap between the 25th and 75th percentile ranged from \$11.65 for roofers to \$28.35 for electricians.

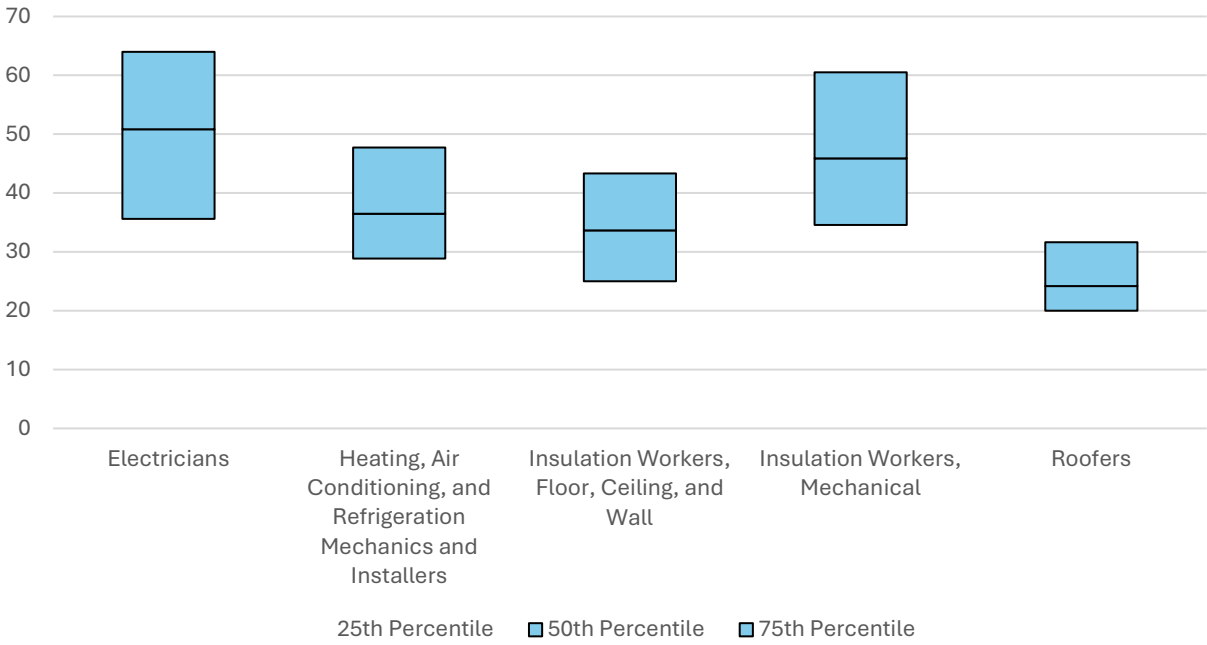
Median quarterly wages showed significant variation depending on the prevalence of part-time jobs.

- The highest median quarterly range in 2024 Q2 was for electricians at \$20,449 (\$6,816 per month).
- The lowest median quarterly wage was for roofers at \$6,878 (\$2,293 per month).
- The gap between the 25th and 75th percentile quarterly wage ranged from \$10,473 for roofers to \$17,950 for electricians.

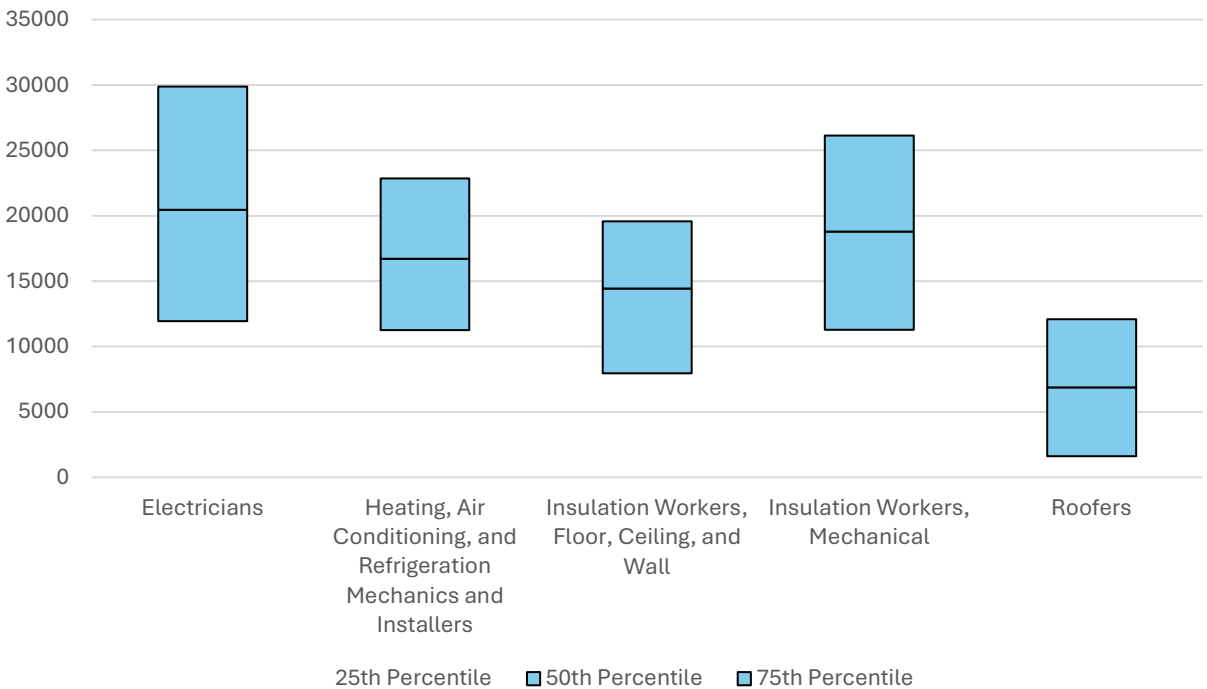
44% of jobs in energy efficiency occupations are part time, though average hourly wages did not differ significantly for most occupations.

- The proportion of part-time jobs varied from 39% for heating, air conditioning, and refrigeration mechanics and installers, to 88% for roofers. However, roofers were a small fraction of overall jobs. The next highest proportion of part-time jobs was 55% for mechanical insulation workers.
- Aside from roofers, all other occupations had a \$4 or less difference in average hourly wages between full-time and part-time jobs.

Hourly Wage 25th, 50th and 75th Percentile,
Energy Efficiency



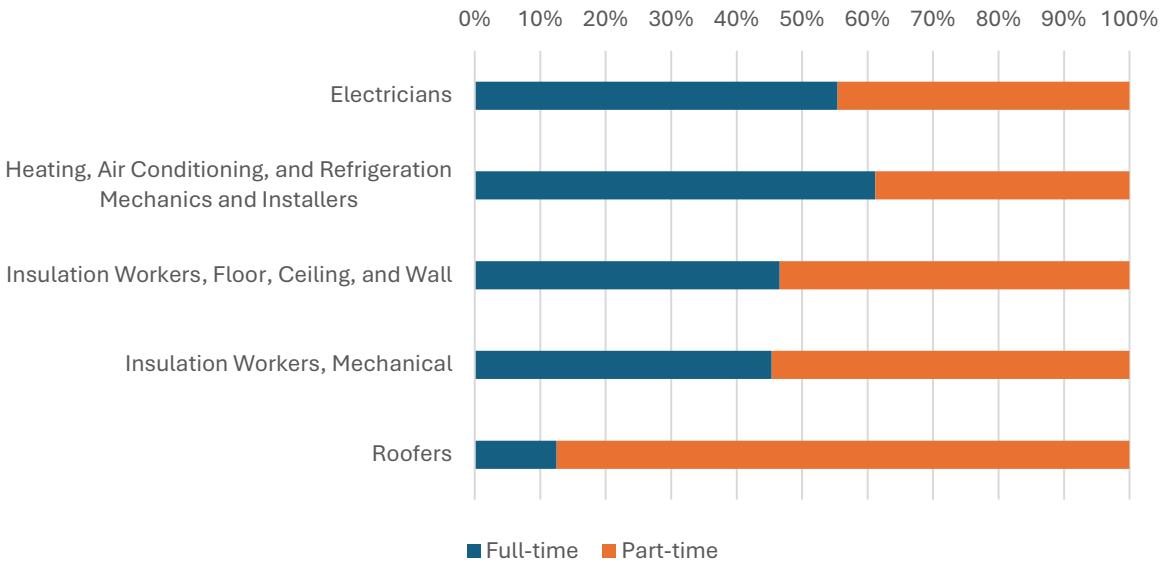
Quarterly Wage 25th, 50th and 75th Percentile,
Energy Efficiency



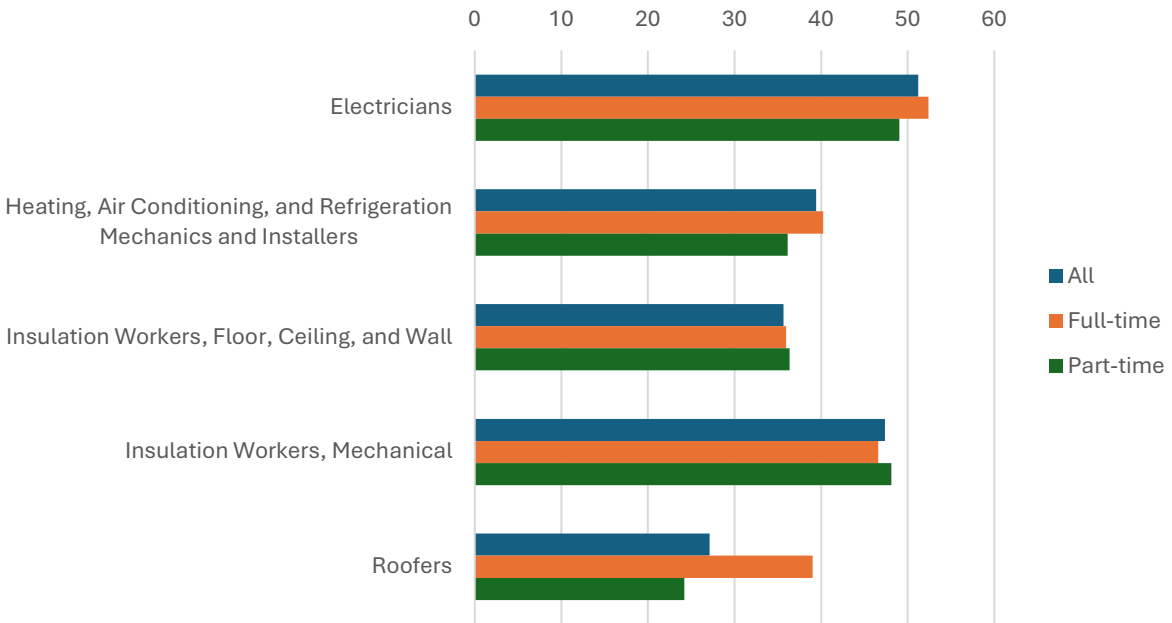
Energy Efficiency Hourly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Electricians	16713	51.21	35.63	50.82	63.98
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	5557	39.41	28.84	36.49	47.74
Insulation Workers, Floor, Ceiling, and Wall	1482	35.64	25	33.64	43.31
Insulation Workers, Mechanical	463	47.36	34.58	45.87	60.5
Roofers	22	27.13	20	24.17	31.65

Energy Efficiency Quarterly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Electricians	17735	21279	11935	20449	29885
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	6274	17219	11268	16719	22855
Insulation Workers, Floor, Ceiling, and Wall	1522	14127	7946	14443	19574
Insulation Workers, Mechanical	473	18324	11292	18786	26149
Roofers	22	7288	1610	6878	12083

Full Time vs. Part Time Energy Efficiency

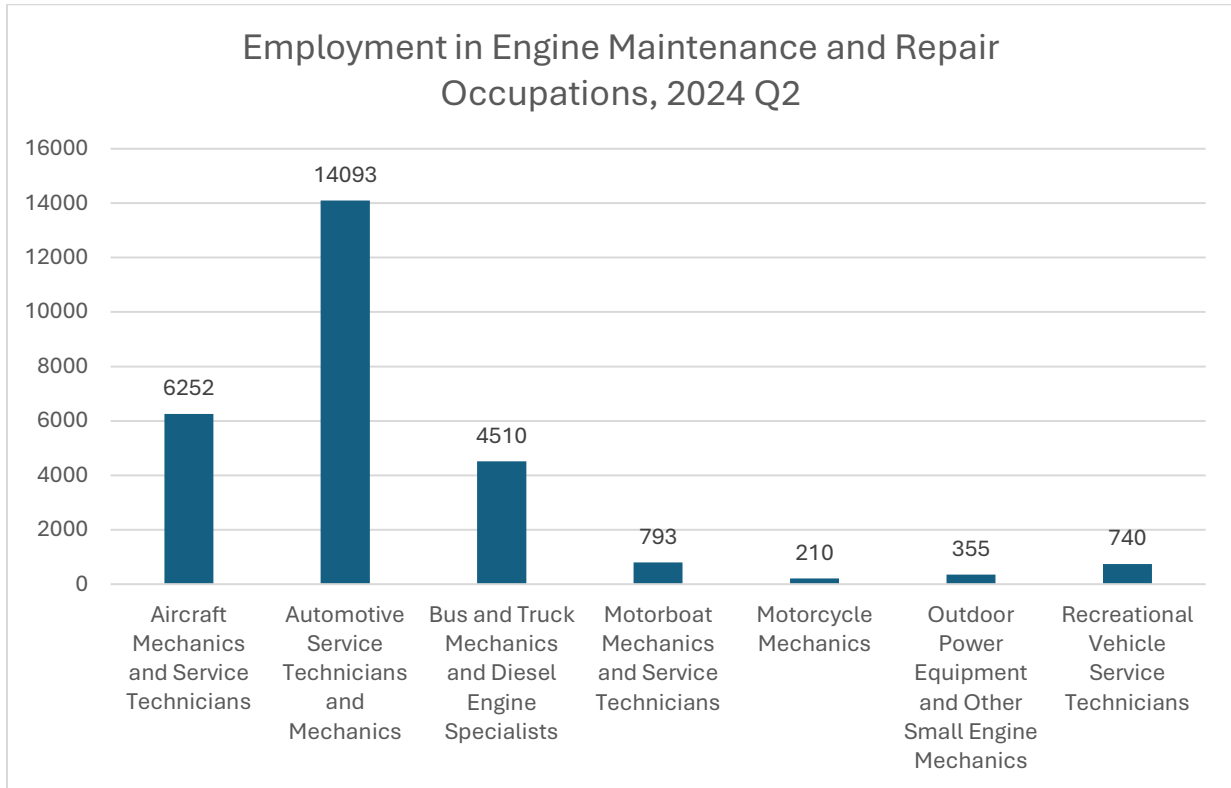


Average Hourly Wage by Hours Worked Energy Efficiency



Engine Maintenance and Repair

Engine maintenance and repair occupations are workers involved in maintenance and repair of motor vehicles and other forms of engine-based transportation.



Employment Snapshot

Total employment in engine maintenance and repair occupations was 26,953 in 2024 Q2.

- The largest occupation was automotive service technicians and mechanics, at 14,093 jobs.
- The smallest occupation was motorcycle mechanics, at 210 jobs.

Wages

Median hourly wages were generally in the lower range, with median wages below \$30 per hour in four of the seven occupations.

- The highest median hourly wage in 2024 Q2 was aircraft mechanics and service technicians at \$52.50 per hour.
- The lowest median hourly wage was for motorcycle mechanics, at \$24.78 per hour.
- The gap between the 25th and 75th percentile ranged from \$10.81 for outdoor power equipment and other small engine mechanics to \$21.59 for aircraft mechanics and service technicians.

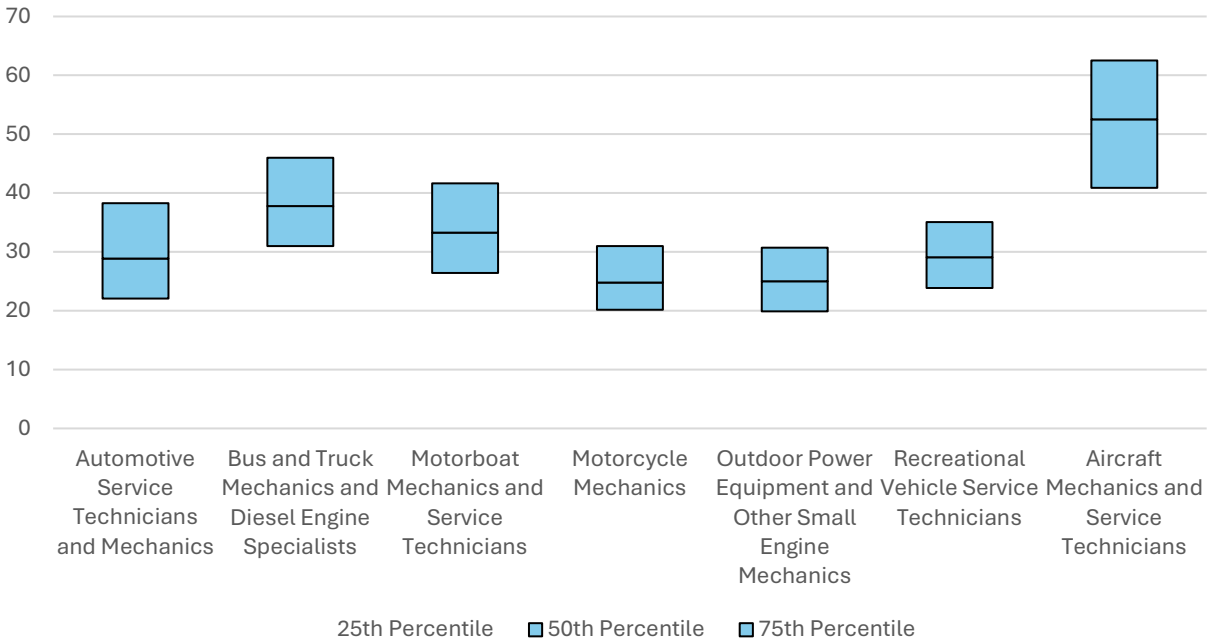
Median quarterly wages followed a similar distributional pattern.

- The highest median quarterly wage was for aircraft mechanics and service technicians at \$28,605, or \$9,535 per month.
- The lowest median quarterly wage was for motorcycle mechanics at \$10,978, or \$3,659 per month.
- Most occupations had a difference of \$7,000 to \$10,000 per quarter between the 25th and 75th percentiles. Aircraft mechanics and service technicians were the exception, at \$18,980 difference.

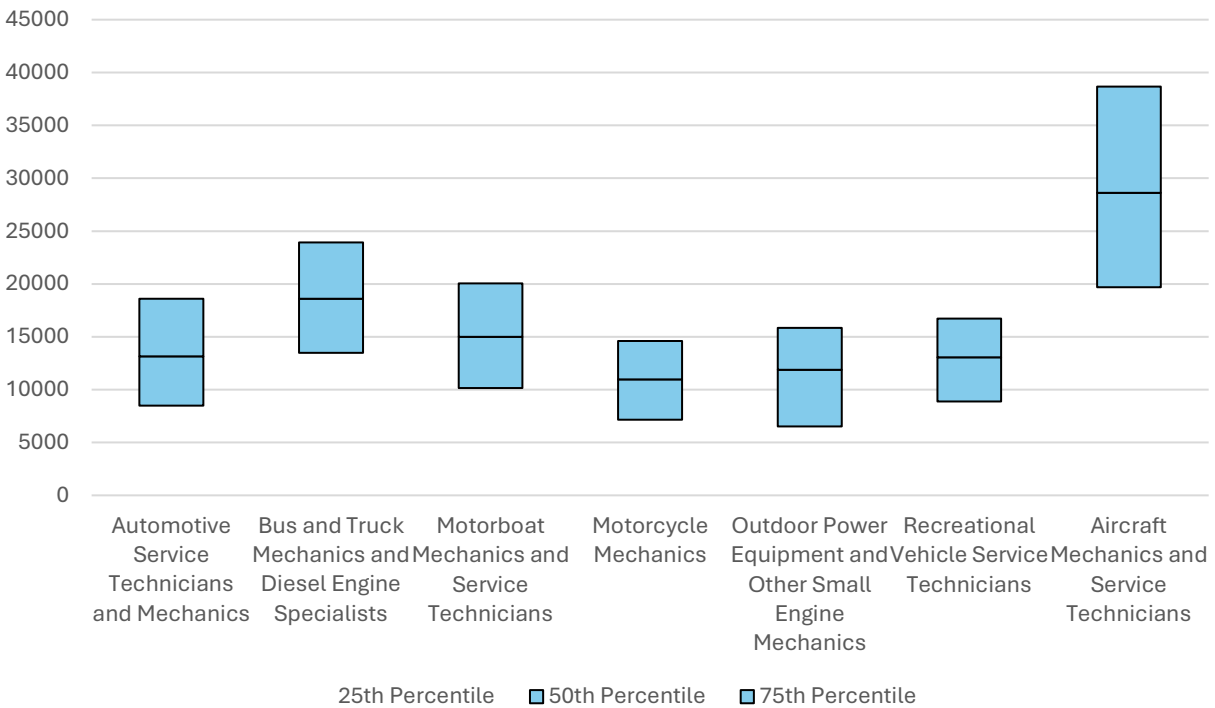
Most jobs in engine maintenance and repair occupations are full time, with only 31% of jobs overall classified at part time.

- The proportion of part-time employment varies between 18% for aircraft mechanics and service technicians and 44% for motorcycle mechanics.
- Full-time average hourly wages are higher than part-time wages for all occupations.
- The largest gap between full and part-time average hourly wages is in aircraft mechanics and service technicians, at \$9.38 per hour.

Hourly Wage 25th, 50th and 75th Percentile, Engine Maintenance and Repair



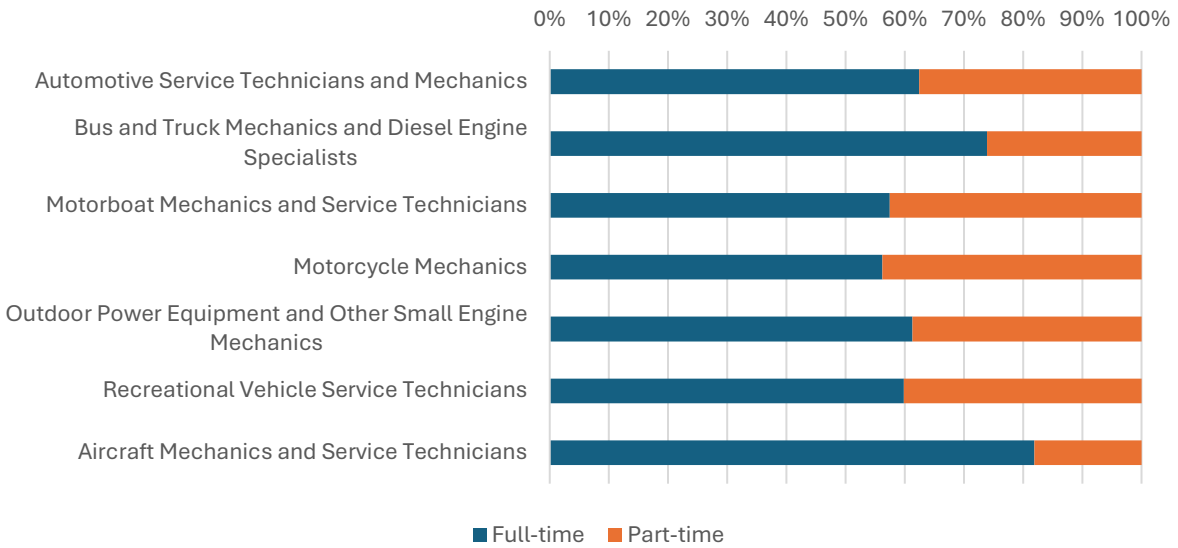
Quarterly Wage 25th, 50th and 75th Percentile, Engine Maintenance and Repair



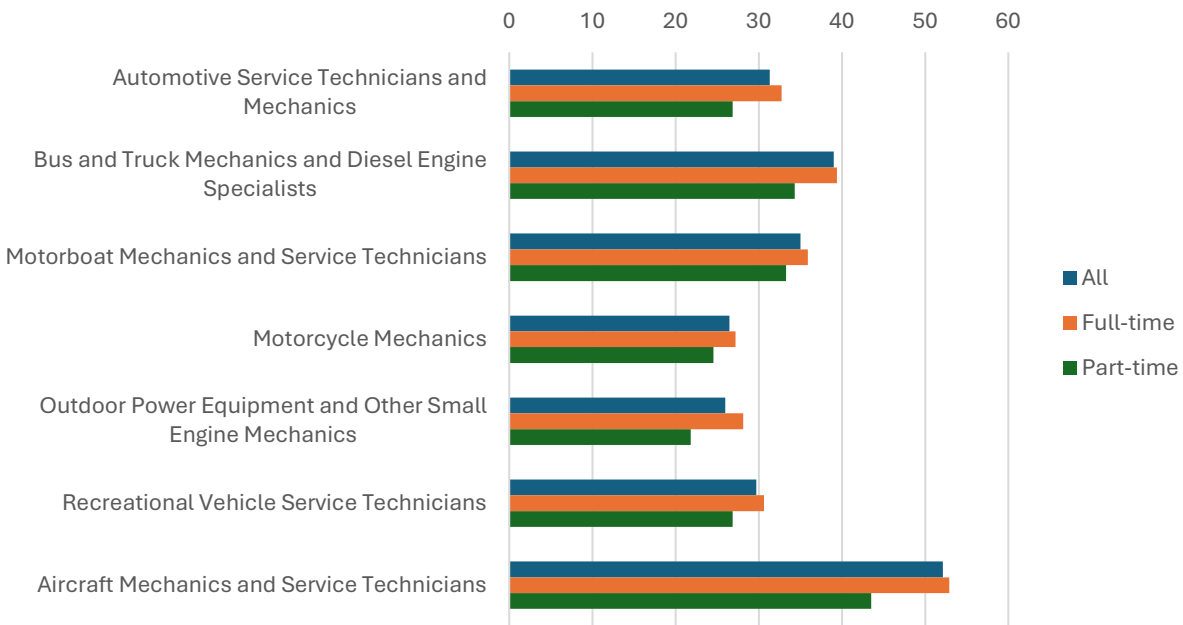
Engine Maintenance and Repair Hourly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Automotive Service Technicians and Mechanics	11635	31.31	22.08	28.87	38.25
Bus and Truck Mechanics and Diesel Engine Specialists	3759	39.03	30.98	37.79	45.97
Motorboat Mechanics and Service Technicians	725	35.01	26.43	33.27	41.67
Motorcycle Mechanics	191	26.46	20.18	24.78	31
Outdoor Power Equipment and Other Small Engine Mechanics	329	25.98	19.88	24.98	30.69
Recreational Vehicle Service Technicians	647	29.71	23.84	29.11	35.07
Aircraft Mechanics and Service Technicians	5259	52.15	40.91	52.5	62.5

Engine Maintenance and Repair Quarterly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Automotive Service Technicians and Mechanics	13617	13702	8499	13135	18584
Bus and Truck Mechanics and Diesel Engine Specialists	4438	18362	13484	18609	23928
Motorboat Mechanics and Service Technicians	773	15046	10163	15007	20061
Motorcycle Mechanics	204	11101	7157	10978	14608
Outdoor Power Equipment and Other Small Engine Mechanics	342	11582	6508	11887	15843
Recreational Vehicle Service Technicians	722	12659	8889	13068	16717
Aircraft Mechanics and Service Technicians	5966	29463	19703	28605	38683

Full Time vs. Part Time Engine Maintenance and Repair



Average Hourly Wage by Hours Worked Engine Maintenance and Repair

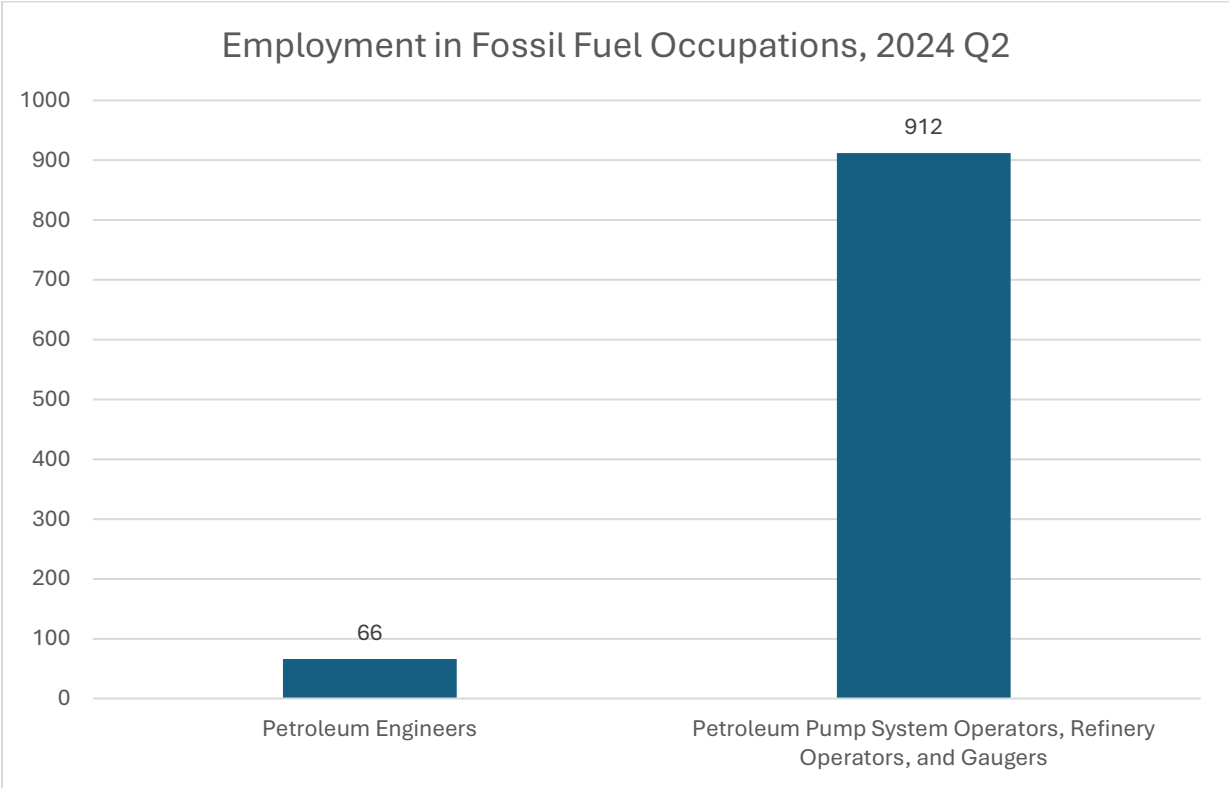


Fossil Fuels

Fossil fuel occupations are workers involved with petroleum-based technologies. These consist of petroleum engineers as well as petroleum pump system operators, refinery operators, and gaugers.

Employment Snapshot

A total of 978 workers were employed in fossil fuel occupations in 2024 Q2. Of these, the majority (93%) were petroleum pump system operators, refinery operators, and gaugers.



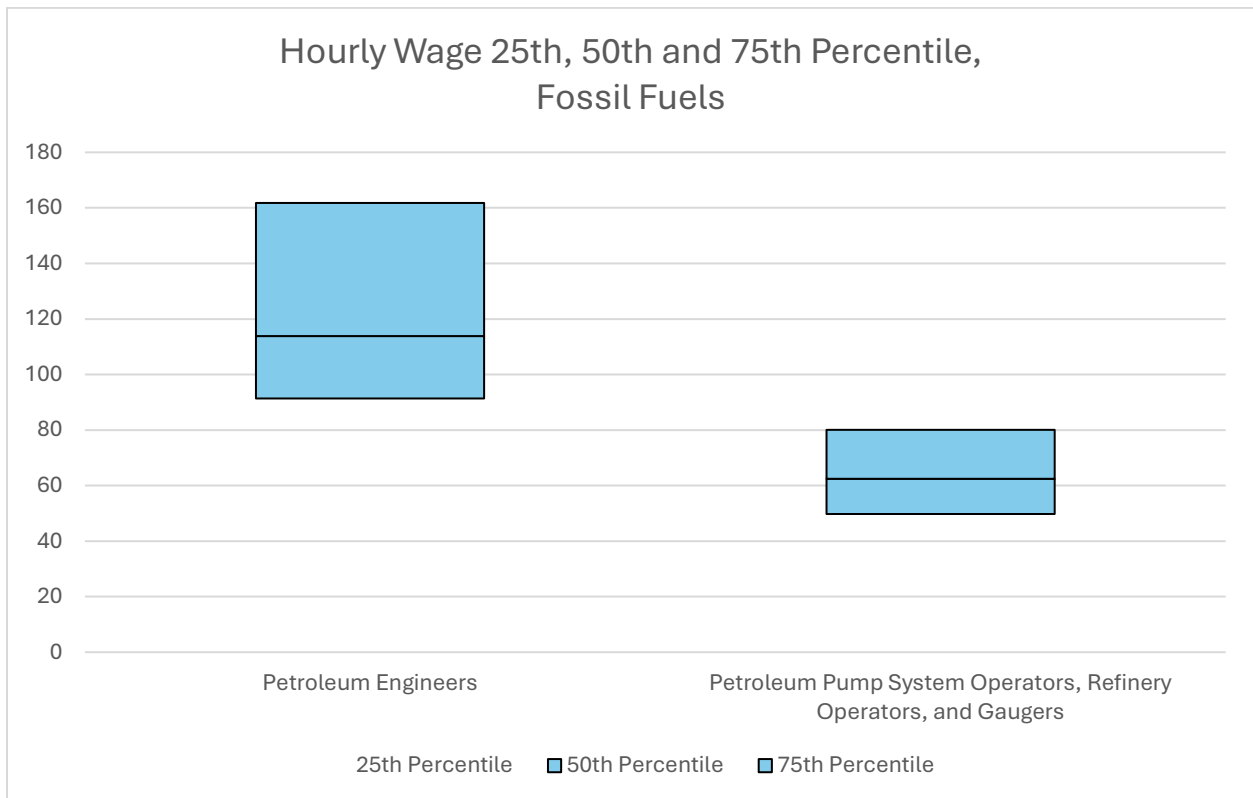
Wages

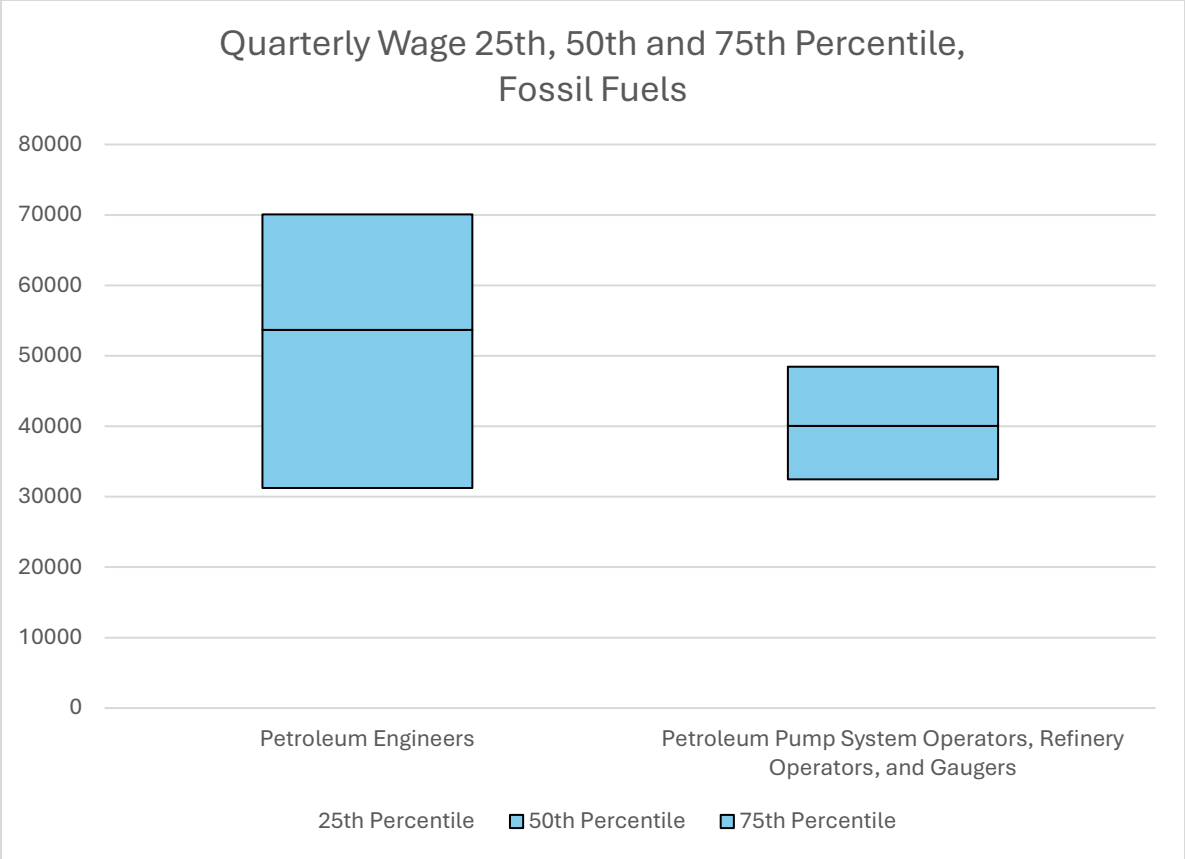
Median hourly wages were generally high, and petroleum engineers had some of the highest wage ranges across energy employment.

- The median wage for petroleum engineers was \$113.81 per hour in 2024 Q2, well above the \$62.39 for other petroleum related occupations. However, the number of petroleum engineers was low.

Median quarterly wages had more overlap. They ranged from \$40,070 per quarter for petroleum pump system operators, refinery operators, and gaugers (\$13,357 per month) to \$53,663 for petroleum engineers (\$17,357 per month).

Average hourly part-time wages were lower for petroleum engineers (22% of jobs part-time), but higher for petroleum pump system operators, refinery operators, and gaugers (10% of jobs part-time).

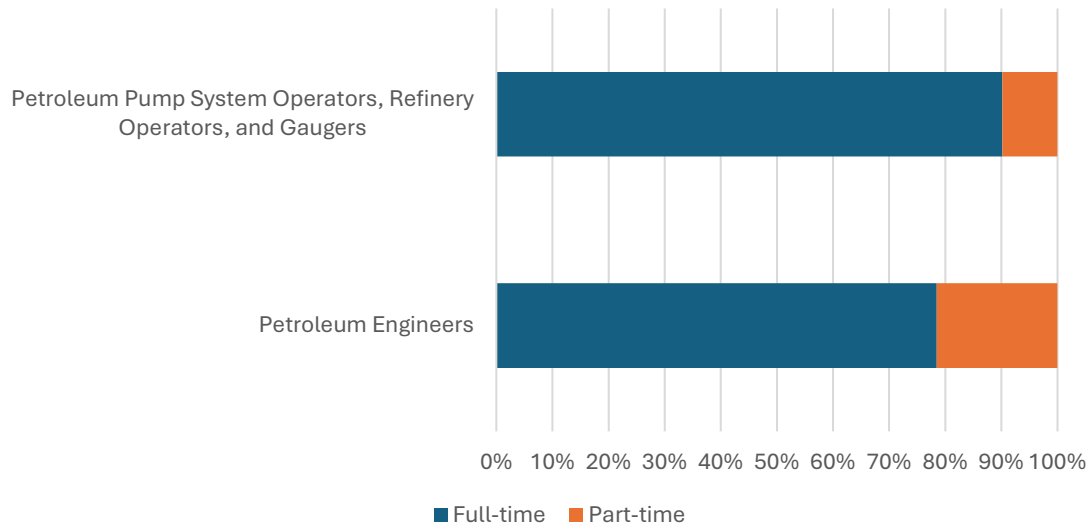




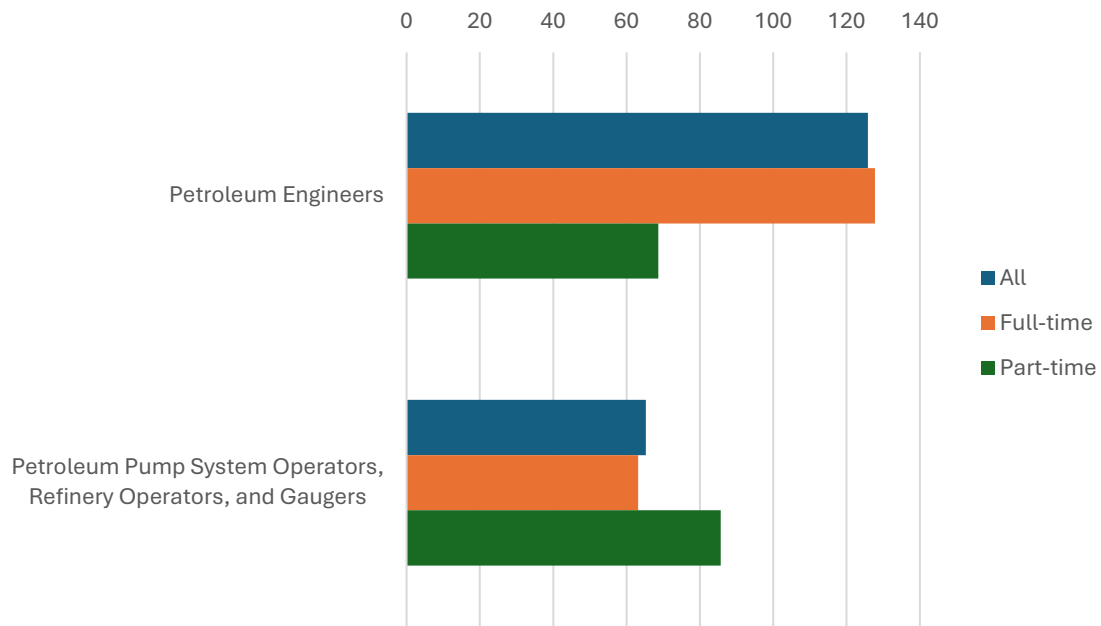
Fossil Fuels Hourly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Petroleum Engineers	52	125.84	91.32	113.81	161.79
Petroleum Pump System Operators, Refinery Operators, and Gaugers	788	65.29	49.75	62.39	80.07

Fossil Fuels Quarterly Wage, 2024 Q2					
Occupation	Employment	Average	25th Percentile	50th Percentile	75th Percentile
Petroleum Engineers	62	55369	31246	53663	70081
Petroleum Pump System Operators, Refinery Operators, and Gaugers	875	40492	32485	40070	48451

Full Time vs. Part Time Fossil Fuels



Average Hourly Wage by Hours Worked Fossil Fuels



SOC Codes Used in Wage Records Analysis		
SOC_CODE	Title	Category
172161	Nuclear Engineers	Clean Energy Generation and Energy Grid
172171	Petroleum Engineers	Fossil Fuels
194051	Nuclear Technicians	Clean Energy Generation and Energy Grid
472111	Electricians	Energy Efficiency
472131	Insulation Workers, Floor, Ceiling, and Wall	Energy Efficiency
472132	Insulation Workers, Mechanical	Energy Efficiency
472180	Roofers	Energy Efficiency
472231	Solar Photovoltaic Installers	Clean Energy Generation and Energy Grid
493011	Aircraft Mechanics and Service Technicians	Engine Maintenance and Repair
493023	Automotive Service Technicians and Mechanics	Engine Maintenance and Repair
493031	Bus and Truck Mechanics and Diesel Engine Specialists	Engine Maintenance and Repair
493051	Motorboat Mechanics and Service Technicians	Engine Maintenance and Repair
493052	Motorcycle Mechanics	Engine Maintenance and Repair
493053	Outdoor Power Equipment and Other Small Engine Mechanics	Engine Maintenance and Repair
493092	Recreational Vehicle Service Technicians	Engine Maintenance and Repair
499021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Energy Efficiency
499051	Electrical Power-Line Installers and Repairers	Clean Energy Generation and Energy Grid
499081	Wind Turbine Service Technicians	Clean Energy Generation and Energy Grid
518012	Power Distributors	Clean Energy Generation and Energy Grid
518013	Power Plant Operators	Clean Energy Generation and Energy Grid
518093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	Fossil Fuels

7. Conclusion and Future Work

Clean energy employment in Washington continues to evolve. Establishing baseline estimates for employment and wages in clean, fossil fuel, and mixed energy industries and occupations is key to assessing the effectiveness of future energy policy.

There are several areas of future work for this report. These include:

- Incorporating demographic data from the Longitudinal Employer Household Database (LEHD) to explore the characteristics of workers in clean energy related industries.
- Further investigation of the connection between industry and occupation present in UI wage records to identify previously excluded clean energy industries and occupations.
- In subsequent years, trend analysis as new occupational wage data is collected through UI wage records.
- An analysis of the skills and education needed in clean energy occupations.

Upcoming surveys and other qualitative studies conducted by the Workforce Training Board (WTB) will add important nuance and detail to the quantitative overview of the clean energy employment and wages presented in this report. Additionally, as CETWAC continues to pool research from all its members and agencies, a clearer picture of the clean energy workforce in Washington should emerge.

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