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Careers in Energy and Natural Resources

EXPLORE THE CLUSTER



Published May 2025





Careers in Energy and Natural Resources

- Energy and Natural Resources (ENR) is **one of 14** Career and Technical Education (CTE) **clusters** in the National Career Clusters Framework
- Approximately **187,240 people** are employed in roles aligning to Energy and Natural Resources (ENR) statewide, including core occupational employment and industry-related employment
- Employment in core ENR occupations saw a **strong recovery** from the pandemic, but baseline forecasts show **modest future growth**
- The **unemployment** rate for core ENR occupations is **low**, at 1.7%
- While the two industries aligned with the ENR cluster are 1) Utilities and 2) Mining, Quarrying, Oil and Gas Extraction, most people employed in core occupations in this cluster work for **other industries**
- Job **postings are down 3%** from the prior year, with the most common job title in postings being Maintenance Technician / Mechanic
- ENR contains **six sub-clusters**:
 - Clean & Alternative Energy
 - Conservation & Land Management
 - Ecological Research & Development
 - Environmental Protection
 - Resource Extraction
 - Utilities

About This Report



RealTime Talent

The Minnesota State Energy Center of Excellence commissioned this report from RealTime Talent, a statewide nonprofit dedicated to providing custom labor market insights to employers, education systems, and workforce and economic development organizations.



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Introducing an Updated Career Clusters Framework

The past two decades have seen seismic shifts in our economy, labor market, and the nature of work. In response, Advance CTE led two-year multi-method research process aimed at modernizing the 2003 Career and Technical Education Framework—often referred to as the Career Wheel—to increase alignment to industry needs and better represent new workforce realities.

This report was developed by the team at RealTime Talent utilizing the new Modernized Career Clusters Framework by AdvanceCTE to refine, define, and activate insights about the core occupations within the Energy and Natural Resources Cluster and the Interdisciplinary Cluster needs aligned to Energy and Natural Resources industries. According to AdvanceCTE, the updated Framework has the following benefits which more effectively reflect the real world of work:¹

- Emphasizes the truly interdisciplinary nature of work through more intersectionality across Clusters
- Updates language and groupings of occupations to better bridge industry's organization of work with education
- Includes emphasis on new sectors, skills, and approaches from the entire world of work, while providing flexibility for the future by leaning more on industry classifications
- Serves as a bridge for education to reflect the real world of work
- Provides learners with more personalized paths to living wage jobs and skills gains for a variety of careers
- Offers educational leaders and educators a means to align and design programs that better prepare learners for these careers
- Encourages industry has learners of all ages with interests, skills, and experiences that match their hiring needs

The Energy Center of Excellence strives to ensure that Minnesota businesses have access to talent that is prepared for the full range of careers in Energy and Natural Resources today and tomorrow. This Framework provides a model for organizing workforce needs and related programs.

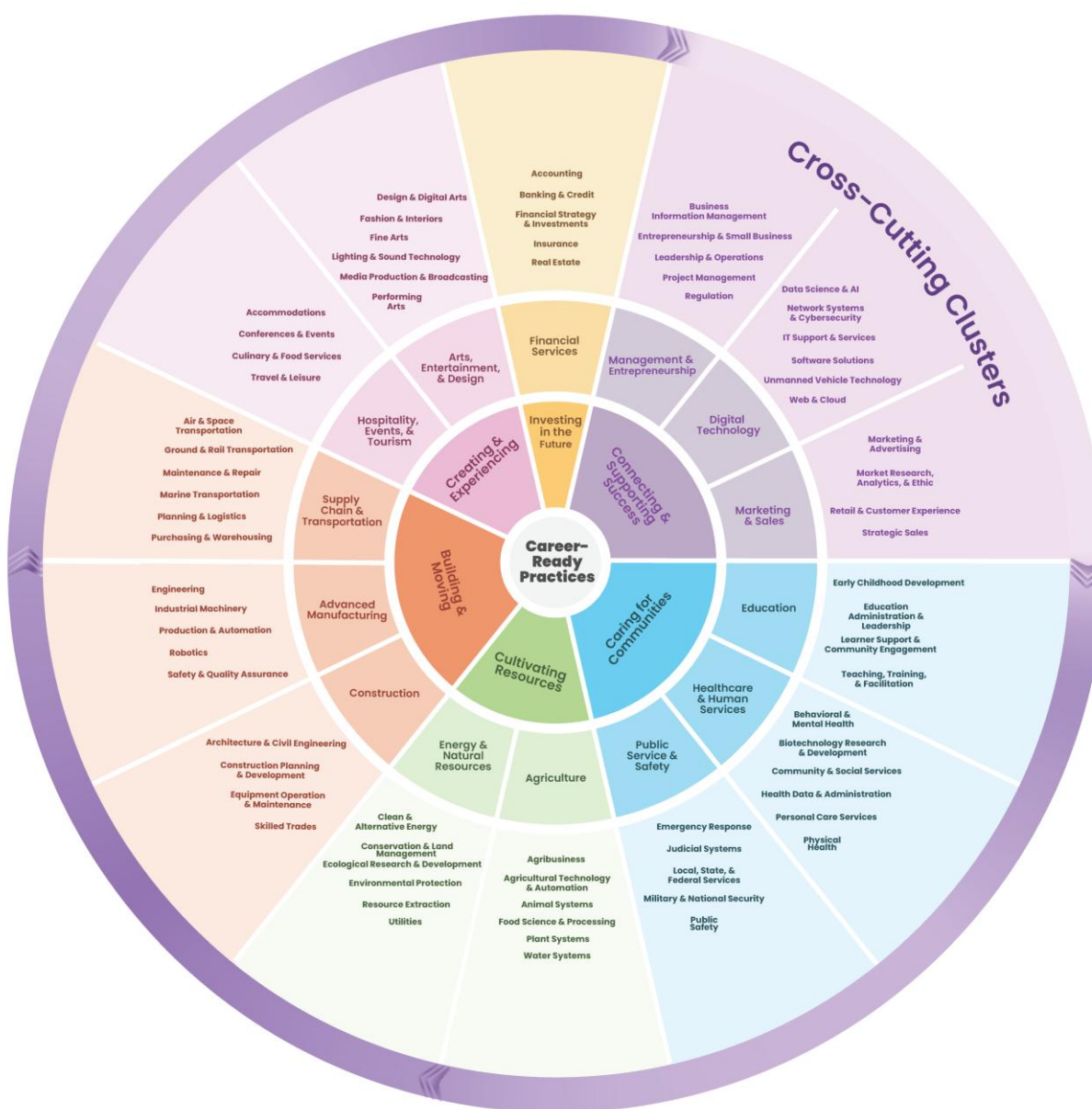
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The National Career Clusters Framework

The National Career Clusters Framework developed by Advance CTE consists of 14 Clusters and 72 Sub-Clusters that serve as the primary organizing structures for CTE programs. These structures are supported by five Cluster Groupings aligned to purpose and impact of included careers, and three Cross-Cutting Clusters that provide both skills and careers that can stand alone and intersect with all other Clusters.



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Energy & Natural Resources Cluster





Exploring Clusters and Sub-Clusters

The National Career Cluster Framework's Sub-Clusters are major groupings of career areas within a given Cluster that have similar skills as defined by industry area. In Energy and Natural Resources, there are six Sub-Clusters.



Interdisciplinary Careers

Cross-Cutting Clusters



Related Clusters



While the Cross-Cutting Career Clusters are designed to be applicable to all other Career Clusters, many other Career Clusters are closely connected. For Energy and Natural Resources, other Related Clusters include **Advanced Manufacturing; Agriculture; Construction; Public Service & Safety; Supply Chain & Transportation.**

Given the increasingly interdisciplinary nature of the world of work, programs may be designed to bridge across two or more Career Clusters.

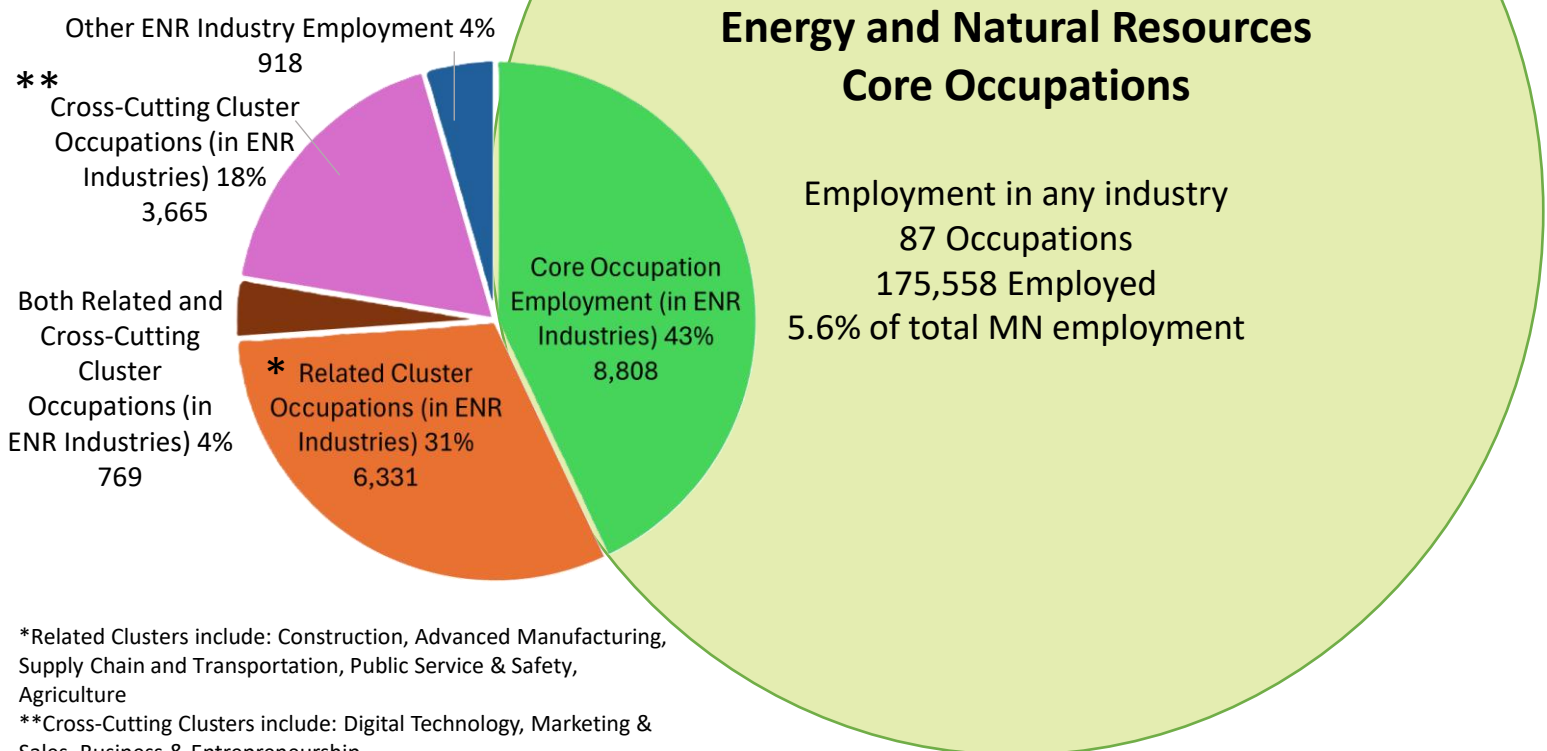


The Energy and Natural Resources Career Cluster

The Energy and Natural Resources Cluster is comprised of 87 core occupations employed in a wide range of industries, as well as all employment in the Utilities (NAICS 22) and Mining, Quarrying, and Oil and Natural Gas Extraction (NAICS 21) industries. An estimated 187,240 people are employed in roles aligning to this Cluster statewide.

88% of all core occupational employment in the Energy and Natural Resources Cluster are shared with other career clusters.

About 21,231 workers in 36 essential core occupations are aligned solely to Energy and Natural Resources and no other clusters.



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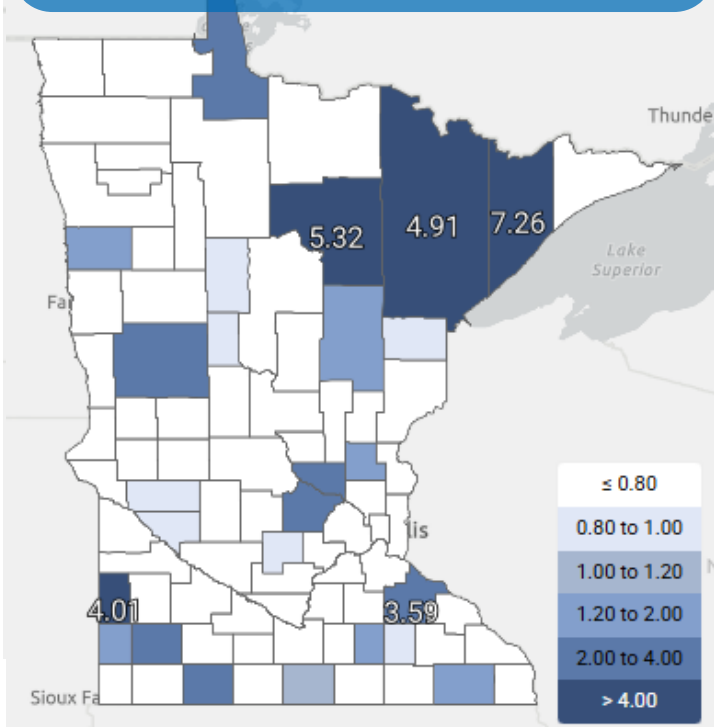
Core Industry Market Demand Overview

Industry	Employed	Mean Annual Wages	LQ	5-Year Historic Employment Trend	GRP	5-Year Forecast
Utilities (NAICS 22)	14,678	\$129,033	0.91		\$8.2B	Annual growth: 0.2% Total demand: 6,548
Mining, Quarrying, Oil and Gas Extraction (NAICS 21)	5,848	\$109,317	0.51		\$2.1B	Annual growth: 0.2% Total demand: 2,774
All Energy & Natural Resources Cluster Industries	20,526	\$123,416	0.75		\$10.3B	Annual growth: 0.2% Total demand: 9,322

0.75

Location quotient

These industry sectors are less concentrated in Minnesota than the United States overall



794

Employers in 2023
(up from 614 in 2016)

92.5%

Private employers
(0.4% self-employed
7.1% local government)

0.7%

Of total MN
employment

Top Five Counties
By number of employees

St. Louis	4,361
Hennepin	4,239
Ramsey	1,509
Wright	1,038
Itasca	853

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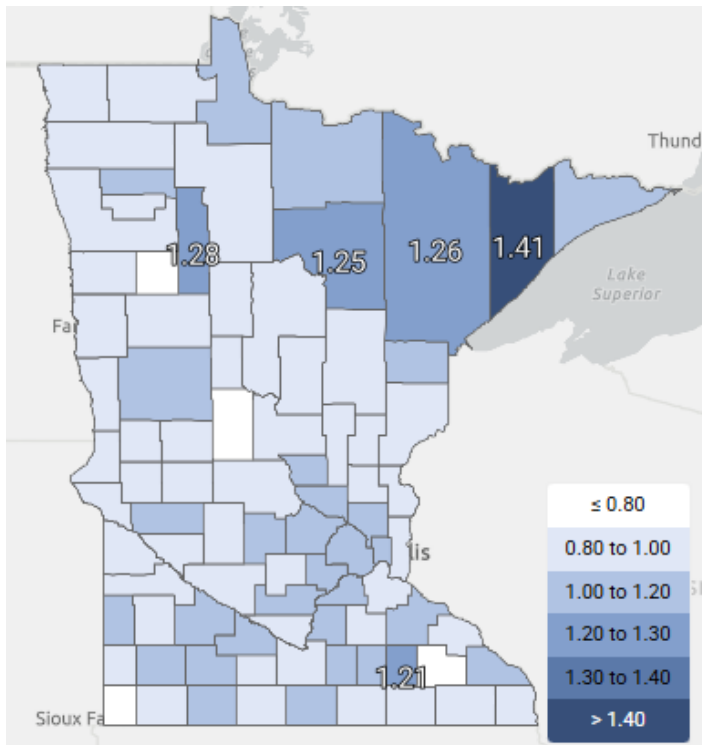
Core Cluster Occupational Market Demand Overview

Core Cluster Occ Empl	Mean Entry-Level Wages	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Forecast Avg Ann Empl Change	5-Year Total Demand Estimate
175,558	\$53,900	\$103,500	1.0	3,001	1.7%	1.6%	0.2%	73,646

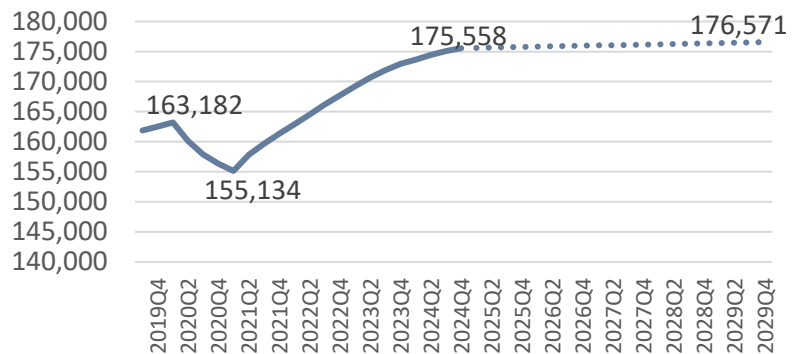
1.0

Location quotient

The Core Careers in Energy & Natural Resources are similarly concentrated in Minnesota to the rest of the United States, and are evenly distributed statewide



Strong Recovery, Flattening Employment Outlook



— Historical Employment
..... Forecast

84.8%

Private employers
(1.4% self-employed
13.8% government)

175,558
Employed

Top Five Counties By number of employees

Hennepin	53,937
Ramsey	19,513
Dakota	11,239
Anoka	8,194
St. Louis	7,171

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Top Ten Core Cluster Occupations by Number Employed, All Industries

#	Core Cluster Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate
1	General and Operations Managers (11-1021)	75,479	\$122,500	1.12	854	1.1%	3.1%	0.2%	31,194
2	First-Line Supervisors of Construction Trades and Extraction Workers (47-1011)	14,227	\$95,900	0.87	353	2.4%	2.1%	0.4%	5,743
3	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	0.84	88	0.9%	1.6%	0.1%	3,837
4	Industrial Machinery Mechanics (49-9041)	7,532	\$72,800	0.94	105	1.4%	2.4%	1.3%	3,594
5	Compliance Officers (13-1041)	6,909	\$88,100	0.95	101	1.4%	3.4%	0.2%	2,774
6	Firefighters (33-2011)	5,310	\$49,600	0.90	86	1.6%	1.0%	0.1%	1,955
7	Industrial Engineering Technologists and Technicians (17-3026)	4,334	\$72,600	3.13	65	1.5%	0.3%	0.1%	1,845
8	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1.05	92	2.2%	1.0%	0.1%	1,341
9	Facilities Managers (11-3013)	2,796	\$111,300	1.07	19	0.7%	-4.0%	0.2%	1,167
10	Refuse and Recyclable Material Collectors (53-7081)	2,663	\$58,100	0.97	70	2.6%	0.8%	0.1%	1,582
	Energy & Natural Resources Cluster – Core Occupations	175,558	\$103,500	1.00	3,001	1.7%	1.6%	0.2%	73,646
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667

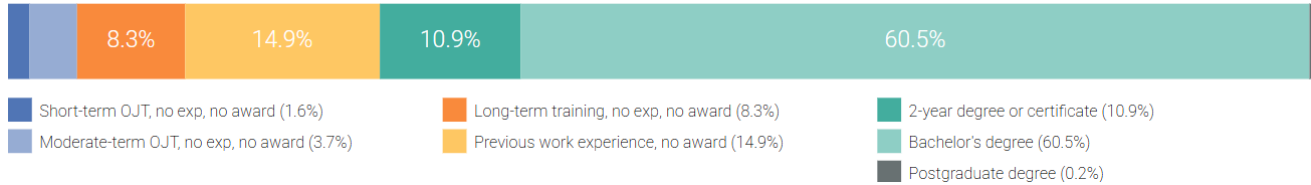
Top occupations are forecast to grow at a much lower rate than historically seen but frequently exceeding the typical forecast across all occupations.

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Education and Training Requirements of Top Core Cluster Occupations, All Industries



#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Employed	Mean Annual Wages	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training
1	General and Operations Managers (11-1021)	75,479	\$122,500	Bachelor's degree	5 years or more	None
2	First-Line Supervisors of Construction Trades and Extraction Workers (47-1011)	14,227	\$95,900	HS or equivalent	5 years or more	None
3	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	HS or equivalent	Less than 5 years	None
4	Industrial Machinery Mechanics (49-9041)	7,532	\$72,800	HS or equivalent	None	Long-term OJT
5	Compliance Officers (13-1041)	6,909	\$88,100	Bachelor's Degree	None	Mod-term OJT
6	Firefighters (33-2011)	5,310	\$49,600	PS Certificate	None	Long-term OJT
7	Industrial Engineering Technologists and Technicians (17-3026)	4,334	\$72,600	Associate Degree	None	None
8	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	Bachelor's Degree	5 years or more	None
9	Facilities Managers (11-3013)	2,796	\$111,300	Bachelor's Degree	Less than 5 years	None
10	Refuse and Recyclable Material Collectors (53-7081)	2,663	\$58,100	None	None	Short-term OJT

Inter-disciplinary Clusters*

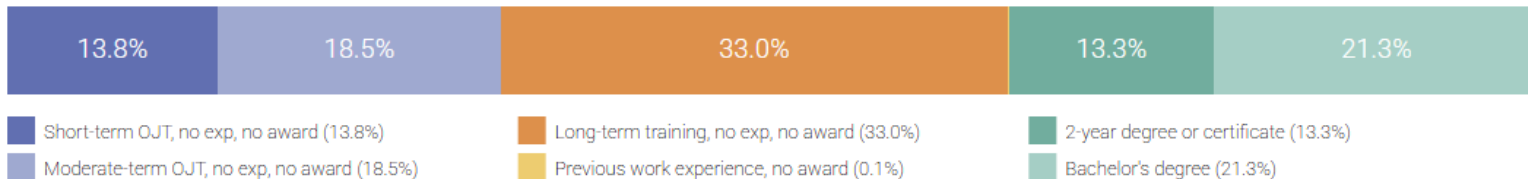


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Education and Training Requirements of Top Essential Core Cluster Occupations



#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program	
1	Refuse and Recyclable Material Collectors (53-7081)	2,663	\$58,100	1,582	None	None	Short-term OJT		Utilities
2	Telecommunications Equipment Installers and Repairers (49-2022)	2,298	\$70,800	993	PS Certificate	None	Mod-term OJT		
3	Water and Wastewater Treatment Plant and System Operators (51-8031)	2,147	\$72,900	827	HS or equivalent	None	Long-term OJT	F	
4	Electrical Power-Line Installers and Repairers (49-9051)	2,005	\$104,400	944	HS or equivalent	None	Long-term OJT	C	
5	Telecommunications Line Installers and Repairers (49-9052)	1,500	\$67,800	641	HS or equivalent	None	Long-term OJT		
6	Environmental Engineers (17-2081)	1,327	\$106,300	446	Bachelor's Degree	None	None	F	
7	Electronics Engineers, Except Computer (17-2072)	1,301	\$122,100	394	Bachelor's Degree	None	None		
8	Surveying and Mapping Technicians (17-3031)	940	\$66,200	599	HS or equivalent	None	Mod-term OJT		
9	Outdoor Power Equipment and Other Small Engine Mechanics (49-3053)	793	\$51,700	405	HS or equivalent	None	Mod-term OJT		
10	Power Plant Operators (51-8013)	765	\$99,100	242	HS or equivalent	None	Long-term OJT	F	

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Core Cluster Occupation Industry Staffing Pattern Overview

Only one of the top ten detailed industries employing talent in the core Energy and Natural Resources occupations is part of one of the cluster's focused industries (Utilities, NAICS 22).

#	NAICS Code*	Industry Title	% of Occ Empl	Empl	Mean Ann Wages	5-Year Exits	5-Year Job Transfers	5-Year Forecast Avg Ann Empl Change	5-Year Total Demand Estimate
1	9211	Executive, Legislative, and Other General Government Support	5.8%	10,153	\$75,700	1,288	2,824	-52	4,060
2	5511	Management of Companies and Enterprises	4.1%	7,130	\$159,200	869	1,924	48	2,841
3	5413	Architectural, Engineering, and Related Services	3.7%	6,550	\$107,700	856	1,741	-8	2,588
4	2382	Building Equipment Contractors	3.2%	5,649	\$101,800	796	1,500	90	2,386
5	2211	Electric Power Generation, Transmission and Distribution	2.9%	5,080	\$116,800	730	1,394	103	2,228
6	5416	Management, Scientific, and Technical Consulting Services	2.4%	4,227	\$128,200	488	1,269	186	1,944
7	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1.9%	3,349	\$127,600	433	814	-16	1,231
8	9221	Justice, Public Order, and Safety Activities	1.6%	2,727	\$84,000	333	761	-37	1,058
9	4238	Machinery, Equipment, and Supplies Merchant Wholesalers	1.6%	2,725	\$93,900	402	705	87	1,193
10	7225	Restaurants and Other Eating Places	1.5%	2,646	\$81,000	297	780	53	1,129
		All Other	71.4%	125,321					
		Energy & Natural Resources Cluster – Core Occupations	100%	175,558	\$103,500	23,116	48,498	2,032	73,646
		Total – All Occupations	N/A	3,124,097	\$70,600	694,283	984,741	12,643	1,691,667

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety



Energy and Natural Resources Cluster Skill and Credential Demand Overview

Job Posting Analysis (Core and Related Industry Roles)

Advertised May 2024 – April 2025

Top Job Titles

- 1) Maintenance Technician / Mechanic
- 2) Master Electrician - Industrial
- 3) NOAA Basic / Commissioned Officer
- 4) Signal Support Systems Specialist
- 5) Truck Driver
- 6) Post Doctoral Associate
- 7) General Manager
- 8) Electrical Engineer
- 9) Field Service Technician
- 10) Project Manager

81,943 Posts

-3% from prior year

\$75-\$120K

Posted Salary Range

Top Essential Skills

- 1) Communication
- 2) Collaboration
- 3) Analysis
- 4) Leadership
- 5) Planning

Hiring Difficulty: **Moderate**

Share Remote Postings: 2%

Share Hybrid Postings: 10%

Top Employers Hiring

- 1) University of Minnesota
- 2) M.A. Mortenson Company
- 3) State of Minnesota
- 4) Army
- 5) Thomson Reuters
- 6) Cargill
- 7) Navy
- 8) Andersen Windows
- 9) Xcel Energy
- 10) Honeywell

Top Knowledge Areas and Technical Skills

- 1) Operations
- 2) Scheduling
- 3) Supervision
- 4) Customer Service
- 5) Project Management

Top Credentials

- 1) Driver's License (CDL)
- 2) OSHA
- 3) HAZMAT
- 4) EPA Certification
- 5) Professional Engineer License



Core Cluster Supply Overview

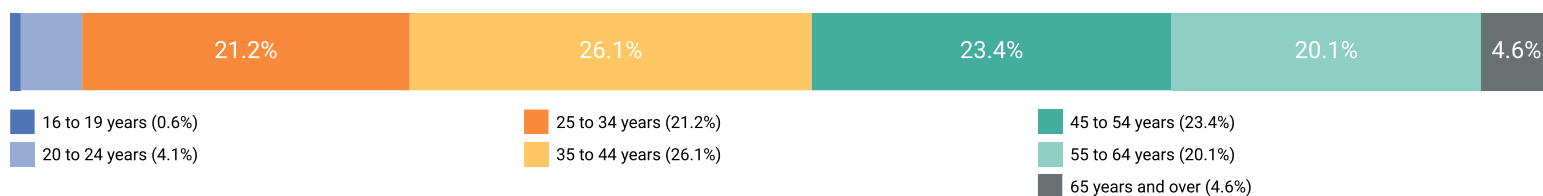
Energy and Natural Resources Core Cluster Occupation Talent Pool Diversity (Across all industries statewide)

Underrepresentation of talent who are:

- Female
- Black or African American

- Asian
- Hispanic or Latine
- Under 25 or over 64 years old

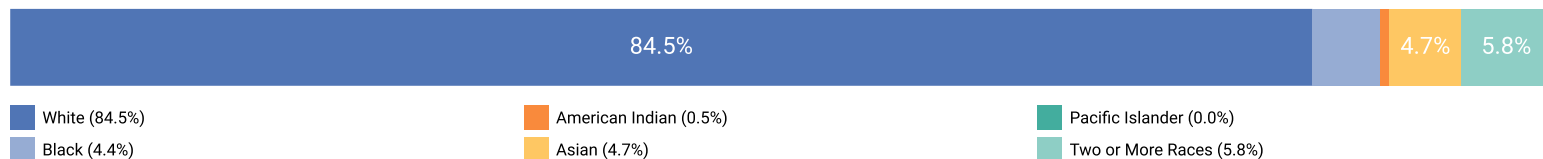
Age



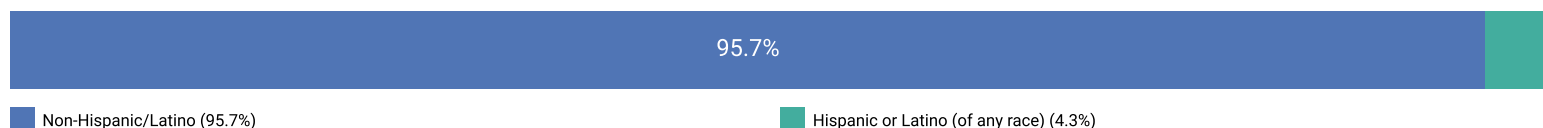
Gender



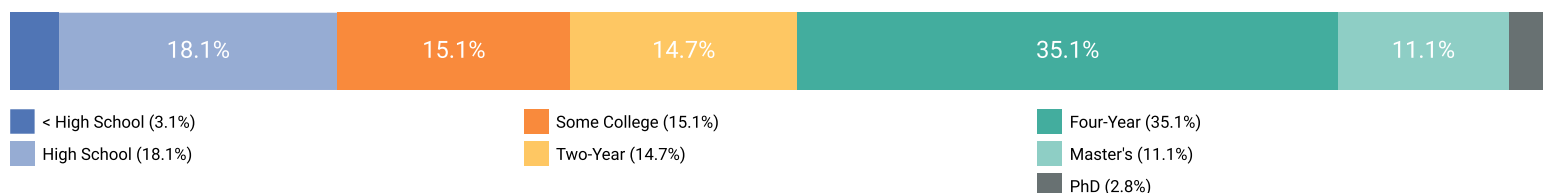
Race



Ethnicity



Educational Attainment



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Sub-Clusters



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Sub-Cluster Market Demand Overview

#	Sub-Clusters	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Avg Ann Hist Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate
1	Clean & Alternative Energy (Core)	20,223	\$112,200	0.90	381	1.8%	1.0%	0.2%	7,705
	+ Related by Industry	1,296							677
2	Conservation & Land Management (Core)	87,899	\$119,600	1.10	1,110	1.3%	2.6%	0.2%	36,512
3	Ecological Research & Development (Core)	17,542	\$116,000	1.04	538	3.0%	0.6%	0.1%	7,129
4	Environmental Protection (Core)	20,826	\$100,400	0.92	371	1.8%	1.6%	0.1%	7,653
5	Resource Extraction (Core)	57,365	\$93,900	0.92	1,136	1.9%	1.3%	0.3%	23,660
	+ Related by Industry	2,787							1,310
6	Utilities (Core)	52,548	\$95,700	0.88	1,019	1.9%	0.5%	0.2%	21,913
	+ Related by Industry	7,566							3,106
	Energy & Natural Resources Cluster – Core Occupations	175,558	\$103,500	1.00	3,001	1.7%	1.6%	0.2%	73,646
	Energy & Natural Resources - All Industry	20,526	\$123,416	0.75	n/a	n/a	1.1%	0.2%	9,322
	All ENR Employment (Core, Interdisciplinary, & Cross-Cutting Combined)	187,240							78,739
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667

The subclusters within the Energy and Natural Resources Cluster overlap with one another, and with other related and cross-cutting clusters. Related clusters sharing core occupations with Energy and Natural Resources include Construction, Advanced Manufacturing, Supply Chain and Transportation, Public Service and Safety, and Agriculture. In addition, employment in occupations within the cross-cutting clusters of Digital Technology, Marketing and Sales, and Business and Entrepreneurship are represented in industry-specific employment (NAICS 21 and 22) where noted.



Sub-Cluster Wage Overview

#	Sub-Clusters	Mean Wage				Location Quotient			
		State wide	MSP Metro	Urban Greater MN	Rural Greater MN	State wide	MSP Metro	Urban Greater MN	Rural Greater MN
1	Clean & Alternative Energy (Core)	\$112,200	\$121,300	\$96,500	\$98,900	0.90	0.88	0.78	0.98
	+ Related by Industry	\$122,543	\$142,271	\$115,238	\$123,336	1.62	0.61	0.78	4.82
2	Conservation & Land Management (Core)	\$119,600	\$128,500	\$105,600	\$99,300	1.10	1.16	0.93	0.93
3	Ecological Research & Development (Core)	\$116,000	\$124,800	\$102,000	\$96,500	1.04	1.11	0.78	0.90
4	Environmental Protection (Core)	\$100,400	\$110,200	\$82,300	\$79,000	0.92	0.98	0.78	0.82
5	Resource Extraction (Core)	\$93,900	\$100,900	\$84,800	\$82,600	0.92	0.89	1.00	0.96
	+ Related by Industry	\$109,317	\$141,250	\$107,005	\$109,440	0.51	0.09	2.27	0.55
6	Utilities (Core)	\$95,700	\$102,900	\$86,900	\$84,600	0.88	0.84	0.85	0.98
	+ Related by Industry	\$128,099	\$144,124	\$116,622	\$102,554	0.83	0.73	0.78	1.19
	Energy & Natural Resources Cluster – Core Occupations	\$103,500	\$112,500	\$91,400	\$86,900	1.0	1.0	0.94	0.99
	Energy & Natural Resources - All Industry	\$123,416	\$136,256	\$109,674	\$114,236	0.75	0.46	1.40	1.15
	Total – All Occupations	\$70,600	\$75,400	\$67,100	\$60,100				

Cost of Living by Region

	Annual Average Salary	Cost of Living Index (Base US)	US Purchasing Power
Minnesota	\$72,473	93.6	\$77,405
MSP Metro	\$79,039	94.1	\$83,961
Urban Greater MN	\$62,386	95.5	\$65,322
Rural Greater MN	\$54,276	91.9	\$59,072
USA	\$73,145	100.0	\$73,145

The Cost of Living Index estimates the relative price levels for consumer goods and services. When applied to wages and salaries, the result is a measure of relative purchasing power.

Careers in Energy



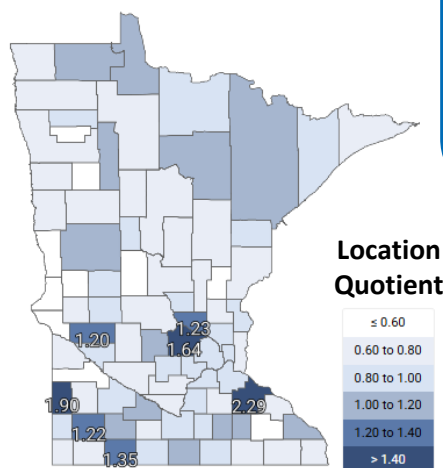
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Clean and Alternative Energy

Sub-Cluster Demand

Summary

Support energy generation and infrastructure development from clean energy sources such as low carbon fuels, natural gas, nuclear, biofuels, hydrogen processes, and other alternative sources. Develop and implement technologies that harness natural elements including solar, nuclear, wind, and hydro power, while advancing efforts in electrification and energy storage solutions. Recycling, carbon capture, and other energy and mineral reuse and reclamation.

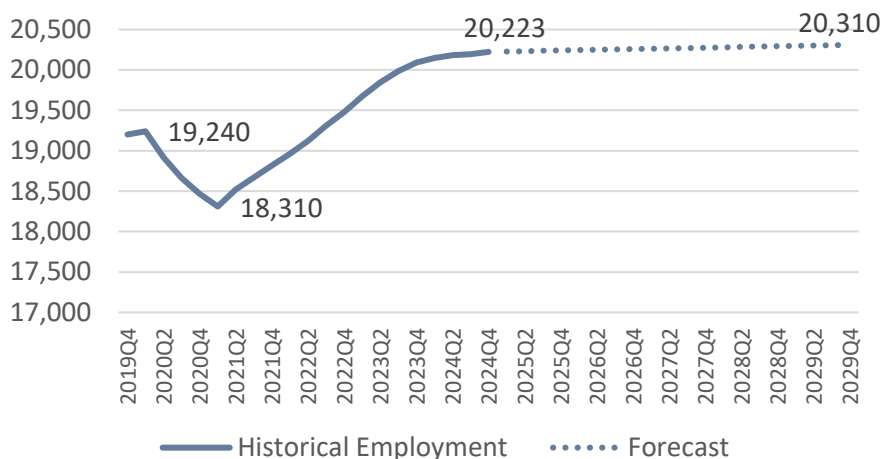


Top Five Counties

By number of employees

Hennepin	6,123
Ramsey	2,247
Dakota	1,218
Anoka	1,013
St. Louis	803

Core Sub-Cluster Employment Forecast



Core Occupation Summary Statistics

(Across all industries statewide)

1.8%
Unemployment
rate

0.90
Location
Quotient

0.2%
Forecast Annual
Growth

1,577
Online job ads
(March 2025)

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Clean and Alternative Energy Sub-Cluster Demand – Core Occupations

#	Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate	% of Total Empl in Ind
1	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	0.84	88	0.9%	1.6%	0.1%	3,837	1%
2	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1.05	92	2.2%	1.0%	0.1%	1,341	1%
3	Engineers, All Other (17-2199)	2,300	\$123,100	0.78	35	1.5%	-1.9%	0.2%	675	1%
4	Engineering Technologists and Technicians (17-3029)	992	\$77,700	0.81	15	1.5%	0.3%	0.1%	425	1%
5	Commercial and Industrial Designers (27-1021)	832	\$86,100	1.34	22	2.6%	-1.7%	0.0%	264	<1%
6	Power Plant Operators (51-8013)	765	\$99,100	1.24	16	2.1%	2.6%	-2.0%	242	23%
7	Solar Photovoltaic Installers (47-2231)	393	\$66,200	0.75	43	9.9%	6.3%	2.9%	267	6%
8	Wind Turbine Service Technicians (49-9081)	316	\$75,300	1.28	20	5.9%	10.6%	5.6%	293	45%
9	Nuclear Engineers (17-2161)	289	\$131,700	1.16	5	1.8%	0.1%	-0.5%	71	63%
10	Power Distributors and Dispatchers (51-8012)	197	\$118,000	1.09	4	2.1%	0.9%	0.5%	96	4%
11	Nuclear Power Reactor Operators (51-8011)	195	\$134,700	1.34	4	2.1%	3.2%	-0.9%	77	92%
12	Nuclear Technicians (19-4051)	162	\$99,800	1.37	31	16.4%	2.3%	-0.7%	80	81%
	Clean & Alternative Energy – Core	20,223	\$112,200	0.90	381	1.8%	1.0%	0.2%	7,705	5%
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667	

Careers in Energy



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Energy Center of Excellence

Clean and Alternative Energy

Nuclear Power Reactor Operators have the highest median and average wage rates at all levels of experience. However, total employment volumes are low in Minnesota.

Sub-Cluster Wages

Core Sub-Cluster Wage Distribution

Mean

\$112,200

Entry Level

\$78,500

Experienced

\$129,100

#	Sub-Cluster Occupation (SOC) with Requirements for an Associate Degree or Less	Wages						
		Mean	Entry Level	Experienced	50% Median	Typical Entry-Level Education	Empl	Under employed
1	Nuclear Power Reactor Operators (51-8011)	\$134,700	\$106,700	\$148,700	\$133,500	HS or equivalent	195	46
2	Power Distributors and Dispatchers (51-8012)	\$118,000	\$88,900	\$132,600	\$121,100	HS or equivalent	197	54
3	Nuclear Technicians (19-4051)	\$99,800	\$68,300	\$115,500	\$101,900	Associate degree	162	-
4	Power Plant Operators (51-8013)	\$99,100	\$74,000	\$111,700	\$100,000	HS or equivalent	765	190
5	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	\$89,400	\$61,200	\$103,500	\$85,900	HS or equivalent	9,514	1,923
6	Engineering Technologists and Technicians, Except Drafters, All Other (17-3029)	\$77,700	\$55,700	\$88,700	\$79,200	Associate degree	992	299
7	Wind Turbine Service Technicians (49-9081)	\$75,300	\$58,300	\$83,800	\$73,000	PS Certificate	316	39
8	Solar Photovoltaic Installers (47-2231)	\$66,200	\$48,900	\$74,900	\$62,400	HS or equivalent	393	86
	Clean & Alternative Energy – Core	\$112,200	\$78,500	\$129,100	\$108,400	-	20,223	2,637
	Total - All Occupations	\$70,600	\$35,100	\$88,300	\$55,300	-	3,124,097	518,636

Careers in Energy



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Clean and Alternative Energy Sub-Cluster Demand – Related Industry Occupations

Related Industries with Demand

- Hydroelectric Power Generation
- Nuclear Electric Power Generation
- Solar Electric Power Generation
- Wind Electric Power Generation
- Biomass Electric Power Generation

#	Occupation (SOC)	Ind Empl	Mean Annual Wages	5-Year Total Demand Estimate	Cross-Cutting Clusters	Inter-disciplinary Clusters	% of Total Empl in Ind
1	Security Guards (33-9032)	126	\$50,200	67	-	●	1%
2	First-Line Supervisors of Production and Operating Workers (51-1011)	100	\$150,400	45	-	●	1%
3	Electrical Engineers (17-2071)	96	\$119,100	31	-	●	2%
4	Industrial Engineers (17-2112)	54	\$108,700	19	-	●	<1%
5	Training and Development Specialists (13-1151)	53	\$83,900	25	○	-	1%
6	Project Management Specialists (13-1082)	47	\$120,500	26	○	-	<1%
7	Electricians (47-2111)	47	\$117,400	29	-	●	<1%
8	Business Operations Specialists, All Other (13-1199)	46	\$101,800	24	○	-	<1%
9	Industrial Production Managers (11-3051)	31	\$170,500	12	○	●	1%
10	Office Clerks, General (43-9061)	29	\$69,500	22	○	-	<1%
	Clean & Alternative Energy – Related Industries	2,661	-	1,384	-	-	-
	Total – All Occupations	3,124,097	\$70,600	1,691,667	-	-	-

Inter-disciplinary Clusters*

Digital Technology
 Marketing & Sales
 Management & Entrepreneurship
 Agriculture
 Advanced Manufacturing
 Construction
 Supply Chain & Transportation
 Public Service & Safety

20,223
Core Occupation Employment

1,296
Related Career Employment

8,382
New Talent by 2029Q4

High
Talent Shortage Severity

Careers in Energy



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Clean and Alternative Energy

Job Posting Analysis
Advertised May 2024 – April 2025

Top Job Titles

- 1) Nuclear Engineer
- 2) Nuclear Operations
- 3) System Maintainers
- 4) Design Phase Managers
- 5) Maintenance Supervisors
- 6) Quality Engineers II
- 7) Quality Power Managers
- 8) Wind Turbine Technicians
- 9) Entry Level Nuclear Engineer
- 10) Hydrogen Design Phase Managers

Top Employers Hiring

- 1) U.S. Navy
- 2) M.A. Mortenson Company
- 3) Xcel Energy
- 4) U.S. Army
- 5) Black & Veatch
- 6) Metropolitan Council
- 7) Vestas
- 8) ABM Industries
- 9) Sky Climber Renewables
- 10) Walmart

1,129 Posts

+62% from prior year

\$93-\$151K

Posted Salary Range

Hiring Difficulty: **Difficult**

Share Remote Postings: 2%

Share Hybrid Postings: 10%

Top Essential Skills

- 1) Communication
- 2) Troubleshooting
- 3) Analysis
- 4) Leadership
- 5) Scheduling

Top Knowledge Areas and Technical Skills

- 1) Operations
- 2) Turbines
- 3) Power Plants
- 4) Electronics / Electrical Systems
- 5) Mathematics

Top Credentials

- 1) Engineer-In-Training
- 2) Total Quality Management Certification
- 3) Driver's License (CDL)
- 4) HVAC Certification
- 5) CIP Compliance



Clean and Alternative Energy

Job Posting and Profile Gap Analysis Advertised May 2024 – April 2025

Top 10 Skill Gaps in Minnesota

Name	Candidates	Openings	Gap
Blueprint Reading	0	24	-24
Personal Computers (PC)	12	30	-17
Boilers	80	95	-15
Mathematics	21	31	-10
Word Processing	3	12	-8
Autodesk Revit	6	15	-8
Dassault Systemes SolidWorks Software	37	45	-8
Yardi	0	8	-8
Welding	24	32	-7
Team Leadership	15	22	-7

Top 10 Certification Gaps in Minnesota

Name	Candidates	Openings	Gap
First Aid Certification	6	13	-7
EPA Universal Certification	0	5	-5
Certification in Cardiopulmonary Resuscitation (CPR)	6	11	-5
Class A Commercial Driver's License (CDL-A)	4	8	-5
Certified Welding Inspector (CWI)	7	11	-4
Industry Radiography Radiation Safety Personnel (IRRSP)	0	3	-3
Medical Physics	0	3	-3
Transportation Worker Identification Credential (TWIC)	0	3	-3
Project Management Professional (PMP)	11	13	-3
Commercial Driver's License (CDL)	10	12	-2

Careers in Energy



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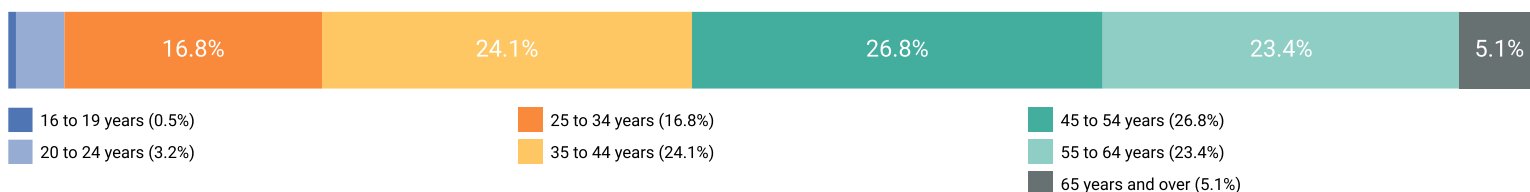
Clean and Alternative Energy

Estimated Talent Pool Diversity (Across all industries statewide)

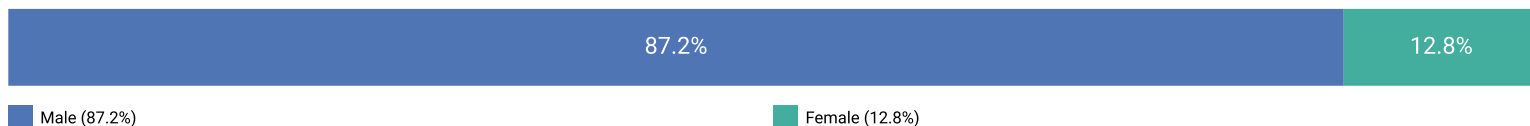
Underrepresentation of talent who are:

- Female
- Black or African American
- More than one race
- Hispanic or Latine
- Under 35 years old

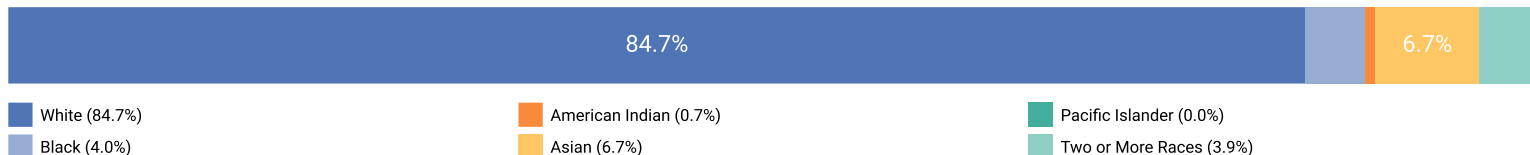
Age



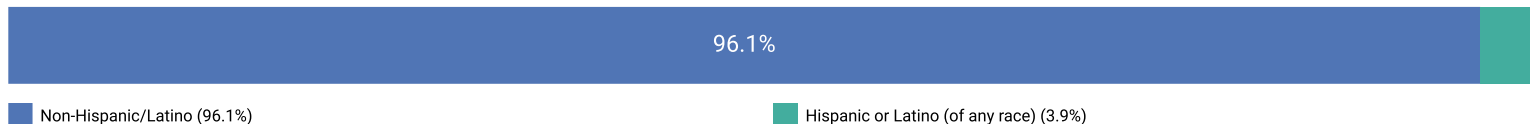
Gender



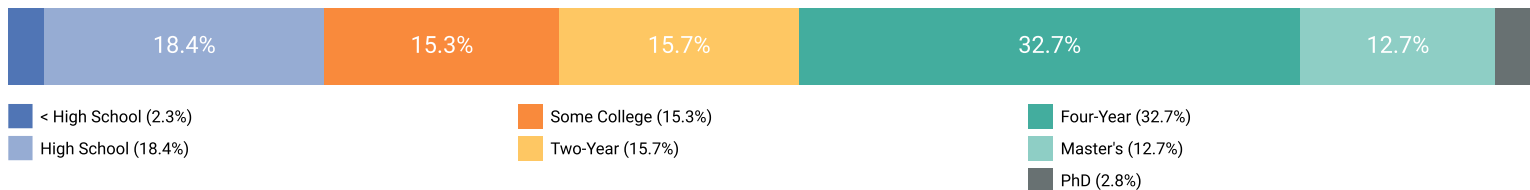
Race



Ethnicity



Educational Attainment



Careers in Energy



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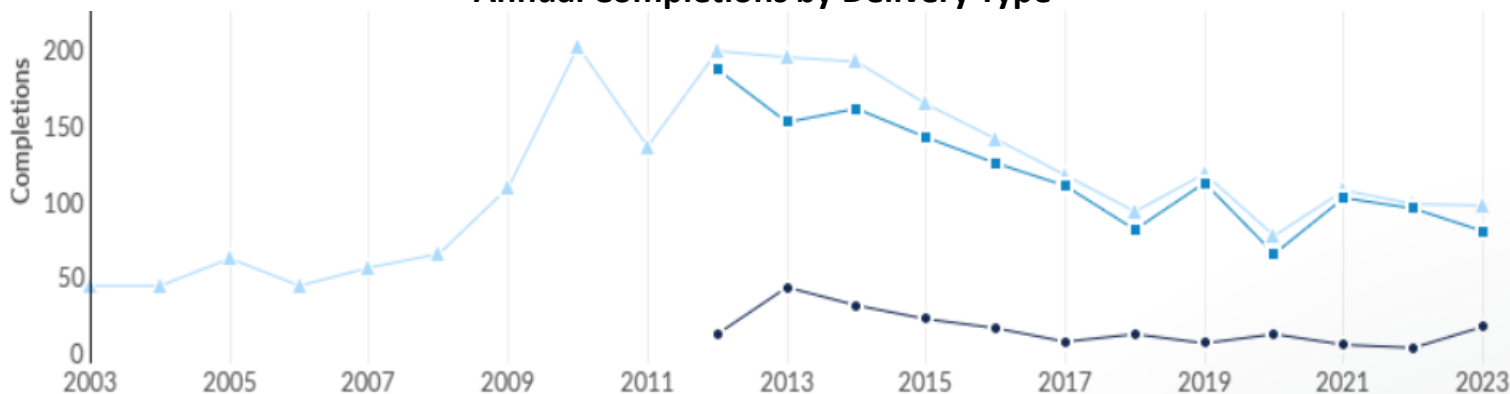
Clean and Alternative Energy

Aligned Postsecondary Programs With Awards Conferred, SY2023



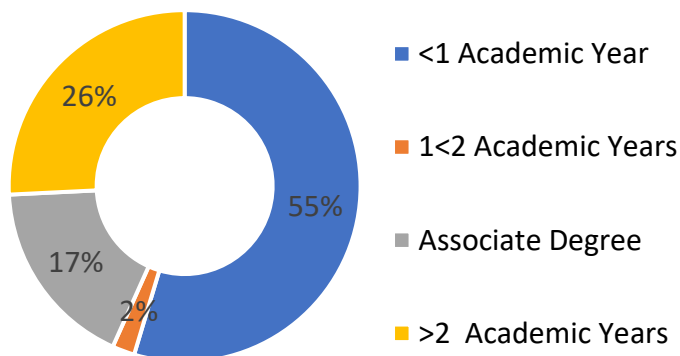
Institution Type	Completions (2023)	Market Share
Public, 2-year	97	100.0%

Annual Completions by Delivery Type



Distance Offered Programs	+41.7%
Non-Distance Offered Programs	-57.2%
All Programs	-51.3%

Completions SY2023



9

Institutions with aligned programs

Careers in Energy

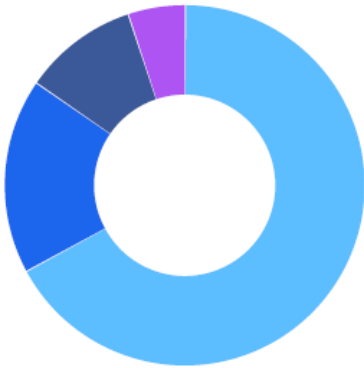


MINNESOTA STATE
Energy Center of Excellence

Clean and Alternative Energy

Aligned Postsecondary Programs With Awards Conferred, SY2023

Market Share by Program



Program	Completions (2023)	Market Share
Industrial Mechanics and Maintenance Technology/Technician (47.0303)	65	67.0%
Energy Systems Technology/Technician (15.1701)	17	17.5%
Solar Energy Technology/Technician (15.1703)	10	10.3%
Nuclear Engineering Technology/Technician (15.1401)	5	5.2%

Institution	Completions (2023)	Growth % YOY (2023)	Market Share (2023)	IPEDS Tuition & Fees (2023)	Completions Trend (2019-2023)
Riverland Community College	35	59.1%	36.1%	\$6,249	
Minnesota North College	16	23.1%	16.5%	\$6,004	
Hennepin Technical College	13	-53.6%	13.4%	\$5,881	
Century College	12	-42.9%	12.4%	\$6,182	
Dakota County Technical College	11	1,000.0%	11.3%	\$6,419	
Alexandria Technical & Community College	5	Insf. Data	5.2%	\$6,213	
Minnesota West Community and Technical College	3	-72.7%	3.1%	\$6,484	
Pine Technical & Community College	1	Insf. Data	1.0%	\$4,681	
St Cloud Technical and Community College	1	0.0%	1.0%	\$4,957	

Careers in Energy



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Clean and Alternative Energy

Aligned Postsecondary Programs With Awards Conferred, SY2023

Graduate Demographics, All Programs



- White
- Black or African American
- American Indian
- Asian
- Pacific Islander
- Two or More Races
- Hispanic or Latine

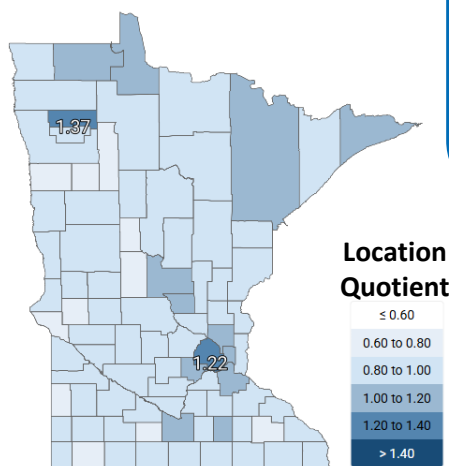
#	Description	Total Completions	Male	Female	Black or African American	Asian	Hispanic or Latine	White	Two or More Races
1	Riverland Community College	35	94%	6%	6%	0%	29%	66%	0%
2	Minnesota North College	16	94%	6%	0%	0%	0%	100%	0%
3	Hennepin Technical College	13	92%	8%	0%	8%	8%	77%	8%
4	Century College	12	92%	8%	33%	17%	0%	50%	0%
5	Dakota County Technical College	11	100%	0%	0%	9%	18%	73%	0%
6	Alexandria Technical & Community College	5	80%	20%	0%	0%	0%	100%	0%
7	Minnesota West Community and Technical College	3	100%	0%	0%	0%	0%	100%	0%
8	Pine Technical & Community College	1	100%	0%	0%	0%	0%	100%	0%
9	St Cloud Technical and Community College	1	100%	0%	0%	0%	0%	100%	0%
	Total	97	94%	6%	6%	4%	13%	75%	1%

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Conservation and Land Management



Top Five Counties

By number of employees

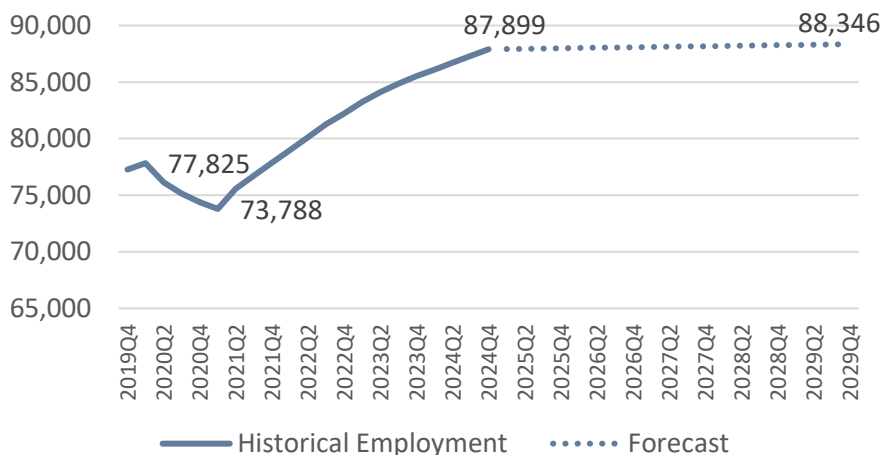
Hennepin	30,167
Ramsey	10,278
Dakota	5,763
Anoka	3,856
Washington	2,640

Sub-Cluster Demand

Summary

With knowledge rooted in environmental and natural sciences, focus on protecting and managing natural resources and landscapes. Operate local, state, and national parks; safeguard forests and waterways; maintain national lands and rangelands; and manage wildlife and marine life. Merge ecological conservation with recreational spaces, preserving nature while enhancing community well-being and environmental stewardship by public accessibility.

Core Sub-Cluster Employment Forecast



Core Occupation Summary Statistics (Across all industries statewide)

1.3%
Unemployment
rate

1.10
Location
Quotient

0.2%
Forecast Annual
Growth

1,085
Online job ads
(March 2025)

Careers in Energy



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Conservation and Land Management Sub-Cluster Demand – Core Occupations

#	Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate	% of Total Empl in Ind 21, 22
1	General and Operations Managers (11-1021)	75,479	\$122,500	1.12	854	1.1%	3.1%	0.2%	31,194	<1%
2	Facilities Managers (11-3013)	2,796	\$111,300	1.07	19	0.7%	-4.0%	0.2%	1,167	2%
3	Environmental Scientists and Specialists, Including Health (19-2041)	1,590	\$86,500	1.04	22	1.4%	-0.2%	0.2%	733	3%
4	Natural Sciences Managers (11-9121)	1,394	\$153,700	0.76	36	2.5%	4.6%	0.4%	537	1%
5	Surveying and Mapping Technicians (17-3031)	940	\$66,200	0.88	9	1.0%	-1.2%	0.3%	599	8%
6	Surveyors (17-1022)	904	\$89,200	0.90	7	0.8%	0.6%	0.1%	314	4%
7	Biological Scientists, All Other (19-1029)	782	\$97,300	0.65	13	1.6%	4.9%	0.3%	303	<1%
8	Conservation Scientists (19-1031)	673	\$85,800	1.48	20	3.0%	3.1%	0.3%	309	<1%
9	Physical Scientists, All Other (19-2099)	650	\$167,400	1.13	14	2.1%	-1.0%	-0.1%	205	2%
10	Forest and Conservation Technicians (19-4071)	561	\$60,700	0.93	12	2.2%	2.4%	-0.1%	342	1%
11	Zoologists and Wildlife Biologists (19-1023)	533	\$79,200	1.59	9	1.7%	-0.1%	0.0%	196	0%
12	Social Scientists and Related Workers, All Other (19-3099)	517	\$91,500	0.75	19	3.6%	1.4%	0.1%	219	0%
	Conservation & Land Management – Core	87,899	\$119,600	1.10	1,110	1.3%	2.6%	0.2%	36,512	1%
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667	

Careers in Energy



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Energy Center of Excellence

Conservation and Land Management

Physical Scientists have the highest median and average wage rates overall, but Natural Sciences Managers have the highest average entry-level wages in Minnesota. There are only four occupations in the sub-cluster that typically do not require a Bachelor's or Master's Degree.

Sub-Cluster Wages

Core Sub-Cluster Wage Distribution

Mean

\$119,600

Entry Level

\$56,200

Experienced

\$151,400

		Wages						
#	Sub-Cluster Occupation (SOC) with Requirements for an Associate Degree or Less	Mean	Entry Level	Experienced	50% Median	Typical Entry-Level Education	Empl	Under employed
1	Surveying and Mapping Technicians (17-3031)	\$66,200	\$49,900	\$74,300	\$63,800	HS or equivalent	940	132
2	Hydrologic Technicians (19-4044)	\$64,300	\$42,200	\$75,300	\$60,000	Associate degree	36	16
3	Forest and Conservation Technicians (19-4071)	\$60,700	\$44,400	\$68,800	\$57,000	Associate degree	561	-
4	Forest Fire Inspectors and Prevention Specialists (33-2022)	\$68,200	\$40,500	\$82,100	\$62,000	HS or equivalent	39	11
	Conservation and Land Management – Core	\$119,600	\$56,200	\$151,400	\$102,000	-	87,899	39,683
	Total - All Occupations	\$70,600	\$35,100	\$88,300	\$55,300	-	3,124,097	518,636

Careers in Energy



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Conservation and Land Management Sub-Cluster Demand – Related Industry Occupations

With less than 1% of employment of sub-cluster talent within the two industries aligned to Energy and Natural Resources, most talent works in industries associated with interdisciplinary clusters.

#	NAICS Code*	Industry Title	% of Occ Empl	Empl	Mean Ann Wages	5-Year Exits	5-Year Job Transfers	5-Year Forecast Avg Ann Empl Change	5-Year Total Demand Estimate
1	5511	Management of Companies and Enterprises	5.2%	4,596	\$183,300	518	1,326	33	1,877
2	5416	Management, Scientific, and Technical Consulting Services	3.4%	2,977	\$144,200	320	938	133	1,391
3	7225	Restaurants and Other Eating Places	3.0%	2,636	\$81,000	295	777	53	1,125
4	5413	Architectural, Engineering, and Related Services	3.0%	2,625	\$111,900	354	777	7	1,138
5	9211	Executive, Legislative, and General Government Support	2.5%	2,222	\$104,700	240	693	-5	929
6	5415	Computer Systems Design and Related Services	1.8%	1,546	\$165,500	182	478	115	775
7	2382	Building Equipment Contractors	1.7%	1,481	\$122,400	165	429	6	600
8	5221	Depository Credit Intermediation	1.6%	1,449	\$122,200	163	421	12	595
9	7139	Other Amusement and Recreation Industries	1.4%	1,244	\$76,300	148	365	40	553
10	8111	Automotive Repair and Maintenance	1.4%	1,215	\$86,900	134	352	3	488
		All Other	73.6%	65,908					

Inter-disciplinary Clusters*

Digital Technology
 Marketing & Sales
 Management & Entrepreneurship
 Agriculture
 Advanced Manufacturing
 Construction
 Supply Chain & Transportation
 Public Service & Safety

87,899
Core Occupation Employment

50
Institutions with aligned programs

36,512
New Talent by 2029Q4

High
Talent Shortage Severity

Careers in Energy



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Energy Center of Excellence

Conservation and Land Management

Job Posting Analysis
Advertised May 2024 – April 2025

Top Job Titles

- 1) General Manager
- 2) Director of Operations
- 3) Environmental Specialist
- 4) Operations Manager
- 5) Environmental Scientist
- 6) Hydrologist
- 7) Naturalist
- 8) Forester
- 9) Survey Technician
- 10) Wildlife Biologist

Top Employers Hiring

- 1) University of Minnesota
- 2) State of Minnesota
- 3) Minnesota DNR
- 4) Minnesota DHS
- 5) Bolton & Menk, Inc.
- 6) Westwood Professional Services
- 7) Natural Resources Conservation Services
- 8) HERC
- 9) The Nature Conservancy
- 10) Minnesota Pollution Control Agency

4,610 Posts

-24% from prior year

\$75-\$120K

Posted Salary Range

Hiring Difficulty: **Difficult**
Share Remote Postings: 5%
Share Hybrid Postings: 20%

Top Essential Skills

- 1) Communication
- 2) Leadership
- 3) Collaboration
- 4) Analysis
- 5) Relationships

Top Knowledge Areas and Technical Skills

- 1) Operations / Operations Management
- 2) Research
- 3) Marketing
- 4) Continuous Improvement
- 5) Forecasting

Top Credentials

- 1) American Council on Exercise
- 2) FINRA Series 7
- 3) Professional Wetland Scientist
- 4) Certified Facility Manager
- 5) Accreditation Board for Engineering and Technology



Conservation and Land Management

Job Posting and Profile Gap Analysis Advertised May 2024 – April 2025

Top 10 Skill Gaps in Minnesota

Name	Candidates	Openings	Gap
Operations Management	442	628	-186
Manufacturing	398	502	-104
Personal Computers (PC)	117	214	-97
Microsoft Office	109	183	-74
Performance Management	263	331	-67
Cash Handling (Cashier)	126	183	-56
Finance	314	365	-52
Manufacturing Resource Planning (MRP)	7	49	-43
Calculators	1	36	-35
Asset Management	60	95	-35

Top 10 Certification Gaps in Minnesota

Name	Candidates	Openings	Gap
Commercial Driver's License (CDL)	17	36	-19
AED Essentials	1	17	-16
Class A Commercial Driver's License (CDL-A)	2	12	-10
Class B Commercial Driver's License (CDL-B)	1	5	-5
Certified Arborist	7	11	-4
Certified Revenue Management Executive (CRME)	0	4	-4
Certification in Cardiopulmonary Resuscitation (CPR)	66	70	-4
HAZMAT	3	7	-4
OSHA 10	3	6	-3
Chartered Property Casualty Underwriter (CPCU)	0	3	-3

Careers in Energy



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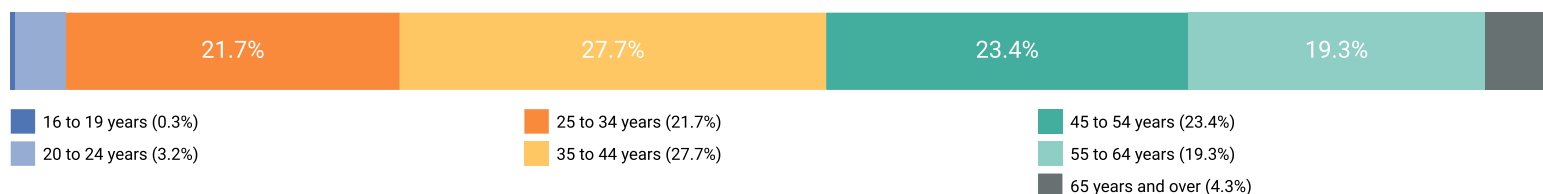
Conservation and Land Management

Estimated Talent Pool Diversity (Across all industries statewide)

Underrepresentation of talent who are:

- Female
- American Indian
- Asian
- Hispanic or Latine
- Under 25 years old

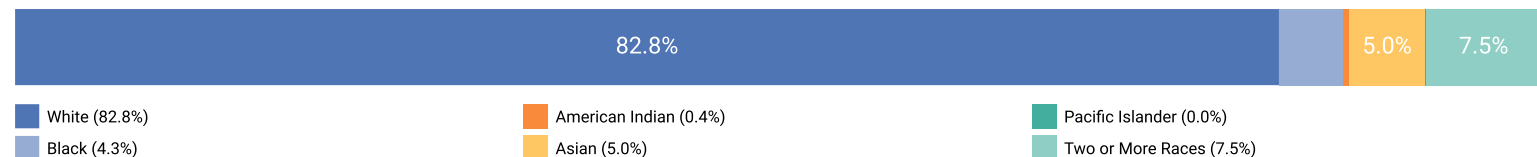
Age



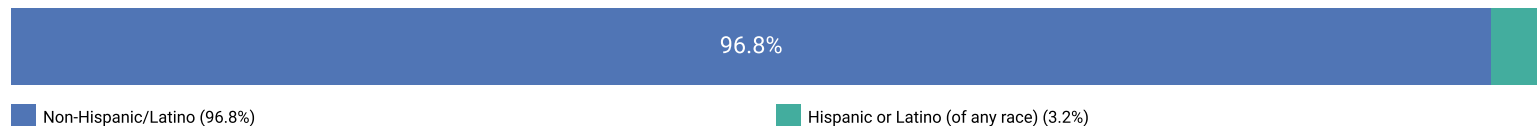
Gender



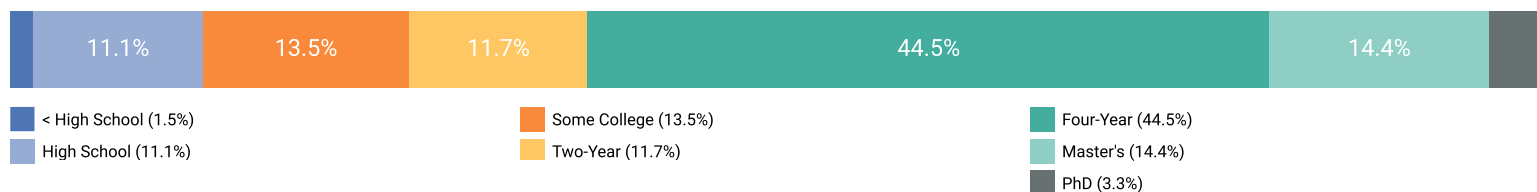
Race



Ethnicity



Educational Attainment



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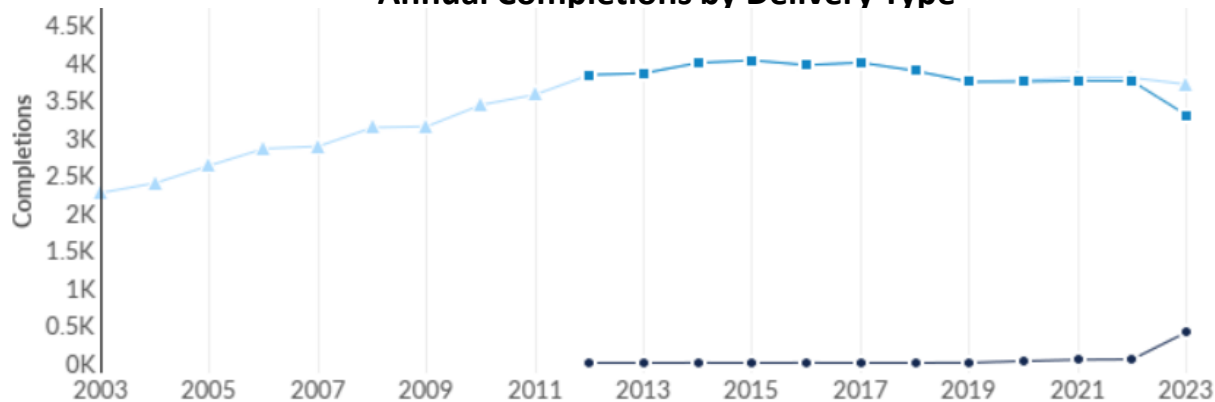
Conservation and Land Management

Aligned Postsecondary Programs With Awards Conferred, SY2023



Institution Type	Completions (2023)	Market Share
Public, 4-year or above	2,184	59.0%
Private not-for-profit, 4-year or above	1,288	34.8%
Public, 2-year	231	6.2%

Annual Completions by Delivery Type

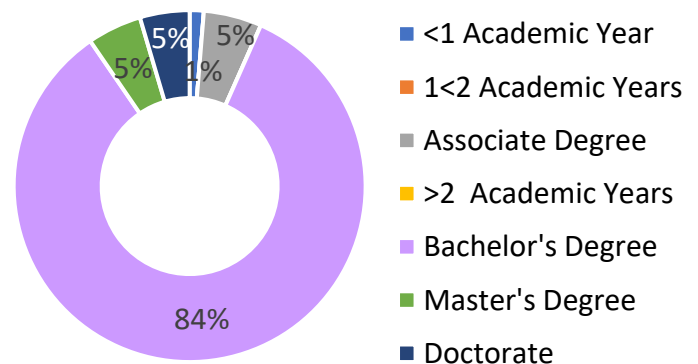


Distance Offered Programs	N/A
Non-Distance Offered Programs	-13.9%
All Programs	-3.3%

50

Institutions with aligned programs

Completions SY2023



Careers in Energy



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Energy Center of Excellence

Conservation and Land Management

Aligned Postsecondary Programs With Awards Conferred, SY2023

Market Share by Program



Program	Completions (2023)	Market Share
Biology/Biological Sciences, General (26.0101)	1,582	42.7%
Chemistry, General (40.0501)	446	12.0%
Biochemistry (26.0202)	244	6.6%
Physics, General (40.0801)	228	6.2%
Other	1,203	32.5%

Institution	Completions (2023)	Growth % YOY (2023)	Market Share (2023)	IPEDS Tuition & Fees (2023)	Completions Trend (2019-2023)
University of Minnesota-Twin Cities	1,181	-1.2%	31.9%	\$16,488	
University of Minnesota-Duluth	342	7.9%	9.2%	\$14,318	
St Olaf College	164	3.8%	4.4%	\$56,970	
Minnesota State University-Mankato	161	-6.9%	4.3%	\$9,490	
University of St Thomas	132	-16.5%	3.6%	\$52,284	
Carleton College	126	-8.7%	3.4%	\$65,457	
Macalester College	116	-10.1%	3.1%	\$64,908	
Winona State University	105	-9.5%	2.8%	\$10,498	
Minnesota North College	104	-9.6%	2.8%	\$6,004	
Gustavus Adolphus College	100	-5.7%	2.7%	\$54,310	

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Conservation and Land Management

Aligned Postsecondary Programs With Awards Conferred, SY2023

Graduate Demographics, All Programs



- White
- Black or African American
- American Indian
- Asian
- Pacific Islander
- Two or More Races
- Hispanic or Latine
- International Students
- Unknown Race/Ethnicity

#	Description	Total Completions	Male	Female	Black or African American	American Indian	Asian	Hispanic or Latine	White	Two or More Races	Unknown Race/Ethnicity	International Students
1	University of Minnesota-Twin Cities	1,181	42%	58%	5%	0%	10%	5%	65%	5%	1%	10%
2	University of Minnesota-Duluth	342	43%	57%	2%	0%	6%	2%	83%	4%	1%	2%
3	St Olaf College	164	42%	58%	2%	0%	9%	5%	74%	4%	0%	5%
4	Minnesota State University-Mankato	161	44%	56%	9%	1%	4%	3%	74%	2%	0%	8%
5	University of St Thomas	132	43%	57%	3%	0%	5%	8%	74%	5%	3%	2%
6	Carleton College	126	47%	53%	2%	0%	15%	6%	55%	7%	4%	11%
7	Macalester College	116	36%	64%	6%	0%	1%	7%	62%	12%	0%	12%
8	Winona State University	105	33%	67%	2%	0%	3%	4%	83%	7%	0%	2%
9	Minnesota North College	104	82%	18%	0%	0%	2%	2%	94%	1%	1%	0%
	Others	1,272	40%	60%	6%	1%	7%	5%	71%	4%	2%	3%
	Total	3,703	42%	58%	5%	1%	8%	5%	71%	4%	1%	6%

Careers in Energy



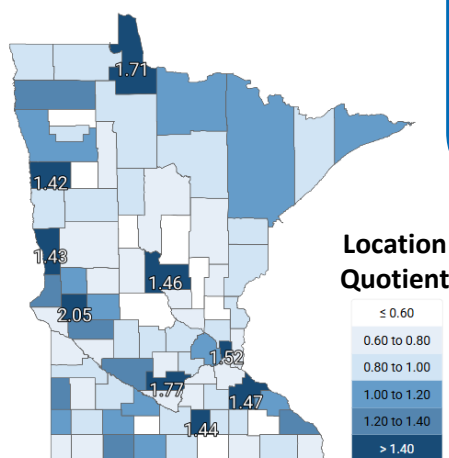
MINNESOTA STATE
Energy Center of Excellence

Ecological Research and Development

Sub-Cluster Demand

Summary

Careers emphasizing the scientific study of and research in ecological, geological, electrical, chemical, nuclear, biological, environmental engineering, and other sciences as they relate to energy production, sustainability, and the management of natural resources; Employ scientific methods to understand ecosystems, biodiversity, and the impacts of energy systems on the environment.

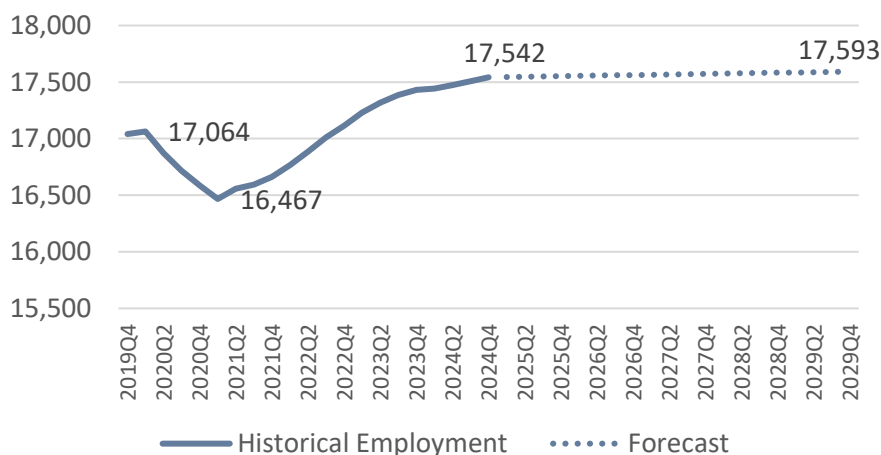


Top Five Counties

By number of employees

Hennepin	6,014
Ramsey	2,807
Dakota	814
Anoka	673
St. Louis	620

Core Sub-Cluster Employment Forecast



Core Occupation Summary Statistics (Across all industries statewide)

3.0%
Unemployment
rate

1.04
Location
Quotient

0.1%
Forecast Annual
Growth

2,165
Online job ads
(March 2025)

Careers in Energy



MINNESOTA STATE
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Ecological Research and Development Sub-Cluster Demand – Core Occupations

#	Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate	% of Total Empl in Ind 21, 22
1	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1.05	92	2.2%	1.0%	0.1%	1,341	3%
2	Environmental Scientists and Specialists (19-2041)	1,590	\$86,500	1.04	22	1.4%	-0.2%	0.2%	733	3%
3	Natural Sciences Managers (11-9121)	1,394	\$153,700	0.76	36	2.5%	4.6%	0.4%	537	1%
4	Environmental Engineers (17-2081)	1,327	\$106,300	1.77	12	0.9%	-2.0%	0.3%	446	4%
5	First-Line Supervisors of Farming, Fishing, and Forestry Workers (45-1011)	1,246	\$68,200	1.07	45	3.5%	0.9%	-0.2%	834	<1%
6	Technical Writers (27-3042)	977	\$83,800	1.07	81	7.7%	-1.9%	0.0%	377	1%
7	Biological Scientists, All Other (19-1029)	782	\$97,300	0.65	13	1.6%	4.9%	0.3%	303	<1%
8	Conservation Scientists (19-1031)	673	\$85,800	1.48	20	3.0%	3.1%	0.3%	309	<1%
9	Physical Scientists, All Other (19-2099)	650	\$167,400	1.13	14	2.1%	-1.0%	-0.1%	205	2%
10	Environmental Science & Protection Technicians (19-4042)	569	\$61,200	0.93	24	4.1%	-0.3%	0.3%	321	4%
11	Forest and Conservation Technicians (19-4071)	561	\$60,700	0.93	12	2.2%	2.4%	-0.1%	342	1%
12	Zoologists and Wildlife Biologists (19-1023)	533	\$79,200	1.59	9	1.7%	-0.1%	0.0%	196	0%
	Ecological Research & Development – Core	17,542	\$116,000	1.04	538	3.0%	0.6%	0.1%	7,129	3%
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667	

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Ecological Research and Development

Of the 25 occupations found in the sub-cluster, six typically require an Associate degree, certificate, or high school diploma as the highest level of education. All of these careers have average annual wages over \$61,000, with Supervisors of Farming, Fishing, and Forestry Workers offering the highest average annual wages.

Sub-Cluster Wages

Core Sub-Cluster Wage Distribution

Mean

\$116,000

Entry Level

\$79,600

Experienced

\$134,200

		Wages						
#	Sub-Cluster Occupation (SOC) with Requirements for an Associate Degree or Less	Mean	Entry Level	Experienced	50% Median	Typical Entry-Level Education	Empl	Under employed
1	First-Line Supervisors of Farming, Fishing, and Forestry Workers (45-1011)	\$68,200	\$45,500	\$79,600	\$62,100	HS or equivalent	1,246	196
2	Environmental Engineering Technologists and Technicians (17-3025)	\$68,000	\$51,400	\$76,300	\$67,200	Associate degree	234	71
3	Environmental Science and Protection Technicians, Including Health (19-4042)	\$61,200	\$37,900	\$72,800	\$57,800	Associate degree	569	-
4	Geological Technicians, Except Hydrologic Technicians (19-4043)	\$61,900	\$51,100	\$67,300	\$57,400	Associate degree	140	67
5	Hydrologic Technicians (19-4044)	\$64,300	\$42,200	\$75,300	\$60,000	Associate degree	36	16
6	Forest and Conservation Technicians (19-4071)	\$60,700	\$44,400	\$68,800	\$57,000	Associate degree	561	-
	Ecological Research & Development – Core	\$116,000	\$79,600	\$134,200	\$110,500	-	87,899	1,052
	Total - All Occupations	\$70,600	\$35,100	\$88,300	\$55,300	-	3,124,097	518,636

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Ecological Research and Development Sub-Cluster Demand – Related Industry Occupations

With about 3% of employment of sub-cluster talent within the two industries aligned to Energy and Natural Resources, most talent works in industries associated with interdisciplinary clusters.

#	NAICS Code*	Industry Title	% of Occ Empl	Empl	Mean Ann Wages	5-Year Exits	5-Year Job Transfers	5-Year Forecast Avg Ann Empl Change	5-Year Total Demand Estimate
1	5413	Architectural, Engineering, and Related Services	12.0%	2,112	\$120,800	206	569	1	777
2	5416	Management, Scientific, and Technical Consulting Services	7.3%	1,280	\$91,200	123	414	55	592
3	9211	Executive, Legislative, and Other Government Support	6.7%	1,179	\$92,800	103	400	-11	492
4	5517	Scientific Research and Development Services	6.3%	1,100	\$141,700	100	310	45	455
5	5511	Management of Companies and Enterprises	5.2%	905	\$154,300	86	241	6	333
6	3345	Navigational, Measuring, and Electromedical Manufacturing	4.6%	803	\$164,500	74	194	-3	265
7	9231	Administration of Human Resource Programs	4.4%	774	\$95,100	66	257	-10	313
8	9221	Justice, Public Order, and Safety Activities	4.1%	719	\$94,300	62	239	-6	295
9	6113	Colleges, Universities, and Professional Schools	4.0%	701	\$107,400	52	212	-7	256
10	2211	Electric Power Generation, Transmission and Distribution	2.8%	493	\$131,800	46	112	-30	128
		All Other	42.6%	7,478					

Inter-disciplinary Clusters*

Digital Technology
 Marketing & Sales
 Management & Entrepreneurship
 Agriculture
 Advanced Manufacturing
 Construction
 Supply Chain & Transportation
 Public Service & Safety

17,542
Core Occupation Employment

50
Institutions with aligned programs

7,129
New Talent by 2029Q4

Moderate
Talent Shortage Severity

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Ecological Research and Development

Job Posting Analysis
Advertised May 2024 – April 2025

Top Job Titles

- 1) Engineering Manager
- 2) Engineering Project Manager
- 3) Management Analyst Specialist
- 4) Environmental Health Manager
- 5) Program Manager
- 6) Technical Writer
- 7) Laboratory Technician
- 8) Fire Protection Engineering PM
- 9) Environmental Specialist
- 10) Water Systems Engineering Specialist

Top Employers Hiring

- 1) University of Minnesota
- 2) State of Minnesota
- 3) M. A. Mortenson Company
- 4) Boston Scientific Corporation
- 5) Medtronic
- 6) MN Pollution Control Agency
- 7) MN Department of Human Services
- 8) Clean Harbors, Inc.
- 9) Baxter
- 10) Burns & McDonnell

5,397 Posts

+23% from prior year

\$93-\$151K

Posted Salary Range

Hiring Difficulty: **Difficult**
Share Remote Postings: 5%
Share Hybrid Postings: 32%

Top Essential Skills

- 1) Communication
- 2) Leadership
- 3) Analysis
- 4) Planning
- 5) Relationships

Top Knowledge Areas and Technical Skills

- 1) Project Management
- 2) Scheduling
- 3) Monitoring
- 4) Environmental Science
- 5) Federal Law

Top Credentials

- 1) Driver's License (D)
- 2) OSHA
- 3) Professional Engineer License
- 4) Project Management Professional (PMP)
- 5) Hazardous Waste Operations and Emergency Response



Ecological Research and Development

Job Posting and Profile Gap Analysis Advertised May 2024 – April 2025

Top 10 Skill Gaps in Minnesota

Name	Candidates	Openings	Gap
Animal Care/Animal Handling	54	81	-26
Microsoft Office	136	162	-26
English	16	33	-17
Presentation	29	45	-16
Microsoft Outlook	24	39	-15
Geographic Information System Software (GIS Software)	2	13	-10
Autodesk AutoCAD	46	56	-10
Microsoft Project	16	25	-9
Machine Learning	13	20	-8
Sterilization	3	10	-7

Top 10 Certification Gaps in Minnesota

Name	Candidates	Openings	Gap
Registered Environmental Manager (REM)	0	10	-10
Engineer in Training (EIT)	11	14	-3
Certified Hazardous Materials Manager (CHMM)	1	4	-3
Project Management Professional (PMP)	11	14	-3
Certified Arborist	7	9	-3
Licensed Practical Nurse (LPN)	0	2	-2
Certification in Cardiopulmonary Resuscitation (CPR)	9	10	-1
Certified Clinical Exercise Physiologist (CEP)	0	1	-1
Certified in Clinical Genetics	1	2	-1
Regulatory Affairs Certification - US (RAC)	0	1	-1

Careers in Energy



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Energy Center of Excellence

Ecological Research and Development

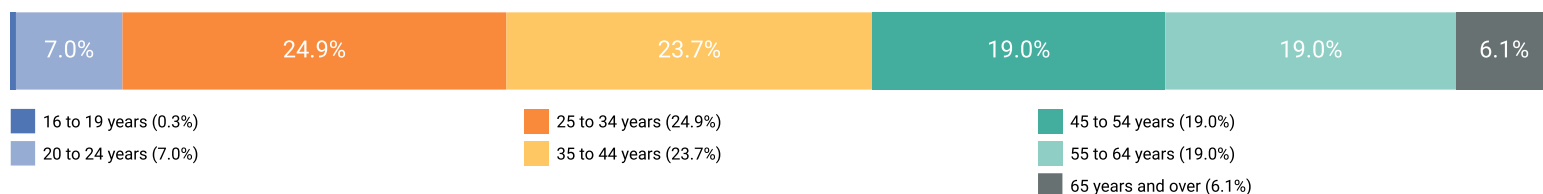
Estimated Talent Pool Diversity (Across all industries statewide)

Underrepresentation of talent who are:

- Female
- Black

- American Indian
- Hispanic or Latine
- Under 25 years old

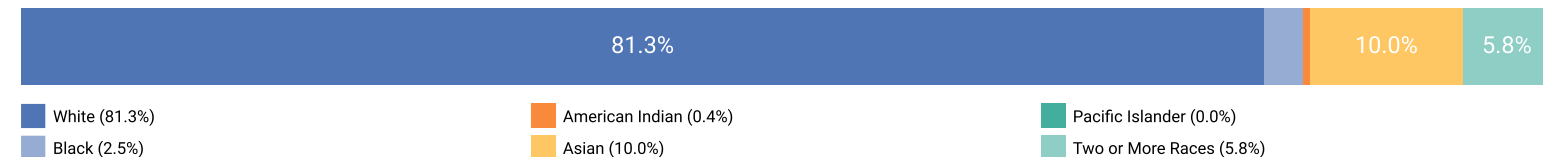
Age



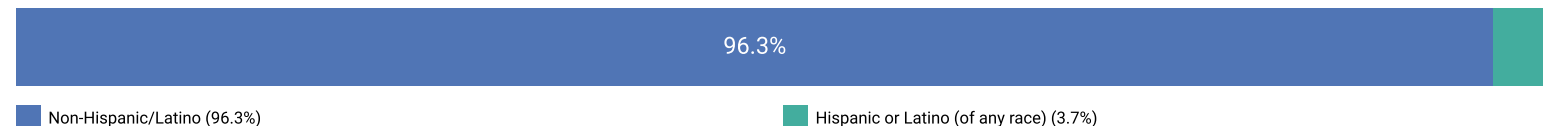
Gender



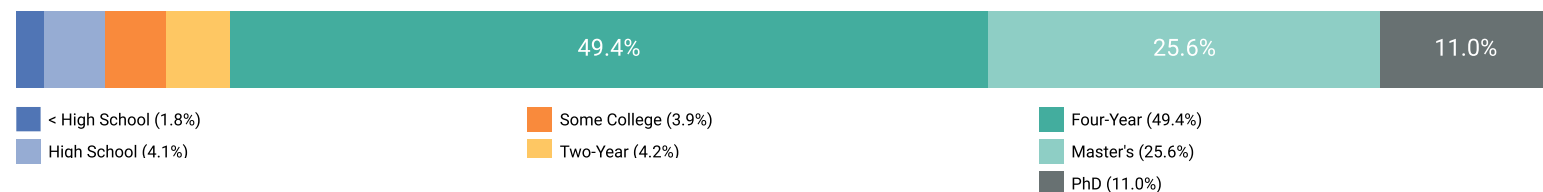
Race



Ethnicity



Educational Attainment



Careers in Energy



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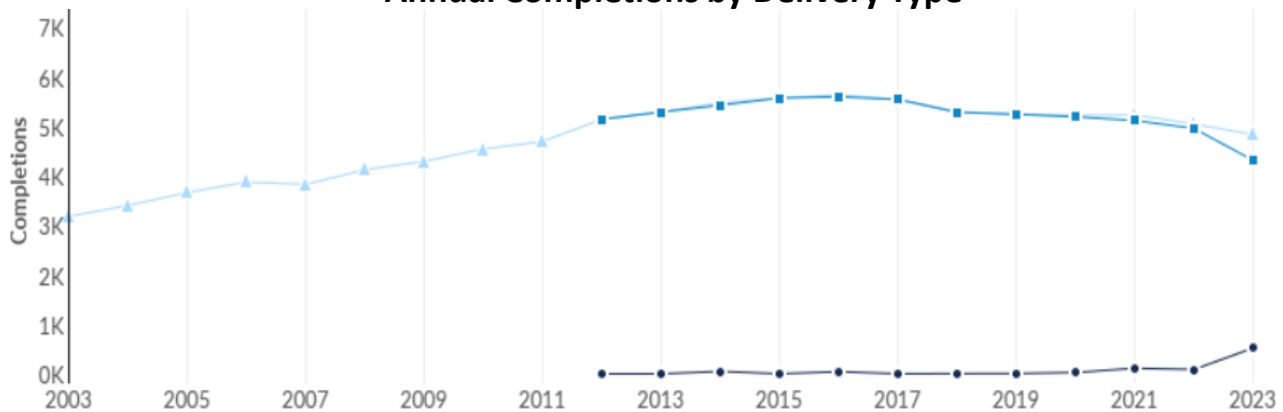
Ecological Research and Development

Aligned Postsecondary Programs With Awards Conferred, SY2023



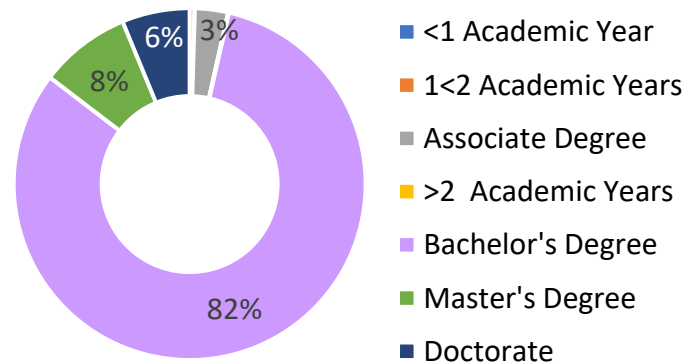
Institution Type	Completions (2023)	Market Share
Public, 4-year or above	2,863	59.2%
Private not-for-profit, 4-year or above	1,820	37.6%
Public, 2-year	153	3.2%

Annual Completions by Delivery Type



Distance Offered Programs	N/A
Non-Distance Offered Programs	-16.2%
All Programs	-6.0%

Completions SY2023



50

Institutions with aligned programs

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Ecological Research and Development

Aligned Postsecondary Programs With Awards Conferred, SY2023



Market Share by Program		Completions (2023)	Market Share
●	Biology/Biological Sciences, General (26.0101)	1,582	32.7%
●	Chemistry, General (40.0501)	446	9.2%
●	Economics, General (45.0601)	344	7.1%
●	Biochemistry (26.0202)	244	5.0%
●	Other	2,220	45.9%

Institution	Completions (2023)	Growth % YOY (2023)	Market Share (2023)	IPEDS Tuition & Fees (2023)	Completions Trend (2019-2023)
University of Minnesota-Twin Cities	1,712	-3.0%	35.4%	\$16,488	
University of Minnesota-Duluth	391	-2.3%	8.1%	\$14,318	
University of St Thomas	315	-13.5%	6.5%	\$52,284	
St Olaf College	247	2.1%	5.1%	\$56,970	
Macalester College	182	-2.2%	3.8%	\$64,908	
Minnesota State University-Mankato	173	-7.5%	3.6%	\$9,490	
Carleton College	163	-5.2%	3.4%	\$65,457	
Gustavus Adolphus College	160	9.6%	3.3%	\$54,310	
Winona State University	115	-8.0%	2.4%	\$10,498	
Saint Cloud State University	105	-17.3%	2.2%	\$10,117	

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Ecological Research and Development

Aligned Postsecondary Programs With Awards Conferred, SY2023

Graduate Demographics, All Programs



- White
- Black or African American
- American Indian
- Asian
- Pacific Islander
- Two or More Races
- Hispanic or Latine
- International Students
- Unknown Race/Ethnicity

#	Description	Total Completions	Male	Female	Black or African American	American Indian	Asian	Hispanic or Latine	White	Two or More Races	Unknown Race/Ethnicity	International Students
1	University of Minnesota-Twin Cities	1,712	45%	55%	5%	0%	10%	5%	60%	4%	1%	15%
2	University of Minnesota-Duluth	391	44%	56%	2%	0%	5%	2%	83%	3%	1%	4%
3	University of St Thomas	315	47%	53%	3%	0%	7%	4%	69%	3%	5%	7%
4	St Olaf College	247	43%	57%	2%	0%	7%	6%	76%	3%	0%	6%
5	Macalester College	182	38%	62%	5%	0%	5%	6%	63%	9%	0%	12%
6	Minnesota State University-Mankato	173	45%	55%	9%	1%	3%	3%	65%	2%	0%	16%
7	Carleton College	163	48%	52%	2%	0%	17%	7%	52%	7%	4%	12%
8	Gustavus Adolphus College	160	42%	58%	6%	0%	4%	3%	83%	3%	2%	1%
9	Winona State University	115	37%	63%	2%	0%	3%	3%	83%	6%	0%	3%
	Others	1,378	43%	57%	7%	2%	7%	5%	68%	4%	2%	4%
	Total	4,836	44%	56%	5%	1%	8%	5%	67%	4%	2%	9%

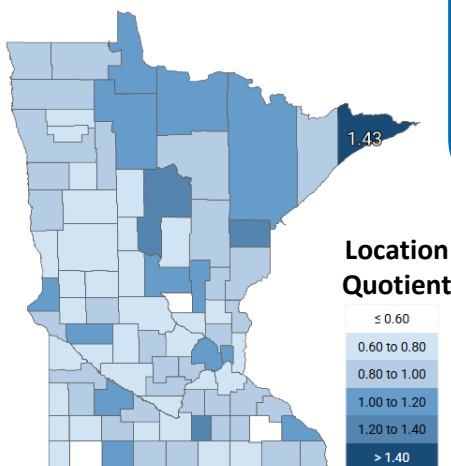
Careers in Energy



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Sub-Cluster Demand

Environmental Protection



Top Five Counties

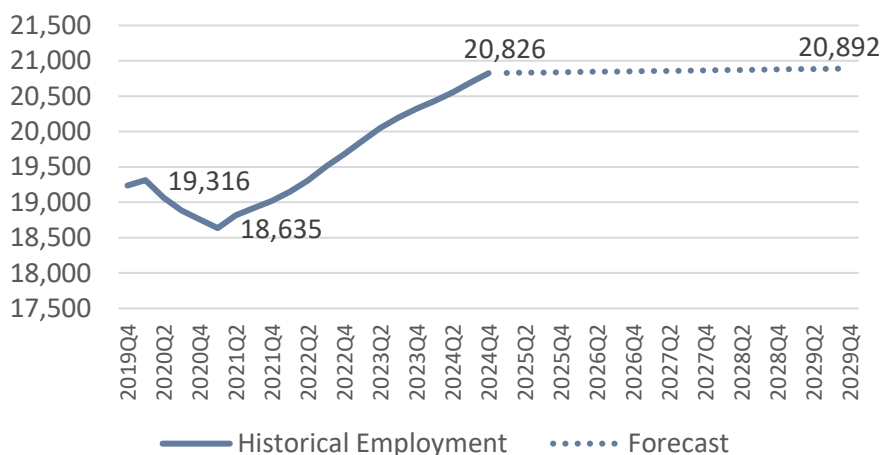
By number of employees

Hennepin	7,022
Ramsey	2,959
Dakota	1,157
Anoka	918
St. Louis	745

Summary

Regulating and managing the impacts of natural processes and human activities, such as resource production and consumption; Developing and enforcing policies to protect ecosystems, including space, air, land, and water, from natural disasters, pollution, and degradation; Conservation of natural habitats and biodiversity and applying scientific and engineering principles to solve environmental problems and improve climate resilience.

Core Sub-Cluster Employment Forecast



Core Occupation Summary Statistics (Across all industries statewide)

1.8%
Unemployment
rate

0.92
Location
Quotient

0.1%
Forecast Annual
Growth

1,435
Online job ads
(March 2025)

Careers in Energy



MINNESOTA STATE
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Environmental Protection Sub-Cluster Demand – Core Occupations

#	Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate	% of Total Empl in Ind 21, 22
1	Compliance Officers (13-1041)	6,909	\$88,100	0.95	101	1.4%	3.4%	0.2%	2,774	0%
2	Firefighters (33-2011)	5,310	\$49,600	0.90	86	1.6%	1.0%	0.1%	1,955	0%
3	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1.05	92	2.2%	1.0%	0.1%	1,341	3%
4	Engineers, All Other (17-1299)	2,300	\$123,100	0.78	35	1.5%	-1.9%	0.2%	675	0%
5	Biological Scientists, All Other (19-1029)	782	\$97,300	0.65	13	1.6%	4.9%	0.3%	303	<1%
6	Conservation Scientists (19-1031)	673	\$85,800	1.48	20	3.0%	3.1%	0.3%	309	<1%
7	Social Scientists and Related Workers, All Other (19-3099)	517	\$91,500	0.75	19	3.6%	1.4%	0.1%	219	0%
8	Fish and Game Wardens (33-3031)	151	\$73,500	1.13	4	2.5%	1.3%	-1.3%	58	0%
9	Hydrologic Technicians (19-4044)	36	\$64,300	0.70	2	4.2%	-2.4%	0.0%	19	2%
	Environmental Protection – Core	20,826	\$100,400	0.92	371	1.8%	1.6%	0.1%	7,653	1%
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667	

Careers in Energy



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Sub-Cluster Wages

Environmental Protection

Of the 9 occupations found in the sub-cluster, only two—Hydrologic Technicians and Firefighters—typically require an Associate degree, certificate, or high school diploma as the highest level of education. Other roles in the sub-cluster may have flexible education requirements due to high talent shortage.

Core Sub-Cluster Wage Distribution

Mean

\$100,400

Entry Level

\$68,400

Experienced

\$116,400

		Wages						
#	Sub-Cluster Occupation (SOC) with Requirements for an Associate Degree or Less	Mean	Entry Level	Experienced	50% Median	Typical Entry-Level Education	Empl	Under employed
1	Hydrologic Technicians (19-4044)	\$64,300	\$42,200	\$75,300	\$60,000	Associate degree	36	16
2	Firefighters (33-2011)	\$49,600	\$31,000	\$58,900	\$42,500	Postsecondary Certificate	5,326	1,526
	Environmental Protection – Core	\$100,400	\$68,400	\$116,400	\$95,000	-	20,826	1,612
	Total - All Occupations	\$70,600	\$35,100	\$88,300	\$55,300	-	3,124,097	518,636

Careers in Energy



MINNESOTA STATE
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Environmental Protection Sub-Cluster Demand – Related Industry Occupations

With about 1% of employment of sub-cluster talent within the two industries aligned to Energy and Natural Resources, most talent works in industries associated with interdisciplinary clusters.

#	NAICS Code*	Industry Title	% of Occ Empl	Empl	Mean Ann Wages	5-Year Exits	5-Year Job Transfers	5-Year Forecast Avg Ann Empl Change	5-Year Total Demand Estimate
1	9211	Executive, Legislative, and Other Government Support	21.5%	4,468	\$59,500	486	1,171	12	1,669
2	5511	Management of Companies and Enterprises	6.3%	1,312	\$129,100	174	299	9	482
3	5413	Architectural, Engineering, and Related Services	6.2%	1,281	\$148,700	128	280	1	408
4	9221	Justice, Public Order, and Safety Activities	5.2%	1,085	\$71,600	128	277	-12	393
5	9231	Administration of Human Resource Programs	4.5%	941	\$77,900	114	239	-9	344
6	3345	Navigational, Measuring, and Electromedical Manufacturing	4.5%	927	\$160,800	96	200	-1	295
7	5417	Scientific Research and Development Services	2.3%	489	\$131,100	47	131	21	199
8	9241	Admin. of Environmental Quality Programs	2.2%	468	\$76,100	55	118	-9	164
9	5241	Insurance Carriers	2.2%	458	\$92,600	74	103	1	177
10	5416	Management, Scientific, and Technical Consulting Services	2.1%	443	\$101,200	59	109	20	188
		All Other	43.0%	8,954					

Inter-disciplinary Clusters*

Digital Technology
 Marketing & Sales
 Management & Entrepreneurship
 Agriculture
 Advanced Manufacturing
 Construction
 Supply Chain & Transportation
 Public Service & Safety

20,826
Core Occupation
Employment

9
Institutions with
aligned programs

7,653
New Talent by
2029Q4

Moderate
Talent Shortage
Severity

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Environmental Protection

Job Posting Analysis
Advertised May 2024 – April 2025

Top Job Titles

- 1) Engineering Manager
- 2) Engineering Project Manager
- 3) Fire Protection Engineering PM
- 4) Program Manager
- 5) Driver and Dealer Examiner
- 6) Design Phase Manager
- 7) Quality Engineer
- 8) Senior Principal Systems Engineer
- 9) Project Controls Professional
- 10) Quality Manager - Power

Top Employers Hiring

- 1) M. A. Mortenson Company
- 2) Medtronic
- 3) Boston Scientific Corporation
- 4) State of Minnesota
- 5) University of Minnesota
- 6) Honeywell
- 7) Wells Fargo
- 8) Baxter
- 9) HDR, Inc.
- 10) Abbott Laboratories

2,600 Posts

+101% from prior year

\$127-\$207K

Posted Salary Range

Hiring Difficulty: **Difficult**
Share Remote Postings: 6%
Share Hybrid Postings: 31%

Top Essential Skills

- 1) Communication
- 2) Leadership
- 3) Collaboration
- 4) Planning
- 5) Analysis

Top Knowledge Areas and Technical Skills

- 1) Project Management
- 2) Scheduling
- 3) Monitoring
- 4) Operations
- 5) Research

Top Credentials

- 1) Driver's License (D)
- 2) Project Management Professional (PMP)
- 3) Professional Engineer License
- 4) OSHA
- 5) Data Encryption Standard



Environmental Protection

Job Posting and Profile Gap Analysis Advertised May 2024 – April 2025

Top 10 Skill Gaps in Minnesota

Name	Candidates	Openings	Gap
Microsoft Outlook	72	87	-15
Word Processing	3	17	-14
Adobe Illustrator	2	15	-13
Yardi	6	16	-10
IT Support	4	13	-9
Computer Aided Design Software (CAD Software)	33	42	-9
Autodesk Revit	6	15	-8
SAP	27	35	-8
Linux	13	20	-7
Adobe Photoshop	2	8	-7

Top 10 Certification Gaps in Minnesota

Name	Candidates	Openings	Gap
First Aid Certification	18	28	-10
Project Management Professional (PMP)	10	16	-6
AED Essentials	1	4	-4
OSHA 10	2	4	-2
Certified Regulatory Compliance Manager (CRCM)	0	2	-2
Engineer in Training (EIT)	4	5	-1
Certified Professional Property Specialist (CPPS)	0	1	-1

Careers in Energy



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Environmental Protection

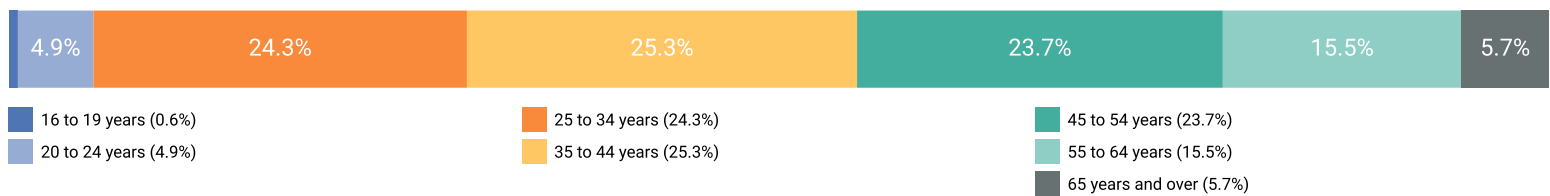
Estimated Talent Pool Diversity (Across all industries statewide)

Underrepresentation of talent who are:

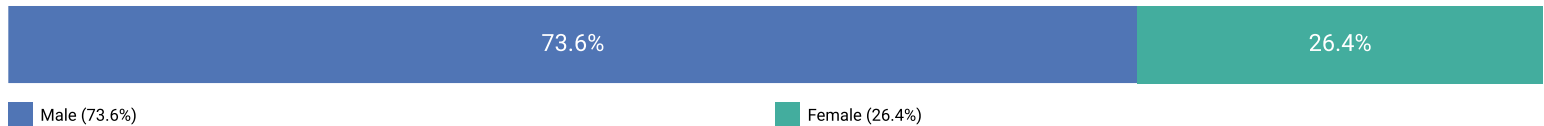
- Female
- Black

- American Indian
- Hispanic or Latine
- Under 25 years old and 55+

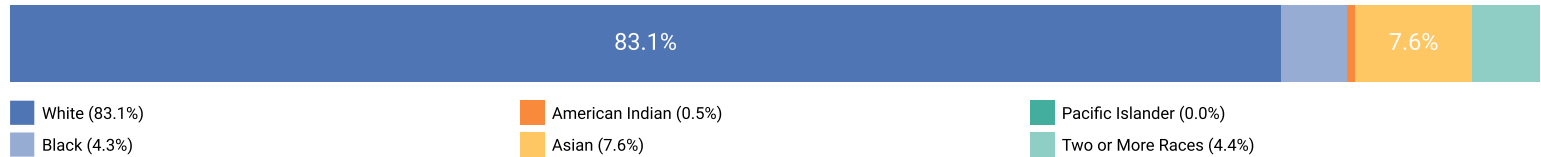
Age



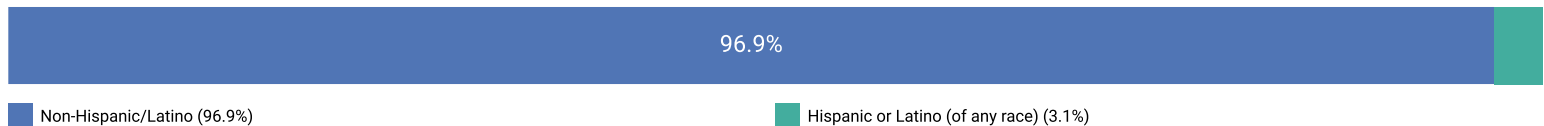
Gender



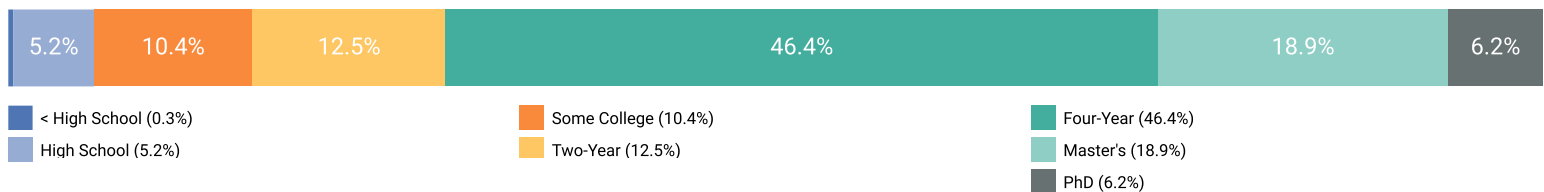
Race



Ethnicity



Educational Attainment



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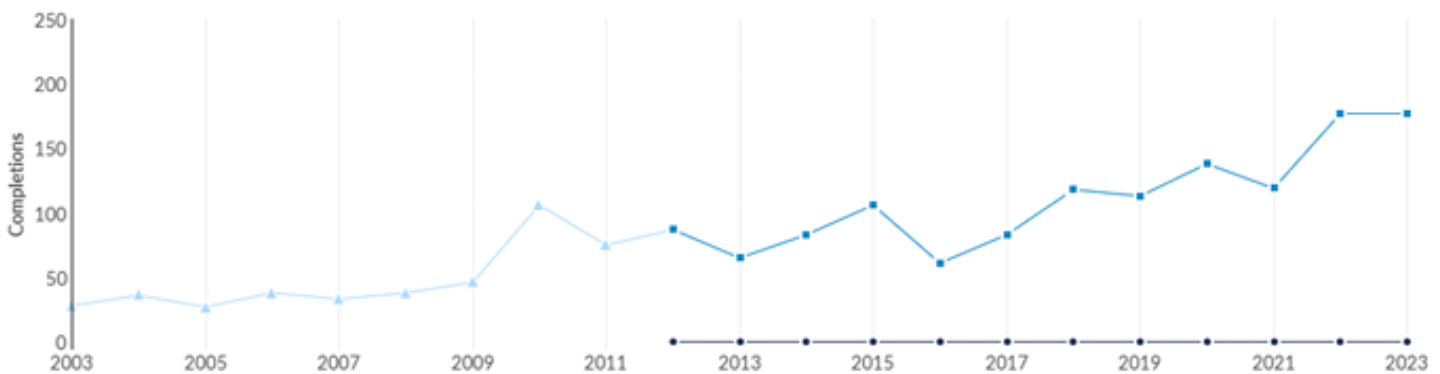
Environmental Protection



Aligned Postsecondary Programs With Awards Conferred, SY2023

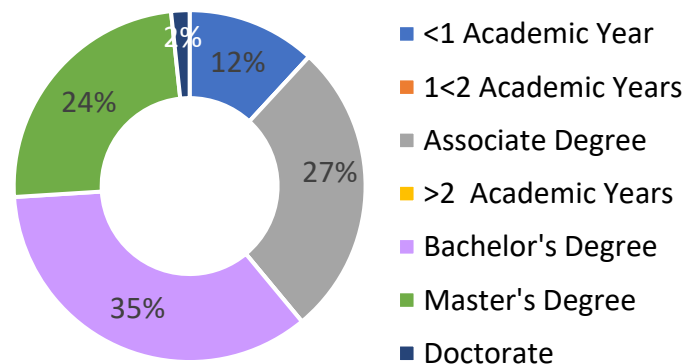
Institution Type	Completions (2023)	Market Share
Public, 4-year or above	109	61.6%
Public, 2-year	67	37.9%
Private not-for-profit, 4-year or above	1	0.6%

Annual Completions by Delivery Type



Distance Offered Programs	N/A
Non-Distance Offered Programs	+103%
All Programs	+103%

Completions SY2023



9

Institutions with aligned programs

Careers in Energy



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Environmental Protection

Aligned Postsecondary Programs With Awards Conferred, SY2023

Market Share by Program



Program	Completions (2023)	Market Share
Wildlife, Fish and Wildlands Science and Management (03.0601)	44	24.9%
Environmental/Natural Resources Law Enforcement and Protective Services (03.0208)	43	24.3%
Ecology and Evolutionary Biology (26.1310)	33	18.6%
Hydrology and Water Resources Science (40.0605)	19	10.7%
Other	38	21.5%

Institution	Completions (2023)	Growth % YOY (2023)	Market Share (2023)	IPEDS Tuition & Fees (2023)	Completions Trend (2019-2023)
Minnesota North College	57	-20.8%	32.2%	\$6,004	
University of Minnesota-Twin Cities	46	35.3%	26.0%	\$16,488	
Bemidji State University	27	-18.2%	15.3%	\$10,114	
Saint Cloud State University	22	10.0%	12.4%	\$10,117	
Minnesota State University Moorhead	12	-7.7%	6.8%	\$10,336	
Central Lakes College-Brainerd	5	150.0%	2.8%	\$6,209	
Saint Paul College	5	Insf. Data	2.8%	\$6,318	
Fond du Lac Tribal and Community College	2	Insf. Data	1.1%	\$5,999	
The College of Saint Scholastica	1	-66.7%	0.6%	\$40,454	

Careers in Energy



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Environmental Protection

Aligned Postsecondary Programs With Awards Conferred, SY2023

Graduate Demographics, All Programs



- White
- Black or African American
- American Indian
- Asian
- Pacific Islander
- Two or More Races
- Hispanic or Latine
- International Students
- Unknown Race/Ethnicity

#	Description	Total Completions	Male	Female	Black or African American	American Indian	Asian	Hispanic or Latine	White	Two or More Races	Unknown Race/Ethnicity	International Students
1	Minnesota North College	57	75%	25%	0%	0%	2%	2%	93%	2%	2%	0%
2	University of Minnesota-Twin Cities	46	43%	57%	2%	2%	0%	4%	67%	7%	0%	17%
3	Bemidji State University	27	63%	37%	0%	0%	0%	0%	96%	0%	4%	0%
4	Saint Cloud State University	22	27%	73%	0%	0%	9%	0%	91%	0%	0%	0%
5	Minnesota State University Moorhead	12	33%	67%	0%	0%	8%	0%	83%	8%	0%	0%
6	Central Lakes College-Brainerd	5	60%	40%	0%	0%	0%	0%	100%	0%	0%	0%
7	Saint Paul College	5	60%	40%	0%	0%	20%	0%	80%	0%	0%	0%
8	Fond du Lac Tribal and Community College	2	0%	100%	0%	100%	0%	0%	0%	0%	0%	0%
9	The College of Saint Scholastica	1	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%
	Total	177	55%	45%	0%	0%	0%	2%	84%	3%	1%	5%

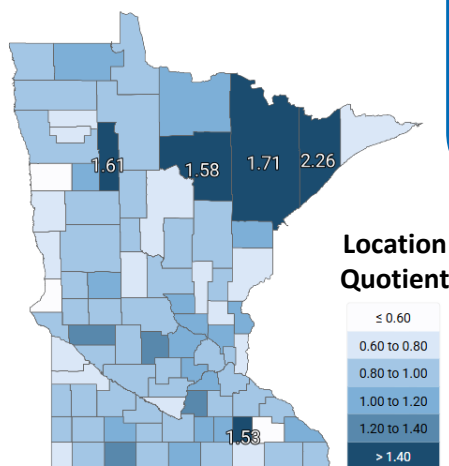
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Sub-Cluster Demand

Resource Extraction



Top Five Counties

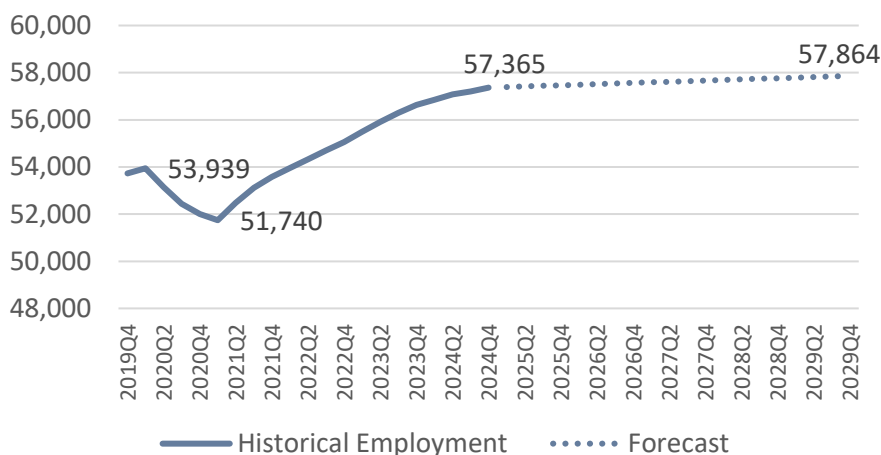
By number of employees

Hennepin	16,148
Ramsey	6,214
Dakota	3,554
St. Louis	3,442
Anoka	2,933

Summary

The efficient removal of natural materials including fossil fuels, minerals, natural gas, and geothermal resources that are essential for fuel production in energy and manufacturing; Fields of work include resource exploration, drilling, mining, fracking, mineral processing, geoscience, quarrying, and petroleum engineering.

Core Sub-Cluster Employment Forecast



Core Occupation Summary Statistics (Across all industries statewide)

1.9%
Unemployment
rate

0.92
Location
Quotient

0.3%
Forecast Annual
Growth

3,098
Online job ads
(March 2025)

Careers in Energy



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Resource Extraction Sub-Cluster Demand – Core Occupations

#	Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate	% of Total Empl in Ind
1	Supervisors of Construction Trades and Extraction Workers (47-1011)	14,227	\$95,900	0.87	353	2.4%	2.1%	0.4%	5,743	2%
2	Supervisors of Mechanics, Installers, Repairers (49-1011)	9,514	\$89,400	0.84	88	0.9%	1.6%	0.1%	3,837	7%
3	Industrial Machinery Mechanics (49-9041)	7,532	\$72,800	0.94	105	1.4%	2.4%	1.3%	3,594	5%
4	Compliance Officers (13-1041)	6,909	\$88,100	0.95	101	1.4%	3.4%	0.2%	2,774	2%
5	Industrial Engineering Techs (17-3026)	4,334	\$72,600	3.13	65	1.5%	0.3%	0.1%	1,845	1%
6	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1.05	92	2.2%	1.0%	0.1%	1,341	3%
7	Engineers, All Other (17-2199)	2,300	\$123,100	0.78	35	1.5%	-1.9%	0.2%	675	2%
8	Civil Engineering Technologists and Technicians (17-3022)	1,424	\$77,500	1.15	21	1.5%	-0.4%	-0.3%	565	1%
9	Engineering Techs (17-3029)	992	\$77,700	0.81	15	1.5%	0.3%	0.1%	425	3%
10	Surveyors (17-1022)	904	\$89,200	0.90	7	0.8%	0.6%	0.1%	314	4%
11	Continuous Mining Machine Operators (47-5041)	754	\$73,900	2.32	82	9.8%	3.5%	0.2%	437	98%
12	Underground Mining Machine Operators, All Other (47-5049)	743	\$77,400	13.77	80	9.9%	-6.8%	0.3%	431	97%
	Resource Extraction – Core	57,365	\$93,900	0.92	1,136	1.9%	1.9%	0.3%	23,660	7%
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667	

Careers in Energy



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Sub-Cluster Wages

Resource Extraction

Construction Trades Supervisors have the highest average wages among careers in this sub-cluster that have no postsecondary education requirements.

Core Sub-Cluster Wage Distribution

Mean

\$93,900

Entry Level

\$66,400

Experienced

\$107,600

#	Sub-Cluster Occupation (SOC) with Requirements for an Associate Degree or Less	Wages						
		Mean	Entry Level	Experienced	50% Median	Typical Entry-Level Education	Empl	Under employed
1	First-Line Supervisors of Construction Trades and Extraction Workers (47-1011)	\$95,900	\$68,100	\$109,800	\$96,200	HS or equivalent	14,227	2,327
2	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	\$89,400	\$61,200	\$103,500	\$85,900	HS or equivalent	9,514	1,923
3	Industrial Machinery Mechanics (49-9041)	\$72,800	\$54,400	\$82,000	\$70,800	HS or equivalent	7,532	765
4	Industrial Engineering Technologists and Technicians (17-3026)	\$72,600	\$53,400	\$82,200	\$69,500	Associate degree	4,334	1,271
5	Civil Engineering Technologists and Technicians (17-3022)	\$77,500	\$63,200	\$84,600	\$75,900	Associate degree	1,424	417
6	Engineering Technologists and Technicians, Except Drafters, All Other (17-3029)	\$77,700	\$55,700	\$88,700	\$79,200	Associate degree	992	299
7	Continuous Mining Machine Operators (47-5041)	\$73,900	\$51,300	\$85,200	\$73,100	None	754	41
8	Underground Mining Machine Operators, All Other (47-5049)	\$77,400	\$57,200	\$87,500	\$76,100	None	743	39
	Resource Extraction– Core	\$93,900	\$66,400	\$107,600	\$91,400	-	57,365	7,430
	Total - All Occupations	\$70,600	\$35,100	\$88,300	\$55,300	-	3,124,097	518,636

Careers in Energy



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Resource Extraction Sub-Cluster Demand – Related Industry Occupations

Related Industry with Demand

- NAICS 21 – Mining, Quarrying, and Oil and Gas Extraction

#	Occupation (SOC)	Ind Empl	Mean Annual Wages	5-Year Total Demand Estimate	Cross-Cutting Clusters	Inter-disciplinary Clusters	% of Total Empl in Ind
1	Operating Engineers and Construction Equipment Operators (47-2073)	429	\$72,800	188	-		5%
2	Mobile Heavy Equipment Mechanics, Except Engines (49-3042)	274	\$85,100	118	-		9%
3	Heavy and Tractor-Trailer Truck Drivers (53-3032)	268	\$69,100	132	-		1%
4	Electricians (47-2111)	103	\$97,600	47	-		1%
5	Maintenance and Repair Workers, General (49-9071)	100	\$75,600	47	-		<1%
6	Construction Laborers (47-2061)	94	\$68,500	42	-		<1%
7	Crushing, Grinding, and Polishing Machine Operators (51-9021)	89	\$75,300	43	-		12%
8	Maintenance Workers, Machinery (49-9043)	71	\$82,500	32	-		5%
9	Office Clerks, General (43-9061)	61	\$55,100	33		-	<1%
10	Laborers and Freight Movers (53-7062)	55	\$65,800	38	-		<1%
	Resource Extraction – Related Industries	2,787	-	1,310	-	-	<1%
	Total – All Occupations	3,124,097	\$70,600	1,691,667	-	-	-

Inter-disciplinary Clusters



57,365
Core Occupation Employment

2,787
Related Career Employment

24,970
New Talent by 2029Q4

High
Talent Shortage Severity

Careers in Energy



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Resource Extraction

Job Posting Analysis

Advertised May 2024 – April 2025

Top Job Titles

- 1) Maintenance Manager / Supervisor
- 2) Quality Engineer
- 3) Systems Maintainer
- 4) Engineering Manager
- 5) Quality Technician
- 6) Field Service Technician
- 7) Assistant Project Manager
- 8) Maintenance Mechanic
- 9) Directional Drill Bore Foreman
- 10) Program Manager

Top Employers Hiring

- 1) Boston Scientific Corporation
- 2) M.A. Mortenson Company
- 3) U.S. Army
- 4) Honeywell
- 5) Medtronic
- 6) State of Minnesota
- 7) Xcel Energy
- 8) Michael Page
- 9) 3M
- 10) GPAC

10,136 Posts

-9% from prior year

\$88-\$143K

Posted Salary Range

Hiring Difficulty: **Moderate**

Share Remote Postings: 4%

Share Hybrid Postings: 16%

Top Essential Skills

- 1) Communication
- 2) Leadership
- 3) Scheduling
- 4) Collaboration
- 5) Analysis

Top Knowledge Areas and Technical Skills

- 1) Operations
- 2) Project Management
- 3) Research
- 4) Continuous Improvement
- 5) Mathematics

Top Credentials

- 1) American Society for Testing Materials
- 2) Total Quality Management Certification
- 3) SCI Clearance
- 4) Six Sigma Black Belt
- 5) ISO 14001



Resource Extraction

Job Posting and Profile Gap Analysis Advertised May 2024 – April 2025

Top 10 Skill Gaps in Minnesota

Name	Candidates	Openings	Gap
Telecommunications	10	179	-169
Google	5	160	-155
Power Tools	85	167	-82
Boilers	78	135	-57
Lathes	17	66	-48
Metal Inert Gas Welding (MIG welding)	14	54	-41
Reading Schematics	44	78	-34
Roofing	15	46	-31
Gauges	59	86	-26
Personal Computers (PC)	60	85	-25

Top 10 Certification Gaps in Minnesota

Name	Candidates	Openings	Gap
Commercial Driver's License (CDL)	12	39	-26
Class A Commercial Driver's License (CDL-A)	5	20	-15
Project Management Professional (PMP)	10	17	-6
EPA Universal Certification	0	5	-5
Certified Production Technician (CPT)	0	4	-4
Transportation Worker Identification Credential (TWIC)	0	4	-4
Certified Welding Inspector (CWI)	7	11	-4
Industry Radiography Radiation Safety Personnel (IRRSP)	0	3	-3
Certified Welder	10	13	-2
Certified Landscape Irrigation Auditor (CLIA)	0	2	-2

Careers in Energy



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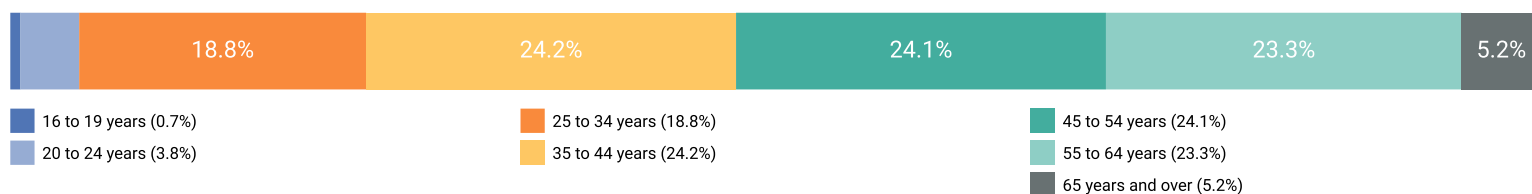
Resource Extraction

Estimated Talent Pool Diversity (Across all industries statewide)

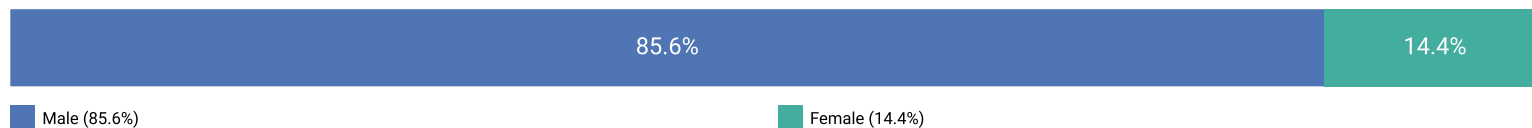
Underrepresentation of talent who are:

- Female
- Black or African American
- Asian
- More than one race
- Hispanic or Latine
- Under 35 years old

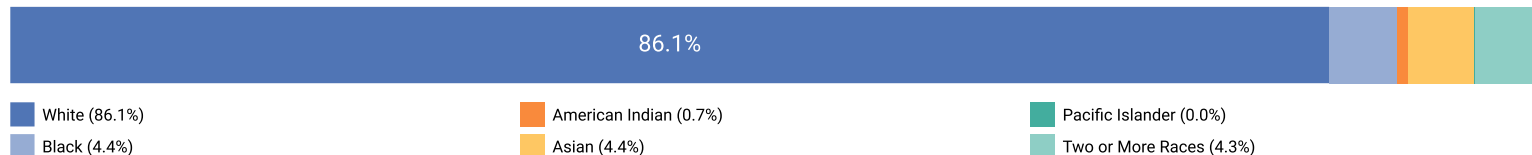
Age



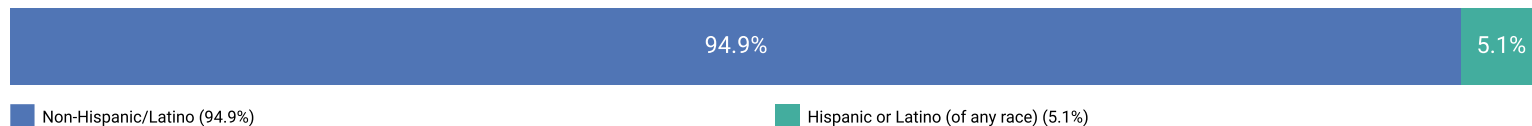
Gender



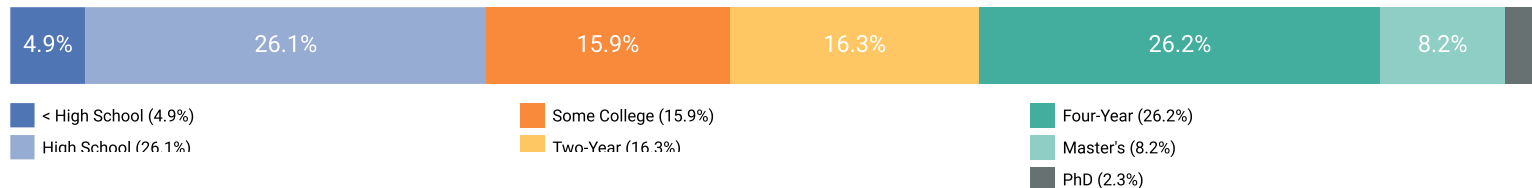
Race



Ethnicity



Educational Attainment



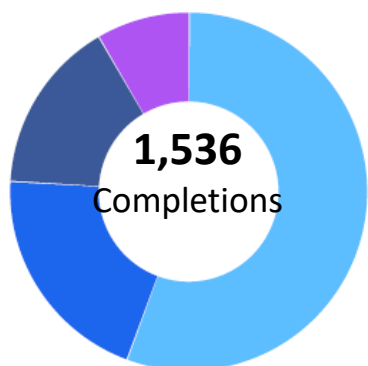
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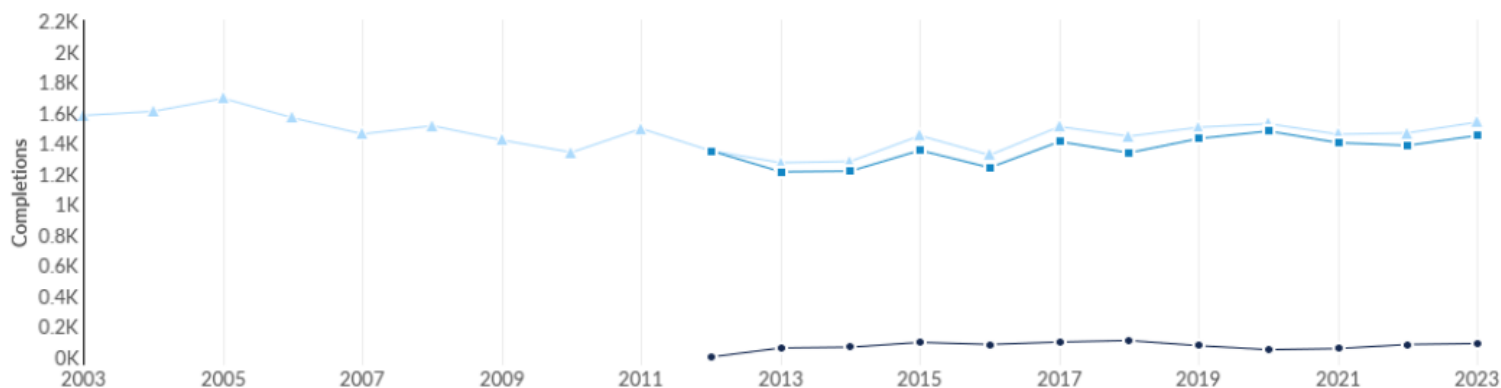
Resource Extraction

Aligned Postsecondary Programs With Awards Conferred, SY2023



Institution Type	Completions (2023)	Market Share
Public, 2-year	853	55.5%
Public, 4-year or above	312	20.3%
Private not-for-profit, less-than-2-year	241	15.7%
Private not-for-profit, 4-year or above	130	8.5%

Annual Completions by Delivery Type

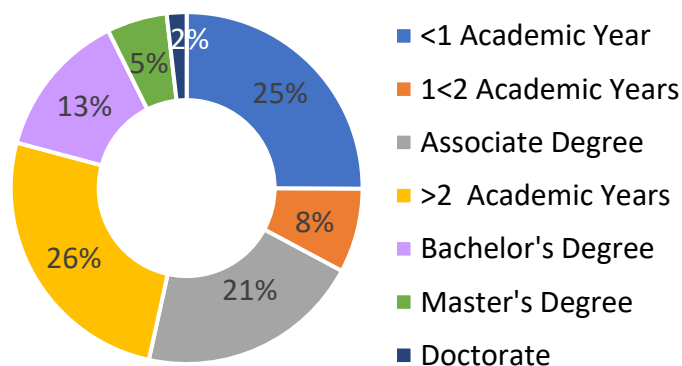


Distance Offered Programs	N/A
Non-Distance Offered Programs	+7.4%
All Programs	+13.9%

39

Institutions with aligned programs

Completions SY2023



Careers in Energy



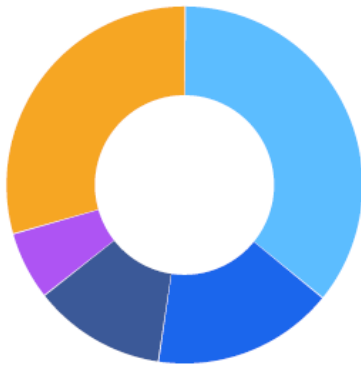
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Resource Extraction

Aligned Postsecondary Programs With Awards Conferred, SY2023

Market Share by Program

Program	Completions (2023)	Market Share
Electrician (46.0302)	550	35.8%
Construction Trades, General (46.0000)	253	16.5%
Carpentry/Carpenter (46.0201)	185	12.0%
Geology/Earth Science, General (40.0601)	95	6.2%
Other	453	29.5%



Institution	Completions (2023)	Growth % YOY (2023)	Market Share (2023)	IPEDS Tuition & Fees (2023)	Completions Trend (2019-2023)
Summit Academy Opportunities Industrialization Center	241	13.1%	15.7%	N/A	
University of Minnesota-Twin Cities	153	7.7%	10.0%	\$16,488	
Dunwoody College of Technology	87	22.5%	5.7%	\$25,659	
Saint Paul College	78	8.3%	5.1%	\$6,318	
Lake Superior College	71	2.9%	4.6%	\$5,785	
Ridgewater College	65	54.8%	4.2%	\$6,109	
St Cloud Technical and Community College	62	-23.5%	4.0%	\$4,957	
Riverland Community College	61	-3.2%	4.0%	\$6,249	
Anoka Technical College	55	-9.8%	3.6%	\$6,267	
Dakota County Technical College	55	-23.6%	3.6%	\$6,419	

Careers in Energy



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Resource Extraction

Aligned Postsecondary Programs With Awards Conferred, SY2023

Graduate Demographics, All Programs



White

Black or African American

American Indian

Asian

Pacific Islander

Two or More Races

Hispanic or Latine

International Students

Unknown Race/Ethnicity

#	Description	Total Completions	Male	Female	Black or African American	American Indian	Asian	Hispanic or Latine	White	Two or More Races	Unknown Race/Ethnicity	International Students
1	Summit Academy Opportunities Industrialization Center	241	83%	17%	37%	1%	10%	19%	21%	9%	2%	0%
2	University of Minnesota-Twin Cities	153	51%	49%	1%	1%	5%	4%	61%	7%	1%	19%
3	Dunwoody College of Technology	87	94%	6%	1%	0%	2%	2%	79%	3%	11%	0%
4	Saint Paul College	78	92%	8%	5%	0%	21%	9%	59%	3%	1%	3%
5	Lake Superior College	71	96%	4%	8%	0%	1%	11%	73%	4%	1%	0%
6	Ridgewater College	65	89%	11%	0%	2%	0%	8%	88%	0%	3%	0%
7	St Cloud Technical and Community College	62	87%	13%	2%	0%	0%	0%	95%	0%	3%	0%
8	Riverland Community College	61	97%	3%	3%	0%	7%	15%	72%	0%	2%	0%
9	Anoka Technical College	55	93%	7%	0%	0%	2%	4%	89%	5%	0%	0%
	Others	663	84%	16%	2%	1%	2%	6%	82%	4%	2%	1%
	Total	1,536	83%	17%	8%	1%	5%	8%	69%	4%	2%	3%

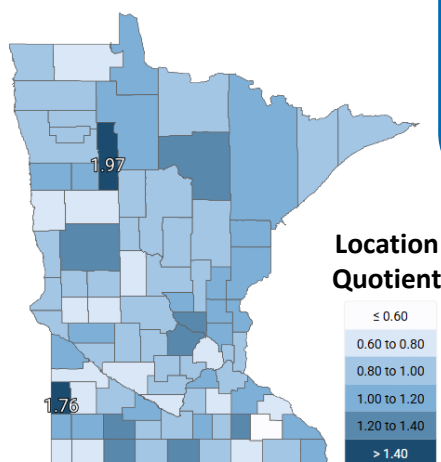
Careers in Energy



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Sub-Cluster Demand

Utilities



Top Five Counties

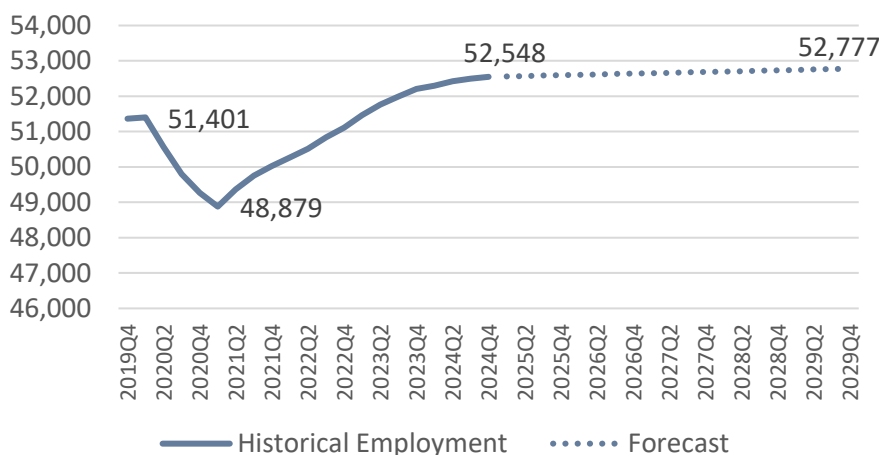
By number of employees

Hennepin	14,338
Ramsey	5,417
Dakota	3,460
Anoka	2,798
St. Louis	2,072

Summary

Manage the transmission and maintenance of utility systems for clean and alternative energy, electricity, water, waste remediation, and telecom/broadband, distribution and infrastructure development, and storage; Ensure reliable connectivity to energy sources, energy efficiency, and other essential services; Focus on operations, maintenance, and security of systems to guarantee uninterrupted access to vital resources.

Core Sub-Cluster Employment Forecast



Core Occupation Summary Statistics (Across all industries statewide)

1.9%
Unemployment
rate

0.88
Location
Quotient

0.2%
Forecast Annual
Growth

2,514
Online job ads
(March 2025)

Careers in Energy



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Utilities Sub-Cluster Demand – Core Occupations

#	Occupation (SOC)	Empl	Mean Annual Wages	LQ	Unempl	Unempl Rate	5-Year Hist Avg Ann Empl Change	5-Year Avg Ann Forecast Empl Change	5-Year Total Demand Estimate	% of Total Empl in Ind
1	First-Line Supervisors of Construction Trades and Extraction Workers (47-1011)	14,227	\$95,900	0.87	353	2.4%	2.1%	0.4%	5,743	2%
2	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	0.84	88	0.9%	1.6%	0.1%	3,837	7%
3	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1.05	92	2.2%	1.0%	0.1%	1,341	3%
4	Refuse and Recyclable Material Collectors (53-7081)	2,663	\$58,100	0.97	70	2.6%	0.8%	0.1%	1,582	<1%
5	Engineers, All Other (17-2199)	2,300	\$123,100	0.78	35	1.5%	-1.9%	0.2%	675	2%
6	Telecommunications Equipment Installers and Repairers (49-2022)	2,298	\$70,800	0.78	46	2.0%	-3.6%	-0.5%	993	3%
7	Water and Wastewater Treatment Plant and System Operators (51-8031)	2,147	\$72,900	0.89	8	0.4%	1.2%	-1.0%	827	13%
8	Electrical Power-Line Installers and Repairers (49-9051)	2,005	\$104,400	0.84	34	1.6%	1.2%	1.3%	944	67%
9	Electrical and Electronic Engineering Technologists and Technicians (17-3023)	1,985	\$76,700	1.09	9	0.4%	-3.1%	-0.1%	892	8%
10	Telecommunications Line Installers and Repairers (49-9052)	1,500	\$67,800	0.80	22	1.4%	-5.3%	-0.3%	641	3%
	Utilities – Core	52,548	\$95,700	0.88	1,019	1.9%	0.5%	0.2%	21,913	9%
	Total – All Occupations	3,124,097	\$70,600	1.00	96,601	3.0%	0.2%	0.1%	1,691,667	

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Utilities

Electrical Power Line Installers have the highest average wage rates at all levels of experience among careers in the sub-cluster that do not require a four-year degree or higher.

Sub-Cluster Wages

Core Sub-Cluster Wage Distribution

Mean

\$95,700

Entry Level

\$69,000

Experienced

\$109,100

#	Sub-Cluster Occupation (SOC) with Requirements for an Associate Degree or Less	Wages						
		Mean	Entry Level	Experienced	50% Median	Typical Entry-Level Education	Empl	Under employed
1	First-Line Supervisors of Construction Trades and Extraction Workers (47-1011)	\$95,900	\$68,100	\$109,800	\$96,200	HS or equivalent	14,227	2,327
2	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	\$89,400	\$61,200	\$103,500	\$85,900	HS or equivalent	9,514	1,923
3	Refuse and Recyclable Material Collectors (53-7081)	\$58,100	\$40,700	\$66,800	\$60,300	None	2,663	259
4	Telecommunications Equipment Installers and Repairers, Except Line Installers (49-2022)	\$70,800	\$51,300	\$80,600	\$70,100	PS Certificate	2,298	470
5	Water and Wastewater Treatment Plant and System Operators (51-8031)	\$72,900	\$57,800	\$80,400	\$72,700	HS or equivalent	2,147	396
6	Electrical Power-Line Installers and Repairers (49-9051)	\$104,400	\$82,700	\$115,300	\$104,800	HS or equivalent	2,005	233
7	Electrical and Electronic Engineering Technologists and Technicians (17-3023)	\$76,700	\$58,300	\$86,000	\$75,700	Associate degree	1,985	485
8	Telecommunications Line Installers and Repairers (49-9052)	\$67,800	\$50,300	\$76,600	\$64,000	HS or equivalent	1,500	242
	Utilities – Core	\$95,700	\$69,000	\$109,100	\$94,100	-	52,548	7,666
	Total - All Occupations	\$70,600	\$35,100	\$88,300	\$55,300	-	3,124,097	518,636

Careers in Energy



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Utilities Sub-Cluster Demand – Related Industry Occupations

Related Industries with Demand

- NAICS 2212 – Natural Gas Distribution
- NAICS 2213 – Water, Sewage and Other Sys.
- NAICS 221122 – Electric Power Distribution
- NAICS 221112 – Fossil Fuel Electric Power
- NAICS 221121 – Electric Bulk Power Transmission and Control
- NAICS 221118 – Other Electric Power Gen.

#	Occupation (SOC)	Ind Empl	Mean Annual Wages	5-Year Total Demand Estimate	Cross-Cutting Clusters	Inter-disciplinary Clusters	% of Total Empl in Ind
1	Customer Service Representatives (43-4051)	734	\$54,900	472		-	1%
2	Electrical Engineers (17-2071)	542	\$119,400	200	-		13%
3	Control and Valve Installers and Repairers, Except Mechanical Door (49-9012)	524	\$76,000	235	-		52%
4	Office Clerks, General (43-9061)	237	\$68,400	99		-	<1%
5	Electricians (47-2111)	220	\$117,900	41	-		2%
6	Project Management Specialists (13-1082)	215	\$119,200	31		-	1%
7	Accountants and Auditors (13-2011)	200	\$106,500	48	-	-	1%
8	Plumbers, Pipefitters, and Steamfitters (47-2152)	186	\$87,700	69	-		2%
	Utilities – Related Industries	7,566	-	3,106	-	-	<1%
	Total – All Occupations	3,124,097	\$70,600	1,691,667	-	-	-

Inter-disciplinary Clusters*

Digital Technology
 Marketing & Sales
 Management & Entrepreneurship
 Agriculture
 Advanced Manufacturing
 Construction
 Supply Chain & Transportation
 Public Service & Safety

52,548
Core Occupation Employment

7,566
Related Career Employment

25,019
New Talent by 2029Q4

High
Talent Shortage Severity



Utilities

Job Posting Analysis

Advertised May 2024 – April 2025

Top Job Titles

- 1) Maintenance Manager
- 2) Field Technician
- 3) Electronics Engineer
- 4) Engineering Manager
- 5) Utility Locator
- 6) Electronics /Electrical Technician
- 7) Electrical Project Manager
- 8) Utilities Equipment Repairer
- 9) Maintenance Director
- 10) Power Generation Equipment Repairer

Top Employers Hiring

- 1) Honeywell
- 2) U.S. Army
- 3) M. A. Mortenson Company
- 4) Navy
- 5) Boston Scientific Corporation
- 6) Xcel Energy
- 7) DISH Network Corporation
- 8) Medtronic
- 9) Michael Page
- 10) Midco

9,464 Posts

-10% from prior year

\$88-\$143K

Posted Salary Range

Hiring Difficulty: **Moderate**
Share Remote Postings: 4%
Share Hybrid Postings: 13%

Top Essential Skills

- 1) Communication
- 2) Leadership
- 3) Scheduling
- 4) Collaboration
- 5) Analysis

Top Knowledge Areas and Technical Skills

- 1) Operations
- 2) Project Management
- 3) Electronics / Electrical Systems
- 4) Preventive Maintenance
- 5) Computer Usage (Mid-Level)

Top Credentials

- 1) Driver's License (CDL)
- 2) Project Management Professional (PMP)
- 3) Professional Engineer License
- 4) EPA Certification
- 5) National Electrical Code



Utilities

Job Posting and Profile Gap Analysis Advertised May 2024 – April 2025

Top 10 Skill Gaps in Minnesota

Name	Candidates	Openings	Gap
Telecommunications	115	277	-162
Google	4	159	-155
Power Tools	91	154	-63
Autodesk AutoCAD	122	159	-37
Roofing	17	47	-30
Reading Schematics	22	47	-25
Procore	25	48	-24
Boilers	92	115	-23
Project Management Software	3	23	-20
Forklifts	44	64	-20

Top 10 Certification Gaps in Minnesota

Name	Candidates	Openings	Gap
Commercial Driver's License (CDL)	135	196	-61
Class A Commercial Driver's License (CDL-A)	36	71	-35
Registered Environmental Manager (REM)	0	8	-8
Engineer in Training (EIT)	9	15	-5
EPA Universal Certification	0	5	-5
Class B Commercial Driver's License (CDL-B)	11	16	-5
Certified Welding Inspector (CWI)	7	11	-4
Transportation Worker Identification Credential (TWIC)	0	4	-4
Industry Radiography Radiation Safety Personnel (IRRSP)	0	3	-3
Project Management Professional (PMP)	11	14	-3

Careers in Energy



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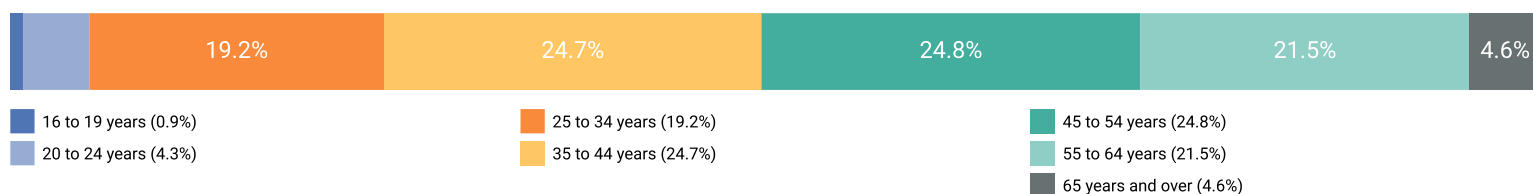
Utilities

Estimated Talent Pool Diversity (Across all industries statewide)

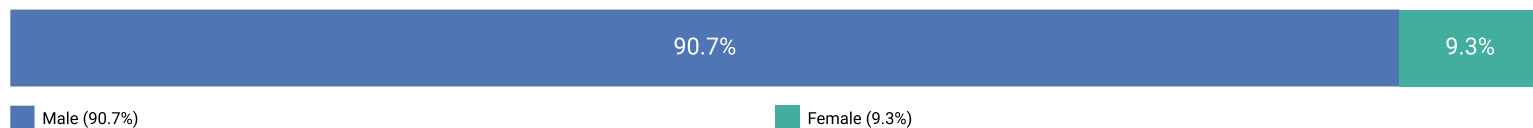
Underrepresentation of talent who are:

- Female
- Black or African American
- Asian
- More than one race
- Hispanic or Latine
- Under 35 years old or over 65

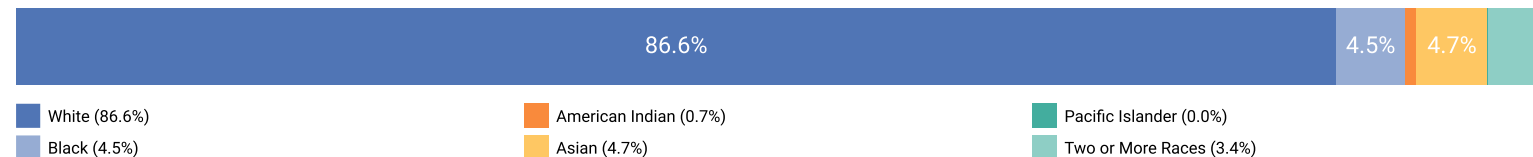
Age



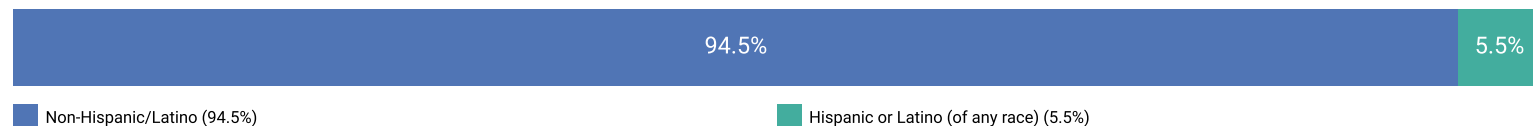
Gender



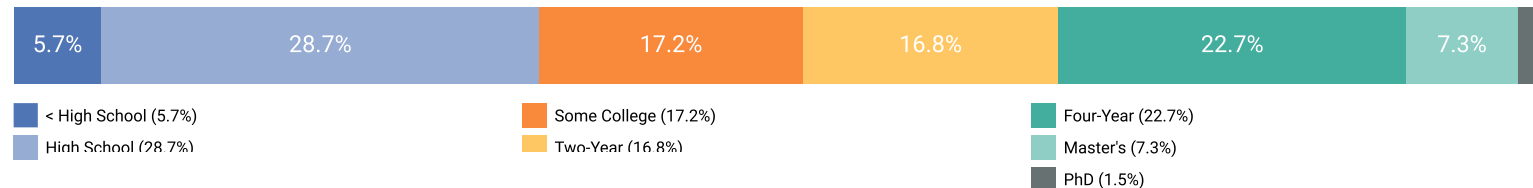
Race



Ethnicity



Educational Attainment



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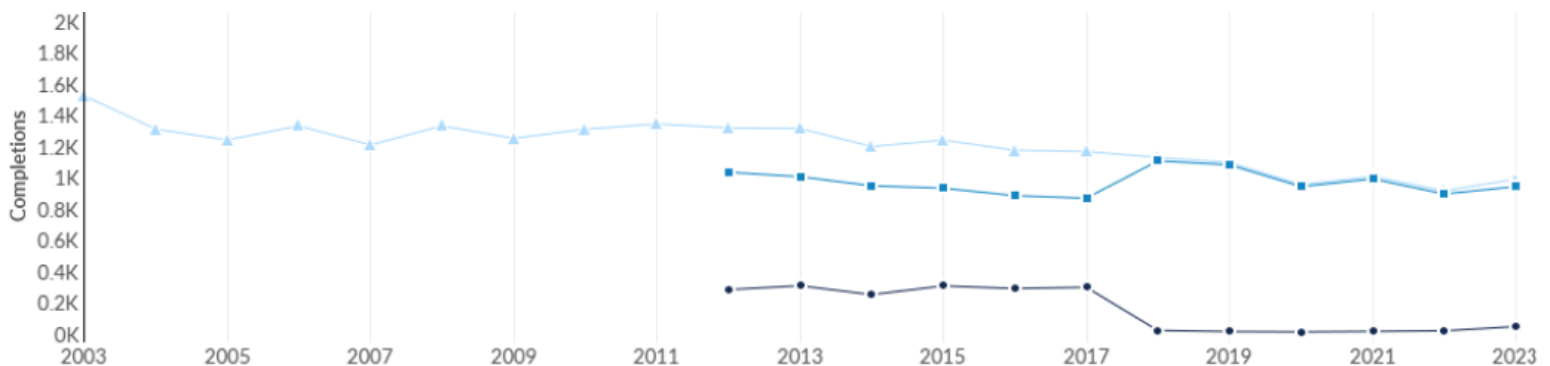
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Aligned Postsecondary Programs With Awards Conferred, SY2023



Institution Type	Completions (2023)	Market Share
Public, 2-year	510	51.6%
Public, 4-year or above	390	39.5%
Private not-for-profit, 4-year or above	88	8.9%

Annual Completions by Delivery Type

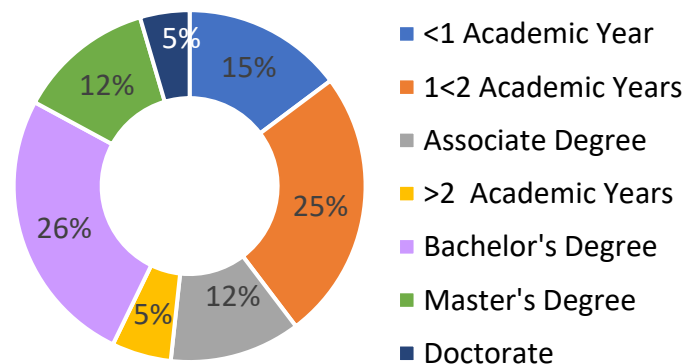


Distance Offered Programs	-83.4%
Non-Distance Offered Programs	-8.9%
All Programs	-24.9%

30

Institutions with aligned programs

Completions SY2023



Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Utilities



Aligned Postsecondary Programs With Awards Conferred, SY2023

Market Share by Program

Program	Completions (2023)	Market Share
Electrical and Electronics Engineering (14.1001)	275	27.8%
Lineworker (46.0303)	157	15.9%
Plumbing Technology/Plumber (46.0503)	135	13.7%
Electrical, Electronic, and Communications Engineering Technology/Technician (15.0303)	105	10.6%
Other	316	32.0%

Institution	Completions (2023)	Growth % YOY (2023)	Market Share (2023)	IPEDS Tuition & Fees (2023)	Completions Trend (2019-2023)
University of Minnesota-Twin Cities	207	8.4%	21.0%	\$16,488	
Minnesota State Community and Technical College	88	18.9%	8.9%	\$5,900	
Hennepin Technical College	88	-14.6%	8.9%	\$5,881	
Minnesota State University-Mankato	66	-13.2%	6.7%	\$9,490	
Minnesota West Community and Technical College	61	-12.9%	6.2%	\$6,484	
University of Minnesota-Duluth	58	9.4%	5.9%	\$14,318	
University of St Thomas	48	-18.6%	4.9%	\$52,284	
Saint Cloud State University	47	38.2%	4.8%	\$10,117	
Dakota County Technical College	42	5.0%	4.3%	\$6,419	
Anoka Technical College	35	150.0%	3.5%	\$6,267	

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Utilities

Aligned Postsecondary Programs With Awards Conferred, SY2023

Graduate Demographics, All Programs



- White
- Black or African American
- American Indian
- Asian
- Pacific Islander
- Two or More Races
- Hispanic or Latine
- International Students
- Unknown Race/Ethnicity

#	Description	Total Completions	Male	Female	Black or African American	American Indian	Asian	Hispanic or Latine	White	Two or More Races	Unknown Race/Ethnicity	International Students
1	University of Minnesota-Twin Cities	207	74%	26%	4%	0%	8%	2%	43%	4%	1%	38%
2	Hennepin Technical College	88	94%	6%	13%	0%	17%	7%	53%	9%	1%	0%
3	Minnesota State Community and Technical College	88	99%	1%	14%	1%	1%	2%	81%	1%	0%	0%
4	Minnesota State University-Mankato	66	79%	21%	5%	0%	8%	5%	67%	3%	0%	14%
5	Minnesota West Community and Technical College	61	100%	0%	0%	0%	0%	7%	93%	0%	0%	0%
6	University of Minnesota-Duluth	58	83%	17%	5%	0%	5%	7%	71%	3%	2%	5%
7	University of St Thomas	48	69%	31%	10%	0%	4%	6%	54%	10%	6%	8%
8	Saint Cloud State University	47	85%	15%	11%	0%	0%	0%	70%	0%	0%	19%
9	Dakota County Technical College	42	100%	0%	0%	0%	0%	0%	98%	2%	0%	0%
	Others	283	84%	16%	3%	1%	4%	8%	79%	2%	1%	1%
	Total	988	85%	15%	6%	1%	5%	8%	68%	3%	1%	11%

Engaging industry.
Enhancing education.
Inspiring students.



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Interdisciplinary Clusters



RealTime Talent

Careers in Energy



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Digital Technology – Cross-Cutting Cluster Demand in the Industry

#	Cross-Cutting Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Software Developers (15-1252)	35,595	88	<1%	21	-	Bachelor's degree
2	Computer User Support Specialists (15-1232)	13,037	70	1%	23	-	Some college, no degree
3	Computer Systems Analysts (15-1211)	11,423	135	1%	48	-	Bachelor's degree
4	Computer and Information Systems Managers (11-3021)	10,868	73	1%	31	-	Bachelor's degree
5	Computer Network Support Specialists (15-1231)	4,853	49	1%	17	-	Associate degree
6	Computer Occupations, All Other (15-1299)	4,780	40	1%	14	●	Bachelor's degree
7	Network and Computer Systems Administrators (15-1244)	4,590	57	1%	15	-	Bachelor's degree
8	Information Security Analysts (15-1212)	3,119	36	1%	16	-	Bachelor's degree
9	Software Quality Assurance Analysts and Testers (15-1253)	2,954	5	<1%	2	-	Bachelor's degree
10	Computer Network Architects (15-1241)	2,519	29	1%	9	-	Bachelor's degree
	All Other	11,931	53	<1%	17	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

105,672

Total Cluster Employment

633

Related Energy Industry Employment

35,734

Total New Talent by 2029Q4

High

Talent Shortage Severity

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Marketing and Sales – Cross-Cutting Cluster Demand in the Industry

#	Cross-Cutting Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Retail Salespersons (41-2031)	69,428	6	<1%	5	-	None
2	Cashiers (41-2011)	62,856	20	<1%	18	-	None
3	Customer Service Representatives (43-4051)	59,637	744	1%	478	-	HS or equivalent
4	Sales Representatives, Wholesale and Manufacturing (41-4012)	31,315	37	<1%	17	-	HS or equivalent
5	First-Line Supervisors of Retail Sales Workers (41-1011)	25,535	2	<1%	1	-	HS or equivalent
6	Market Research Analysts and Marketing Specialists (13-1161)	22,639	100	<1%	31	-	Bachelor's degree
7	Sales Representatives of Services, Except Advertising, Insurance, Financial Services, and Travel (41-3091)	19,253	104	1%	40	-	HS or equivalent
8	Sales Managers (11-2022)	10,666	29	<1%	10	-	Bachelor's degree
9	Marketing Managers (11-2021)	8,368	41	<1%	17	-	Bachelor's degree
10	Purchasing Agents, Except Wholesale, Retail, and Farm Products (41-4011)	7,228	110	2%	48	-	Bachelor's degree
	All Other	36,983	65	<1%	44	-	None
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

353,911

Total Cluster Employment

1,259

Related Energy Industry Employment

209,470

Total New Talent by 2029Q4

Average

Talent Shortage Severity

Careers in Energy



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Management and Entrepreneurship – Cross-Cutting Cluster Demand in the Industry

#	Cross-Cutting Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	General and Operations Managers (11-1021)	75,479	627	1%	196		Bachelor's degree
2	Office Clerks, General (42-9061)	57,093	326	1%	154	-	HS or equivalent
3	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive (43-1011)	35,150	186	1%	101	-	HS or equivalent
4	Supervisors of Office and Admin. Support Workers (43-1011)	25,260	185	1%	73	-	HS or equivalent
5	Management Analysts (13-1111)	22,326	206	1%	71		Bachelor's degree
6	Business Operations Specialists, All Other (13-1199)	18,270	241	1%	107	-	Bachelor's degree
7	Project Management Specialists (13-1082)	17,574	278	2%	63	-	Bachelor's degree
8	Human Resources Specialists (13-1071)	17,032	100	1%	36	-	Bachelor's degree
9	Managers, All Other (11-9199)	16,752	132	1%	50		Bachelor's degree
10	Financial Managers (11-3031)	16,734	112	1%	31	-	Bachelor's degree
	All Other	107,868	4,431	4%	447	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

409,676

Total Cluster Employment

6,823

Related Energy Industry Employment

183,506

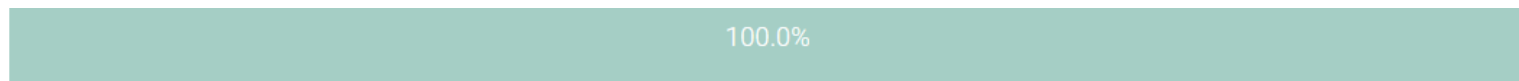
Total New Talent by 2029Q4

High

Talent Shortage Severity



Management and Entrepreneurship –Shared Core Occupations



■ Short-term OJT, no exp, no award (0.0%)
 ■ Long-term training, no exp, no award (0.0%)
 ■ 2-year degree or certificate (0.0%)
■ Moderate-term OJT, no exp, no award (0.0%)
 ■ Previous work experience, no award (0.0%)
 ■ Bachelor's degree (100.0%)

#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program	
1	General and Operations Managers (11-1021)	75,479	\$122,500	31,194	Bachelor's degree	>5 years	None		
2	Compliance Officers (13-1041)	6,909	\$88,100	2,774	Bachelor's degree	None	Mod-term OJT	C	
3	Facilities Managers (11-3013)	2,796	\$111,300	1,167	Bachelor's degree	<5 years	None	C	
4	Mathematical Science Occupations, All Other (15-2099)	66	\$83,200	22	Bachelor's degree	None	None		
5	Mathematicians (15-2021)*	23	\$118,800	7	Master's degree	None	None		





*Both Digital Technology and Marketing and Sales only share the Mathematician occupation with the Energy and Natural Resources Core Cluster Occupations.

Careers in Energy



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Agriculture – Related Cluster Demand in the Industry

#	Cross-Cutting Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Farmers, Ranchers, and Other Agricultural Managers (11-9013)	22,594	-	-	-		HS or equivalent
2	Farmworkers and Laborers, Crop, Nursery, and Greenhouse (45-2092)	6,710	1	<1%	1		None
3	Animal Caretakers (39-2021)	6,085	-	-	-		HS or equivalent
4	Farmworkers, Farm, Ranch, and Aquacultural Animals (45-2093)	5,566	-	-	-		None
5	Architectural and Engineering Managers (11-9041)	4,147	141	3%	29	  	Bachelor's degree
6	Meat, Poultry, and Fish Cutters and Trimmers (51-3022)	3,773	-	-	-		None
7	Veterinary Technologists and Technicians (29-2056)	3,741	-	-	-		Associate degree
8	Slaughterers and Meat Packers (51-3023)	2,566	-	-	-		None
9	Food Processing Workers, All Other (51-3099)	2,548	-	-	-		None
10	Butchers and Meat Cutters (51-3021)	2,470	-	-	-		None
	All Other	18,819	395	2%	61	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

79,019

Total Cluster Employment

538

Related Energy Industry Employment

45,968

Total New Talent by 2029Q4

Moderate

Talent Shortage Severity

Careers in Energy



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Agriculture – Shared Core Occupations



■ Short-term OJT, no exp, no award (0.0%)
 ■ Long-term training, no exp, no award (0.0%)
 ■ 2-year degree or certificate (7.8%)
 ■ Moderate-term OJT, no exp, no award (0.0%)
 ■ Previous work experience, no award (11.6%)
 ■ Bachelor's degree (80.6%)

#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program
1	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1,341	Bachelor's degree	>5 years	None	F
2	Engineers, All Other (17-2199)	2,300	\$123,100	675	Bachelor's degree	None	None	F
3	First-Line Supervisors of Farming, Fishing, and Forestry Workers (45-1011)	1,246	\$68,200	834	HS or equivalent	<5 years	None	C
4	Biological Scientists, All Other (19-1029)	782	\$97,300	303	Bachelor's degree	None	None	
5	Forest and Conservation Technicians (19-4071)	561	\$60,700	342	Associate degree	None	None	C
6	Microbiologists (19-1022)	462	\$99,700	178	Bachelor's degree	None	None	
7	Soil and Plant Scientists (19-1013)	383	\$74,500	146	Bachelor's degree	None	None	
8	Foresters (19-1032)	367	\$77,700	156	Bachelor's degree	None	None	F
9	Environmental Engineering Technologists and Technicians (17-3025)	234	\$68,000	96	Associate degree	None	None	F
10	Hydrologists (19-2043)	187	\$91,100	68	Bachelor's degree	None	None	

Careers in Energy



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Advanced Manufacturing – Related Cluster Demand in the Industry

#	Cross-Cutting Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Team Assemblers (51-2092)	27,379	2	<1%	2	-	HS or equivalent
2	Industrial Engineers (17-2112)	17,371	136	1%	45	-	Bachelor's degree
3	First-Line Supervisors of Production and Operating Workers (51-1011)	13,770	331	2%	122	-	HS or equivalent
4	Inspectors, Testers, Sorters, Samplers, and Weighers (51-9061)	11,182	72	1%	33	-	HS or equivalent
5	Machinists (51-4041)	10,374	19	<1%	8	-	HS or equivalent
6	Welders, Cutters, Solderers, and Brazers (51-4121)	10,015	80	1%	31	●	HS or equivalent
7	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	677	7%	316	● ● ●	HS or equivalent
8	Industrial Machinery Mechanics (49-9041)	7,532	372	5%	117	●	HS or equivalent
9	Mechanical Engineers (17-2141)	5,901	38	1%	15	-	Bachelor's degree
10	Printing Press Operators (51-5112)	5,546	1	<1%	0	-	HS or equivalent
	All Other	132,153	2,620	2%	1,126	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

250,743

Total Cluster Employment

4,346

Related Energy Industry Employment

117,157

Total New Talent by 2029Q4

High

Talent Shortage Severity

Careers in Energy



MINNESOTA STATE Energy Center of Excellence

Advanced Manufacturing – Shared Core Occupations



#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program
1	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	3,837	HS or equivalent	<5 years	None	C
2	Industrial Machinery Mechanics (49-9041)	7,532	\$72,800	3,594	HS or equivalent	None	Long-term OJT	F
3	Industrial Engineering Technologists and Technicians (17-3026)	4,334	\$72,600	1,845	Associate degree	None	None	
4	Architectural and Engineering Managers (11-9041)	4,147	\$178,800	1,341	Bachelor's degree	>5 years	None	F
5	Engineers, All Other (17-2199)	2,300	\$123,100	675	Bachelor's degree	None	None	F
6	Electrical and Electronic Engineering Technologists and Technicians (17-3023)	1,985	\$76,700	892	Associate degree	None	None	C
7	Environmental Scientists and Specialists, Including Health (19-2041)	1,590	\$86,500	733	Bachelor's degree	None	None	C
8	Natural Sciences Managers (11-9121)	1,394	\$153,700	537	Bachelor's degree	>5 years	None	F
9	Engineering Technologists and Technicians, Except Drafters (17-3029)	992	\$77,700	425	Associate degree	None	None	C
10	Commercial and Industrial Designers (27-1021)	832	\$86,100	264	Bachelor's degree	None	None	C

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Construction – Related Cluster Demand in the Industry

#	Cross-Cutting Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Maintenance and Repair Workers, General (49-9071)	30,867	308	1%	159	-	HS or equivalent
2	Construction Laborers (47-2061)	28,428	153	1%	60	-	None
3	Carpenters (47-2031)	18,245	8	<1%	4	-	HS or equivalent
4	Supervisors of Construction Trades and Extraction Workers (47-1011)	14,227	294	2%	107		HS or equivalent
5	Electricians (47-2111)	12,094	370	3%	117	-	HS or equivalent
6	Welders, Cutters, Solderers, and Brazers (51-4121)	10,015	80	1%	31		HS or equivalent
7	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	677	7%	316		HS or equivalent
8	Plumbers, Pipefitters, and Steamfitters (47-2152)	9,139	204	2%	79	-	HS or equivalent
9	Construction Managers (11-9021)	8,216	75	1%	23		Bachelor's degree
10	Operating Engineers and Other Construction Equipment Operators (47-2073)	8,123	510	6%	209	-	HS or equivalent
	All Other	93,864	23,586	4%	1,824	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

242,728

Total Cluster Employment

6,265

Related Energy Industry Employment

105,151

Total New Talent by 2029Q4

High

Talent Shortage Severity

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Construction – Shared Core Occupations

5.4% 67.5% 6.6% 20.6%

Short-term OJT, no exp, no award (0.0%)

Long-term training, no exp, no award (0.0%)

2-year degree or certificate (6.6%)

Moderate-term OJT, no exp, no award (5.4%)

Previous work experience, no award (67.5%)

Bachelor's degree (20.6%)




#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program
1	Supervisors of Construction Trades and Extraction Workers (47-1011)	14,227	\$95,900	5,743	HS or equivalent	>5 years	None	C
2	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	3,837	HS or equivalent	<5 years	None	C
3	Architectural and Engineering Managers (11-9042)	4,147	\$178,800	1,341	Bachelor's degree	>5 years	None	F
4	Engineers, All Other (17-2199)	2,300	\$123,100	675	Bachelor's degree	None	None	F
5	Civil Engineering Technologists and Technicians (17-3022)	1,424	\$77,500	565	Associate degree	None	None	
6	Engineering Technologists and Technicians, Except Drafters, All Other (17-3029)	992	\$77,700	425	Associate degree	None	None	C
7	Surveyors (17-1022)	904	\$89,200	314	Bachelor's degree	None	Internship/residency	
8	Continuous Mining Machine Operators (47-5049)	754	\$73,900	437	None	None	Mod-term OJT	F
9	Underground Mining Machine Operators, All Other (47-5049)	743	\$77,400	431	None	None	Mod-term OJT	F
10	Excavating and Loading Machine and Dragline Operators, Surface Mining (47-5022)	728	\$76,600	385	HS or equivalent	<5 years	Mod-term OJT	F

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Supply Chain and Transportation – Related Cluster Demand in the Industry

#	Related Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Laborers and Freight, Stock, and Material Movers, Hand (53-7062)	53,026	122	<1%	65	-	None
2	Stockers and Order Fillers (53-7065)	43,755	93	<1%	83	-	HS or equivalent
3	Heavy and Tractor-Trailer Truck Drivers (53-3032)	41,001	302	1%	144	-	PS Certificate
4	Light Truck Drivers (53-3033)	18,677	11	<1%	6	-	HS or equivalent
5	Shipping, Receiving, and Inventory Clerks (43-5071)	15,155	38	<1%	19	-	HS or equivalent
6	Automotive Service Technicians and Mechanics (49-3023)	13,855	67	<1%	31	-	PS Certificate
7	Bus Drivers, School (53-3051)	10,518	-	-	-	-	HS or equivalent
8	Supervisors of Transportation and Material Moving Workers (53-1047)	9,553	34	<1%	21	-	HS or equivalent
9	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	677	7%	316	  	HS or equivalent
10	Driver/Sales Workers (53-3031)	8,744	1	<1%	1	-	HS or equivalent
	All Other	130,037	854	1%	393	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

353,833

Total Cluster Employment

2,198

Related Energy Industry Employment

203,948

Total New Talent by 2029Q4

Moderate

Talent Shortage Severity



Supply Chain and Transportation – Shared Core Occupations

71.4%

18.1%

10.5%

Short-term OJT, no exp, no award (0.0%)

Long-term training, no exp, no award (0.0%)

2-year degree or certificate (18.1%)

Moderate-term OJT, no exp, no award (0.0%)

Previous work experience, no award (71.4%)

Bachelor's degree (10.5%)

#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program
1	First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011)	9,514	\$89,400	3,837	HS or equivalent	<5 years	None	C
2	Civil Engineering Technologists and Technicians (17-3022)	1,424	\$77,500	565	Associate degree	None	None	
3	Natural Sciences Managers (11-9121)	1,394	\$153,700	537	Bachelor's degree	>5 years	None	F
4	Engineering Technologists and Technicians, Except Drafters (17-3029)	992	\$77,700	425	Associate degree	None	None	C

Careers in Energy



MINNESOTA STATE
Energy Center of Excellence

Public Service and Safety – Related Cluster Demand in the Industry

#	Related Cluster Occupation (SOC)	Total Empl	NAICS 21-22 Ind Empl	% Empl in NAICS 21-22	5-Year Total Industry Demand Estimate	Other Inter-disciplinary Clusters	Typical Entry-Level Edu
1	Management Analysts (13-1111)	22,326	206	1%	71		Bachelor's degree
2	Managers, All Other (11-9199)	16,752	132	1%	50		Bachelor's degree
3	Security Guards (33-9032)	14,088	159	1%	84	-	HS or equivalent
4	Lawyers (23-1011)	13,093	35	<1%	6	-	Doctorate
5	Police and Sheriffs Patrol Officers (33-3051)	10,505	-	-	-	-	HS or equivalent
6	Cooks, Institution and Cafeteria (35-2012)	9,365	-	-	-		None
7	Compliance Officers (13-1041)	6,909	108	2%	29		Bachelor's degree
8	Court, Municipal, and License Clerks (43-4031)	6,459	-	-	-	-	HS or equivalent
9	Postal Service Mail Carriers (43-5052)	5,764	-	-	-	-	None
10	Social and Community Service Managers (11-9151)	5,733	-	-	-	-	Bachelor's degree
	All Other	90,164	1,467	1%	337	-	
	Total – All Occupations	3,124,097	20,526	<1%	9,322	-	-



Energy & Natural Resources

Inter-disciplinary Clusters*



Digital Technology



Marketing & Sales



Management & Entrepreneurship



Agriculture



Advanced Manufacturing



Construction



Supply Chain & Transportation



Public Service & Safety

201,166

Total Cluster Employment

1,467

Related Energy Industry Employment

90,218

Total New Talent by 2029Q4

High

Talent Shortage Severity

Careers in Energy

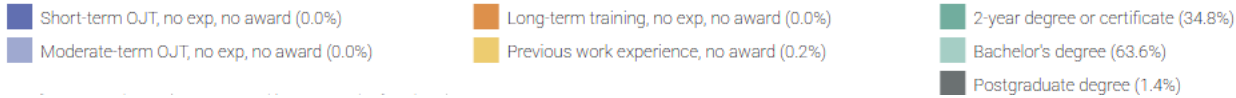


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Public Service and Safety – Shared Core Occupations

34.8%

63.6%



#	Core Cluster Occupation (SOC) with Interdisciplinary Alignments	Empl	Mean Annual Wages	5-Year Total Demand Estimate	Typical Entry-Level Education	Previous Work Experience	Typical On-the-Job Training	Current (C) or Future (F) MN State ENR Program
1	Compliance Officers (13-1041)	6,909	\$88,100	2,774	Bachelor's degree	None	Mod-term OJT	C
2	Firefighters (33-2011)	5,310	\$49,600	1,955	Postsecondary Certificate	None	Long-term OJT	F
3	Facilities Managers (11-3013)	2,796	\$111,300	1,167	Bachelor's degree	Less than 5 years	None	C
4	Environmental Scientists and Specialists, Including Health (19-2041)	1,590	\$86,500	733	Bachelor's degree	None	None	C
5	Engineering Technologists and Technicians, Except Drafters, All Other (17-3029)	992	\$77,700	425	Associate degree	None	None	C
6	Conservation Scientists (19-1031)	673	\$85,800	309	Bachelor's degree	None	None	F
7	Environmental Science and Protection Technicians, Including Health (19-4042)	569	\$61,200	321	Associate degree	None	None	C
8	Social Scientists and Related Workers, All Other (19-3099)	517	\$91,500	219	Bachelor's degree	None	None	F
9	Life Scientists, All Other (19-1099)	239	\$115,600	60	Bachelor's degree	None	None	
10	Cartographers and Photogrammetrists (17-1021)	212	\$79,800	75	Bachelor's degree	None	None	

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Appendix

CONTEXT & METHODOLOGY



RealTime Talent



The Impetus Behind an Updated Career Clusters Framework

Since the Career and Technical Education Framework's first creation in 2002, there have been sizeable shifts in the labor market and nature of work influenced by a changing economy and evolving influence of technology. This two-year modernization effort led by Advance CTE is an exciting opportunity to increase structural alignment and foster a common language among industry and education, state and local levels, and across Career Clusters to more fully prepare learners for the world of work.¹ The modernized Framework is flexible for every state and:

- Is grounded in multi-method research that engaged the CTE community at numerous stages in the development process
- Emphasizes the truly interdisciplinary nature of work through more intersectionality across Clusters
- Updates language and groupings of occupations to better bridge industry's organization of work with education
- Includes emphasis on new sectors, skills, and approaches from the entire world of work, while providing flexibility for the future by leaning more on industry classifications
- Serves as a bridge for education to reflect the real world of work in their CTE systems and programs
- Provides learners with more personalized paths to living wage jobs and skills gains for a variety of careers
- Offers CTE leaders and educators a means to align and design programs that better prepare learners for these careers
- Encourages industry has learners of all ages with interests, skills, and experiences that match their hiring needs

A modernized Framework is a step toward improving the quality of CTE programs to have more flexibility that is reflective of the real world of work, and ensuring all learners are fully prepared for the workplace no matter what career they explore.



The Structure of the National Career Clusters Framework

The new, modernized Framework consists of 14 Clusters and 72 Sub-Clusters that serve as the primary organizing structures for CTE programs. Eleven of these Clusters are associated with specific industries, classified into five Cluster Groupings aligned to purpose and impact of included careers. Three Cross-Cutting Clusters are industry-agnostic and provide both skills and careers that can stand alone and intersect with all other Clusters. Twelve Career-Ready Practices to ensure that every program includes the skills that are essential to every career and life.

Notable Updates in the New Framework for Energy and Natural Resources

The new framework moves away from the previous Agriculture, Food, and Natural Resources Cluster structure which included eight distinct career pathways in favor of an industry-driven structure, which places Energy and Natural Resources into a new Career Cluster apart from Agriculture. According to Advance CTE, this stems from “the evolving focus and broader scope of natural resource management and energy production and transmission as validated by industry input and field research. Industry experts from Energy and Natural Resources felt that natural resource management in the 21st century was inextricably related to energy.” Distinguishing Energy and Natural Resources as its own prioritized Cluster allows for the elevation of efforts in environmental preservation and sustainability, which are increasingly central to the energy sector.²

Cluster Groupings

The broadest groupings of careers are by large, purpose-driven meta-sectors that help guide young people toward Clusters that are aligned with their interests, their sense of purpose, and the impact they want to make on their communities.

Cluster Groupings represent the roll-up employment of all occupations and industry employment represented within the Clusters beneath them. For instance, the Clusters of 1) Energy and Natural Resources and 2) Agriculture together comprise the “Cultivating Resources” Cluster Grouping.



The Structure of the National Career Clusters Framework (continued)

Clusters

More detailed industry sector-driven groupings as defined by a combination of analysis of both Standard Occupational Classification (SOC) and North American Industry Classification System (NAICS) codes. There are eleven Industry-Based Clusters and three Cross-Cutting Clusters.

For determining labor market demand, wage, and skill requirement thresholds, both six-digit SOC and two-digit NAICS are used to identify occupations of analysis. First, all employment (industry-agnostic) are included as “core functions” to each Cluster. Second, industry-based staffing patterns are utilized to identify additional, Interdisciplinary Occupations of two kinds: a) related occupational employment from Related Clusters that are found in high volume among the Cluster’s relevant industries (defined by NAICS code), yet outside the core functional career path, and b) additional occupational employment from the three Cross-Cutting Clusters among the Cluster’s relevant industries (defined by NAICS code). The industry-specific employment volumes for the Interdisciplinary Occupations found within the Related and Cross-Cutting Clusters are included in the analysis of opportunities within the Cluster as a whole.

Sub-Clusters

The National Career Cluster Framework’s Sub-Clusters are major groupings of career areas within a given Cluster that have similar skills as defined by industry area. These groupings are industry-specific, with a core set of occupations of functional priority among each. Industry specifications are prioritized for understanding of labor market demand, while core occupations are prioritized for program evaluation or creation purposes in alignment to each Cluster. In Energy & Natural Resources, there are six Sub-Clusters.



The Structure of the National Career Clusters Framework (continued)

Core Occupations

At the cluster and sub-cluster level, six-digit SOC occupations aligned directly to the cluster are considered “core occupations” regardless of the industry in which workers are employed. This is an inclusive count of all employment which frequently overlaps with other clusters.

In the case of the Energy and Natural Resources Cluster, 88% of all Minnesota employment in Core Cluster Occupations overlaps with other clusters, and only 12% (or 21,230 workers as of 2024Q4) are solely aligned with the Energy and Natural Resources Cluster.

Essential Core Occupations

Any Core Occupations that are solely aligned with one career cluster are referred to as Essential Core Occupations in this report. These are important occupations of focus for programming supported by Centers of Excellence due to the fact that no other clusters name these occupations as their own under the new National Career Clusters Framework.

Shared Core Occupations

Any Core Occupations that are matched across multiple career clusters are referred to as Shared Core Occupations. These are important occupations of focus for collaboration between Centers of Excellence for coordination of programming in support of shared industry needs.



Clean and Alternative Energy

Careers focused on energy generation and infrastructure development from clean energy sources such as low carbon fuels, natural gas, nuclear, biofuels, hydrogen processes, and other alternative sources aimed at addressing climate change impacts. Professionals in this field develop and implement technologies that harness natural elements including solar, nuclear, wind, and hydro power, while advancing efforts in electrification and energy storage solutions. This Sub-Cluster also includes recycling of batteries and waste, carbon capture, and other energy and mineral reuse and reclamation.

Example Programs of Study

- Renewable Energy
- Electric Vehicle Installation & Maintenance
- Solar System Design & Installation
- Wind Turbine Installation & Maintenance

Industries for Related Cluster Market Analysis

- NAICS 221111 – Hydroelectric Power Generation
- NAICS 221113 – Nuclear Electric Power Generation
- NAICS 221114 – Solar Electric Power Generation
- NAICS 221115 – Wind Electric Power Generation
- NAICS 221117 – Biomass Electric Power Generation

Conservation and Land Management

Careers rooted in environmental and natural sciences, focusing on protecting and managing natural resources and landscapes. Professionals in this field operate local, state, and national parks; safeguard forests and waterways; maintain national lands and rangelands; and manage wildlife and marine life. This field merges ecological conservation with recreational spaces, aiming to preserve nature while enhancing community well-being and environmental stewardship through public accessibility.

Example Programs of Study

- GIS Mapping
- Natural Resource Conservation
- Wildlife Management



Ecological Research and Development

Careers emphasizing the scientific study of and research in ecological, geological, electrical, chemical, nuclear, biological, environmental engineering, and other sciences as they relate to energy production, sustainability, and the management of natural resources. Professionals in this field employ scientific methods to understand ecosystems, biodiversity, and the impacts of energy systems on the environment.

Example Programs of Study

- Environmental Engineering
- Environmental Management
- Environmental Science & Sustainability

Environmental Protection

Careers centered on regulating and managing the impacts of both natural processes and human activities, such as resource production and consumption. This Sub-Cluster involves developing and enforcing policies to protect all ecosystems, including space, air, land, and water, from natural disasters, pollution, and degradation. This field focuses on conserving natural habitats and biodiversity and applying scientific and engineering principles to solve environmental problems and improve climate resilience.

Example Programs of Study

- Climate Resilience
- Sustainable Communities



Resource Extraction

Careers focused on the efficient extraction of natural materials including fossil fuels, minerals, natural gas, and geothermal resources that are essential for fuel production in energy and manufacturing. This Sub-Cluster includes careers in exploration, drilling, mining, fracking, mineral processing, geoscience, quarrying, and petroleum engineering.

Example Programs of Study

- Clean Energy System Design
- Energy Transfer
- Mining Technology

Industries for Related Cluster Market Analysis

- NAICS 21 – Mining, Quarrying, and Oil and Gas Extraction

Utilities

Careers involving the transmission and maintenance of utility systems for clean and alternative energy, electricity, water, waste remediation, and telecom/broadband; distribution and infrastructure development; and storage. Professionals in this field ensure reliable connectivity to energy sources, energy efficiency, and other essential services. Opportunities exist in public utilities, as well as commercial and industrial companies, with a focus on operations, maintenance, and security of systems to guarantee uninterrupted access to vital resources.

Example Programs of Study

- Telecommunications
- Water & Wastewater Systems
- Plant Operations
- Underground or Overhead Linework
- Utility Maintenance and Repair

Industries for Related Cluster Market Analysis

- NAICS 2212 – Natural Gas Distribution
- NAICS 2213 – Water, Sewage and Other Systems
- NAICS 221122 – Electric Power Distribution
- NAICS 221112 – Fossil Fuel Electric Power Generation
- NAICS 221121 – Electric Bulk Power Transmission and Control
- NAICS 221118 – Other Electric Power Generation