New York State Offshore Wind Workforce Skills Analysis, 2022

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New York State Offshore Wind Workforce Skills Analysis, 2022

Final Report

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Abstract

This report provides detailed occupational profiles for in-demand offshore wind occupations in New York State, including information on wages, career transition options, and typical education, experience, skill, and certification requirements. The offshore wind workforce is viewed through the five project phases: planning, design, and development, ports and infrastructure development, manufacturing and assembly, construction and installation, and operations and maintenance. The report also includes an appendix on the current state of New York's offshore wind training infrastructure and how these training opportunities overlay with public transportation and accessibility for disadvantaged communities. Strategic recommendations and programmatic design considerations are included to support workforce development stakeholders in planning and design for the offshore wind workforce recruitment and training pipeline.

Keywords

Offshore Wind, Offshore Wind Workforce, Offshore Wind Training, Offshore Wind Industry, Offshore Wind Occupations, Offshore Wind Job Skills, Offshore Wind Certifications, Offshore Wind Education, New York State Offshore Wind

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Executive Summary

With 4.2 gigawatts (GW) of offshore wind capacity currently in development across Sunrise Wind, Empire Wind 1, Beacon Wind, and Empire Wind 2, plus an overall addition of 10,000 to 20,000 megawatts (MW) of capacity in the coming years, it is critical for New York State officials and workforce development stakeholders to understand the specific training, certification, and education requirements for critical components of the offshore wind supply chain.

Previous publications reviewing the needs of the offshore wind workforce and the State's readiness to meet these demands have generally found there to be a particular gap in the manufacturing and construction sectors. Without proper planning and information, it is likely that New York State's Supply Chain Investment Plan will further exacerbate many of the initial workforce gaps projected in the 2022 research. This follow-on research builds on this initial gap analysis, but with a more specific focus on the skills and certifications needed for in-demand occupations in the four project phases of offshore wind development: ports and infrastructure development, manufacturing and assembly, construction and installation, and operations and maintenance.

In an assessment of almost three dozen in-demand offshore jobs across these project phases, the research uncovered some high-level trends in skill and certification requirements across offshore wind careers. Though there are many varied certification requirements across these jobs, six key certifications were most prominent in the analysis: Occupational Safety and Health Administration (OSHA) 10, OSHA 30, Global Wind Organization (GWO) Certifications, Project Management Professional (PMP) Certification, American Welder Society (AWS) Certified Welder, and Professional Engineer Licensing. Similarly, in reviewing all required skills for offshore wind occupations, the following were most evident: Microsoft Office, forklift operation, power tools, Autodesk AutoCAD, and blueprints. For more information and the full distribution of certifications and skills for in-demand offshore wind jobs, please see Figure 1 and Figure 2 of this report.

In order to meet the rising demands of the State's growing offshore wind industry, three critical populations pools were identified for specific focus. Workers in adjacent industries who could easily transition into offshore wind, incumbent workers in fossil energy sectors, and individuals from priority or disadvantaged communities can be the focus of future strategic workforce planning and program efforts. Concerted efforts aimed at connecting these groups to the appropriate training and credentialing programs can help New York State quickly and effectively capitalize on the multitude of economic benefits forthcoming from these offshore wind developments.

1 Introduction

1.1 Offshore Wind Development in New York State

Over the next decade, the New York State offshore wind (OSW) industry will transition from a nascent, emerging sector to one of innovation and expansion, responsible for thousands of new jobs in the State. With 4.2 gigawatts (GW) of offshore wind capacity currently in development across Sunrise Wind, Empire Wind 1, Beacon Wind, and Empire Wind 2, plus an overall addition of between 10,000 to 20,000 megawatts (MW) of capacity in the coming years, New York State is positioned to create thousands of jobs in a number of sectors. In the past year, the State has significantly enhanced the potential for positive economic impact from offshore wind, driven through a series of policy decisions and incentives.

Central to this expanded potential is a comprehensive Supply Chain Investment Plan strategy that provides critical funding and supports New York State as an offshore wind manufacturing hub, fostering in-State economic impacts and workforce growth. NYSERDA's $500 million Supply Chain Investment Plan framework could result in more than $1.5 billion of total investment in new supply chain facilities in the State, significant port upgrades, and other infrastructure investments that will result in many more jobs than previously contemplated, particularly in manufacturing and assembly. Additionally, attracting and supporting new Original Equipment Manufacturers (OEM) and Tier One supplier facilities is likely to create anchors for exporting offshore wind equipment outside the State. Clustering around these sites will further enhance New York State offshore wind innovation and economic development.

In its most recent solicitation for offshore wind projects,[1] NYSERDA requested offers that include supply chain investments for new factories, ports, and other supply chain activities, with up to $300 million in State funding (and a 2-1 leveraged match). Critically, the solicitation also placed special emphasis on hiring and investment that occurs in disadvantaged communities and among workers transitioning from fossil energy.

Due to the potential for rapid expansion of the industry, NYSERDA commissioned BW Research to conduct an offshore wind occupational gap analysis[2] which was released in 2022. Among the takeaways:

- New York State's offshore wind workforce will grow significantly by 2040, with much of this growth concentrated in the manufacturing and construction industries.
- There are 117 distinct offshore wind occupations that are critical to developing a local OSW supply chain.

- While New York State has an above-average concentration of jobs required for the planning and development phase of OSW project development, jobs in manufacturing, operations and maintenance, and construction are less concentrated in the State compared to the national average.
- The occupations with the most severe and moderate workforce gaps are exclusively found in the construction and manufacturing industries.
- Much of the "wind-specific" training is geared toward engineering and professional services, although New York State has a wide swath of vocational trade programs that could support offshore wind workforce development.
- There is an abundance of programs for occupations with mild gaps but fewer programs for those occupations with projected severe to moderate workforce gaps, such as wind energy technicians or Computerized Numerical Control (CNC) machinists.

This new research is designed to build on the analysis by answering several follow-on questions that emerged from the study and are foundational to developing a New York State offshore wind workforce as well as can support strategic policy, funding, and programmatic decisions by New York State officials. Those questions are:

1. **What are the occupational skill needs for New York State's offshore wind workforce?** Complementing our understanding of the occupations that will be needed to develop, supply, build, and maintain offshore wind farms with the skills required for success in those occupations, is an important foundational analysis for the State. Its workforce development ecosystem, in particular, will benefit from more comprehensive insights into what the future offshore wind workforce will need in terms of skill development and transfer.

2. **What additional credentials and certifications will be required for future workers to enter this sector? Is New York State ready to meet these needs?** Entry into and long-term success in most occupations in the offshore wind workforce will require training and education toward specific credentials and certifications. Understanding these needs, especially in conjunction with the larger package of other necessary workforce policies and programs, is an important step toward ensuring that New York State's existing workforce development infrastructure can support the training and credentialing needs for future offshore wind workers, and if it cannot, prioritizing investments in specific training and education strategies.

3. **How can the future supply of New York State workers who may want to transition into offshore wind—such as those in traditional fossil fuel occupations, workers in adjacent industries with transferable skills, priority workers from disadvantaged communities, or future workers—be best prepared to pursue these occupations?**
   As identified in BW Research's 2022 investigation, a number of occupations are less likely to be filled by the existing New York State workforce, due to gaps in the supply of those trained and experienced in those occupations. Other workers who can fill those gaps will come from different sectors, regions, and occupations. Some will have decades of experience, while others will be entering the workforce for the first time. Each worker will face different barriers in securing these jobs, especially if they come from disadvantaged communities around the State. A strategic approach to reaching workers requires understanding those differences to prepare them to enter these occupations.

While there is extensive interest and excitement about the potential for offshore wind jobs, there has, to date, been little information that can answer any of these questions within the State. Responding to the questions can help prepare the workforce development system for the right kind of capacities that will be needed for the industry, and will ensure opportunities are identified to produce workers quickly.

Additionally, as State and federal policies are incentivizing project labor agreements and prevailing wages, many of the anticipated jobs will be high-quality unionized jobs, especially in the area of port and facility construction, marshalling, staging, final assembly of wind projects, and transmission activities. Understanding the intersection of unions and union-sponsored training programs with the above questions will be critical to a full response to those questions. In areas where unions will predominantly lead work, partnerships with unions, rather than independent or parallel actions, are more likely to lead to successful outcomes. Similarly, union apprenticeships (and accompanying pre-apprenticeship and apprentice-readiness programs) will be crucial to ensuring that those who can access these union jobs in the long run represent the diversity of the State's population.

1.2 Structure of the Report

To conduct its workforce analysis, BW Research organized offshore wind occupations into four distinct phases. A fifth, planning, design, and development, was excluded given the availability of this workforce generally and lack of workforce development investments required. While there is some overlap in job needs across each of these phases, there are still important and distinct occupational skill needs that are specific to each project phase.

1. **Ports and Infrastructure Development**–activities include heavy construction activities related to expanding and improving port and other key elements such as constructing supply chain manufacturing facilities.
2. **Manufacturing and Assembly**–activities include manufacturing and assembly of blades, nacelles, cables, towers, platforms, steel, and other components of wind turbines.
3. **Construction and Installation**–the phase includes the staging, marshalling, and other quayside activities as well as at-sea installation of turbines and cables.
4. **Operations and Maintenance**–activities include routine maintenance, repair, troubleshooting, and other operational activities after the wind farm is commissioned.

In section three, the research team categorized the most in-demand occupations within each of these phases, and then analyzed the specific skills, education, and certification needs for those occupations.

This analysis allowed the research team to address the question:

- What are the occupational skills needed for New York State's offshore wind workforce?

The research team then expanded on its earlier assessment of the existing current New York State's offshore wind training infrastructure and compared how these training opportunities overlay with public transportation and accessibility for disadvantaged communities across the State.

This analysis allowed the research team to address the questions:

- What additional credentials and certifications will be required for future workers to enter this sector?
- Is New York State ready to meet these needs?

In section 4, the research team reviewed three critical priority categories of potential workers who could transition into offshore wind to understand and reflect the distinct strategies that will be needed to ensure these specific populations of workers can engage in offshore wind. The three categories are:

1. **Adjacent industry workers** in unpredictable or evolving industries can relatively easily transition into offshore wind-related occupations with limited amounts of new training and experience. Here the research team selected the top ten most naturally aligned adjacent occupations with offshore wind occupations and conducted a skill gap analysis to determine additional training and certification needs.
2. **Current workers in occupations connected to traditional fossil energy sectors**, who will be impacted by the transition to clean energy. The occupations were identified through research for New York State's Just Transition Working Group, and the research team used the occupations for a skill comparison overlap between transitioning roles and specific offshore wind occupations.

3. **Workers from disadvantaged backgrounds and future new workforce entrants**, who need more targeted support, education, and training to enter offshore wind-related occupations. These are critical, priority populations who will require additional support and a comprehensive strategy to ensure they can access future offshore wind jobs.

This analysis allowed the research team to address the question:

- How can the future supply of New York State workers (including adjacent workers who could transfer into the roles) be best prepared to pursue the necessary occupations?

Finally, the report provides an appendix with extensive detail on almost three dozen occupations available in offshore wind.

2 Review of 2022 Gap Analysis

In 2022, BW Research completed a report for NYSERDA—2022 New York State Offshore Wind Workforce Gap Analysis. This report was commissioned to understand the potential for workforce supply gaps across the State for occupations associated with the growing offshore wind industry. Additionally, this report provides an overview of New York State's training landscape which will help in an initial exploration of the State's position to address these supply gaps:

There are a number of takeaways from the analysis. They include:

- **New York State's offshore wind workforce will grow significantly by 2040** with the manufacturing and construction industries accounting for six in 10 offshore wind jobs (56.5 percent) in 2040.[3]
- **There are 117 distinct offshore wind occupations in a local offshore wind supply chain.** These 117 occupations are spread across project phases: Planning and Development, Manufacturing and Assembly, Construction and Installation, and Operations and Maintenance. Many OSW-related jobs, such as engineers, electricians, and welders will be required across multiple phases of OSW project development.
- **While New York State has an above-average concentration of jobs required for the planning and development phase, jobs in manufacturing, operations and maintenance, and construction are less concentrated in the State compared to the national average.** Offshore wind-related planning and development jobs are roughly nine percent more concentrated in New York State compared to the national average. Meanwhile, the manufacturing industry comprised roughly five percent of total jobs in the State, compared to approximately 10 percent across the U.S., and compared to the national average, the concentration of construction and operations and maintenance jobs in New York State is slightly lower.
- **The occupations with the most severe and moderate workforce gaps are found primarily in construction and manufacturing industries.** The research team identified four occupations which display "severe" potential workforce gaps where the projected shortage of workers exceeds the size of the existing talent pool within the State. These were Plant and System Operators, Hoist and Winch Operators, Continuous Mining Machine Operators, and Wind Turbine Service Technicians. Thirty-five occupations are classified as having "moderate" workforce gaps, as they have substantial projected workforce shortages, but those shortages are smaller in magnitude than the total number of workers in the State currently working in that occupation. The top six occupations with "moderate" projected supply gaps include Metal-Refining Furnace Operators and Tenders, Metal Workers and Plastic Workers, Computer Numerically Controlled (CNC) Tool Programmers, Structural Metal Fabricators and Fitters, Plating Machine Setters, Operators, and Tenders, and Engine and Other Machine Assemblers.

- **Much of the "wind-specific" training in the New York State is geared toward engineering and professional services, although the State has a wide swath of vocational trade programs that could support offshore wind workforce development.** Out of the 12 wind energy-specific training programs identified in the state, 10 programs are focused on either electrical or structural and materials engineering. However, there are more than 750 programs that offer programs for occupations in the offshore wind supply chain, such as electricians, machinists, technicians, and equipment operators. These trade programs may not currently contain offshore wind-specific material, but the baseline knowledge is applicable to the construction and operations phases of offshore wind project development.
- **There is an abundance of programs for occupations with mild gaps but fewer programs for those occupations with projected severe to moderate workforce gaps, such as wind energy technicians or CNC machinists.** There are fewer than 100 program offerings for wind turbine service technicians and computer numerically controlled (CNC) machinists occupations that are projected to have severe to moderate workforce gaps.

Developments in New York State over the past year have done little to change these overall takeaways and, in fact, the State's Supply Chain Investment Plan is likely to further exacerbate many of the gaps in manufacturing occupations highlighted in the 2022 research. This is due both to the likelihood of projects relying on more in-State manufacturing and supply chains, as well as the potential for export of wind equipment and components outside the State. Future research will be needed to further refine this analysis based on the siting of infrastructure (especially ports), manufacturing facilities, and complementary offshore wind supply chain activities.

The breadth of potential occupations, coupled with the occupational gaps, are the primary drivers of this next phase of research to understand what these occupations will require in terms of skills and certifications, and how New York State can meet these gaps through critical worker populations from the fossil fuel sector, adjacent industries facing job losses, those workers from disadvantaged communities, and new workforce entrants.

Addressing these needs informs the remainder of research in this report.

3 Occupational Needs and Concurrent Assessment of Skills, Education, and Certification

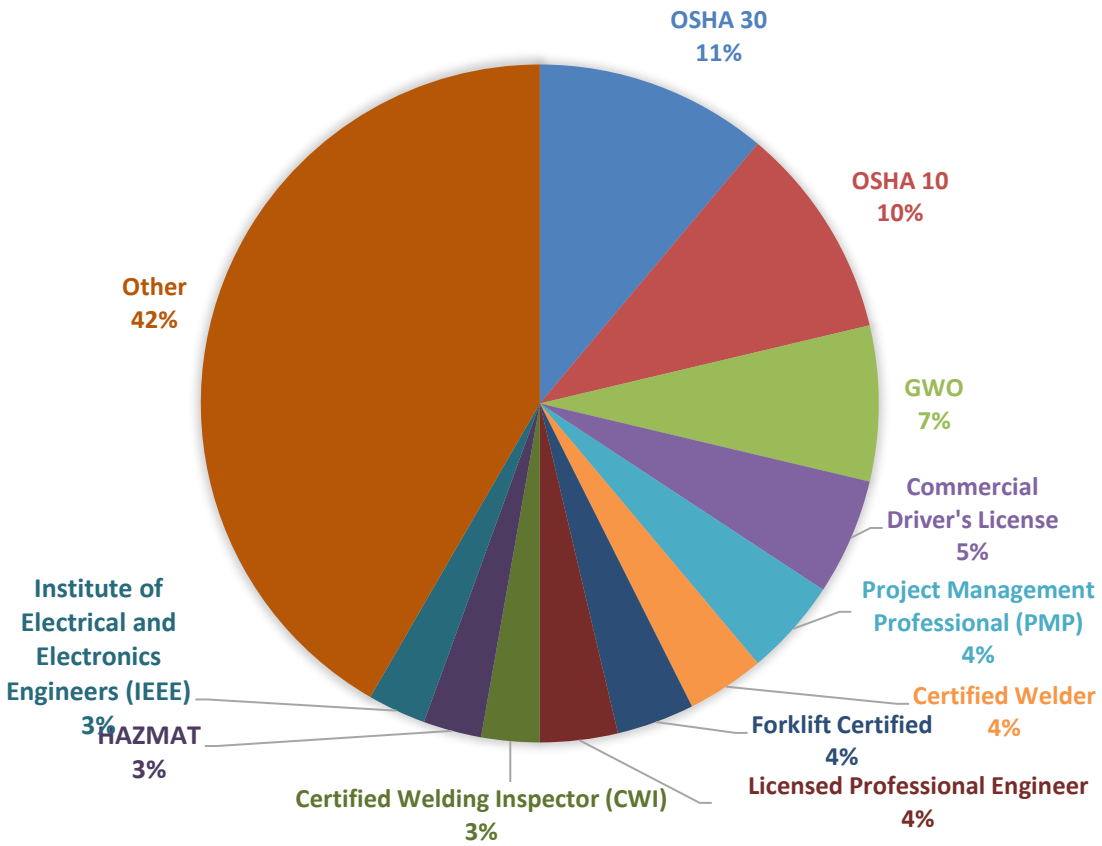
3.1 Cross Occupational Certifications

The research team reviewed all expected and required certifications for occupations in the offshore wind sector.[4] The most frequently mentioned certification requirements are:

1. **OSHA 10**—a 10-hour training course developed by the Occupational Safety and Health Administration (OSHA), to provide workers with basic knowledge and awareness of workplace hazards, and to help them avoid workplace injuries. Course topics include introduction to OSHA, electrical safety, fall protection, personal protective equipment, hazard communication, and materials handling. The course needs to be delivered by an authorized trainer. This course is offered by community colleges, trade schools, and unions, online and in-person, along with numerous private companies.
2. **OSHA 30**—a more rigorous program than OSHA 10 on workplace safety and health. The 30 hours of training are delivered over several days in-person or online, covering personal protective equipment (PPE), fall protection, electrical safety, hazardous materials, and machine guarding, among other topics. Upon completion of the course, participants receive an OSHA 30 card. Similar to OSHA 10, the course must be led by an authorized trainer and is available virtually and in-person in a variety of settings.
3. **Global Wind Organization (GWO) Certifications**—a set of training standards created by the wind industry. The GWO certification program includes Basic Safety Training, Basic Technical Training, and Basic Sea Survival Training in areas such as first aid, fire safety, manual handling, working at heights, and sea survival. GWO certification is obtained through approved training providers, including both dedicated wind energy training organizations and general safety training companies who are authorized to deliver the training courses and issue the certifications. Once obtained, the certifications are valid for two years and can be renewed through refresher training. GWO training is provided through authorized training centers.
4. **Project Management Professional (PMP) Certification**—This credential is awarded by the Project Management Institute (PMI) to project managers who pass the PMP exam, and meet degree, project management experience and project management training requirements. Certification must be updated every three years. In addition to PMI-directed training, there are a range of other in-person, on-line and self-study options from third party and alternative PMI-certified trainers.

5. **Certified Welder–American Welder Society (AWS)**—Getting welder certification from AWS consists of passing written and practical exams that test the welder's ability to produce quality welds in various welding processes and positions. Training includes welding safety, equipment, codes, inspection, repairs and quality control, and a variety of welding processes. The certification is valid for two years and can be renewed by meeting specific requirements. Individuals can attend training courses at AWS-accredited welding schools or through AWS-approved testing facilities. The training typically includes both classroom instruction and hands-on welding experience. Training providers include vocational schools, community colleges, and private welding schools.
6. **Professional Engineer License**—A professional engineer license allows someone to practice of engineering in various fields, take responsibility for designing, supervising, and approving engineering projects such as buildings and structures, and conducting testing of engineering projects to ensure compliance. There are several requirements to become a licensed professional engineer, including getting a bachelor's engineering degree, having a minimum of four years of engineering work experience, and passing the NCEES Fundamentals of Engineering exam and the NCEES Principles and Practice of Engineering exam. The license must be renewed annually and lasts for three years.

Figure 1. Distribution of Certification Needs for All In-Demand Occupations



3.2 Cross Occupational Skills and Educational Requirements

The research team reviewed all expected and required skills for occupations in the offshore wind sector. The most frequently mentioned skill requirements are:

1. **Microsoft Office**—This is the most commonly used package of software programs across most workplaces in business, education, healthcare, and government. Proficiency in Microsoft Office allows for word, visual and data processing as well as email and calendaring.
2. **Forklift Operation**—involves the safe handling of forklifts to move loads in warehouses, factories, and other settings. It requires a good understanding of the forklift's controls, safety procedures, and the principles of weight distribution. Specific operating skills include operating controls, load handling, safety awareness, communication, and basic maintenance.
3. **Power Tools**—the ability to operate various power tools safely and effectively. It involves knowledge of various tools, their functions and applications, and techniques needed to use them properly. Tools may include saws, drills, sanders, and grinders for cutting, shaping, sanding, and drilling.
4. **Autodesk AutoCAD**—Proficiency in computer-aided design software allows for the creation of accurate and detailed technical 2D and 3D drawings and models of buildings, machinery and products. It is commonly used for designing blueprints, floor plans, electrical diagrams, piping systems, and mechanical components. This skill is important in a range of design, technical, construction and manufacturing roles and can also be used in documentation, project management, and analysis roles.
5. **Blueprints**—The ability to read and interpret technical drawings, schematics, and plans used in construction, manufacturing, engineering, and architecture. A wide variety of occupations require blueprint skills to translate blueprints into physical structures or products such as architects, engineers, contractors, carpenters, welders, and machinists.

Additionally, most positions do not require a college degree, with about four in 10 requiring only high school education for entry.[5]

Figure 2. Distribution of Skill Needs for All In-Demand Occupations

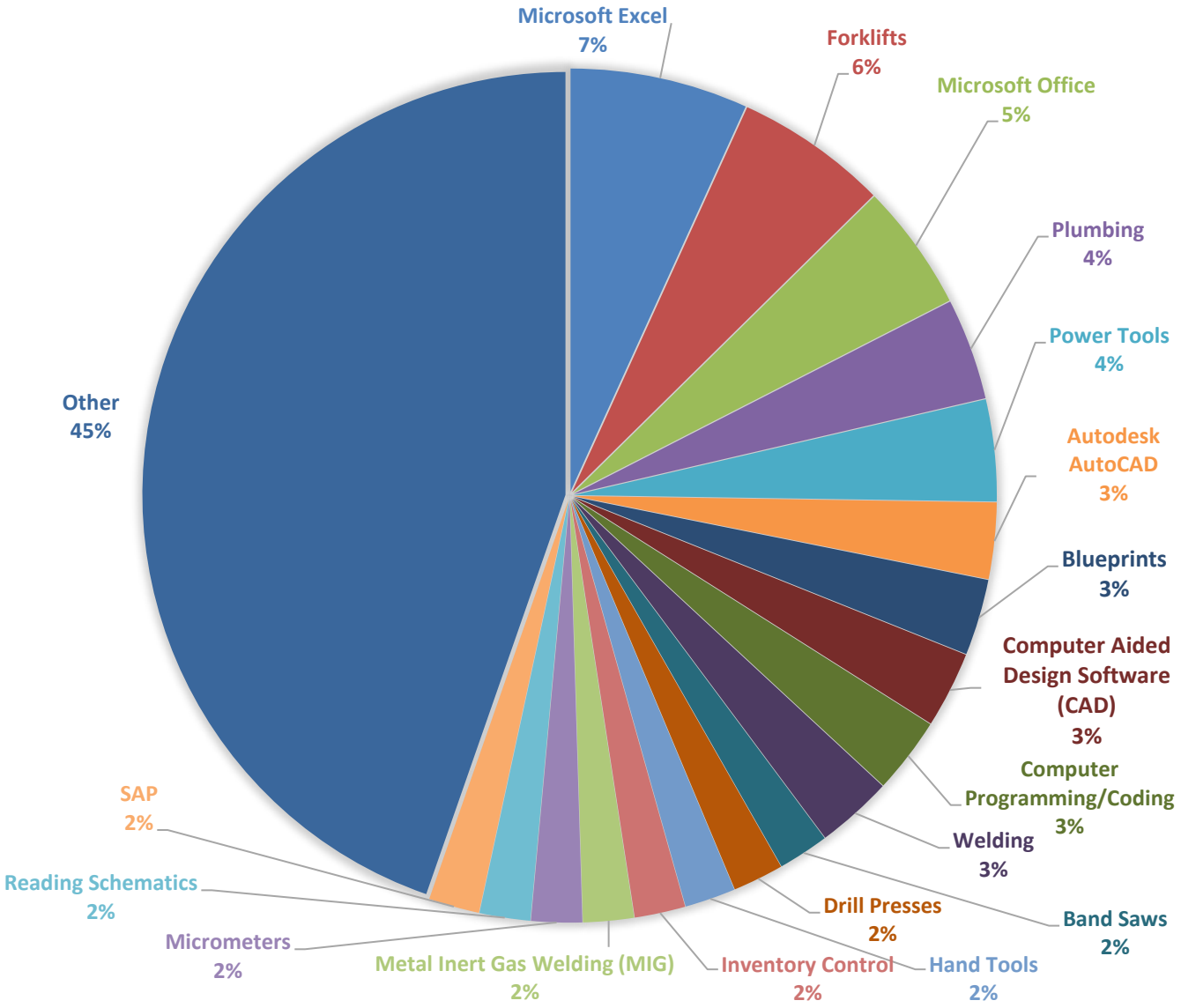
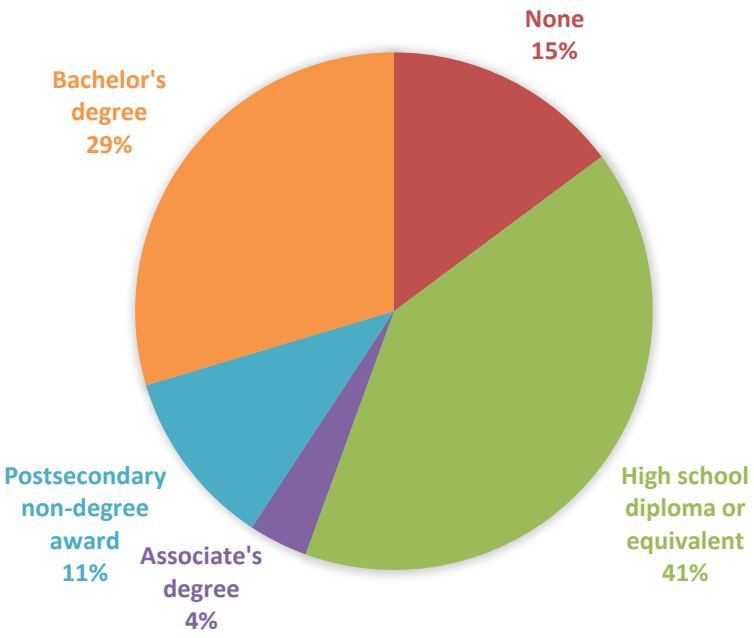


Figure 3. Distribution of Educational Attainment for All In-Demand Occupations



3.3 In-Demand Occupations by Project Phase

Offshore wind workforce needs can be best understood through the lens of project development phases, in part because the phases are likely to cluster around certain regions, giving more certainty to local training providers. The workforce needs for an offshore wind project extend far beyond simply the design and installation of the offshore wind farm, and include the development of ports and accompanying infrastructure, manufacturing and assembly of components, and the operations and maintenance of the wind farm.[6] Though there is some overlap in the job types that are needed across each project phase, important distinctions still exist for skills and occupations that are distinct to each phase.

Previous research highlighted the number (117) and range of occupations, along with potential gaps in the supply of workers who could meet those gaps. The research team expanded on this previous gap analysis with a real world look at jobs likely to be created in the New York State offshore wind industry, that could potentially be filled by in-State workers, especially in light of recent policy developments that increased the occupational areas of the value chain likely to be based in the State. The research team began with the comprehensive list of offshore wind occupations from previous research and used a number of criteria[7] to assemble a list of occupations for the report that was then reviewed for skills, certifications, and educational attainment required. The occupations were subsequently categorized by project phase.

3.3.1 Ports and Infrastructure Development

This phase is focused on the upgrades and new construction of ports and other infrastructure and manufacturing facilities required for the development of the offshore wind industry. Most direct occupations are centered around construction and engineering activities; therefore, most occupations are not as OSW-specific as in other phases and transition for these workers is less challenging. Facilities that require these occupations are likely to be in areas with access to water transportation, mainly downstate and in upstate cities near the Hudson River.

Necessary skills for construction occupations in this phase are centered around the use of power and hand tools, welding, and operating equipment such as lifts. Certifications required are in safety, first aid, and welding.

Management and engineering occupations require skills in software such as Computer-aided Design (CAD), Microsoft Excel, and Structural Analysis and Design (STAAD). These occupations also have certification requirements in safety, along with others in Project Management (PMP), Wind (GWO), and Operations.

Table 1. Ports and Infrastructure Development Occupations

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
11-1021	General and Operations Managers	Bachelor's degree	Microsoft Excel, Finance, Microsoft Office	GWO, OSHA 10, OSHA 30, Certified Welding Inspector (CWI), American Welding Society.
11-9021	Construction Managers	Bachelor's degree	Microsoft Office, Blueprints, Equipment Operation	GWO, OSHA 10, OSHA 30, First Aid Certification.
17-2051	Civil Engineers	Bachelor's degree	Autodesk AutoCAD, Microsoft Excel, Bentley STAAD, Computer Aided Design Software (CAD)	Professional Traffic Operations Engineer (PTOE), Licensed Professional Engineer, OSHA 30, 40-hour HAZWOPER, LEED Accredited Professional, International Electrotechnical Commission (IEC) 614000, NICET Level 1.
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	High school diploma or equivalent	Microsoft Office, Blueprints, Equipment Operation, Power Tools, Hand Tools	GWO, OSHA 10, OSHA 30, First Aid Certification.
47-2061	Construction Laborers	None	Forklifts, Power Tools, Plumbing, Hand Tools	OSHA 10, OSHA 30, First Aid Certification.
47-2073	Operating Engineers and Other Construction Equipment Operators	High school diploma or equivalent	Heavy Equipment Operation, Excavators, Backhoes, Bulldozers	Commercial Driver's License, OSHA 10, Forklift Certified.
47-2111	Electricians	High school diploma or equivalent	Programable Logic Controllers (PLC), Blueprints, Installation	GWO, OSHA 10, OSHA 30, Certified Welder.
47-2221	Structural Iron and Steel Workers	High school diploma or equivalent	Welding, Aerial Lifts, Metal Shears, Scissor Lifts, Operating Equipment.	OSHA 10, OSHA 30, Certified Welder, ISO 3834.
47-3019	Helpers, Construction Trades, All Other	None	Hand Tools, Plumbing	OSHA 10, OSHA 30
49-9071	Maintenance and Repair Workers, General	High school diploma or equivalent	Equipment Maintenance, Troubleshooting, Installation, Computer Aided Design (CAD) software	Commercial Driver's License, EPA Section 608 Certification (EPA 608), OSHA 10, OSHA30, Forklift Certified.

3.3.2 Manufacturing and Assembly

The Manufacturing and Assembly phase consists of all component manufacturing activities and is heavily dependent on production and construction occupations. Secondary steel production, tower, blade and nacelle manufacturing, and cable manufacturing are some of the activities in this phase. Occupations in this phase require more OSW-specific skills, therefore present more barriers for adjacent workers to transfer into the OSW industry. Manufacturing and Assembly facilities will require longer term workers with skills, certifications, and experience more directly applicable to OSW component manufacturing. These jobs will likely be in cities with proximity to the Hudson River or to other transportation methods appropriate for large OSW components.

Necessary skills for these occupations are mostly in reading blueprints, welding, and the use of tools and equipment for manufacturing, such as drill presses, forklifts, and power tools.

There is a necessity for GWO wind industry-specific certifications for occupations in this phase. Other certifications are in welding, welding inspection, quality auditing, and safety (OSHA 10 and 30).

Table 2. Manufacturing and Assembly Occupations

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
11-3051	Industrial Production Managers	Bachelor's degree	Microsoft Excel, Internal Auditing, Quality Control, SAP	Certified Quality Engineer (CQE), Certified Quality Auditor (CQA), Six Sigma Green Belt Certification (SSGB), Certified Welding Inspector (CWI), Project Management Professional (PMP), Certified Purchasing Professional (CPP), ISO 45001 (Health and Safety).
17-2112	Industrial Engineers	Bachelor's degree	Microsoft Excel, Computer Programming/Coding	Certified Quality Engineer (CQE), Certified Quality Auditor (CQA), Six Sigma Green Belt Certification (SSGB), Certified Welding Inspector (CWI), Six Sigma Black Belt Certification (SSBB), Licensed Professional Engineer, Certified Manager of Quality/Organizational Excellence (CMQ/OE).
47-2031	Carpenters	High school diploma or equivalent	Power Tools, Blueprints, Installation, Cutting and Shaping Materials	OSHA 10, OSHA 30
47-2061	Construction Laborers	None	Forklifts, Power Tools, Plumbing, Hand Tools	OSHA 10, OSHA 30, First Aid Certification
47-2073	Operating Engineers and Other Construction Equipment Operators	High school diploma or equivalent	Heavy Equipment Operation, Excavators, Backhoes, Bulldozers	Commercial Driver's License, OSHA 10, Forklift Certified.
47-2111	Electricians	High school diploma or equivalent	Programable Logic Controllers (PLC), Blueprints, Installation	GWO, OSHA 10, OSHA 30, Certified Welder.
47-2221	Structural Iron and Steel Workers	High school diploma or equivalent	Welding, Aerial Lifts, Metal Shears, Scissor Lifts, Operating Equipment	OSHA 10, OSHA 30, Certified Welder, ISO 3834.
51-2031	Engine and Other Machine Assemblers	High school diploma or equivalent	Power Tools, Blueprints, Micrometers, Installation, Equipment Operation	GWO, IPC-A 610 Acceptability of Electronic Assemblies, OSHA 10, OSHA 30.
51-4041	Machinists	High school diploma or equivalent	Milling Machines, Micrometers, Band Saws, Drill Presses, Forklifts	GWO, Certified Welder, Transportation Worker Identification Credential (TWIC).
51-4121	Welders, Cutters, Solderers, and Brazers	High school diploma or equivalent	Welding, Metal Inert Gas Welding (MIG), Blueprints, Forklifts, Fabrication	GWO, Certified Welder, American Welding Society, ISO 3834, OSHA 10, HAZMAT.
51-9162	Computer Numerically Controlled Tool Programmers	Postsecondary non-degree award	Computerized Numerical Control (CNC) Software, Mastercam, Computer Aided Design (CAD) Software, Dassault Systems SolidWorks Software	Institute of Electrical and Electronics Engineers (IEEE).
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	None	Pallet Jacks, Hand Trucks, Inventory Control	GWO, Forklift Certified, HAZMAT, Commercial Driver's License, OSHA 10.

3.3.3 Construction and Installation

The Construction and Installation phase consists of onshore activities such as staging, marshalling, and other quayside activities, and the offshore installation of turbines, platforms, and cables. Most work in this phase is OSW-specific and requires workers to have skills and knowledge of OSW processes and activities. The majority of these jobs must be close to the installation sites, in offshore facilities, and in the installation vessels. Therefore, the bulk of the demand for occupations in this phase will be in the downstate New York State region.

Occupations in this phase not only require applied skills in soldering, reading schematics, computer programming and circuit boards, but also management and operations skills in Microsoft Excel and inventory control. There are occupations relevant to this phase that are very specialized, mainly those in operating the installation vessels, where specific training, skills, and certifications are required.

The certifications most often required for these occupations are mostly in wind-specific areas, technical aspects, and health and safety measures. Occupational Safety and Health Administration (OSHA), Global Wind Organization (GWO), crane operation (NCCCO), and electrical and electronics engineering (IEEE) certifications are the most common requirements for these occupations.

Table 3. Construction and Installation Occupations

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
11-1021	General and Operations Managers	Bachelor's degree	Microsoft Excel, Finance, Microsoft Office	GWO, OSHA 10, OSHA 30, Certified Welding Inspector (CWI), American Welding Society
11-3071	Transportation, Storage, and Distribution Managers	High school diploma or equivalent	Microsoft Excel, Supply Chain Management, SAP, Inventory Control	Certified Supply Chain Professional (CSCP), Project Management Professional (PMP), Certified Professional in Supply Management (CPSM), Commercial Driver's License, Certified Materials and Resource Professional (CMRP)
13-1199	Business Operations Specialists, All Other	Bachelor's degree	Microsoft Excel, Microsoft Office, Customer Relationship Management (CRM)	Project Management Professional (PMP), Electronic Safety and Security Designer (ESS), Certified Business Continuity Professional (CBCP)
17-2071	Electrical Engineers	Bachelor's degree	Autodesk AutoCAD, Computer Programming, Coding, Reading Schematics, Python	Licensed Professional Engineer, OSHA 30, LEED Accredited Professional, Institute of Electrical and Electronics Engineers (IEEE), Certified Energy Manager (CEM)
17-3023	Electrical and Electronic Engineering Technologists and Technicians	Associate degree	Soldering, Circuit Boards, Computer Programming, Coding, Reading Schematics	IPC-A 610 Acceptability of Electronic Assemblies, Industrial Electronic Certification (IND), OSHA 30, NABCEP Certification, Institute of Electrical and Electronics Engineers (IEEE), Certified Welding Inspector (CWI)
47-2061	Construction Laborers	None	Forklifts, Power Tools, Plumbing, Hand Tools	OSHA 10, OSHA 30, First Aid Certification
47-2111	Electricians	High school diploma or equivalent	Programable Logic Controllers (PLC), Blueprints, Installation, Welding	GWO, OSHA 10, OSHA 30, Certified Welder
49-9081	Wind Turbine Service Technicians	Postsecondary non-degree award	Electrical Components and Systems, Mechanical and Hydraulic Systems, Underground Transmission Systems, Wind Field Substations, Fiber Optic Sensing and Control Systems, Hand and Power Tools, Generators, Supervisory Control and Data Acquisition Software (SCADA Software), Microsoft Office	Commercial Driver's License, OSHA 10, OSHA 30, Cisco Certified Network Associate (CCNA), Forklift Certified, EPA Section 608 Certification, Certification in Cardiopulmonary Resuscitation (CPR), Construction Health and Safety Technician (CHST), GWO
53-5021	Captains, Mates, and Pilots of Water Vessels	Postsecondary non-degree award	Route Navigation Software, FURUNO Navigational Chart Software, Jeppesen Marine Nobeltec Admiral, Maptech The CAPN, Equipment Operation	Transportation Worker Identification Credential (TWIC), Certification in Cardiopulmonary Resuscitation (CPR), First Aid Certification, HAZMAT, Lifeguard Certification
53-7021	Crane and Tower Operators	High school diploma or equivalent	Operating Mobile Cranes, Operating Overhead Cranes, Human Machine Interface Software, Forklifts	Certified Crane Operator (NCCCO), Commercial Driver's License, Overhead Crane Operator

3.3.4 Operations and Maintenance

This phase requires long-term workers for the routine maintenance, repair, and periodic operation of the wind farm. Work in this phase must be tailored toward offshore wind activities, and the necessary skills and experience are specific to wind, therefore current workers of other energy sectors will encounter some barriers to entry. These workers will be doing offshore work or working in the relevant ports, likely in downstate locations that are closest to the wind farms.

The skills most often required for these occupations are like those required in the Construction and Installation phase, and further specialization in offshore wind is also necessary. Soldering, programming, and reading schematics are common requirements for jobs directly in the wind farm, and Microsoft Excel and Autodesk AutoCAD are skills required for management, operations, and engineering work. For occupations in water vessels, more years of specialization are required to become captain, mate, or pilot.

Since there is overlap between Construction and Installation and Operation and Maintenance occupational requirements, the certifications most often needed for this phase of an OSW project are also focused on health and safety, engineering, and management. These certifications include OSHA, IEEE, Certified Construction Manager (CCM), and Certified Energy Manager (CEM).

Table 4. Operations and Maintenance Occupations

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
11-3071	Transportation, Storage, and Distribution Managers	High school diploma or equivalent	Microsoft Excel, Supply Chain Management, SAP, Inventory Control	Certified Supply Chain Professional (CSCP), Project Management Professional (PMP), Certified Professional in Supply Management (CPSM), Commercial Driver's License, Certified Materials and Resource Professional (CMRP)
11-9041	Architectural and Engineering Managers	Bachelor's degree	Microsoft Excel, Autodesk AutoCAD, Microsoft Office, Lean Six Sigma	Project Management Professional (PMP), Licensed Professional Engineer, Certified Construction Manager (CCM), OSHA 10, OSHA 30
17-2071	Electrical Engineers	Bachelor's degree	Autodesk AutoCAD, Computer Programming, Coding, Reading Schematics, Python	Licensed Professional Engineer, OSHA 30, LEED Accredited Professional, Institute of Electrical and Electronics Engineers (IEEE), Certified Energy Manager (CEM)
17-3023	Electrical and Electronic Engineering Technologists and Technicians	Associate degree	Soldering, Circuit Boards, Computer Programming, Coding, Reading Schematics	IPC-A 610 Acceptability of Electronic Assemblies, Industrial Electronic Certification (IND), OSHA 30, NABCEP Certification, Institute of Electrical and Electronics Engineers (IEEE), Certified Welding Inspector (CWI)
49-9081	Wind Turbine Service Technicians	Postsecondary non-degree award	Electrical Components and Systems, Mechanical and Hydraulic Systems, Underground Transmission Systems, Wind Field Substations, Fiber Optic Sensing and Control Systems, Hand and Power Tools, Generators, Supervisory Control and Data Acquisition Software (SCADA Software), Microsoft Office	Commercial Driver's License, OSHA 10, OSHA 30, Cisco Certified Network Associate (CCNA), Forklift Certified, EPA Section 608 Certification, Certification in Cardiopulmonary Resuscitation (CPR), Construction Health and Safety Technician (CHST), GWO
53-5021	Captains, Mates, and Pilots of Water Vessels	Postsecondary non-degree award	Route Navigation Software, FURUNO Navigational Chart Software, Jeppesen Marine Nobeltec Admiral, Maptech The CAPN, Equipment Operation	Transportation Worker Identification Credential (TWIC), Certification in Cardiopulmonary Resuscitation (CPR), First Aid Certification, HAZMAT, Lifeguard Certification

4 Priority Areas for Future Workforce Supply

Filling projected occupational gaps is an opening for New York State to bring forward a wider range of worker populations into the offshore wind sector. In some areas or regions that will experience more rapid offshore wind employment demand than can easily be met, the ability to bring new workers forward at a quick pace will be critical to leverage that opportunity. This section highlights three groups that are important priority areas in the State that could meet additional offshore wind workforce demands with varying levels of training and support. They include:

1. **Adjacent industry workers** who can relatively easily transition into offshore wind related occupations with limited new training and experience.
2. **Current workers in occupations connected to traditional fossil energy sectors**, who will be impacted by the transition to clean energy and may want to transition into offshore wind.
3. **Workers from areas designated as disadvantaged communities (DACs) and future new workforce entrants**, who need more targeted support, education, and training to enter offshore wind-related occupations.

Transitioning each group into offshore wind work, especially within any time constraints, will require intentional focus and an understanding of how to address their different challenges and barriers to prepare these worker populations to access these new jobs. Done effectively, this can address several challenges associated with the transition to a decarbonized economy, including how to bring along impacted workers in current fossil industries and adjacent sectors, how to increase diversity and inclusion in the new workforce and how to encourage a new generation of workers to enter these fields.

4.1 Adjacent Industry Workers

The first priority category of workers are those working in occupations in "adjacent industries." Adjacent industries are those businesses or sectors that are closely related to each other, but not necessarily in the same industry or sector, usually connected that are complementary or interdependent products or services. Transferability opportunities are an important element of a healthy workforce, and the offshore wind industry could serve as a safety valve for similarly skilled occupations.

The table below shares 10 occupations from adjacent industries, and provides the skills associated with those occupations, as well as most similar offshore wind-related occupations. To explore the certifications and skills needed to help support transfer into these new occupations, please refer to section 4.5.

Table 5. Adjacent Industry Occupations

Adjacent Occupation	Industries with High Density of Occupation	New York LQ	Related OSW Occupations
Elevator and Escalator Installers and Repairers	Buildings Equipment Contractors (NAICS 2382): 90% of all NYS workers in this occupation are in this industry that is projected to slightly decline in the next 10 years.	2.69	• Electrician • Maintenance and Repair Workers, General • Wind Turbine Service Technicians
Molders, Shapers, and Casters, Except Metal and Plastic	Cement and Concrete Product Manufacturing (NAICS 3273), Glass and Glass Product Manufacturing (NAICS 3272), Other Nonmetallic Mineral Product Manufacturing (NAICS 3279): 47% of all NYS workers in this occupation are in these three industries that have average annual wages under $50,000.	0.59	• Structural Metal Fabricators and Fitters • Welders, Cutters, Solderers, and Brazers • Machinists
Engineering Technologists and Technicians, Except Drafters, All Other	Architectural, Engineering, and Related Services (NAICS 5413), Scientific Research and Development Services (5417): 32% of all NYS workers in this occupation are in these two industries that are projected to either decline or remain constant.	0.53	• Industrial Engineers • Computer Numerically Controlled Tool Programmers • Electrical and Electronic Engineering Technologists and Technicians
Marine Engineers and Naval Architects	Architectural, Engineering, and Related Services (NAICS 5413), Computer Systems Design and Related Services (NAICS 5415), Ship and Boat Building (NAICS 3366): 58% of all NYS workers in this occupation are in one of these industries that are projected to slightly decline or remain constant.	0.43	• Electrical Engineers • Architectural and Engineering Managers • Civil Engineers
Model Makers, Metal and Plastic	Specialized Design Services (NAICS 5414), Architectural, Engineering, and Related Services (NAICS 5413), Plastics Product Manufacturing (NAICS 3261): 55% of all NYW workers in this occupation are in these three industries that are projected to slightly decline.	0.56	• Structural Metal Fabricators and Fitters • Machinists
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	Architectural and Structural Metals Manufacturing (NAICS 3323), Motor Vehicle Parts Manufacturing (NAICS 3363), Semiconductor and Other Electronic Component Manufacturing (NAICS 3344): 37% of all NYS workers in this occupation are in these industries that are projected to decline in the next 10 years.	0.43	• Assemblers and Fabricators, All Other • Welders, Cutters, Solderers, and Brazers
Electric Motor, Power Tool, and Related Repairers	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance (NAICS 8113), Miscellaneous Durable Goods Merchant Wholesalers (NAICS 4239): 35% of all NYS workers in this occupation are in these declining industries.	0.55	• Maintenance and Repair Workers, General • Wind Turbine Service Technicians

Table 5 Continued

Adjacent Occupation	Industries with High Density of Occupation	New York LQ	• Related OSW Occupations
Industrial Machinery Mechanics	Machinery, Equipment, and Supplies Merchant Wholesalers (NAICS 4238), Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance (NAICS 8113): 18% of NYS workers in this occupation are in these industries that have average wages below $56,000.	0.48	• Maintenance and Repair Workers, General • Wind Turbine Service Technicians
Electrical Power-Line Installers and Repairers	Electric Power Generation, Transmission and Distribution (NAICS 2211): 67% of all NYS workers in this occupation are in this industry which projects a decline in demand for this occupation in the next 10 years.	0.52	• Maintenance and Repair Workers, General • Wind Turbine Service Technicians
Control and Valve Installers and Repairers, Except Mechanical Door	Electric Power Generation, Transmission and Distribution (NAICS 2211), Natural Gas Distribution (NAICS 2212): 55% of all NYS workers in this occupation are in these two industries which project a decline in demand for this occupation in the next 10 years.	1.38	• Maintenance and Repair Workers, General • Wind Turbine Service Technicians

4.2 Current Fossil Fuel Workers Impacted by the Transition to Clean Energy

New York State's Just Transition Working Group completed a detailed analysis within the Just Transition Working Group's Jobs Study to understand the occupations that will be most heavily impacted through the State's decarbonization strategy. In the table below, the research team looked at those occupations, and the skills connected to those occupations to allow for a skill comparison overlap analysis with specific offshore wind occupations. The following table shows some of the occupations expected to be most impacted by 2030 through New York State's decarbonization strategy, as well as potential transition pathways into similar occupations.

To explore the certifications and skills needed to help support transfer into these new occupations, please refer to section 4.5.

Table 6. Impacted Occupations

Occupation	Skills	OSW-Related Occupations: Possible Transition Pathways
Laborers and Freight, Stock, and Material Movers, Hand	Pallet Jacks, Hand Trucks, Inventory Control	Occupation already in list of OSW-relevant occupations. Able to obtain OSW-specific skills and certifications to transition.
Heavy and Tractor-Trailer Truck Drivers	Loading and unloading of vehicles, Inventory, Operating equipment	• Conveyor Operators and Tenders • Crane and Tower Operators • Transportation, Storage, and Distribution Managers
Light Truck Drivers	Loading and unloading of vehicles, Inventory, Operating equipment	• Transportation, Storage, and Distribution Managers
First-Line Supervisors of Office and Administrative Support Workers	Accounting, Microsoft Excel, Enterprise Resource Planning (ERP) software, Project Management software, Inventory	• General and Operations Managers • Business Operations Specialists, All Other
Welders, Cutters, Solderers, and Brazers	Welding, Metal Inert Gas Welding (MIG), Blueprints, Forklifts, Fabrication	Occupation already in list of OSW-relevant occupations. Able to obtain OSW-specific skills and certifications to transition.
Industrial Machinery Mechanics	Equipment repair and maintenance, Assembly and disassembly, Equipment and machinery cleaning and adjustment, Industrial control software, Operation of equipment	• Machinists • Maintenance and Repair Workers, General • Operating Engineers and Other Construction Equipment Operators
Team Assemblers	Quality Control, Blueprints, Component assembly	• Engine and Other Machine Assemblers
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Testing electrical circuits or components, Electrical test equipment, Blueprints, Circuit troubleshooting, Checking compliance to standards, Equipment Installation	• Engine and Other Machine Assemblers • Transportation, Storage, and Distribution Managers
Structural Metal Fabricators and Fitters	Welding, Aerial Lifts, Metal Shears, Scissor Lifts	• Structural Iron and Steel Workers
Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	Graphics software, Component assembly, Hand Tools, Power Tools, Quality Control	• Electrical and Electronic Engineering Technologists and Technicians • Electricians
First-Line Supervisors of Mechanics, Installers, and Repairers	Vehicle Management software, Quality Control, Installation, Equipment Operation	• First-Line Supervisors of Construction Trades and Extraction Workers • Construction Managers • Industrial Production Managers
Machinists	Milling Machines, Micrometers, Band Saws, Drill Presses, Forklifts	Occupation already in list of OSW-relevant occupations. Able to obtain OSW-specific skills and certifications to transition.
Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	Equipment Operation, Operations Monitoring, Quality Control, Computer Aided Manufacturing (CAM) software	• Welders, Cutters, Solderers, and Brazers • Structural Iron and Steel Workers
Maintenance and Repair Workers, General	Equipment Maintenance, Troubleshooting, Installation, Computer Aided Design (CAD) software	Occupation already in list of OSW-relevant occupations. Able to obtain OSW-specific skills and certifications to transition.

4.3 Workers from Areas Designated as Disadvantaged Communities and Future New Workforce Entrants

Recruiting priority populations, such as disadvantaged communities (DACs), into offshore wind roles is critical to meeting the equity and inclusion goals of New York State's decarbonization strategy. This strategy is also vital to meeting the demand for labor. However, this will require addressing specific barriers and developing a comprehensive strategy that may include varying investments and incentives for education and training, wraparound services, career and job placement services, and other supports.

4.3.1 Entry-Level Occupations

One near-term strategy for more immediate access to the offshore wind industry is to support entry into jobs with lower initial barriers to entry. "Lower barriers to entry" can be defined several ways, from less skills or experience to proximity, to willingness to accept involvement with the judicial system, and so forth. The table below highlights four roles with generally no minimum educational requirements.

Table 7. Entry-Level Occupations

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
47-2061	Construction Laborers	None	Forklifts, Power Tools, Plumbing, Hand Tools	OSHA 10, OSHA 30, First Aid Certification
47-3019	Helpers, Construction Trades, All Other	None	Hand Tools, Plumbing	OSHA 10, OSHA 30
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	None	Pallet Jacks, Hand Trucks, Inventory Control	GWO, Forklift Certified, HAZMAT, Commercial Driver's License, OSHA 10

The next tier or roles has a high school diploma requirement, but there are more technical aspects required and more OSW-specific skills or certifications. Some of these are electricians, engine assemblers, machinists, welders, cutters, solderers, structural iron and steel workers, and construction equipment operators.

Table 8. Mid-Tier Occupations

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	High school diploma or equivalent	Microsoft Office, Blueprints, Equipment Operation, Power Tools, Hand Tools	GWO, OSHA 10, OSHA 30, First Aid Certification
47-2073	Operating Engineers and Other Construction Equipment Operators	High school diploma or equivalent	Heavy Equipment Operation, Excavators, Backhoes, Bulldozers	Commercial Driver's License, OSHA 10, Forklift Certified
47-2111	Electricians	High school diploma or equivalent	Programable Logic Controllers (PLC), Blueprints, Installation	GWO, OSHA 10, OSHA 30, Certified Welder
47-2221	Structural Iron and Steel Workers	High school diploma or equivalent	Welding, Aerial Lifts, Metal Shears, Scissor Lifts, Operating Equipment	OSHA 10, OSHA 30, Certified Welder, ISO 3834
49-9071	Maintenance and Repair Workers, General	High school diploma or equivalent	Equipment Maintenance, Troubleshooting, Installation, Computer Aided Design (CAD) software	Commercial Driver's License, EPA Section 608 Certification (EPA 608), OSHA 10, OSHA30, Forklift Certified
47-2031	Carpenters	High school diploma or equivalent	Power Tools, Blueprints, Installation, Cutting and Shaping Materials	OSHA 10, OSHA 30
47-2073	Operating Engineers and Other Construction Equipment Operators	High school diploma or equivalent	Heavy Equipment Operation, Excavators, Backhoes, Bulldozers	Commercial Driver's License, OSHA 10, Forklift Certified
47-2111	Electricians	High school diploma or equivalent	Programable Logic Controllers (PLC), Blueprints, Installation	GWO, OSHA 10, OSHA 30, Certified Welder
47-2221	Structural Iron and Steel Workers	High school diploma or equivalent	Welding, Aerial Lifts, Metal Shears, Scissor Lifts, Operating Equipment	OSHA 10, OSHA 30, Certified Welder, ISO 3834
51-2031	Engine and Other Machine Assemblers	High school diploma or equivalent	Power Tools, Blueprints, Micrometers, Installation, Equipment Operation	GWO, IPC-A 610 Acceptability of Electronic Assemblies, OSHA 10, OSHA 30
51-4041	Machinists	High school diploma or equivalent	Milling Machines, Micrometers, Band Saws, Drill Presses, Forklifts	GWO, Certified Welder, Transportation Worker Identification Credential (TWIC)
51-4121	Welders, Cutters, Solderers, and Brazers	High school diploma or equivalent	Welding, Metal Inert Gas Welding (MIG), Blueprints, Forklifts, Fabrication	GWO, Certified Welder, American Welding Society, ISO 3834, OSHA 10, HAZMAT

Table 8 continued

SOC Code	Occupation Title	Minimum Educational Requirement	Skills	Certifications
11-3071	Transportation, Storage, and Distribution Managers	High school diploma or equivalent	Microsoft Excel, Supply Chain Management, SAP, Inventory Control	Certified Supply Chain Professional (CSCP), Project Management Professional (PMP), Certified Professional in Supply Management (CPSM), Commercial Driver's License, Certified Materials and Resource Professional (CMRP)
47-2111	Electricians	High school diploma or equivalent	Programable Logic Controllers (PLC), Blueprints, Installation, Welding	GWO, OSHA 10, OSHA 30, Certified Welder
53-7021	Crane and Tower Operators	High school diploma or equivalent	Operating Mobile Cranes, Operating Overhead Cranes, Human Machine Interface Software, Forklifts	Certified Crane Operator (NCCCO), Commercial Driver's License, Overhead Crane Operator
11-3071	Transportation, Storage, and Distribution Managers	High school diploma or equivalent	Microsoft Excel, Supply Chain Management, SAP, Inventory Control	Certified Supply Chain Professional (CSCP), Project Management Professional (PMP), Certified Professional in Supply Management (CPSM), Commercial Driver's License, Certified Materials and Resource Professional (CMRP)

4.3.2 Need for Wraparound and Other Support

In addition to identifying these occupations that have lower barrier for entry, and supporting recruitment into them, many disadvantaged workforces will still require, or at least strongly benefit from wraparound supports and other efforts to address barriers to entry. These barriers can include criminal justice-involvement, and/or documentation of immigrant status, non-native English language challenges, childcare and transportation needs and/or the opportunity cost of leaving their existing work. Trying to reduce these barriers can be especially helpful to returning citizens, undocumented workers, and youth and young adults. Rather than duplicating efforts or creating multiple layers of systems, one strategy is to focus on the existing system of supporting organizations that offer wraparound services and providing additional funding for them to focus on individuals seeking to enter these occupations.

4.3.3 Supporting Pre-Apprenticeships and Apprenticeships

Unions provide high-quality jobs with strong safety standards and career pathways. Entry into unions typically occurs through multiyear apprentice programs that can require specific math and literacy requirements, experience in a field, and passage of an application exam. However, once in, union apprentices get years of free training accompanied by “earn-as-you-learn” wages alongside an experienced journeyman.

To engage priority populations in union programs similarly requires overcoming a number of barriers, including lack of awareness about union opportunities, concern over cultural fit, and difficulty meeting apprentice entry requirements for the same types of reasons as described above. One strategy that begins to address this is a pre-apprenticeship or an apprentice-readiness program operated in partnership with labor unions. These include targeted efforts to recruit populations through direct outreach and community partners, adult basic education and basic skills training, and exposure and connection to specific unions.

Appendix A. Career Profiles

A.1 Architectural and Engineering Managers

Summary: Architectural and engineering managers oversee activities related to the architectural and engineering components of a project. They create project plans, determine what types of staffing, training, and equipment will be required for the project; and organize and direct the work processes. They must have excellent communication, problem solving, and leadership skills as well as experience with architecture or engineering concepts. Managers involved in the offshore wind energy industry must have a comprehensive working knowledge of the industry so that they can provide the most accurate project oversight and avoid costly mistakes or misunderstandings.

The entry-level and experienced median hourly wages for New York architectural and engineering managers are greater than the statewide averages, respectively. The typical entry-level education requirement is a bachelor's degree. On top of their education, these managers often have experience in leadership roles. They can attain director or executive positions during their careers. Jobs from within the architecture and engineering and the educational instruction and library occupational groups could easily transition into an architectural and engineering manager position.

A.1.1 Job Description

Architectural and engineering managers oversee the architectural and engineering operations at a project site. They plan, direct, and coordinate the design and development activities for new products related to their specialized fields including research that advances the development. When a new project begins, these managers create detailed plans related to the development of the project, determine the training and equipment needs; handle the budget and timeline of the project; and hire or assign necessary workers. Throughout the course of the project, architectural and engineering managers supervise the staff and coordinate the work, ensure accuracy and productivity, and resolve issues if they arise. They typically work 40 hours a week, but some may work more than 40 hours depending on project schedules and deadlines.

These managers are found in various industries and sectors, including manufacturing, government, scientific research and development, and energy. They must have a comprehensive understanding of architecture and engineering to manage the development of a project and create detailed plans. It is important for managers to have a working knowledge of operations in their primary field or industry

to provide accurate direction and insight on the projects. Architectural and engineering managers in the wind energy industry are involved in almost all aspects of a project, including project development, component manufacturing, construction, and operations. They oversee the operations related to the design and development of wind turbines, including managing several different types of engineers due to the complexity of the wind turbines.[8]

A.1.2 Wages

The entry-level, median, and experienced wages for architectural and engineering managers in New York State are all greater than the statewide averages. An entry-level architectural and engineering manager earns roughly $60 an hour while an average entry-level employee in the State earns just over $16 an hour. Experienced managers earn $100 an hour which is more than double the New York State average wage for experienced workers. The median hourly wage for architectural and engineering managers is over $80 an hour.[9]

Table A-1. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Architectural and Engineering Managers (Annual)	$124,900	$167,300	$208,000
Architectural and Engineering Managers (Hourly)	$60.05	$80.43	$100.00

A.1.3 Education, Experience, Skill Requirements, and Certifications

Architectural and engineering managers are typically required to have a bachelor's degree in either architecture or engineering. Before becoming managers, these individuals gain experience working as architects or engineers as well as experience in leadership roles. Some earn a graduate degree in management, often in a business or technology field, and others may earn a graduate degree while working as a manager.

These managers must be good communicators, organized, detail oriented, and analytical. These skills help the managers in their supervising, planning, and problem-solving tasks. Architectural and engineering managers who work in the wind energy industry should have sufficient field knowledge of the industry to ensure accurate management.

Of the current pool of New York State architectural and engineering managers, less than half a percent have less than a high school diploma and two percent have a high school diploma or equivalent. Approximately 90 percent have either a four-year college degree or a master's degree or higher. Specifically, 45 percent have a bachelor's degree and 46 percent have a graduate-level degree. The remaining seven percent have some college or a two-year degree.[10]

There were 14,994 active job postings in New York State for architectural and engineering managers between January 2022 through January 2023.[11] Listed below are the current in-demand certifications from employers[12]:

- Project Management Professional (PMP)
- Licensed Professional Engineer
- driver's license
- Engineer in Training (EIT)
- Certified Construction Manager
- OSHA 10
- OSHA 30

Because project planning and development are significant duties of architectural and engineering managers, it is important for them to have experience with various software such as Microsoft Office and Agile. In addition, these managers must have good communication and presentation skills to provide direction or instruction to workers as well as to provide information to executives and/or clients. Familiarity with the processes in their field or industry is also necessary to perform the job well and prevent mistakes or misunderstandings. The most frequently required technical skills for architectural and engineering managers are the following:

- Microsoft Excel
- Manufacturing
- Autodesk AutoCAD
- Agile
- Lean Six Sigma

Figure A-1. Educational Attainment of Current Workers

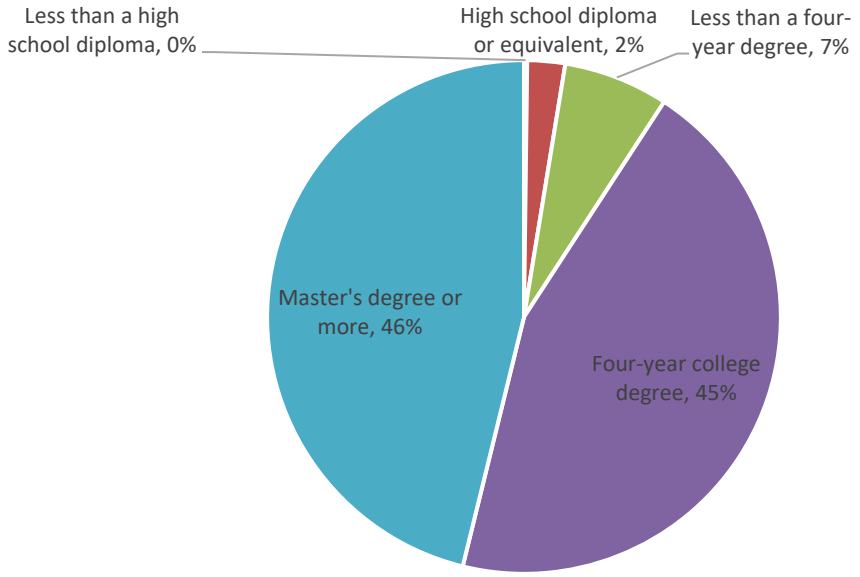
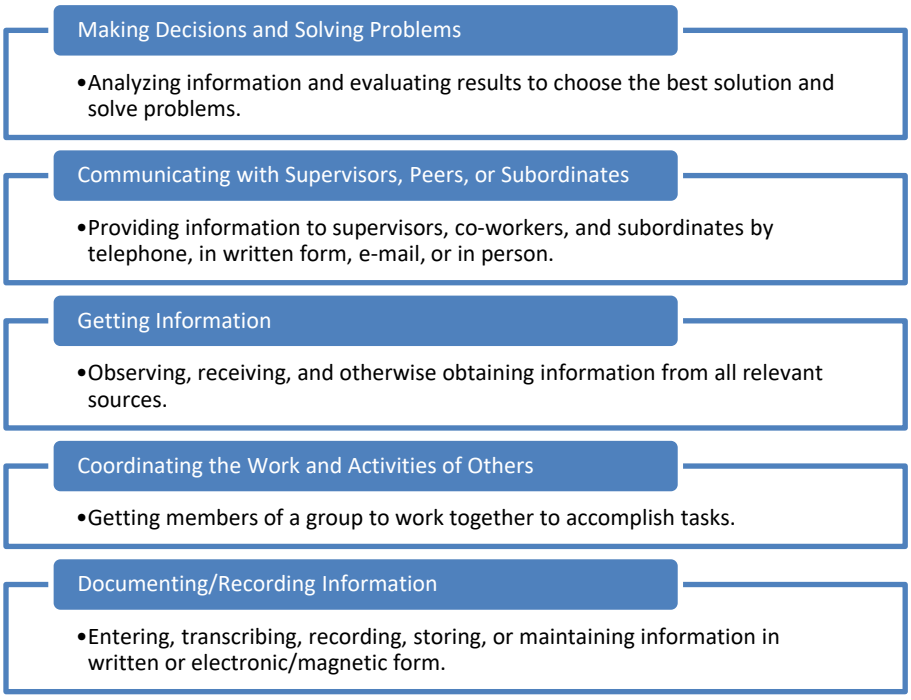


Figure A-2. Top Work Activities



A.1.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to architectural and engineering managers and could therefore more easily transition into one of these manager positions with minimal additional preparation. These transferrable jobs are found within the architecture and engineering occupational group and the educational instruction and library occupational group.[13]

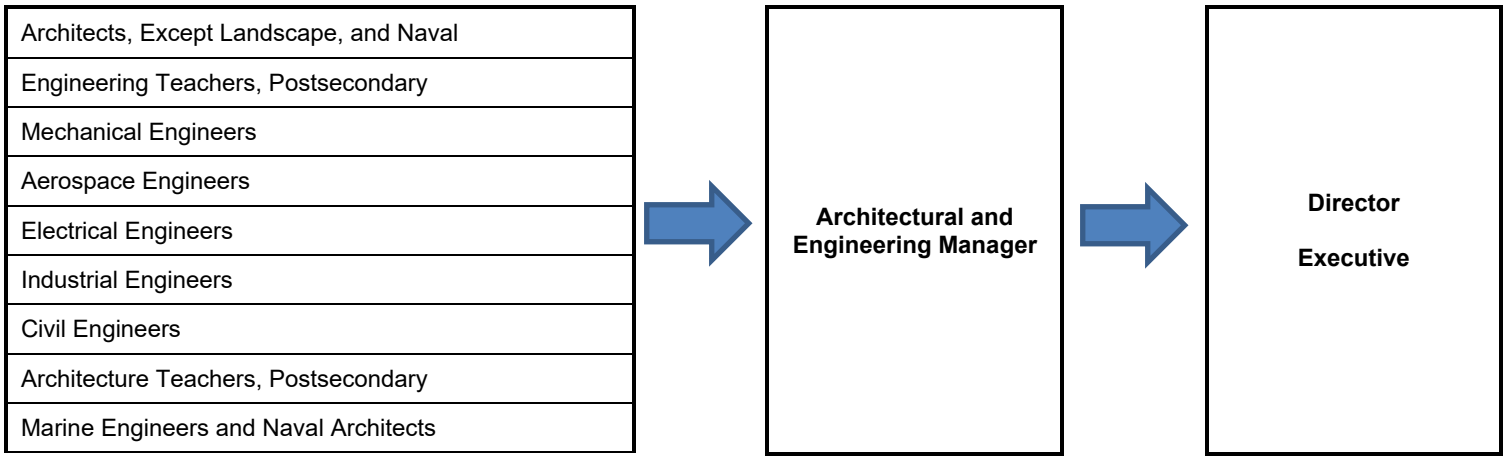
Transferrable occupations are listed in the below table and figure. An architectural and engineering manager career is a good way for others with architecture or engineering experience to enter the offshore wind energy industry. Those with management experience would already know how to plan, direct, and coordinate workers and projects. Workers with architecture and/or engineering, but not management, experience would need to strengthen their leadership, organization, and communication skills to develop as managers.

Postsecondary teachers would exceed the typical entry-level education requirement for architectural and engineering managers. Architects and engineers with bachelor's degrees would meet the entry-level education requirements. These workers would need specialized training in offshore wind and wind turbines to excel in an architectural and engineering manager role in this industry. Transferable occupations listed would see a significant increase in their median hourly wages as well.[14]

Table A-2. Transferable Occupations

Occupation	Total Jobs in New York State, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Architectural and Engineering Managers	**6,741**	**$80.43**	**Bachelor's degree**
Architects, Except Landscape and Naval	11,569	$48.40	Bachelor's degree
Engineering Teachers, Postsecondary	3,302	$57.48	Doctoral or professional degree
Architecture Teachers, Postsecondary	1,054	$61.98	Doctoral or professional degree
Marine Engineers and Naval Architects	231	$50.33	Bachelor's degree
Mechanical Engineers	9,562	$46.40	Bachelor's degree
Aerospace Engineers	664	$55.95	Bachelor's degree
Electrical Engineers	9,392	$50.90	Bachelor's degree
Industrial Engineers	11,900	$46.79	Bachelor's degree
Civil Engineers	15,253	$47.93	Bachelor's degree

Figure A-3. Career Transferability and Progression



A.2 Assemblers and Fabricators, All Other

Summary: Assemblers and fabricators build entire products or the components of products using hand and power tools as well as machinery and other equipment when necessary. In some industries, they must understand complex and technical blueprints or specifications in order to assemble the product correctly and without defects. Quality control is an important aspect of this role. In the wind energy industry, these workers assemble components of the wind turbines which require precision and sometimes use of large equipment or machinery. The manufacturing and assembling process in the offshore wind energy industry is labor-intensive and highly technical.

Jobs found within the production occupational group could easily transition into an assembler and fabricator position in the wind energy industry. These entry-level assemblers and fabricators earn a wage that is lower than the average entry-level wage in New York State. The typical entry-level education requirement for this occupation is a high school diploma or equivalent. Individuals often learn the trade during several months of on-the-job training and technical instruction. From there, they could later transition into supervisor or manager positions.

A.2.1 Job Description

Assemblers and fabricators, in general, build products. They are a production occupation that assembles an entire product or a component of a product. In the assembly process, these workers are able to perform every task or step. They may use a variety of hand tools or machinery to make products for the industry n which they work. Sometimes, they must trim, cut, and make other adjustments to align and fit components together to create the finished product. Assemblers and fabricators are required to read detailed, and sometimes complex, blueprints or schematics. They conduct quality control checks as well. Other common job titles include mechanical assembler, assembly technician, assembly operator, and electrical mechanical assembler.

Assemblers and fabricators build many types of products such as aircraft structures and systems, electrical systems and electronics, engines, and structural metal. Wind industry assemblers and fabricators are an emerging type of production worker. These workers assemble various components of wind turbines such as the towers and blades, which are an intricate and labor-intensive component of a turbine. They may also assemble components of wind energy electrical systems, generators, and computers. Wind turbine production workers may be employed by various third-party suppliers of wind turbine components or by wind turbine original equipment manufacturers.[15]

A.2.2 Wages

The entry-level, median, and experienced wages for these types of assemblers and fabricators in New York State are all less than the statewide averages. Entry-level workers across the State earn a little more than $16 an hour while entry-level assembler and fabricator workers earn just under $15 an hour. Experienced assemblers and fabricators earn approximately $22 an hour, compared to the average experienced worker in New York State earning over $45 an hour. Their median hourly wage is $18 an hour.[16]

Table A-3. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Assemblers and Fabricators, All Other (Annual)	$30,700	$37,500	$46,000
Assemblers and Fabricators, All Other (Hourly)	$14.74	$18.03	$22.13

A.2.3 Education, Experience, Skill Requirements, and Certifications

Entry-level assemblers and fabricators typically need a high school diploma or equivalent. In general, assembler and fabricator workers receive several months of on-the-job training and sometimes technical instruction. More advanced or skilled workers may earn an associate degree for certain employers. Some workers may choose to earn a certificate through the International Fabricators and Manufacturers Association to improve their credentials.[17]

Assemblers and fabricators need a strong attention to detail, dexterity, and basic mathematics skills. In addition, technical and mechanical skills are valuable for workers who use computers, equipment, and machinery. Sometimes, physical strength and stamina are needed for assemblers and fitters who work with heavy and/or large components, such as wind turbine components. This may require workers to climb, stand for long periods of time, and lift heavy items.

Of the current pool of these assembler and fabricator workers, approximately half have a high school diploma or equivalent and 15 percent have less than a high school diploma. Roughly three in ten have some college or a two-year degree and one in ten have a four-year college degree. Approximately two percent of current workers have a master's degree or more.

Based on 948 active job postings in New York State for these types of assemblers and fabricators from January 2022 through January 2023,[18] the current in-demand certifications from employers include those listed below[19]:

- driver's license
- OSHA 10
- OSHA 30

Assemblers and fabricators who work with large and heavy components, including those in the wind energy industry, need physical strength to lift the components. An understanding of assembly and manufacturing processes is valuable for assemblers and fabricators in addition to experience using various hand and power tools. In general, the most frequently required technical skills for assemblers and fabricators are listed below:

- ability to lift 41-50 pounds
- mechanical assembly
- drill presses
- power tools
- hand tools
- manufacturing

Figure A-4. Educational Attainment of Current Workers

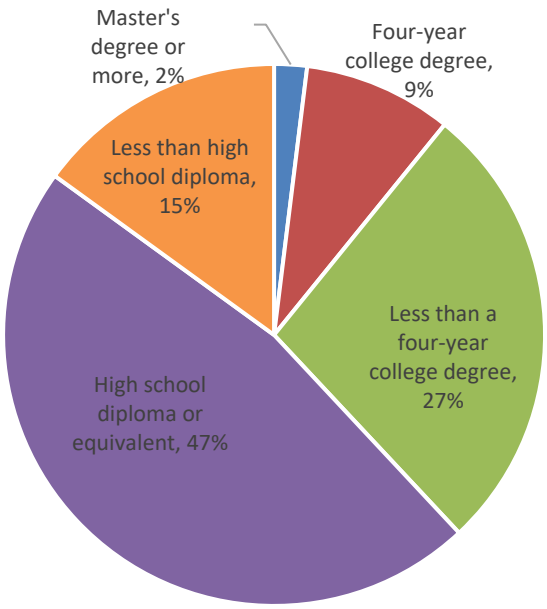
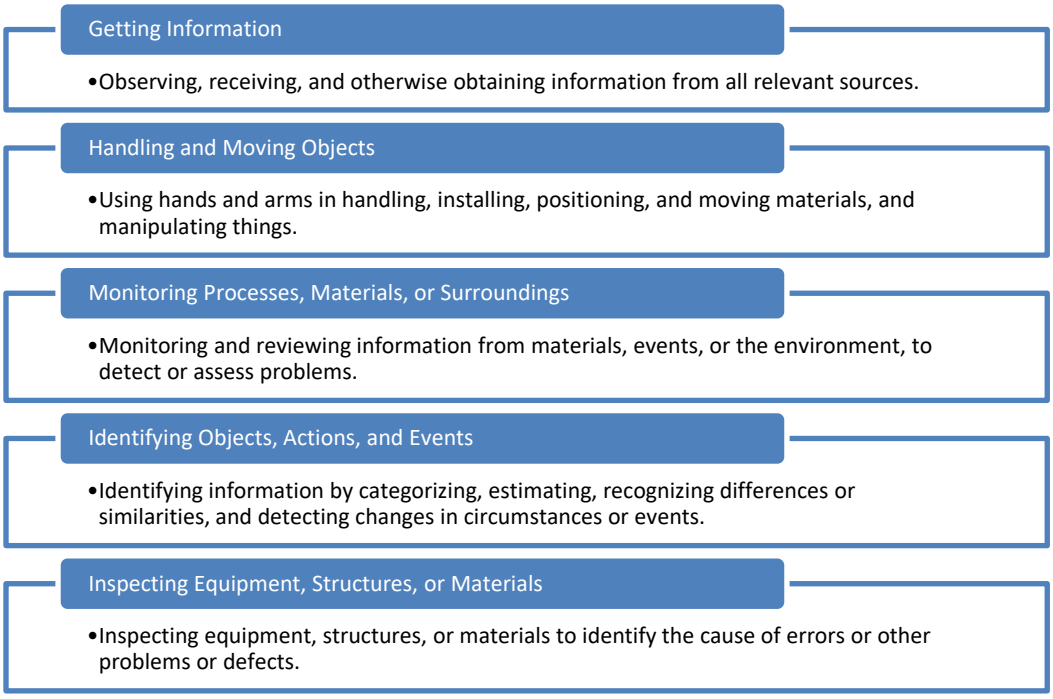


Figure A-7. Top Work Activities



A.2.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to assemblers and fabricators and could therefore more easily transition into this assembler and fabricator position in the offshore wind energy industry with minimal additional preparation. These jobs are found within the production occupational group. [20]

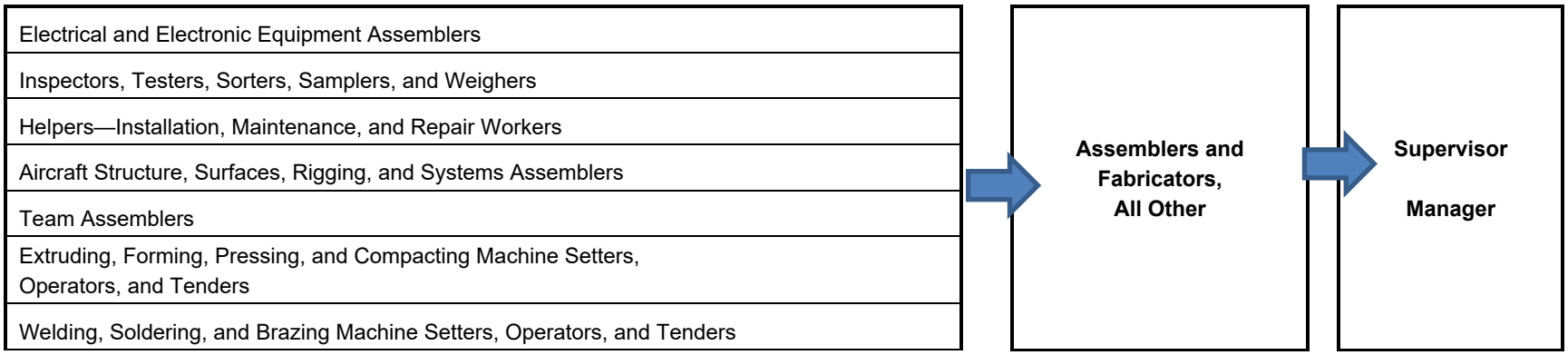
The below table and figure feature workers who may find assembler and fabricator careers to be good transition jobs into the offshore wind energy industry. Some workers are in other types of production and assembler positions and therefore already understand assembling and manufacturing processes. Electrical assemblers would be able to easily transition into assembling the electrical systems of wind turbines. All workers use precision and dexterity in their current work and can use those skills to benefit the wind energy industry. In addition, laborers with mechanical and technical knowledge from setting up and operating various types of machinery can use this knowledge to learn about wind turbines and their assembly process.

Team assemblers in New York State would see a wage increase in this transition. The median hourly wage for these unconventional assemblers and fabricators is, however, lower than the median hourly wages of the other transferable occupations in the State. The typical entry-level education requirement for all transferable occupations listed is a high school diploma or equivalent. Receiving the appropriate on-the-job training and technical instruction specific to the offshore wind industry are the primary transition requirements for these workers.[21]

Table A-4. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry- Level Education
Assemblers and Fabricators, All Other	**8,646**	**$18.03**	**High school diploma or equivalent**
Electrical, Electronics, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	13,088	$18.46	High school diploma or equivalent.
Inspectors, Testers, Sorters, Samplers, and Weighers	22,545	$22.46	High school diploma or equivalent.
Helpers—Installation, Maintenance, and Repair Workers	4,810	$19.15	High school diploma or equivalent.
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	485	$22.60	High school diploma or equivalent.
Team Assemblers	34,617	$17.75	High school diploma or equivalent.
Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	2,759	$20.99	High school diploma or equivalent.
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	872	$22.68	High school diploma or equivalent.

Figure A-5. Career Transferability and Progression



A.3 Business Operations Specialists, All Other

Summary: Business operations specialists are responsible for creating, analyzing, and improving business processes such as systems management, procurement and shipping logistics, inventory and vendor management, and administrative tasks. They improve business processes by tracking key performance indicators and conducting market analysis and research to assess the effectiveness of current business operations and identify opportunities for growth. Business operations specialists working in the offshore wind sector are responsible for analyzing and improving the operations of offshore farms.

The entry-level and experienced median hourly wages for business operations specialists are greater than the statewide averages. The typical entry-level education requirement is a bachelor's degree. Business operations specialists must be detail oriented and have excellent communication and organization skills. Jobs that could easily transition into business operations specialist position are largely found within the business and financial operations occupational group and the computer and mathematical occupation group.

A.3.1 Job Description

Business operations specialists, in general, are responsible for analyzing business processes to identify areas of improvement as well as developing and implementing new processes and procedures to increase efficiency. To do this, they typically track key performance indicators to assess the effectiveness of business operations and conduct market analysis and research to identify opportunities for business growth. Business operations specialists also collaborate with other departments to ensure processes are optimized across the organization and provide training to employees on any new procedures. Business operations specialists are a key component in successfully implementing and executing projects.

Business operations specialists work in many industries and sectors, including government, finance, professional, scientific, and technical services, as well as manufacturing. In the offshore wind sector, business operations specialists are responsible for analyzing the operational processes of offshore wind farms to identify areas of improvement and cost reduction. These workers are often responsible for engaging with vendors to procure the necessary hardware and software for the successful installation of offshore wind technology, researching transportation and shipping requirements, and managing inventory records. Business operations specialists may need foundational knowledge of materials, methods, and tools involved in offshore wind farm construction to work in the offshore wind industry.

A.3.2 Wages

The entry-level, median, and experienced wages for business operation specialists in New York State are all greater than the statewide averages. An entry-level business operations specialist earns nearly $24 an hour while an average entry-level employee in the State earns just over $16 an hour. Experienced managers earn almost $53 an hour while the New York State average wage for experienced workers is over $45 an hour. The median hourly wage for architectural and engineering managers is over $39 an hour.[22]

Table A-5. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Business Operations Specialists, All Other (Annual)	$49,800	$82,000	$109,800
Business Operations Specialists, All Other (Hourly)	$23.94	$39.44	$52.78

A.3.3 Education, Experience, Skill Requirements, and Certifications

Business operations specialists are typically required to have a bachelor's degree. Of the current pool of New York State business and operations specialists, approximately 77 percent have either a four-year college degree or a master's degree or higher. Specifically, 43 percent received a four-year college degree and 34 percent received a master's degree or more. About 16 percent completed some college or a two-year degree. Of the remaining seven percent of business operations specialists, six percent have a high school diploma or equivalent but did not complete any college and one percent have less than a high school diploma. [23]

Business operations specialists must have good communication skills to provide training and support to employees on updated business processes as well as collaborating with other departments to ensure processes are optimized across the organization. They must also have strong organizational skills and attention to detail to analyze and manage several business processes simultaneously.

Based on the 14,512 active job postings in New York State for all other business operations specialists between January 2022 through January 2023,[24] the current in-demand certifications from employers include those listed below[25]:

- Project Management Professional (PMP)
- Electronic Safety and Security Designer (ESS)
- secret clearance
- driver's license
- Certified Public Accountant (CPA)
- Certified Business Continuity Professional (CBCP)
- Series 63
- notary public

Because business and operations specialists are responsible for conducting research to create new business processes and identify new opportunities for business growth, they must have experience using Microsoft Office to create reports and presentations communicating their recommendations to senior management. Business operations specialists should also have experience with customer relationship management to analyze customer data and improve customer retention. The most frequently required technical skills for business operations specialists are listed below:

- Microsoft Office
- presentation skills
- Customer Relationship Management (CRM)

Figure A-6. Educational Attainment of Current Workers

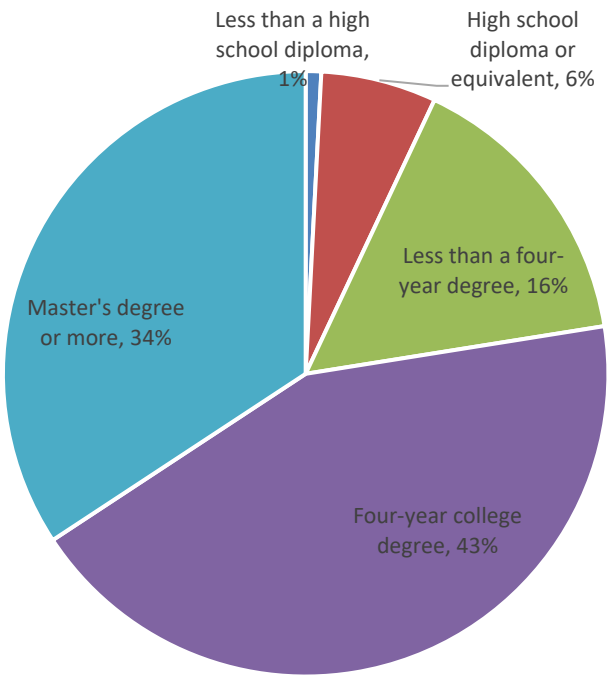
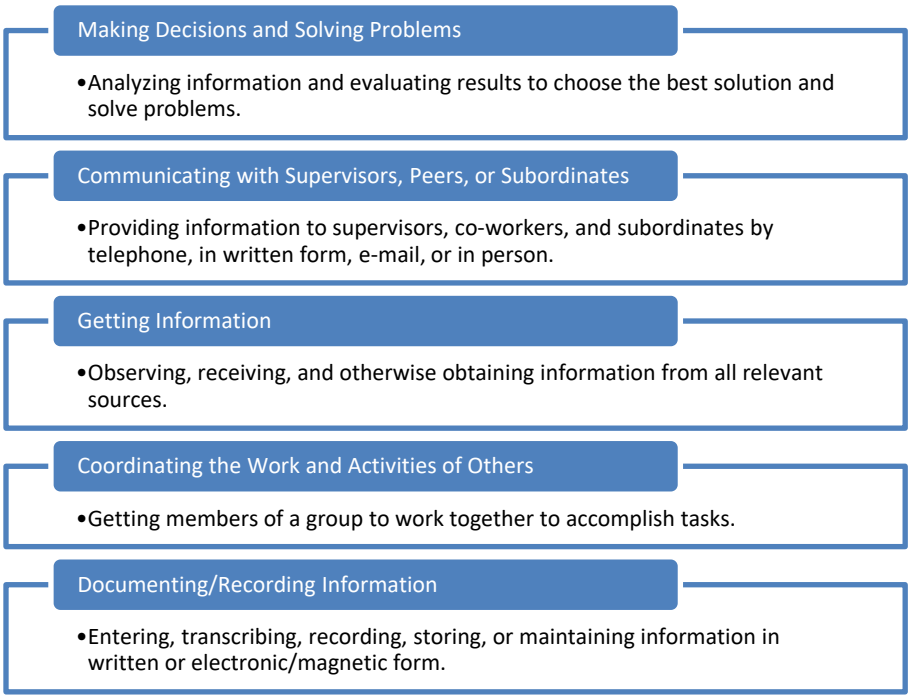


Figure A-7. Top Work Activities



A.3.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to business operations specialists and could therefore more easily transition into one of these positions with minimal additional preparation.[26] Jobs that could easily transition into a business operation specialist position are largely found within the business and financial operations occupational group. Workers in these occupations typically have a bachelor's degree in a business field, satisfying the minimum education requirement for business operations specialists. Workers in business and financial operations occupations also have experience in creating or improving business administration processes but may need training in systems management, procurement and shipping logistics, and inventory and vendor management.[27]

Table A-6. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Business Operations Specialists, All Other	**50,244**	**$39.44**	**Bachelor's degree**
Training and Development Specialists	23,469	$35.38	Bachelor's degree
Human Resources Specialists	50,545	$37.93	Bachelor’s Degree

Figure A-8. Career Transferability and Progression

A.4 Captains, Mates, and Pilots of Water Vessels

Summary: Water vessel captains, mates, and pilots operate ships that transport cargo and people over water. The captain is responsible for steering and operating the vessel and directing crew members. Mates are responsible for overseeing cargo, safety, and assisting the captain in navigation. Pilots go aboard unfamiliar ships to guide them through particular waterways. In the offshore wind industry, captains, mates, and pilots of water vessels are responsible for safely and efficiently transporting personnel and equipment to and from offshore wind farms. These workers may need training to work on the specialized vessels used to transport wind turbine components to project sites, but most of their skills are largely transferrable to the offshore wind industry.

The entry-level and experienced median hourly wages for New York State water vessel captains, mates, and pilots are greater than the statewide averages. The typical entry-level education requirement for a mate is a high school diploma, while pilot and captain positions typically require a bachelor's degree. Experience is a key component in career progression for water transportation workers; captains, mates, and pilots each require several years of experience in previous ranks to qualify for their positions. These workers must have excellent communication skills and be detail oriented and analytical. Jobs that could easily transition into mates are largely found within other water transportation occupations. Additionally, mates could transition into captains or pilots.

A.4.1 Job Description

Captains, mates, and pilots of water vessels operate and maintain nonmilitary vessels responsible for taking personnel and cargo over water. Captains are responsible for steering and operating the vessel, directing crew members, keeping logs of the ship's activities, overseeing any loading and unloading of cargo or passengers, purchasing equipment and supplies and arranging vessel maintenance, and ensuring the safety of the crew, passengers, and cargo aboard the ship.

Mates are responsible for supervising and coordinating the deck crew, directing the vessel when the captain is off duty, assisting with docking the ship, inspecting cargo hold during loading and ensuring that cargo is stored correctly, monitoring the vessel's position using navigational aids, and determining the speed and direction of the ship. There are typically three mates on large ships—the first mate oversees cargo and passengers, the second oversees navigation, and the third oversees safety.

Pilots are not part of a vessel's crew but go aboard unfamiliar ships to guide them through a particular harbor, river, or confined waterway. Captains typically give control of the vessel to a pilot to guide the ship into a harbor when coming into a commercial port. Pilots consult with captains about the vessel's destination and its specific requirements and receive mooring instructions from dispatchers on the shore.

Captains, mates, and pilots of water vessels are found in various industries and sectors, including commercial shipping, passenger transportation, and offshore oil and gas. In the offshore wind industry, captains, mates, and pilots play a critical role in the safe and efficient transportation of personnel and equipment to and from offshore wind farms. These workers may need training to work on the specialized vessels used to transport wind turbine components to project sites, but most of their skills are largely transferrable to the offshore wind industry.[28]

A.4.2 Wages

The entry-level, median, and experienced wages for captains, mates, and pilots of water vessels in New York State are all greater than the statewide averages. An entry-level captain, mate, or pilot of water vessels earns roughly $32 an hour while an average entry-level employee in the State earns just over $16 an hour. Experienced captains, mates, and pilots of water vessels earn nearly $62 while the New York State average wage for experienced workers is roughly $46 an hour. The median hourly wage for captains, mates, and pilots of water vessels is over $51 an hour.[29]

Table A-7. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Captains, Mates, and Pilots of Water Vessels (Annual)	$65,900	$107,100	$128,700
Captains, Mates, and Pilots of Water Vessels (Hourly)	$31.69	$51.50	$61.90

A.4.3 Education, Experience, Skill Requirements, and Certifications

Educational requirements for captains, mates, and pilots of water vessels vary. Mates are typically required to have a high school diploma, though employers may prefer to hire candidates who have received a bachelor's degree from a merchant marine academy. Pilots are typically required to have a bachelor's degree in a marine or maritime related field, such as marine transportation, marine engineering, or nautical science. Ship captains are also required to have a bachelor's degree in a relevant field, such as maritime studies or marine engineering. Some captains also hold graduate degrees.

All crew members working on ships with U.S. flags are required to have a Transportation Worker Identification Credential (TWIC) from the Transportation Security Administration. Additionally, crew members working on ships traveling on the open ocean are required to obtain the Standards of Training, Certification, and Watchkeeping (STWC) endorsement from the U.S. Coast Guard. All captains, mates, and pilots of water vessels are required to obtain a Merchant Mariner Credential (MMC) from the U.S. Coast Guard.

Because water transportation workers typically progress from lower positions to higher ones, experience is a critical component in becoming a captain, mate, or pilot. Able seamen can advance to become third mates after gaining 3 years of experience in the deck department. They must also take several training courses and pass several exams to obtain a third mate endorsement on their MMC. Alternatively, crew members who graduate from a maritime academy receive an MMC with a third mate endorsement and can begin working as a third mate. To progress from third mate to second mate, first mate, and captain, crew members must spend a minimum of 365 days of experience at the previous level. Pilots typically have 2 years of experience working as an officer and hold a minimum of second mates.

Captains, mates, and pilots must be good communicators, detail oriented, and analytical. Strong communication skills are necessary to direct the crew and communicate with other vessels and shore dispatchers. Captains, mates, and pilots must be detail-oriented to keep detailed logs of the ship's activities and ensure all cargo is stored according to specifications. Strong analytical skills are necessary in using charts and navigational tools to monitor the ship's position, speed, and direction.

Of the current pool of New York State captains, mates, and pilots of water vessels, 30 percent have a high school diploma as their highest level of educational attainment. A quarter of current captains, mates, and pilots of water vessels obtained a four-year college degree, and another quarter completed some college but did not receive a four-year degree. Of the remaining 20 percent of captains, mates, and pilots of water vessels, 12 percent obtained a master's degree or more and eight percent did not complete high school.[30]

There were 274 active job postings in New York State for captains, mates, and pilots of water vessels between February 2022 through February 2023.[31] The current in-demand certifications from employers, based on these postings, are listed below[32]:

- Transportation Worker Identification Credential (TWIC)
- driver's license
- Certification in Cardiopulmonary Resuscitation (CPR)
- first aid certification
- Standards of Training, Certification, and Watchkeeping (STWC) Endorsement
- Licensed Professional Engineer
- lifeguard certification
- Merchant Mariner Credential (MMC)

Because steering the vessel and monitoring its position is a critical component of the role of captain, mate, or pilot, it's crucial that these workers are skilled in using charts and other navigational tools. Mechanical skills are also important to these positions, as mates and captains may be responsible for performing routine maintenance on the ship, including repairing equipment. The most frequently required technical skills for captains, mates, and pilots of water vessels are included below:

- Microsoft Excel
- navigation
- mechanical skills
- HVAC Systems
- ability to lift 51-100 pounds

Figure A-9. Educational Attainment of Current Workers

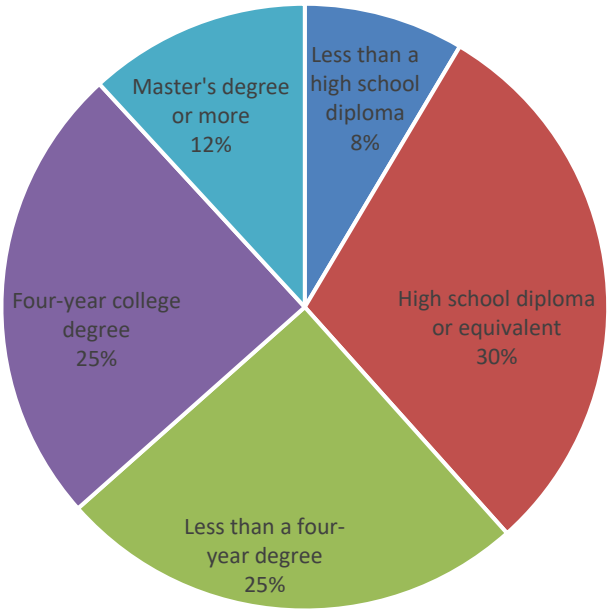


Figure A-10. Top Work Activities

Operating Vehicles, Mechanized Devices, or Equipment

- Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or watercraft.

Inspecting Equipment, Structures, or Materials

- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

Identifying Objects, Actions, and Events

- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

Making Decisions and Solving Problems

- Analyzing information and evaluating results to choose the best solution and solve problems.

Controlling Machines and Processes

- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).

A.4.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to captains, mates, and pilots of water vessels and could therefore more easily transition into one of these positions with minimal additional preparation. Jobs that could easily transition into a water vessel captain, mate, or pilot position are largely found within the farming, fishing, and forestry occupational group and the transportation and material moving occupational group.[33]

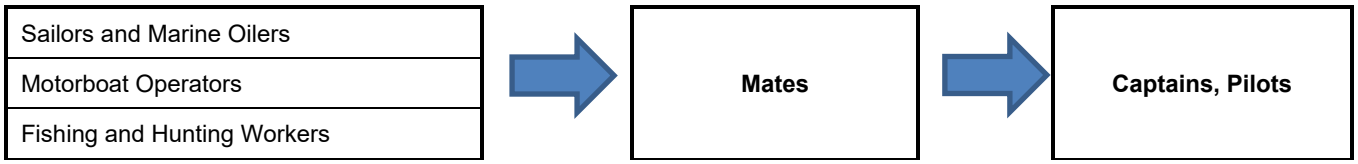
Transferrable occupations are listed in the below table and figure. A career as mate is a good way for others with experience in water transportation to enter the offshore wind energy industry. Those with water transportation experience would already be familiar with steering a vessel and operating navigational instruments. However, these workers would need to undergo training to receive all necessary certifications, including the Merchant Mariner Credential with a third mate endorsement, Transportation Worker Identification Credential, and the Standards of Training, Certification, and Watchkeeping endorsement. After becoming a third mate, workers can progress to second mate, first mate, and finally captain. To become a pilot, workers would need to reach second mate and have 2 years of experience as an officer.

Sailors and marine oilers, motorboat operators, and fishing and hunting workers all meet the entry-level education requirements for a mate. To progress from a mate to a pilot or captain, however, workers would have to earn a bachelor's degree.[34]

Table A-8. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Captains, Mates, and Pilots of Water Vessels	**1,697**	**$51.50**	**Postsecondary non-degree award**
Sailors and Marine Oilers	1,454	$31.01	Postsecondary non-degree award
Motorboat Operators	158	$23.61	Postsecondary non-degree award
Fishing and Hunting Workers	414	n/a	Postsecondary non-degree award

Figure A-11. Career Transferability and Progression



A.5 Carpenters

Summary: Carpenters work on structures and frameworks, often for homes and buildings, but may be found working on other types of infrastructure as well. Reading blueprints and measuring, cutting, and securing materials to build the structures and frameworks are typical duties of carpenters. Some direct other construction workers at project sites. Carpenters involved in the offshore wind energy industry work on wind turbine construction and project site structures. They play an important role in making sure the turbine components and offshore wind farm frameworks are assembled properly according to their specifications.

Jobs largely found within the construction and extraction; installation, maintenance, and repair; and production occupational groups could easily transition into carpentry positions. Entry-level carpenters earn more than the statewide average wages for entry-level workers. They typically need to meet an entry-level education requirement of a high school diploma or equivalent. These individuals gain industry- or technology-specific knowledge through hands-on experience and may be able to transition into lead carpenter, independent contractor, and construction supervisor positions.

A.5.1 Job Description

Carpenters are a vital component of construction projects because they are involved throughout the entire process. Generally, they construct, repair, and install structures and frameworks, typically for buildings and other infrastructures, ranging from kitchen cabinet installation to bridge construction. Carpenters may work indoors, outdoors, or both since they support buildings and infrastructure.

More specifically, carpenters read blueprints and instructions to construct frameworks and structures; install, inspect, and repair structures, frameworks, and fixtures such as kitchen cabinets; measure, cut, and shape various materials including wood and plastic; and fasten materials together with nails, screws, staples, or adhesives. Carpenters must also be skilled at operating various hand and power tools to measure, cut, and shape materials. In addition, some carpenters may give instruction to other laborers at the project site.

Carpenters employed in the offshore wind energy industry are vital to the wind farm construction. They use extreme precision and accuracy to construct the wind turbines and the offshore wind farm frameworks such as the tower foundations and platform decking. Carpenters must read and fully understand the highly technical blueprints and drawings to assemble the wind turbines that are comprised of large, heavy, and expensive components. They may also conduct routine maintenance and repair tasks on the turbines and project frameworks.[35]

A.5.2 Wages

Overall, the wages for carpenters in New York State are greater than the statewide averages. Entry-level carpenters earn almost $20 an hour, compared to the State average of roughly $16 per hour for all entry-level workers. Experienced carpenters can earn significantly more at over $41 per hour. The median hourly wage for carpenters in the State is just over $29 an hour.[36]

Table A-9. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Carpenter (Annual)	$41,500	$60,700	$86,100
Carpenter (Hourly)	$19.96	$29.20	$41.41

A.5.3 Education, Experience, Skill Requirements, and Certifications

Carpenters are typically trained via apprenticeships for hands-on experience. These apprenticeships can run from three to four years, so that trainees earn both technical experience and paid, on-the-job training. Some apprenticeships include the OSHA 10-hour and 30-hour safety and first aid certifications.

While there is no standard entry-level education requirement, a high school diploma or equivalent is generally expected. This is because it is useful for carpenters to be familiar with certain high school courses such as mathematics and mechanical drawing. Apprenticeships teach carpenters basics such as blueprint reading, applied mathematics, and safety practices in addition to specialized skills including rigging, welding, scaffold building, and working with concrete forms.

Of the current pool of carpenters in New York State, 42 percent have a high school diploma or equivalent, and 25 percent have less than a high school diploma. Roughly one in 10 carpenters have a four-year degree or higher, while 21 percent have some college or a two-year degree.

Based on 1,531 active job postings in New York State for carpenters between August 2021 through August 2022,[37] the current in-demand certifications from employers include the following:

- driver's license
- OSHA 10
- OSHA 30

Because carpenters measure and cut materials that are components of larger frameworks or structures, they are expected to be physically fit, detail oriented, and problem solvers in the event they need to make necessary modifications or adjustments onsite. They must be able to read blueprints and use hand and power tools to carry out their tasks. Frequently required technical skills for carpenters include the following:

- ability to lift 41-100 pounds
- power tools
- hand tools
- reading blueprints
- measure, cut, and shape materials

Figure A-12. Educational Attainment of Current Workers[38]

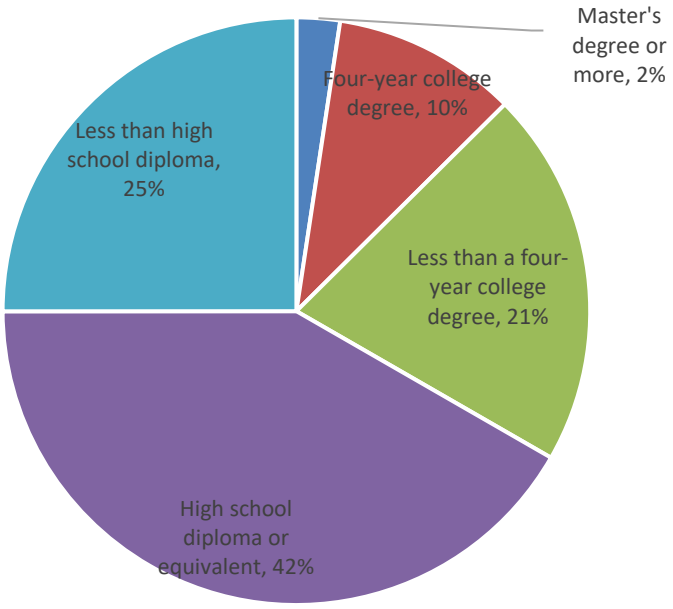
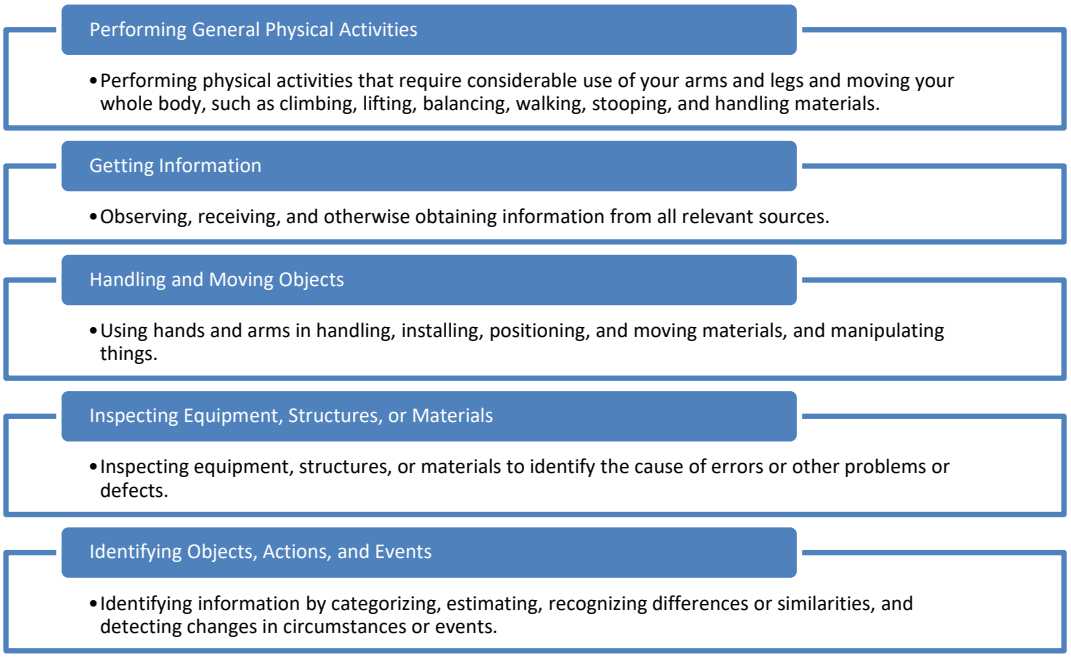


Figure A-13. Top Work Activities



A.5.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to carpenters and could therefore more easily transition into a carpenter job with minimal additional preparation. Jobs that could easily transition into a carpenter position come from the following occupational groups: construction and extraction; installation, maintenance, and repair; and production.[39]

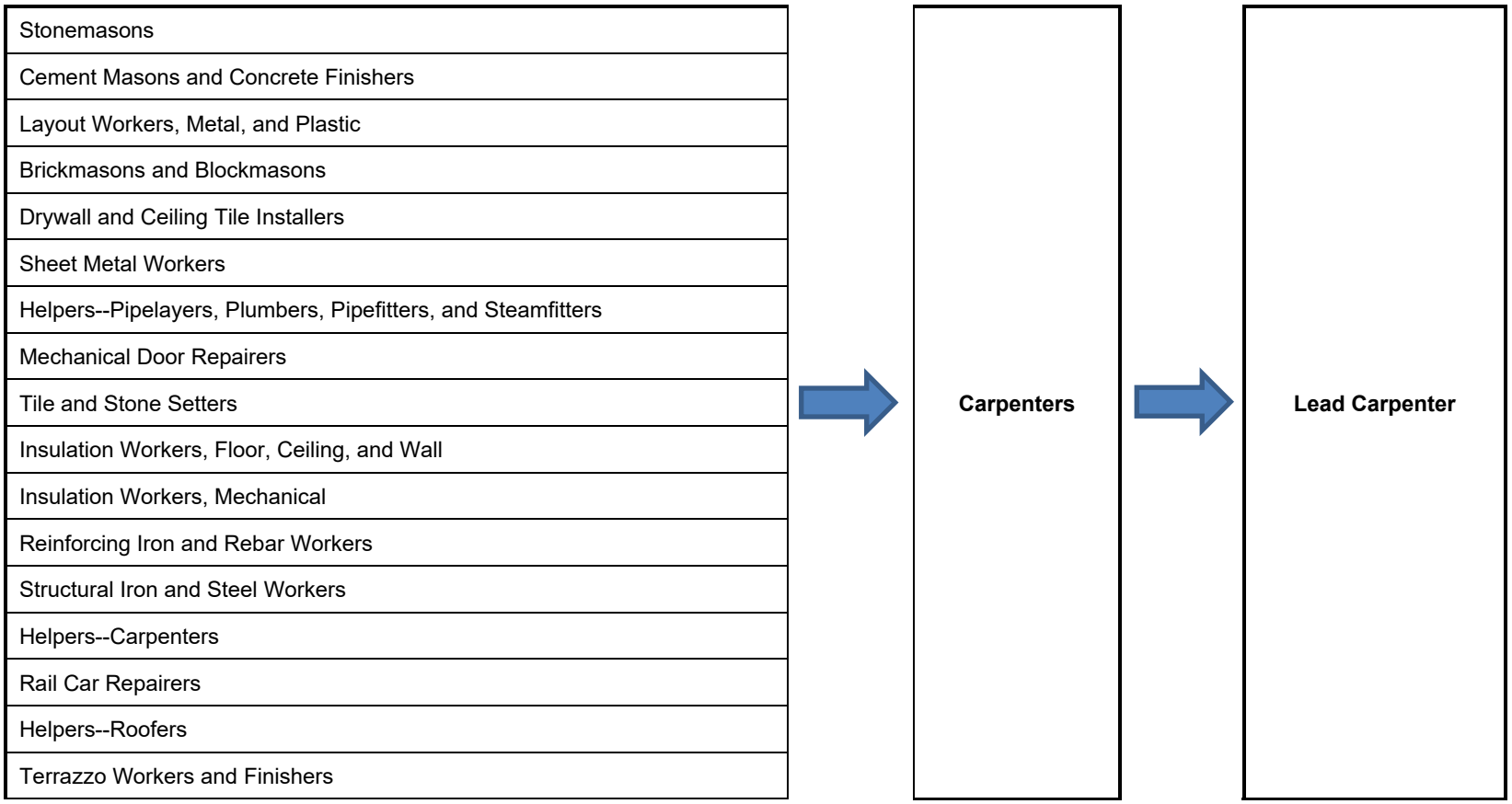
Carpenters may be considered a reliable entry-point to employment in the offshore wind energy industry for workers featured in the below tables. Notably, drywall and ceiling tile installers, structural iron and steel workers, and construction-related helpers could most easily transition into carpenter positions. Drywall and ceiling tile installers must be detail oriented and know how to follow instructions and work with tools like carpenters. Structural iron and steel workers are already familiar with installing frameworks while helpers in roofing, plumbing, pipefitting, pipelaying, and steamfitter have transferable skills including measuring, calculating, and precision. Further, drywall and ceiling tile installers, some insulation workers, and the various helpers would also see a wage increase from this career transition.

Typical educational requirements for these positions match demands for carpenters, with a high school diploma or equivalent commonly required for most, but not all, occupations. Roughly half of the 17 transferable occupations would, however, see a wage decrease. In addition, while these workers have a background in buildings and construction trades, they would need hands-on training to become carpenters which may take several years to complete.[40]

Table A-10. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry-Level Education
Carpenters	53,802	$28.85	HS diploma or equivalent.
Stonemasons	654	$28.36	HS diploma or equivalent.
Cement Masons and Concrete Finishers	6,197	$31.35	None
Layout Workers, Metal and Plastic	113	$26.75	HS diploma or equivalent.
Brickmasons and Blockmasons	5,034	$36.24	HS diploma or equivalent.
Drywall and Ceiling Tile Installers	6,537	$22.70	None
Sheet Metal Workers	6,521	$29.71	HS diploma or equivalent.
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	2,739	$17.98	HS diploma or equivalent.
Mechanical Door Repairers	1,306	$22.68	HS diploma or equivalent.
Tile and Stone Setters	5,047	$29.44	None
Insulation Workers, Floor, Ceiling, and Wall	1,234	$21.50	None
Insulation Workers, Mechanical	1,484	$59.12	HS diploma or equivalent.
Reinforcing Iron and Rebar Workers	1,186	$33.10	HS diploma or equivalent.
Structural Iron and Steel Workers	3,772	$44.39	HS diploma or equivalent.
Helpers--Carpenters	1,583	$22.22	None
Rail Car Repairers	1,106	$38.44	HS diploma or equivalent.
Helpers--Roofers	217	$17.64	None
Terrazzo Workers and Finishers	239	$46.70	HS diploma or equivalent.

Figure A-14. Career Transferability and Progression



A.6 Civil Engineers

Summary: Civil engineers plan, design, build, supervise, and maintain infrastructure projects in both the private and public sector, including roads, bridges, buildings, dams, and tunnels. They use computer-aided design (CAD) software to plan and design structures, conduct project feasibility studies, and ensure the project meets safety and regulatory requirements. In the wind energy industry, civil engineers are responsible for designing and supervising the construction of the tower, foundation, and other structures which must be strong enough to support the weight of the turbines and withstand the forces of waves, currents, and wind. Civil engineers involved in the offshore wind energy industry must have a working knowledge of the industry and its specific regulatory requirements.

The entry-level and experienced median hourly wages for New York State civil engineers are greater than the statewide averages. The typical entry-level education requirement is a bachelor's degree. The most frequently required technical skills for civil engineering positions are experience with design and modeling software such as AutoCAD, HydroCAD, Revit, and STAAD. They must also have excellent problem-solving, communication, and organizational skills. Jobs that could easily transition into an architectural and engineering manager position are largely found within the architecture and engineering and management occupational groups.

A.6.1 Job Description

Civil engineers plan, design, build, construct, supervise, and maintain both public and private sector infrastructure projects—including roads, bridges, buildings, dams, tunnels, water supply, and sewage treatment systems. They use computer-aided design (CAD) software to plan and design structures and systems that meet the needs of their clients and users. Before a project begins, civil engineers conduct feasibility studies to determine whether the project is practical and financially feasible. They consider factors such as site location, environmental impact, and cost estimates for labor, materials, and equipment. They also ensure the project meets safety and regulatory requirements and submit permit applications to local, State, and federal agencies. Civil engineers typically specialize on one of several areas in their field, choosing to focus more specifically on construction, geotechnical, structural, or transportation engineering.

Civil engineers are found in various industries and sectors, including construction, transportation, and water and wastewater management. In the wind energy industry, civil engineers are responsible for devising and supervising construction of wind turbine structures such as the tower and foundation, which must be strong enough to support the weight of the turbines and withstand the forces of waves, currents, and wind.[41]

A.6.2 Wages

The entry-level, median, and experienced wages for civil engineers in the State are all greater than the statewide averages. An entry-level civil engineer earns over $32 an hour while an average entry-level employee earns just over $16 an hour. Experienced civil engineers earn over $61 an hour while the New York State average wage for experienced workers is over $46 an hour. The median hourly wage for architectural and engineering managers is nearly $48 an hour.[42]

Table A-11. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Civil Engineers (Annual)	$67,800	$99,700	$128,100
Civil Engineers (Hourly)	$32.60	$47.93	$61.57

A.6.3 Education, Experience, Skill Requirements, and Certifications

Civil engineers are typically required to have a bachelor's degree in either civil engineering or civil engineering technologies. Some civil engineers have bachelor's degrees in related fields, such as construction. For promotion to senior positions, civil engineers typically need a graduate degree and a professional engineer license.[43]

Civil engineers must have good problem-solving skills to identify and evaluate complex problems that arise and develop safe, cost-efficient solutions. They must also have good speaking and writing skills to communicate their project plans to other engineers and project managers, as well as non-technical team members, stakeholders, elected officials, and citizens. Because they often manage several projects at one time and are responsible for monitoring the project's progress to sign design documents, civil engineers must have good organizational skills.

Of the current pool of New York State civil engineers, approximately 93 percent have either a four-year college degree or a master's degree or higher. Specifically, 55 percent have a bachelor's degree and 38 percent have a graduate level degree. Of the remaining seven percent, five percent have some college, or a two-year degree, and two percent have a high school diploma or GED but did not attend college.

There were 1,378 active job postings in New York State for civil engineers between February 2022 through February 2023.[44] The current in-demand certifications from employers, based on these postings, are listed below[45]:

- Engineer in Training (EIT)
- Professional Traffic Operations Engineer (PTOE)
- Licensed Professional Engineer
- driver's license
- OSHA 30
- 40 Hour HAZWOPER
- LEED Accredited Professional (not specified)
- NICET Level 1

Because planning and designing infrastructure are significant duties of civil engineers, it is important for them to have experience with various design and modeling software such as Autodesk AutoCAD, Autodesk Revit, Bentley STAAD, and HydroCAD. In addition, civil engineers must have good communication and presentation skills to explain project plans to other workers—such as architects, construction managers, and urban planners—as well as clients or elected officials. Familiarity with the processes in their field or industry are also necessary to perform the job well and prevent mistakes or misunderstandings. The most frequently required technical skills for civil engineers are included below:

- Autodesk AutoCAD
- Microsoft Excel
- Autodesk Revit
- Computer Aided Design Software (CAD Software)
- Bentley STAAD
- HydroCAD
- technical writing

Figure A-15. Educational Attainment of Current Workers

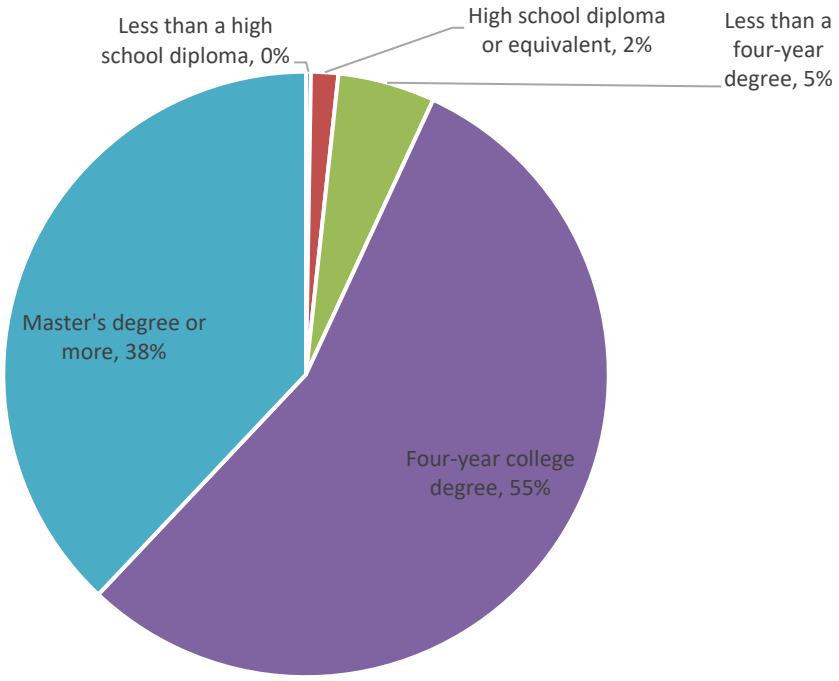


Figure A-16. Top Work Activities

Making Decisions and Solving Problems

- Analyzing information and evaluating results to choose the best solution and solve problems.

Communicating with Supervisors, Peers, or Subordinates

- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment

- Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices, parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used.

Evaluating Information to Determine Compliance with Standards

- Using relevent information and individual judgement to determine whether events or processes comply with laws, regulations, or standards.

A.6.4 Career Transition Potential

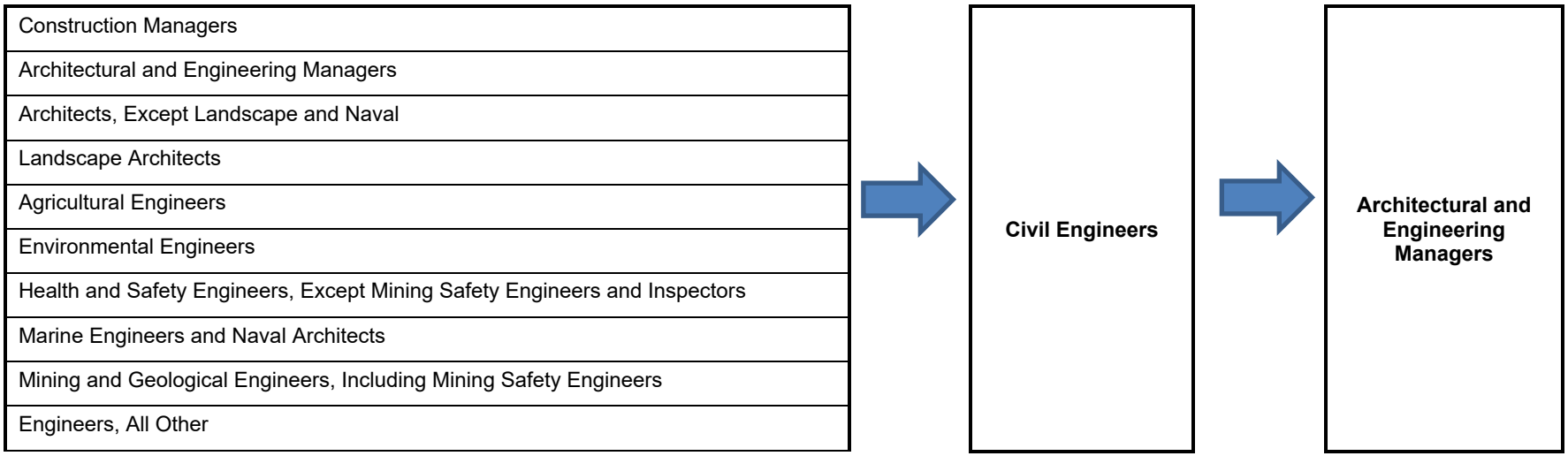
This section highlights the occupations that have similar skills and experience levels to civil engineers and could therefore more easily transition into one of the following positions with minimal additional preparation. Jobs that could easily transition into a civil engineering position are largely found within the architecture and engineering occupational group and the management occupational group.[46]

Transferable occupations are listed in the below table and figure. A career in civil engineering is a good way for others with engineering, architecture, or construction experience to enter the offshore wind energy industry. Those with engineering experience would already have the mathematical background used in civil engineering projects and have familiarity with design tools like AutoCAD. Workers with architecture, construction, or engineering—though not civil engineering—experience would need to be trained in design and modeling/simulation software and become familiar with government infrastructure regulations. All transferrable occupations would meet the typical entry-level education requirement for civil engineers.[47]

Table A-12. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Civil Engineers	**15,253**	**$47.93**	**Bachelor's degree**
Construction Managers	17,740	$61.17	Bachelor's degree
Architects, Except Landscape and Naval	11,569	$48.40	Bachelor's degree
Landscape Architects	1,341	$44.69	Bachelor's degree
Agricultural Engineers	43	$42.97	Bachelor's degree
Environmental Engineers	2,494	$47.57	Bachelor's degree
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	1,318	$52.42	Bachelor's degree
Marine Engineers and Naval Architects	231	$50.33	Bachelor's degree
Mining and Geological Engineers, Including Mining Safety Engineers	225	$42.84	Bachelor's degree
Engineers, All Other	6,072	$54.46	Bachelor's degree

Figure A-17. Career Transferability and Progression



A.7 Computer Numerically Controlled Tool Programmers

Summary: Computer Numerically Controlled (CNC) tool programmers write computer programs using Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) Software to control how mechanical machines will form, cut, and shape materials for finished products. They read blueprints and program the machines to create the products according to the specifications as well as test and revise the programs if there are any issues. CNC tool programmers employed in the offshore wind energy industry are part of the wind turbine manufacturing process. They write computer programs that control the processing of wind turbine components which requires extreme precision.

Jobs that could easily transition into a CNC tool programmer position are found within the architectural and engineering occupational group. Entry-level CNC tool programmers earn a wage higher than an entry-level worker in the State on average. These individuals typically become professional CNC tool programmers after earning a postsecondary nondegree award or certificate and gaining hands-on experience. CNC tool programmers can become supervisors or CNC engineers once experienced.

A.7.1 Job Description

Computer Numerically Controlled (CNC) tool programmers are involved in manufacturing and production processes. They write and develop as well as troubleshoot and revise, when necessary, the computer programs of automatic and mechanical machine tools, equipment, or systems to control the precise machining or processing of materials. These workers must understand the various languages of machine controllers or computers and how to store and test the programs they develop. CNC tool programmers design the programs based on blueprints or other schematics. The materials that are processed in these machines are formed, cut, and shaped by these mechanical manufacturing machines according to the programs that the CNC tool programmers write.

CNC tool programmers typically work with engineers, technicians and technologists, and CNC tool machine operators to develop and test the programs as well as run the machines for production. Wind industry CNC tool programmers write the programs to control how machines precisely cut and shape wind turbine components. This process is important to turbine production since parts of wind turbine components, such as generator and drive train parts, require extremely fine cutting.[48]

A.7.2 Wages

The entry-level and median wages for CNC tool programmers in New York State are greater than the statewide averages. Entry-level CNC tool programmers earn roughly $5 an hour more than the average entry-level worker in the State. Experienced CNC tool programmers earn, on average, almost $36 an hour. This is, however, approximately $10 an hour less than the average experienced-level wage in the State. The median hourly wage for CNC tool programmers is $30 an hour.[49]

Table A-13. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Computer Numerically Controlled Tool Programmers (Annual)	$44,400	$62,500	$74,600
Computer Numerically Controlled Tool Programmers (Hourly)	$21.34	$30.04	$35.88

A.7.3 Education, Experience, Skill Requirements, and Certifications

The typical entry-level education requirement for CNC tool programmers is a postsecondary non-degree award or certificate. Some CNC tool programmers complete associate degree programs, though it is not typically a requirement. Similarly, apprenticeships may be available and useful for these workers to gain experience working with CNC machines and software such as Mastercam. In addition to educational instruction, these workers usually complete on-the-job, technical training. A combination of education instruction, and hands-on experience, learned either on-the-job or in training programs, is necessary for CNC tool programmers.[50]

A strong background in mathematics and mechanics is helpful for these workers to succeed and learn the software programming and design. CNC tool programmers need strong analytical and problem-solving skills as well as a strong attention to detail to perform the job well. Workers also use creativity and logic to write and debug CNC programs.

Of the current pool of CNC tool programmers in New York State, seven percent have less than a high school diploma. Approximately four in 10 have a high school diploma or equivalent while another four in 10 have a two-year degree or some college. Some workers achieve additional education credentials as 11 percent of current CNC tool programmers have a four-year college degree, and the remaining two percent have a master's degree or higher.

There were 203 active job postings in New York State for Computer Numerically Controlled tool programmers between February 2022 and February 2023.[51] A current in-demand certification from employers includes:

- CNC Certification

CNC tool programmers must understand the CNC software that they work with to develop the programs to control the machines. Experience with Mastercam and other Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) Software is a hard skill often preferred by employers. Similarly, CNC tool programmers should have familiarity with the machining tools they frequently work with, such as a lathe. Additionally, to ensure that the end products have accurate dimensions, CNC tool programmers must be skilled at blueprint reading so they can design the programs according to the specifications. The most frequently required technical skills for CNC tool programmers are included below:

- Computerized Numerical Control Software (CNC Software)
- Mastercam
- lathes
- Computer Aided Design Software (CAD Software)
- blueprint reading
- CAD/CAM
- Autodesk AutoCD
- Dassault Systems SolidWorks Software
- manufacturing
- Microsoft Excel

Figure A-18. Educational Attainment of Current Workers

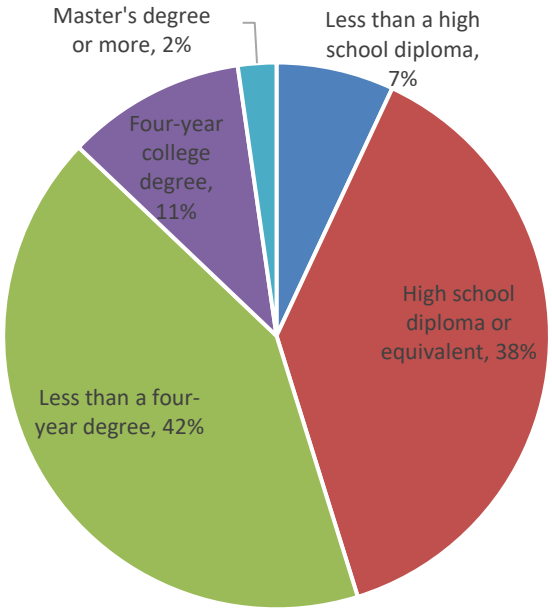


Figure A-19. Top Work Activities

Working with Computers

- Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Making Decisions and Solving Problems

- Analyzing information and evaluating results to choose the best solution and solve problems.

Controlling Machines and Processes

- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).

Communicating with Supervisors, Peers, or Subordinates

- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

A.7.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to CNC tool programmers and could therefore more easily transition into a CNC tool programmer job with minimal additional preparation. These occupations come from the architecture and engineering fields. Transitioning into a CNC tool programmer position in the wind energy industry would provide these workers with a detailed understanding of various wind turbine components and the manufacturing processes of the turbines.[52]

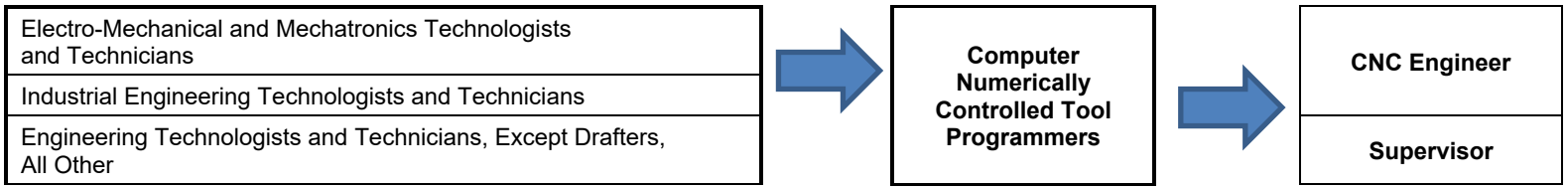
Engineering technologists and technicians typically help solve engineering problems, study engineering drawings and blueprints, prepare machinery and equipment plans. Electro-mechanical and mechatronics technologists and technicians understand mechanical technology and electrical circuits in order to operate electromechanical equipment. These workers have skills in problem solving, blueprint reading, and mechanical and electrical systems and can utilize these skills as CNC tool programmers. In addition, some technologists and technicians have already experience working with CNC tool programmers and the CNC machines.

Industrial engineering technologists and technicians and other engineering technologists and technicians would see an increase in the median hourly wage if they made this career transition. The median hourly wage for electro-mechanical and mechatronics technologists and technicians is $3 an hour more than the median hourly wage for CNC tool programmers. In addition, all workers in the transferrable occupations need an associate degree for their current work, though they would likely need to achieve CNC tool programming certificates and gain hands-on experience or on-the-job training to make this transition.[53]

Table A-14. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Computer Numerically Controlled Tool Programmers	**1,033**	**$30.04**	**Postsecondary non-degree award**
Electro-Mechanical and Mechatronics Technologists and Technicians	409	$33.25	Associate degree
Industrial Engineering Technologists and Technicians	2,907	$29.73	Associate degree
Engineering Technologists and Technicians, Except Drafters, All Other	2,420	$29.51	Associate degree

Figure A-20. Career Transferability and Progression



A.8 Construction Laborers

Summary: Construction laborers perform the physical labor duties at project sites and use various hand and power tools in their work. There are low barriers to entry, with few educational, experiential, and credentialing requirements. These workers should be prepared to learn new tasks and skills during on-the-job training or other work activities. Construction laborers are also expected to follow instructions from their supervisors and other skilled tradesmen on site. Their physical labor duties in the offshore wind energy industry support the maintenance of a clean, safe, and efficient project site. In this industry, construction laborers are involved in the construction activities at an offshore wind farm by performing many physical labor requirements.

Jobs that could easily transition into a construction laborer position are largely found within building and grounds cleaning and maintenance, transportation and material moving, construction and extraction, and farming, fishing, and forestry occupational groups. Entry-level construction laborers earn more than the statewide average and may be considered a great entry-point to employment in the offshore wind energy industry. These individuals learn the necessary skills and industry- or technology-specific knowledge through hands-on experience. From there, construction laborers could transition into a site supervisor or foreman role. As a laborer, these individuals become acquainted with the industry and learn skills and tasks that prepare them for work in other wind energy roles or renewable energy-related fields.

A.8.1 Job Description

Construction laborers are essential to daily operations at any project site. They are involved in preparing a site area by setting up and cleaning the area, loading, and unloading tools or raw materials that are often heavy, and assembling equipment and temporary structures. Laborers must be skilled at operating various hand and power tools in order to complete tasks.

Other common job titles for a construction laborer include water restoration technician, concrete laborer, and commercial construction laborer. Construction laborers are important to supporting work in the offshore wind energy industry since they perform many physical labor duties to set up and construct offshore wind farms and support the maintenance of a clean, safe, and efficient project site.[54]

A.8.2 Wages

The entry-level and median wages for construction laborers in New York State are greater than the statewide averages. Entry-level construction laborers earn roughly $1 an hour more than the average wage for entry-level workers in the State. Experienced construction laborers can almost double their entry-level wages to over $35 per hour. However, their hourly wage is roughly $8 less than the State average for experienced workers. The median hourly wage for construction laborers is close to $27 an hour.[55]

Table A-15. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$31,900	$50,700	$89,900
State Average (Hourly)	$15.32	$24.40	$43.23
Construction Laborer (Annual)	$33,900	$55,400	$73,700
Construction Laborer (Hourly)	$16.31	$26.65	$35.41

A.8.3 Education, Experience, Skill Requirements, and Certifications

Experience is valuable though not necessarily required for this job position. Many firms do have experiential requirements, but a near equal amount also reported that they have neither preferences nor requirements for amount of experience. In general, construction laborers engage in short-term, on-the-job training and must be ready to learn new skills and tasks on-the-job as needed.[56]

While there is no "typical" entry-level education requirement, employers generally expect construction laborers to have at least a high school diploma, and some employers noted that they require or prefer their staffed construction laborers to have gone through some type of related construction training program, trade school certification program, or OSHA certification program.

Of the current pool of construction laborers in New York State, 40 percent have a high school diploma or equivalent and 30 percent have less than a high school diploma. About one in ten construction laborers have a four-year degree or higher, while 18 percent have less than a four-year degree but more than a high school diploma.

There were 2,149 active job postings in New York State for construction laborers between January 2022 and January 2023.[57] Listed below are some of the current in-demand certifications from employers:

- driver's license
- OSHA 10
- Commercial Driver's License (CDL)
- OSHA 30
- first aid certification

Because construction laborers are responsible for operating and maintaining machinery and loading and unloading heavy materials, they are expected to be physically fit, reliable, and hard working. Construction laborers must know how to operate machinery commonly found at project sites and use hand and power tools required to complete various duties. The most frequently required technical skills for construction laborers are included below:

- ability to lift 41-50 pounds
- ability to lift 51-100 pounds
- forklifts
- power tools
- mechanical skills
- plumbing
- manufacturing
- hand tools

Figure A-21. Educational Attainment of Current Workers

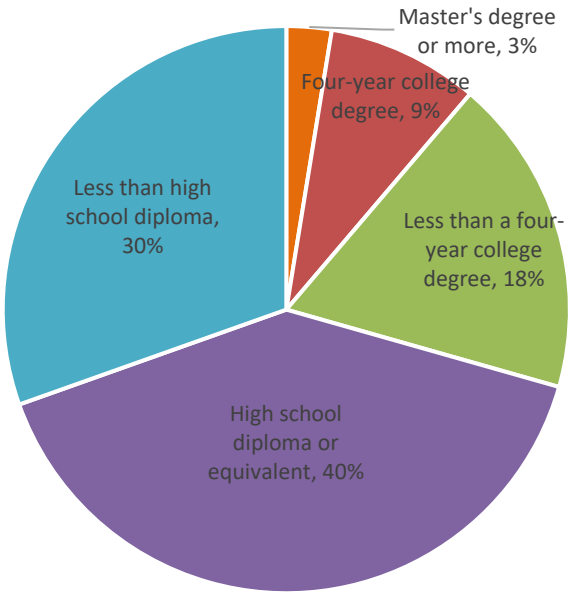
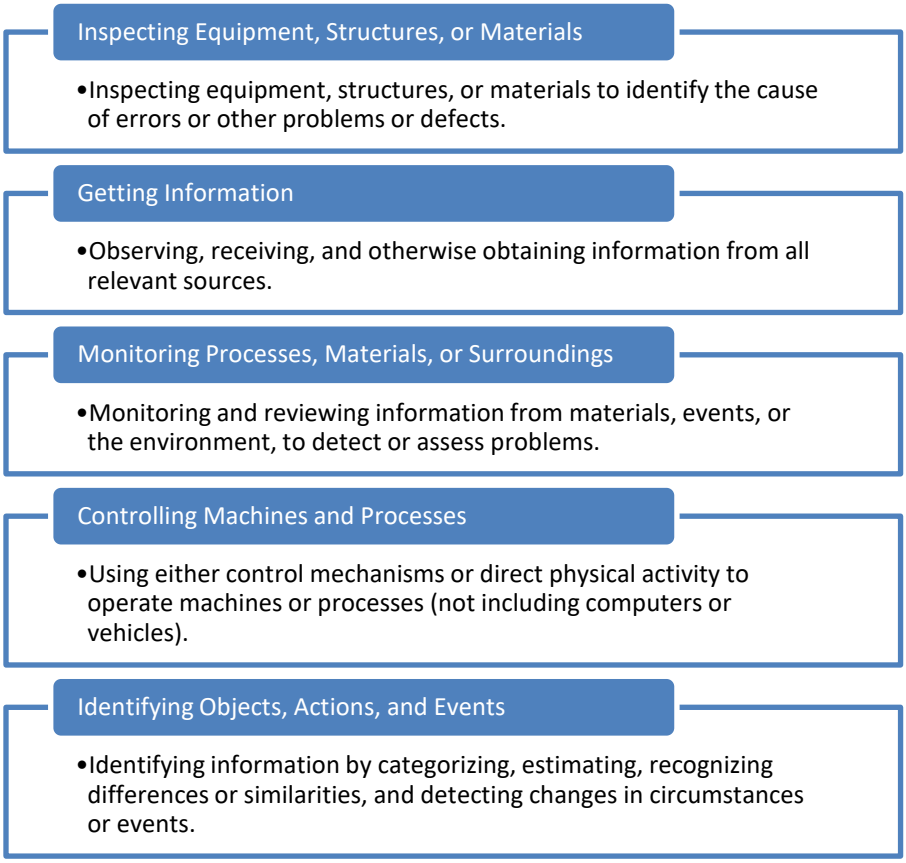


Figure A-22. Top Work Activities



A.8.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to construction laborers and could therefore more easily transition into a construction laborer job with minimal additional preparation. Jobs from the following major occupational groups could easily transition into a construction laborer position: construction and extraction, transportation and material moving, and farming, fishing, and forestry.[58]

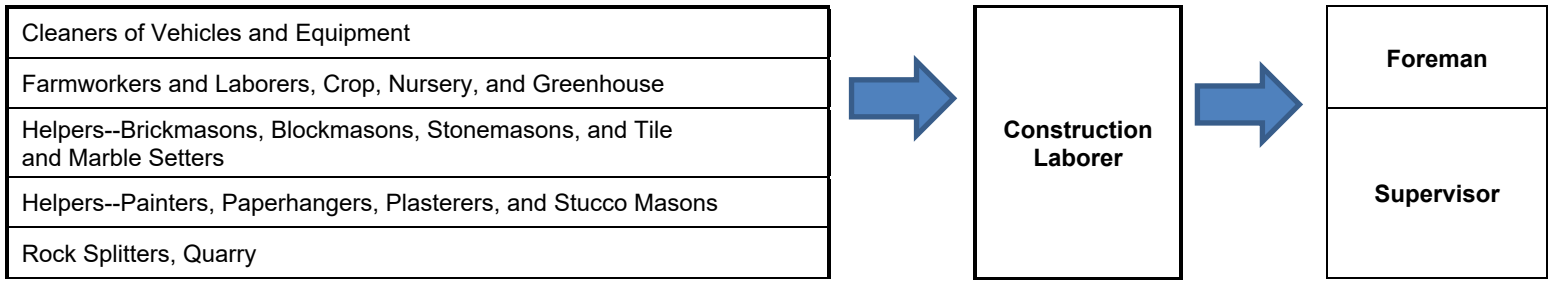
Construction laborers may be considered a great entry-point to employment in the offshore wind energy industry for workers featured in the below tables. These workers have experience with learning new skills and performing physical labor from their current positions. With no "typical" entry-level education requirement, workers in these transferrable careers can begin to gain experience and technical knowledge of the offshore wind energy industry by starting as construction laborers.

With the exception of helpers of brickmason, blockmason, stonemason, and tile and marble setter workers, all transferrable occupations would see an increase in the median hourly wage if they made this career transition. In addition, all workers in the transferrable occupations would not have any entry-level education requirement to meet.[59]

Table A-16. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry-Level Education
Construction Laborers	**65,990**	**$26.65**	**None**
Cleaners of Vehicles and Equipment	20,235	$16.61	None
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	10,683	$14.31	None
Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	1,209	$35.22	None
Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	478	$17.59	None
Rock Splitters, Quarry	81	$22.45	None

Figure A-23. Career Transferability and Progression



A.9 Construction Managers

Summary: Construction managers with excellent communication, problem solving, and leadership skills are essential to making sure that construction projects run smoothly and efficiently. They plan, coordinate, and monitor projects as well as develop the budget and timeline of the projects. Construction managers collaborate with hired subcontractors, architects, engineers, clients, and any other parties involved with the project to ensure compliance and productivity.

The entry-level and experienced hourly wages for New York State construction managers are greater than the statewide averages. The typical entry-level education requirement for a construction manager is a bachelor's degree. Construction managers' degrees are generally in construction, business, engineering, or another related field. On top of their education, construction managers have experience in the construction industry and in leadership roles. Some states also require construction managers to have a license. Construction managers can attain director of construction positions during their careers. Jobs that could easily transition into a construction manager position are largely found within the architecture and engineering occupational group.

A.9.1 Job Description

Construction managers oversee construction projects from start to finish. They plan and coordinate the various components of the project, they handle the budget and timeline of the project, and they make the big decisions that may affect the finished product. These managers also hire subcontractors to complete parts of the construction process and address any emergencies or problems that arise. They may have both a main office and a field office that is located at a project site.

Construction managers are also referred to as general managers or project managers. They work closely with architects, engineers, other specialists in the construction industry, and sometimes lawyers or government officials to ensure proper planning. In addition, they consult with the client to ensure the project is meeting expectations. In this leadership role, construction managers typically hold a bachelor's degree and have had some management training in previous roles. They are important to maintaining an efficient, safe, and productive project site.[60]

A.9.2 Wages

The entry-level and median wages for construction managers in New York State are greater than the statewide averages. An entry-level construction manager earns almost $44 an hour while an average entry-level employee in the State earns just under $14 an hour. Experienced construction managers also earn more than the New York State average for experienced employees. They can almost double their entry-level wage and earn around $78 an hour. The median hourly wage for construction managers is a little over $60 an hour.

Table A-17. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$ 29,100	$ 50, 800	$ 132,000
State Average (Hourly)	$ 13.97	$ 24.46	$ 63.49
Construction Manager (Annual)	$ 91,440	$ 125,340	$ 162,780
Construction Manager (Hourly)	$ 43.96	$ 60.26	$ 78.26

A.9.3 Education, Experience, Skill Requirements, and Certifications

Construction managers are typically required to have a bachelor's degree and management training from on-the-job experience. Employers generally prefer that the construction manager's degree and training are related to the construction industry or an adjacent field. A bachelor's degree in construction, business, or engineering are usually accepted since they usually include courses in project management, design, construction methods and materials, and cost estimation. These courses are all extremely useful for a construction manager on the job.[61]

It is sometimes acceptable for construction managers to not have a degree as long as they have appropriate experience in construction and leadership. Typically, these individuals opt for self-employment or contracting roles. Only some states require construction managers to be licensed. There are optional certifications available for these managers to earn to provide them with more credibility.

Of the current pool of New York State construction managers, half of them have either a four-year college degree or a master's degree or more. Only five percent of current construction managers have less than a high school diploma. Roughly two in ten have a high school diploma or equivalent while the remaining 23 percent have more than a high school diploma or equivalent but less than a four-year college degree.

Based on 3,344 active job postings in New York State for construction managers between August 2021 through August 2022,[62] the current in-demand certifications from employers include the following:

- Project Management Professional (PMP)
- Certified Construction Manager (CCM)
- driver's license
- Licensed Professional Engineer
- OSHA 30
- OSHA 10

Because cost estimation, budgeting, project planning, and time management are major parts of a construction manager's role, it is important that the individual is familiar with various Microsoft programs. In addition, a construction manager must be familiar with construction processes and functions to perform their job well and prevent mistakes or misunderstandings. In general, the most frequently required technical skills for construction managers include the following:

- Microsoft Excel
- Autodesk AutoCAD
- commercial construction

Figure A-24. Educational Attainment of Current Workers

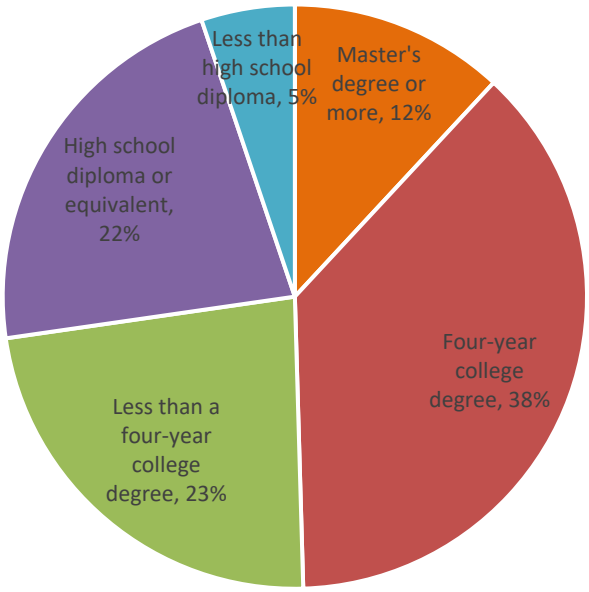
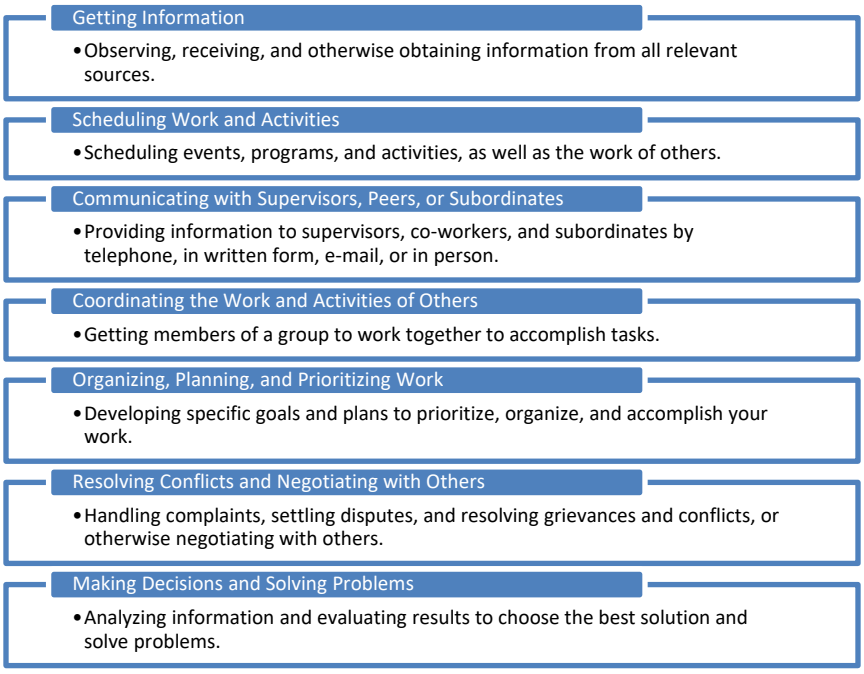


Figure A-25. Top Work Activities



A.9.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to construction managers and could therefore more easily transition into a construction manager job with minimal additional preparation. Jobs found within the architecture and engineering and the construction and extraction occupational groups could easily transition into a construction manager position.[63]

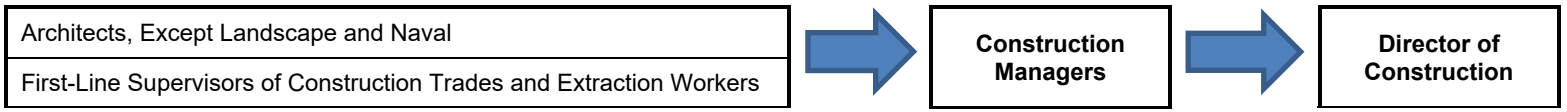
A construction manager career is a good way for individuals with design, construction, and supervisor or leadership experience to enter the offshore wind energy industry. Architects who are not in the landscape or naval fields have experience in planning and designing various structures, including those that a construction manager would oversee. These architects also have experience meeting with clients, preparing cost estimations, and managing other workers. Frequently, they visit the construction sites of buildings they design, providing them with an initial introduction to the construction processes and industry. First-line supervisors of construction trades and extraction workers bring to this role their leadership skills and important construction expertise from working both in the field and with upper management.

The typical entry-level education requirement is the same for both construction managers and architects, excluding landscape and naval architects. In addition, these architects would see a significant median hourly wage increase from roughly $47 an hour to just a little over $60 an hour. While first-line supervisors of construction trades and extraction workers are in a good position to transfer into this occupation, it is likely they would need to earn a bachelor's degree. Some employers may accept first-line supervisors without a bachelor's degree if they can demonstrate their construction and leadership skills, but many first-line supervisors may be required to earn a bachelor's degree. This requires several years and potentially high costs to complete. Upon transferring into a construction management position, however, they would see an increase in their median hourly wages by roughly $20 an hour.[64]

Table A-18. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry-Level Education
Construction Managers	**17,734**	**$60.26**	**Bachelor's degree**
Architects, Except Landscape and Naval	11,445	$47.11	Bachelor's degree
First-Line Supervisors of Construction Trades and Extraction Workers	30,812	$39.87	High school diploma or equivalent.

Figure A-26. Career Transferability and Progression



A.10 Crane and Tower Operators

Summary: Crane and tower operators use cranes and towers to lift heavy objects like materials, machines, and products used in the construction of wind towers. They set up and inspect their equipment, direct workers to load and unload materials, keep records of the materials they move, and perform minor equipment repairs. Crane and tower operators involved in the offshore wind energy industry aid in wind turbine construction, stacking tower segments atop one another, placing the nacelle on top of the stacked tower segments, and lifting the blades to the hub.

The entry-level and experienced median hourly wages for New York State crane and tower operators are greater than the statewide averages. The typical entry-level education requirement is a high school diploma or equivalent. Crane and tower operators must have excellent communication, coordination and visual acuity, and mechanical skills. Jobs that could easily transition into an architectural and engineering manager position are largely found within the construction and extraction occupational group.

A.10.1 Job Description

Crane and tower operators are responsible for operating and maintaining equipment used to move products, materials, machines, and other heavy objects. They set up and inspect the equipment used to move materials, which includes mechanical boom and cable or tower and cable equipment, direct workers to load and unload materials, keep records of the materials they move, and perform minor repairs on the equipment. Crane and tower operators are typically guided by workers on the ground. They typically work 40 hours a week, but some may work more than 40 hours depending on project schedules and deadlines.

These crane and tower operators are found in various industries and sectors, including construction, manufacturing, government, and mining. In the wind energy industry, skilled crane operators aid in the construction of turbines by stacking tower segments atop one another and then placing the nacelle on top of the stacked tower segments and lifting the blades to the hub.[65]

A.10.2 Wages

The entry-level, median, and experienced wages for crane and tower operators in New York State are all greater than the statewide averages. An entry-level crane and tower operator earns roughly $27 an hour while an average entry-level employee in the State earns just over $16 an hour. Experienced managers earn over $77 an hour while the State average wage for experienced workers is over $46 an hour. The median hourly wage for architectural and engineering managers is over $54 an hour.[66]

Table A-19. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Crane and Tower Operators (Annual)	$ 56,400	$ 113,200	$161,300
Crane and Tower Operators (Hourly)	$27.13	$54.43	$77.53

A.10.3 Education, Experience, Skill Requirements, and Certifications

Crane and tower operators are typically only required to have a high school diploma or equivalent. Additionally, crane and tower operators require months of training to be able to operate such complex machinery. Crane and tower operators working on construction, demolition, or excavation projects in New York State are required to obtain a Crane Operator Certificate of Confidence.[67]

These managers must be good communicators to give and receive directions from other workers about loading, unloading, and moving materials. They must also have good coordination and visual acuity to maneuver machinery precisely and avoid obstacles. Mechanical skills also aid crane and tower workers in performing maintenance on their machinery.

Of the current pool of New York State crane and tower operators, 58 percent have a high school diploma or equivalent but did not attend college. Nearly a quarter (24 percent) have completed some college or received a two-year degree. Of the remaining 18 percent of crane and tower operators, 10 percent have less than a high school diploma, six percent have a four-year college degree, and two percent have a master's degree.[68]

There were 34 active job postings in New York State for crane and tower operators between February 2022 through February 2023.[69] The current in-demand certifications from employers, based on these postings, are listed below[70]:

- Certified Crane Operator (NCCCO)
- driver's license
- Commercial Driver's License (CDL)
- overhead crane operator

It is important for crane and tower operators to be able to operate construction equipment such as overhead cranes, mobile cranes, and forklifts to lift materials, machines, and other heavy objects. The most frequently required technical skills for crane and tower operators are included below:

- ability to lift 41-50 pounds
- ability to lift 51-100 pounds
- forklifts
- self-contained breathing apparatus
- ability to lift 21-30 pounds
- Human Machine Interface Software (HMI)
- overhead cranes
- mobile cranes

Figure A-27. Educational Attainment of Current Workers

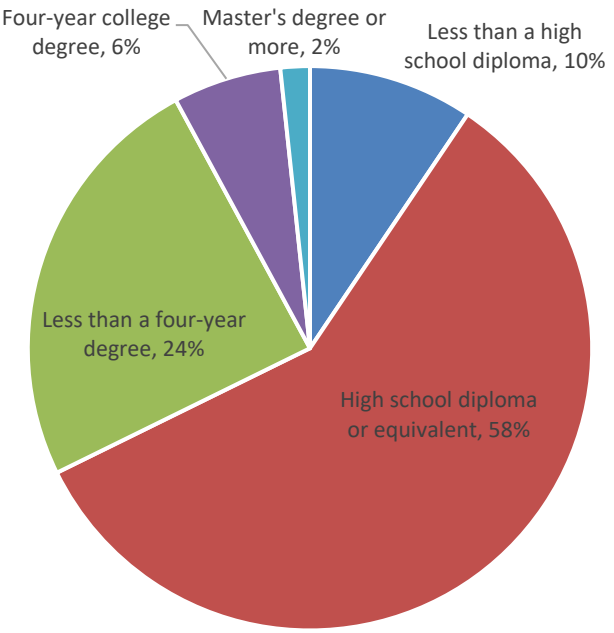
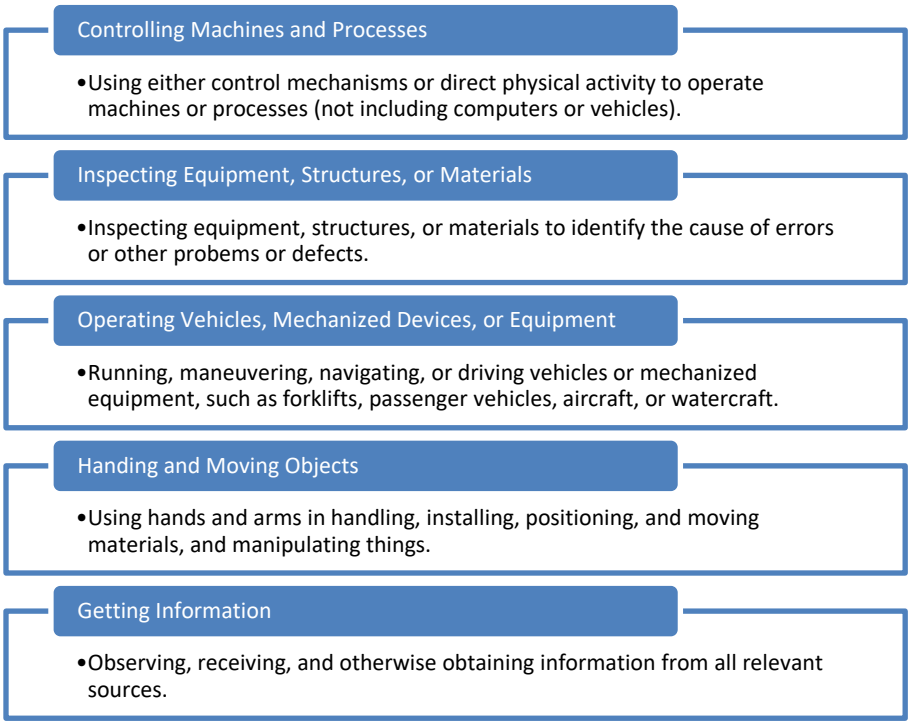


Figure A-28. Top Work Activities



A.10.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to crane and tower operators and could therefore more easily transition into one of these positions with minimal additional preparation. Jobs that could easily transition into a crane and tower operator position are largely found within the construction and extraction occupational group.[71]

Transferrable occupations are listed in the below table and figure. A crane and tower operator career is a good way for others with construction equipment operator experience to enter the offshore wind energy industry. Those with construction equipment operator experience would already know how to operate one or several types of construction equipment, follow safety regulations and guidelines, and communicate efficiently with team members. However, these workers would need specific training on how to operate and repair cranes and towers.

The only transferrable career listed is operating engineers and other construction equipment operators. These workers meet the typical entry-level education requirement for crane and tower operators. Operating engineers and other construction equipment operators would also see a significant increase in their median hourly wages as a crane and tower operator.[72]

Table A-20. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Crane and Tower Operators	**1,377**	**$54.43**	**High school diploma or equivalent**
Operating Engineers and Other Construction Equipment Operators	16,374	$35.46	High school diploma or equivalent.

Figure A-29. Career Transferability and Progression

A.11 Electrical and Electronic Engineering Technologists and Technicians

Summary: Electrical and electronic engineering technologists and technicians assist electrical and electronics engineers in planning and developing equipment powered by electricity. They draw diagrams, build prototypes, create, test, and maintain electrical components and basic circuitry, and inspect designs for quality control issues. Electrical and electronic engineering technologists and technicians involved in the offshore wind energy industry must aid engineers in designing and testing electrical components for wind turbines, including electric motors, lighting and wiring, machinery controls, communication systems, generators, and electricity transmission systems.

The entry-level hourly wage for New York State electrical and electronic engineering technologists and technicians is greater than the statewide average, though the hourly wage for experienced electrical and electronic engineering technologists and technicians is lower than the statewide average. The typical entry-level education requirement is an associate degree. They must have excellent communication and problem-solving skills as well as strong attention to detail. Jobs that could easily transition into an electrical and electronic engineering technologist and technician position are largely found within the architecture and engineering occupational group, the installation, maintenance, and repair occupational group, and the production occupational group.

A.11.1 Job Description

Electrical and electronic engineering technologists and technicians assist electrical and electronics engineers in planning and developing equipment powered by electricity, including computers, communications equipment, and medical monitoring devices. Electrical engineering technologists and technicians draw diagrams, assemble electrical systems and prototypes, identify solutions to design problems, and conduct quality control analysis on designs. Electronic engineering technologists build prototypes, create, test, and maintain electrical components and basic circuitry, replace defective electronic components or circuitry, and use machine tools like bench lathes and drills to make parts like coils and terminal boards. Both electrical and electronic engineering technologists often work in product evaluation—testing, adjusting, and repairing equipment using diagnostic devices.

Electrical and electronic engineering technologists and technicians are found in various industries and sectors, including manufacturing, engineering services, research and development, telecommunications, and the federal government. In the offshore wind industry, electrical and electronic engineering technologists and technicians help engineers in designing and testing electrical components for turbines. They test manufactured products to ensure quality control and troubleshoot any design problems that occur. Electrical component manufacturing for wind projects includes electric motors, lighting and wiring, machinery controls, communication systems, generators, and electricity transmission systems.[73]

A.11.2 Wages

The entry-level and median wages for electrical and electronic engineering technologists and technicians in New York State are greater than the statewide averages. An entry-level electrical and electronic engineering technologist and technician earns over $22 an hour while an average entry-level employee in the State earns just over $16 an hour. The median hourly wage for an electrical and electronic engineering technologist and technician is almost $33 an hour, compared to the State average of about $26 an hour. However, the wage for an experienced electrical and electronic engineering technologist and technician is lower than the statewide average for experienced workers. Experienced electrical and electronic engineering technologists and technicians make about $41 an hour compared to the statewide average of over $45 an hour.[74]

Table A-21. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Electrical and Electronic Engineering Technologists and Technicians (Annual)	$46,600	$68,300	$86,000
Electrical and Electronic Engineering Technologists and Technicians (Hourly)	$22.43	$32.83	$41.34

A.11.3 Education, Experience, Skill Requirements, and Certifications

Electrical and electronic engineering technologists and technicians are typically required to have an associate degree in electrical or electronic engineering technology. Depending on the industry or the tasks necessary for the job, some employers prefer to hire candidates with a bachelor's degree while others may require only a high school diploma.

Electrical and electronic engineering technologists and technicians must be good communicators to be able to receive direction from engineers, clearly convey any problems that arise to engineers, and write reports detailing construction, design problems, and testing results. They should have strong problem-solving skills to identify and fix problems with engineers' designs and prototypes. Electrical and electronic engineering technologists should also be detail oriented, paying close attention when assembling and repairing electrical systems.

Of the current pool of New York State electrical and electronic engineering technologists and technicians, 59 percent have completed some college or a two-year degree. About 19 percent have a four-year degree and 16 percent have a high school diploma or equivalent but did not attend college. Of the remaining six percent, four percent have a master's degree or more and two percent have less than a high school diploma.[75]

There were 1,388 active job postings in New York State for electrical and electronic engineering technologists and technicians between February 2022 through February 2023.[76] The current in-demand certifications from employers, based on these postings, are listed below[77]:

- Commercial Driver's License (CDL)
- security clearance
- IPC-A-610 Acceptability of Electronic Assemblies
- driver's license
- Industrial Electronic Certification (IND)
- OSHA 30
- Certified Welding Inspector
- NABCEP Certification

Because electrical and electronic engineering technologists and technicians test, adjust, and repair electrical equipment, it is important for them to have experience with reading schematics, manufacturing, soldering, and working with circuit boards. Because they aid engineers in designing electrical components, electrical and electronic engineering technologists and technicians should have experience with programming and modeling software such as National Instruments LabVIEW. The most frequently required technical skills for electrical and electronic engineering technologists and technicians are included below:

- reading schematics
- Microsoft Office
- circuit boards
- computer programming/coding
- radio frequency (rf)
- soldering
- manufacturing
- National Instruments LabVIEW

Figure A-30. Educational Attainment of Current Workers

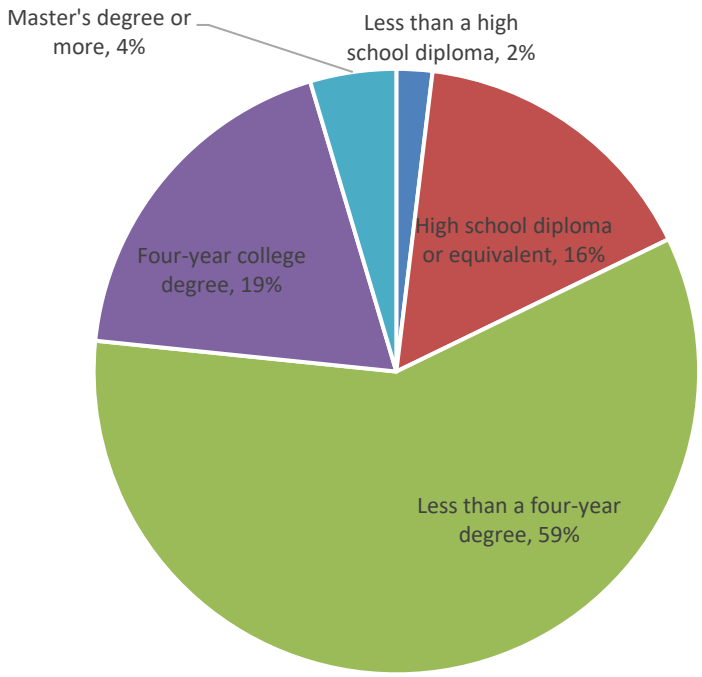
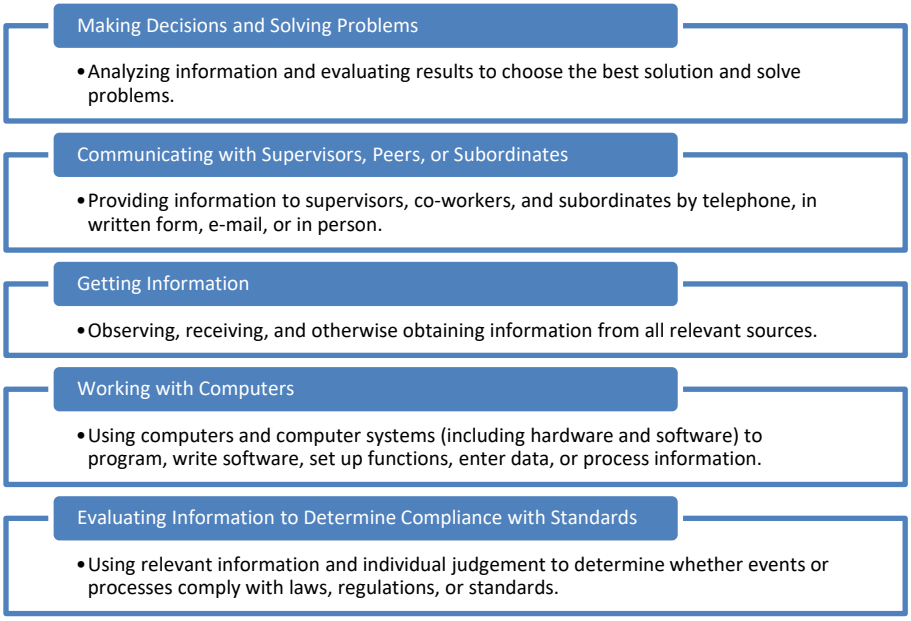


Figure A-31. Top Work Activities



A.11.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to Electrical and electronic engineering technologists and technicians and could therefore more easily transition into one of these manager positions with minimal additional preparation. Jobs that could easily transition into an electrical and electronic engineering technologist and technician position are largely found within the architecture and engineering occupational group, the installation, maintenance, and repair occupational group, and the production occupational group.[78]

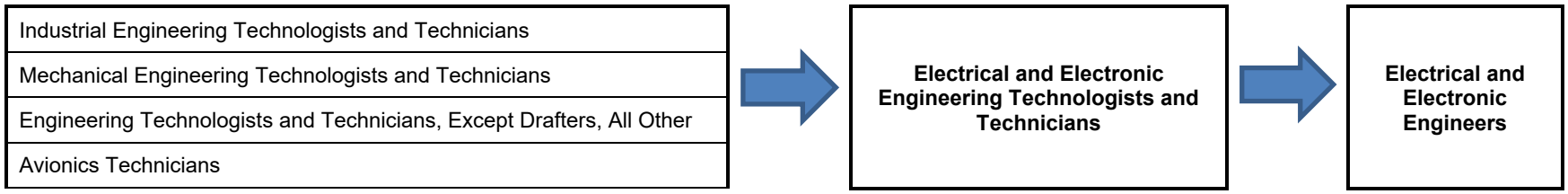
Transferrable occupations are listed in the below table and figure. An electrical and electronic engineering technologist and technician career is a good way for others with technologist or technician experience to enter the offshore wind energy industry. Those with experience working as a technician may already be familiar with using design software, ensuring designs meet specifications, and testing electronic equipment or other components.

All transferrable occupations listed meet the entry-level education requirements for electrical and electronic engineering technologists and technicians. Except for avionics technicians, all transferrable occupations would see an increase in their median hourly wages as well.[79]

Table A-22. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Electrical and Electronic Engineering Technologists and Technicians	**4,873**	**$32.83**	**Associate degree**
Industrial Engineering Technologists and Technicians	2,907	$29.73	Associate degree
Mechanical Engineering Technologists and Technicians	1,539	$30.05	Associate degree
Engineering Technologists and Technicians, Except Drafters, All Other	2,420	$29.51	Associate degree
Avionics Technicians	139	$36.70	Associate degree

Figure A-32. Career Transferability and Progression



A.12 Electrical Engineers

Summary: Electrical engineers design, test, and supervise electrical equipment manufacturing to ensure that products meet specifications and codes. They must have excellent communication, problem-solving, and analytical skills. Electrical engineers involved in the offshore wind energy industry design, test, and supervise the manufacturing of electrical components for wind turbines, including electric motors, lighting and wiring, machinery controls, communication systems, generators, and electricity transmission systems.

The entry-level and experienced median hourly wages for New York State electrical engineers are greater than the statewide averages. The typical entry-level education requirement is a bachelor's degree. Jobs that could easily transition into an electrical engineering position are largely found within the architecture and engineering and the business and financial operations occupational groups.

A.12.1 Job Description

Electrical engineers design, test, and supervise the manufacturing of electrical equipment, including electric motors, broadcast and communication systems, navigation and radar systems, power generation equipment, etc. They use computer-aided design (CAD) software to create models and test their designs, work with engineering managers to ensure projects are completed on time and within budget and ensure that manufactured components meet required specifications and quality standards. Electrical engineers are often involved in research and development, working to create new technologies such as advanced communication systems or renewable energy systems.

Electrical engineers are found in various industries and sectors, including manufacturing, engineering services, research and development, telecommunications, and the federal government. Within the wind energy industry, electrical engineers design, develop, test, and supervise electrical component manufacturing for turbines. They oversee production of electrical components in factories, test manufactured products to ensure quality control, and troubleshoot any design problems that occur. Electrical component manufacturing for wind projects includes electric motors, lighting and wiring, machinery controls, communication systems, generators, and electricity transmission systems.[80]

A.12.2 Wages

The entry-level, median, and experienced wages for electrical engineers in New York State are all greater than the statewide averages. An entry-level electrical engineer earns $34 an hour while an average entry-level employee in New York State earns just over $16 an hour. Experienced electrical engineers earn nearly $65 an hour, while the State average wage for experienced workers is over $45 an hour. The median hourly wage for architectural and engineering managers is nearly $51 an hour.[81]

Table A-23. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Electrical Engineers (Annual)	$70,800	$105,900	$135,200
Electrical Engineers (Hourly)	$34.03	$50.90	$ 64.98

A.12.3 Education, Experience, Skill Requirements, and Certifications

Electrical engineers are typically required to have a bachelor's degree in electrical or electronics engineering. Some electrical engineers have bachelor's degrees in another related engineering field. To work in research and development, electrical engineers typically need a graduate degree. Wind turbine manufacturers typically prefer to hire engineers with 3-5 years of experience. These engineers are then given between a few weeks to months of additional training prior to beginning work on a wind energy project, and then receive on-the-job training.

Electrical engineers must have good communication skills to explain their designs and give instructions during product development and production, as well as writing technical publications such as product manuals, project proposals, and design methods documents. Electrical engineers must also be skilled problem-solvers to troubleshoot and resolve issues with existing electrical systems, such as faulty wiring or malfunctioning components. They must also be analytical; while developing complex electrical components, electrical engineers must account for multiple design elements and technical characteristics and analyze data to ensure the product is meeting specifications.

Of the current pool of New York State electrical engineers, approximately 90 percent have either a four-year college degree or a master's degree or higher. Specifically, 48 percent have a bachelor's degree and 42 percent have a graduate-level degree. Of the remaining 10 percent, eight percent have some college or a two-year degree and two percent have a high school diploma or equivalent but did not attend college.[82]

There were 4,210 active job postings in New York State for electrical engineers between February 2022 through February 2023.[83] The current in-demand certifications from employers, based on these postings, are listed below[84]:

- Licensed Professional Engineer
- security clearance
- OSHA 30
- LEED Accredited Professional
- Engineer in Training (EIT)
- driver's license
- Project Management Professional (PMP)
- Certified Energy Manager (CEM)

Because designing and testing electrical components are significant duties of electrical engineers, it is important for them to have experience with various design and modeling software such as Autodesk AutoCAD and Autodesk Revit as well as the ability to read electrical schematics. Electrical engineers are also involved in the development of firmware and software which requires knowledge of computer programming languages like Python. In addition, electrical engineers must have good communication and presentation skills to work closely with other engineers and technicians, clearly explain their designs, and give instructions during product development and production. The most frequently required technical skills for architectural and engineering managers are included below:

- Autodesk AutoCAD
- Microsoft Office
- Microsoft Excel
- Computer Programming/Coding
- Microsoft PowerPoint
- Computer Aided Design Software (CAD Software)
- reading schematics
- Autodesk Revit
- Radio Frequency (RF)
- Python

Figure A-33. Educational Attainment of Current Workers

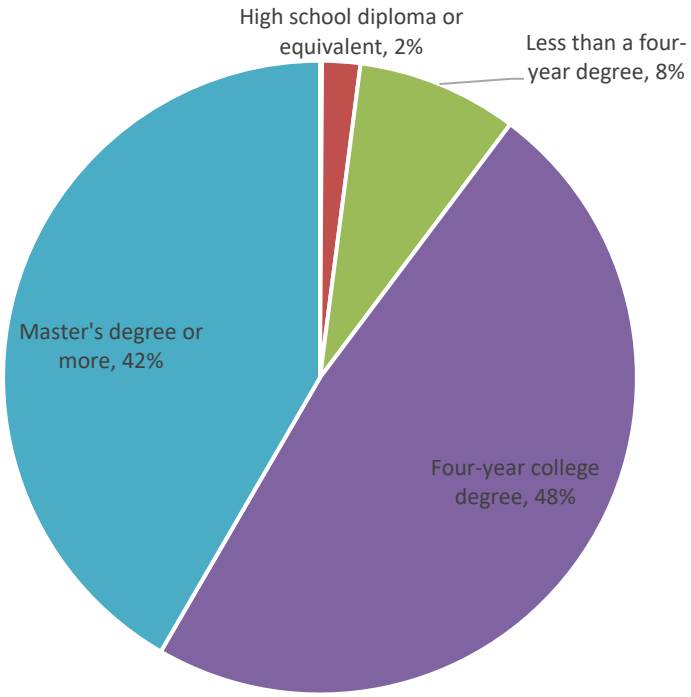


Figure A-34. Top Work Activities

Making Decisions and Solving Problems

- Analyzing information and evaluating results to choose the best solution and solve problems.

Communicating with Supervisors, Peers, or Subordinates

- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Working with Computers

- Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.

Analyzing Data or Information

- Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.

A.12.4 Career Transition Potential

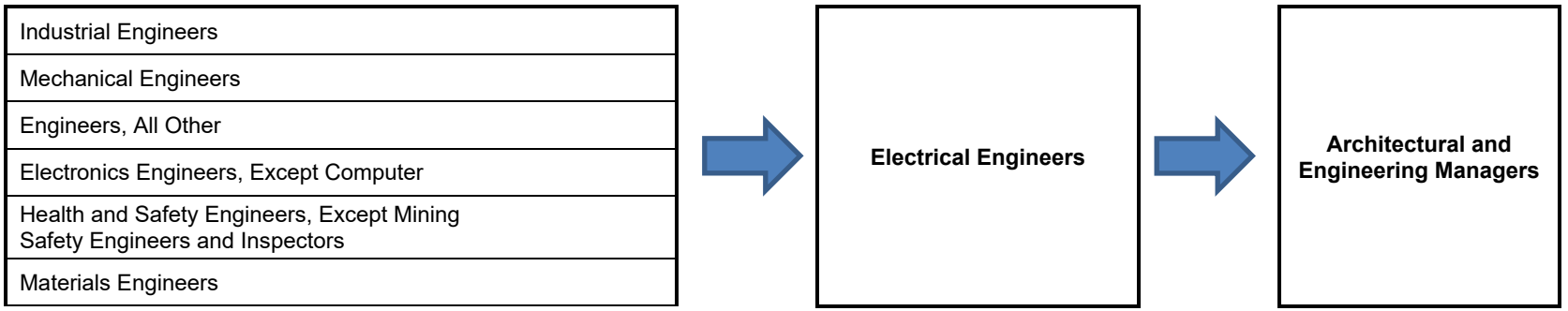
This section highlights the occupations that have similar skills and experience levels to electrical engineers and could therefore more easily transition into one of these positions with minimal additional preparation. Jobs that could easily transition into an electrical engineering position are largely found within the architecture and engineering occupational group and the business and financial operations occupational group.[85]

Transferrable occupations are listed in the below table and figure. An electrical engineering career is a good way for workers with engineering experience to enter the offshore wind energy industry. Those with other engineering experience would already have the mathematical background necessary to work on electrical engineering projects and have familiarity with design and modeling tools like AutoCAD and Revit. However, those with other engineering background experience would require education on electronics and circuit design, training to use circuit design software, and training on programming. All transferrable occupations would meet the typical entry-level education requirement for electrical engineers.[86]

Table A-24. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Electrical Engineers	**9,392**	**$50.90**	**Bachelor's degree**
Industrial Engineers	11,900	$46.79	Bachelor's degree
Mechanical Engineers	9,562	$46.40	Bachelor's degree
Engineers, All Other	6,072	$54.46	Bachelor's degree
Electronics Engineers, Except Computer	3,153	$56.48	Bachelor's degree
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	1,318	$52.42	Bachelor's degree
Materials Engineers	719	$53.90	Bachelor's degree

Figure A-35. Career Transferability and Progression



A.13 Electricians

Summary: Electricians are specialized in the electrical systems found in various fields and industries, including buildings, construction, and energy. They install, maintain, and repair the electrical equipment and systems, making sure to follow the safety regulations and industry standards and codes. In the offshore wind energy industry, electricians perform their job functions on the electrical equipment and systems of the wind turbines. They must be able to work on location, at heights, in confined spaces, and on call in case of unexpected events or malfunctions.

Jobs that could easily transition into an electrician position are largely found within the construction and extraction and the installation, maintenance, and repair occupational groups. The entry-level wage for electricians in New York State is greater than the statewide average wage for entry-level workers. Electricians learn the necessary skills and technology-specific knowledge through either a four-to-five-year apprenticeship or a formal education. They must have a high school diploma or equivalent and be at least 18 years old to enter the trade. Many states require electricians to obtain a license. Electricians may advance to become master electricians, supervisors, or other related roles in project management.

A.13.1 Job Description

Electricians are necessary in the construction and energy industries because they install, maintain, and repair electrical equipment, systems, and fixtures, and ensure that the work follows industry standards and codes. Electricians must be vigilant about safety. They execute the electrical wiring plans according to blueprints, test the electrical systems, and connect the systems to the power grid. Electricians must be flexible with their work schedules and be on call in the event of a system malfunction. They must have a working knowledge of the specific electrical requirements of the industry in which they work as well as experience using hand and power tools to install and manipulate the electrical wiring. Other common job titles of electricians include installation technician, maintenance electrician, and industrial electrician.

In the offshore wind energy industry, electricians connect the turbine generator electrical systems to the power grid as well as install, maintain, and repair the electrical equipment and systems found in wind turbines and their associated infrastructure. They are included in the component manufacturing, construction, and operations phases of an offshore wind energy project. It is important that they understand the wind industry as a whole and the electrical standards and requirements of the industry to perform their job.[87]

A.13.2 Wages

The entry-level and median wages for electricians in New York State are greater than the statewide averages. Entry-level electricians earn approximately $20 an hour, compared to the State average of just over $15 an hour for entry-level workers. Experienced electricians can more than double their entry-level wages and earn almost $49 per hour. The median hourly wage for electricians in the State is $37 exactly.[88]

Table A-25. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$ 31,900	$ 50,700	$ 89,900
State Average (Hourly)	$ 15.32	$ 24.40	$ 43.23
Electricians (Annual)	$ 41,800	$ 77,000	$ 101,700
Electricians (Hourly)	$ 20.08	$ 37.00	$ 48.88

A.13.3 Education, Experience, Skill Requirements, and Certifications

Electricians must have at least a high school diploma or equivalent to pursue this career. They often learn the trade in a four-to-five-year apprenticeship or a formal education. To become certified professionals, these individuals can take a two-year electrician course at a technical school. These individuals must be at least 18 years old to pursue either path. A basic understanding of algebra is important for success.

Many states require electricians to obtain a license. Electricians must be able to read blueprints and interpret technical diagrams as well as understand the National Electrical Code and other location-based regulations. They often learn electrical theory and soldering as apprentices or students as well. Electricians are required to stay up to date on these codes and regulations as new safety measures and new products are released.

In offshore wind specifically, electricians must be able to work on location. They will often be required to work at heights, in confined spaces, and lift heavy items. Experience working with high voltages and strong communication skills are both beneficial for these laborers. A proficiency in offshore wind farm processes and in mechanical and hydraulic equipment is also valuable for offshore wind energy electricians.

Of the current pool of electricians in New York State, 37 percent have a high school diploma or equivalent. Only seven percent have less than a high school diploma. Roughly four in 10 electricians have some college or a two-year degree while 14 percent of electricians possess a four-year college degree or higher.

The current in-demand certifications of employers, based on 1,356 active job postings[89] in New York State for electricians between January 2022 and January 2023, include the following[90]:

- driver's license
- OSHA 10
- OSHA 30
- Commercial Driver's License
- certified welder

Electricians are responsible for connecting and installing electrical circuits and systems, so they are expected to know how to read blueprints and schematics. Often, they advance into master electricians, supervisors, and related types of project managers, so they must be able to teach and train others in the trade. The most frequently required technical skills for electricians include those listed below:

- reading schematics
- job teaching/training
- blueprint reading
- installing wiring, control, and lighting systems
- repairing or replacing electrical wiring
- hand tools
- power tools

Figure A-36. Educational Attainment of Current Workers[91]

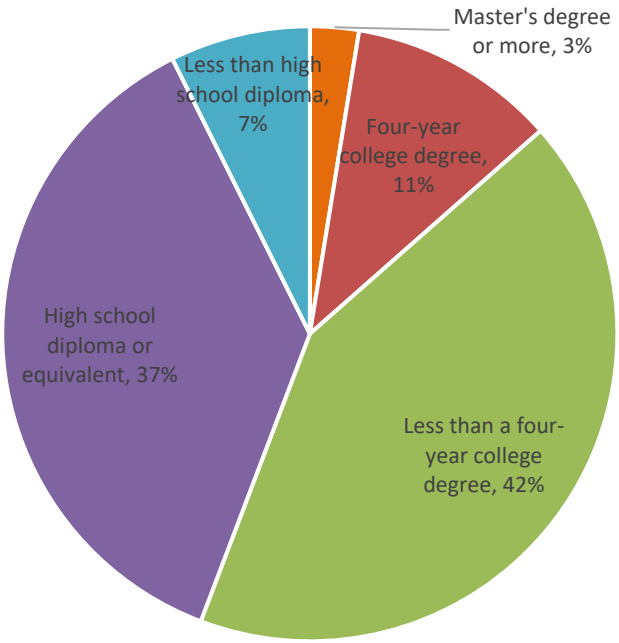


Figure A-37. Top Work Activities

Getting Information
- Observing, receiving, and otherwise obtaining information from all relevant sources.

Identifying Objects, Actions, and Events
- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

Making Decisions and Solving Problems
- Analyzing information and evaluating results to choose the best solution and solve problems.

Inspecting Equipment, Structures, or Materials
- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

Handling and Moving Objects
- Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.

Monitoring Processes, Materials, or Surroundings
- Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

A.13.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to electricians and could therefore more easily transition into an electrician job with minimal additional preparation. These occupations are largely found within the construction and extraction and the installation, maintenance, and repair occupational groups.[92]

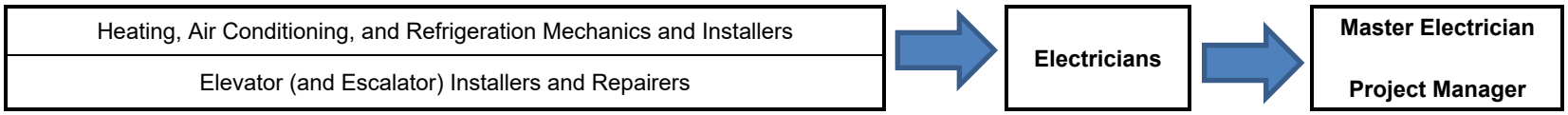
An electrical career is a good pathway into the offshore wind industry for workers featured in the below table. Heating, air conditioning, and refrigeration mechanics and installers already understand the electrical components and wiring of these systems in order to test, install, and maintain them. This familiarity with electrical systems can be expanded upon easily. Additionally, these mechanics would see a wage increase from this career transition. These workers would need to learn the specific electrical requirements and systems of wind turbines to work in the offshore wind energy industry.

Similarly, elevator and escalator installers and repairers must have the ability to read and understand blueprints and connect electrical wiring for elevators and escalators. These workers, however, may not see a median hourly wage increase. Overall, both occupational groups have similar educational requirements. All three careers require at least a high school diploma or equivalent. The biggest hurdle for individuals in these transferrable occupations would be taking the time to complete an apprenticeship or technical school courses as well as specific offshore wind industry trainings to become electricians in this industry.[93]

Table A-26. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry-Level Education
Electricians	**42,910**	**$37.00**	**High school diploma or equivalent**
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	24,005	$29.31	Postsecondary non-degree award.
Elevator (and Escalator) Installers and Repairers	3,968	$48.41	High school diploma or equivalent.

Figure A-38. Career Transferability and Progression



A.14 Engine and Other Machine Assemblers

Summary: Engine and other machine assemblers construct machines such as motors, turbines, construction equipment, mining equipment, machines used in automobiles, and power generators. These workers read and follow blueprints, use power tools, and perform quality control checks. In the offshore wind industry, engine and other machine assemblers are responsible for assembling and maintaining several of the components used in wind turbines, including the gearbox, generator, and rotor.

The entry-level and median hourly wage for New York State engine and other machine assemblers are on par with statewide averages. However, experienced engine and other machine assemblers have a lower hourly wage than the average wage for experienced workers in New York State. The typical entry-level education requirement is a high school diploma, though several months of on-the-job training is typically required for entry-level engine and other machine operators. Engine and other machine assemblers must have physical strength, stamina, and dexterity. Jobs that could easily transition into an architectural and engineering manager position are largely found within the installation, maintenance, and repair occupational group and the production occupational group.

A.14.1 Job Description

Engine and other machine assemblers construct and rebuild machinery including motors and turbines, construction equipment, mining equipment, machines used in automobiles, and power generators. They read detailed blueprints and schematics to determine how parts should connect, position parts manually or with hoists, and use hand tools or machines to assemble components. After the machinery is assembled, they perform quality control checks to ensure it meets quality and safety standards.

Engine and other machine assemblers are found in various industries and sectors, including manufacturing, construction, extraction, and textiles. Engine and other machine assemblers working in the wind energy industry are responsible for assembling and maintaining several of the components used in wind turbines, including the gearbox, generator, and rotor.[94]

A.14.2 Wages

The entry-level and median wages for engine and other machine assemblers in New York State are on par with statewide averages. Average entry-level employees and entry-level engine and other machine assemblers in the State both earn about $16 an hour. Similarly, the median hourly wage for engine and other machine assemblers and the statewide median wage are both about $26 an hour. However, while the average wage for experienced workers is over $45 an hour, experienced engine and other machine assemblers only earn $29 an hour.[95]

Table A-27. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Engine and Other Machine Assemblers (Annual)	$34,600	$54,200	$60,400
Engine and Other Machine Assemblers (Hourly)	$16.61	$26.04	$29.03

A.14.3 Education, Experience, Skill Requirements, and Certifications

Engine and other machine assemblers are typically required to have a high school diploma or equivalent. They typically undergo on-the-job training for several months and sometimes receive employer-sponsored technical instruction. Skilled assemblers—including workers in electronic and aircraft motor vehicle product manufacturing—may require an associate degree or special training, including apprenticeship programs.

Engine and other machine assemblers must have the physical strength and stamina to stand for long periods of time, perform repetitive physical tasks, and lift heavy machinery components. These workers are also required to have good dexterity; steady hands and good hand-eye coordination are necessary for manipulating and assembling small machinery components.

Of the current pool of New York State engine and other machine assemblers, just over half (51 percent) have a high school diploma or equivalent but did not complete college. About one third (33 percent) have completed some college or a two-year degree. Of the remaining 16 percent, 10 percent have less than a high school diploma and six percent received a four-year college degree.[96]

There were 44 active job postings in New York State for engine and other machine assemblers between February 2022 through February 2023.[97] The following is current in-demand certification from employers, based on these postings[98]:

- IPC-A-610 Acceptability of Electronic Assemblies (IPC-A-610)

To assemble machinery, engines and other machine assemblers must be able to read blueprints, operate power tools, and use tools for measurement such as micrometers. The most frequently required technical skills for engine and machine assemblers are included below:

- power tools
- blueprint reading
- ability to lift 51-100 pounds
- assembly
- mathematics
- routers
- ability to lift 41-50 pounds
- mechanical
- micrometers

Figure A-39. Educational Attainment of Current Workers

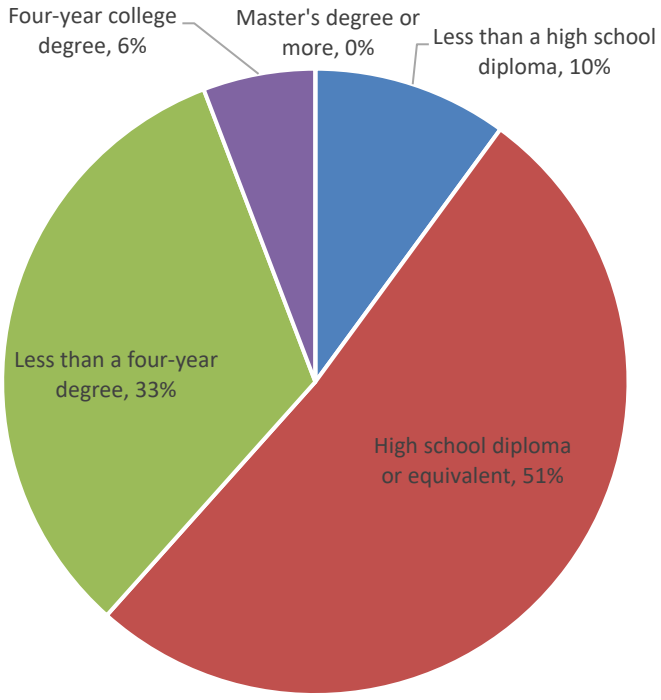
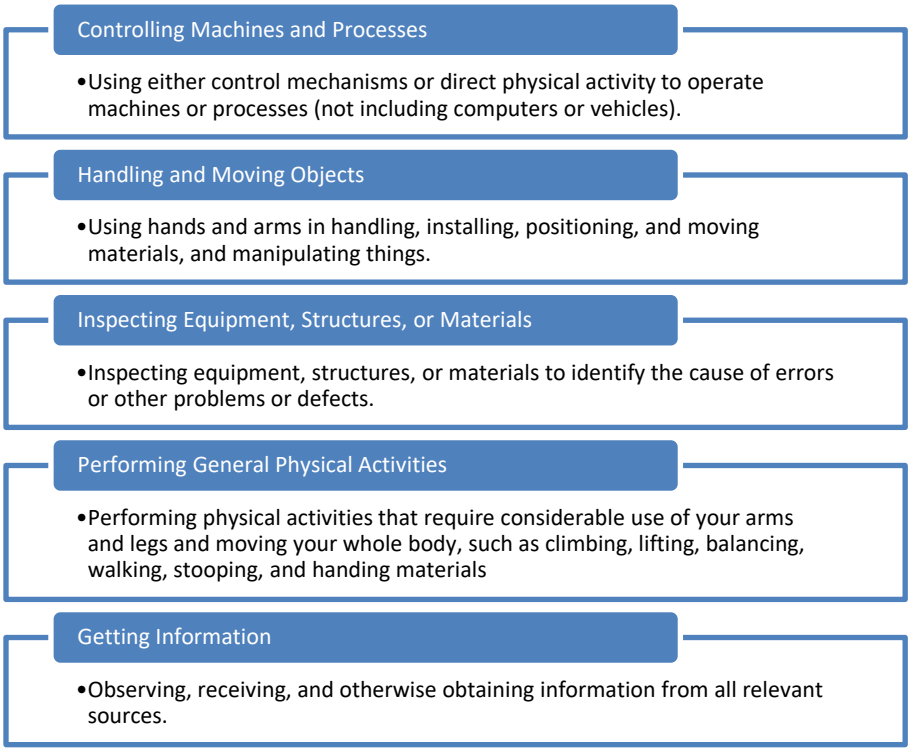


Figure A-40. Top Work Activities



A.14.4 Career Transition Potential

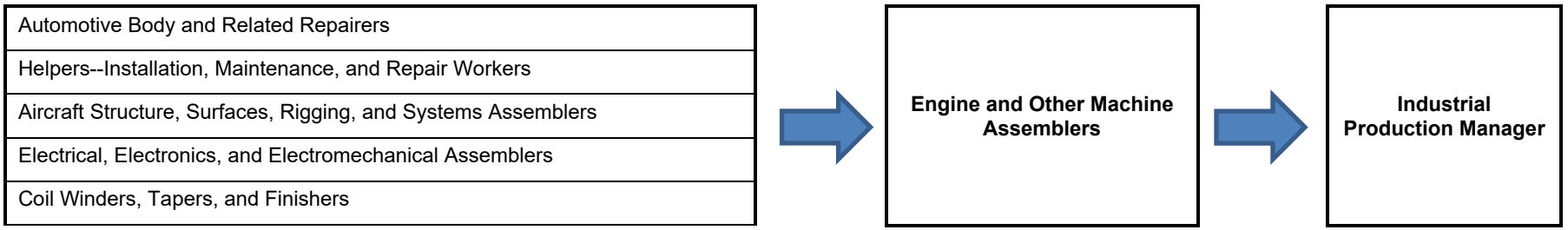
This section highlights the occupations that have similar skills and experience levels to engine and other machine assemblers and could therefore more easily transition into one of these positions with minimal additional preparation. Jobs that could easily transition into an engine or other machine assembler position are largely found within the installation, maintenance, and repair occupational group and the production occupational group. These workers typically have experience with many of the responsibilities of engine and other machine assemblers—including using reading schematics and blueprints, using hand tools, and conducting quality control checks—though they will likely still undergo several months of on-the-job training upon placement as an engine and other machine assembler.[99]

Transferable occupations are listed in the below table and figure. An engine or other machine assembler career is a good way for others with installation, maintenance, and repair experience to enter the offshore wind energy industry. All transferrable occupations listed meet the entry-level education requirements for engine and other machine assemblers. The transferable occupations listed would also see a significant increase in their median hourly wages.[100]

Table A-28. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Engine and Other Machine Assemblers	**1,389**	**$26.04**	**High school diploma or equivalent**
Automotive Body and Related Repairers	7,972	$23.98	High school diploma or equivalent.
Helpers--Installation, Maintenance, and Repair Workers	4,810	$19.15	High school diploma or equivalent.
Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	485	$22.60	High school diploma or equivalent.
Electrical, Electronic, and Electromechanical Equipment Assemblers, Except Coil Winders, Tapers, and Finishers	13,088	$18.46	High school diploma or equivalent.
Coil Winders, Tapers, and Finishers	615	$19.55	High school diploma or equivalent.

Figure A-41. Career Transferability and Progression



A.15 First-Line Supervisors of Construction Trades and Extraction Workers

Summary: First-line supervisors of construction trades and extraction workers are essential to making sure the daily operations at a project site happen efficiently and effectively. They oversee the laborers at the site and share information between the laborers and upper management who otherwise would not be aware of the specific tasks and challenges of the workers on the ground. These first-line supervisors have intensive background knowledge of the functions at a construction project site and take care to ensure all individuals are complying with the safety regulations to limit potential accidents and injuries. In the offshore wind energy industry, first-line supervisors of construction trades and extraction workers directly oversee the daily activities that occur at an offshore wind energy project construction site.

Jobs that could easily transition into a first-line supervisor of construction trades and extraction workers position are largely found within the life, physical, and social science; farming, fishing, and forestry; building and grounds cleaning and maintenance; and installation, maintenance, and repair occupational groups. The entry-level wage for these first-line supervisors is just over $29 an hour, more than the state average of entry-level wages. Workers with construction industry knowledge and managing experience may see first-line supervisor positions as good entry points into the offshore wind energy industry. Often, first-line supervisors are promoted from within the construction industry or hired from a related field so they can begin the job with pre-existing industry knowledge. They can then work towards other management positions such as general supervisors.

A.15.1 Job Description

First-line supervisors of construction trades and extraction workers are key to ensuring that construction and project sites run smoothly. They oversee the day-to-day operations by setting goals based on client and upper management timetables and making sure company policies and safety regulations are being followed. Often, first-line supervisors are completing clerical tasks such as developing work schedules, tracking attendance and punctuality of others at the work site, and attending meetings with vendors or customers.

These individuals sometimes play an important peacemaker role since they relay information between upper management, site workers, and customers. These parties need to understand each other's challenges or limitations for better working relationships. First-line supervisors ensure each party's needs are being met and work to please labor unions at times, too.[101]

In their position, first-line supervisors must have an extensive knowledge of construction activities to do their job well, as well as industry-specific knowledge. The offshore wind industry requires specific, technical knowledge due to the complexity of wind turbines. While working with heavy and potentially dangerous construction machinery and equipment as well as large and expensive wind turbine components, these individuals must be vigilant in their oversight to keep themselves and the workers they supervise safe.

A.15.2 Wages

The entry-level, median, and experienced wages for first-line supervisors in New York State are higher than the statewide averages. Entry-level first-line supervisors earn a little over $29 per hour which is almost twice the state average of $16 an hour. Experienced first-line supervisors earn almost $56 an hour. The median hourly wage for a first-line supervisor of construction trade workers in New York roughly $45.50 per hour.[102]

Table A-29. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
First-Line Supervisors of Construction Trades and Extraction Workers (Annual)	$61,000	$94,700	$116,100
First-Line Supervisors of Construction Trades and Extraction Workers (Hourly)	$29.32	$45.51	$55.80

A.15.3 Education, Experience, Skill Requirements, and Certifications

Due to the organizational position of a first-line supervisor, between lower-level site workers and upper management, first-line supervisors must have extensive knowledge of the construction and offshore wind energy industries from a broader perspective as well as the operations in the field. Often, first-line supervisors have prior training in construction or a related field and are promoted into this position. Typically, entry-level first-line supervisors of construction trades and extraction workers need a high school diploma or equivalent.

A major task of first-line supervisors includes making sure everyone at the project site is meeting the proper safety regulations. Therefore, these individuals need to be trained in The Occupational Safety and Health Administration (OSHA) courses. It is also helpful for first-line supervisors to understand labor union guidelines since workers who they oversee may be members of a labor union. Communication, problem solving, decision making, and organizing skills are all key for first-line supervisors, on top of basic management skills.

Of the current pool of first-line supervisors in New York State, 42 percent have a high school diploma or equivalent. Significantly, almost two in ten first-line supervisors have a four-year degree or higher. A quarter of first-line supervisors have less than a four-year degree but more than a high school diploma or equivalent while 14 percent have less than a high school diploma.[103]

Based on 2,357 active job postings in New York State for construction supervisors between August 2021 through August 2022,[104] the current in-demand certifications from employers include the following:

- driver's license
- OSHA 10
- OSHA 30
- Certification in Cardiopulmonary Resuscitation (CPR)
- first aid certification

Since first-line supervisors oversee the daily operations at a construction site, they need to understand systems commonly worked on and general commercial construction affairs. The clerical tasks require first-line supervisors to be able to use certain software and importantly, to ensure that workers follow safety regulations, proper OSHA knowledge is required. In general, the most frequently required technical skills for first-line supervisors in the construction and extraction industry include the following:

- Microsoft Excel
- commercial construction
- blueprint reading
- Occupational Safety and Health Administration (OSHA) Regulations

Figure A-42. Educational Attainment of Current Workers

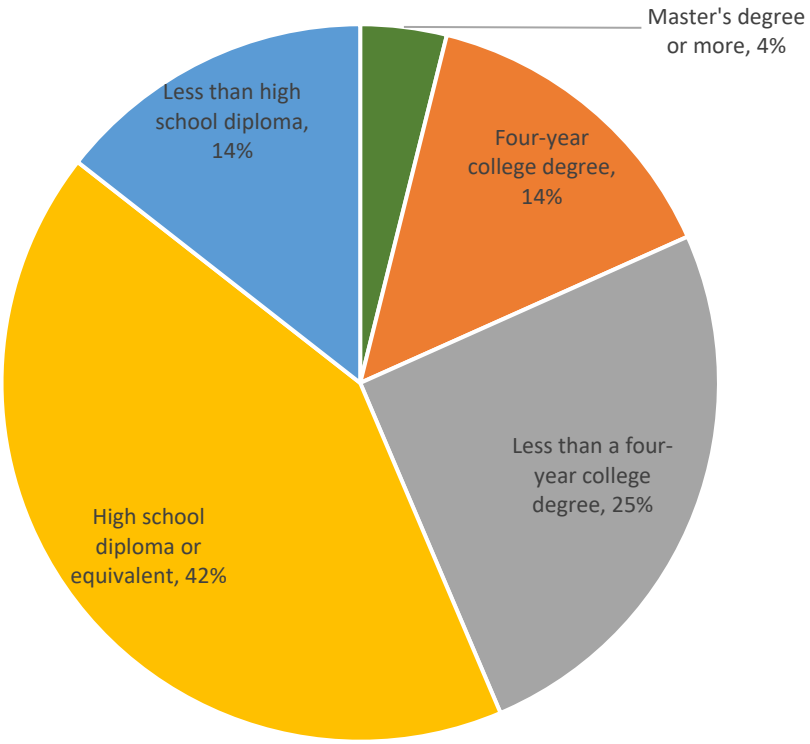
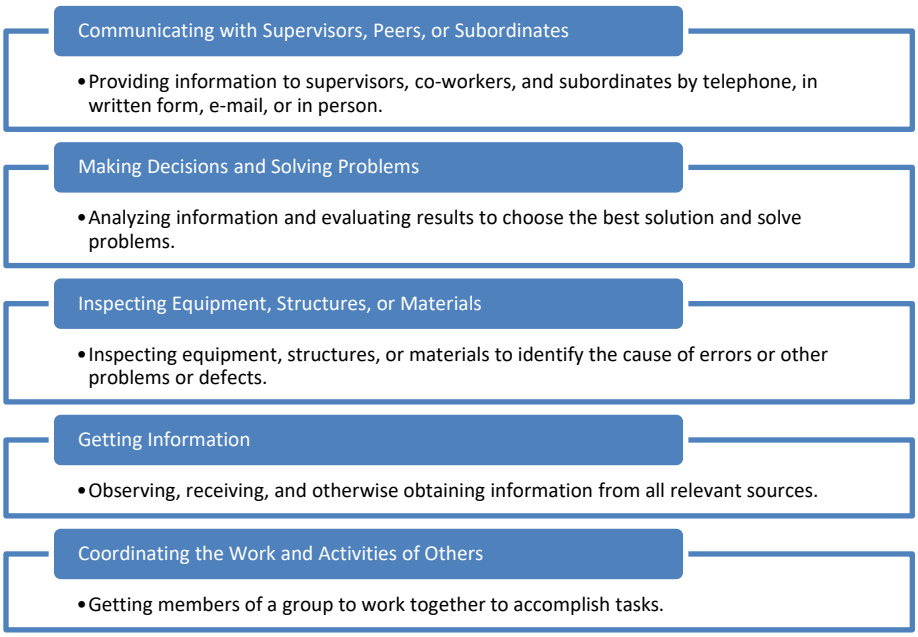


Figure A-43. Top Work Activities



A.15.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to first-line supervisors in construction trades and extraction workers and could therefore more easily transition into a first-line supervisor job with minimal additional preparation. These easily transferrable jobs are largely found within the life, physical, and social science; farming, fishing, and forestry; building and grounds cleaning and maintenance; and installation, maintenance, and repair occupational groups.[105]

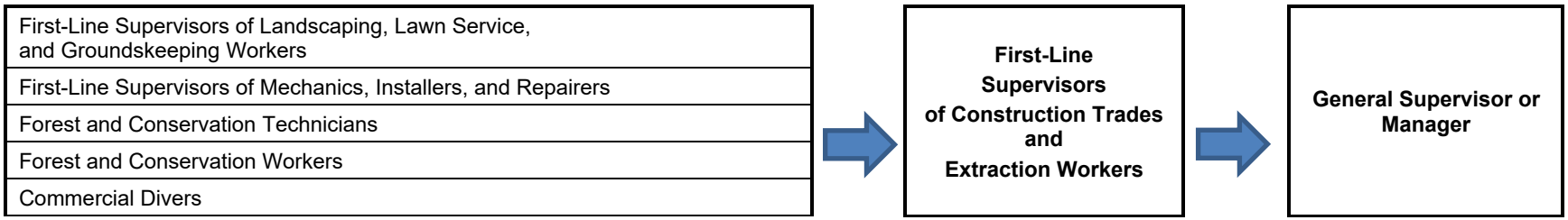
Workers with an understanding of construction activities and supervisory tasks may view a first-line supervisor role in construction trades and extraction workers as a good entry point into the offshore wind energy industry. The below tables feature some of these workers. First-line supervisors of related fields could easily transition to becoming first-line supervisors in construction trades and extraction since they already have experience in supervising workers and managing day-to-day operations. Commercial divers' pre-existing familiarity with industrial, construction, engineering, and maintenance work will aid them in taking on a first-line supervisory role in construction and extraction. The biggest requirement for the workers who want to transition is receiving construction industry and management training in addition to receiving technical training specific to the offshore wind energy industry.

All these transferrable occupations could see a wage increase by transitioning to first-line supervisors of construction trades and extraction workers and entering the offshore wind energy industry. Further, workers in these transferrable occupations would already meet the typical entry-level education requirement for these first-line supervisors.[106]

Table A-30. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry-Level Education
First-Line Supervisors of Construction Trades and Extraction Workers	**30,812**	**$39.87**	**HS diploma or equivalent**
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	9,041	$29.90	HS diploma or equivalent.
First-Line Supervisors of Mechanics, Installers, and Repairers	31,148	$37.24	HS diploma or equivalent.
Forest and Conservation Technicians	205	$24.03	Associate degree
Forest and Conservation Workers	177	$18.27	HS diploma or equivalent.
Commercial Divers	173	$32.59	Postsecondary non-degree award.

Figure A-44. Career Transferability and Progression



A.16 General and Operations Managers

Summary: General and operations managers with excellent communication, problem solving, and leadership skills are essential to making sure that projects run smoothly and efficiently. In addition to planning, coordinating, and monitoring the projects, they are involved in the budget and timeline development decisions. In certain industries, including the construction and energy industries, general and operations managers collaborate with engineers, technicians, and other specialists involved with the project to ensure compliance and productivity. Offshore wind energy managers are essential for ensuring that operations at an offshore wind farm are functioning well to avoid any energy generation or supply disruption.

The entry-level and experienced hourly wages for New York general and operation managers are greater than the statewide averages of these working groups. The typical entry-level education requirement for a general or operations manager is a bachelor's degree. General and operations managers' degrees are generally in a field related to the industry in which they work. On top of their education, these managers often have experience in leadership roles and a working knowledge of the industry. They can attain director and executive positions during their careers. Jobs that could easily transition into this manager position are largely found within the management and the transportation and material moving occupational groups.

A.16.1 Job Description

General and operations managers oversee the various workers and operations of a project. They plan, direct, and coordinate the various components of the project, they handle the budget and timeline of the project, and they make the big decisions that may affect the finished product. These managers also address emergencies or problems that arise and complete many administrative tasks. They are found in many types of industries. Other common job titles include area manager, operations director, and field operations manager.[107]

Managers in the construction and energy industries work closely with technicians, engineers, and other specialists at the project site. In the offshore wind energy industry, they must have a strong working knowledge of operations in the wind energy field to provide accurate direction and insight across the various working divisions. They are vital to ensuring that operations at an offshore wind farm are

effective and that energy disruptions are avoided. In this leadership role, general and operations managers typically hold a bachelor's degree and have some management training from previous roles. They are important to maintaining an efficient, safe, and productive project site.

A.16.2 Wages

The entry-level, median, and experienced wages for general and operations managers in New York State are all greater than the statewide averages. An entry-level manager earns almost $29 an hour while the average entry-level employee wage in the State is just over $15 an hour. Experienced managers earn more than double the State average for experienced employees. The median hourly wage for general and operations managers is over $60 an hour.[108]

TableA-31. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$ 31,900	$ 50,700	$ 89,900
State Average (Hourly)	$ 15.32	$ 24.40	$ 43.23
General and Operations Managers (Annual)	$ 59,500	$ 125,700	$ 187,500
General and Operations Managers (Hourly)	$ 28.62	$ 60.43	$ 90.14

A.16.3 Education, Experience, Skill Requirements, and Certifications

General and operations managers are typically required to have both a bachelor's degree and management training from on-the-job experience. Employers generally prefer that the college degree and training are related to the industry or an adjacent field. A bachelor's degree that includes courses in project management, project design, and cost estimation are the most valuable for general and operations managers. Renewable energy field knowledge, including the methods and materials used, is important for managers who work in the offshore wind energy industry so that they can plan, direct, and troubleshoot properly.

Of the current pool of New York general and operations managers, 42 percent have a four-year college degree. Another 21 percent have a master's degree or more. Only two percent of current general and operations managers have less than a high school diploma. Roughly one in ten have a high school diploma or equivalent while the remaining 23 percent have some college or a two-year college degree.[109]

There were 10,472 active job postings in New York State for general and operations managers between January 2022 and January 2023.[110] The current in-demand certifications from employers include the following[111]:

- driver's license
- Associate Service Executive (ASE)
- Certification in Cardiopulmonary Resuscitation (CPR)
- Project Management Professional (PMP)
- first aid certification
- OSHA 30

Because project planning and time management are major parts of a general and operations manager's role, it is important that the individual is familiar with various Microsoft programs. In addition, these managers must be hospitable with their workers and customers to create productive working relationships. For managers in the offshore wind energy industry, familiarity with offshore wind energy processes and functions are necessary to perform the job well and prevent mistakes or misunderstandings. The most frequently required technical skills for a general and operations manager include the following:

- Microsoft Excel
- inventory management
- operations management
- finance
- Customer Relationship Management (CRM)

Figure A-45. Educational Attainment of Current Workers

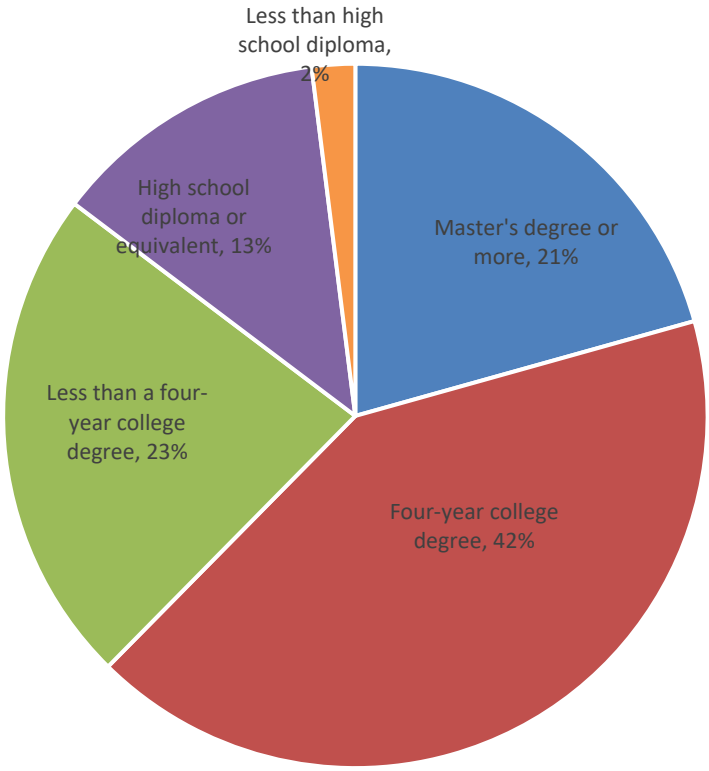
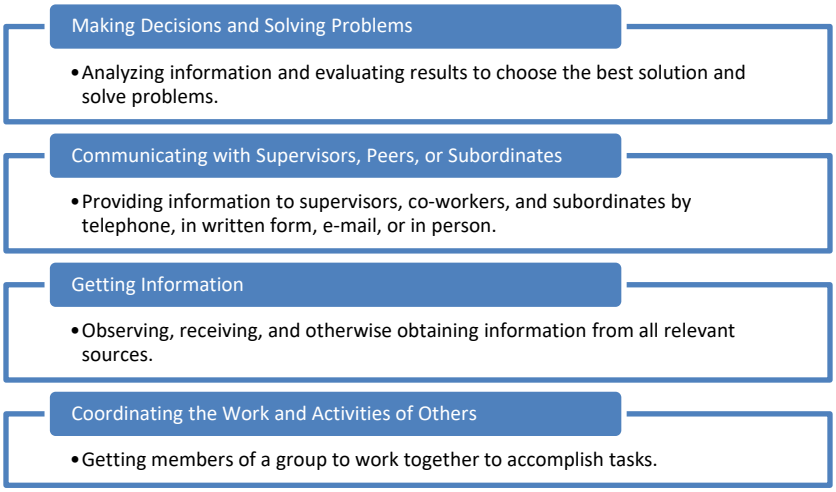


Figure A-46. Top Work Activities



A.16.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to general and operations managers and could therefore more easily transition into this manager job with minimal additional preparation. Workers from the management and the transportation and material moving occupational groups could easily transition into a general and operations manager position.[112]

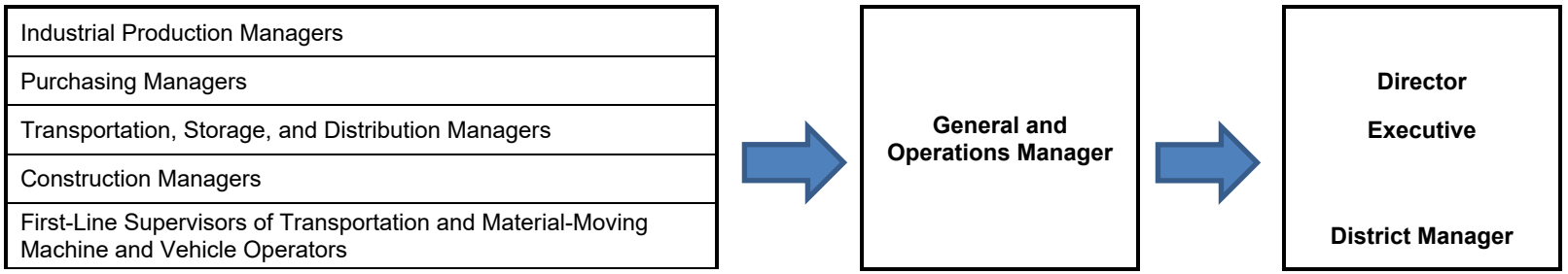
A general and operations manager career is a good way for others with management and supervisory experience to enter the offshore wind energy industry. They already understand how to plan, direct, and coordinate operations and other workers. Transitioning managers and supervisors would need to gain a working knowledge of the wind energy field.

All transferrable occupations listed in the below table and figure, except for purchasing managers, would see a median hourly wage increase. The typical entry-level education requirement for industrial production, purchasing, and construction managers is the same for general and operations managers. They would have the greatest ease in transitioning into a general and operations manager role. The other managers and supervisors would need to earn a bachelor's degree, if they do not already have one, which requires several years to complete in addition to living and tuition costs.[113]

Table A-32. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry-Level Education
General and Operations Managers	**205,806**	**$60.43**	**Bachelor's degree**
Industrial Production Managers	5,706	$60.04	Bachelor's degree
Purchasing Managers	3,938	$72.58	Bachelor's degree
Transportation, Storage, and Distribution Managers	6,201	$53.59	High school diploma or equivalent.
Construction Managers	17,734	$60.26	Bachelor's degree
First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators. Except Aircraft Cargo Handling Supervisors	33,811	$29.69	High school diploma or equivalent.
Aircraft Cargo Handling Supervisors	503	$37.49	High school diploma or equivalent.

Figure A-47. Career Transferability and Progression



A.17 Helpers, Construction Trades, All Other

Summary: Construction trade helpers are responsible for providing support and assistance to skilled tradespeople, including carpenters, electricians, plumbers, and other construction professionals. In the offshore wind industry, construction helpers support skilled tradespeople in the installation and maintenance of offshore wind turbines and associated infrastructure. This includes assembling and installing wind turbines and towers as well as performing basic maintenance such as cleaning and lubricating equipment.

Entry-level wages for construction worker helpers are on par with the average wage for entry-level workers in New York. As construction helpers gain experience, however, their wages fall behind the statewide average wage for experienced workers in New York. There is no entry-level education requirement for helpers in the construction trades. They must have excellent communication skills, attention to detail, and hands-on experience using power tools. Jobs that could easily transition into a construction helper position are largely found within construction and extraction occupational group.

A.17.1 Job Description

Helpers in construction trades typically provide support and assistance to skilled tradespeople such as carpenters, electricians, plumbers, and other construction professionals. They assist skilled tradespeople with tasks such as measuring, cutting, drilling, or assembling materials. They may also be responsible for operating machinery, including power drills, saws, and other power tools.

These workers are found in various industries and sectors, including the oil and gas industry as well as residential, commercial, and industrial construction. Construction trade helpers in the wind energy industry are responsible for supporting skilled tradespeople in the installation and maintenance of offshore wind turbines and associated infrastructure. They assist with assembling and installing wind turbines, towers, and other equipment and performing basic maintenance such as cleaning and lubricating equipment.[114]

A.17.2 Wages

The entry-level wages for helpers within the construction trade are on par with the statewide average. Entry-level helpers in the construction trades and average entry-level workers in New York State both earn roughly $16 an hour. Experienced construction trade helpers, however, earn just $27 an hour, which

is significantly lower than the New York State average wage of $45 for experienced workers. Additionally, the median hourly wage for construction trade helpers is over $22 an hour, compared to the statewide median wage of nearly $25 an hour.[115]

Table A-33. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Helpers, Construction Trades, All Other (Annual)	$34,700	$47,100	$57,700
Helpers, Construction Trades, All Other (Hourly)	$16.66	$22.66	$27.74

A.17.3 Education, Experience, Skill Requirements, and Certifications

There are no educational requirements to begin working as a helper in a construction trade. These workers must have good communication skills to communicate effectively with other workers and supervisors to ensure their work is done safely and efficiently. Attention to detail is also important for this role, since helpers in construction trades must pay close attention to details to ensure that work is done correctly and to avoid errors that could lead to safety hazards and rework.

Of the current pool of New York State construction trade helpers, 39 percent have a high school diploma or equivalent but did not complete any college. About 34 percent have less than a high school diploma and 17 percent completed some college or a two-year degree. Of the remaining 10 percent of construction trade helpers, eight percent earned a four-year college degree and two percent earned a master's degree or more.[116]

There were 27 active job postings in New York State for all other helpers of construction trades between February 2022 through February 2023.[117] The current in-demand certification[118] from employers, based on these postings, is the following:

- driver's license

Because construction trades helpers assist skilled tradespeople in measuring, cutting, drilling, or assembling materials, it is important for them to have hands-on experience using power tools and related construction tools including tape measures. The most frequently required technical skills for helpers in the construction trades are included below:

- tape measures
- ability to lift 41-50 pounds
- ability to lift 51-100 pounds
- hand tools
- JavaScript

Figure A-48. Educational Attainment of Current Workers

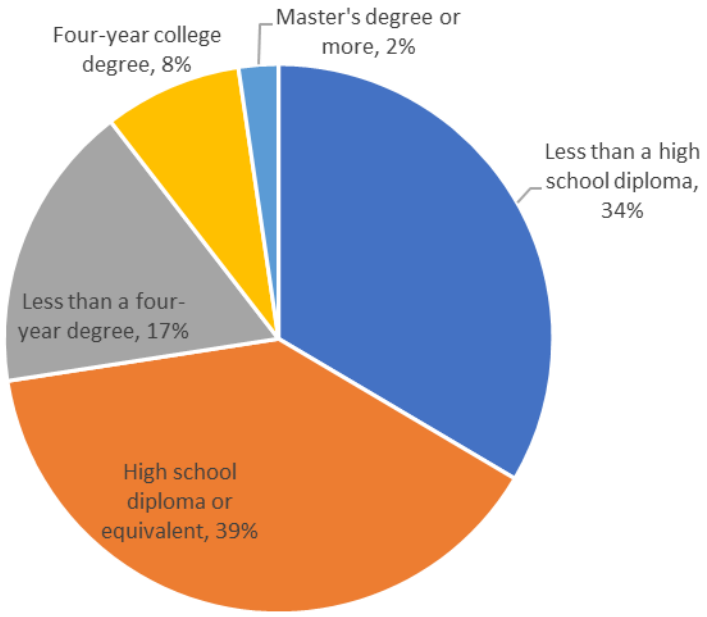
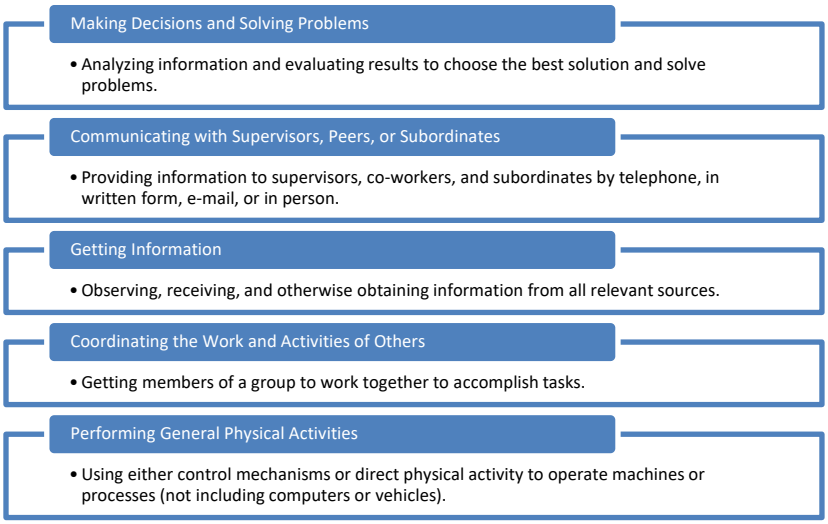


Figure A-49. Top Work Activities



A.17.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to helpers in the construction trades and could therefore more easily transition into one of these positions with minimal additional preparation. Jobs that could easily transition into a helper in the construction trades are largely found within the construction and extraction occupational group.[119]

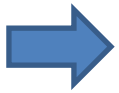
Transferrable occupations are listed in the below table and figure. A career as a helper in the construction trades is a good way for others with little construction experience to enter the offshore wind energy industry. Workers with experience measuring, cutting, drilling, or assembling materials and using machinery such as power drills, saws, and other power tools can easily transition to a career as a construction trade helper with minimal training. Because there is no entry-level education requirement to work as a helper in construction trades, there are no educational barriers for anyone working in the transferrable occupations.[120]

Table A-34. Transferable Occupations

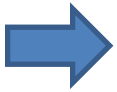
Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Helpers, Construction Trades, All Other	**1,550**	**$22.66**	**None**
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	10,686	$15.71	None
Farmworkers, Farm, Ranch, and Aquacultural Animals	6,266	$14.99	None
Tile and Stone Setters	5,089	$29.96	None
Insulation Workers, Floor, Ceiling, and Wall	1,227	$23.01	None
Reinforcing Iron and Rebar Workers	1,196	$33.37	High school diploma or equivalent.
Helpers--Electricians	4,349	$21.64	High school diploma or equivalent.
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	2,745	$18.48	High school diploma or equivalent.
Helpers--Roofers	218	$19.65	None
Fence Erectors	1,251	$21.75	None
Septic Tank Servicers and Sewer Pipe Cleaners	1,716	$22.86	High school diploma or equivalent.
Derrick Operators, Oil and Gas	77	$29.97	None
Continuous Mining Machine Operators	225	$31.56	None
Rock Splitters, Quarry	82	$21.20	None
Roustabouts, Oil and Gas	304	$24.23	None
Helpers--Installation, Maintenance, and Repair Workers	4,810	$19.15	High school diploma or equivalent.
Cleaners of Vehicles and Equipment	20,574	$16.66	None

Figure A-50. Career Transferability and Progression

Farmworkers and Laborers, Crop, Nursery, and Greenhouse
Farmworkers, Farm, Ranch, and Aquacultural Animals
Tile and Marble Setters
Insulation Workers, Floor, Ceiling, and Wall
Reinforcing Iron and Rebar Workers
Helpers--Electricians
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters
Helpers--Roofers
Fence Erectors
Septic Tank Servicers and Sewer Pipe Cleaners
Derrick Operators, Oil and Gas
Continuous Mining Machine Operators
Rock Splitters, Quarry
Roustabouts, Oil and Gas
Helpers--Installation, Maintenance, and Repair Workers
Cleaners of Vehicles and Equipment



Helpers, Construction Trades, All Other



Construction Laborers

A.18 Helpers—Installation, Maintenance, and Repair Workers

Summary: Helpers of installation, maintenance, and repair workers perform routine inspections on machinery and equipment; install replacement parts of machines and equipment; and make necessary adjustments to the wiring, tubing, or piping systems. These workers frequently perform tests on the machinery, equipment, and systems to make sure no malfunctions are present. They may also clean or lubricate machinery, equipment, vehicles, or tools. These workers know how to use various hand and power tools to complete their tasks. Helpers of installation, maintenance, and repair workers in the offshore wind energy industry work with wind turbine service technicians to complete routine maintenance and repairs on the turbines. In addition, they help ensure the turbines are cleaned and running effectively.

Jobs that could easily transition into an installation, maintenance, and repair helper position are largely found within the construction and extraction occupational group. Entry-level helpers earn slightly less than the average New York entry-level worker. The typical entry-level education requirement for this occupation is a high school diploma or equivalent. Individuals often learn the trade while on the job and sometimes in apprenticeships. Once experienced, they could transition into more advanced installation, maintenance, and repair positions or to other construction related occupations.

A.18.1 Job Description

Installation, maintenance, and repair helpers aid in the maintenance, replacement, and repair of machinery, and electrical and electronic equipment. These workers inspect various types of machinery or equipment for damage, defect, or wear; install required replacement parts; adjust wiring, piping, tubing, and other components; and test the machinery, equipment, and systems to ensure proper functioning. Helpers of installation, maintenance, and repair works may also perform cleaning or lubricating tasks for vehicles, machinery, equipment, tools, and other objects.

These workers often use hand tools, power tools, and cleaning equipment to complete their tasks. They are versatile laborers found in many industries and are integral to ensuring that the machinery and equipment in various industries are working effectively. Facility helper is another common job title for these workers. Installation, maintenance, and repair helpers in the offshore wind energy industry work with wind turbine service technicians to install, maintain, and repair various components of wind turbines and keep them clean and functioning properly.[121]

A.18.2 Wages

The entry-level, median, and experienced wages for installation, maintenance, and repair helpers in New York State are all less than the statewide averages. Entry-level helpers earn almost $16 an hour while experienced helpers earn over $23 an hour. The median hourly wage for helpers of installation, maintenance, and repair workers is a little over $19 an hour.[122]

Table A-35. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Helpers—Installation, Maintenance, and Repair Workers (Annual)	$33,000	$39,800	$48,400
Helpers—Installation, Maintenance, and Repair Workers (Hourly)	$15.86	$19.15	$23.28

A.18.3 Education, Experience, Skill Requirements, and Certifications

Entry-level education requirements for helpers of installation, maintenance, and repair workers are typically required to have a high school diploma or equivalent. Mathematics and science courses provide individuals learning this trade with familiarity in mechanics and blueprint reading. These workers often learn the trade while on the job alongside experienced colleagues, or in apprenticeships. On-the-job training can take anywhere from several months to a year.

Installation, maintenance, and repair helpers must be dependable, adaptable, and detail oriented to perform their job well. Dexterity, control precision, and multilimbed coordination are physical attributes helpful for these workers. Over time, these workers can transition into more advanced installation, maintenance, and repair positions and to other construction related occupations.

Of the current pool of installation, maintenance, and repair helpers in New York State, 33 percent have less than a high school diploma. Almost half, or 44 percent, have a high school diploma or equivalent. Approximately 16 percent have some college or a two-year degree while four percent of current workers have a four-year college degree. The remaining three percent have a master's degree or higher.[123]

Based on the 29 active job postings in New York State for general maintenance and repair workers from January 2022 through January 2023,[124] the current in-demand certifications from employers for those jobs are listed below[125] :

- Certified Electrical Safety Worker
- OSHA 10
- OSHA 30

Understanding common equipment and systems such as plumbing is frequently required of these workers so that they can perform routine maintenance and repairs on them. Use of various hand and power tools is a crucial part of this occupation, so employers often require these skills as well. In general, the following are the most frequently required technical skills for helpers of installation, maintenance, and repair workers:

- forklifts
- electrical components and systems
- mechanical and hydraulic systems
- fiber optic sensing and control systems
- hand and power tools
- cleaning tools

Figure A-51. Educational Attainment of Current Workers

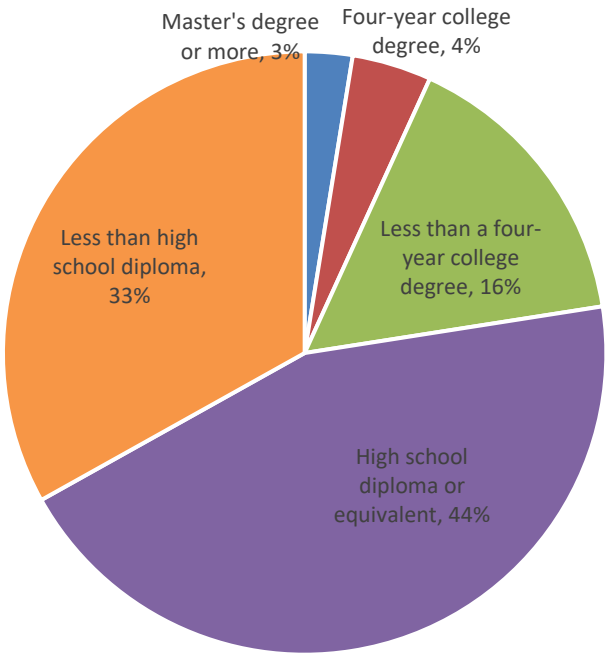
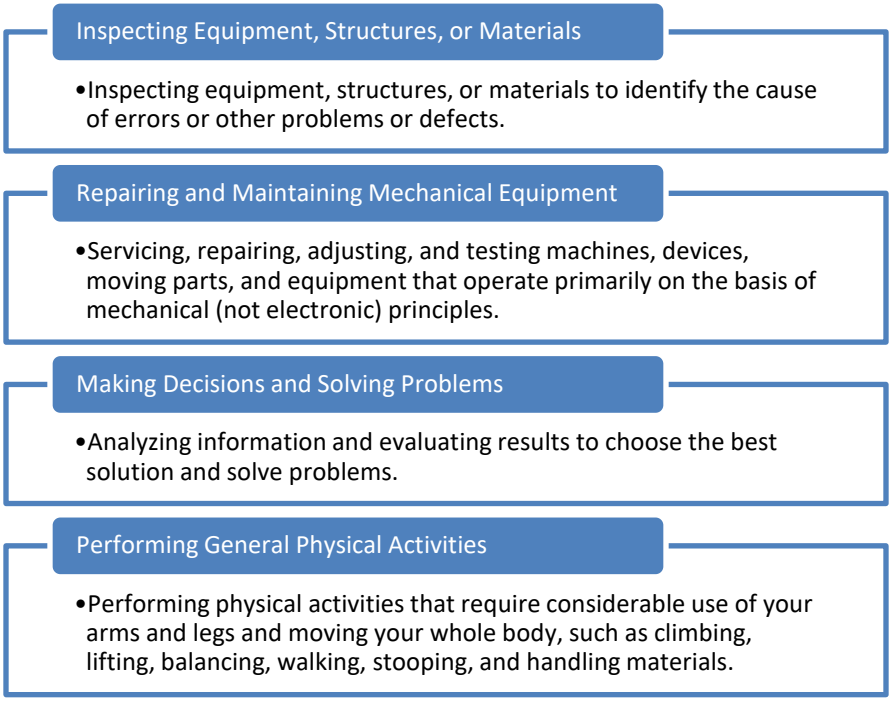


Figure A-52. Top Work Activities



A.18.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to installation, maintenance, and repair helpers and could therefore more easily transition into this helper position with minimal additional preparation. These jobs primarily come from the construction and extraction occupational group.[126]

The below table and figure feature workers who may find helper careers for installation maintenance, and repair workers to be good transition jobs into the offshore wind energy industry. Both pipelayers and helpers of electrician workers would need to learn the mechanics of machinery and equipment to add to their current electrical and plumbing skills and knowledge to make this transition. For those transitioning into the offshore wind energy industry, they would also need training in wind turbine components and systems.

Electrician helpers already meet the typical entry-level education requirements. Pipelayers may need to earn a high school diploma or equivalent if they do not already have one. Both electrician helpers and pipelayers would, however, see a decrease in their median hourly wages. This decrease would be significant for pipelayers.[127]

Table A-36. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Helpers—Installation, Maintenance, and Repair Workers	**4,810**	**$19.15**	**High school diploma or equivalent**
Pipelayers	344	$39.45	None
Helpers--Electricians	4,349	$21.64	High school diploma or equivalent.

Figure A-53. Career Transferability and Progression

A.19 Helpers—Production Workers

Summary: These helpers aid and increase the productivity of production workers. This could include supplying the production workers with the necessary materials or tools and keeping the equipment and production spaces clean. Those employed in the offshore wind energy industry help production workers who are specifically involved in the production of wind turbine components.

Jobs that could easily transition into production worker helper positions are primarily from the production occupational groups, along with a few other occupational groups. Entry-level helpers earn less than the statewide average entry-level wage. These individuals learn the necessary skills and industry- or technology-specific knowledge through hands-on experience. The typical entry-level education requirement for production worker helpers is a high school diploma or equivalent. As helpers in the offshore wind energy industry, these individuals become acquainted with the production processes and requirements specific to the industry. This experience can prepare them for other work in wind energy and advance into production worker, technician, quality control specialist, or other specialized roles.

A.19.1 Job Description

Production worker helpers are vital to the production processes in various industries. Overall, they assist production workers with multiple tasks including assembly processes, obtaining the necessary tools and materials, and checking the equipment that production workers use to ensure they are functioning properly. These helpers may need to perform physical labor duties such as lifting and carrying heavy materials or equipment, holding supplies for production workers, cleaning the work areas, and operating hand and power tools. They must be open to learning new skills and techniques related to their industry.

Offshore wind industry production worker helpers perform daily tasks similar to the helpers in other industries but specifically for the production of wind turbines. They may be involved in the production of the nacelles, blades, or generators, among other turbine components. They are essential for ensuring that these components are produced safely and efficiently. Because wind turbines are expensive pieces of equipment, their work is important for avoiding mistakes or malfunctions.[128]

A.19.2 Wages

The entry-level and median wages for production worker helpers in New York State are less than the statewide averages. Entry-level helpers earn almost $15 an hour while the State average wage for entry-level workers is just over $16 an hour. Experienced helpers can increase their entry-level wages to over $21 per hour, which is less than half of what experienced workers earn on average in the State. The median hourly wage for helpers of production workers is close to $18 an hour.[129]

Table A-37. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Helpers--Production Workers (Annual)	$30,700	$36,900	$43,800
Helpers--Production Workers (Hourly)	$14.77	$17.75	$21.08

A.19.3 Education, Experience, Skill Requirements, and Certifications

Entry-level production worker helpers are typically required to have a high school diploma or equivalent. While this role, in general, requires less skill and experience, a basic understanding of production processes and the common tools and equipment used for production is valuable for these workers. In addition, technical training provides a strong background for helpers which is commonly preferred by employers. This allows the workers to learn their specific role faster, which increases productivity.

Helpers need strong attention to detail and communication skills to excel in this position. They need to be open to learning new skills and techniques related to the industry in which they work while on the job. Production worker helpers need to be vigilant about safety and complete the Office of Safety and Health Administration (OSHA) safety training. For helpers specifically in the offshore wind industry, training related to wind turbine maintenance is valuable.

Of the current pool of production worker helpers in New York State, 47 percent have a high school diploma or equivalent and 22 percent have less than a high school diploma. Another 17 percent have some college or a two-year degree. About one in ten helpers have a four-year degree and a small percentage, or five percent, have a master's degree or higher.[130]

There were 36 active job postings in New York State for helpers of production workers between February 2022 and February 2023.[131] Below are some of the current in-demand certifications from employers:

- OSHA 10
- OSHA 30
- first aid certification

Because these helpers assist production workers with various day-to-day tasks, they should have a basic understanding of manufacturing processes. In the offshore wind energy industry, they help production workers who manufacture wind turbine components that are large and heavy which may require helpers to lift and carry the components or operate equipment to handle the components. The most frequently required technical skills for helpers of production workers are included below:

- manufacturing
- tape measures
- mechanical
- boilers
- forklifts
- keyboarding/typing
- 5S
- ability to lift 31-40 pounds
- ability to lift 41-50 pounds

Figure A-54. Educational Attainment of Current Workers

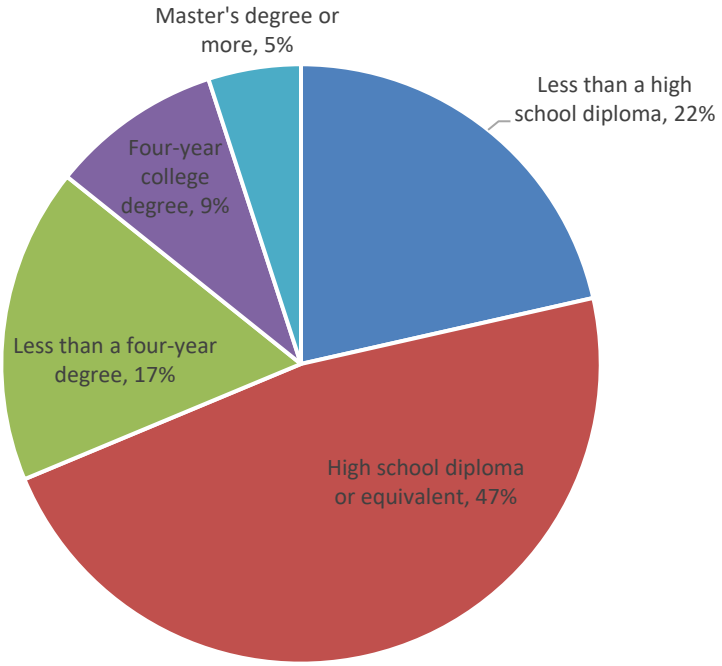


Figure A-55. Top Work Activities

Handling and Moving Objects

- Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Performing General Physical Abilities

- Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling materials.

Controlling Machines and Processes

- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).

Identifying Objects, Actions, and Events

- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

A.19.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to production helpers and could therefore more easily transition into a helper job with minimal additional preparation. Jobs that could easily transition into a production worker helper position are largely found within the following major occupational groups: food preparation and serving related; production; farm, fishing, and forestry; and construction and extraction.[132]

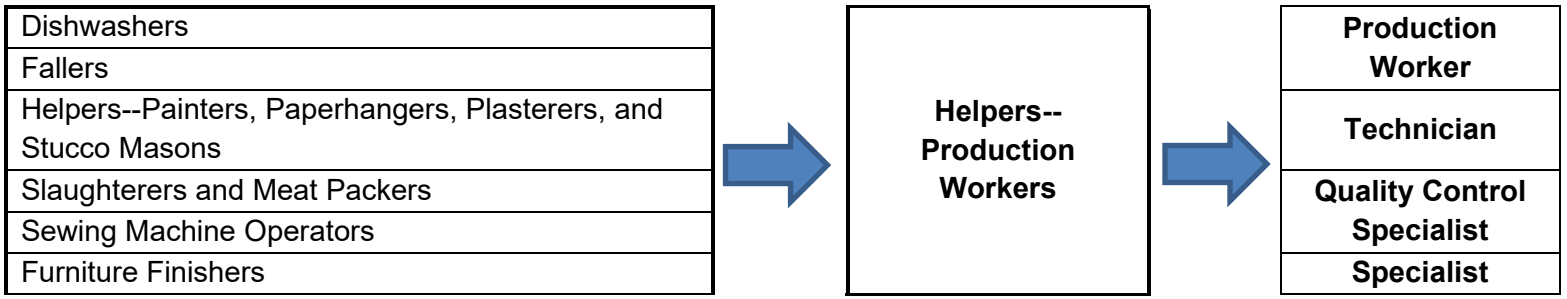
These transferrable occupations can easily begin working as production worker helpers because they typically complete manual labor in their current positions and are involved with machine operations or production processes already. Since helpers of production workers do not need prior experience before starting their roles, this position is a great entry point into the offshore wind energy industry for these other workers. They would begin learning about the offshore wind energy production processes and wind turbine construction to prepare them for other occupations in the industry.

Except for fallers and furnisher finishers, all transferrable occupations would see an increase in the median hourly wage if they made this career transition. They would also meet the typical entry-level education requirement upon transitioning. Dishwashers, sewing machine operators, slaughterers, and meat packers as well as helpers of painter, paperhangers, plasterers, and stucco masons may not already meet the education requirement for production helpers. They would need to earn a high school diploma or equivalent if they do not already have one. Earning a high school diploma or equivalent and gaining the frequently required technical skills are the biggest barriers for individuals entering this occupation.[133]

Table A-38. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Helpers--Production Workers	6,447	$17.75	High school diploma or equivalent.
Dishwashers	26,393	$16.28	None
Fallers	121	$18.24	High school diploma or equivalent.
Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	485	$16.46	None
Slaughterers and Meat Packers	751	$17.07	None
Sewing Machine Operators	7,571	$16.58	None
Furniture Finishers	856	$20.11	High school diploma or equivalent.

Figure A-56. Career Transferability and Progression



A.20 Industrial Engineers

Summary: Industrial engineers study production processes and identify ways to increase the efficiency and productivity of them. They must study the industry, regulations, and the systems involved in production to identify the places where there is waste and room for improvement. These engineers then use mathematical methods and models to plan out new systems or system changes that will reduce time, money, and other hindrances they identified. Industrial engineers who work in the offshore wind energy industry study and improve the wind turbine production processes. They must develop an expertise in offshore wind energy production regulations, the turbine component requirements and specifications, and the various steps involved in manufacturing the turbines.

Jobs that could easily transition into an industrial engineering position are largely found within the architecture and engineering occupational group. Entry-level and experienced industrial engineers earn more than the statewide average wages of entry-level and experienced workers, respectively. The typical entry-level education requirement for industrial engineers is a bachelor's degree. They learn the necessary skills and concepts in these degree programs and sometimes hands-on experience, and then continue refining their expertise while on the job. Industrial engineers can advance into technical specialist positions, also called engineering and technician supervisors, once experienced.

A.20.1 Job Description

Industrial engineers are essential to production processes found in many industries because they work to improve the efficiency and productivity of these processes. They review schedules, specifications, and systems to identify wastefulness and places where adjustments can be made. Some specialize in improving manufacturing processes specifically. These workers consider available workers, supplies, time, and technologies as well as costs and constraints. Using mathematical methods and models, industrial engineers develop new systems to reduce costs, delays, and other problems in production processes while meeting product requirements. Sometimes they are also involved in financial planning and analysis related to production processes. They may be employed by private companies, governments, or nonprofit organizations.[134]

Wind industry industrial engineers are involved with improving the production processes of wind turbines and their components. Their goal is to increase productivity while decreasing costs and waste in the production and manufacturing of wind turbines. They must have a comprehensive understanding of the turbine system and component designs and the technologies used to manufacture them. It is equally important for industrial engineers in the offshore wind energy industry to know the regulations and requirements related to the production of wind turbines.

A.20.2 Wages

Entry-level industrial engineers earn roughly $33 an hour which is more than double the average entry-level worker wage in New York State. Experienced industrial engineers can increase their entry-level wages to earn $58 an hour. This wage is higher than the state average for experienced workers. The median hourly wage for industrial engineers in the State is close to $47 an hour.[135]

Table A-39. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Industrial Engineers (Annual)	$68,800	$97,300	$120,800
Industrial Engineers (Hourly)	$33.06	$46.79	$58.08

A.20.3 Education, Experience, Skill Requirements, and Certifications

Entry-level industrial engineers in New York State typically need a bachelor's degree. While there are four-year degree programs in industrial engineering, individuals with mechanical, electrical, manufacturing, or general engineering bachelor's degrees often become industrial engineers. Basic skills in mathematics, computer science, and science are useful in this occupation. Advanced courses in statistics, production systems planning, and manufacturing systems design are often part of college degree programs. In addition, cooperative education programs are valuable in providing students with hands-on experience alongside their educational instruction.

In addition to experience and education, industrial engineers must have strong problem-solving and critical thinking skills. Industrial engineers need to be able to communicate their ideas and designs coherently so that the production workers can effectively implement the changes. They also need to be creative when designing the changes because the best solutions often depend on the setting.

Individuals in engineering occupations may attain a Professional Engineering license to demonstrate their competency and expertise. In New York State, engineers may earn this license if they can prove they are of good moral character, are older than 21 years old, and meet the education, examination, and experience requirements. The education requirement involves having a degree from an ABET-accredited college or university.

Of the current pool of industrial engineers in New York State, 53 percent have a four-year college degree while 30 percent have a master's degree or higher. Less than 0.05 percent of current industrial engineers have less than a high school diploma and four percent have earned up to a high school diploma or equivalent. The remaining 13 percent have some college or a two-year degree.[136]

There were 3,113 active job postings in New York State for industrial engineers between February 2022 and February 2023.[137] The current in-demand certifications[138] from employers include the following:

- Certified Quality Engineer (CQE)
- Six Sigma Green Belt Certification (SSGB)
- Certified Quality Auditor (CQA)
- Engineer in Training (EIT)
- Certified Six Sigma Blackbelt (CSSBB)
- Six Sigma Black Belt (ICBB)
- Certified Manager of Quality/Organizational Excellence (CMQ/OE)
- driver's license
- licensed professional engineer

Because industrial engineers evaluate production processes, they must have a comprehensive understanding of manufacturing operations. Skills in Microsoft Office applications are often preferred by employers because industrial engineers can utilize the software to organize and share their ideas and designs. Additionally, many employers prefer that their industrial engineering workers are familiar with Lean Six Sigma, a team-focused method to reduce wastefulness and improve system performance in collaborative ways. In general, the most frequently required technical skills for industrial engineers include:

- manufacturing
- Microsoft Excel
- Lean Six Sigma
- computer programming/coding
- Lean Manufacturing
- Statistical Process Control (SPC)
- Agile

Figure A-57. Educational Attainment of Current Workers

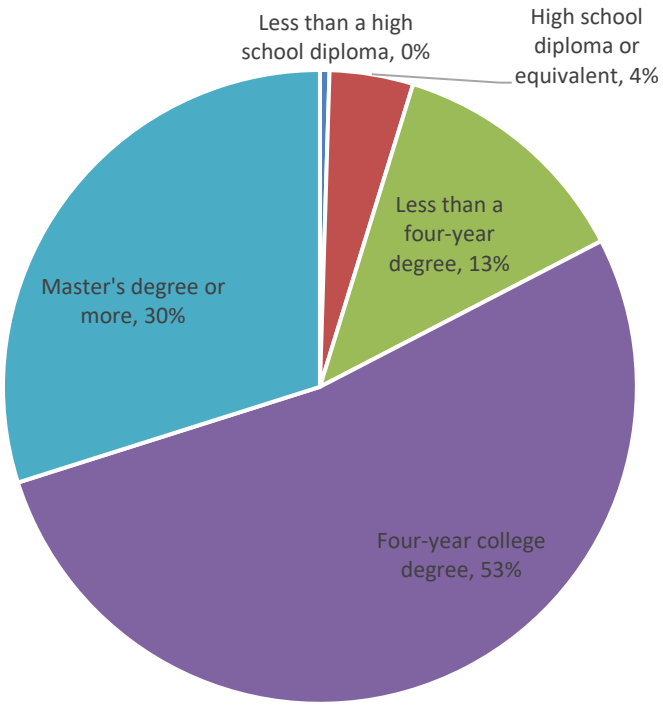
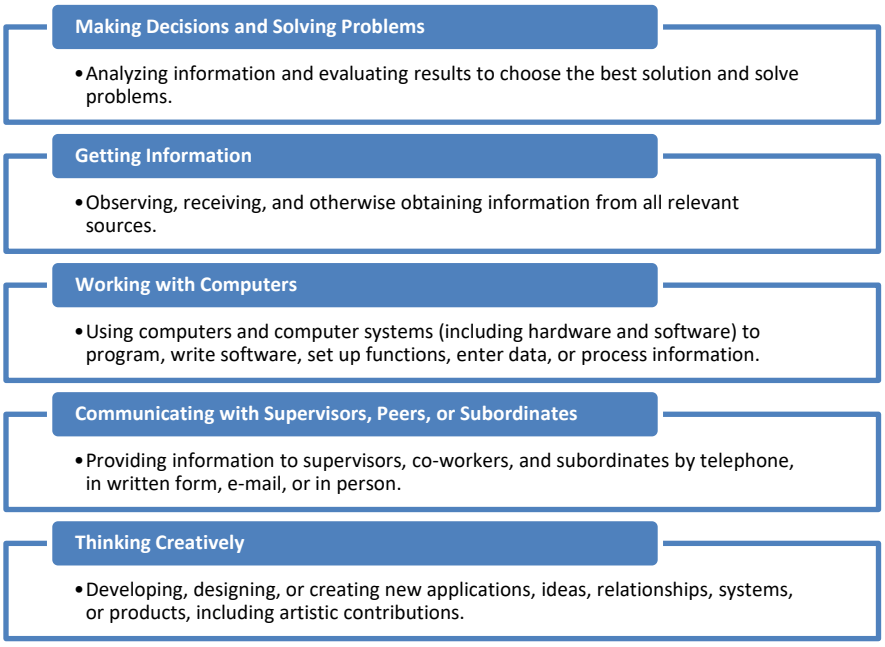


Figure A-58. Top Work Activities



A.20.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to industrial engineers and could therefore more easily transition into an industrial engineering job with minimal additional preparation. These transferrable jobs primarily come from the architecture and engineering occupational group as well as the arts, design, entertainment, sports, and media occupational group.[139]

Materials engineers must understand the materials required and the manufacturing processes for the materials based on the material designs and specifications. This familiarity with manufacturing will aid these engineers in transitioning into industrial engineering. Miscellaneous engineers have general engineering training and experience that is transferrable to this occupation since workers who have earned mechanical, electrical, manufacturing, or general engineering degrees may be found in industrial engineering positions.

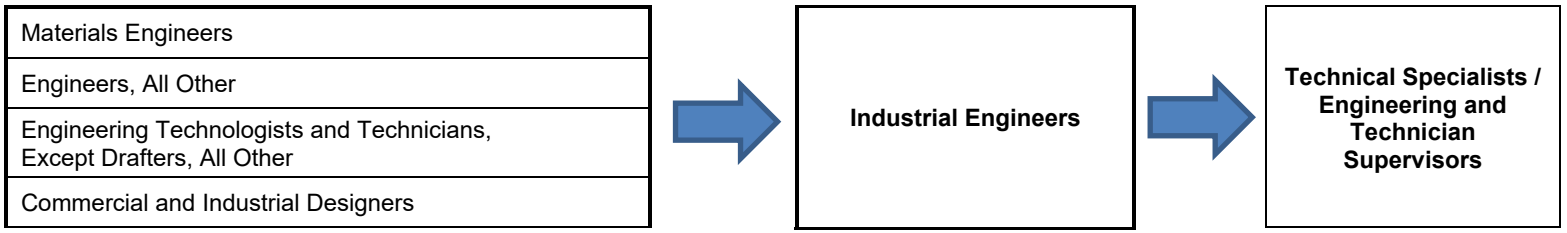
Miscellaneous engineering technologists and technicians who are not drafters would likely not already have a bachelor's degree and would need to earn one if they transitioned into an industrial engineering career. This is a strong barrier since working toward a four-year degree requires a significant time and money commitment. While commercial and industrial designers would meet the typical entry-level education requirement of industrial engineers in New York State and excel in the system design aspect of an industrial engineering role, they would likely have a bachelor's degree specific in design, not engineering. Both transferrable occupations would see an increase in their median hourly wages in this career transition.

The median hourly wage for materials engineers and miscellaneous engineers would decrease by roughly $7 and $8, respectively. In addition, all transferrable occupations would need to gain experience and expertise in the wind energy industry if they were to become offshore wind industrial engineers in order to properly evaluate and improve wind turbine production processes.[140]

Table A-40. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Industrial Engineers	**11,900**	**$46.79**	**Bachelor's degree**
Materials Engineers	719	$53.90	Bachelor's degree
Engineers, All Other	6,072	$54.46	Bachelor's degree
Engineering Technologists and Technicians, Except Drafters, All Other	2,420	$29.51	Associate degree
Commercial and Industrial Designers	1,937	$39.88	Bachelor's degree

Figure A-59. Career Transferability and Progression



A.21 Industrial Production Managers

Summary: Industrial production managers are involved with managing the operations at manufacturing facilities. They may be referred to as plant managers or quality control system managers since they are responsible for ensuring that the products manufactured under their management meet the specifications and do not have any defects. More specifically, these managers make decisions on hiring and assigning workers, the budget and timeline of production, and the overall production processes. In the offshore wind industry, industrial production managers are responsible for overseeing the production processes of wind turbine components.

Easily transferrable occupations for industrial production managers are found in the following major occupational groups: management; farming, fishing, and forestry; installation, maintenance, and repair; production; and transportation and material moving. Entry-level and experienced industrial production managers earn more than average entry-level and experienced workers in New York State. The typical entry-level education requirement for industrial production managers is a bachelor's degree. Once experienced, they can advance to other supervisory positions such as supply chain director, operations director, and vice president of operations.

A.21.1 Job Description

Industrial production managers carry out many responsibilities related to manufacturing and production plants. Their goals include ensuring productivity, safety, and accuracy at the plants they oversee. They are found in various industries including auto, technology, and energy. Quality control is extremely important that sometimes industrial production managers are called quality control managers. They work to eliminate the production of any defective goods or materials that are manufactured. They may be called plant managers as well. Hiring workers, analyzing production data, and creating project plans are other common duties of industrial production managers.

Industrial production managers who work in the offshore wind energy industry specifically oversee the production of wind turbine components manufactured at production plants. High productivity at these plants is important for increasing the capacity and effectiveness of offshore wind farms. Industrial production managers' quality control checks are vital in this industry because any malfunction or defect can be costly.[141]

A.21.2 Wages

Entry-level industrial production managers earn just over $43 an hour which is roughly $27 an hour higher than the State average for entry-level workers. Industrial production managers can increase their wages to a little over $82 an hour once experienced, which is almost double the state average for New York State experienced workers. The median hourly wage for these managers is just under $63 an hour.[142]

Table A-41. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Industrial Production Managers (Annual)	$89,800	$131,000	$171,000
Industrial Production Managers (Hourly)	$43.19	$62.98	$82.20

A.21.3 Education, Experience, Skill Requirements, and Certifications

The typical education requirement for entry-level industrial production managers is a bachelor's degree. This degree is often related to business administration or industrial engineering. Years of experience and graduate degrees are also commonly preferred by employers. Some industrial production managers start by working in the production industry as a production worker and later take on additional leadership or supervisory roles before becoming managers. They must understand the plant's production processes, policies, and safety regulations to earn this management position.

As they gain experience in the role, industrial production managers may earn certificates that are available to demonstrate their abilities. These include the American Society of Quality certifications related to quality control and Six Sigma certifications. Industrial production managers need strong organization, leadership, business, and problem-solving skills to excel in this position. It is with these skills that they can ensure their plants are safe and productive and are outputting limited errors or defects.

Of the current pool of industrial production managers in New York State, only three percent have less than a high school diploma. Roughly four in 10 have a four-year college degree and 21 percent have a master's degree or higher. Another 21 percent have some college or a two-year degree while 16 percent have at most a high school diploma or equivalent.[143]

There were 1,207 active job postings in New York State for industrial production managers between February 2022 and February 2023.[144] Listed below are some of the current in-demand certifications from employers[145]:

- Certified Quality Engineer (CQE)
- Six Sigma Green Belt Certification (SSGB)
- Certified Quality Auditor (CQA)
- Certified Welding Inspector (CWI)
- driver's license
- Project Management Professional (PMP)
- Six Sigma Black Belt
- Certified Purchasing Professional (CPP)
- Certified Master Black Belt

Since industrial production managers oversee production and manufacturing plants, they must have an expertise in manufacturing processes. Employers typically prefer these managers to have experience with Microsoft Office for organization and communication purposes. Familiarity with Lean Six Sigma, a team-focused method to reduce wastefulness and improve system performance, is also useful for increasing productivity. In general, the following are the most frequently required technical skills for industrial production managers:

- manufacturing
- Microsoft Excel
- Lean Six Sigma
- internal auditing
- Lean Manufacturing
- SAP

Figure A-60. Educational Attainment of Current Workers

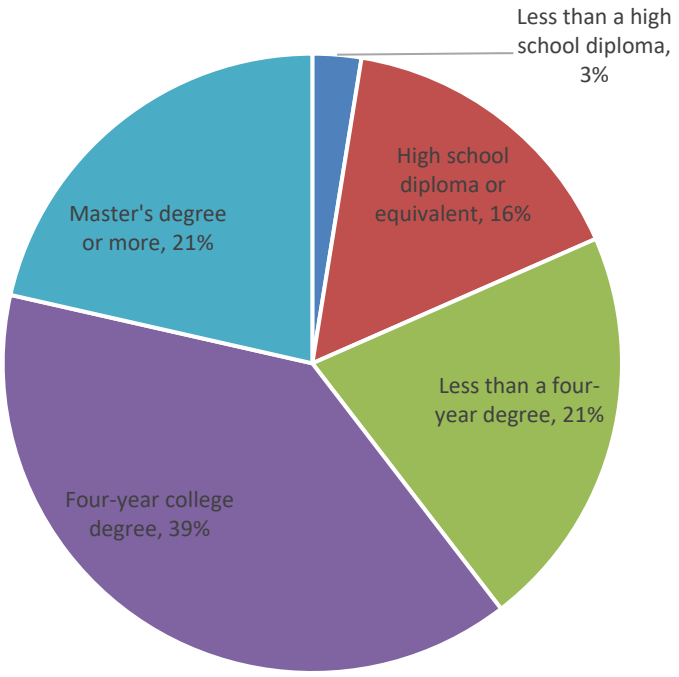


Figure A-61. Top Work Activities

Making Decisions and Solving Problems

- Analyzing information and evaluating results to choose the best solution and solve problems.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Working with Computers

- Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.

Communicating with Supervisors, Peers, or Subordinates

- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

Monitoring Processes, Materials, or Surroundings

- Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

A.21.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to industrial production managers and could therefore more easily transition into this manager job with minimal additional preparation. Jobs that could easily transition into an industrial production manager position are found within the following major occupational groups: management; farming, fishing, and forestry; installation, maintenance, and repair; production; and transportation and material moving.[146]

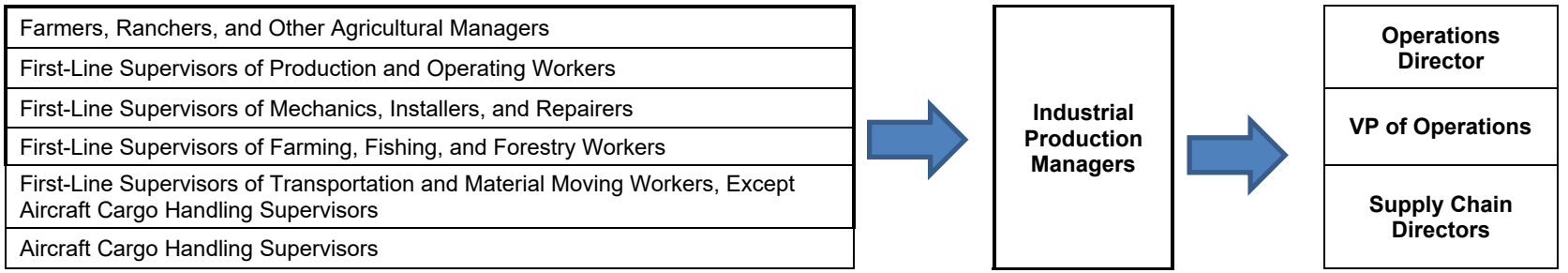
Transition into this occupation requires a combination of soft skills in management and organization, and hard skills in industrial production such as quality control and an understanding of manufacturing standards. Similar occupations or Industrial Production Managers in other industries also require knowledge of OSW-specific processes and components to enter the industry. The major barrier to performing the duties of an Industrial Production Manager in the offshore wind industry is the educational requirement of a four-year degree. Supervisors of construction, production, and manufacturing activities possess similar skills to those required of an Industrial Production Manager, but the time and cost required to obtain a four-year degree presents a challenge to workers in transferable occupations.

All transferrable occupations would earn a median hourly wage higher than their current wage if they transitioned into industrial production management roles. They would, however, need to earn four-year degrees or demonstrate their expertise in production processes and leadership.[147]

Table A-42. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Industrial Production Managers	**5,758**	**$62.98**	**Bachelor's degree**
Farmers, Ranchers, and Other Agricultural Managers	16,537	$31.60	High school diploma or equivalent.
First-Line Supervisors of Production and Operating Workers	24,836	$35.59	High school diploma or equivalent.
First-Line Supervisors of Mechanics, Installers, and Repairers	31,406	$38.43	High school diploma or equivalent.
First-Line Supervisors of Farming, Fishing, and Forestry Workers	1,177	$29.22	High school diploma or equivalent.
First-Line Supervisors of Transportation and Material Moving Workers, Except Aircraft Cargo Handling Supervisors	34,051	$30.31	High school diploma or equivalent.
Aircraft Cargo Handling Supervisors	513	$35.04	High school diploma or equivalent.

Figure A-62.Career Transferability and Progression



A.22 Inspectors, Testers, Sorters, Samplers, and Weighers

Summary: These workers inspect, test, sort, sample, or weigh parts or products for defects or wear. These products may have been machined, fabricated, or assembled. They ensure quality control of the materials, products, or equipment produced. They use various measurement techniques, ensure products are matching the specifications, and discard or reject any product that does not meet the standards. Accuracy and precision are vital, especially when the products are complex and expensive pieces of machinery, such as those in the wind energy industry. Inspectors, testers, sorters, samplers, and weighers help reduce the risk of mistakes or malfunctions. In the wind energy industry, mistakes or malfunctions can be costly.

Jobs that could easily transition into an inspector, tester, sorter, sampler, or weigher position are largely found within the office and administrative support and the production occupational groups. Entry-level workers in this occupation earn approximately the same as the statewide entry-level average. The typical entry-level education requirement for this occupation is a high school diploma or equivalent. Individuals often learn the trade from experienced workers while on the job and some learn in apprenticeships. Once experienced, they may train new workers or transition into supervisory or manager positions.

A.22.1 Job Description

Inspectors, testers, sorters, samplers, and weighers are essential to the production process to ensure accuracy and proper functioning of products. In general, these workers inspect, test, sort, sample, or weigh machined, fabricated, or assembled parts or products for defects, or wear and tear. In this job, workers measure products or materials in many ways including measuring the dimensions, weight, and number of subcomponents, to verify conformance to the industry standards and specifications. They discard or reject products that do not meet the required specifications. Other common job titles include quality inspector, receiving inspector, and quality assurance technician.

In the offshore wind energy industry, it is vital that the specialized wind turbine components match the design specifications exactly to avoid the risk of malfunctions. Any mistake can be costly since the turbines are complex and expensive pieces of machinery. Wind turbine production workers may be employed by various third-party suppliers of wind turbine components or by original equipment manufacturers.[148]

A.22.2 Wages

The entry-level wage for inspectors, testers, sorters, samplers, and weighers in New York State is a little over $16 an hour and is almost the same as the statewide averages. Inspectors, testers, sorters, samplers, and weighers can increase their wages to over $28 an hour when they become experienced. The experienced wage for these workers is, however, significantly less than the average State experienced-level wage. The median hourly wage for inspectors, testers, sorters, samplers, and weighers in New York State is roughly $22.50 an hour. [149]

Table A-43. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Inspectors, Testers, Sorters, Samplers, and Weighers (Annual)	$33,800	$46,700	$58,600
Inspectors, Testers, Sorters, Samplers, and Weighers (Hourly)	$16.24	$22.46	$28.16

A.22.3 Education, Experience, Skill Requirements, and Certifications

Typically, entry-level inspectors, testers, sorters, samplers, and weighers must have a high school diploma. Programs or courses in math, engineering, and science teach students units of measurement, instruments used for measuring, and the functions and characteristics of raw materials. They can also provide workers with an understanding of basic manufacturing and production processes. Mechanical knowledge is also helpful for inspectors, testers, sorters, samplers, and weighers since they work with various machines and tools.

Typically, on-the-job training for general manufacturing and production workers can take a few months to a year. Entry-level employees work alongside experienced colleagues to learn their duties and role. Some inspectors, testers, sorters, samplers, and weighers may learn the trade through apprenticeships.

Of the current pool of inspector, tester, sorter, sampler, and weigher workers in New York State, seven percent have less than a high school diploma and 34 percent have a high school diploma or equivalent. Approximately three in 10 have some college or a two-year degree. Around two in 10 New York State inspectors, testers, sorters, samplers, and weighers have a four-year college degree while seven percent have a master's degree or higher. [150]

Based on 2,522 active job postings in New York State for mechanical insulation workers from January 2022 through January 2023,[151] the following are the current in-demand certifications from employers[152]:

- IPC-A-610 Acceptability of Electronic Assemblies (IPC-A-610)
- Certified Welding Inspector (CWI)
- certified welder
- OSHA 10
- Society for Protective Coatings Certification (SSPC)

Understanding manufacturing processes is important for inspectors, testers, sorters, samplers, and weighers to have in a production occupation. They must be familiar with various units of measurements and know how to use measurement instruments to complete their typical duties. Listed below are the most frequently required technical skills for inspectors, testers, sorters, samplers, and weighers:

- manufacturing
- Microsoft Excel
- micrometers
- gauges

Figure A-63. Educational Attainment of Current Workers

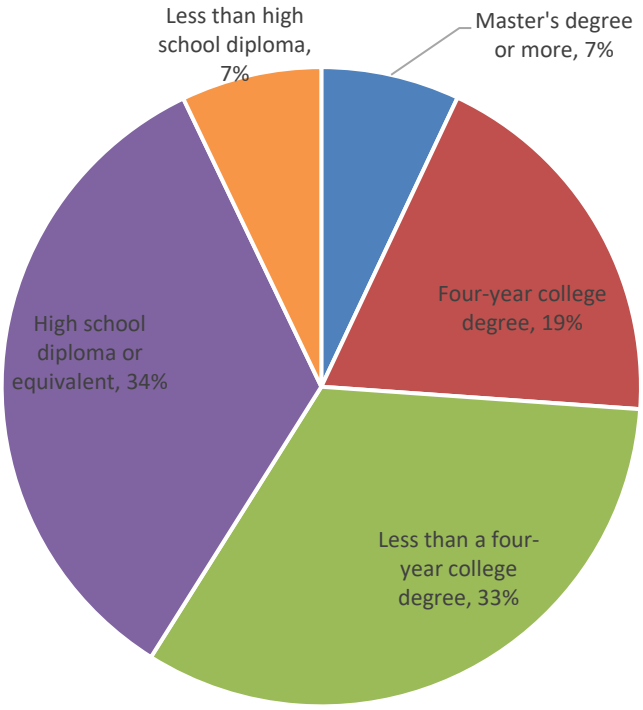


Figure A-64. Top Work Activities

Monitoring Processes, Materials, or Surroundings

- Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

Inspecting Equipment, Structures, or Materials

- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

Identifying Objects, Actions, and Events

- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

Documenting/Recording Information

- Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.

Communicating with Supervisors, Peers, or Subordinates

- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

A.22.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to inspectors, testers, sorters, samplers, and weighers and could therefore more easily transition one of these positions with minimal additional preparation. Jobs most transferrable are found within the office and administrative support occupational group and the production occupational group.[153]

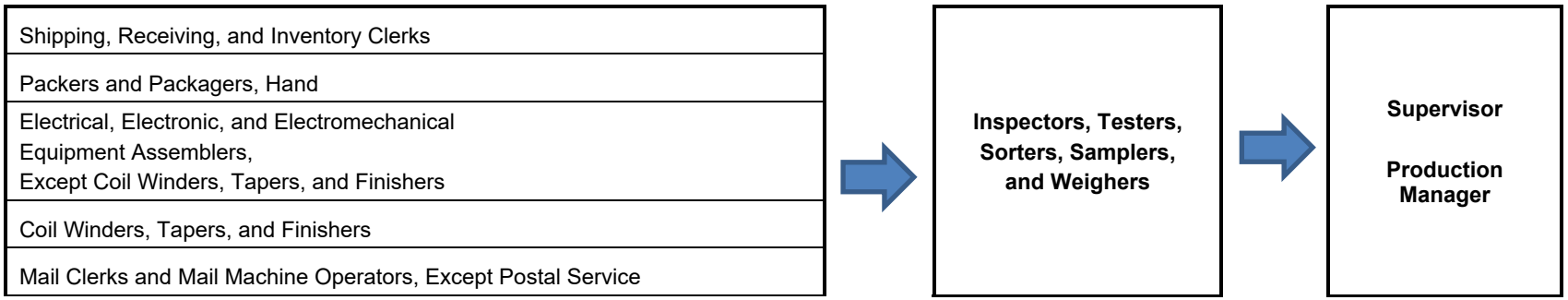
The below table and figure feature workers who may find inspector, tester, sorter, sampler, and weigher careers to be good transition jobs into the offshore wind energy industry. Precision and detail orientation are skills that workers employed in these transferrable occupations must practice in their current work and can utilize as inspectors, testers, sorters, samplers, and weighers. Hand packers and packagers and shipping clerks use various measurement units and instruments while mail clerks and operators often record and sort incoming and outgoing mail.

All transferable occupations listed would see a wage increase in this transition. Hand packers and packagers would see the largest rise in median hourly wages, of almost $6 an hour. Most workers would already meet the typical entry-level education requirement for inspectors, testers, sorters, samplers, and weighers. Hand packers and packagers would need to earn a high school diploma or equivalent, if they do not already have one, to make the transition.[154]

Table A-44. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022, Q3	Typical Entry-Level Education
Inspectors, Testers, Sorters, Samplers, and Weighers	**22,545**	**$22.46**	**High school diploma or equivalent**
Shipping, Receiving, and Inventory Clerks	32,255	$19.87	High school diploma or equivalent.
Packers and Packagers, Hand	23,495	$16.60	None
Electrical, Electronic, and Electromechanical Equipment Assemblers, Except Coil Winders, Tapers, and Finishers	13,088	$18.46	High school diploma or equivalent.
Coil Winders, Tapers, and Finishers	615	$19.55	High school diploma or equivalent.
Mail Clerks and Mail Machine Operators, Except Postal Service	6,715	$18.19	High school diploma or equivalent.

Figure A-65. Career Transferability and Progression



A.23 Laborers and Freight, Stock, and Material Movers, Hand

Summary: Hand laborers and freight, stock, and material movers are often called "pickers" and are frequently employed in warehouses. In general, these workers move various materials going into production or storage processes. They load or unload the materials onto or from machines, trucks, ships, containers, and other production or storage equipment and spaces. Physical abilities including strength, stamina, and hand-eye coordination are needed in this occupation to perform the labor fully, carefully, and accurately. Wind energy industry pickers handle heavy and expensive wind turbine components and sub-components in the production and manufacturing processes of the industry. They are involved in moving these materials from manufacturing sites and factories to the assembly sites.

Jobs that could easily transition into hand laborer and freight, stock, and material mover positions are found in the protective service, office and administrative support, and installation, maintenance, and repair occupational groups. Entry-level and experienced hand laborers and material movers earn less than the New York averages for entry-level and experienced workers. Pickers in the offshore wind energy industry learn about wind turbine components and processes in this role. These individuals do not need to meet an entry-level education requirement and they learn the necessary skills typically through on-the-job training. Later, they become experienced workers or could transition into a supervisor role.

A.23.1 Job Description

Hand laborers and freight, stock, and material movers perform manual labor and are important workers in many production and storage processes. In general, these workers move freight, stock, and other materials to or from machines, production areas, storage areas, loading docks, containers, or various types of vehicles including trucks and ships. Often, they are found working in warehouses. Hand laborers and freight, stock, and material movers must have good hand-eye coordination and physical strength and stamina to move objects that are potentially large and heavy.

Another common job title for a hand laborer and freight, stock, and material mover is a "picker." Pickers in the offshore wind energy industry may be found in warehouses containing wind turbine components and sub-components; loading and unloading the turbine materials onto and from containers, trucks, or

ships; and identifying and tracking the materials they are moving. They are essential in getting the turbine components and sub-components from factories to the construction sites or staging ports for assembling. Since wind turbines and their components are very expensive and heavy, these workers must ensure that the materials are moved securely and safely.[155]

A.23.2 Wages

The wages for pickers in New York State are less than the statewide averages. Entry-level hand laborers and freight, stock, and material movers earn roughly $1 an hour less than the average wage for entry-level workers in the State. Experienced hand laborers and freight, stock, and material movers can increase their entry-level wages to almost $22 per hour, though they will earn less than half of what experienced workers earn on average. The median hourly wage for these workers is just over $18 an hour.[156]

Table A-45. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Laborers and Freight, Stock, and Material Movers, Hand (Annual)	$31,800	$37,800	$45,700
Laborers and Freight, Stock, and Material Movers, Hand (Hourly)	$15.28	$18.17	$21.95

A.23.3 Education, Experience, Skill Requirements, and Certifications

There is no “typical” entry-level education requirement for these laborers and experience is not necessarily required either. Many new workers can learn how to perform these tasks within one month of on-the-job training from supervisors or experienced workers, and some learn within only a few days. They are trained according to the Occupational Safety and Health Administration (OSHA) standards. It is important that these hand laborers and material movers are physically able to perform the tasks required.

Pickers must exercise caution when they move or manipulate objects that could be heavy, large, or both. Since these workers are commonly found in warehouses, employers may prefer that their employees have a forklift certification or other warehouse equipment certifications. Hand laborers and freight, stock, and material movers with a commercial driver’s license, which requires passing written, vision, and driving tests, are also appealing to employers.

Of the current pool of hand laborers and freight, stock, and material movers in New York State, 16 percent have less than a high school diploma. Almost half, or 48 percent, of these workers have a high school diploma or equivalent and 24 percent have completed some college or have a two-year degree. About one in 10 pickers have a four-year college degree while two percent have a master's degree or higher.[157]

There were 11,627 active job postings in New York State for hand laborers and freight, stock, and material movers between February 2022 and February 2023.[158] Listed below are some of the current, in-demand certifications from employers[159]:

- driver's license
- forklift certified
- Commercial Driver's License (CDL)
- HAZMAT
- OSHA 10
- Class A Commercial Driver's License (CDL-A)
- Class B Commercial Driver's License (CDL-B)

Hand laborers and freight, stock, and material movers are responsible for moving and manipulating objects that may be heavy, so they must have physical strength and stamina to lift and carry the objects. Due to the costly element of wind turbine components and sub-components these workers must be reliable, diligent, and attentive to avoid any damage to the objects they handle. The ability to operate common warehouse equipment such as forklifts, pallet jacks, and hand trucks is important for these laborers who often work in warehouses. The following are most frequently required technical skills for hand laborers and freight, stock, and material movers:

- ability to lift 51-100 pounds
- ability to lift 41-50 pounds
- forklifts
- pallet jacks
- hand trucks
- JavaScript
- manufacturing
- stand-up forklifts
- inventory control
- Microsoft Excel

Figure A-66. Educational Attainment of Current Workers

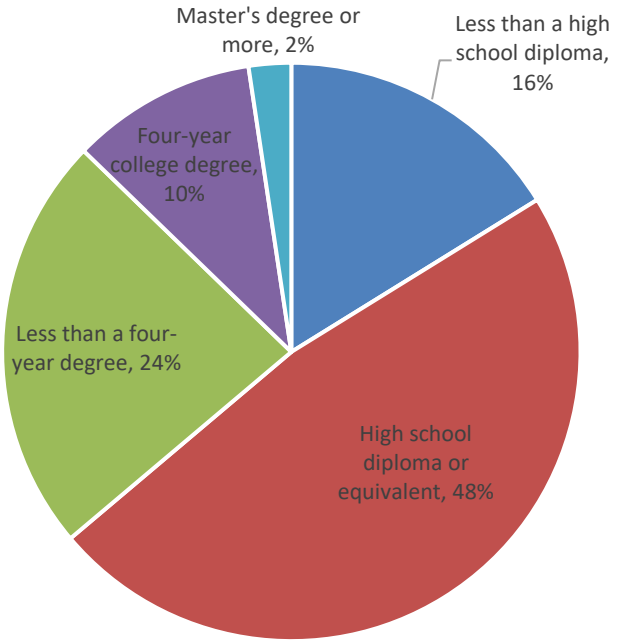


Figure A-67. Top Work Activities

Performing General Physical Activities

- Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling materials.

Handling and Moving Objects

- Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.

Operating Vehicles, Mechanized Devices, or Equipment

- Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or watercraft.

Controlling Machines and Processes

- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).

Identifying Objects, Actions, and Events

- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

A.23.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to hand laborers and freight, stock, and material movers and could therefore more easily transition into one of these positions with minimal additional preparation. These workers come from the protective service, office and administrative support, and installation, maintenance, and repair occupational groups.[160]

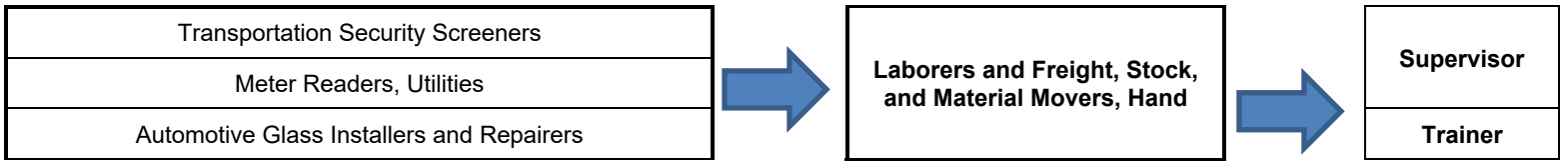
Pickers may be seen as a good position to enter the offshore wind energy industry for workers featured in the below tables. They would learn the types of materials required for the development of wind turbines and how phases of the manufacturing and production processes run, which can enable them to later transition into other roles in the wind energy industry. Diligence and attention to detail are important qualities in these transferrable occupations and will aid these workers in the wind energy industry, too. Automotive glass installers and repairers would meet the physical strength requirements for hand laborers and freight, stock, and material movers since they lift heavy automotive parts such as windshields in their current work.

Workers in all transferrable occupations would all have at least a high school diploma or equivalent, though they would not typically be required to meet any entry-level education requirement for pickers. All workers would, however, see a decrease in their median hourly wages if they made this career transition.[161]

Table A-46. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Laborers and Freight, Stock, and Material Movers, Hand	**121,438**	**$18.17**	**None**
Transportation Security Screeners	3,265	$23.32	High school diploma or equivalent.
Meter Readers, Utilities	1,135	$29.37	High school diploma or equivalent.
Automotive Glass Installers and Repairers	788	$22.62	High school diploma or equivalent.

Figure A-68. Career Transferability and Progression



A.24 Machinists

Summary: Machinists set up, operate, and maintain equipment or machines used to produce metal parts, instruments, and tools. Overall, they read and interpret blueprints to accurately set up, align, and secure the machine tools, ensure that the materials are fed through the machine at the proper speeds, and conduct quality control inspections in the finished metals. Offshore wind energy machinists are essential in the manufacturing of wind turbine components, and they develop a comprehensive understanding of the turbine manufacturing processes.

Jobs that could easily transition into a machinist position are other production occupations. Entry-level machinists earn more than the New York statewide average wage for entry-level workers. These individuals learn the necessary skills and technology-specific knowledge through hands-on experience or technical training. Technical courses offered at high schools, apprenticeships, and community colleges are also valuable. The typical entry-level education requirement for machinists is a high school diploma or equivalent. Experienced machinists can move up into supervisor roles or transition into Computer Numerically Controlled (CNC) programming, engineering, or quality control inspection positions.

A.24.1 Job Description

Machinists set up and operate computer-controlled and mechanical equipment or machines that are used in the production of various metal parts, instruments, and tools, when extreme precision is required. Machinists are involved with aligning and securing the machine cutting tools, monitoring the feeding and speed of the machines, and inspecting the finished products to ensure they meet the design specifications. They must be familiar with reading blueprints and Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) software to operate the machine tools. In addition, these workers should wear protective equipment including safety glasses to protect their eyes from small pieces of metal that can fly up.

In general, machinists may be involved in the production of metal bolts and screws or automobile parts. Offshore wind industry machinists operate and maintain the machines that produce wind turbine components, including the fine, metal components. They must understand the exact specifications of these components and how they are used to properly set up the machine tools.[162]

A.24.2 Wages

Entry-level machinists in New York State earn roughly $1 an hour more than the average entry-level worker in the State. Experienced machinists earn roughly $30 per hour which is almost $16 an hour less than what the average experienced worker earns in the State. The median hourly wage for machinists is close to $25 an hour.[163]

Table A-47. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Machinists (Annual)	$36,800	$51,700	$62,600
Machinists (Hourly)	$17.69	$24.84	$30.12

A.24.3 Education, Experience, Skill Requirements, and Certifications

Machinists need a high school diploma or equivalent to enter this occupation. Courses in math, blueprint reading, metalworking, and CAD/CAM software is particularly important for these workers. They may gain valuable experience from vocational or technical training, apprenticeship training, and community college courses. Many employers prefer this type of hands-on experience.

These workers must have strong analytical, mechanical, and technical skills to do well in this career. In addition, physical abilities such as manual dexterity to align the machine tools accurately and stamina to stand for long periods of time is helpful. Certification programs are available through colleges and private organizations for machinists to demonstrate their skills and competency as well as to advance in their positions. These include Computer Numerical Control (CNC) machine operation and Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) software certifications.

Of the current pool of machinists in New York State, seven percent have less than a high school diploma or equivalent. Roughly half have a high school diploma or equivalent and 40 percent have some college or a two-year degree. Only one percent have a master's degree or higher while the remaining six percent have a four-year college degree.[164]

There were 1,316 active job postings in New York State for machinists between February 2022 and February 2023.[165] Some of the current in-demand certifications from employers include the following[166]:

- driver's license
- Transportation Worker Identification Credential (TWIC)
- certified welder

Employers commonly prefer workers who are already familiar with the various precision machines and tools used on the job such as lathes, milling machines, and grinders. Because of the precision required in this job, workers must have comprehensive mechanical and mathematics skills and be able to interpret blueprints to ensure the accurate metal cutting. The most frequently required technical skills for machinists are:

- lathes
- milling machines
- blueprint reading
- forklifts
- micrometers
- mechanical
- band saws
- mathematics
- drill presses

Figure A-69. Educational Attainment of Current Workers

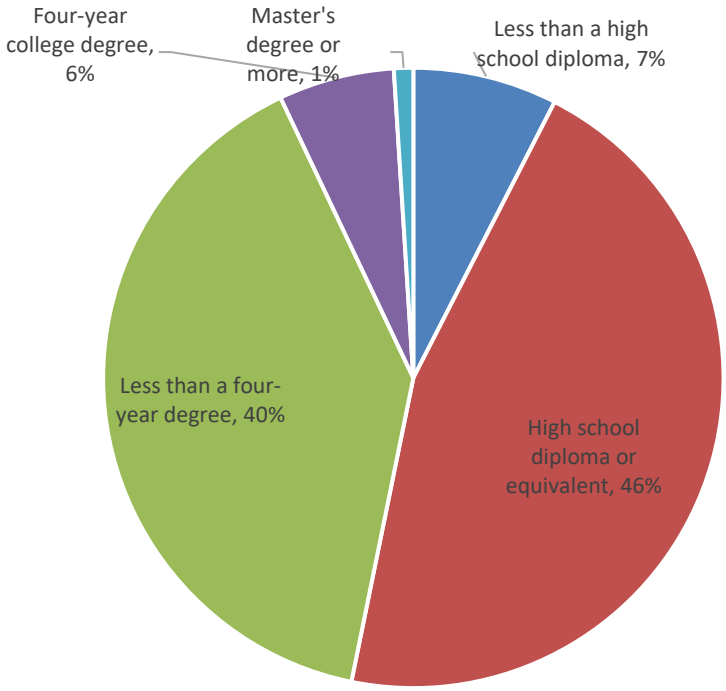


Figure A-70. Top Work Activities

Inspecting Equipment, Structures, or Materials

- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Monitoring Processes, Materials, or Surroundings

- Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

Controlling Machines and Processes

- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).

Identifying Objects, Actions, and Events

- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

A.24.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to machinists and could therefore more easily transition into a machinist position with minimal additional preparation. The jobs that could easily transition come from the production occupational group. An individual in a machinist position would develop a deep understanding of wind turbine manufacturing processes and materials.[167]

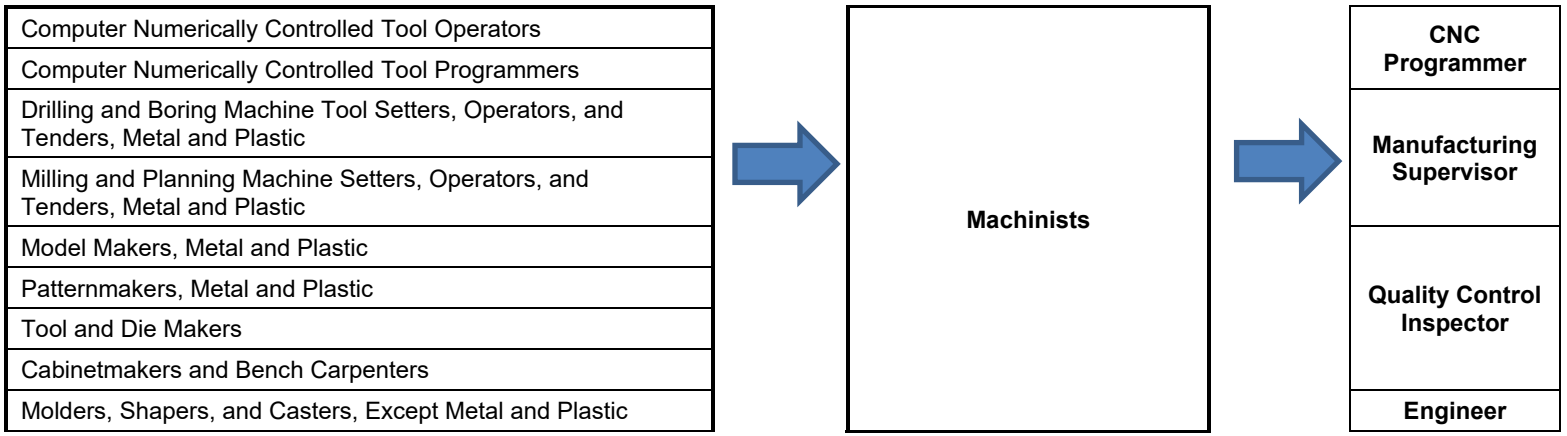
Occupations that have experience in the constructing and shaping of materials and the setting of machines could easily transition into a machinist position and enter the offshore wind energy industry since machinists, similarly, set the machines to cut and shape metals according to specifications. In addition, tool and die makers are a specialized type of machinist who construct precision tools that are used when cutting and shaping various materials, often using CAD software.

Most transferable occupations would see an increase in the median hourly wage if they made this career transition. Metal and plastic model makers, followed by CNC tool programmers, would see the largest drop in median wages of around $5 an hour. All workers in the transferrable occupations would already meet the typical entry-level education requirement for machinists which is a high school diploma or equivalent, though they would likely need to complete on-the-job training or gain another type of hands-on experience.[168]

Table A-48. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Machinists	11,628	$24.84	High school diploma or equivalent
Computer Numerically Controlled Tool Operators	5,424	$21.79	High school diploma or equivalent.
Computer Numerically Controlled Tool Programmers	1,033	$30.04	Postsecondary non-degree award.
Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	183	$22.78	High school diploma or equivalent.
Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	482	$27.47	High school diploma or equivalent.
Model Makers, Metal and Plastic	148	$30.53	High school diploma or equivalent.
Patternmakers, Metal and Plastic	62	$29.15	High school diploma or equivalent.
Tool and Die Makers	2,014	$29.41	Postsecondary non-degree award.
Cabinetmakers and Bench Carpenters	4,183	$21.46	High school diploma or equivalent.
Molders, Shapers, and Casters, Except Metal and Plastic	1,626	$19.14	High school diploma or equivalent.

Figure A-71. Career Transferability and Progression



A.25 Operating Engineers and Other Construction Equipment Operators

Summary: Operating engineers and other construction equipment operators are responsible for operating, maintaining, and repairing various types of heavy machinery and power equipment. These workers must implement technical and mechanical knowledge, coordination with other construction site workers, and proper safety measures in every aspect of their role. They are very important workers in the construction process. In the offshore wind energy industry, these engineers and operators are responsible for the machinery and equipment used to construct the offshore wind farms and the wind turbines.

Jobs that could easily transition into an operating engineer or other construction equipment operator position are found within the transportation and material moving occupational group. The entry-level and median hourly wages for these construction equipment operators are greater than the statewide averages. These workers typically need a high school diploma or equivalent to enter an entry-level position. They learn the trade through apprenticeships or on-the-job training from experienced workers. Once experienced, they may consider becoming carpenters.

A.25.1 Job Description

Operating engineers and other construction equipment operators drive and maneuver heavy machinery and power equipment at construction sites. This may include motor graders, bulldozers, scrapers, compressors, pumps, tractors, derricks, or front-end loaders. These workers use the machinery and equipment to clear and prepare land for a project, carry heavy materials used to build structures, and complete many other tasks. In addition to operating, these engineers and operators may conduct maintenance and repairs on the machinery and equipment as well. Operating engineers and other construction equipment operators are essential to the construction of offshore wind farms. Due to the large and heavy nature of the wind turbine components, these workers are needed for maneuvering, assembling, and maintaining the turbines and their components.

Operating engineers and other construction equipment operators are outside every day at the construction and project sites. Often, these workers have irregular schedules and work around the clock or late at night, depending on the potential public disruption that the construction project may cause. They need certain physical abilities to perform their job well including vision, depth perception, precision, and multilimbed

coordination. The job also requires construction and technical knowledge, proper communication and coordination, and extreme safety precautions due to the high risk of injury and serious consequences if errors occur. Overall, these workers are a significant component to the construction process.[169]

A.25.2 Wages

The entry-level and median wages for operating engineers and other construction equipment operators in New York State are greater than the statewide averages. The entry-level hourly wage for an operating engineer is a little over $23 while the State average is just over $16. The median hourly wage for an operating engineer is around $35. Experienced construction equipment operators earn almost $51 an hour which is approximately $5 an hour more than the State average wage for experienced employees.[170]

Table A-49. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Operating engineers and other construction equipment operators (Annual)	$48,200	$73,800	$105,300
Operating engineers and other construction equipment operators (Hourly)	$23.16	$35.46	$50.63

A.25.3 Education, Experience, Skill Requirements, and Certifications

Operating engineers and other construction equipment operators are typically expected to have a high school diploma or equivalent upon entering an entry-level position. An apprenticeship or on-the-job training spanning from several months to a year is common for operating engineers and other construction equipment operators. They need to develop technical knowledge about the machinery and equipment they operate and maintain. An apprenticeship may last three to four years.

Mathematics and auto mechanics courses are helpful for equipment operators and engineers. Since they perform routine maintenance and make repairs, if necessary, they need to learn how the machinery and equipment behave and perform. Proper safety standards are also crucial for operating engineers and other construction equipment operators to learn to prevent serious injuries and consequences.

Of the current pool of operating engineers and other construction equipment operators, more than half, specifically 55 percent, have a high school diploma or equivalent. Only 19 percent have less than a high school diploma or equivalent. Roughly two in 10 workers have less than a four-year college degree but more than a high school diploma. Five percent have a four-year college degree or a master's degree or higher.[171]

Based on 702 active job postings in New York State for operating engineers between August 2021 through August 2022,[172] the current in-demand certifications from employers include the following:

- Commercial Driver's License (CDL)
- OSHA 10
- forklift certified

Because operating engineers and other construction equipment operators are specialized in operating heavy machinery and power equipment, they need to be trained in operating the common types found at a construction site. In general, the most frequently required technical skills for construction equipment operators include the following:

- heavy equipment operation
- excavators
- backhoes
- bulldozers
- end loaders
- skid steers
- dump truck operation

Figure A-72. Educational Attainment of Current Workers

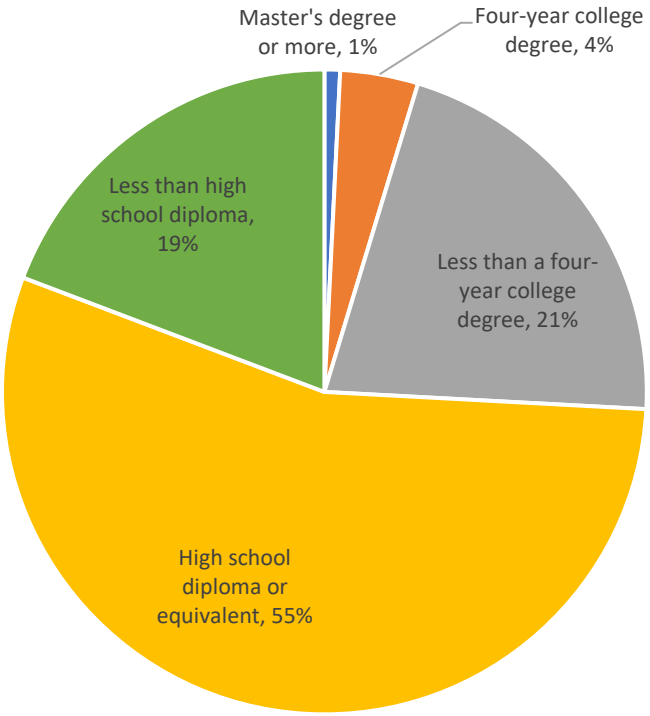


Figure A-73. Top Work Activities

Controlling Machines and Processes
- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).

Monitoring Processes, Materials, or Surroundings
- Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

Operating Vehicles, Mechanized Devices, or Equipment
- Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or watercraft.

Getting Information
- Observing, receiving, and otherwise obtaining information from all relevant sources.

Making Decisions and Solving Problems
- Analyzing information and evaluating results to choose the best solution and solve problems.

Inspecting Equipment, Structures, or Materials
- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

A.25.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to operating engineers and other construction equipment operators and could therefore more easily transition into one of these positions with minimal additional preparation. These occupations come from the transportation and material moving occupational group.[173]

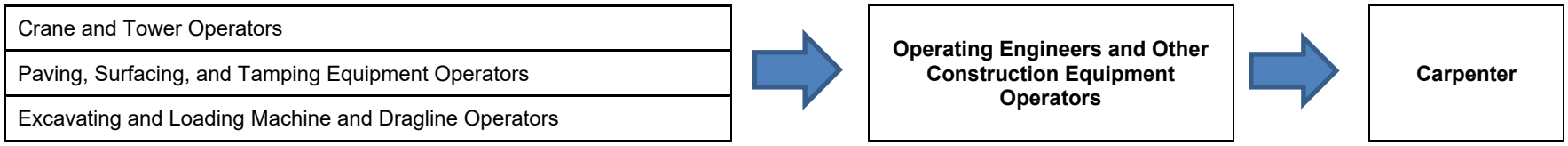
Paving, surfacing, and tamping equipment operators and excavating and loading machine and dragline operators who want to enter the offshore wind energy industry may consider transitioning to a construction equipment operator career. These operators, along with crane and tower operators, already have experience in operating machinery and maneuvering or carrying heavy materials. They also have a pre-existing notion of safety and proper coordination priorities. These individuals would need training in the equipment and machinery specific for construction and the offshore wind industry.

The typical entry-level education requirement for both occupation types is a high school diploma or equivalent. An operating engineer or other construction equipment operator earns a lower median hourly wage, however. The median hourly wage for crane and tower operators is roughly $50 compared to just over $35 for construction equipment operators.[174]

Table A-50. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry- Level Education
Operating Engineers and Other Construction Equipment Operators	**16,374**	**$35.46**	**High school diploma or equivalent**
Paving, Surfacing, and Tamping Equipment Operators	2,566	$24.71	High school diploma or equivalent.
Excavating and Loading Machine and Dragline Operators	1,329	$25.04	High school diploma or equivalent.
Crane and Tower Operators	1,377	$54.43	High school diploma or equivalent.

Figure A-74. Career Transferability and Progression



A.26 Plant and System Operators, All Other

Summary: Plant and system operation workers control, operate, and maintain machinery used in production plants of various materials and power. Those who work in power and electricity generation, including those in the offshore wind energy industry, monitor the flow of the electricity by reading various measurement instruments on the machinery, regulate the flow of the power, and start or stop the machinery as needed. Their work schedules are typically rotating 8- or 12-hour shifts due to the constant flow of electricity. A strong technical and mechanical knowledge is commonly preferred by employers.

Jobs that could easily transition into a plant and system operator position in the offshore wind energy industry are largely found within the production occupational group. Entry-level operators earn almost $3 an hour more than the average New York State entry-level wage. The typical entry-level education requirement for this occupation is a high school diploma or equivalent. In addition to the educational requirements, individuals entering the field complete extensive on-the-job training that may last for several years and continue throughout their careers. As they advance, plant and system operators may be promoted to plant manager or other supervisory positions or specialize in related fields.

A.26.1 Job Description

In general, plant and system operators work in various types of production plants. They control, operate, and maintain machinery used in generating power or other products. Operators work in plants for different power sources such as nuclear, electric, oil, and gas as well as in chemical, water, and wastewater treatment plants. Plant and system operators in the wind energy industry are an emerging type of operator. In this niche field, they control, operate, and maintain the wind turbines and the power generated from them.

Plant and system operators who work in power generation know how to read charts, meters, and gauges of the machines to monitor the electricity voltage and flow, adjust the controls to regulate the flow, and start or stop the electricity generators, turbines, and other equipment when necessary. Other common job titles for this occupation include auxiliary operator, station operator, and control room operator. All operators must be vigilant at all times to avoid serious risk of accident and injury. Due to the constant demand for electricity, operators who work in power typically work in rotating, 8- or 12-hour shifts. They must adjust to the irregular work and sleep patterns.[175]

A.26.2 Wages

The entry-level and median wages for these plant and system operators in New York State are greater than the statewide averages. Entry-level workers across New York State earn a little more than $16 an hour while these entry-level operators earn almost $19 an hour. The median hourly wage for these workers is roughly $27 an hour. The wage for experienced workers in this occupation, however, is roughly $12 an hour less than the average wage for all experienced workers in the State.[176]

Table A-51. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Plant and System Operators, All Other (Annual)	$39,500	$56,900	$70,600
Plant and System Operators, All Other (Hourly)	$18.97	$27.36	$33.92

A.26.3 Education, Experience, Skill Requirements, and Certifications

Entry-level plant and system operators typically need a high school diploma or equivalent to begin working. Sometimes, a college degree or a career technical education is preferred by employers. In addition to schooling, this occupation also requires extensive on-the-job training. This training may take several years, and some operators continue trainings throughout their careers to stay up to date on their skills and industry knowledge. Employers often prefer a strong mathematics and science knowledgebase because this occupation is highly technical.

Plant and system operators may need to pass background checks and screenings for drugs and alcohol for some employers. Experienced operators could transition into supervisor, trainer, and consultant positions in their industry. Workers who are in positions which could affect the power grid may be required to earn a System Operator certification through the North American Electric Reliability Corporation.

Of the current pool of these plant and system operators, eight percent have less than a high school diploma and 35 percent have a high school diploma or equivalent. Exactly four in 10 have some college or a two-year degree and 16 percent have a four-year college degree. Approximately two percent have a master's degree or higher.[177]

There were 13 active job postings in New York State for all other plant and system operator workers from January 2018 through January 2023.[178] The current in-demand certifications from employers for these plant and system operators are listed below:[179]

- driver's license
- Commercial Driver's License (CDL)
- Certified 40 Hour HAZWOPER
- North American Electric Reliability Corporation's System Operator Certification

To monitor the electricity voltage and flow, plant and system operators who work with electricity should have experience with reading gauges and meters. Mechanical and technical knowledge is also useful since these workers control, operate, and maintain the machinery used in generating power. The most frequently required technical skills for plant and system operators are included below:

- boilers
- gauges
- mechanical
- flow meter usage
- working with reactors

Figure A-75. Educational Attainment of Current Workers

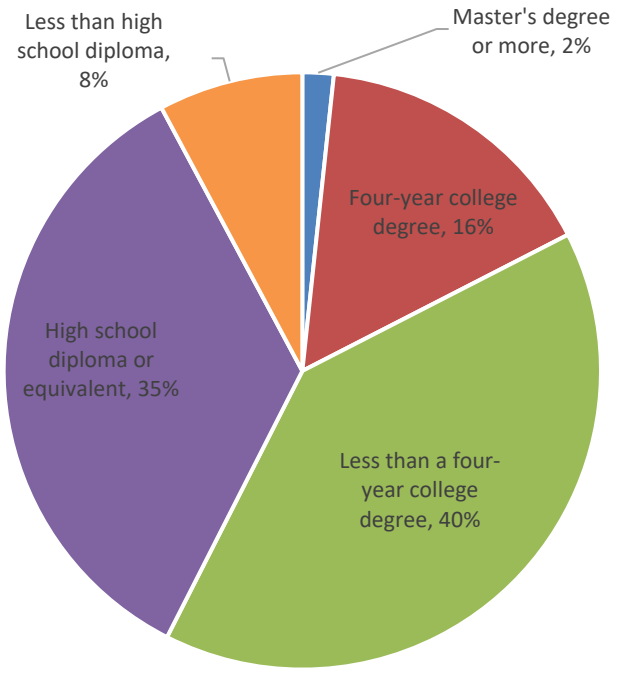
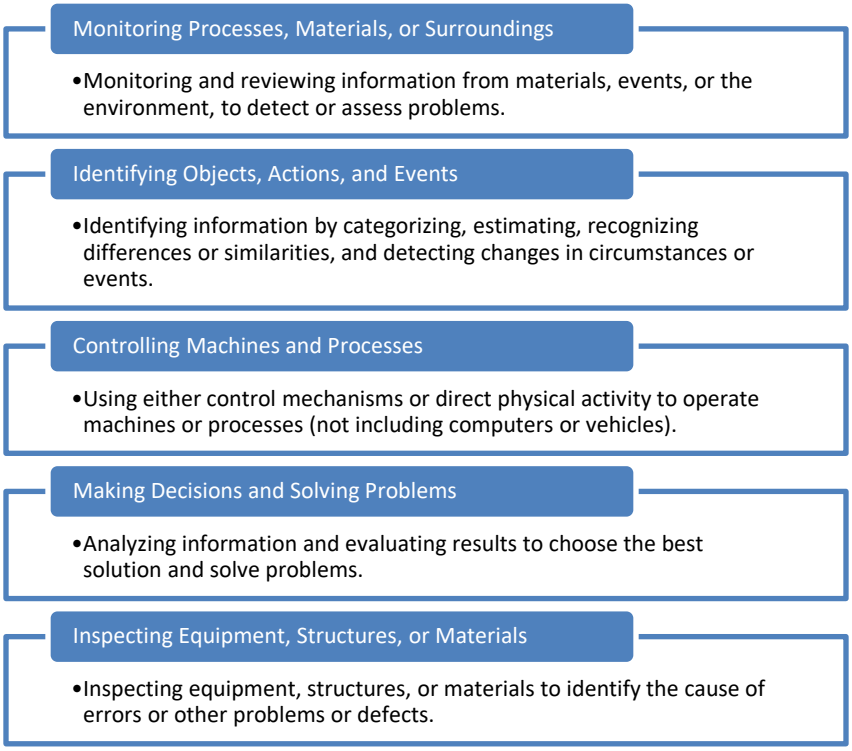


Figure A-76. Top Work Activities



A.26.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to wind energy plant and system operators and could therefore more easily transition into one of these positions with minimal additional preparation. These jobs that could easily transition come from the production occupational group.[180]

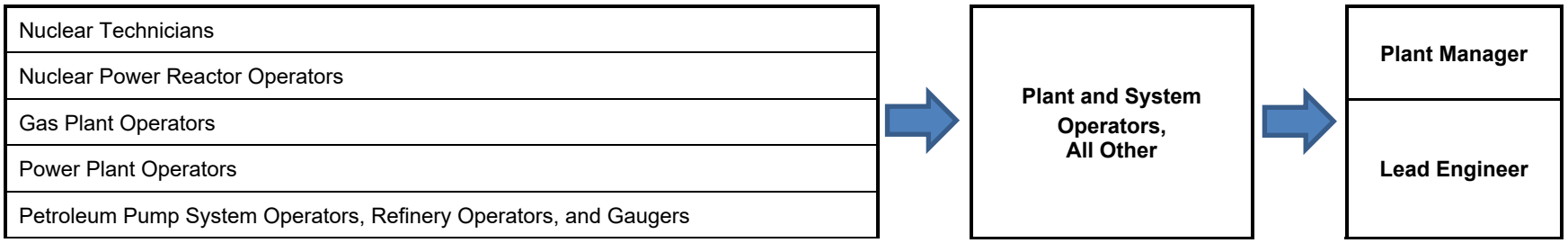
The below table and figure feature workers who may find plant and system operator careers to be good transition jobs into the offshore wind energy industry. All transferable occupations listed would not, however, see any median wage increase in this transition. Nuclear technicians and reactor operators would see the largest decrease in their median hourly wages.

All workers would meet the typical entry-level education requirements. They would need to complete the extensive on-the-job training for operations in the offshore wind energy industry. The skill sets and knowledgebases they developed in their current careers will be valuable in the transition. These workers have technical knowledge, safety awareness, and machinery skills that are important for work in wind energy. In addition, these operators and technicians have experience working in plants and with other types of power sources.[181]

Table A-52. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Plant and System Operators, All Other	**244**	**$27.36**	**High school diploma or equivalent**
Nuclear Technicians	249	$52.21	Associate degree
Nuclear Power Reactor Operators	232	$60.74	High school diploma or equivalent.
Gas Plant Operators	396	$49.90	High school diploma or equivalent.
Power Plant Operators	1,787	$47.39	High school diploma or equivalent.
Petroleum Pump System Operators, Refinery Operators, and Gaugers	182	$43.12	High school diploma or equivalent.

Figure A-77. Career Transferability and Progression



A.27 Structural Iron and Steel Workers

Summary: Structural iron and steel workers install and reinforce the metal framework of buildings, bridges, and other large structures. They use specialized tools and equipment to connect steel beans, columns, and girders to form the structural framework for buildings and bridges. Structural iron and steel workers in the offshore wind energy industry are responsible for installing and maintaining the steel support structures for offshore wind turbines. They also assemble and connect several other wind turbine components, including the tower, rotor blades, nacelle, and hub.

The entry-level and experienced median hourly wages for New York structural iron and steel workers are greater than the statewide averages. The typical entry-level education requirement is a high school diploma and a 3 to 4 yearlong apprenticeship. They must also have physical strength, stamina, good hand-eye coordination, depth perception, and balance. Jobs that could easily transition into a structural iron and steel worker position are largely found within the construction and extraction occupational group and the installation, maintenance, and repair installation group.

A.27.1 Job Description

Structural iron and steel workers are responsible for installing iron and steel beams, columns, and girders to create structural frameworks for buildings, bridges, roads, and other large structures. They read and follow blueprints and schematics, cut, bend, and connect steel components using shears, hand tools, rigging gear, and welding equipment, install metal decking, and direct crane operators who lift and position the structural steel.

Structural iron and steel workers are found in various industries and sectors, including construction, manufacturing, government, aerospace, and power generation. Within the wind energy industry, structural iron and steel workers play a vital role in the installation, maintenance, and repair of wind turbines and surrounding infrastructure. Structural iron and steel workers install and maintain the steel support structures for offshore wind turbines, including the monopile which anchors the turbine to the seabed. Structural iron and steel workers also assemble and connect several of the turbine components, including the tower, rotor blades, nacelle, and hub.[182]

A.27.2 Wages

The entry-level, median, and experienced wages for structural iron and steel workers in New York State are all greater than the statewide averages. An entry-level structural iron and steel worker earns roughly $26 an hour while an average entry-level employee in the State earns just over $16 an hour. Experienced structural iron and steel workers earn nearly $54 an hour while the New York State average wage for experienced workers is over $46 an hour. The median hourly wage for structural iron and steel workers is nearly $44 an hour.[183]

Table A-53. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Structural Iron and Steel Workers (Annual)	$54,400	$91,400	$112,200
Structural Iron and Steel Workers (Hourly)	$26.14	$43.96	$53.96

A.27.3 Education, Experience, Skill Requirements, and Certifications

Structural iron and steel workers are typically required to have a high school diploma. Many structural iron and steel workers complete an apprenticeship in reinforcing and structural ironworking typically lasting 3 to 4 years. Each year of an apprenticeship requires 144 hours of technical training and 2,000 hours of paid on-the-job training. Apprenticeship programs are sponsored by unions and contractor associations. Some structural iron and steel workers receive on-the-job training from their employer which varies in length.

Structural iron and steel workers must have physical strength, stamina, good hand-eye coordination, depth perception, and balance. These skills are important for guiding heavy beams, tying rebar quickly and precisely, directing crane operators, and walking on narrow beams. Critical thinking is a critical skill in this position since structural iron and steel workers need to identify and assess potential problems and risks and evaluate the safest course of action.

Of the current pool of New York State structural iron and steel workers, over half (52 percent) have a high school diploma or equivalent but did not complete any college. Approximately 28 percent completed some college or have a two-year degree. Of the remaining 20 percent, 14 percent have less than a high school diploma and six percent received a four-year college degree.[184]

There were 36 active job postings in New York State for structural iron and steel workers between February 2022 through February 2023.[185] The current in-demand certifications from employers, based on these postings, are listed below[186]:

- OSHA 10
- Certified Welder
- driver's license
- OSHA 30

Because structural iron and steel workers must cut, bend, and connect steel components, they must be skilled in welding and using tools such as metal shears and acetylene torches. Structural iron and steel workers often work at great heights to connect girders for tall buildings and bridges, so workers must be experienced in using aerial lifts, scissor lifts, and hoisting equipment. The most frequently required technical skills for structural iron and steel workers are included below:

- welding
- aerial lifts
- mechanical
- metal shears
- hoisting equipment
- Microsoft Excel
- scissor lifts
- acetylene torches

Figure A-78. Educational Attainment of Current Workers

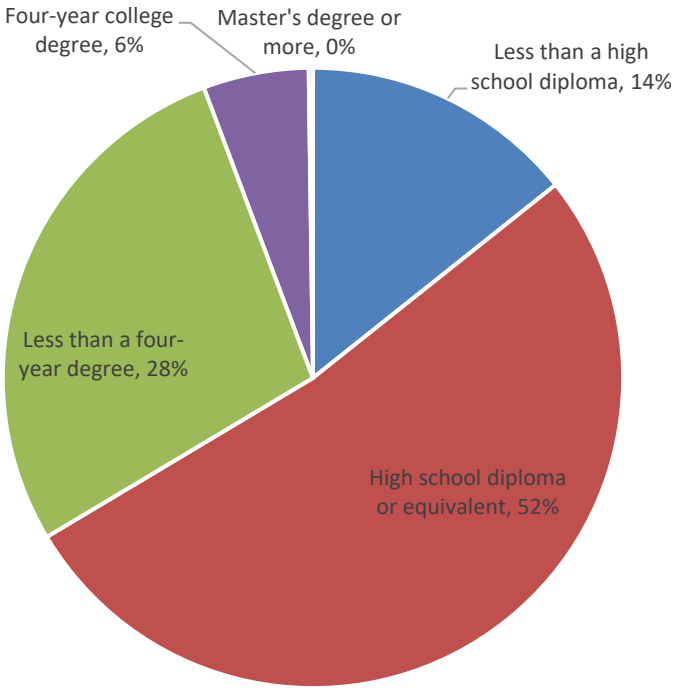


Figure A-79. Top Work Activities

Handling and Moving Objects

- Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.

Communicating with Supervisors, Peers, or Subordinates

- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Inspecting Equipment, Structures, or Materials

- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

Performing General Physical Abilities

- Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling materials.

A.27.4 Career Transition Potential

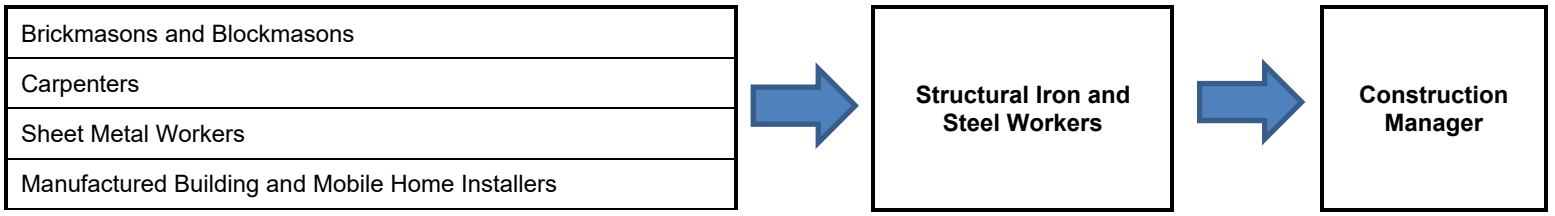
This section highlights the occupations that have similar skills and experience levels to structural iron and steel workers and could therefore more easily transition into one of these positions with minimal additional preparation. Jobs that could easily transition into structural iron and steel workers are largely found within the construction and extraction occupational group and the installation, maintenance, and repair occupational group.[187]

Transferrable occupations are listed in the below table and figure. A career in structural iron and steel worker is a good way for others with construction experience to enter the offshore wind energy industry. All transferrable occupations meet the entry-level education requirements for structural iron and steel workers. The transferrable occupations listed would see a significant increase in their median hourly wages as well.[188]

Table A-54. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Structural Iron and Steel Workers	3,820	$43.96	High school diploma or equivalent
Carpenters	54,129	$29.20	High school diploma or equivalent
Sheet Metal Workers	6,548	$33.64	High school diploma or equivalent
Brickmasons and Blockmasons	5,064	$37.40	High school diploma or equivalent
Manufactured Building and Mobile Home Installers	117	$19.58	High school diploma or equivalent

Figure A-80. Career Transferability and Progression



A.28 Structural Metal Fabricators and Fitters

Summary: Structural metal fabricators and fitters are part of the production occupational group and are a type of assembler and fabricator. They work with metal products or components for various types of structures to fabricate and fit them together. They use precision and accuracy to do this while interpreting product specifications and operating welding, riveting, and other types of metalworking and fabricating equipment. In the wind energy industry, structural fabricators and fitters carefully fabricate, align, and fit together parts of the wind turbines.

Jobs that could easily transition into a structural metal fabricator and fitter position are largely found within the production occupational group. Entry-level structural metal fabricator and fitter workers earn almost $3 an hour more than the statewide entry-level average wage. The typical entry-level education requirement for these workers is a high school diploma or equivalent. Individuals learn the trade often from other experienced workers on the job and sometimes in apprenticeships, or at career technical education schools. From there, they could transition into trainer or supervisor positions.

A.28.1 Job Description

Structural metal fabricators and fitters fabricate, position, align, and fit parts of metal products to create products or product components. The products or components are for various types of structures including infrastructures and containers. These workers read blueprints and specifications; operate welding, cutting, riveting, and other types of metalworking and fabricating equipment; and inspect the metal pieces or structures to ensure no errors or defects exist. They are considered a type of assembler and fabricator in the production sector. Other common job titles include metal work mechanic, architectural metal fabricator, and framing fabrication specialist.

Wind turbines and their components contain pieces of metal among other materials. In the wind energy industry, structural metal fabricators and fitters work on the fabrication, assembly, and installation of the metal components of the turbines. Wind turbine production workers may be employed by various third-party suppliers of wind turbine components or by wind turbine original equipment manufacturers.[189]

A.28.2 Wages

The entry-level wages for structural metal fabricators and fitters in New York State are greater than the statewide average wages. Entry-level workers across the State earn a little more than $16 an hour while entry-level fabricator and fitter workers earn almost $19 an hour. The median hourly wage for these workers is around $1.50 less than the state average. Experienced structural metal fabricators and fitters earn approximately $30.50 an hour, compared to the average experienced-level wage of over $43 an hour in New York State.[190]

Table A-55. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Structural Metal Fabricators and Fitters (Annual)	$39,300	$50,600	$63,500
Structural Metal Fabricators and Fitters (Hourly)	$18.91	$24.32	$30.51

A.28.3 Education, Experience, Skill Requirements, and Certifications

Typically, entry-level structural metal fabricators and fitter workers are required to have a high school diploma or equivalent. In addition to this education requirement, entry-level workers typically start learning the trade from more experienced workers while on the job. This training may last from one to two years. Structural metal fabricators and fitters must learn how to use metalworking equipment to cut, bend, or manipulate the material in other ways while exercising extreme caution.

Some entry-level workers choose to learn metal fabricating and fitting in apprenticeships or in technical educational schools and some may be required by their employer to enter an apprenticeship. Structural metal fabricators and fitters in the offshore wind energy industry will need to understand unique wind turbine requirements and specifications. Otherwise, they will typically be required to meet similar skills and training expectations as production and manufacturing workers in other industries.

Of the current pool of structural metal fabricators and fitter workers in New York State, approximately half have a high school diploma or equivalent. Roughly one in 10 have less than a high school diploma and three in 10 have some college without a four-year degree. While one percent of current structural metal fabricators and fitters have a master's degree or more, seven percent have a four-year college degree.[191]

Based on 102 active job postings in New York State for structural metal fabricators and fitters from January 2022 through January 2023,[192] the current in-demand certifications from employers include the following[193]:

- driver's license
- American Welding Society Certification (AWS Certification)
- Certified Welding Inspector (CWI)
- OSHA 10
- OSHA 30

Structural metal fabricators and fitters need to have physical strength to lift heavy metal components and dexterity to align the components. Skills and experience in welding and fabricating machinery as well as in blueprint reading are valuable in this trade. In general, the most frequently required technical skills for structural metal fabricators and fitters include those listed below:

- welding
- Metal Inert Gas Welding (MIG Welding)
- Metal Fabrication
- Band Saws
- Forklifts
- blueprint reading

Figure A-81. Educational Attainment of Current Workers

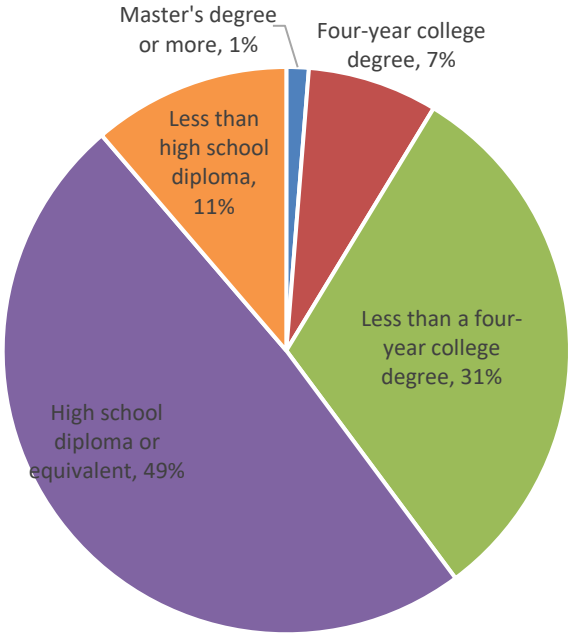
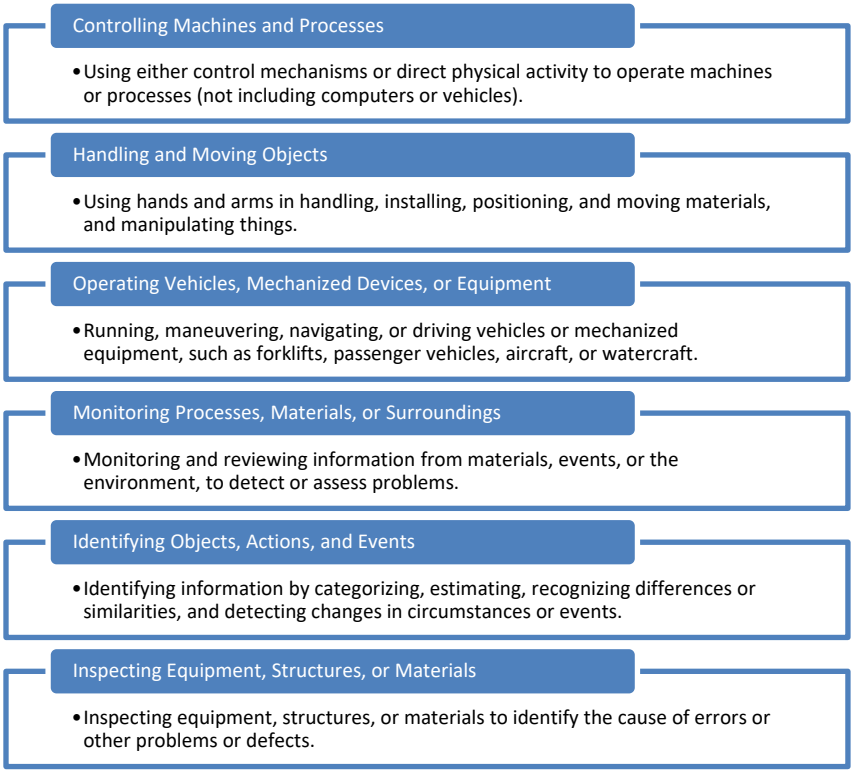


Figure A-82. Top Work Activities



A.28.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to structural metal fabricators and fitters and could therefore more easily transition into this fabricator and fitter position with minimal additional preparation. These jobs are found within the production occupational group.[194]

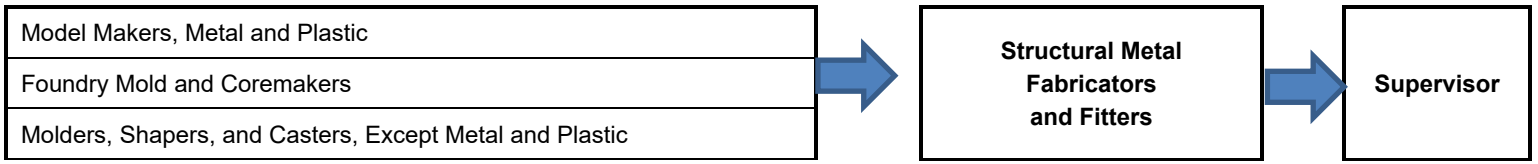
The below table and figure feature workers who may find structural metal fabricator and fitter careers to be good transition jobs into the offshore wind energy industry. These production workers use precision and attention to detail to measure, cut, and shape materials to fit a design and create molds and models. They also have familiarity with reading blueprints and other specification documents. These skills are valuable in wind energy work as well, though these workers would need to gain hands-on experience or on-the-job training to learn this trade and industry.

Foundry mold and coremakers as well as molders, shapers, and casters of non-metal and non-plastic materials would see a wage increase in this transition. The median hourly wage for metal and plastic model makers is, however, lower than that of structural metal fabricators and fitters in New York State. All transferrable occupations listed would meet the typical entry-level education requirement for structural metal fabricators and fitters.[195]

Table A-56. Transferable Occupations

Occupation	Total Jobs in New York, 2022, Q3	Median Hourly Wage, 2022 Q2	Typical Entry- Level Education
Structural Metal Fabricators and Fitters	**2,127**	**$24.32**	**High school diploma or equivalent**
Model Makers, Metal and Plastic	148	$30.53	High school diploma or equivalent.
Foundry Mold and Coremakers	136	$19.39	High school diploma or equivalent.
Molders, Shapers, and Casters, Except Metal and Plastic	1,622	$19.14	High school diploma or equivalent.

Figure A-83. Career Transferability and Progression



A.29 Transportation, Storage, and Distribution Managers

Summary: Transportation, storage, and distribution managers plan and organize the storage and movement of materials, equipment, and workers from production sites to operations or construction sites. They ensure that the operations they oversee comply with policies, laws, and regulations and align with the operations of other business departments. These managers also supervise or direct transportation, storage, and distribution workers who report to them. Transportation, storage, and distribution managers who work in the offshore wind energy industry are essential to ensuring that the required materials, equipment, and laborers are stored and moved appropriately so that the offshore wind farm can function effectively and produce energy that meets demand.

Jobs that could easily transition into a transportation, storage, and distribution manager position are largely found within several occupational groups including management; business and financial operations; and transportation and material moving. Entry-level and experienced transportation, storage, and distribution managers earn more than the statewide averages for entry-level and experienced workers, respectively. Transportation, storage, and distribution managers typically enter the position with previous work experience in related fields such as warehouse work, driving, shipping, supply chain, and logistics. These managers who work in offshore wind need a basic knowledge and experience of the industry's supply, logistic, and transportation activities. In this role, however, they can develop expertise and further advance in the industry. Over time, these managers could transition into other supervisory roles including project managers, logistics directors, or operations executives.

A.29.1 Job Description

Transportation, storage, and distribution managers are essential to operations in various industries. Overall, these managers organize and direct the storage and movement of materials and goods; stay up to date on policies, laws, and regulations relating to the transportation, storage, and distribution activities; and supervise workers carry out the day-to-day tasks. They often coordinate with suppliers, customers, and other business departments, including sales, accounting, or shipping departments, to increase efficiency of the business. Transportation, storage, and distribution managers are commonly found in offices, warehouses, distribution centers, and transportation hubs.[196]

These managers are employed in many different industries including manufacturing, wholesale and retail, government, and energy. Transportation, storage, and distribution managers who work in the offshore wind energy industry oversee the movement and storage of offshore wind farm materials and equipment from production sites to assembly and construction sites. This may include the wind turbine components, equipment needed to assemble and operate the turbines, and workers who need to travel to the wind farm to be onsite. Transportation, storage, and distribution managers are especially important in the offshore wind energy industry because they help ensure that the offshore wind farms run effectively and efficiently and provide a constant supply of energy.

A.29.2 Wages

Entry-level and experienced transportation, storage, and distribution managers earn wages higher than their statewide counterparts. Entry-level managers in New York State earn almost $38 an hour and can double their wages to $76 an hour once experienced. The median hourly wage for transportation, storage, and distribution managers is close to $59 an hour.[197]

Table A-57. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Transportation, Storage, and Distribution Managers (Annual)	$78,700	$122,400	$158,900
Transportation, Storage, and Distribution Managers (Hourly)	$37.84	$58.82	$76.39

A.29.3 Education, Experience, Skill Requirements, and Certifications

Transportation, storage, and distribution managers typically need a high school diploma or equivalent to work in this career. Field and industry experience and expertise is extremely important for these managers. This typically comes from working in the field such as in a transportation and material moving occupations, like warehouse worker and drivers, or in supply chain or logistics occupations. Workers can also gain a comprehensive understanding of supply chain operations and logistics from courses offered by various academic institutions. This field knowledge is important for these managers so that they can plan operations based on the current activities, opportunities, and constraints in the field to problem solve accordingly.

Offshore wind energy transportation, storage, and distribution managers typically need years of experience in logistics and transportation. This may include experience in offshore wind energy manufacturing plants, shipping, or warehouses containing wind turbine components. This experience guides the managers with planning which materials and equipment to move as well as when and where to move them.

These managers need strong customer service and communication skills in addition to organizational and leadership abilities. The qualities help the managers perform their duties efficiently. There are several credentials that employers commonly prefer when hiring transportation, storage, and distribution managers including various management and supply chain certifications. First aid, CPR, and other safety trainings may also be mandatory for these managers due to the potential safety hazards at warehouses, on transportation vehicles, and at offshore wind farms.

Of the current pool of in New York State, five percent have less than a high school diploma or equivalent. Most of the current transportation, storage, and distribution managers, specifically 31 percent, have a four-year college degree. Exactly one quarter have a high school diploma or equivalent while another 26 percent have a two-year degree or some college. The remaining 13 percent of current managers have a master's degree or higher.[198]

There were 1,407 active job postings in New York State for transportation, storage, and distribution managers between February 2022 and February 2023.[199] Some of the current in-demand certifications from employers include[200]:

- Certified Supply Chain Professional (CSCP)
- driver's license
- Project Management Professional (PMP)
- Certified Professional in Supply Management (CPSM)
- Commercial Driver's License (CDL)
- Certified Project Manager (CPM)
- Certified Materials and Resource Professional (CMRP)

Because transportation, storage, and distribution managers are responsible for overseeing the storage and movement of goods, materials, and sometimes workers, employers often prefer that these managers have a comprehensive understanding of supply chain and manufacturing processes to plan effectively. Microsoft Office programs are also useful for organizing plans. In addition, experience with inventory management is valuable for transportation, storage, and distribution managers who determine what needs to be moved and when they should be moved. Overall, the most frequently required technical skills for transportation, storage, and distribution managers are the following:

- Microsoft Excel
- Supply Chain Management
- purchasing
- SAP
- manufacturing
- Inventory Management
- Inventory Control

Figure A-84. Educational Attainment of Current Workers

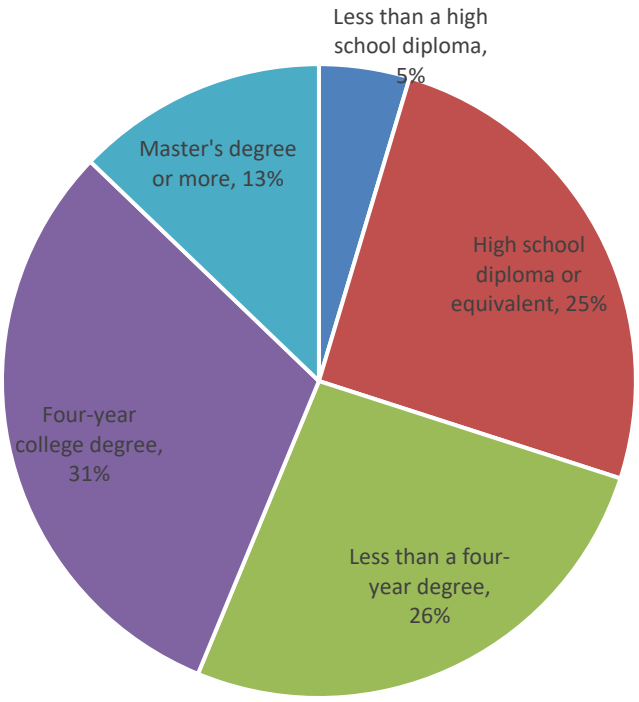
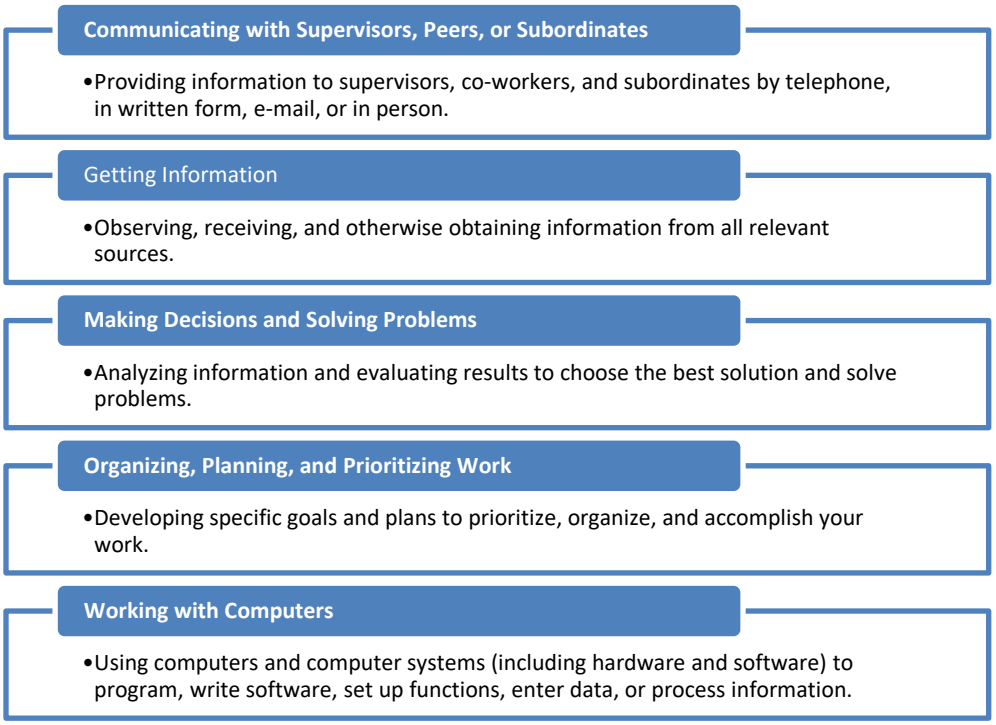


Figure A-85. Top Work Activities



A.29.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to transportation, storage, and distribution managers, and could therefore more easily transition into a transportation, storage, and distribution managers job with minimal additional preparation. These transferrable jobs are primarily found within the management; business and financial operations; life, physical, and social science; sales; and transportation and material moving occupational groups.[201]

Individuals currently working in logistics, planning, supply chain operations, and transportation could easily transition since their experiences are directly applicable to a transportation, storage, and distribution manager position. Logisticians work in purchasing, transportation, inventory, and warehousing while purchasing managers have experience in supplies, contract negotiations, and

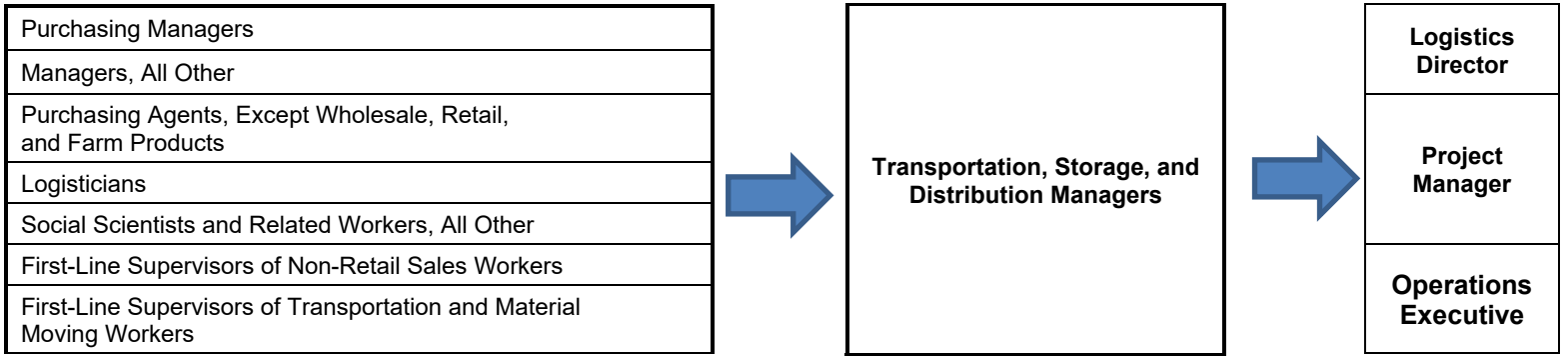
management. Transportation planners, a type of social science and related worker, study and analyze transportation activities and trends. In addition, first-line supervisors of transportation and material moving workers have a background in transportation operations and leadership that they can bring to this position. These transitioning workers would need to gain direct experience or training in offshore wind processes to become a manager in this industry.

Purchasing managers and miscellaneous managers would experience a decrease in their median hourly wages by roughly $16 an hour if they transitioned into a transportation, storage, and distribution manager position, while all other transferrable occupations would see an increase in the median hourly wages. First-line supervisors of transportation and material moving workers would experience the largest increase of around $19 an hour. Finally, all workers in the transferrable occupations meet the typical entry-level education requirements for transportation, storage, and distribution managers.[202]

Table A-58. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Transportation, Storage, and Distribution Managers	**6,265**	**$58.82**	**High school diploma or equivalent**
Purchasing Managers	3,978	$74.93	Bachelor's degree
Managers, All Other	19,803	$75.08	Bachelor's degree
Purchasing Agents, Except Wholesale, Retail, and Farm Products	16,578	$37.04	Bachelor's degree
Logisticians	5,590	$43.35	Bachelor's degree
Social Scientists and Related Workers, All Other	2,389	$46.06	Bachelor's degree
First-Line Supervisors of Non-Retail Sales Workers	28,214	$52.78	High school diploma or equivalent.
First-Line Supervisors of Transportation and Material Moving Workers, Except Aircraft Cargo Handling Supervisors	34,051	$30.21	High school diploma or equivalent.
Aircraft Cargo Handling Supervisors	513	$35.04	High school diploma or equivalent.

Figure A-86. Career Transferability and Progression



A.30 Welders, Cutters, Solderers, and Brazers

Summary: Welders, cutters, solderers, and brazers are production workers who join or cut metals based on blueprints. They use hand-held or remote-controlled equipment that produce heat and light required to manipulate the metals. It is important that these workers are extremely careful in their work to avoid injury and perform inspections on their work to ensure quality control and accuracy. Those in the offshore wind energy industry typically join and fuse the metal pieces that make up the components of wind turbines such as the turbine towers which consist of steel cylinders.

Jobs that could easily transition into a welder, cutter, solderer, and brazer position are largely found within the production occupational group. Entry-level welders, cutters, solderers, and brazers earn more than the New York average entry-level wage and typically need a high school diploma or equivalent to enter the trade. These workers learn the necessary skills from both technical and on-the-job training. Once experienced, they could transition into a site supervisor role, technician, inspector, or instructor training new workers. As a welder, cutter, solderer, and brazer in offshore wind, these individuals become familiar with the wind energy industry and the production processes of wind turbines.

A.30.1 Job Description

Welders, cutters, solderers, and brazers in general join or cut metal parts or pieces using various types of equipment. They work from blueprints or other schematics, measure the metal parts before cutting or welding them, and inspect the metal pieces to ensure there are no holes or indentations. These workers use equipment such as welding torches to apply the appropriate amount of heat to the metal to melt and fuse them for shaping and bonding. The equipment may be hand-held or controlled remotely.

These workers may specialize in one of these skills or multiple of them. Extreme caution is especially important for this job due to the heat required to join or cut the metal and the ensuant light that is emitted. They typically work 40-hour weeks, and some manufacturing firms hire these workers in rotating 8- or 12-hour shifts for continuous production. Welders, cutters, solderers, and brazers are involved in the manufacturing phase of the offshore wind energy industry. They work on the metal pieces that form wind turbine components including welding together steel cylinders to create a stable turbine tower.[203]

A.30.2 Wages

Entry-level welders, cutters, solderers, and brazers earn just under $19 an hour which is roughly $2 an hour more than the New York State entry-level average wage. They can increase their wages to $32 an hour as they become experienced workers. On average, however, experienced welders, cutters, solderers, and brazers earn less than the average wage for experienced workers in the State. The median hourly wage for welders, cutters, solderers, and brazers is just over $25 an hour.

Table A-59. Wage Distribution[204]

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Welders, Cutters, Solderers, and Brazers (Annual)	$39,000	$52,300	$66,600
Welders, Cutters, Solderers, and Brazers (Hourly)	$18.76	$25.16	$32.01

A.30.3 Education, Experience, Skill Requirements, and Certifications

Due to the technical nature of the job, welders, cutters, solderers, and brazers must meet a typical entry-level education requirement of a high school diploma or equivalent and complete technical training. Technical training may come from courses at technical high schools, technical institutes, community colleges, or private trade schools. Individuals of the U.S. Armed Forces have the option to complete welding training while enlisted. Apprenticeships are also available to provide training for entry-level workers or targeted training for more experienced workers. Often, even with the technical training, many employers prefer their workers to complete several months of on-the-job training.

Welders, cutters, solderers, and brazers are required to complete the Occupational Health and Safety Administration (OSHA) training for electrical safety. In some states and localities, these workers must hold a welding license. In New York City, for example, these workers must hold a welder license to work on structural systems. Welders, cutters, solderers, and brazers may also receive general certifications such as the American Welding Society's Certified Welder credential which is a commonly preferred certification of employers. Advanced certifications are available including a certification from the American Society of Mechanical Engineers and a soldering certification from the Institute for Printed Circuits.

Of the current pool of welders, cutters, solderers, and brazers in New York State, 16 percent have less than a high school diploma. Almost half, or 49 percent, have a high school diploma or equivalent and 30 percent have a two-year degree or some college. Of the remaining five percent of current workers, four percent have a four-year college degree and one percent have a master's degree or higher.[205]

There were 811 active job postings in New York State for welders, cutters, solderers, and brazers between February 2022 and February 2023.[206] Some of the current in-demand certifications from employers include the following[207]:

- driver's license
- certified welder
- Commercial Driver's License (CDL)
- American Welding Society Certification (AWS Certification)
- OSHA 10
- Certified Environmental Drycleaner (CED)
- HAZMAT
- Transportation Worker Identification Credential (TWC)

Welders, cutters, solderers, and brazers must be skilled in welding, blueprint reading, and measuring to complete their tasks accurately. Since they may work with heavier metals, often these workers need to have the physical strength to lift and carry the metals. In general, the most frequently required technical skills for welders, cutters, solderers, and brazers are included below:

- welding
- Metal Inert Gas Welding (MIG welding)
- blueprint reading
- ability to lift 41-50 pounds
- mechanical
- manufacturing
- forklifts
- tape measures
- fabrication

Figure A-87. Educational Attainment of Current Workers

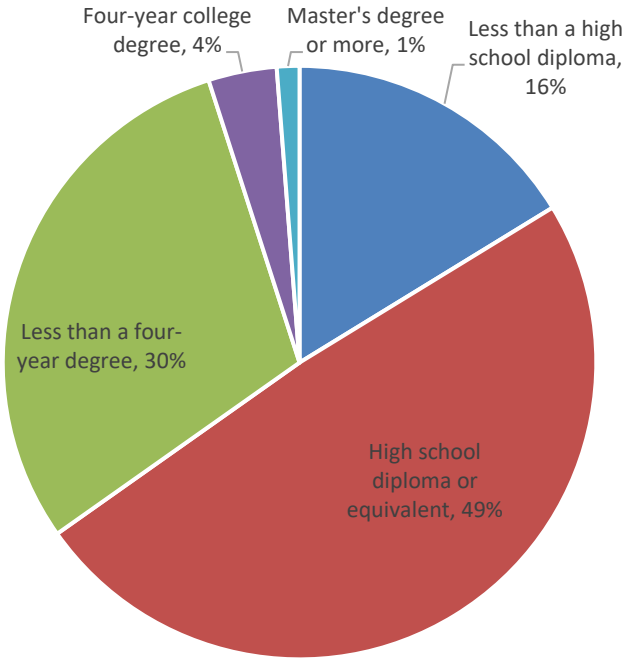


Figure A-88. Top Work Activities

Inspecting Equipment, Structures, or Materials

- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

Getting Information

- Observing, receiving, and otherwise obtaining information from all relevant sources.

Monitoring Processes, Materials, or Surroundings

- Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

Handling and Moving Objects

- Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.

Identifying Objects, Actions, and Events

- Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.

A.30.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to welders, cutters, solderers, and brazers and could therefore more easily transition into a welder, cutter, solderer, and brazer job with minimal additional preparation. These jobs come from the production occupational group.[208]

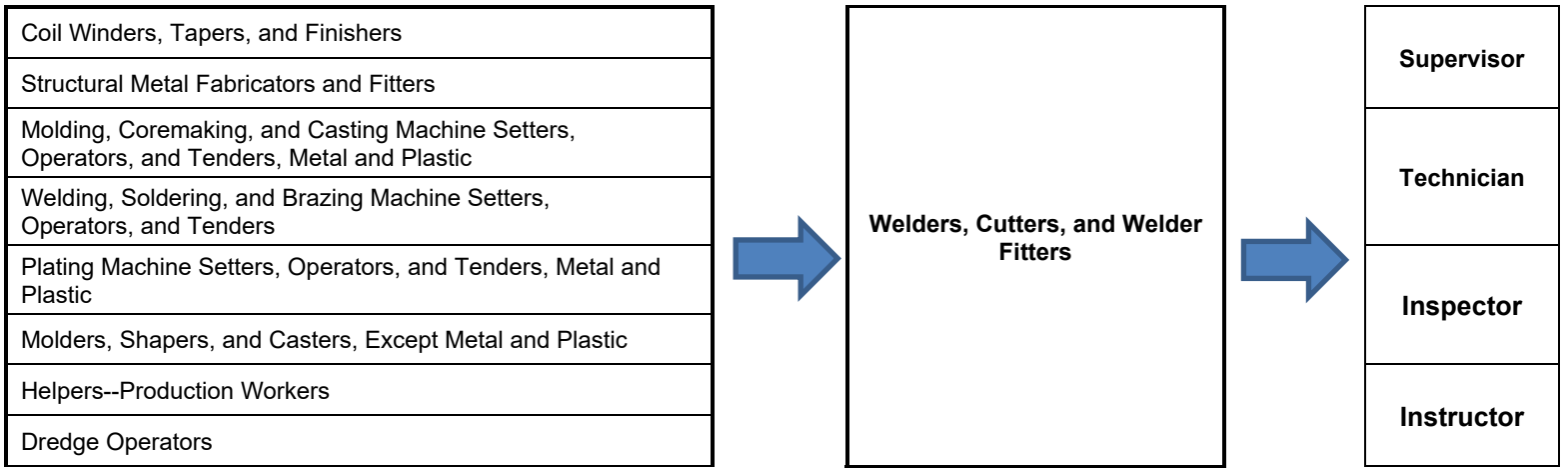
Operators and tenders who work with welding, plating, and molding machines could easily transition into this occupation and work in the offshore wind energy industry. Since they set up and operate the machines used in these trades, they have a pre-existing understanding of the processes involved and experience working with metals. In addition, workers who currently handle structural metal and shape materials based on blueprints or schematics may find ease in this transition since they can use their experiences to work with the metal pieces of wind turbines and manipulate them based on the turbine specifications. Even with these skills and backgrounds, workers who transition into becoming welders, cutters, solderers, and brazers for the offshore wind energy industry will likely need to complete technical training courses and months of on-the-job training.

Apart from dredge operators, all transferrable occupations would see an increase in the median hourly wage if they made this career transition. Helpers of production workers would see the largest increase of almost $7.50 an hour. In addition, all workers in the transferrable occupations would already meet the typical entry-level education requirement for welders, cutters, solderers, and brazers based on their current occupation requirements.

Table A-60. Transferable Occupations[209]

Occupation	Total Jobs in New York, 2022 Q3	Median Hourly Wage, 2022 Q3	Typical Entry-Level Education
Welders, Cutters, and Welder Fitters	**10,982**	**$25.16**	**High school diploma or equivalent**
Coil Winders, Tapers, and Finishers	615	$19.55	High school diploma or equivalent.
Structural Metal Fabricators and Fitters	2,127	$24.32	High school diploma or equivalent.
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	4,882	$17.86	High school diploma or equivalent.
Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	872	$22.68	High school diploma or equivalent.
Plating Machine Setters, Operators, and Tenders, Metal and Plastic	1,139	$18.90	High school diploma or equivalent.
Molders, Shapers, and Casters, Except Metal and Plastic	1,626	$19.14	High school diploma or equivalent.
Helpers--Production Workers	6,447	$17.75	High school diploma or equivalent.
Dredge Operators	77	$26.05	High school diploma or equivalent.

Figure A-89. Career Transferability and Progression



A.31 Wind Turbine Service Technicians / General Maintenance and Repair Workers

Summary: General maintenance and repair workers perform maintenance and repair tasks on various machinery, equipment, or structures. They inspect the products, diagnose problems, and develop solutions to fix the problems. General maintenance and repair workers may work on a wide range of systems, including electrical and plumbing systems, though they defer certain, more complicated issues to specialized and licensed tradespeople. They may need to work in uncomfortable positions or environments. In the offshore wind energy industry, general maintenance and repair workers are called wind turbine service technicians. They install, maintain, and repair wind turbines and their components. They must be comfortable working at heights and using ladders to perform their daily duties. Wind turbine service technicians are essential to offshore wind farms because they ensure the turbines are running properly and generating electricity at their capacities.

Jobs that could easily transition into a wind turbine service technician role are largely found within the construction and extraction and the installation, maintenance, and repair occupational groups. Entry-level wind turbine service technicians earn an hourly wage of around $25 which is more the average wage of statewide entry-level workers. The typical entry-level education requirement for wind turbine service technicians is a postsecondary non-degree award. Individuals often learn the trade in technical education programs and hands-on experience. Once experienced, they could transition into advanced technician, instructor, or supervisory positions, or into specialized tradesperson careers.

A.31.1 Job Description

General maintenance and repair workers use skills to maintain machinery, mechanical equipment, or structures. They perform routine maintenance tasks, assemble machinery or equipment, and fix or replace faulty components or systems, including those related to electrical or plumbing systems. These workers are good problem-solvers as they often inspect machinery or equipment, diagnose problems, and develop the best solutions. Though very versatile, general maintenance and repair workers understand when certain issues require a licensed tradesperson, such as electricians and plumbers, to complete specialized maintenance and repairs.[210]

These workers may work indoors or outdoors, depending on their industry and tasks. They often use common hand and power tools to complete their work and may find themselves standing, walking, or reaching for long periods of time, lifting heavy materials, and working in uncomfortable environments. Typically, general maintenance and repair workers work 40 hours a week with occasional overtime if emergency repairs are needed. Other common job titles include Maintenance Technician, Service Technician, Repair Technician, and Field Service Technician.

Service technicians in the offshore wind industry are called wind turbine service technicians, or "wind techs." In general, wind techs perform routine maintenance and inspections on the wind turbines and their components to prevent malfunctions and ensure they are running at an efficient capacity. If malfunctions do occur, these workers identify the problem and replace the defective components when necessary. Wind techs must be able to work onsite at the offshore wind farms and climb up and down ladders to reach the turbine components at high elevations, such as the blades.

A.31.2 Wages

The entry-level wage for general maintenance and repair workers in New York State is slightly greater than the statewide average for entry-level workers. Wind tech earns $25 an hour which is roughly $10 an hour more than the average entry-level wage in New York State. The experienced hourly wages for both wind techs and general maintenance and repair workers are less than the State average wages for experienced laborers. The median hourly wage is $32 an hour for wind techs and roughly $23 an hour for general maintenance and repair workers.[211]

Table A-61. Wage Distribution

	Entry-Level	Median	Experienced
State Average (Annual)	$33,900	$53,900	$94,900
State Average (Hourly)	$16.29	$25.93	$45.66
Wind Turbine Service Technicians (Annual)	$52,000	$66,600	$79,000
Wind Turbine Service Technicians (Hourly)	$25.00	$32.01	$38.00
Maintenance and Repair Workers, General (Annual)	$34,900	$48,800	$64,600
Maintenance and Repair Workers, General (Hourly)	$16.79	$23.47	$31.04

A.31.3 Education, Experience, Skill Requirements, and Certifications

Typically, entry-level New York State general maintenance and repair workers need a high school diploma or equivalent. These workers often learn the trade while on the job, alongside experienced colleagues, generally from three months to a year. Some high school courses as well as technical education programs provide students with basic skills in fields such as mechanics, blueprint reading, and mathematics. Over time, these workers learn how to conduct maintenance and repairs on a wide variety of systems, machines, and equipment. Once experienced, general maintenance and repair workers may transition into manager positions, become licensed tradespeople in a specialized trade, or start their own businesses.

Wind turbine service technicians must gain a working knowledge of industry and wind energy technology. Most attend a technical school and complete two years of technical training. Some technical schools or programs have onsite wind turbines for students to practice on. A wind turbine technician typically receives at least a year of on-the-job training, on top of educational training.

Of the current pool of general maintenance and repair workers in the State, 12 percent have less than a high school diploma. Exactly four in 10 have a high school diploma or equivalent while 34 percent have some college or a two-year college degree. Another 12 percent of current workers have a four-year college degree and three percent have a master's degree or higher.[212]

Roughly four in 10 current wind techs in New York State have a high school diploma or equivalent and 32 percent have some college or a two-year degree. Approximately one in 10 have less than a high school diploma. Another 12 percent have a four-year college degree and three percent have a master's degree or higher.

There were 18,350 active job postings in New York State for general maintenance and repair workers from January 2022 through January 2023.[213] Between February 2022 and February 2023, there were 37 active job postings for wind turbine service technicians in New York.[214] Based on these job postings, the current in-demand certifications from employers include those listed below[215]:

- Commercial Driver's License (CDL)
- Class B Commercial Driver's License (CDL-B)
- EPA Section 608 Certification (EPA 608)
- Cisco Certified Network Associate (CCNA)
- forklift certification

- OSHA 10
- OSHA 30
- Certification in Cardiopulmonary Resuscitation (CPR)
- first aid certification
- Construction Health and Safety Technician (CHST)
- Global Wind Organization (GWO) safety training

General maintenance and repair workers typically understand electrical, plumbing, and heating, ventilation, and air conditioning systems so that they can perform routine maintenance and common repairs on them. Both general maintenance and repair workers and wind turbine service technicians must know how to read schematics and use hand and power tools such as screwdrivers, drills, and hammers in order to install equipment, machinery, or other systems, and to make repairs. Wind turbine service technicians should have expertise in the common systems found in and around wind turbines. The most frequently required technical skills for wind turbine service technicians are listed below:

- Electrical Components and Systems
- Mechanical and Hydraulic Systems
- Underground Transmission Systems
- Wind Field Substations
- Fiber Optic Sensing and Control Systems
- hand and power tools
- generators
- Supervisory Control and Data Acquisition Software (SCADA Software)
- reading schematics
- Microsoft Office
- using ladders
- gauges

Figure A-90. Educational Attainment of Current Workers—General Maintenance and Repair Workers

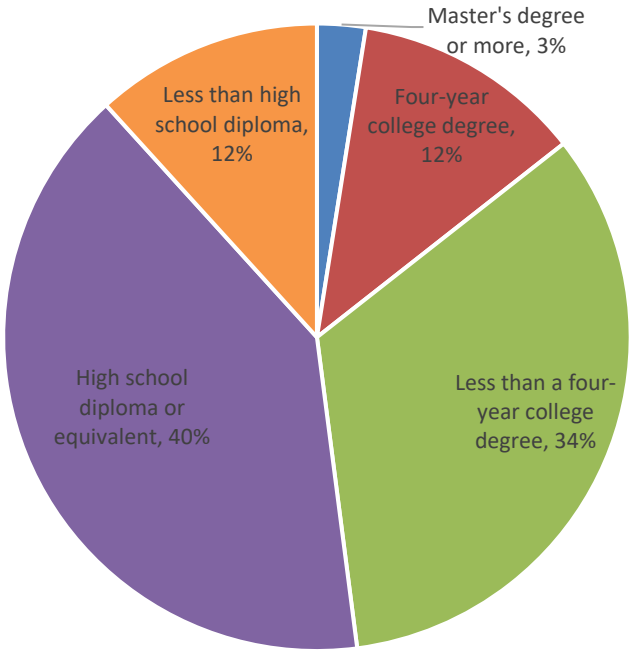


Figure A-91. Educational Attainment of Current Workers—Wind Turbine Service Technicians[216]

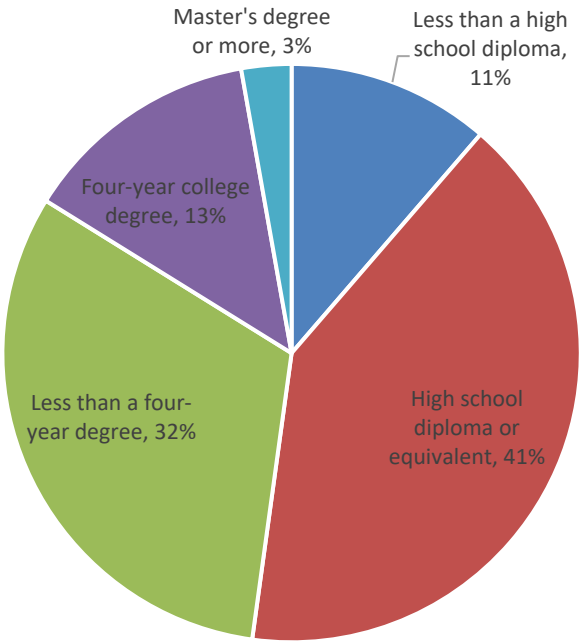
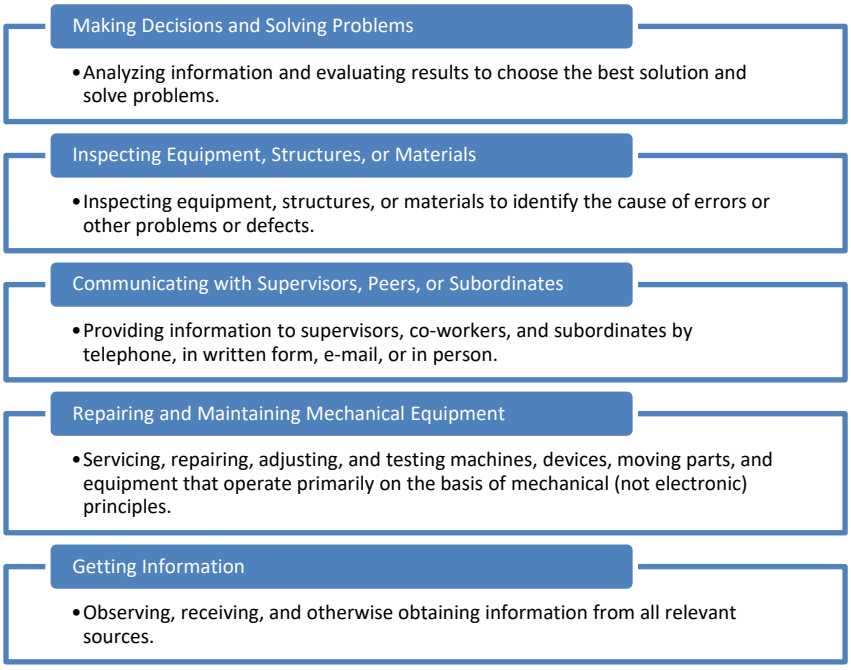


Figure A-92. Top Work Activities



A.31.4 Career Transition Potential

This section highlights the occupations that have similar skills and experience levels to wind turbine service technicians and could therefore more easily transition into a wind tech job with minimal additional preparation. These jobs come from within the construction and extraction and the installation, maintenance, and repair occupational groups.[217]

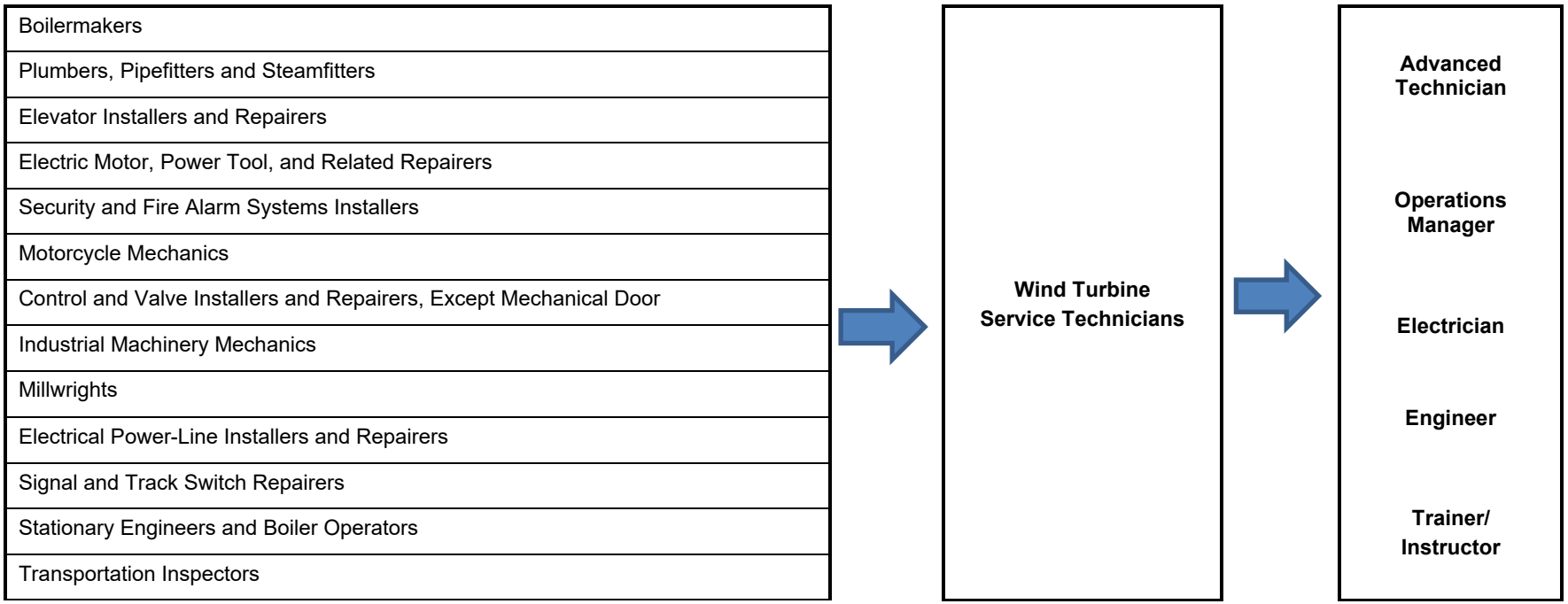
The below table and figure feature workers who may find wind turbine service technician careers to be good transition jobs into the offshore wind energy industry. These workers understand certain types of machinery and equipment as well as general mechanics. Some workers, such as elevator installers and repairers, have knowledge of electrical systems. Individuals in these transferrable occupations could expand their skills to other types of machinery, equipment, and systems to become general maintenance and repair workers. Their existing skills and knowledge would also aid them in wind turbine technician training if they were to pursue wind technician careers.

Motorcycle mechanics, millwrights, industrial machinery mechanics, security and fire alarm installers, and electric motor, power tool, and related repairers would all see a median hourly wage increase in this transition to wind turbine service technician positions. Although motorcycle mechanics would meet the typical entry-level education requirement for wind turbine service technicians, all transferrable occupations would need to earn postsecondary non-degree awards or certificates and receive formal training in wind turbine maintenance and repairs.[218]

Table A-62. Transferable Occupations

Occupation	Total Jobs in New York, 2022 Q2	Median Hourly Wage, 2022 Q2	Typical Entry- Level Education
Maintenance and Repair Workers, General	**126,563**	**$22.95**	**High school diploma or equivalent**
Wind Turbine Service Technicians	**315**	**$32.01**	**Postsecondary non-degree award**
Boilermakers	537	$37.79	High school diploma or equivalent.
Plumbers, Pipefitters and Steamfitters	27,777	$36.93	High school diploma or equivalent.
Elevator Installers and Repairers	3,968	$48.41	High school diploma or equivalent.
Electric Motor, Power Tool, and Related Repairers	657	$26.30	High school diploma or equivalent.
Security and Fire Alarm Systems Installers	5,145	$23.23	High school diploma or equivalent.
Motorcycle Mechanics	622	$20.95	Postsecondary non-degree award.
Control and Valve Installers and Repairers, Except Mechanical Door	3,987	$40.67	High school diploma or equivalent.
Industrial Machinery Mechanics	11,601	$28.94	High school diploma or equivalent.
Millwrights	1,449	$29.02	High school diploma or equivalent.
Electrical Power-Line Installers and Repairers	4,153	$48.28	High school diploma or equivalent.
Signal and Track Switch Repairers	2,079	$38.83	High school diploma or equivalent.
Stationary Engineers and Boiler Operators	4,189	$37.79	High school diploma or equivalent.
Transportation Inspectors	5,427	$39.41	High school diploma or equivalent.

Figure A-93. Career Transferability and Progression



Appendix B. Training Infrastructure and Program Accessibility

B.1 Training Programs Overview

This Offshore Wind Training Analysis aims at providing an understanding of New York State's training resources in this specific industry, including the strengths and weaknesses of available resources for wind-related careers. In order to provide a robust context to the following analysis, the research team developed a training inventory of 516 offshore wind trainings, degrees, and apprenticeships in New York State, which was built on prior training inventories and publicly available listings on union, nonprofit organizations, government, school, business, and association websites.

This section provides an overview of the currently available training programs in the State, that could provide a robust pipeline for the state's future needs of offshore wind talents. The research team identified a total of 516 training programs, all of which are physically held in New York State locations.

B.2 Program Outcomes

Of all the offered training programs, approximately 90 percent are apprenticeships that are offered through private companies, unions, nonprofit organizations, and trade associations. These apprenticeships typically offer participants on-the-job training and expect trainees to accept a full-time position upon completion of their training period. Boards of Cooperative Educational Services (BOCES), community colleges, trade schools, training centers, and universities account for the most programs that result in job readiness (four percent). BOCES, nonprofit Organizations, community colleges, training centers, and universities offered upskilling courses (10 programs), which give an opportunity for workers to deepen their knowledge on offshore wind. Certificates and associate degrees were both offered by community colleges, while bachelor and master's degrees were both offered by universities. The only micro-credential offered was through a community college.

Table B-1. Percent of Programs by Degree/Outcome

Degree/Outcome	Number of Programs	Percent of Programs
Apprenticeship	464	90%
Job Readiness	18	4%
Upskilling	10	2%
Certificate	9	2%
Associate	9	2%
Bachelor's	3	1%
Master's	2	0%
Micro-credential	1	0%

B.3 Occupational Focus

Over two out of five of the training programs offered are geared towards operations and maintenance occupations (42 percent), followed by construction (33 percent), welding (10 percent), engineering (eight percent), offshore wind (three percent), professional services (two percent) and safety[219] (one percent).

Table B-2. Percent of Programs by Degree/Outcome

Occupational Category	Number of Programs	Percent of Programs
Operations and Maintenance	219	42%
Construction	171	33%
Welding	52	10%
Engineering	43	8%
Offshore Wind	15	3%
Professional Services	11	2%
Safety	5	1%

B.4 Training Providers

Over half of the training programs offered were provided by private companies that give on-the-job trainings and apprenticeships; these are programs that are largely taken from the Department of Labor Registered Apprenticeships. Unions offered about one fifth of the available programs (18 percent), with apprenticeships mostly targeted towards occupations in construction, engineering, welding, and

operations and maintenance. Community colleges are the third most prolific training provider, with 22 training programs (four percent), mostly targeted at occupations in construction and welding. Trade schools' (four percent) training programs are mostly targeted at jobs in construction and operations and maintenance.

Table B-3. Percent of Programs by Training Provider

Training Provider	Number of Programs	Percent of Programs
Private Company	301	58%
Union	93	18%
Community College	22	4%
State Agency	33	6%
Nonprofit Organization	17	3%
Trade School	16	3%
University	15	3%
Board of Cooperative Educational Services (BOCES)	8	2%
Trade Association	7	1%
Training Center	4	1%

B.4.1 Department of Labor Registered Apprenticeships

Department of Labor registered apprenticeships accounted for 90 percent of the available training compiled by the research team. Out of the 464 DOL registered apprenticeships, 218 are targeted at occupations in operations and maintenance (47 percent), or close to half of registered apprenticeships. Another 169 of these registered apprenticeships are targeted at occupations in construction (36 percent). Engineering apprenticeships are the third most available, with 34 programs across the state. DOL registered apprenticeships in welding (six percent), professional services (two percent) safety (one percent), and offshore wind (zero percent), were not readily available.

Table B-4. Percent of Programs by Training Provider

Occupational Category	Number of Programs	Percent of Programs
Operations and Maintenance	218	47%
Construction	169	36%
Engineering	34	7%
Welding	26	6%
Professional Services	11	2%
Safety	5	1%
Offshore Wind	1	0%

B.5 Geographic Distribution

Finger Lakes (16 percent), Central (13 percent), Capital (12 percent) and Western New York (12 percent) emerged as the leading Regional Economic Development Council (REDC) regions, pertaining to the number of training programs offered (Table 1). Out of the 516 total programs offered, the region of Finger Lakes offered 84 programs (16 percent), followed by Central New York that offered 69 programs (13 percent), and by the Capital region, which offered 61 training programs (12 percent). North Country (six percent), and Mohawk Valley (five percent), were the regions that offered the least amount of training programs.

Table B-5. Percent of Programs Offered by Regional Economic Development Council Region (REDC) Region

REDC	Number of Programs	Percent of Programs
Finger Lakes	84	16%
Central	69	13%
Capital	61	12%
Western New York	61	12%
Long Island	56	11%
New York City	53	10%
Southern Tier	43	8%
Mid-Hudson	36	7%
North Country	29	6%
Mohawk Valley	24	5%

B.6 Disadvantaged Communities and Public Transportation Resources

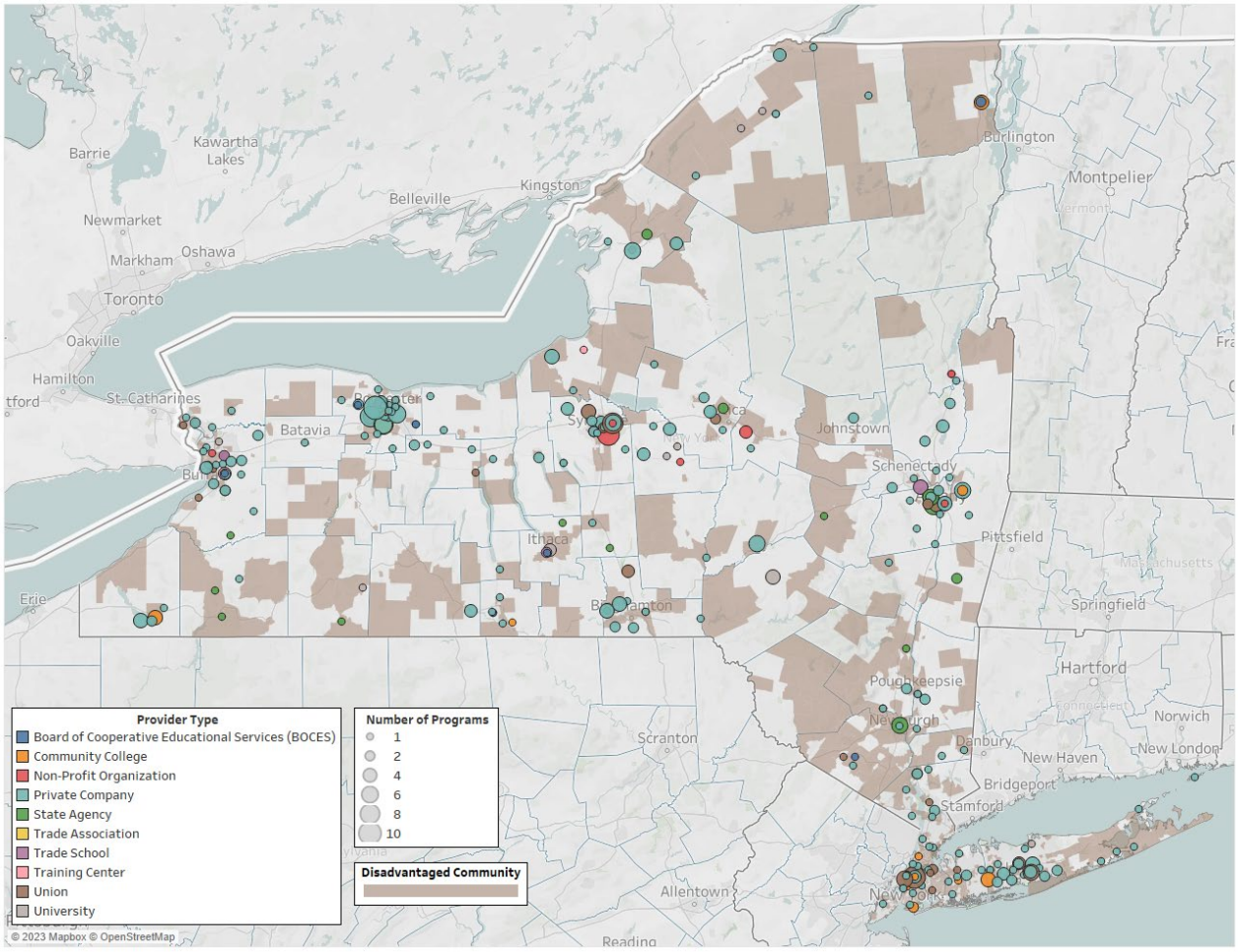
The geospatial mapping data in this section examines the intersection between (1) training, (2) geographic accessibility, and (3) disadvantaged communities.[220] For the purposes of this report, accessibility is defined as logistical and geographic accessibility for individuals from their homes to training centers via modes of public transportation.

The following figure shows the overall State view of offshore wind-related training programs across New York State by program/provider type. In the regionally focused maps on the following pages, the system of active bus and subway lines is also included. These transit overlays are used to illuminate where individuals from disadvantaged communities may be lacking public transportation resources to training offerings outside of their immediate neighborhood.

The research team identified a total of 516 training programs for offshore wind jobs in the State. In general, these programs are concentrated across six regional clusters in Buffalo, Capital Region, Long Island, New York City, Rochester, and Syracuse.

In the following pages, more focused maps are provided for each of these regions in order to better understand training accessibility within these specific areas.

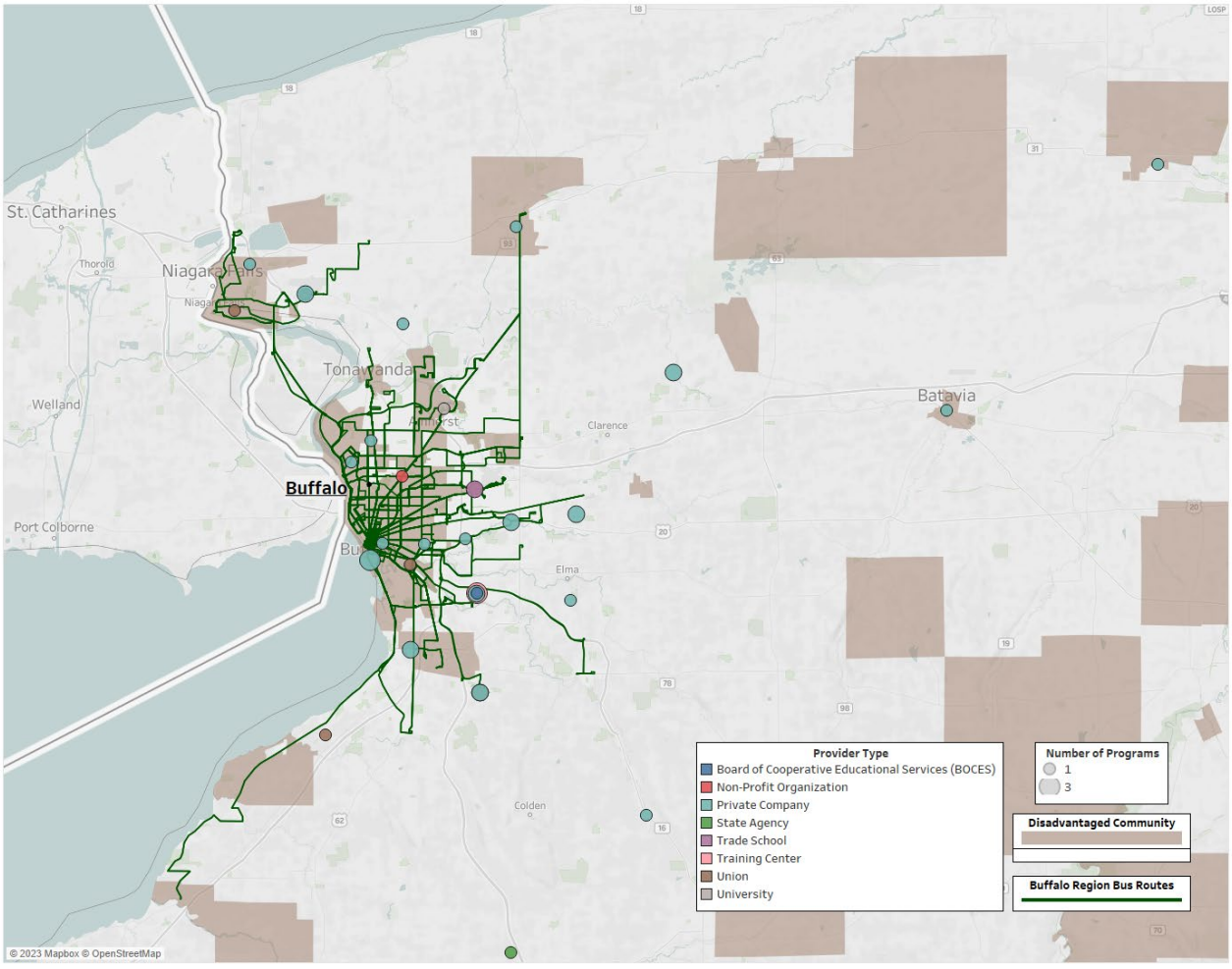
Figure B-1. OSW Training Providers and Socioeconomic Characteristics



B.7 Region-Specific Maps

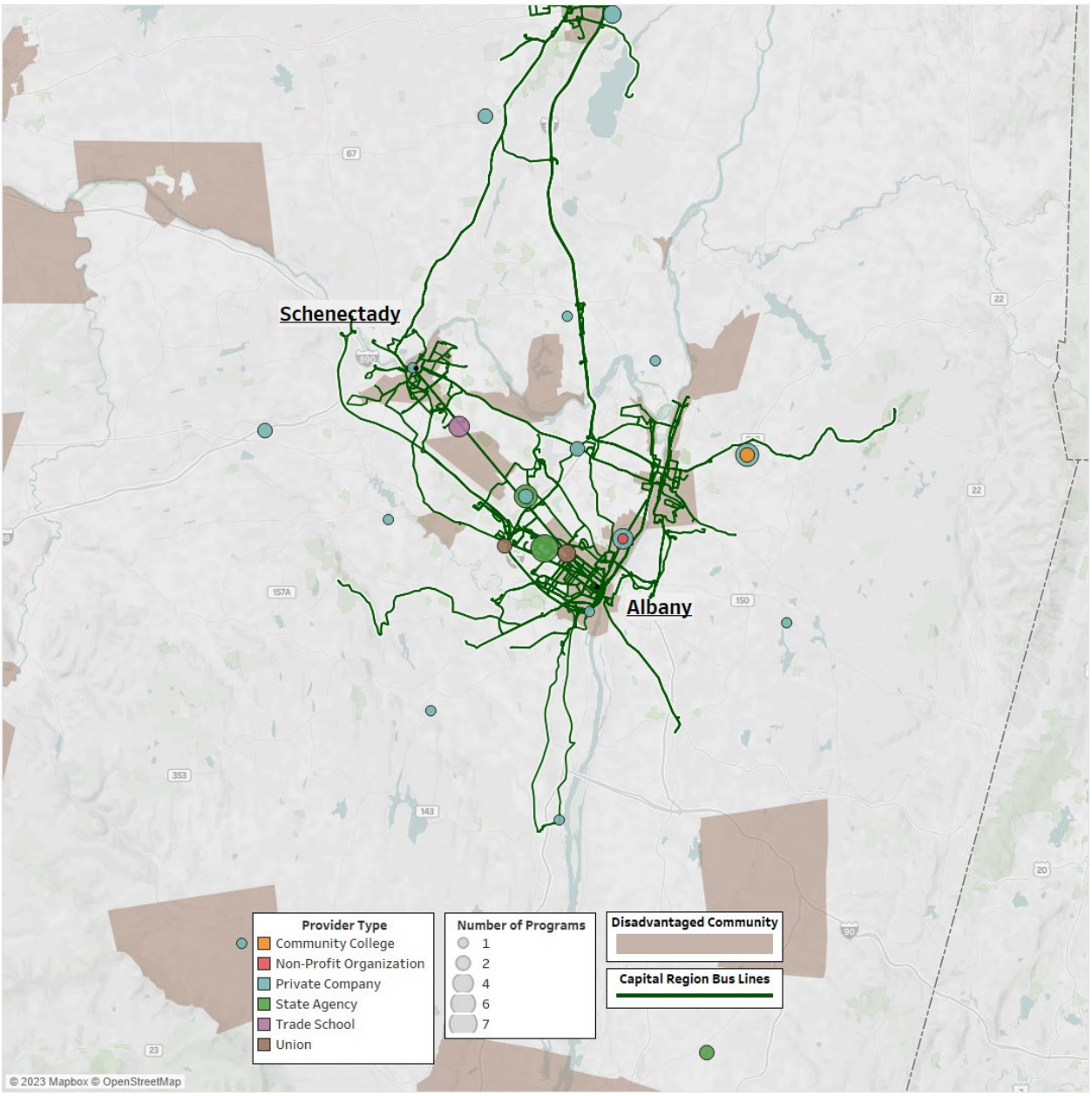
In the Buffalo region, residents in underrepresented communities along the State's western border have access to bus lines as well as eight offshore wind-related apprenticeships through Driscoll Electrical Construction, Inc.; General Mills Operations' GM Powertrain Division; International Union of Elevator Constructors; Wittburn Enterprises; and the Independent Contractors Guild of WNY. The University of Buffalo also offers an engineering degree which focuses on clean energy and structural or materials engineering and Erie 1 BOCES offers a welding technician program.

Figure B.2. Training Accessibility—Buffalo



Schenectady, in the Capital Region, is home to the Modern Welding School, Inc., which offers welding technician certifications. There are 25 apprenticeships concentrated in the Albany area, and residents in disadvantaged communities within the Capital Region have access to the bus system that would take them to Albany. Twelve out of the 25 apprenticeships are offered through The Center for Economic Growth and New York State's Department of Corrections and Community Supervision.

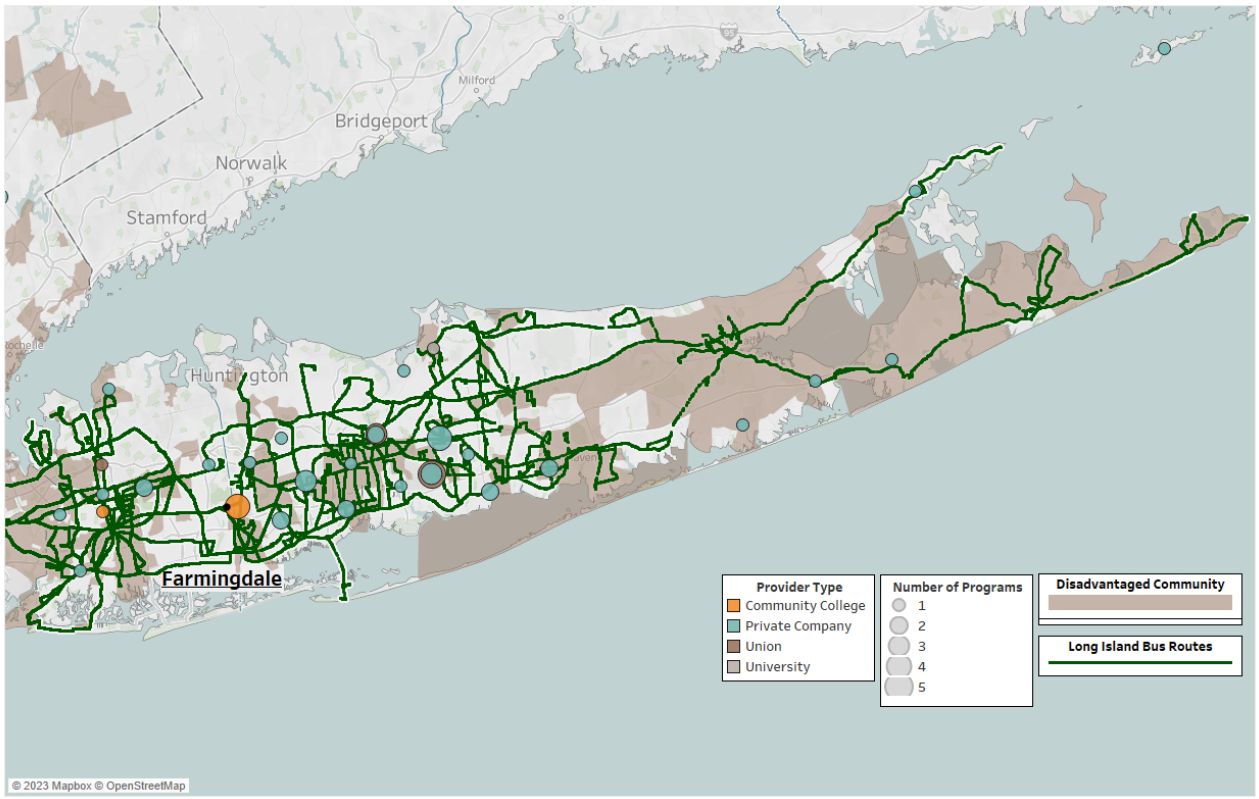
Figure B.-3 Training Accessibility—Capital Region



Farmingdale State College in Long Island offers a certificate and micro-credential program for offshore wind. Long Island is also home to Nassau Community College, which also offers a certificate in sustainable design and renewable energy with a wind turbine applications course, and Suffolk County Community College, which is currently developing a non-credit wind energy program with funding from Eversource and Ørsted.

Ten apprenticeships for offshore wind-related trades are also available in Long Island, largely along the bus routes.

Figure B-4. Training Accessibility—Long Island

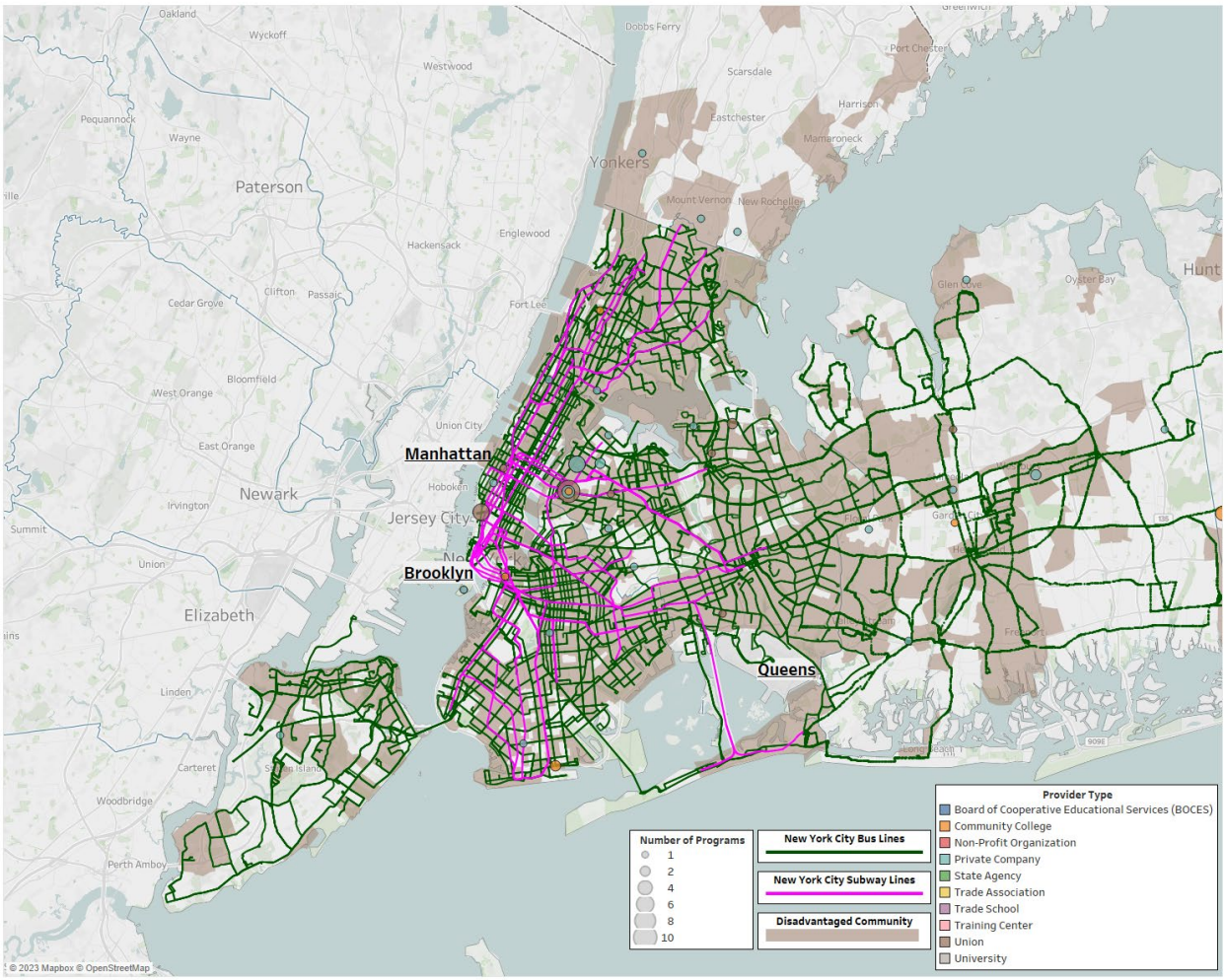


New York City is home to the following community colleges:

1. LaGuardia Community College
2. Kingsborough Community College
3. New York City College of Technology
4. College of Staten Island

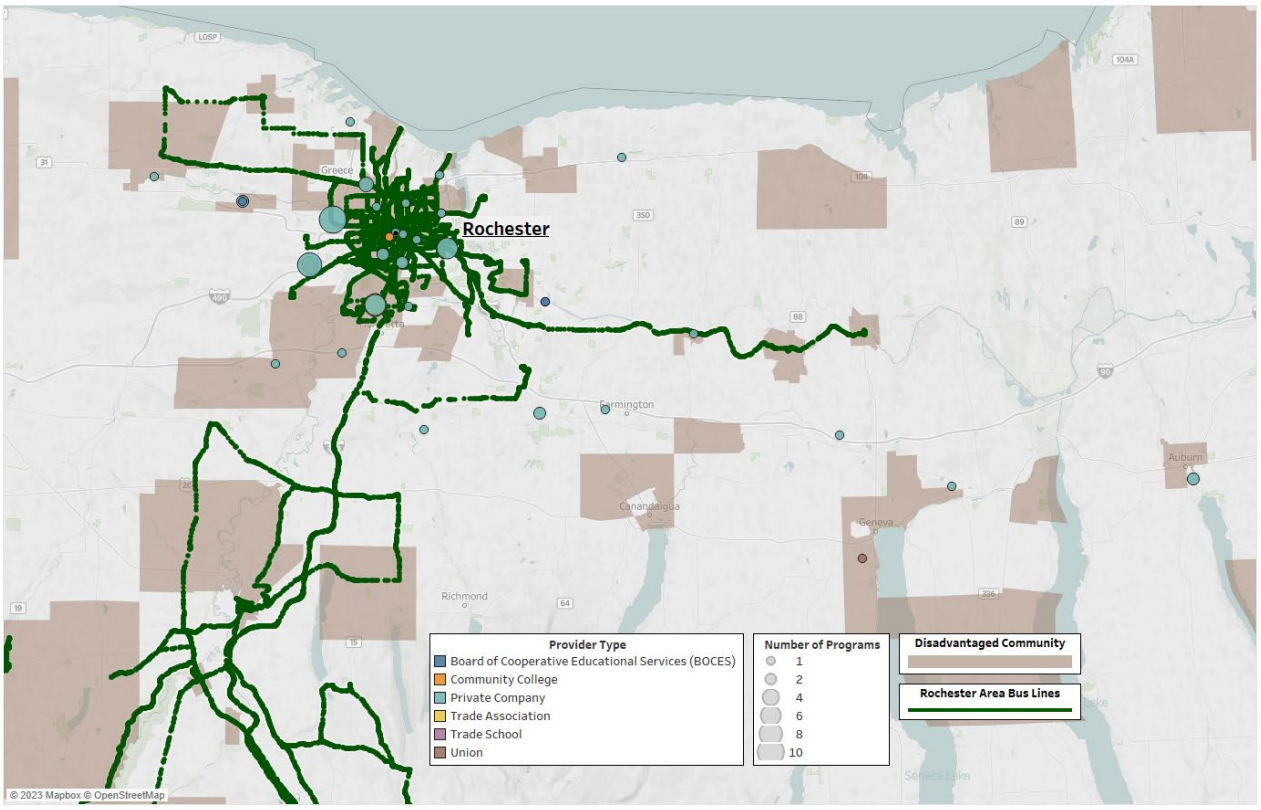
Kingsborough Community College offers a Maritime Technology program, which provides certification for offshore wind basic safety training. These colleges are collaborating on the Bridge to Offshore Wind Program that will provide opportunities for individuals to explore OSW career pathways as well as the education and training required to enter the industry, with a specific focus on maritime, electrical, construction, and supply chain segments.

Figure B-5. Training Accessibility—New York City



Rochester is home to roughly 60 apprenticeships and one training center—the Monroe 2-Orleans BOCES—which offers an in-house welder training program at their 6,000 square foot facility. Sixteen apprenticeships are offered through Kennedy Mechanical Plumbing and Heating, Machine Tool Research, Rebuild Optimization Technology, and The Rochester Technology and Manufacturing Association (RTMA).

Figure B-6. Training Accessibility—Rochester

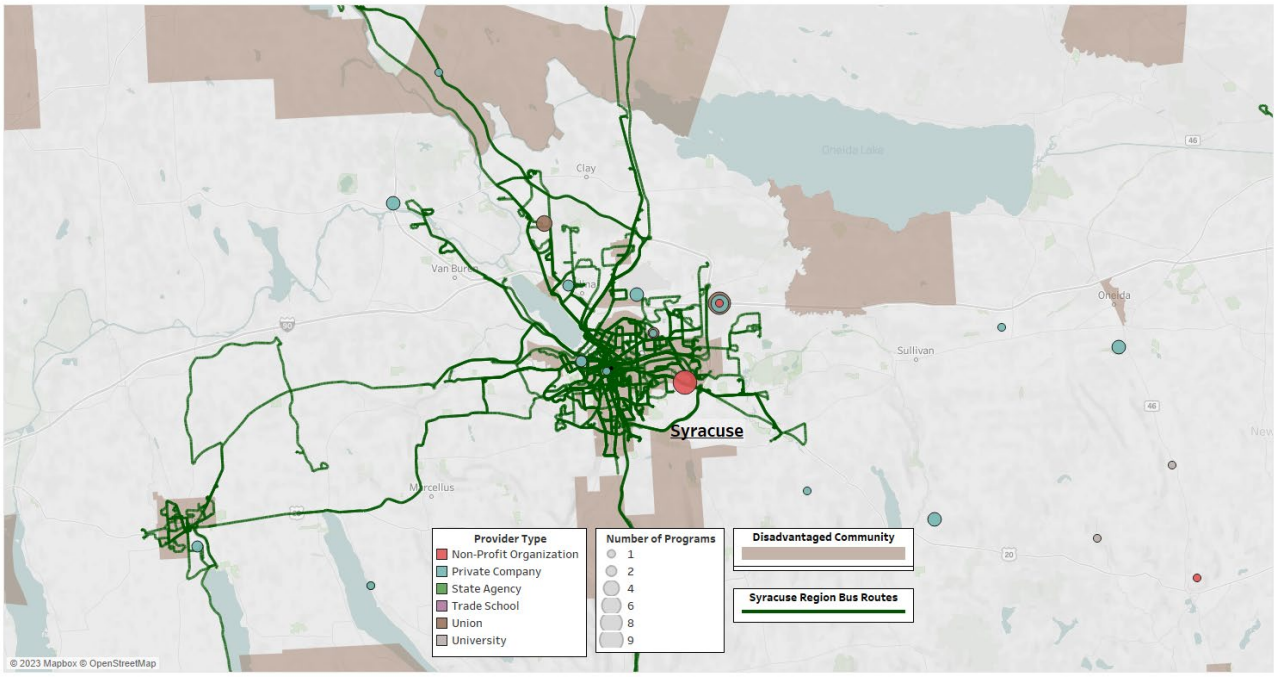


Syracuse is home to SUNY Morrisville, which offers two programs:

1. Renewable Energy Bachelor of Technology, including a wind track.
2. Renewable Energy Technology Associate Program, which prepares students to install, operate, troubleshoot, and maintain a broad array of renewable energy systems, including wind.

The campus is reachable by bus lines for individuals outside of the immediate vicinity. There are also 36 apprenticeships in the city that are accessible via bus routes for residents within the city that reside in disadvantaged communities.

Figure B-7. Training Accessibility—Syracuse



Endnotes

[1] To view NYSEREDA's offshore wind solicitation and associated documents stored on the NYSERDA offshore wind website visit: https://www.nyserda.ny.gov/offshore-wind-2022-solicitation

[2] To view the 2022 NYSERDA Workforce Gap Analysis: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/New-York-State-Workforce-Gap-Analysis-2022.pdf

[3] Given the recent policy developments described in the Introduction of this report, the forecasts of job growth figures provided remain directionally correct but will not reflect the additional manufacturing and supply chain growth.

[4] The other category includes a number of certifications, such as the American Welding Society Certification (AWS); Certification in Cardiopulmonary Resuscitation (CPR); Certified Quality Auditor (CQA); Certified Quality Engineer (CQE); EPA Section 608 Certification (EPA 608); First Aid; IPC-A 610 Acceptability of Electronic Assemblies; ISO 3834; LEED Accredited Professional; Six Sigma Green Belt Certification (SSGB); Transportation Worker Identification Credential (TWIC); among others.

[5] The other category includes a number of skills, such as Aerial Lifts; Autodesk Revit; Bentley STAAD; Circuit Boards; Computerized Numerical Control Software (CNC Software); Customer Relationship Management (CRM); Dassault Systems SolidWorks Software; among others.

[6] The research team is not including the "Planning, Design, and Development" phase, which is the initial phase in developing an offshore wind generating facility. The reasoning for this is threefold: 1) There are too few OSW-specific occupational needs in this phase; 2) Occupational transitions from other sectors are less skill-based, and 3) These are not OSW-specific enough for a certification analysis.

[7] Criteria included 1) likelihood of that occupation being present in New York, 2) the need for advanced degree; 3) 2030 demand for the role compared to 2020 supply of workers, and 4) existing location quotient.

[8] U.S. Bureau of Labor Statistics and Occupational Information Network

[9] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[10] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[11] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[12] Based on the 14,994 New York State job postings for architectural and engineering managers active from 1/18/2022 to 1/18/2023

[13] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Occupations which are within the top 5 most highly related or transferable occupations are included in this analysis. In addition to these, the research team added other transferrable occupations based on the experience and education requirements of this occupation.

[14] JobsEQ. Based on place of work employment estimates. Accessed January 19, 2023.

[15] U.S. Bureau of Labor Statistics and Occupational Information Network

[16] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[17] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[18] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[19] Based on the 948 New York State job postings for all other assemblers and fabricators active from 1/18/2022 to 1/18/2023

[20] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Due to the lack of occupations listed in O*NET Career Changers Matrix with transition potential into All Other Assemblers and Fabricators positions, the

research team made conservative estimates and selected occupations with transition potential into Team Assemblers, Engine and Other Machine Assemblers, and Electrical and Electronic Equipment Assemblers positions. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[21] JobsEQ. Based on place of work employment estimates. Accessed January 20, 2023.

[22] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[23] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[24] Based on the 14,512 New York State job postings All Other Business Operations Specialists active from 2/12/2022 to 2/12/2023

[25] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[26] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[27] JobsEQ. Based on place of work employment estimates. Accessed January 19, 2023.

[28] U.S. Bureau of Labor Statistics and Occupational Information Network

[29] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[30] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[31] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[32] Based on the 274 New York State job postings for captains, mates, and pilots of water vessels active from 2/13/2022 to 2/13/2023

[33] Transferable occupations are taken from the Bureau of Labor Statistics Occupational Outlook Handbook. The research team chose the occupations with the most applicable skillet. Sailors and marine oilers, motorboat operators, and fishing and hunting workers were chosen for their relevant and transferrable experience working on water vessels.

[34] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[35] U.S. Bureau of Labor Statistics and Occupational Information Network.

[36] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[37] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed August 2022.

[38] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1.

[39] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[40] JobsEQ. Accessed November 2022.

[41] U.S. Bureau of Labor Statistics and Occupational Information Network

[42] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[43] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[44] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[45] Based on the 1,378 New York State job postings for civil engineers active from 2/13/2022 to 2/13/2023.

[46] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 9 most highly related or transferable occupations are included in this analysis.

[47] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[48] U.S. Bureau of Labor Statistics and Occupational Information Network

[49] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[50] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[51] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[52] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[53] JobsEQ. Based on place of work employment estimates. Accessed February 15, 2023.

[54] U.S. Bureau of Labor Statistics and Occupational Information Network

[55] JobsEQ. Occupational wages from 2022 Q2. Data accessed January 2023.

[56] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[57] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[58] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[59] JobsEQ. Based on place of work employment estimates. Accessed January 18, 2023.

[60] U.S. Bureau of Labor Statistics and Occupational Information Network

[61] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1.

[62] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed August 2022.

[63] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis. In addition to these, the research team added other transferrable occupations based on the experience and education requirements of this occupation.

[64] JobsEQ. Accessed November 2022.

[65] U.S. Bureau of Labor Statistics and Occupational Information Network

[66] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[67] New York State Department of Labor. Crane Exams. https://dol.ny.gov/crane-exams.

[68] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[69] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[70] Based on the 34 New York State job postings for crane and tower operators active from 2/13/2022 to 2/13/2023.

[71] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[72] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[73] U.S. Bureau of Labor Statistics and Occupational Information Network

[74] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[75] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[76] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[77] Based on the 1,388 job postings in New York State for electrical and electronic engineering technologists and technicians active from 2/13/2022 to 2/13/2023.

[78] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[79] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[80] U.S. Bureau of Labor Statistics and Occupational Information Network

[81] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[82] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[83] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[84] Based on the 4,210 New York State job postings for electrical engineers active from 2/13/2022 to 2/13/2023

[85] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 10 most highly related or transferable occupations are included in this analysis.

[86] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[87] U.S. Bureau of Labor Statistics and Occupational Information Network

[88] JobsEQ. Occupational wages from 2022 Q2. Data accessed January 2023.

[89] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[90] Based on the 1,356 New York State job postings for electricians active from 1/18/2022 to 1/18/2023

[91] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[92] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[93] JobsEQ. Based on place of work employment estimates. Accessed January 18, 2023.

[94] U.S. Bureau of Labor Statistics and Occupational Information Network

[95] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[96] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[97] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[98] Based on the 44 job postings in New York State for engine and other machine assemblers active from 2/13/2022 to 2/13/2023.

[99] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[100] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[101] U.S. Bureau of Labor Statistics and Occupational Information Network

[102] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[103] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1.

[104] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed August 2022.

[105] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[106] JobsEQ. Accessed November 2022.

[107] U.S. Bureau of Labor Statistics and Occupational Information Network

[108] JobsEQ. Occupational wages from 2022 Q2. Data accessed January 2023.

[109] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[110] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[111] Based on the 10,472 New York State job postings for general and operations managers active from 1/18/2022 to 1/18/2023

[112] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis. Due to the wide variety of occupations listed in O*NET Career Changers Matrix with transition potential into General and Operations Manager positions, the research team made conservative estimates and selected only those occupations which were identified as most relevant.

[113] JobsEQ. Based on place of work employment estimates. Accessed January 18, 2023.

[114] U.S. Bureau of Labor Statistics and Occupational Information Network

[115] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[116] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[117] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[118] Based on the 27 New York State job postings for helpers, construction trades, all other active from 2/13/2022 to 2/13/2023

[119] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis. Occupations transferrable to Helpers, Construction Trades were considered for this analysis.

[120] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[121] U.S. Bureau of Labor Statistics and Occupational Information Network

[122] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[123] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[124] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[125] Based on the 29 New York State job postings for active from 1/18/2022 to 1/18/2023

[126] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[127] JobsEQ. Based on place of work employment estimates. Accessed January 19, 2023.

[128] U.S. Bureau of Labor Statistics and Occupational Information Network

[129] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[130] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[131] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[132] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[133] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[134] U.S. Bureau of Labor Statistics and Occupational Information Network

[135] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[136] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[137] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[138] Based on the 3,113 New York State Job Postings for Industrial Engineers active from 2/14/2022 to 2/14/2023.

[139] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[140] JobsEQ. Based on place of work employment estimates. Accessed February 15, 2023.

[141] U.S. Bureau of Labor Statistics and Occupational Information Network

[142] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[143] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[144] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[145] Based on the 1,207 New York State Job Postings for industrial production managers active from 2/14/2022 to 2/14/2023.

[146] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis. Due to the wide variety of occupations listed in O*NET Career Changers Matrix with transition potential into General and Operations Manager positions, the research team made conservative estimates and selected only those occupations which were identified as most relevant.

[147] JobsEQ. Based on place of work employment estimates. Accessed February 15, 2023.

[148] U.S. Bureau of Labor Statistics and Occupational Information Network

[149] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[150] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[151] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[152] Based on the 2,522 New York State job postings for inspectors, testers, sorters, samplers, and weighers active from 1/18/2022 to 1/18/2023

[153] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[154] JobsEQ. Based on place of work employment estimates. Accessed January 19, 2023.

[155] U.S. Bureau of Labor Statistics and Occupational Information Network

[156] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[157] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[158] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[159] Based on the 11,627 job postings in New York State for laborers and freight, stock, and material movers active from 2/13/2022 to 2/13/2023.

[160] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[161] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[162] U.S. Bureau of Labor Statistics and Occupational Information Network

[163] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[164] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[165] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[166] Based on the 1,316 New York State Job Postings for machinists active from 2/14/2022 to 2/14/2023.

[167] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[168] JobsEQ. Based on place of work employment estimates. Accessed February 15, 2023.

[169] U.S. Bureau of Labor Statistics and Occupational Information Network

[170] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[171] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1.

[172] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed August 2022.

[173] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Due to the lack of occupations listed in O*NET Career Changers Matrix with top transition potential into Operating Engineer and Other Construction Equipment Operator positions, the research team made conservative estimates and did not limit the analysis to only the top, most highly related or transferable occupation.

[174] JobsEQ. Accessed February 2023.

[175] U.S. Bureau of Labor Statistics and Occupational Information Network

[176] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[177] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[178] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[179] Based on the New York State job postings for Plant and System Operators, All Other active from 1/18/2018 to 1/18/2023

[180] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis. Due to the lack occupations listed in O*NET Career Changers Matrix with transition potential into All Other Plant and System Operators positions, the research team selected occupations with transition potential into Power Plant Operators which was identified as most relevant.

[181] JobsEQ. Based on place of work employment estimates. Accessed January 20, 2023.

[182] U.S. Bureau of Labor Statistics and Occupational Information Network

[183] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[184] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[185] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[186] Based on the 36 job postings in New York State for structural iron and steel workers active from 2/13/2022 to 2/13/2023

[187] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[188] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[189] U.S. Bureau of Labor Statistics and Occupational Information Network

[190] JobsEQ. Occupational wages from 2022 Q3. Data accessed January 2023.

[191] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[192] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[193] Based on the 102 New York State job postings for structural metal fabricators and fitters active from 1/18/2022 to 1/18/2023

[194] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. These transferrable occupations have indices 8-10 because they are the only occupations returned in the Career Changers matrix.

[195] JobsEQ. Based on place of work employment estimates. Accessed January 18, 2023.

[196] U.S. Bureau of Labor Statistics and Occupational Information Network

[197] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[198] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[199] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[200] Based on the 1,407 job postings in New York State for transportation, storage, and distribution managers active from 2/13/2022 to 2/13/2023.

[201] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[202] JobsEQ. Based on place of work employment estimates. Accessed February 14, 2023.

[203] U.S. Bureau of Labor Statistics and Occupational Information Network

[204] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[205] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[206] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[207] Based on the 811 job postings in New York State for welders, cutters, solderers, and brazers active from 2/14/2022 to 2/14/2023.

[208] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[209] JobsEQ. Based on place of work employment estimates. Accessed February 15, 2023.

[210] U.S. Bureau of Labor Statistics and Occupational Information Network

[211] JobsEQ. Occupational wages from 2022 Q3. Data accessed February 2023.

[212] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q1. Based on place of residence employment estimates.

[213] JobsEQ. Real Time Intelligence (RTI) Job Postings. Data accessed January 2023.

[214] JobsEQ Real Time Intelligence (RTI) Job Postings. Data accessed February 2023.

[215] Based on the 18,350 New York State job postings for general maintenance and repair workers active from 1/18/2022 to 1/18/2023 and 37 New York State job postings for wind turbine service technicians active from 2/16/2022 to 2/16/2023.

[216] Educational attainment for all occupational profiles is taken from JobsEQ for the current workforce of the selected occupation as of 2022 Q3. Based on place of residence employment estimates.

[217] Transferable occupations are taken from O*NET's Career Changers Matrix: https://www.onetcenter.org/dictionary/20.3/excel/career_changers_matrix.html. Only occupations which are within the top 5 most highly related or transferable occupations are included in this analysis.

[218] JobsEQ. Based on place of work employment estimates. Accessed January 18, 2023.

[219] These programs include: Quality Assurance Auditor; Hazardous Materials Removal Worker; and, Site Safety Manager.

[220] These are based on NYSERDA's definition which can be found here: https://www.nyserda.ny.gov/ny/disadvantaged-communities.

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