Master Plan 2.0: Navigating Workforce Opportunities and Challenges of Scaling Up Offshore Wind Targets in New York State

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Master Plan 2.0: Navigating Workforce Opportunities and Challenges of Scaling Up Offshore Wind Targets in New York State

Final Report

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Abstract

This report assesses the workforce opportunities and challenges associated with scaling offshore wind deployment in New York State under the State Energy Plan's Additional Action scenario. It evaluates two deployment pathways—5 GW and 7 GW of installed capacity between 2024 and 2040—and quantifies associated employment, skills requirements, and regional workforce distribution across the project lifecycle. The study combines economic modeling of full-time equivalent (FTE) employment, supply chain analysis, stakeholder engagement, and a review of prior workforce studies and case examples from early U.S. offshore wind projects. Results indicate that a 7 GW build-out could generate approximately 36,500 direct and indirect FTE-years, with the majority concentrated in New York City (NYC) and Long Island and significant demand in operations and maintenance. Around 19% of roles are identified as "critical" due to their specialization and strategic importance. The analysis finds that most workforce needs can be met through transferable skills from existing sectors, supplemented by training in targeted offshore wind. Key challenges include regulatory uncertainty, funding constraints, training scalability, and limited workforce awareness. The report provides recommendations to improve workforce awareness, enhance curriculum flexibility, increase access to funding, support inclusive participation, and strengthen coordination across industry, training providers, and government to enable a responsive and sustainable workforce pipeline.

Keywords

offshore wind workforce; job creation and modelling; supply chain development; workforce training and certification; clean energy transition

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Acronyms and Abbreviations

ACP	American Clean Power Association
AIMS	adjacent industry manufacturing scale
AMA	American Welder Association
ARROW	Academic Center for Reliability and Resilience of Offshore Wind
BIPOC	black, indigenous, and people of color
BOCES	Boards of Cooperative Educational Services
BOEM	Bureau of Ocean Management
BST	Basic Safety Training
BTT	Basic Technical Training
BVGA	BVG Associates
CAC	Climate Action Council
CBO	Community-based organization
CEO	Chief executive officer
CFO	Chief financial officer
City Tech	New York City College of Technology
Climate Act	Climate Leadership and Community Protection Act of 2019
CNC	Computer numerical control
COP	Construction and Operations Plan
CTE	Career and technical education
CTV	Crew transfer vessels

CUNY	City University of New York
DAC	Disadvantaged community
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
EPCI	Engineering, procurement, construction and installation
EV	Electric vehicle
FTE	Full-time equivalent
FTE-year	Equivalent of one full-time job for one year
GVA	Gross Value Added
GWO	Global Wind Organisation
HR	Human resources
HSE	Hea
HUET	Helicopter Underwater Escape Training
HVAC	Heating, ventilation, and air conditioning
HVDC	High-voltage direct current
IBEW	International Brotherhood of Electrical Workers
IEO	Initial Employment Outputs
IIJA	Infrastructure Investment and Jobs Act
IMPLAN	Impact Analysis for Planning
IRA	Inflation Reduction Act of 2022
ISO–NE	Independent System Operator New England
IT	Information technology
JEDI	Jobs and Economic Development Impact
Jonas Act	Merchant Marine Act of 1920
LCOE	Levelized cost of energy
MAPP	Multi-Craft Apprenticeship Preparation Program
MWBE	Minority and Women-owned Business Enterprises
NABTU	North America's Building Trades Unions
NAICS	North American Industry Classification System
NCCER	National Center for Construction Education and Research
NGOs	non-governmental organizations
NJBPU	New Jersey Board of Public Utilities
NJDCA	New Jersey Department of Community Affairs
NJDEP	New Jersey Department of Environmental Protection
NJDOL	New Jersey Department of Labor and Workforce Development
NJDOT	New Jersey Department of Transportation
NJEDA	New Jersey Economic Development Authority
NOWA	National Offshore Wind Agreement
NOWTC	National Offshore Wind Training Center

NRL	National Laboratory of the Rockies
NYC	New York City
NYCEDC	New York City Economic Development Council
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOL	New York State Department of Labor
NYSDOS	New York State Department of State
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
OFTO	Offshore transmission owner
ONC BOCES	Otsego Northern Catskills Boards of Cooperative Educational Services
ORBIT	Offshore Renewables Balance of System Installation Tool
OSHA	Occupational safety and health administration
OSS	Offshore substation
OSW HVDC Transmission	Offshore Wind High-Voltage Direct Current Transmission
OWSP	Offshore Wind Strategic Planning
OWTG	Offshore Wind Turbine Generator
OWTI	Offshore Wind Training Institute
PLA	Project Labor Agreement
PMP	Project Management Professional
REDC	Regional Economic Development Council
ReEDS	Regional Energy Deployment System
RFI	Request for information
RFP	Request for proposal
ROV	Remotely operated vehicle
SBMT	South Brooklyn Marine Terminal
SCADA	Supervisory control and data acquisition
SDVOBs	Service-Disabled Veteran-Owned Small Businesses
SEA	Sustainable Energy Advantage
SEO	Secondary Employment Outputs
SEP	State Energy Plan
SOV	service operation vessels
SPOWT2	SUNY Polytechnic Institute Offshore Wind Training Team
SUNY Poly	SUNY Polytechnic Institute
SUNY	State University of New York
T&I	Transport and installation
UMass	University of Massachusetts
UNC	University of North Carolina

USEER	U.S. Energy and Employment Report
WEAs	wind energy areas
WIND Institute	Wind Innovation & New Development Institute
WISDEM	Wind-Plant Integrated System Design and Engineering Model
WTG	Wind turbine generator
WTIVs	Wind turbine installation vessels

Summary

New York State (NYS) is advancing a domestic offshore wind industry under the "2025 State Energy Plan" (SEP) as part of its commitment to a zero-emissions electricity system by 2040 (New York State Energy Planning Board 2025). The SEP provides a strategic framework for transitioning to a clean, reliable, and affordable energy system while reducing greenhouse gas emissions, forming the basis for energy planning across New York State. Building on this, the New York State Energy Research and Development Authority (NYSERDA) commissioned this analysis to assess job creation and workforce needs associated with offshore wind deployment under the SEP Additional Action scenario, considering two scenarios: 5 GW and 7 GW installed between 2024 and 2040. It highlights the factors influencing workforce demand and the need for critical roles, providing guidance for workforce planning to support New York' clean energy transition.

S.1 Expected Offshore Wind Job Creation

Offshore wind development represents a major economic opportunity for New York State, supporting employment across a full project lifecycle. Previous studies highlight the sector's potential to generate long-term employment and workforce development opportunities, with the scale of impact dependent on deployment volume and level of supply chain participation.

For an offshore wind build-out of 7 GW by 2040, projections indicate that 36,500 direct and indirect full-time equivalent years (FTE-years) will be created in New York State between 2018 and 2070 (see Figure ES-1). This timeframe captures early-stage development activity beginning around 6 years before the first project reaches commercial operation, through to approximately 30 years after the final capacity is installed. The peak level of employment was reached in 2025, with an estimated total of 2,140 full-time equivalent (FTE) positions created in New York State.

Under a lower deployment scenario of 5 GW, around 27,080 FTE-years will be created in New York State, covering the full lifecycle of installed projects. In both scenarios, approximately 86% of employment is expected in New York City (NYC) and Long Island, 7% in the Mid-Hudson and Capital regions, and 7% across other regions of the State.

The offshore wind supply chain opportunities vary by region, with their volume differing by scenario (Table ES-1). In New York City and Long Island, the greatest opportunity is in the operations and maintenance (O&M) phase. This phase is expected to create around 19,440 FTE-years between 2024 and 2046 under the 7 GW of offshore wind scenario and 14,400 FTE-years under the 5 GW offshore wind scenario.

A typical project in the NYS pipeline is expected to operate for 25 years, resulting in the highest cumulative FTE-years and long-term jobs. Shorter phases, such as manufacturing and installation and commissioning, generate fewer total FTE-years across the pipeline but involve higher short-term labor demands. In the Mid-Hudson and Capital regions and other NYS regions, the greatest opportunities will be in installation and commissioning support and manufacturing, respectively.

Figure S-1. Total Employment Impacts by Region in New York State

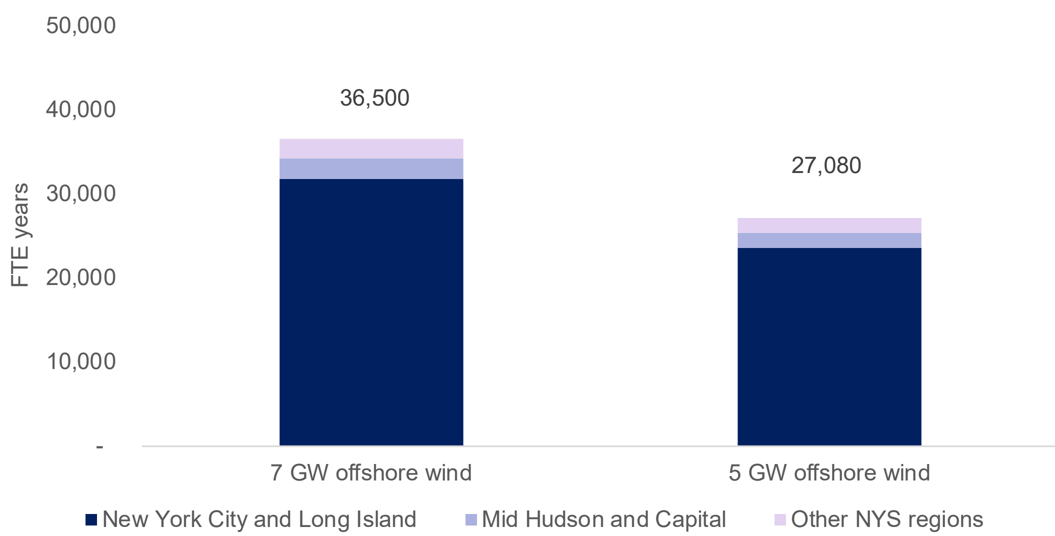


Table S-1. Direct and Indirect Full-Time-Equivalent Years Created in New York State by Supply Chain Category

Category	7 GW Offshore Wind			5 GW Offshore Wind		
	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions
Development and project management	1,840	220	220	1,510	180	180
Manufacturing and assembly	—	230	1,640	—	170	1,220
Installation and commissioning	8,200	2,060	430	5,980	1,510	310
O&M	19,440	—	—	14,400	—	—
Decommissioning	2,200	—	—	1,630	—	—
Total	**31,680**	**2,510**	**2,290**	**23,520**	**1,860**	**1,710**

S.2 Workforce Demand Assessment

New York State benefits from a strong network of academic institutions, technical colleges, and organized labor training programs, all well positioned to meet much of the workforce demand expected across the offshore wind supply chain. The majority of offshore wind-related training already exists within the State's labor market. Roles such as engineers, accountants, human resources (HR) professionals, and project managers are highly transferable across industries and directly applicable to offshore wind.

Industry-specific training is also needed for certain offshore wind roles, including industry awareness, on-the-job learning, or specific external training. Roles requiring niche training are considered strategically important, or "critical," for supporting the NYS offshore wind pipeline. A structured approach was used to identify critical roles based on transferability, leadership, technical specialization, and workforce volume.

Based on this, 153 critical job roles were identified across the development and project management, manufacturing, installation and commissioning, and O&M phases. This accounts for approximately 19% of total expected job creation in New York State. The highest demand for specialized offshore wind expertise is in the development and project management phase and the O&M phase, while manufacturing and installation rely more heavily on transferable, trade-based skills. In these phases, critical roles account for roughly 24% and 28% of total jobs created in the State, respectively. By comparison, the installation and commissioning phase and the manufacturing phase have a smaller share of critical roles, accounting for about 8% and 6% of job creation, respectively.

Regionally, New York City and Long Island account for the majority of demand for critical roles (over 6,600 FTE-years), driven by the high concentration of development and O&M activity. The Mid-Hudson and Capital regions and other NYS regions have less demand for critical roles, with workforce needs focused more on installation and manufacturing work.

The remainder of the workforce outside critical job roles, 81% of the total workforce, is expected to come from the existing labor base in New York State, drawing on skills from construction, engineering, maritime, and energy sectors. The key challenge is ensuring these workers are prepared and that systems are in place to support working in offshore wind. The current landscape presents both opportunities and challenges in preparing the wider workforce and building the skills needed to meet demand for critical roles ahead of offshore wind development.

S.3 Recommendations

New York State has a strong foundation of courses and programs that provide the skills needed for the offshore wind workforce, particularly for critical job roles. Skills from the construction, engineering, maritime, energy, and professional sectors are highly transferable and can support both critical job roles and the broader workforce. The overall current training system demonstrates a strong capacity to meet the skills and training needs across all stages of the offshore wind supply chain. Approximately 40 active programs were identified, collectively training an average of approximately 2,300 participants per year in 2024–25. Most provision is concentrated in New York City and Long Island, aligning well with where offshore wind employment demand is expected to be highest.

Offshore wind training during this period has focused on introductory offshore wind programs, Global Wind Organisation (GWO) safety certification, and transferable trade skills, particularly electrical and welding. Several universities and colleges offer degree programs in engineering, environmental science, and related disciplines that build strong foundational skills for the offshore wind sector. The current landscape generally targets the right skill areas and offers opportunities to build on existing programs and partnerships as industry demand grows.

Challenges exist in the scalability of its systems, program delivery, and alignment with industry demand. Uncertainty about regulations and project delays hinders training providers and employers from predicting what skills will be required and when. Many funding and training grants address immediate needs, creating challenges in establishing lasting capacity or maintaining engagement when industry demand declines. While GWO training is available, challenges lie less in course availability and more in instructor capacity and the ability to scale quickly when demand materializes.

Much of the knowledge required for offshore wind, particularly for critical roles, is specialized, including knowledge of procurement processes, management of offshore infrastructure projects, and the technical requirements of key components and services. This is ultimately developed through on-the-job experience, with support from employers. Building on this, to sustain a skilled workforce that meets future industry needs, New York State should continue to strengthen coordination among stakeholders to create a scalable, transferable skills-based training system that enables the workforce to respond quickly as project activity grows. To accomplish this, the State should concentrate on:

1. **Workforce awareness:** Continue to expand coordinated outreach to increase awareness of offshore wind careers among individuals and businesses. This includes clearly communicating the range of roles available, highlighting transferable skills from related sectors. Stronger engagement with local suppliers and educational institutions will help build a talent pipeline that is informed about opportunities and job availability.
2. **Curriculum development**: Increase flexibility across the training system. Existing university and college programs should be broadened to include offshore wind content, particularly within disciplines such as engineering, environmental science, and related fields, from which much of the future workforce is likely to come. This will help build awareness of opportunities while embedding relevant skills early. Stronger employer involvement in course design will ensure content stays aligned with industry needs and can adapt quickly as demand changes.

   Offshore wind-specific courses should remain flexible in content, focusing on broad, transferable skills so they remain relevant during periods of lower demand. Designing programs for scalability is important in this context, particularly for GWO-related training. This requires addressing practical constraints such as instructor availability and investing in the necessary training facilities to ensure capacity can be scaled up efficiently as demand increases.

3. **Strategic funding:** Improve funding mechanisms to make training more accessible, flexible, and responsive to industry needs. This includes streamlining application processes, shortening funding timelines, and broadening eligible uses of funding, for example, to include equipment, staffing, curriculum development, and outreach. Strengthening long-term funding stability will help to improve program effectiveness and resilience.
4. **Accessibility:** Continue to engage with underrepresented and disadvantaged communities (DACs) to help ensure inclusive growth of the workforce. This can be achieved through closer collaboration with community-based organizations and trusted local partners, which play a big part in increasing awareness of opportunities and job availability. This can be supported by wraparound services, financial assistance such as stipends and scholarships, and targeted outreach, particularly to high school students, to help communicate offshore wind career pathways.
5. **Industry coordination:** Strengthen collaboration between industry, training providers, unions, and government to better align workforce development with real-time employer demand. This includes improving communication on hiring needs, timelines, and required skills with triaging providers. This coordination will ensure training investments are better targeted and the workforce system can scale effectively as the industry grows.

1. Introduction

New York State (NYS) is taking significant steps to develop a domestic offshore wind industry. The State has substantial offshore wind capacity under development and a strong future pipeline, with several projects in advanced stages. South Fork Wind, the first utility-scale offshore wind farm, became fully operational in 2024, with a capacity of approximately 130 MW. A further 1.7 GW of capacity is under construction and expected to come online by 2027, providing enough electricity to power around 1 million homes. New York State is also investing in port infrastructure and building a local supply chain to support manufacturing and installation activities.

As part of the State's broader commitment to achieving a zero-emissions electricity system by 2040, the "2025 State Energy Plan" (SEP) sets a strategic framework for transitioning to a clean, reliable, and affordable energy system (New York State Energy Planning Board 2025). This forms the basis for energy planning across the State and presents a series of planning scenarios that illustrate different pathways to meet future electrical demand while achieving a zero-emissions electric grid by 2040. These scenarios reflect differing levels of policy action and the pace of infrastructure development. The Additional Action scenario reflects a pathway in which the State undertakes further policy and investment measures to accelerate clean energy deployment beyond those already in place. The Additional Action scenario considers two scenario variants, based on assumptions about the level of new nuclear generation and the pace of transmission infrastructure development over the next 15 years. In both cases, offshore wind remains a key component of the resource mix needed to meet long-term decarbonization and energy demand.

Building on this, the New York State Energy Research and Development Authority (NYSERDA) commissioned BVG Associates (BVGA), Sustainable Energy Advantage (SEA), and Empowering Work Advisors to assess workforce needs associated with offshore wind deployment under the SEP Additional Action scenario. This analysis considers both scenario variants, covering two offshore wind deployment cases of approximately 5 GW and 7 GW installed between 2024 and 2040.

By assessing regional strengths and supply chain capabilities, this study identified the strategically important occupations required in New York State to support offshore wind deployment. It assesses how demand for these roles may vary with deployment rate and discusses the implications for overall workforce needs. The study includes:

- Section 2: Review of previous offshore wind studies
- Section 3: Lessons learned from New York State east coast offshore wind projects
- Section 4: Expected offshore job creation
- Section 5: Assessment of workforce demand and training needs to support offshore wind development
- Section 6: Existing offshore wind certification and training program review
- Section 7: Recommendations

2. Review of Previous Offshore Wind Workforce Studies

Twenty previous studies, reports, and plans about the offshore wind workforce were reviewed to validate or comment on each study's offshore wind development assumptions, methodologies, characterization of workforce needs, and overall findings. The studies range from state-specific to nationwide analyses. Appendix A includes detailed summaries of the workforce-related portions of each study.

NYSERDA published numerous reports regarding the offshore wind workforce development landscape. Publications began in 2017 and have explored the skills required across the offshore wind industry, opportunities for workforce growth, and strategies to expand participation in the sector. Key publications include early workforce assessments produced as part of the New York State Offshore Wind Master Plan, as well as more recent reports, including the New York State Offshore Wind Workforce Gap Analysis and the New York State Offshore Wind Workforce Skills Analysis.

This review also draws on national studies on the offshore wind workforce published by the U.S. Department of Energy (DOE), the National Laboratory of the Rockies (NRL)[1], and the industry American Clean Power Association (ACP). Additionally, studies from New Jersey, including work by the New Jersey Board of Public Utilities (NJBPU) and the New Jersey Economic Development Authority (NJEDA), were reviewed to better reflect the regional nature of offshore wind workforce development. The findings of these studies are discussed by considering:

- The workforce development ecosystem
- Stakeholder coordination and standardization
- Disadvantaged communities (DACs)
- Federal incentives
- Regional strategy
- Workforce estimates

2.1 Workforce Development Ecosystem

The offshore wind workforce development ecosystem has many stakeholders, including governments, private employers (developers, manufacturers, and service providers), labor unions, educational institutions (community colleges, universities, primary and secondary schools, and vocational schools), and community-based organizations (CBOs). Each group plays an important, sometimes overlapping, role in preparing workers for offshore wind careers. This section summarizes key findings about each stakeholder's role.

2.1.1 Employers

Research by the National Renewable Energy Laboratory (NREL) and workforce development resources published by ACP highlights the important role of employers in delivering offshore wind workforce training, including on-the-job training, either on a standalone basis or in coordination with other training providers (NREL 2023; ACP n.d.). Expanding on-the-job training opportunities can accelerate training timelines and create more opportunities for in-state workers.

Several studies recommend that developers and employers provide opportunities for U.S. trainees to gain practical experience at construction and operations sites in more established offshore wind markets. This exposure helps workers develop offshore wind-specific knowledge and experience. Employer involvement is particularly important in manufacturing, where hands-on experience is essential. Train-the-trainer programs can also strengthen vocational training provision by helping instructors develop relevant industry expertise. Employers that actively support these programs often contribute to stronger training outcomes (NYSERDA 2024b). Employers can also work with schools and colleges to develop apprenticeship programs for high school graduates. These programs create clear career pathways and help build a future workforce pipeline (NREL 2023; NJEDA 2022; NYSERDA 2024b).

2.1.2 Labor Unions

Many studies have highlighted the pivotal role labor unions play in developing the core skills needed for offshore wind and linking workers to opportunities within the sector. Many unions are integrating offshore wind training into their existing apprenticeship and training programs. The International Brotherhood of Electrical Workers (IBEW) and the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers, for example, have both updated their programs to ensure members gain the skills required for offshore wind projects. They have also developed new, specialized courses, such as intensive workshops focused on wind turbines and renewable energy systems, to develop offshore wind-specific expertise (NREL 2022b). Some local NYS chapters are also offering in-house Global Wind Organisation (GWO) training.

Union-led programs are especially valuable because they develop transferable skills that are relevant across multiple sectors. Previous studies highlight the importance of union apprenticeships and training programs in areas such as electrical work, welding, construction, and maritime operations, all of which are relevant to offshore wind (NREL 2022b; NJEDA 2022). These programs provide practical, hands-on training and help connect workers to employment opportunities through established industry networks. As many offshore wind occupations draw on skills used in other industries, union training can also support worker mobility between sectors as workforce demand evolves (NYSERDA 2023b).

2.1.3 Educational Institutes

Educational institutions, including schools, colleges, and universities, have been highlighted in previous studies as critical to raising awareness of offshore wind careers (NREL 2022b; NYSERDA 2022a). Primary and secondary schools are especially important for engaging students early, particularly in coastal communities, where offshore wind activity is generally concentrated. Partnerships between developers and K–12 schools have led to activities such as job fairs, virtual reality simulations, and site visits, which have helped to build interest in the sector. For example, Windscape Brooklyn, an offshore wind learning center developed on behalf of Empire Wind 1 and in collaboration with NYSERDA and the New York City Economic Development Corporation, hosts school field trips where students are exposed to the history of wind energy, offshore wind engineering, and environmental science exhibits and interactive displays (NYCEDC 2023).

NREL recommends that universities incorporate offshore wind content into existing degree programs to help students develop sector-specific knowledge and awareness (NREL 2022b). New York State has seen successful offshore wind modules emerge within both the State University of New York (SUNY) and the City University of New York (CUNY) systems. At the community college level, existing and forthcoming programs offering wind turbine technician certificates, GWO training, and National Center for Construction Education and Research (NCCER) certifications ensure that graduates acquire the hands-on skills and industry-recognized qualifications needed for roles such as welding, electrical work, and wind turbine maintenance (NYSERDA 2023b; NYSERDA 2024b).

2.1.4 Community-based Organizations

Workforce programs delivered by community-based organizations (CBOs) provide important entry points into offshore wind careers for workers from DACs (NYSERDA 2021; NYSERDA 2024b). CBOs are well-positioned to partner with labor unions and construction industry contractor associations because these organizations help connect community members to opportunities. CBO-led programs can provide foundational technical skills, professional development, wraparound support, and pathways into more advanced training and employment (DOE 2022b; NYSERDA 2021). Examples of how insights from prior studies on the strengths of CBO-led training have been translated into action include NYSERDA's funding of the Offshore Wind Career Pathway Program at the Capital Region Board of Cooperative Educational Services (BOCES) and Soulful Synergy's offshore wind workforce training program (NYSERDA 2019; NYSERDA 2022b).

2.2 Stakeholder Coordination and Standardization

Coordinating activities among employers, government agencies, and educational institutions is essential for aligning training with real job opportunities. A critical part of this is building and maintaining strong industry partnerships to ensure a clear understanding of where jobs exist and what skills are needed. In practice, this can include employer input into curriculum design, participation in advisory boards, provision of work-based learning or on-the-job training, and guidance on priority skills. Embedding this level of employer engagement helps ensure training remains relevant and responsive to industry needs (NYSERDA 2024b; NJBPU 2020b).

Examples of this approach are already seen in offshore wind. In New York State, the Offshore Wind Training Institute (OWTI), led by NYSERDA in partnership with SUNY Farmingdale State College and Stony Brook University, incorporates employer input to help guide training priorities and align with demand. Similarly, developers such as Ørsted have partnered with building trades training institutes to support apprenticeship and work-based training models, helping to create clearer pathways from training into employment (Orsted 2022). Allowing employers to play a leading role in shaping training is often the most effective approach because they have the clearest understanding of the specific skills and workforce volumes required.

At the federal level, the DOE previously recommended that the U.S. Department of Labor (DOL), in coordination with the U.S. Department of Education, convene a broad range of workforce stakeholders, including multiple federal agencies, regional employers, State and city governments, labor unions, training partners, and CBOs, to advance clean energy workforce development (DOE 2022a). Similar stakeholder engagement models can also be applied at the state level. In New York State, NYSERDA's Jobs and Supply Chain Technical Working Group provides an example of how industry, workforce and government stakeholders can be brought together to support offshore wind workforce and supply chain development (NYSERDA n.d.).

Previous studies also emphasize the importance of aligning skill requirements and communicating workforce needs clearly to training providers (NYSERDA 2024b; NJBPU 2020b). Without this common understanding, workforce development programs cannot be effectively designed or scaled. Several organizations (including NREL through its offshore wind workforce research and analysis, the Oceantic Network, the ACP, and the U.S. Climate Alliance Governors' Climate-Ready Workforce Initiative) focus on clarifying skill requirements, aligning training provision with industry demand, and supporting pathways across the sector (NREL 2022b).

Many industry-adjacent workers, such as those in the maritime and oil and gas sectors, already possess relevant skills for working in offshore wind. Previous studies highlight the value of upskilling and recognizing prior experience through stackable credentials, certificates, and targeted transition pathways (NREL 2022b; NYSERDA 2023b). In some cases, workforce development initiatives have also explored opportunities for commercial fisheries workers to support offshore wind activities such as monitoring and marine coordination roles (NJBPU and Interagency Taskforce on Offshore Wind 2020).

2.3 Disadvantaged Communities

The New York State Offshore Wind Skill Gap Analysis identified three priority population pools where targeted intervention could support offshore wind workforce growth through targeted training and engagement (NYSERDA 2022c):

- Workers in adjacent industries who could easily transition into offshore wind
- Individuals from priority populations and DACs[2]
- Future workers and new entrants to the workforce

Prior studies emphasize the importance of understanding the specific barriers DAC residents face to effectively recruit and retain them in workforce programs. (NYSERDA 2023d). Offshore wind training should be designed to be accessible in terms of delivery methods, timing, resource commitment, language, education level, and wrap-around services. Examples of accessible training include online training options, concise instructional materials, translation services, or staff support for live training sessions. Working with CBOs to draw on their expertise and relationships with residents within DACs is recommended when considering accessibility. (NYSERDA 2021; NYSERDA 2024b).

Many workers from DACs will require, or strongly benefit from, wraparound support such as stipends, transportation, or childcare. To avoid duplicating efforts, the literature recommends focusing on existing nonprofits that offer wraparound services and providing them with additional funding dedicated to individuals seeking to enter offshore wind occupations (DOE 2022b). Workforce program administrators should develop and implement mechanisms to assess and track the participation of diverse and local workers (NYSERDA 2022c).

For individuals from DACs, connecting with job opportunities, particularly in offshore wind and related sectors, can be especially challenging. While limited awareness of available opportunities remains a barrier, additional challenges also hinder successful entry and retention in positions, even after receiving required training. Labor unions play a critical role in bridging this gap by providing structured pathways, direct connections to employers, and targeted support for DAC residents, such as pre-apprenticeship and apprentice-readiness programs (NYSERDA 2023b). Some unions are also auditing their membership diversity to ensure equity goals are met and to strengthen links between union membership and DACs.

One effective mechanism for supporting DAC residents in entering and sustaining employment is the inclusion of targeted provisions within Project Labor Agreements (PLAs). NYSERDA's third, fourth, and fifth offshore wind solicitations (ORECRFP22-1, ORECRFP23-1, and ORECRFP24-1) required affiliated PLAs to include provisions that promote participation from Minority and Women-Owned Business Enterprises (MWBEs), Service-Disabled Veteran-Owned Small Businesses (SDVOBs), and employment of workers residing in DACs. Empire Wind 1 and Sunrise Wind executed PLAs covering all components of their project construction activities (Appendix B). (NYSERDA 2022c; NYSERDA 2023d; NYSERDA 2024c) PLA requirements ensure that offshore wind projects are constructed safely, with family-sustaining wages, and advance workforce equity and broaden access to careers across New York State.

Sunrise Wind provides many examples of benefits that flow to residents and businesses in DACs. The project creates $700 million of local investment in Suffolk County and 800 direct jobs plus thousands more indirect jobs. (NYSERDA, 2024b). Suffolk County contains several DAC census tracts, including in the Town of Brookhaven, which executed a $170 million host community agreement with Sunrise Wind (Winzelberg 2023). Other elements of Sunrise Wind that will at least partially flow to DACs in Suffolk County include:

- A $200 million offshore wind supply chain award to Long Island-based Haugland Group, supporting approximately 400 jobs (Eversource and Ørsted 2023).

- Supporting a new National Offshore Wind Training Center (NOWTC) at Suffolk County Community College with a $10 million investment (MarineLog 2024).
- Investing $5 million into a research partnership with Stony Brook University
- Establishing an operations and maintenance hub in East Setauket to support wind farm operations and the long-term associated operations and maintenance (O&M) jobs

Despite previous efforts to promote participation by workers living in DACs, many DACs have a lower share of residents employed in clean energy compared to the statewide average. Specifically, nearly two-thirds of counties with DACs have a smaller share of residents with clean energy jobs than the statewide average, even though nearly one-third of all clean energy jobs are found within DACs across New York State.(NYSERDA 2023a). Efforts surrounding job and training accessibility within DACs must therefore continue to scale.

2.4 Federal Support

Federal support for offshore wind workforce development during the Biden administration was delivered primarily through provisions enacted by the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act of 2022 (IRA). These laws linked clean energy deployment to labor standards, apprenticeship utilization, and domestic supply-chain development.

Key workforce-related measures relevant to offshore wind include:

- Embedding strong labor standards and support for organized labor in federally funded projects, including prevailing wage and apprenticeship requirements administered by the DOE, strengthening protections for workers, and supporting the use of organized labor.
- Funding to establish regional and State-level sector partnerships and registered apprenticeships, aimed at recruiting, training, and placing workers into occupations critical to domestic clean-energy and offshore wind supply chains, as supported under IIJA and DOE workforce programs (DOE 2022a).
- Incentives for private employers to incorporate equity and sustainability considerations into supply-chain decision-making, recognizing that domestic sourcing, high-road labor practices, and inclusive workforce development require additional resources (NYSERDA 2024b).

Several of these measures were implemented through the IRA, which strengthened workforce and labor outcomes by linking access to enhanced clean-energy tax credits to compliance with prevailing wage and registered apprenticeship requirements. Offshore wind and associated manufacturing projects that meet these requirements are eligible for tax credits of up to 30 %, compared with a base credit of 6% for projects that do not meet the labor standards.

The IRA also introduced Domestic Content and Energy Communities Bonus Credits, which can each provide an additional 10-percentage-point Investment Tax Credit or Production Tax Credit for qualifying projects, further incentivizing domestic manufacturing, workforce development, and investment in historically energy-dependent communities.

In March 2024, the U.S. Department of the Treasury and the Internal Revenue Service issued guidance clarifying eligibility for the Energy Communities Bonus Credit, including provisions relevant to offshore wind generation and associated infrastructure, providing greater certainty to developers and investors (Treasury 2022).

2.5 Regional Strategy

As offshore wind development expands in the U.S., coordinating regional strategies among State and local governments and industry is critical to meeting peak workforce demand during installation (NYSERDA 2024b). Industry should increase transparency and visibility into its plans to develop ports and manufacturing facilities so that labor unions and community colleges can strategically expand their recruitment, training programs, and facilities. Increased visibility and coordination between industry and educational institutions will also prepare workers for jobs beyond offshore wind, such as oil and gas, aerospace, defense, other energy technologies, and related maritime sectors (NREL 2022b).

2.6 Workforce Estimates

In 2025, the SEP published updated offshore wind workforce estimates under the Additional Action scenario, which includes approximately 7 GW of offshore wind deployment (New York State Energy Planning Board 2025). The SEP provides the most up-to-date, policy-aligned assessment of offshore wind employment impacts in the State. The SEP considers employment impacts across construction, professional services, manufacturing, other supply chain activities, and induced effects. It does not include employment associated with the long-term operation and maintenance of offshore wind farms.

Appendix A summarizes earlier offshore wind workforce studies for New York State. While these studies provide useful context, they were developed under different assumptions regarding deployment scale, delivery timelines, levels of local content, and the broader policy environment. As a result, their estimates are not directly comparable with the SEP's updated scenario-based approach.

Table 1 presents offshore wind workforce estimates from the 2025 SEP Additional Action scenario, disaggregated by supply-chain category and expressed in FTE-years (New York State Energy Planning Board 2025). The results highlight the dominance of construction employment during peak build-out periods, alongside increasing contributions from induced effects and broader supply chain activity as offshore wind deployment accelerates. Operational employment impacts expected beyond 2040 are not captured in these estimates.

Table 1. State Energy Plan Offshore Wind Workforce Estimates under the Additional Action Scenario

Represented in FTE-years.

Supply category	2023	2025	2030	2035	2040
Construction	2,325	2,597	10,446	10,081	13,668
Professional services	1,969	1,998	2,842	2,802	3,188
Manufacturing	522	530	743	733	831
Other supply chain	494	570	2,759	2,657	3,658
Induced	1,396	1,497	4,414	4,279	5,612
Total	**507**	**654**	**7,599**	**8,141**	**13,024**

2.7 Summary

Previous studies suggest that successful workforce development is most effective when all players in the ecosystem work together. Employers and labor unions are central to delivering practical skills through apprenticeships, on-the-job training, and structured career pathways. These mechanisms help workers build transferable, foundational skills and provide direct access to employment opportunities as they arise.

Educational institutions and CBOs play an equally important role, particularly in improving access to the offshore wind sector. Schools, colleges, and training providers support early awareness and deliver credentialed training, helping individuals understand the range of career pathways and opportunities available in the industry. CBOs serve as trusted entry points, particularly for underrepresented groups and residents of DACs. They are well-positioned to support outreach, preemployment preparation, and direct connections to training and job opportunities. Across the literature, CBOs are consistently viewed as best placed to deliver or coordinate wraparound services, which are identified as critical enablers of participation and retention for DACs.

Procurement and incentive requirements, such as provisions in PLAs and project contracts, can strengthen labor protections, ensure that labor unions include residents and businesses from DACs, and help residents from communities where jobs are located secure those jobs. Elements of PLAs that provide pathways from pre-apprenticeships to careers in offshore wind, and require a minimum percentage of labor hours to be performed by registered apprentices, play a significant role in supporting local workers.

3. Lessons Learned from New York State's East Coast Offshore Wind Projects

South Fork Wind and Vineyard Wind 1 are the first operational commercial-scale offshore wind farms in the U.S. and serve as key case studies for identifying lessons learned in workforce development. The following case studies were prepared based on interviews with developers that explored lessons learned throughout their development lifecycle to date. For Vineyard Wind 1, the information was provided by the joint venture partner, Avangrid. South Fork Wind information was provided by Ørsted. Although South Fork and Vineyard Wind 1 were the focus of interviews, insights from other projects were welcome.

3.1 Vineyard Wind 1

Vineyard Wind 1, jointly developed by Avangrid and Copenhagen Infrastructure Partners, is an 806 MW offshore wind farm located approximately 15 miles south of Martha's Vineyard and Nantucket, and 35 miles from mainland Massachusetts. Interviews on lessons learned were conducted while the project was still under construction and partially generating power, with 17 of the 62 turbines exporting electricity. Construction was completed in March 2026, with full commissioning anticipated by July 2026, at which point the wind farm will produce enough power for over 400,000 homes (Vineyard Wind 2025).

In July 2021, Vineyard Wind 1 signed the first PLA for an offshore wind project in the U.S., a milestone for the industry. Negotiated with the Southeastern Massachusetts Building Trades Council, the agreement aimed to ensure the delivery of high-quality construction, executed by the highest-skilled and best-trained workforce in the region. The agreement also sought to create local jobs and promote diversity and inclusion, particularly for MWBEs. The PLA was also designed to serve as a model for other developers and to provide a foundation for potential multistate agreements.

The PLA committed to creating more than 500 union jobs during project construction and set hiring goals for women, black, indigenous, and people of color (BIPOC), as well as residents. In the first two years of construction (September 2021 through August 2023), 937 union workers were employed, 72% of whom were from southeastern Massachusetts. Among nearly 1,000 nonunion workers, 31% were from the region and another 40% from elsewhere in Massachusetts (Vineyard Offshore 2025).

At the project level, implementing diversity goals posed some challenges. The agreement limited the pool of eligible workers, which was particularly difficult in a tight labor market where union members faced competing opportunities. Nonunion contractors, including smaller equipment suppliers and maintenance providers, were often ready to participate but struggled to secure contracts under the PLA. As a result, many MWBEs and smaller, nonunionized businesses were effectively excluded from participation. Regarding diversity outcomes, BIPOC employment among union workers was 19.6%, nearly reaching the PLA goal of 20%. Women's employment (3.6% vs. 10%) and apprenticeships (12.4% vs. 20%) fell short of targets (BOEM 2025). Diversity within union membership is an important consideration for PLAs to achieve the intended goal of providing equitable opportunities across the labor pool.

The Vineyard Wind 1 PLA requirements added financial complexity to an already constrained labor and contracting environment. In this context, limited pools of eligible labor and contractors reduced competition, making sourcing more difficult from a project perspective and increasing coordination overhead as well as the need to understand the cost implications in any future implementation and to have realistic expectations about what can be achieved through PLAs. Striking the right balance can be achieved by engaging with industry stakeholders and unions to understand labor availability and capacity ahead of setting the terms.

Despite these challenges, the PLA serves as a valuable framework for collaboration among developers, contractors, and unions, establishing labor standards and guiding workforce development across the growing offshore wind sector. Looking ahead, standardizing PLAs to some extent, by creating a common framework or set of rules that can be applied across multiple projects, could improve future implementation. Standardization could include setting clear expectations for skilled labor and contractors and defining work scopes and exclusions. Implementing standardization within the context of regional capabilities and local workforce realities is important. Understanding the gaps between supply and expected demand is best assessed before project development begins to inform the terms of a PLA.

Vineyard Offshore 1 continues to draw lessons from the project to determine how to maximize employment opportunities for local workers, union and nonunion, on the offshore wind projects that will power the U.S. economy of the future.

These lessons learned to date highlight the need for a coordinated, long-term approach to workforce development involving developers, unions, contractors, and government. Union capacity, skills, and membership vary by region and should be assessed before setting terms or starting project work. A collaborative strategy is essential for fostering sustainable industry growth and developing a skilled, diverse, and local workforce. Government can play a key role by coordinating programs across projects, providing financial incentives to build capacity, and facilitating mutual understanding.

3.2 South Fork Wind

South Fork Wind, jointly developed by Ørsted and Eversource Energy, is a 132 MW offshore wind farm located about 35 miles east of Montauk Point, Long Island, NY. It was first approved by the Long Island Power Authority Board of Trustees in 2017; South Fork Wind began construction in February 2022 and is now fully operational. Building South Fork helped to build a robust domestic supply chain in the U.S. The project used a combination of NYS-based and broader U.S.-based suppliers, covering 173 contracts, and is estimated to have created around 1,000 jobs across offshore and onshore construction, installation, and supply chain activities (Ørsted 2025a).

To support long-term workforce development, Ørsted partnered with North America's Building Trades Unions (NABTU) by signing the National Offshore Wind Agreement (NOWA) in 2022. Unlike the agreement for Vineyard Wind 1, this PLA established the framework for all Ørsted U.S. offshore wind projects. It committed Ørsted to using union labor for all its offshore wind construction and set terms for wages, working conditions, safety, and diversity recruitment.

The PLA delivered significant benefits, creating substantial work for union members, with over 1.5 million union labor hours recorded during the construction of South Fork (Town and County of Nantucket, Massachusetts v. Burgum 2025). Providing opportunities in the skilled trades within the offshore wind supply chain proved particularly valuable. Several NYS companies secured contracts, including the Haugland Group on Long Island, which was expected to create more than 100 union positions for local skilled trade workers. Other NYS-based companies, such as Roman Stone Construction Company and Elecnor Hawkeye, also secured contracts.

Under NOWA, Ørsted considered the local workforce when evaluating bids, requiring many Tier 1 and Tier 2 suppliers to recruit workers through New York State union hiring halls. A major challenge was that many local workers lacked the offshore safety certifications needed for installation and commissioning, including GWO Basic Safety Training (BST) and an offshore medical certificate. To address this, Ørsted and Tier 1 suppliers worked closely with labor unions and other organizations to align training with project needs. Coordination included identifying the scale of GWO certifications required for South Fork Wind and Ørsted's future projects.

Ørsted and its supply chain have prioritized expanding the pool of qualified workers for future projects. They engaged potential workers early, introducing them to offshore wind careers and the skills required in the sector. Those assessed as suitable for offshore work received targeted safety training in coordination with relevant providers, including GWO BST, Helicopter Underwater Escape Training (HUET), and medical offshore certifications. Between April 2024 and September 2024, the program produced 182 workers with medical clearances, 166 HUET-certified workers, and 162 GWO BST-certified workers, with equity targets of 11% women, 18% BIPOC, and 18% residents of environmental justice communities.

A key lesson from South Fork Wind is the importance of strong partnerships among developers, suppliers, unions, and training providers to communicate project needs effectively. Partnerships ensure the right number and type of certifications are delivered at the right time. Any training conducted in advance of project needs is effective only with a consistent flow of work. Without steady project activity, workers can become disengaged, and offshore working certifications can expire, reducing the long-term impact of training investments.

4. Expected Offshore Wind Job Creation

Offshore wind presents major opportunities for job creation during both the construction and operational phases. Projects such as South Fork Wind and Vineyard Wind 1 have already generated substantial employment in engineering, welding, and installation. These early projects have helped identify the types of jobs that can be created, and will continue to be created, as more offshore wind projects come online.

During the operational phase, offshore wind offers long-term employment lasting 25 years or more, and provides opportunities for stable, long-term careers in turbine maintenance and operations management. As New York State's offshore wind pipeline expands, further job growth is expected across the State. The number of jobs created will depend on the size of the pipeline and the proportion of project expenditure allocated within New York State.

This section outlines the main assumptions and key workforce capabilities used in this analysis. Determining how many jobs will be created and the types of roles involved is a critical first step in understanding the State's training and workforce needs. Section 5 considers the specific roles needed by various employers in the offshore wind supply chain.

4.1 Methodology

Economic impacts are quantified in terms of Gross Value Added (GVA) and FTE-years for the project. GVA is the value generated by a business or organization engaged in the production of goods and services. One FTE-year is the equivalent of one full-time job sustained for 1 year. The FTE-year is a standardized measure of employment, allowing comparisons across roles and projects where individuals may work varying hours or durations. In the context of wind farm development and operation, employment is often temporary or part-time and varies significantly across project phases, so FTE-years provide a consistent way of expressing total labor input over time. The analysis distinguishes between direct and indirect economic impacts, where:

- Direct impacts are associated with the project partners and their major contractors
- Indirect impacts are associated with suppliers to project partners and the suppliers to the project's major contractors

Appendix C provides a detailed explanation of the methodology.

4.1.1 Areas of Impact

The location of economic benefits largely depends on where each project's supply chain and grid connection are based. Given the State's supply chain capabilities and infrastructure, different regions will support various types of activity. Professional services, construction, and grid interconnection are likely to take place in New York City and on Long Island. Manufacturing activities are expected in the Mid-Hudson and Capital regions, where lower labor and land costs combine with access to the ocean via the Hudson River. Other parts of the State will also see activity, based on the locations of companies with expertise relevant to the industry. Based on this, impacts are modeled for three geographic areas:

1. New York City and Long Island
2. Mid-Hudson and Capital
3. Other NYS regions

4.1.2 Key Assumptions and Data Inputs

The economic model used the following key inputs:

- Deployment scenario
- Supply chain narrative
- Wind farm costs
- Salaries and employment costs

Deployment scenarios: Each scenario is aligned with the SEP's Additional Action pathway, one of NYS's forward-looking strategies for meeting the State's energy needs through 2040. The Additional Action pathway envisions an accelerated and widespread adoption of clean energy technologies (including offshore wind), which is supported by government policies and the development of transmission infrastructure.

The scenarios consider two variants, based on assumptions about the level of new nuclear generation and the pace of transmission infrastructure development over the next 15 years. Where lower nuclear capacity or slower transmission infrastructure development is assumed, more offshore wind is required to meet the State's decarbonization and energy demand requirements. This relates to 7 GW of offshore wind capacity installed between 2024 and 2040 (Figure 1).

In cases where higher nuclear capacity and faster development occur, the estimated offshore wind requirement is less. This relates to 5 GW of offshore wind capacity installed between 2024 and 2038 (Figure 2).

Figure 1. Offshore Wind Capacity Installation Profile, 7 GW

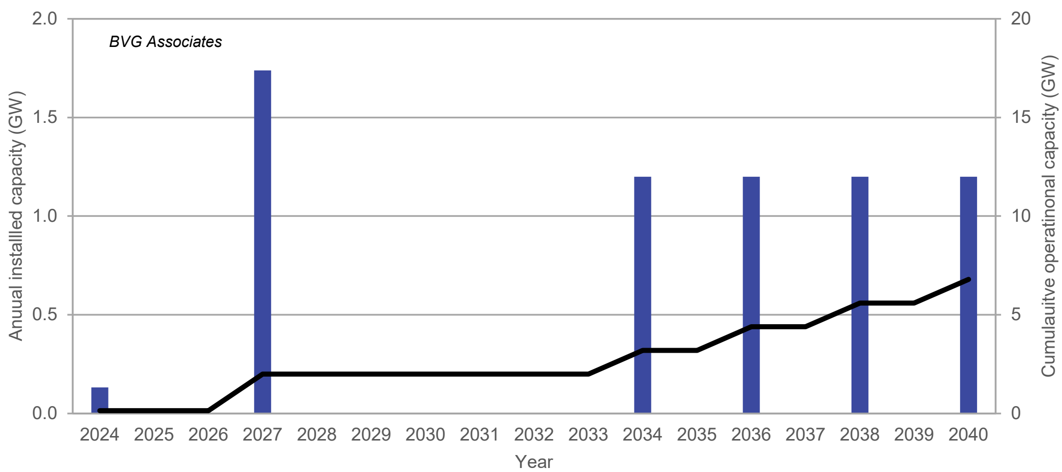
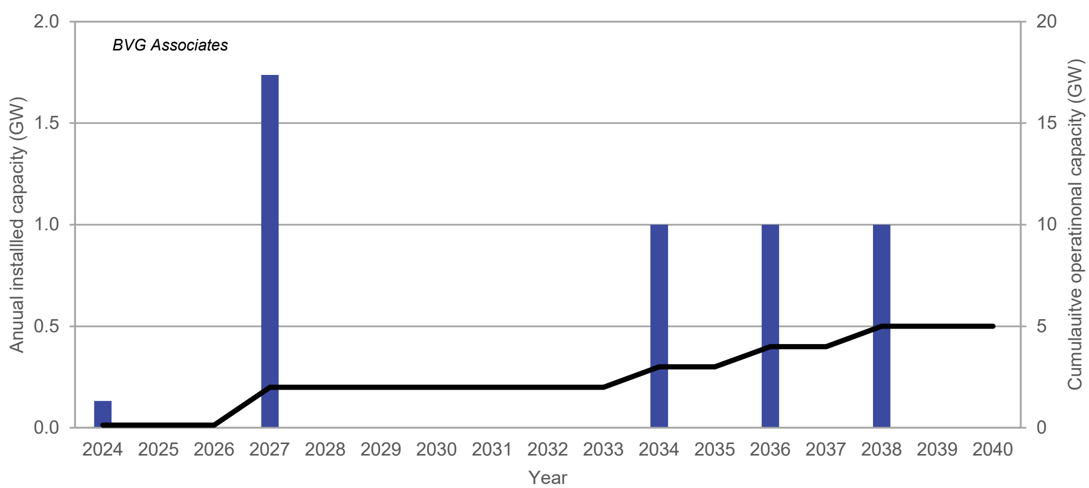


Figure 2. Offshore Wind Capacity Installation Profile, 5 GW



Supply chain narrative: The supply chain narrative describes which area of New York State the different products and services are assumed to come from. The narrative was developed by evaluating suppliers in each supply chain category and region, focusing on where project developers expect to source locally versus globally. Assessments were conducted annually to capture changes in New York State's supply chain localization over time. This evaluation considered:

- Industry trends from comparable offshore wind projects
- Technology requirements of the projects
- Expected availability of capable local suppliers at the time of procurement
- Potential new investments in New York State
- Logistical advantages of local versus global sourcing

The narrative was "quantified" by calculating the local content—the net percentage value of the expenditure spent locally—for each NYS area. Table 2 shows the supply chain categories used in the analysis.

Table 2. Supply Chain Categories Used in the Analysis

Level 1	Level 2
Planning and development	Engineering and survey
	Project management
Manufacturing and assembly	Blade
	Nacelle
	Tower
	Array cable
	Export cable
	Foundation
	Offshore substation
	Onshore substation
Construction and installation	Offshore substation
	Offshore cables
	Onshore export cables
	Turbine
	Foundation
	Onshore substation
O&M	Wind facility operation
	Turbine maintenance
	Balance of plant maintenance

Wind farm costs: A key input to the economic impact modeling is the predicted expenditure for the projects. Cost estimates were derived from the BVGA in-house model, with adjustments over time to reflect technology changes and learning rates. An average cost inflation factor was used to account for changes in the cost data over time (U.S. Senate Joint Economic Committee 2022).

Salaries and employment costs: BVGA gathered salary data from publicly available sources, drawing on previous analyses of states in the region. An average wage inflation factor was used to account for changes in cost data over time (EPI n.d). Profit margins in the supply chain were assumed to be similar to those reported for other established offshore wind markets. BVGA has gathered a significant amount of data over 10 years on the number of jobs associated with different offshore wind activities. The results of this analysis were validated by comparing this data with DOL data.

4.2 Results

4.2.1 Supply Chain Overview

This section describes the current availability of the NYS supply chain and how it may develop by 2040. This analysis assumes no significant increase in installed capacity and follows a business-as-usual scenario, with no major new investments beyond those already justified by existing demand and planned activity.

Table 3 summarizes the key supply chain assumptions. For each supply chain category, the table shows the local content, defined as the net percentage of total expenditures retained within each respective NYS region. High content is indicated by a darker shade. These estimates reflect current capabilities and assume organic growth from this point through to 2040.

Table 3. Summary of Supply Chain Assumptions

Level 1	Level 2	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions
Planning and development	Engineering and survey	31%–45% content	1%–15% content	1%–15% content
	Project management	31%–45% content	1%–15% content	1%–15% content
Manufacturing and assembly	Blade	—	—	—
	Nacelle	—	—	—
	Tower	—	—	1%–15% content
	Array cables	—	—	—
	Export cables	—	—	—
	Foundation	—	—	1%–15% content
	Offshore substation	—	—	—
	Onshore substation	—	1%–15% content	1%–15% content

Table 3 (continued)

Level 1	Level 2	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions
Installation and commissioning	Offshore substation	1%–15% content	1%–15% content	—
	Offshore cables	16%–30% content	—	—
	Onshore export cables	31%–45% content	16%–30% content	—
	Turbine	16%–30% content	—	—
	Foundation	1%–15% content	—	—
	Onshore substation	46%–60% content	1%–15% content	1%–15% content
O&M	Wind facility operation	46%–60% content	—	—
	Turbine maintenance	46%–60% content	—	—
	Balance of plant maintenance	31%–45% content	—	—
Decommissioning	Decommissioning	1%–15% content	—	—

Planning and development:

- **Scope:** The planning and development phase of a wind farm encompasses activities necessary to secure planning consent, such as surveys, project design, engineering work, and project management.
- **Capability:** These activities are typically high in local content due to the need for local knowledge and expertise. Developers often rely on local planning lawyers, surveyors, and engineering firms because specific local knowledge is often required.
- **Assumption:** A significant portion of the consenting work is undertaken by developers, with their efforts split between NYS and other U.S. offices. Local companies are heavily involved in planning, consenting, and survey work because of their expertise and familiarity with the region. Additionally, more specialized services, such as wind resource measurement and offshore geophysical and geotechnical surveys, are increasingly provided locally as new companies establish operations in New York State. Engineering and design services for low-voltage equipment, especially those related to substations, onshore cable routing, and associated transmission studies, are delivered by using resources within the State. Overall project management is predominantly led in-house by the developers' local teams, further boosting local content.

Manufacturing and assembly:

- **Scope:** This phase encompasses the supply of turbines and the balance of plant components. Turbine supply includes the fabrication of towers, nacelles, generators, and blades, while the balance of plant covers all other components necessary for the wind farm, including foundations, cabling, and substations.
- **Capability:** New York State has some companies already capable of supporting the manufacturing and assembly of offshore wind components. Companies such as Ljungström (from Western New York) have contributed to early U.S. East Coast projects by providing secondary steelwork. Sabik Offshore (from New York City) and MSM North America (from Long Island) provide navigational aid and safety lighting for offshore wind farms. Roman Stone also provides subsea concrete mattresses for scour and cable protection, with a manufacturing facility in New York City. Technostrobe Offshore Solutions can manufacture and assemble electrical packages required to fabricate transition pieces at its Albany facility. The Port of Coeymans is leading turbine foundation work for the Sunrise Wind project, and the Port of Coeymans Offshore Wind Infrastructure Project has proposed infrastructure improvements to service the offshore wind industry supply chain (Ørsted 2024; OffshoreWIND.biz 2024).
- **Assumption:** Major wind turbine components are manufactured by companies located in Europe or elsewhere and then transported to a construction port outside New York State for marshaling and preassembly. Investments by NYSERDA could lead to lower-tier manufacturing of secondary steelwork for internal platforms and walkways used for towers and foundations. These investments also create the capability to produce cable protection systems, such as cable entry systems and bend restrictors.

  Monopiles, jackets, high-voltage cables, and offshore substations are sourced from an established supply chain outside the U.S. and transported either directly to the site or through a NYS construction staging port. The local supply chain contributes to project development, secondary steelwork, and onshore civil engineering. Manufacturing activity is concentrated in other NYS regions.

Installation and commissioning:

- **Scope:** The installation and commissioning phase involves the transportation and installation of all offshore and onshore equipment.

  Capability: For onshore components, including substations and cables, NYS-based companies, including Haugland Group (Long Island), Roman Stone (Long Island), and Elecnor Hawkeye (Long Island), have secured involvement in early projects (see Section 3). Most offshore wind installation work has been in Europe, so offshore installation services for foundations, cables, and turbines are typically carried out by large contractors using non-U.S.-flagged vessels. However, some U.S. companies and shipyards have experience and capabilities building vessels for the offshore wind industry. For example, Edison Chouest is building U.S.-flagged barges and tugs, and Great Lakes Dredge & Dock Company has built and owns a subsea rock installation vessel, which is expected to support construction activities on Equinor's 1.2 GW Empire Wind 1 project located 15–30 miles south of Long Island (Equinor n.d). Another example is Liberty Green Logistics, based in Long Island, which provides offshore wind logistics management services, supporting logistics, vessels, and port operations (Liberty Green Logistics N.d.) The company's capabilities include its own subsidiary, Patriot Offshore Maritime Services, which owns and operates crew transfer vessels (CTVs). The company was also awarded a 10-year CTV services contract for the Equinor Empire Wind 1 project (OffshoreWIND.biz 2024).

During construction and installation, significant port space is needed for the pre-assembly, fitting, and marshaling of turbines and foundations. The use of ports for these activities accounts for a significant number of portside jobs in the construction and installation phase. The South Brooklyn Marine Terminal (SBMT) is being upgraded to become a major regional hub for offshore wind, with completion expected by the end of 2026. The upgrades include heavy lift platforms for wind turbines and over 60 acres available for wind turbine storage and preassembly.

In addition to SBMT, several other ports in the region, such as Millers Launch, Brooklyn Marine Terminal, Homeport Pier, and Erie Basin (WindServe Marine), could support various aspects of project construction. These ports could accommodate activities such as component storage, smaller-scale assembly, and marine support, including vessel staging and mobilization.

- **Assumption:** Following NYSERDA's investment in port infrastructure in New York State, project construction and installation are consistently performed by local NYS ports, resulting in greater local content. An increasing number of U.S.-flagged vessels is slightly increasing the demand for local vessel crews.

  Investment in capability in secondary steel production is used to produce temporary structures to support turbine preassembly.

  Local civil engineering and electrical companies transition into the industry and handle a significant portion of onshore activities, including excavation, road crossings, cable laying, and the construction of substation buildings, O&M warehouses, and staff facilities.

  Construction and installation activities are focused on New York City, Long Island, the Hudson Valley, and the Capital Region.

Operations and maintenance:

- **Scope:** The O&M phase supports the ongoing operation of wind turbines, balance of plant, and associated transmission assets. The O&M area of the supply chain typically has a high level of local content, which continues through the operational lifetime of the wind farm. For all NYS offshore wind projects, the maintenance base will be located in New York. The maintenance base is where the developer manages the control room and asset management of its projects. It includes an associated quayside space for housing service operation vessels (SOVs) or CTVs that transport technicians and parts to offshore wind farms for routine turbine maintenance.
- **Capability:** Port Jefferson on Long Island will serve as an SOV facility, and Port Montauk will serve as a CTV facility for Ørsted's Sunrise Wind and South Fork Wind projects. Ørsted's O&M facility in East Setauket, which currently serves as the onshore hub for Sunrise Wind, will also support South Fork and Revolution projects (Ørsted 2020). SBMT in New York City and Long Island will be the O&M base for the Empire Wind 1 (Equinor 2024).

  In other regions where offshore wind has been developed, developers have expanded their maintenance bases, extending their remit from a single project focus to provide broader coordination for O&M activities across a wider geographic area. For example, Equinor constructed its O&M building at SBMT on a larger scale to accommodate both Empire Wind 1 and other potential O&M activities for other projects.

- **Assumption:** Unplanned maintenance activities, such as blade replacements, cable repairs and subsea repairs, are typically carried out by external contractors which may or may not be based locally but will use local crews.

Decommissioning:

- **Scope:** Decommissioning involves the removal or making safe of offshore infrastructure at the end of its useful life. Turbines, foundations, cables, and substations must be removed and shipped to shore. Activities include dismantling, offshore heavy lifting, recycling, and environmental restoration in line with regulatory requirements. This is reflective of current practice in offshore wind planning, where decommissioning is the standard end-of-life assumption. In practice, approaches to end-of-life may evolve over the operational life of the wind farm as policies and technologies change.
- **Capability:** Decommissioning will involve similar skills and contractors to those used in the installation and commissioning phase of the offshore wind farm. This includes marine engineering, heavy lift operations, port services, and onshore civil works. New York State has growing capability to support these activities through planned port infrastructure upgrades and supply chain capability.

- **Assumption:** Decommissioning activities are largely delivered using experienced global contractors, supported by NYS ports and service providers. Firms based in New York City and Long Island play a key role in onshore dismantling, transport, and waste handling, while offshore operations rely on specialized vessels and international expertise.

4.2.2 Economic Impacts

The following section presents the economic impacts of deploying 7 GW of offshore wind capacity by 2040 (Figure 7), highlighting the potential scale and workforce demand associated with a higher offshore wind deployment. Impacts are reported from 2018 to 2070, capturing employment from early-stage development activity, beginning approximately 6 years before the first project reaches commercial operation, and extending through to approximately 30 years after the final capacity is installed. For comparison, Appendix D provides the impacts associated with 5 GW of offshore wind capacity.

Impacts are presented for:

- New York City and Long Island
- Mid-Hudson and Capital regions
- Other NYS regions

The total economic impact for New York State reflects the combined impacts of these three regions.

Table 4 shows the direct and indirect FTE-years created by 7 GW of offshore wind capacity. The pipeline is expected to create approximately 36,500 direct FTE-years in New York State, of which around 31,690 are in New York City and Long Island, 2,520 in the Mid-Hudson and Capital regions, and 2,290 in other NYS regions.

Table 4. Direct and Indirect Full-Time Equivalent Years in New York State Created by 7 GW of Offshore Wind by Region

Figures are rounded, and some columns and rows may not total exactly.

Category	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions	Total in NYS	Peak FTEs in NYS
Direct	21,950	1,440	1,540	24,930	1,170
Indirect	9,740	1,080	750	11,570	970
Total	**31,690**	**2,520**	**2,290**	**36,500**	**2,140**

Table 5 presents these impacts by supply chain category. In New York City and Long Island, the largest share of direct economic impact comes from operations and maintenance, reflecting strong port capability in Port Jefferson. In the Mid-Hudson and Capital regions, installation and commissioning account for the largest share of FTE-years, totaling approximately 2,060. This region also benefits from manufacturing activities, including foundation assembly and secondary steel supply. In other parts of the State, the greatest opportunities lie in manufacturing.

Table 5. Direct and Indirect Full-Time Equivalent Years in New York State Created by 7 GW of Offshore Wind by Supply Chain Category and Region

Figures are rounded, and some columns and rows may not total exactly.

	Full-Time-Equivalent Years								
	New York City and Long Island			Mid-Hudson and Capital Region			Other NYS Regions		
Category	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Development and project management	1,000	840	1,840	120	100	220	120	100	220
Manufacturing and assembly	—	—	—	160	70	230	1,160	480	1,640
Installation and commissioning	4,360	3,840	8,200	1,160	900	2,060	270	160	430
O&M	14,700	4,740	19,440	—	—	—	—	—	—
Decommissioning	1,880	320	2,200	—	—	—	—	—	—
Total	**21,940**	**9,740**	**31,680**	**1,440**	**1,070**	**2,510**	**1,550**	**740**	**2,290**

Figure 3shows the annual employment impact in New York State created by 7 GW of offshore wind. Figures 4, 5, and 6 show the annual employment impact in New York City and Long Island, the Mid-Hudson and Capital regions, and other NYS regions, respectively.

This analysis covers the period from 2018, 6 years before the first project in the New York State pipeline (South Fork Wind) began operations, through 2070, 30 years after the final project currently planned is expected to come online in 2040. If additional capacity comes online after 2040, impacts are expected to continue past 2040, rather than drop off as shown. The peak level of employment in NYS was reached in 2025, with an estimated total of 2,140 FTE-years created across NYS. Peak employment across all other regions considered also occurred in 2025.

Figure 3. Annual Employment Impacts in New York State Created by 7 GW of Offshore Wind

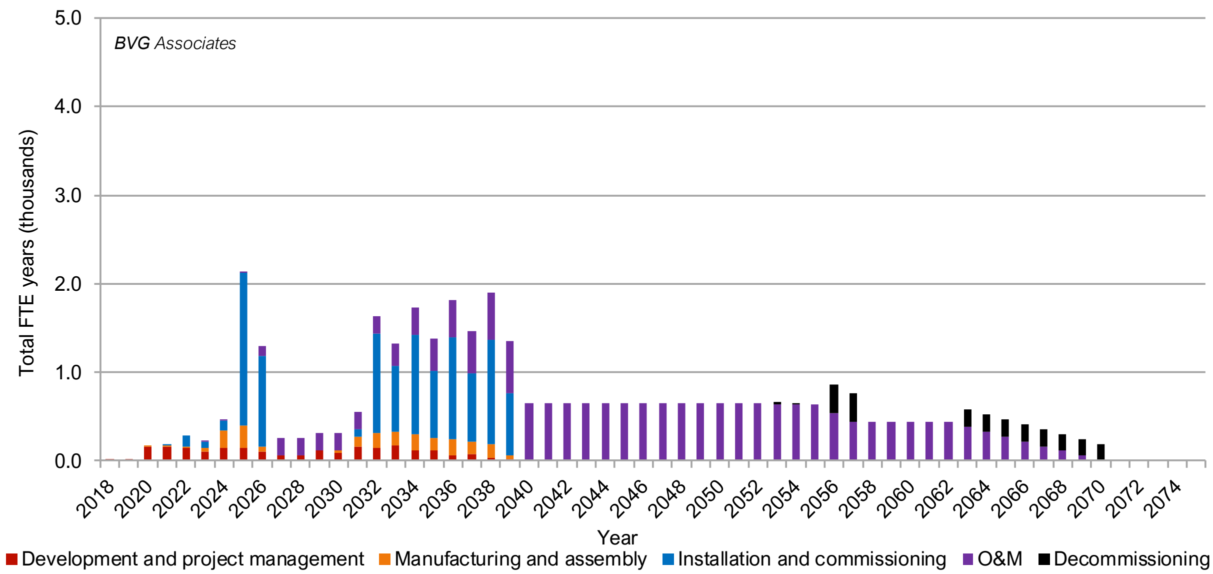


Figure 4. Annual Employment Impacts in New York City and Long Island Created by 7 GW of Offshore Wind

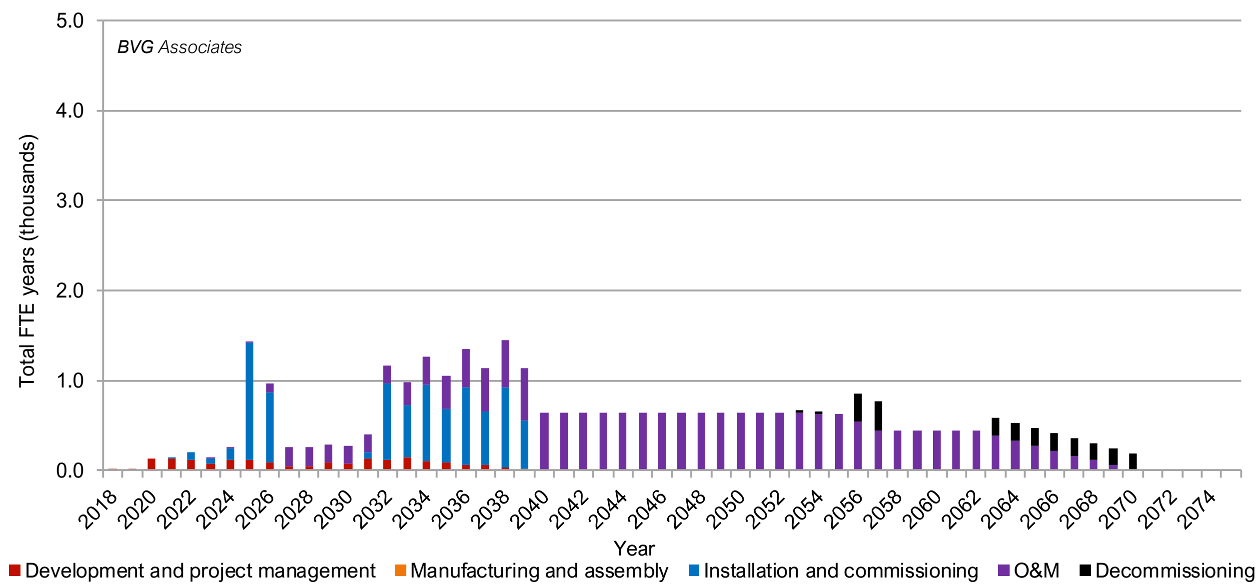


Figure 5. Annual Employment Impacts in Mid-Hudson and Capital Regions Created by 7 GW of Offshore Wind

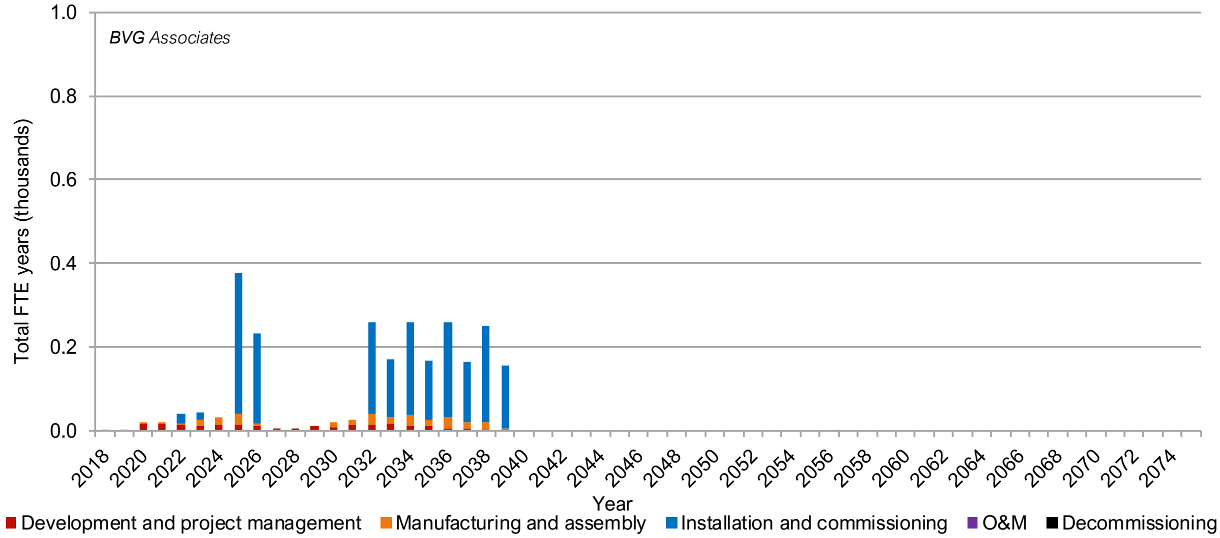
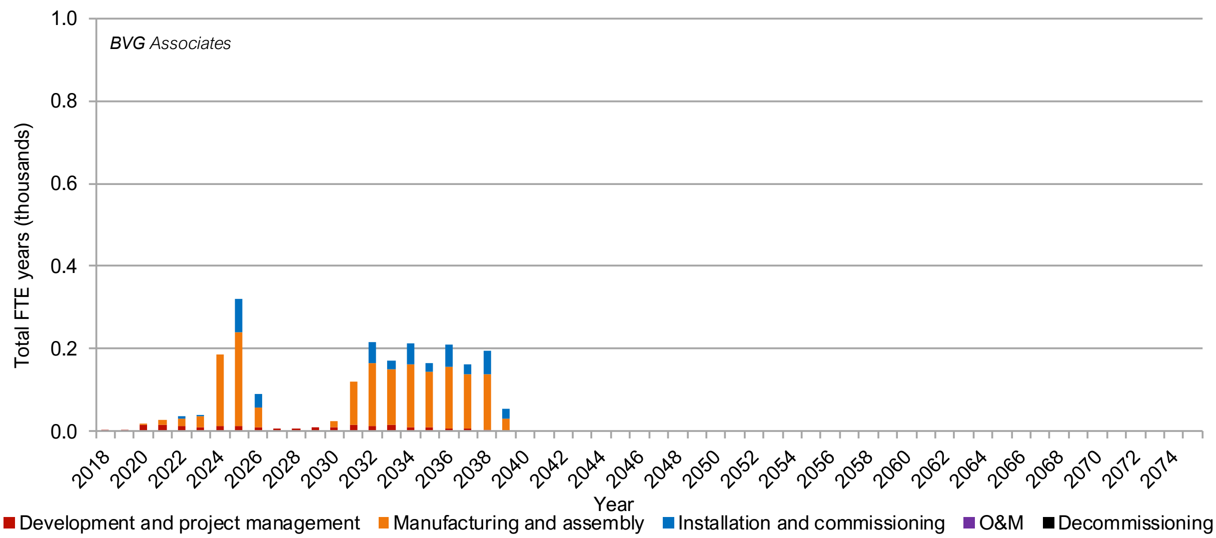
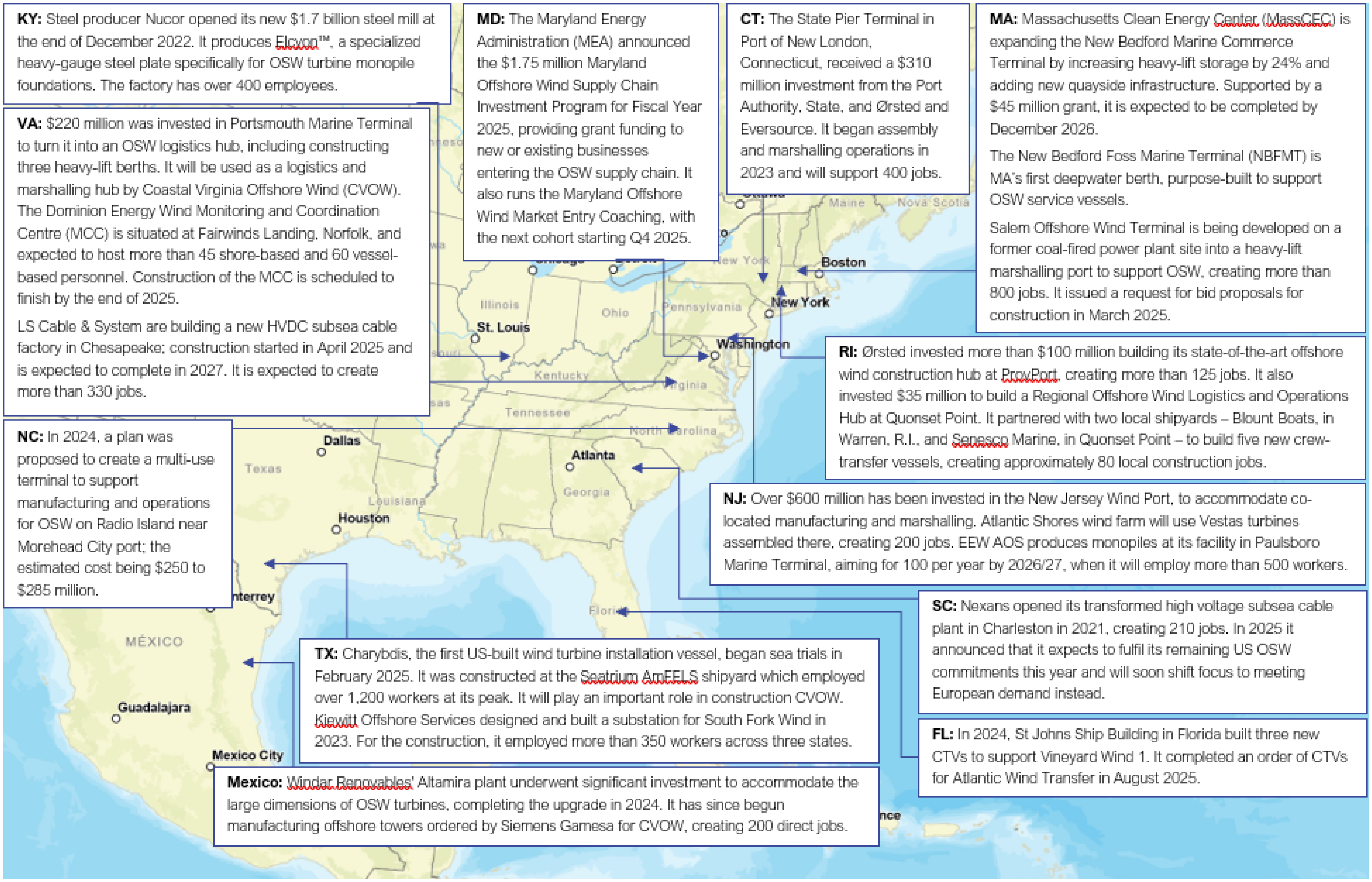


Figure 6. Annual Employment Impacts in Other New York State Regions Created by 7 GW of Offshore Wind



Offshore Wind in the rest of the U.S.: Outside New York State, other parts of the U.S. have key capabilities to support the build-out of NYS projects. These capabilities are expected to generate economic impacts and create jobs in areas with existing offshore wind expertise and infrastructure. Figure 7 summarizes the key capabilities across East Coast states.

Figure 7. Summary of Offshore Wind Supply Chain and Infrastructure Investments across East Coast States, Kentucky, Texas, and Mexico



5. Workforce Needs Assessment

Understanding workforce training needs requires a detailed view of the roles involved, the skills required, where they are needed across New York State, and the likely timing of demand. The assessment of workforce needs was carried out in the following stages:

- Identify critical job roles in NYS offshore wind value chain
- Calculate FTE-year requirements
- Identify training requirements for a subset of roles

BVGA maintains a database of required roles, which was the basis for this work. The database was updated to reflect the specific needs of offshore wind projects in New York State and the availability of the local supply chain. It excludes generalist roles, such as HR professionals, accountants, information technology (IT) specialists, which are assumed to already be part of the broader NYS economy.

5.1 Identify Critical Jobs

Offshore wind development requires a broad range of workforce skills, many of which already exist within New York State's labor market. Core skills in engineering, construction, and professional services will be highly transferable to offshore wind and account for a large share of the workforce demand required to develop and operate offshore wind projects in the State. However, some roles will require industry-specific training, and demand for these roles will vary across the State's regional supply chain.

To determine which roles are critical to New York State, BVGA ranked its jobs-role database against four criteria. In this context, "critical" means strategically important for supporting the NYS offshore wind pipeline. The four criteria are:

1. Transferability: The extent to which similar skills are needed in other sectors
2. Leadership: The importance of the role in providing senior-level oversight
3. Technical specialty: The extent to which the role requires specific qualifications or expertise
4. Volume: The number of workers required for the role

Table 6 illustrates the methodology for evaluating and ranking each role across these criteria. Each role was scored for each criterion, and the scores were summed to produce a total score. Roles with a total score of 10 or higher were identified as strategically important, or "critical."

Table 6. Assessment Criteria Applied for Each Job Role

Score	Criteria			
	Leadership	**Specialist**	**Transferability**	**Volume**
1	Junior roles, often in administration	Roles requiring no training after high school	Roles available in most other sectors	Less or equal to 5 roles for a 1 GW wind farm
2	Roles with substantial levels of responsibility	Roles requiring basic training after high school	Roles widely available in other sectors	6–10 roles for a 1 GW wind farm
3	Managerial level roles	Roles requiring substantive training after high school	Roles available in other engineering and construction sectors	11-30 roles for a 1 GW wind farm
4	Senior roles in the supply chain	Roles requiring a specific educational qualification	Roles only available in 1–2 other sectors	31–50 roles for a 1 GW wind farm
5	Director-level roles in the project team	Roles requiring a high degree of specialization	Roles only required in offshore wind	More than 50 roles for a 1 GW wind farm

Overall, about 19% of total job creation in New York State is expected to be associated with critical jobs, excluding decommissioning activities. Critical jobs cover about 153 distinct job roles across the development and project management, manufacturing, installation and commissioning, and O&M phases. Table 7 presents the specific roles and the regions in which they will be needed across New York State. Under both offshore wind scenarios, the profile of critical job roles is expected to be the same, with differences only in volume.

Table 7. Critical Job Role by Region

ID	Job Role	Supply Chain Category	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions
1.	Captain	1.1	✓	✓	✓
2.	Design and Certification Package Manager	1.1	✓	✓	✓
3.	Ecologists	1.1	✓	✓	✓
4.	Electrical Engineer	1.1	✓	✓	✓
5.	Electrical Network Lead	1.1	✓	✓	✓
6.	Engineering and Design Manager	1.1	✓	✓	✓
7.	Engineering Package Lead	1.1	✓	✓	✓

Table 7. (continued)

ID	Job Role	Supply Chain Category	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS regions
8.	EPC Director	1.1	✓	✓	✓
9.	Foundation Engineer	1.1	✓	✓	✓
10.	Geophysicists	1.1	✓	✓	✓
11.	Geotechnical Engineer	1.1	✓	✓	✓
12.	Geotechnical Manager	1.1	✓	✓	✓
13.	Grid Commercial Lead	1.1	✓	✓	✓
14.	Grid Connections Lead	1.1	✓	✓	✓
15.	Grid Technical Lead	1.1	✓	✓	✓
16.	Inter Array Cable Engineer	1.1	✓	✓	✓
17.	Logistics Package Engineer	1.1	✓	✓	✓
18.	Logistics Package Lead	1.1	✓	✓	✓
19.	Marine Biologist	1.1	✓	✓	✓
20.	Noise Specialist	1.1	✓	✓	✓
21.	Offshore Substation Electrical Engineer	1.1	✓	✓	✓
22.	Onshore Substation Electrical Engineer	1.1	✓	✓	✓
23.	Ornithologist	1.1	✓	✓	✓
24.	Senior Geotechnical Engineer	1.1	✓	✓	✓
25.	Specialist Wind Analyst	1.1	✓	✓	✓
26.	Certification Manager	1.2	✓	✓	✓
27.	Commercial and Procurement Director	1.2	✓	✓	✓
28.	Commercial/LCOE Business Case Manager	1.2	✓	✓	✓
29.	Construction Commissioning Manager	1.2	✓	✓	✓
30.	Construction Manager	1.2	✓	✓	✓
31.	Planning and Consents Manager	1.2	✓	✓	✓
32.	Decommissioning Package Manager	1.2	✓	✓	✓
33.	Development and Consents Director	1.2	✓	✓	✓
34.	EPCI Director	1.2	✓	✓	✓
35.	Fabrication Manager	1.2	✓	✓	✓
36.	Finance Director	1.2	✓	✓	✓
37.	Foundation Package Manager	1.2	✓	✓	✓
38.	Grid and Power Offtake Manager	1.2	✓	✓	✓
39.	Grid Commercial Lead	1.2	✓	✓	✓

Table 7. (continued)

ID	Job Role	Supply Chain Category	New York City and Long Island	Mid-Huson and Capital Region	Other NYS Regions
40.	Grid Connections Lead	1.2	✓	✓	✓
41.	Grid OFTO Lead	1.2	✓	✓	✓
42.	Grid Policy and Regulation Lead	1.2	✓	✓	✓
43.	Grid Technical Lead	1.2	✓	✓	✓
44.	HSE Director	1.2	✓	✓	✓
45.	HSE Manager	1.2	✓	✓	✓
46.	Inter Array Cable Package Manager	1.2	✓	✓	✓
47.	Lead Advocate (Examination Hearings)	1.2	✓	✓	✓
48.	Legal Counsel	1.2	✓	✓	✓
49.	Legal Counsel Internal	1.2	✓	✓	✓
50.	O&M Director	1.2	✓	✓	✓
51.	O&M Engineer	1.2	✓	✓	✓
52.	O&M Package Manager	1.2	✓	✓	✓
53.	Offshore Substation Package Manager	1.2	✓	✓	✓
54.	Onshore Substation Package Manager	1.2	✓	✓	✓
55.	Project CEO	1.2	✓	✓	✓
56.	Project CFO	1.2	✓	✓	✓
57.	Project Director	1.2	✓	✓	✓
58.	Risk Lead	1.2	✓	✓	✓
59.	Risk Manager	1.2	✓	✓	✓
60.	SCADA Engineer	1.2	✓	✓	✓
61.	SCADA Package Commercial Contracts Manager	1.2	✓	✓	✓
62.	SCADA Package Manager	1.2	✓	✓	✓
63.	Senior Risk Manager	1.2	✓	✓	✓
64.	Technical Director	1.2	✓	✓	✓
65.	Wind Turbine Generator Engineer	1.2	✓	✓	✓
66.	Wind Turbine Generator Package Manager	1.2	✓	✓	✓
67.	Civil Engineer	2.3	—	—	✓
68.	Commercial Manager	2.3	—	—	✓
69.	Construction Manager	2.3	—	—	✓
70.	Fabrication Manager	2.3	—	—	✓
71.	Machine Operatives	2.3	—	—	✓

Table 7. (continued)

ID	Job Role	Supply Chain Category	New York City and Long Island	Mid-Huson and Capital Region	Other NYS Regions
72.	WTG Engineer	2.3	—	—	✓
73.	WTG Package Manager	2.3	—	—	✓
74.	WTG Package Technical Manager	2.3	—	—	✓
75.	Civil Design Manager	2.6	—	—	✓
76.	Civil Engineering Manager	2.6	—	—	✓
77.	Commercial Manager	2.6	—	—	✓
78.	Fabrication Manager	2.6	—	—	✓
79.	Foundation Package Manager	2.6	—	—	✓
80.	Foundation Package Technical Manager	2.6	—	—	✓
81.	Geotechnical Engineer	2.6	—	—	✓
82.	Onshore Installation Manager	2.6	—	—	✓
83.	Structural Engineer	2.6	—	—	✓
84.	Commercial Manager	2.8	—	✓	✓
85.	Construction Manager	2.8	—	✓	✓
86.	Electrical Engineer	2.8	—	✓	✓
87.	Electrical Technician	2.8	—	✓	✓
88.	Fabrication Manager	2.8	—	✓	✓
89.	Onshore Installation Manager	2.8	—	✓	✓
90.	Onshore Works Package Commercial Contracts Manager	2.8	—	✓	✓
91.	Onshore Works Package Manager	2.8	—	✓	✓
92.	Structural Engineer	2.8	—	✓	✓
93.	Captain	3.1	✓	✓	—
94.	Commercial Manager	3.1	✓	✓	—
95.	Commissioning Engineer	3.1	✓	✓	—
96.	Commissioning Manager	3.1	✓	✓	—
97.	Design Manager	3.1	✓	✓	—
98.	Electrical Engineer	3.1	✓	✓	—
99.	Electrical Technician	3.1	✓	✓	—
100.	Offshore Installation Manager	3.1	✓	✓	—
101.	OSS Package Manager	3.1	✓	✓	—
102.	Captain	3.2	✓	—	—
103.	Commercial Manager	3.2	✓	—	—
104.	Electrical Engineer	3.2	✓	—	—
105.	Electrical Technician	3.2	✓	—	—

Table 7. (continued)

ID	Job Role	Supply Chain Category	New York City and Long Island	Mid-Huson and Capital Region	Other NYS Regions
106..	HSE Manager	3.2	✓	—	—
107.	Inter Array Cable Package Manager	3.2	✓	—	—
108.	Inter Array Cable T&I Manager	3.2	✓	—	—
109.	Offshore Installation Manager	3.2	✓	—	—
110.	Commercial Manager	3.3	✓	✓	—
111.	Construction Manager	3.3	✓	✓	—
112.	Electrical Engineer	3.3	✓	✓	—
113.	Electrical Technician	3.3	✓	✓	—
114.	Grid Connection Package Manager	3.3	✓	✓	—
115.	Onshore Installation Manager	3.3	✓	✓	—
116.	66 kV Senior Authorized Person	3.4	✓	—	—
117.	Captain	3.4	✓	—	—
118.	Commercial Manager	3.4	✓	—	—
119.	Design Manager	3.4	✓	—	—
120.	Electrical Engineer	3.4	✓	—	—
121.	Electrical Technician	3.4	✓	—	—
122.	HSE Manager	3.4	✓	—	—
123.	Offshore Installation Manager	3.4	✓	—	—
124.	WTG Package Manager	3.4	✓	—	—
125.	WTG T&I Manager	3.4	✓	—	—
126.	Captain	3.5	✓	—	—
127.	Commercial Manager	3.5	✓	—	—
128.	Design Manager	3.5	✓	—	—
129.	Foundation Package Manager	3.5	✓	—	—
130.	HSE Manager	3.5	✓	—	—
131.	Offshore Installation Manager	3.5	✓	—	—
132.	Commercial Manager	3.6	✓	✓	✓
133.	Commissioning engineer	3.6	✓	✓	✓
134.	Construction Manager	3.6	✓	✓	✓
135.	Termination And Testing Technicians	3.6	✓	✓	✓
136.	Asset Manager	4.1	✓	—	—
137.	Chief engineer	4.1	✓	—	—
138.	Control Room Manager	4.1	✓	—	—
139.	Deputy Supervisor	4.1	✓	—	—
140.	Head of Legal	4.1	✓	—	—

Table 7. (continued)

ID	Job Role	Supply Chain Category	New York City and Long Island	Mid-Huson and Capital Region	Other NYS Regions
141.	Head of Operational Support	4.1	✓	—	—
142.	Integration Manager	4.1	✓	—	—
143.	Production Manager	4.1	✓	—	—
144.	Project Controls Head	4.1	✓	—	—
145.	SCADA Engineer	4.1	✓	—	—
146.	Service Manager	4.1	✓	—	—
147.	Balance of Plant Technician	4.2 and 4.3	✓	—	—
148.	Blade Repair Technician	4.2 and 4.3	✓	—	—
149.	CTV Captain	4.2 and 4.3	✓	—	—
150.	HV Technicians	4.2 and 4.3	✓	—	—
151.	Rope Access and Blade Repair Technician	4.2 and 4.3	✓	—	—
152.	ROV Technician	4.2 and 4.3	✓	—	—
153	Wind Turbine Technician	4.2 and 4.3	✓	—	—
Total			**12,840**	**418**	**335**

5.2 Identify Full-Time-Equivalent Year Requirements

The following section presents the total and annual demand for each role associated with 7 GW of offshore wind capacity deployed by 2040, as shown in Figure 2.

5.2.1 New York State

Figure 8 shows the total demand for critical job roles in New York State by supply chain area. Of the total FTE-years created in the State, 7,036 FTE-years are associated with critical job roles, about 19% of total job creation. In total, 153 critical job roles are identified across all areas of the supply chain.

The highest demand for specialized offshore wind expertise is in the development and project management phase and the O&M phase. In these phases, critical roles account for roughly 24% and 28% of jobs created in New York State, respectively. By comparison, the installation and commissioning phase and the manufacturing phase have a smaller share of critical roles, accounting for about 8% and 6% of job creation, respectively.

In FTE-years, O&M roles account for the largest share of critical job-role demand, followed by installation and commissioning roles, development and project management roles, and manufacturing and assembly roles.

Figure 8. Total Critical Job Role Demand Relative to Total Employment Created by 7 GW of Offshore Wind in New York State

The inner ring represents total FTE-years by supply chain category, with the outer segments representing the share of critical job roles within each category.

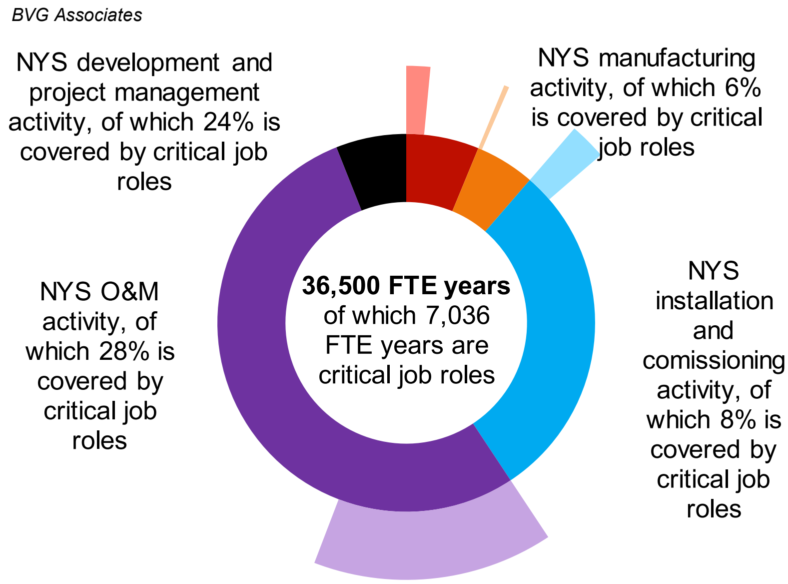
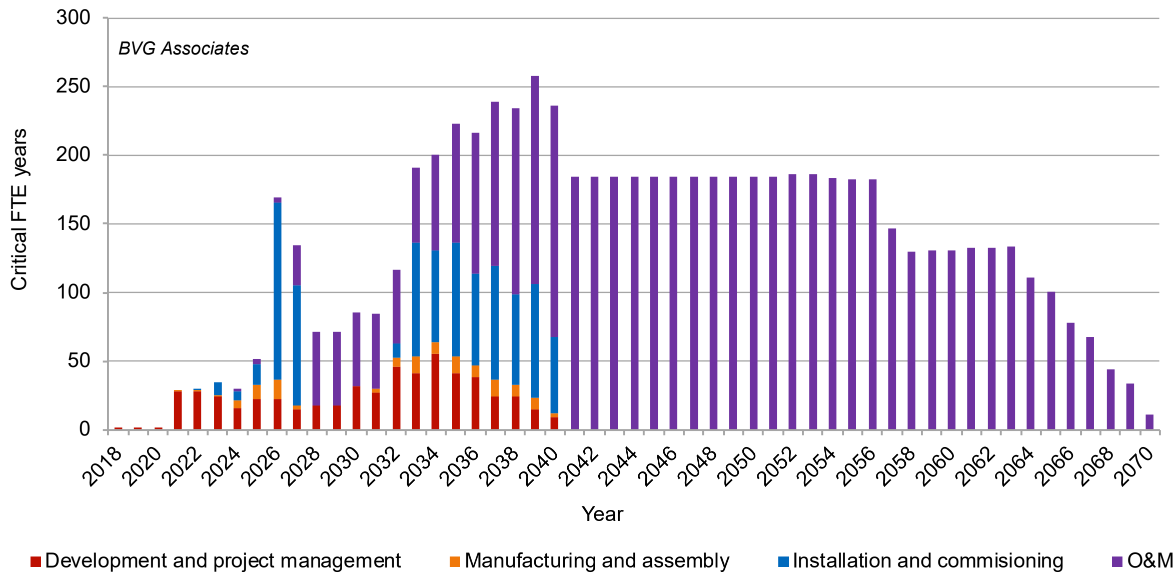


Figure 9 shows the annual demand for critical job roles in New York State created by 7 GW of offshore wind capacity. The annual demand will be influenced by the pace and timing of offshore wind deployment. A steady rollout of capacity spreads workforce needs more evenly over time, while a more concentrated project timeline produces sharper year-over-year increases. Highly clustered activity can lead to temporary peaks in demand, whereas a gradual build can spread demand more consistently but still sees higher needs as projects are completed.

The critical job role demand is calculated based on an approximately 7 GW project pipeline in the State, with deployment timescales through to 2040. If additional capacity comes online beyond this period, critical job demand related to development, project management, manufacturing and installation, commissioning, and O&M is expected to continue past 2040, rather than drop off, as shown.

Figure 9. Annual Critical Job Role Demand by Supply Chain Category Created by 7 GW of Offshore Wind in New York State



5.2.2 New York City and Long Island

Figure 10 shows the total demand for critical job roles in New York City and Long Island by supply chain area. Of the total FTE-years created in New York City and Long Island, 6,647 FTE-years are associated with critical job roles, or about 21% of total job creation. In total, 127 critical job roles are required in New York City and Long Island across all areas of the supply chain.

Figure 10. Total Critical Job Role Demand Relative to Total Employment Created by 7 GW of Offshore Wind in New York City and Long Island

The inner ring represents total FTE-years by supply chain category, with the outer segments representing the share of critical job roles within each category.

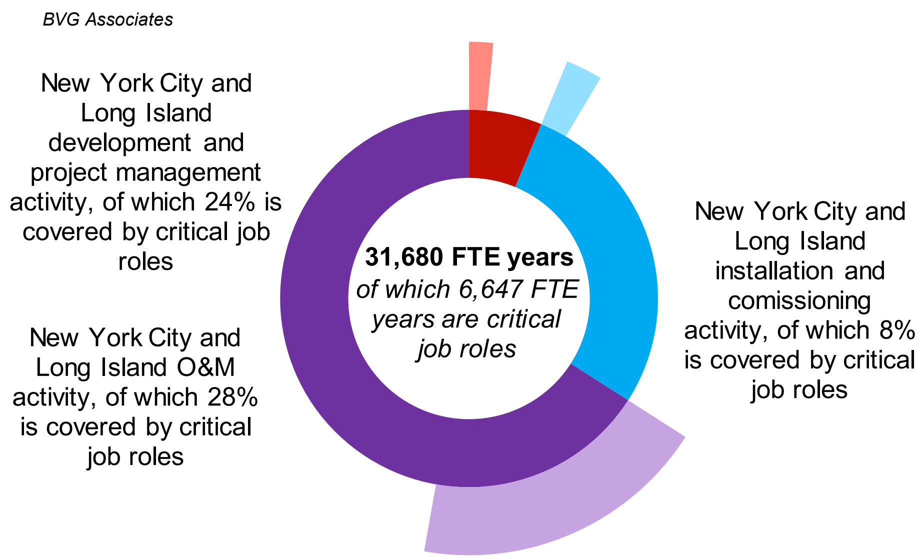
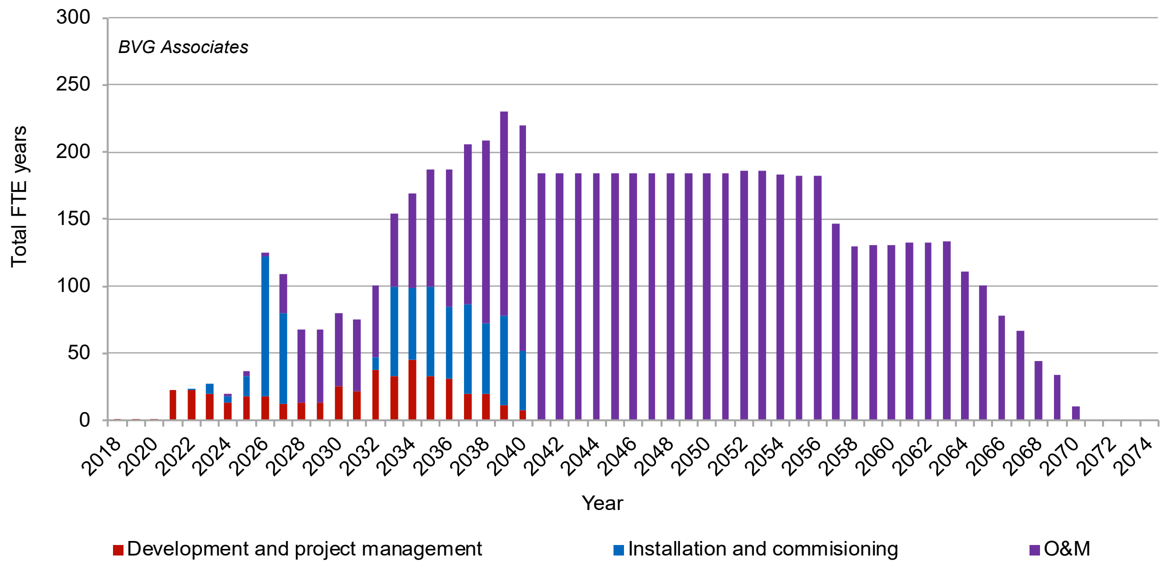


Figure 11. Annual Critical Job Role Demand by Supply Chain Category Created by 7 GW of Offshore Wind in New York City and Long Island



5.2.3 Mid-Hudson and Capital Regions

Figure 12 shows the total demand for critical job roles in Mid-Hudson and Capital regions by supply chain area. Of the total FTE-years created in Mid-Hudson and Capital regions by the project pipeline, 216 FTE-years are associated with critical job roles. In FTE-years, Installation and commissioning roles account for the largest share of critical job role demand (64.3%), followed by development and project management roles (24.3%) and manufacturing and assembly roles (11.4%).

Figure 12. Total Critical Job Role Demand Relative to Total Employment Created by 7 GW of Offshore Wind in Mid-Hudson and Capital Regions

The inner ring represents total FTE-years by supply chain category, with the outer segments representing the share of critical job roles within each category.

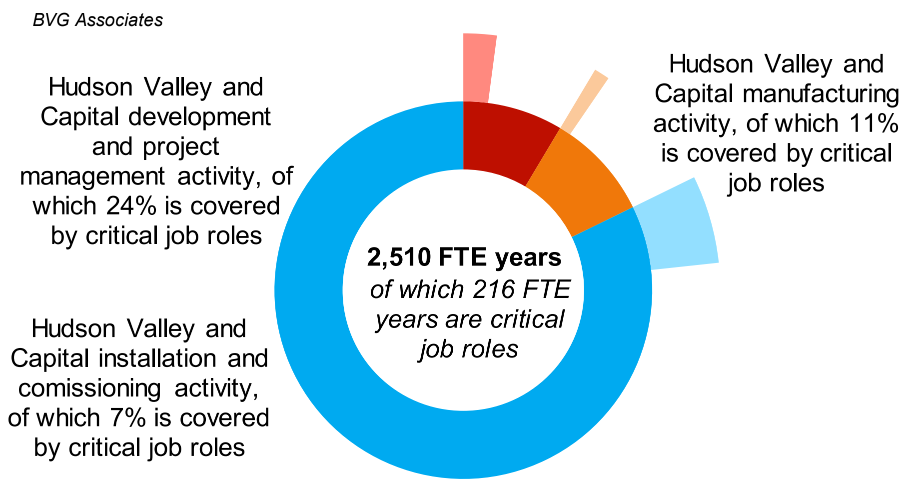
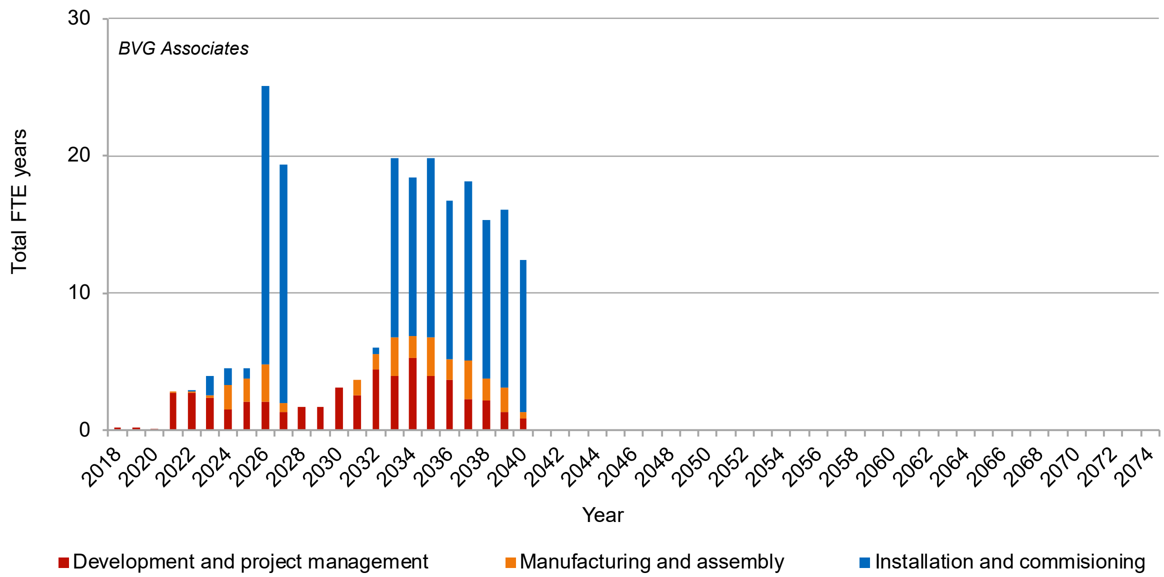


Figure 13 illustrates the annual demand for critical job roles in the 7 GW scenario. In this region, demand is largely driven by installation and commissioning roles, so the timing and magnitude of annual peaks closely follow the installation schedule.

Figure 13. Annual Critical Job Role Demand by Supply Chain Category Created by 7 GW of Offshore Wind in Mid-Hudson and Capital Regions



5.2.4 Other New York State Regions

Figure 14 shows the total demand for critical job roles in other NYS regions by supply chain area. Of the total FTE-years created in other NYS regions by the project pipeline, 172 FTE-years are associated with critical job roles. In total, 96 critical job roles are identified in other NYS regions, across project management, manufacturing and assembly, and installation and commissioning. Manufacturing and assembly roles comprise the largest share of critical job role demand (54.2%), followed by development and project management roles (30.4%) and installation and commissioning roles (15.3%).

Figure 14. Total Critical Job Role Demand Relative to Total Employment Created by 7 GW of Offshore Wind in Other New York State Regions

The inner ring represents total FTE-years by supply chain category, with the outer segments representing the share of critical job roles within each category.

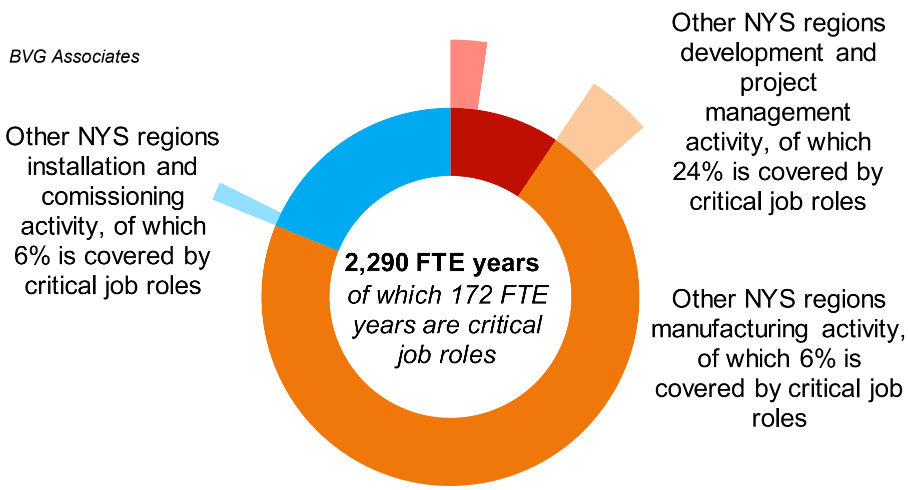
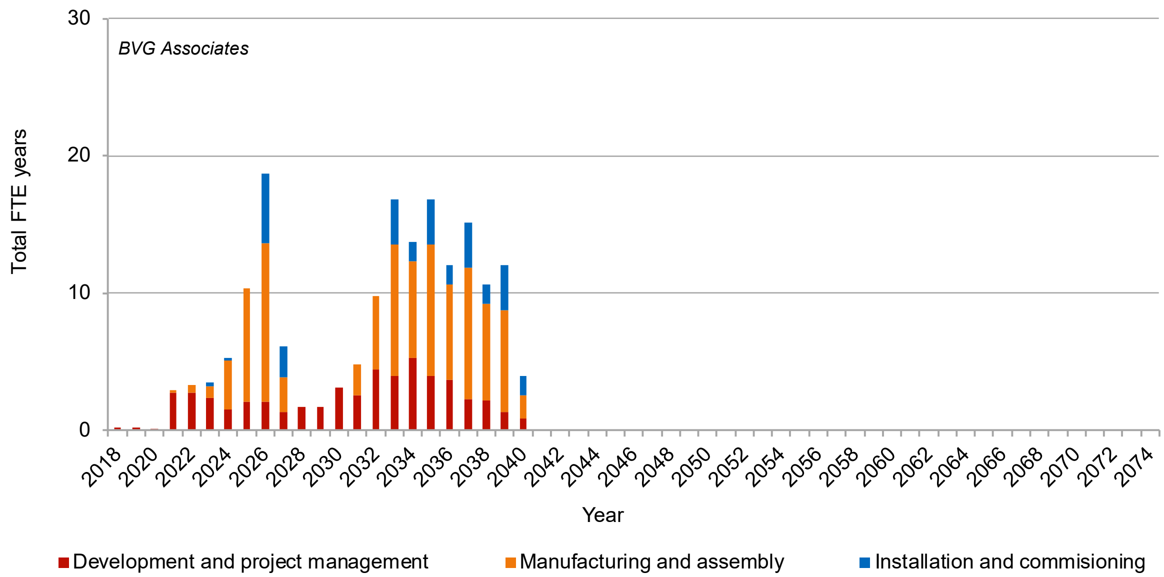


Figure 15 illustrates the annual demand for critical job roles in the 7 GW scenario. In this region, demand is primarily driven by manufacturing and assembly roles. The patterns of peaks and fluctuations are similar to those observed in the Mid-Hudson and Capital regions, and New York City and Long Island, although at lower volumes.

Figure 15. Annual Critical Job Role Demand by Supply Chain Category Created by 7 GW of Offshore Wind in Other New York State Regions



5.3 Training Requirements

The training requirements for critical offshore wind roles vary across the project lifecycle, reflecting differences in technical specialization, baseline qualifications, and the extent to which skills can be transferred from adjacent sectors. This section outlines the key training needs by supply chain phase.

5.3.1 Development and Project Management

These roles are required across New York State, but with most activity centered in New York City and Long Island. Critical job roles primarily relate to engineering, surveying, and project management. A typical baseline requirement for these positions is a degree in engineering or environmental science. Depending on the specific employer and level of seniority, some engineering roles will require professional accreditation.

As Figure 8 illustrates, of the total FTE-years created in New York State through project management and development activities, around 24% are associated with critical job roles. Most of the demand in this phase is for roles where technical understanding of offshore wind systems, environmental impacts, and project procurement is important. Specific employers may require certain certifications in addition to academic background, but demonstrating understanding of the key skills and knowledge required is likely to be important. This includes:

- Project management roles
    - Understanding of the offshore wind project lifecycle, from design and permitting to installation and operation
    - Expertise in logistics, procurement, and inventory management specific to offshore wind supply chains
    - Understanding of financial modeling, risk assessment, and cost control for large-scale infrastructure projects
- Engineering and survey roles
    - Knowledge of permitting and environmental regulations, including the National Environmental Policy Act and Bureau of Ocean Energy Management (BOEM) processes
    - Expertise in conducting geophysical, geotechnical, and environmental surveys for offshore structures
    - Skills in electrical, civil, and structural engineering for onshore substations, cable routes, and transmission systems
    - Technical understanding of offshore wind turbine and substructure design and industry standards

5.3.2 Manufacturing

Manufacturing activity will be concentrated in other NYS regions and Mid-Hudson and Capital regions, focusing on the production of secondary steelwork for towers and foundations, as well as cable protection systems. A typical baseline requirement for these manufacturing positions is experience in mechanical trades, often obtained through vocational training, apprenticeships, or community college programs. This requirement is particularly important for most critical job roles in manufacturing such as electrical technicians and machine operatives. However, of the total FTE-years generated in New York State by this manufacturing activity, only 6% are associated with critical job roles. These critical roles are primarily linked not to general fabrication or steelwork but to production management and technical design aspects within this phase. Examples include technical package managers, structural engineers, and wind turbine generator engineers, all of whom require higher-level, applied offshore wind engineering expertise. Appendix C contains a full list. The key skills and knowledge requirements for these roles are:

- Skills in fabrication and production management, including quality control of steelwork and components

- Practical knowledge and experience of wind turbine generator systems, and electrical integration
- Experience in applying civil, structural, geotechnical, and electrical engineering principles with software design and offshore wind industry standards
- Experience in commercial and contract management within large-scale infrastructure projects
- Expertise in steelwork design and assembly, machinery operation and mechanical engineering
- Understanding of health, safety, and environmental compliance

5.3.3 Installation and Commissioning

Installation and commissioning work will occur mainly in New York City and Long Island, with support from Mid-Hudson and Capital regions. As Figure 9 illustrates, among the total FTE-years generated in New York State through installation and commissioning activities, around 8% are associated with critical job roles. Critical job roles are driven by the requirement that personnel working offshore complete GWO BST, which includes modules in working at height, first aid, fire awareness, manual handling, and sea survival. Workers must also hold a valid offshore medical certificate issued by a U.S.-based physician in accordance with GWO, Offshore Energies UK, or U.S. Coast Guard standards (depending on employer). The technical knowledge and skills required for this phase will vary and do not necessarily require formal certification. GWO Basic Technical Training (BTT) is recommended to develop turbine-specific competencies and support the practical application of mechanical, electrical, and hydraulic systems.

Other technical skills and knowledge for critical job roles include:

- Leadership skills in operating and maintaining vessels used in offshore wind farms (including vessel navigation, crew supervision, and knowledge of maritime regulations)
- Experience in package and project management for offshore infrastructure and coordination of multidisciplinary teams
- Experience in commissioning and testing of electrical components, including cables, substations, and energy transmission
- Expertise in mechanical engineering and knowledge of turbine mechanics, blade technology, and turbine assembly
- Extensive experience in marine logistics for offshore wind operations, including docking, transportation, and storage of wind turbine components

- Understanding of safety and regulation compliance, and familiarity with offshore health, safety, and environmental standards and industry best practices for safe offshore operations

5.3.4 Operations and Maintenance

New York City and Long Island will serve as hubs for O&M activities, which require skills similar to those in the installation and commissioning phase. A significant portion of demand in this phase is for turbine technician roles, which require a strong foundation in both electrical and mechanical skills. Working offshore in these roles requires GWO BST and a valid offshore medical certificate as highlighted earlier. Technical knowledge and skills can be developed through GWO BTT and advanced GWO modules, such as enhanced first aid, blade repair, confined space entry, high voltage safety, and advanced rescue. These are not necessarily mandatory but are valuable for building practical competencies in offshore turbine operations.

Other areas of demand include vessel masters, crew transfer captains, and offshore support personnel, who require skills in operating and maintaining vessels used in offshore wind farms. Depending on the role, these positions may also require relevant maritime certifications to meet U.S. Coast Guard or industry safety standards. The O&M phase also requires an understanding of operating control room systems and long-term asset management.

5.4 Summary

Supporting workers in critical roles in New York State will be important in achieving the projected job creation. Across all areas of the supply chain, most critical roles are not entry level and either require built-up expertise in a specific field, or technical understanding of offshore wind. Excluding O&M, the largest concentration of critical roles is in the development and project management phase. These positions are typically senior and require specialized expertise in offshore wind, including contracts, commercial structures, and engineering considerations. Such knowledge is usually gained over time through hands-on experience in offshore wind or related sectors. The O&M phase also involves a significant number of critical roles, typically spread over a longer timeframe and focusing on a smaller set of skills.

For most critical roles, training needs will be demand-driven and delivered internally by industry. As seen in other offshore wind markets, most training gaps are typically addressed dynamically as demand emerges. When the right conditions are in place, developers and suppliers work with training institutions to design programs that deliver the required skills at the right time. Each employer has unique processes and ways of doing things, so specific requirements may vary across organizations. This demand-driven approach is expected to continue, provided that investment in workforce development remains strong and industry confidence in project delivery is maintained. Section 7 outlines some targeted interventions that may be needed to support this environment.

The remainder of the workforce outside critical job roles, 81% of the total workforce, is expected to come from the existing labor base, drawing on skills from construction, engineering, maritime, and energy sectors. The key challenge is ensuring these workers are prepared and that systems are in place to support working in offshore wind. Sections 6 and 7 discuss the current opportunities and challenges, as well as the recommended actions to strengthen this workforce framework.

6. Existing Offshore Wind Certification and Training Programs

This section provides a detailed assessment of existing offshore wind workforce certification and training programs in New York State. The objective is to identify opportunities and challenges related to expanding offshore wind workforce training. Information was gathered through stakeholder engagement with training programs across the State. Data was collected via interviews and email correspondence between November 2024 and February 2025. The stakeholder engagement process gathered feedback from institutions to understand the offshore wind programs they offer, including the skills areas covered, attendance numbers, and any challenges or opportunities associated with implementation.

6.1 Overview of Training Landscape

New York State has a strong and coordinated training network to develop the workforce needed for its growing offshore wind industry. The State collaborates with academic institutions, labor unions, nonprofits, and private training institutions to develop training programs and infrastructure to prepare people for offshore wind careers. NYSERDA has played a major role in funding the existing programs through both the OWTI and other programs (Table 12). CUNY operates several programs supported by the New York City Economic Development Council (NYCEDC)[3] and other sources, and additional programs are funded by developers.

Launched in 2020 by NYSERDA, OWTI is part of New York State's efforts to develop a skilled workforce. Established with a $20 million commitment from NYSERDA, OWTI aims to train or certify 2,500 workers for offshore wind careers. Its mission centers on identifying workforce gaps, partnering with academic institutions and industry, and directing resources toward training, credentials, outreach, and support for priority populations such as veterans, low-income individuals, and those from DACs. OWTI funding supports equipment purchase, certification or licensing assistance, development of training infrastructure, and operating costs for training programs.

In 2023 and 2024, OWTI issued 28 grants totaling $8 million over two rounds to SUNY campuses, with Stony Brook University and Farmingdale State College as key recipients. Between 2023 and 2025, NYSERDA awarded funds to six additional workforce programs, including Hudson Valley Community College, LaGuardia Community College, Capital Region BOCES, New York City Iron Workers Locals 40 and 361, New York City IBEW Local 3, and Soulful

Synergy. In addition to NYSERDA- and NYCEDC-funded programs, private investments by developers, particularly Ørsted and Equinor, have contributed millions as part of their economic benefits plans for projects that are operational and under construction. Ørsted invested $10 million to create the NOWTC at Suffolk County Community College, associated with Sunrise Wind, which has trained over 160 New York State union workers (NOWTC 2024). Sunrise Wind also provided funding to the Multi-Craft Apprenticeship Preparation Program (MAPP) for expansion in the Mid-Hudson and Capital regions. Ørsted also invested in a Navigation Enhancement and Training Program that offers vouchers to mariners for professional training, and approved navigation equipment for eligible commercial and for-hire fishermen. Eligible fishing license holders can also access experiential learning opportunities with Ørsted's offshore wind simulation (Ørsted 2025b).

Equinor's investments include the $5 million Offshore Wind Ecosystem Fund established together with bp to support the participation and involvement of historically marginalized communities and MWBEs, enabling it to better benefit from offshore wind development in New York City (Equinor 2022). Equinor and BP also supported the Offshore Wind NYC Waterfront Pathways Program to assist NYS MWBEs in participating in offshore wind waterfront construction contracts (NYCDEC 2023). K–12 and community outreach were also invested in by Equinor through its funding and operation of WindScape, NYS first learning center focused on offshore wind education.

Table 8. Overview of Offshore Wind Workforce Development Programs in New York State

Institution	Area	Programs Offered
Alfred University	Other NYS region	• Bachelor of Science in Renewable Energy Engineering
Baruch College	New York City and Long Island	• Bridges to Offshore Wind Program • Bachelor of Business Administration
Capital Region Board of Cooperative Education Services (BOCES)	Mid-Hudson and Capital regions	• Career and technical education (CTE), including welding, electrical and building trades
CUNY City Tech	New York City and Long Island	• Bridges to Offshore Wind Program • Department of Construction Management
CUNY College of Staten Island	New York City and Long Island	• GWO BST • Engineering and environmental science degrees in renewable energy • Welding program • CNC machinist program • Wind Turbine Training Program

Table 8. (continued)

Institution	Area	Programs Offered
CUNY Grove School of Engineering	New York City and Long Island	• Offshore wind–related electrical engineering courses
CUNY Kingsborough Community College	New York City and Long Island	• GWO BST • Introduction to Welding for Offshore Wind Careers • Seafarers International Union Pre-Apprenticeship Program • Deckhand Training Program
CUNY LaGuardia Community College	New York City and Long Island	• Wind Turbine Technician, including GWO BTT and BST
Institute for Workforce Advancement	New York City and Long Island	• Careers Workshop for Offshore Wind (planned)
Iron Workers Locals 40 and 361	New York City and Long Island	• GWO training
National Offshore Wind Training Center	New York City and Long Island	• GWO training
Port of Albany South End Workforce Training Center	Capital region	• Part of MAPP
Soulful Synergy	New York City and Long Island	• Developing an offshore wind workforce program designed to help workers from DACs succeed
SUNY Alfred State College	Another NYS region	• Relevant electrical and welding courses
SUNY Farmingdale State College	New York City and Long Island	• MWBE Online Sustainable Business and Technology Workshops • Preparing the Workforce for Cutting-Edge Manufacturing in Offshore Wind
SUNY Hudson Valley Community College	Mid-Hudson and Capital regions	• Introduction to Wind Energy • Introduction to Wind Power • GWO Entry-Level Wind Technician Framework • Welding and Fabrication • Welding Basics
SUNY Maritime	New York City and Long Island	• GWO-Basic Safety Training Center
SUNY Morrisville	Other NYS regions	• Renewable Energy Training Center's Offshore Wind Technician Training
SUNY Oneonta	Mid-Hudson and Capital regions	• SUNY Oneonta/8ONC BOCES Offshore Wind Program
SUNY Poly	Other NYS regions	• SUNY Poly Offshore Wind Training Team (SPOWT2)

Table 8 (continued)

Institution	Area	Programs Offered
Stony Brook University	New York City and Long Island	• OSW HVDC Transmission • WINDPLUS • Navigating the Clean Energy Transition • SUPERWIND: SBU Program for Upskilling • Empowering and Reskilling Workforce for Offshore WIND Sector
SUNY Suffolk County Community College	New York City and Long Island	• Strengthening the Wind Energy Education Pipeline
SUNY University at Albany	Hudson Valley and Capital	• Offshore Wind Technology Workforce Training Program
SUNY University at Buffalo	Other NYS regions	• Preparing NYS's Renewable Energy and Offshore Wind Supply Chain • Leveraging the Power of SUNY to Achieve New York State's Offshore Wind Energy Goals
The New York City International Brotherhood of Electrical Workers (IBEW) Local 3	New York City and Long Island	• GWO training
TMI Waterfront	New York City and Long Island	• GWO training
WindScape Brooklyn	New York City and Long Island	• K–12 education

6.1.1 Discussion

New York State developed a wide range of training programs to build skills needed in the workforce for the offshore wind industry. Many programs are directly focused on offshore wind and help to develop the specific skills and knowledge involved in the construction and O&M phases of the supply chain. Geographically, most training providers are in New York City and Long Island. This concentration aligns with the demand for critical job roles, which are primarily needed in this region.

The number of existing and planned NYS offshore wind workforce development programs that responded to data collection efforts for this study was counted and broken down by skill categories and number of participants per year (Table 9). The data are representative of the training programs through February 2025, although the number of programs and participants is constantly changing. Importantly, this analysis does not capture all activities that contribute to offshore wind workforce development because many of the skills used in the industry are highly transferable from other sectors. Around 40 active programs were identified, collectively training an average of approximately 2,310 participants per year in 2024-25.

As outlined in Section 5, many critical roles across the offshore wind industry require expertise in fields such as engineering, environmental science, and maritime operations, much of which is developed through universities, colleges, labor unions, and private employer-led training programs.

Table 9. Skills Represented in Existing and Planned Offshore Wind Workforce Training Programs

Skill Category	Existing Programs	Average Annual Participants	Planned Programs	Projected annual Participants
Intro/general	19	1,528	4	300+
GWO	6	300	2	TBD
Electrical	5	385	0	N/A
Welding	6	469	0	N/A
Manufacturing	2	36	0	N/A
Development	2	48	0	N/A
Total[a]	**40**	**2,310**	**6**	**300+**

[a.] Eliminates double-counting from overlapping programs.

Of the programs analyzed, the largest number relate to introductory or general offshore wind training. These programs, offered by institutions such as SUNY, CUNY, and the Institute for Workforce Advancement, are designed to raise awareness and expand access to job pathways in the sector. Introductory or general offshore wind courses are spread across New York State, with a concentration in New York City and Long Island. The introductory or general category also has the highest participant volume, with approximately 1,500 individuals accessing it in an average year at the time the data were collected. Introductory programs are particularly important because they promote awareness and highlight the job opportunities in offshore wind.

As highlighted in Section 5, the standardized industry requirement for formal certification is GWO training. These courses provide the mandatory offshore safety certifications needed to work offshore. GWO programs are concentrated in New York City and Long Island, where installation, commissioning, and operational activities are expected to take place. As of spring 2025, capacity existed to train approximately 300 participants per year in GWO (see Section 6.4.6 for a breakdown by training administrator).

Several programs analyzed also focus on developing specific technical skills relevant to offshore wind, including electrical, welding, and manufacturing skills. These programs operate on SUNY and CUNY campuses, as well as through unions. As highlighted in Section 5, electrical skills (both practical and technical) will be important across the entire supply chain, particularly in the manufacturing, installation, and commissioning phases. This is reflected in the relatively highly projected FTE-year demand for electrical technicians and engineering roles. Among the programs assessed, five focus on electrical skills, with an average of 385 participants annually. Technical skills offshore wind courses with electrical content are offered at LaGuardia Community College, the College of Staten Island, Stony Brook University, Alfred State College, and IBEW Local 3.

New York State's manufacturing capability focuses on secondary steelwork for towers and foundations, as well as cable protection systems. As outlined in Section 5, only about 6% of FTE-years in this phase are tied to critical roles, which are primarily in production management and technical design. Existing training capacity is largely focused on welding skills, which can provide a foundation for related entry-level manufacturing roles. The analysis identified seven offshore wind–tailored welding programs that enroll an average of 469 participants annually and are hosted by the New York City Iron Workers Locals 40 and 361, Alfred State College, the College of Staten Island, Kingsborough Community College, and several at Hudson Valley Community College. The offshore wind–tailored manufacturing courses are located at the College of Staten Island and Farmingdale State College and enroll an average of 36 participants annually.

Lastly, offshore wind development classes are offered as part of the OWTI program at the SUNY Polytechnic Institute (SUNY Poly) and Stony Brook University. SUNY Poly Offshore Wind Training Team (SPOWT2) focuses on engineering skills while WINDPLUS at Stony Brook University focuses on offshore wind project management. Of all the workforce needs across project phases, the development phase requires the highest concentration of critical skills. This is due to the highly specialized offshore wind expertise needed at this stage, including knowledge of procurement processes, the management of offshore infrastructure projects, and the technical characteristics of key components.

Feedback from developers indicates that much of the necessary expertise will ultimately be gained through on-the-job experience and through partnerships between employers and training institutions as specific needs arise. Existing training programs are strong and generally target the right areas, but ensuring alignment with real-time industry needs will require continued coordination across the broader ecosystem. New York State's network of academic institutions, labor unions, employers, and industry partners is well-positioned to support this effort. The foundations of offshore wind skills are built on existing strengths in engineering, environmental science, and manufacturing, areas in which the State already has substantial capacity. Opportunities exist to work with industry to ensure that course timing and content align with workforce needs as the industry evolves. Addressing broader challenges related to industry coordination and program delivery will help establish the structures needed to implement these systems (see Section 6.4).

6.2 Strengths and Opportunities

6.2.1 Skill Transferability

Feedback from developers indicated that many of the skills needed for offshore wind already exist within the NYS labor market, particularly in construction, engineering, maritime, energy, and professional sectors. The availability of relevant, existing training programs creates a strong foundation of experienced workers who, with targeted training and guidance, are well-positioned to take on roles in offshore wind.

Training administrators noted that emphasizing the transferability of skills, rather than branding programs exclusively as "offshore wind" or even "clean energy," has improved enrollment. Programs framed around broader core competencies, such as manufacturing, electrical systems, or general technical trades, are more appealing because they offer career flexibility beyond offshore wind alone.

To that end, Hudson Valley Community College and Suffolk County Community College have redesigned several of their offshore wind programs to incorporate a wider set of foundational skills, such as general manufacturing and electrical training. This approach has been well received, giving prospective students confidence that their skills will remain employable even during fluctuations in offshore wind activity. Other SUNY campuses report similar success with trade-focused courses, such as electrical work, welding, and fabrication, given the wide applicability of these skills across industries.

At the same time, a higher education program administrator noted challenges in engaging high school students aware of the uncertainty in the offshore wind market. To address this, outreach efforts focus on broader manufacturing and technical content, emphasizing that the skills developed will be transferable across industries.

Overall, while many programs already offer offshore wind–specific training, significant opportunities exist to further integrate offshore wind content into existing academic courses, apprenticeships, and technical programs. Embedding offshore wind elements into broader curricula, such as manufacturing, electrical systems, or renewable energy technologies, will help build the foundational workforce the industry needs and ensure employment opportunities during industry downturns.

6.2.2 Partnerships

Partnerships between training providers, employers, and community-based organizations are critical to the success of offshore wind workforce programs and remain a key opportunity for New York State to continue developing a skilled workforce. Existing partnerships, such as OWTI and NOWTC, deliver multiple benefits, including:

- Aligning training with employer needs
- Expanding access to facilities, equipment, and funding resources
- Increasing employer engagement by connecting trainees directly to job pipelines

OWTI programs have shown particular success in involving employers in curriculum development. For example, Stony Brook University worked with utilities, manufacturers, and Independent System Operator New England (ISO–NE) to design its curriculum. To increase MWBE enrollment, Farmingdale State College also noted positive engagement with CBOs and developers.

Academic partnerships are also strong in New York State's offshore wind workforce ecosystem. SUNY institutions collaborate across disciplines—for example, Farmingdale State College's School of Business works with the Pasternack School of Engineering Technology to support multidisciplinary learning. These partnerships broaden the program's reach and increase accessibility for students with diverse skill sets. Collaborations among academic institutions and research centers further support innovation and curriculum development. For example, SUNY Poly partners with the University of Massachusetts (UMass) Amherst Wind Energy Center through the DOE-funded Academic Center for Reliability and Resilience of Offshore Wind (ARROW) project and works with Johns Hopkins University to integrate offshore wind content into its programs. Some unions in New York City and Long Island are even discussing partnerships with SUNY to use their equipment for wind turbine technician training.

Several opportunities were highlighted to expand and deepen these partnerships. OWTI administrators had various levels of success in collaborating with the private sector on employment. One OWTI administrator described positive partnerships with both onshore and offshore wind projects that provided useful guidance on workforce requirements, including years of experience needed. In contrast, another program administrator reported limited responsiveness from employers and received little guidance on typical requirements. Local union leaders similarly expressed frustration over the lack of clarity regarding the workforce needed for offshore wind.

Partnerships to boost recruitment could also be improved. Although many training providers collaborate with CBOs and school districts, these efforts have had mixed results, particularly in reaching and retaining participants from DACs. Some programs plan to seek grant funding to build stronger CBO partnerships. Training programs are most effective when employers actively refer and send their employees. For example, community college courses had higher participation rates when requested by employers rather than when offered independently by community colleges.

As offshore wind demand grows, maintaining existing partnerships and forming new ones will be essential to understand workforce needs. Industry involvement is critical for designing relevant training and aligning courses with required skills. This collaboration also helps ensure strong course attendance and a direct connection to real employment opportunities. By combining the expertise of employers, training providers, and CBOs, these partnerships can help build a skilled and diverse workforce.

6.3 Challenges

Although New York State has a strong foundation of offshore wind training provision, several challenges may limit the sector's ability to scale workforce development in line with future project demand. This section outlines the key barriers identified through the review. This includes regulatory uncertainty, funding and grant constraints, training capacity, and the need for stronger alignment between training provision and industry requirements.

6.3.1 Regulatory Uncertainty

The U.S. offshore wind industry is experiencing significant delays and heightened uncertainty in project development and long-term pipeline visibility due to hostile executive actions and legislation enacted under the Trump administration. Notable actions have included halting all offshore wind permitting activities (including by de-designating Wind Energy Areas and withdrawing future wind energy lease sales), remanding the approved Construction and Operations Plan (COP), a key federal permit, for SouthCoast Wind, and the introduction of the Build Back Better agenda through the IRA, which has contributed to the temporary halting of construction of Empire Wind 1 (White House 2025; BOEM 2025; Town and County of Nantucket, Massachusetts v. Burgum 2025; Seafarers International Union n.d.). While offshore wind will remain part of the NYS energy mix, no additional offshore wind beyond the nearly 2 GW provided by the first three projects (South Fork Wind, Empire Wind 1, and Sunrise Wind) is likely to begin commercial operation before 2034.

Given that workforce training is most effective when clear, time-bound demand exists for specific skills, suppliers, developers, and training providers have become hesitant to invest in workforce programs or participate in multiorganizational training initiatives. The uncertainty is particularly challenging for smaller suppliers, who have limited capacity to absorb risk or invest ahead of confirmed project activity. Concurrently, training providers are likely to face challenges designing relevant programs, placing people into jobs, and recruiting and retaining participants. The industry will also be impacted by reduced access to federal funding for workforce training and associated incentives to prioritize DACs, priority populations, and the local workforce.

6.3.2 Funding and Training Grants

For offshore wind workforce programs to be effective, they must be sustainable, scalable, and closely integrated with industry. Funding and training grants can support this by reducing financial risk for training providers, but their impact depends on how they are structured and administered. Several workforce trainers reported challenges in implementing programs, including insufficient funds to meet program needs, challenges with grant administration, and a lack of clarity in the job pipeline.

Recruiting qualified faculty and trainers is challenging because their skills are in high demand and require compensation that typical funding does not allow. Interviews with providers reported that grants often do not cover costs for accessible online courses or specialized equipment needed for hands-on training. While increased funding can support wraparound services and help recruit and retain students from DACs, industry partnerships are often the most cost-effective way to provide equipment training because employers already have these resources and understand the needs. Such collaborations allow programs to deliver hands-on experience efficiently.

The research conducted for this study has shown that even well-funded programs can fall short without strong connections to employment opportunities. Providers may struggle to fully use funds when immediate offshore wind jobs are scarce, and some avoid applying because they cannot justify starting programs without clear employment pathways. Training administrators emphasized the need for longer grant timelines that align with offshore wind development cycles and strengthen the connection between training and workforce demand.

Beyond timing and costs, the grant application and reporting processes themselves present additional challenges, particularly for small and midsized providers. Applications often require significant time and resources, making independent submission difficult. Many providers have found success by partnering with larger university systems that have grant-writing capacity. Simplified application procedures and support for collaborative submissions can help smaller providers access funding and scale programs effectively. Tracking participant outcomes adds another layer of complexity. Funders typically require job placement and retention data, sometimes linking compliance to funding, but programs often lack the resources to conduct these surveys, and graduates may be unresponsive.

The greatest challenges reported by providers were limited insight into job pipelines and difficulty establishing strong employer partnerships, both of which constrain program effectiveness and access to funding. Access to employer hiring forecasts would help align training programs with actual workforce demand, but obtaining this information is often difficult. Providers noted that having an "anchor client" or committed employer partner significantly simplifies securing funding and designing relevant training, yet developing these relationships can be challenging.

6.3.3 Industry Standards

The offshore wind industry relies on globally recognized accreditation systems, namely GWO, to maintain consistent safety standards. In New York State, all GWO training providers are located in New York City and Long Island, where most installation, commissioning, and O&M jobs are expected to take place. Table 10 shows the existing and planned GWO programs in New York State as of data collected between November 2024 and February 2025.

Table 10. Global Wind Organisation Programs in New York State

Reported by region and number of participants.

GWO Program Administrator	Region	Participants per Year
CUNY of Staten Island (Planned)	New York City and Long Island	To be determined
CUNY Kingsborough College Community College (Planned)	New York City and Long Island	To be determined
CUNY LaGuardia Community College	New York City and Long Island	18
IBEW Local 3	New York City and Long Island	50
Iron Workers Locals 40 & 361	New York City and Long Island	45
NOWTC	New York City and Long Island	Significant overlap with Ørsted's Offshore Wind Credentialing Program
Ørsted	New York City and Long Island	162
SUNY Maritime	New York City and Long Island	25

GWO training is widely available across New York City and Long Island, with a strong number of participants already trained. The number of workers needed will depend on the deployment scenario and concentration of installation activity.

A key challenge reported was not course availability, but the flexibility to send workers on short notice or switch participants if project schedules change. This issue is common in offshore wind, where installation and maintenance activities can be disrupted due to weather, permitting, or logistical delays. To address this, the Iron Workers union developed a wind safety training program aligned with GWO standards, giving it greater control over scheduling while preparing workers for offshore wind industry requirements. Ensuring sufficient capacity and scalable training programs, particularly in New York City and Long Island, will be important as deployment increases and installation activities increase. (See Section 7.5 for additional information.)

6.3.4 Offshore Wind Awareness

Awareness of careers in offshore wind is an important tool to expand the workforce supply. A key challenge is that many potential workers are unfamiliar with the types of roles, required skills, and pathways to enter the sector, even in regions with active project development across New York State. This is reflected in low participation rates at career events and training programs, particularly those targeted at DAC residents.

Some grant-funded training programs use their funding to offer free courses and wraparound services for DAC residents, yet they have had trouble with participant recruitment and retention. For instance, a summer program for high school students barely met its enrollment target, and the administrator believes its resources could be put to better use, although they do not know why enrollment was so difficult. That program offered wraparound services to reduce barriers. Another program administrator has partnered with the NYS Department of Corrections for recruitment, and is conducting outreach to community colleges, high schools, and BOCES to increase enrollment.

The current volume of introductory and general programs represents some efforts focusing on exposing workers from DACs to the opportunities in the offshore wind industry. Administrators of several programs targeting those communities said that many more wraparound services are needed to help increase participants from DACs. This was a particularly common comment from the OWTI program administrators.

The challenge is further intensified by the relatively new and specialized nature of the offshore wind sector, which makes it less visible compared with more established industries. Without a clear understanding of the industry, attracting diverse candidates or engaging workers from different backgrounds can be challenging. Over time, this lack of awareness may limit the size and diversity of the workforce.

7. Recommendations

New York State has built the foundation for a capable and well-prepared offshore wind workforce. The systems, partnerships, and skills are largely in place. The key challenge now is to strengthen the transferable skills required by industry and reduce the barriers that prevent workers and companies from participating. This will help to ensure that the right skills are available at the right time. The following recommendations focus on improving coordination and removing immediate barriers in the system, ensuring that when project activity increases, the workforce can respond quickly. Importantly, only with a stable and competitive offshore wind market will workforce development efforts be fully relevant and effective.

7.1 Workforce Awareness and Visibility

Offshore wind is an emerging industry in New York State, and many people and organizations are still becoming aware of the range of career opportunities it offers. This applies to both individuals entering the workforce and local companies, including MWBEs, seeking to contribute. Even in areas with operational projects, such as Block Island, awareness of the industry is limited. Several entities, including NYSERDA, SUNY, CUNY, BOCES, and NYCEDC, have already made significant efforts to raise awareness of offshore wind careers. Given current project delays and the associated uncertainty about the long-term stability of offshore wind jobs, continuing this awareness-building is important.

The offshore wind workforce includes a wide range of roles, and messaging should reflect the industry as a whole. As highlighted in Section 5, many critical positions are senior roles that rely on skills and years of experience. In many cases, the fundamentals of these can be built from working in other related sectors in New York State such as construction, engineering, and environmental services. Recognizing and communicating the transferability of these skills can help attract experienced workers and support career transitions. Developing online resources that explain the range of skills needed can reach more people and help build a larger, more diverse workforce. Examples from European markets include the Guide to an Offshore Wind Farm (UK) and Building Offshore Wind (Ireland), which have helped to demonstrate that offshore wind offers more than technical positions, appealing to a broader pool of potential workers.

Building a local workforce includes supporting local companies. Many current suppliers understand the opportunities but lack certainty about future demand, which complicates workforce planning. Potential suppliers, including those currently working in other sectors, may have limited knowledge of long-term opportunities. Direct engagement with current and potential suppliers can clarify supply chain requirements and ensure local companies are ready to participate as the industry scales. This approach is most effective once a certain degree of confidence in the offshore wind market has been established. Working in offshore wind often requires a different type of worker than in many other industries. Roles demand a higher level of individual responsibility and care, particularly during installation, commissioning, and operational phases, which entail greater risk. Clearly communicating these expectations helps prospective workers understand the nature of the roles and attracts individuals whose abilities and work styles are well suited to the industry's demands.

Any communication about workforce opportunities should be clear and coordinated with the industry. Participants in any training program need to understand the timing, locations, and types of offshore wind jobs that are likely to become available. Completion of training without sufficient employment opportunities can undermine confidence in the industry and discourage participation.

7.2 Curriculum Development

Expanding the curricula of existing courses can help build foundational skills for a large audience, increasing the number of people capable of working in offshore wind. Much of the existing training focuses narrowly on offshore wind technical skills, which can limit participation and interest. Expanding courses to include transferable skills helps develop the core competencies needed in the industry and provides workers with greater flexibility to move across sectors.

For existing training programs, curriculum development can be achieved in several ways, including through course design and branding. For example, emphasizing "trade skills" rather than labeling a course specifically as "offshore wind" signals broader applicability. Unions do this very well and tend to focus programs on trades rather than a single sector. Another successful example is the oversubscribed high-voltage direct current (HVDC) transmission program at Stony Brook University, funded by OWTI, which trains students in skills that are applicable across multiple energy sectors, not just offshore wind.

For courses that currently include no offshore wind content, several approaches can be used to integrate offshore wind content into educational programs. Providing educator training, for example, can increase the inclusion of offshore wind content in courses and equip teachers to guide students toward careers. Incorporating employer input also helps ensure programs stay aligned with evolving industry needs. For instance, Alfred State College hires industry instructors for its welding courses, giving students up-to-date, practical knowledge.

Some of these strategies are already being implemented successfully. For example, clean energy career fairs were organized at the University at Buffalo, and the existing apprenticeship programs at IBEW Local 3 and Iron Workers Locals 40 and 361 incorporated several hours of instruction in the clean energy module, including offshore wind. Both reported the integration helped participants become more knowledgeable about offshore wind opportunities. Farmingdale State College has also successfully added advanced manufacturing modules for casting and molding large offshore wind components to existing materials science courses.

Lastly, partnerships with industry can greatly enhance curricula. Stony Brook University's SUPERWIND program has been very successful, collaborating with a wide range of industry partners, including utilities, original equipment manufacturers, and ISO–NE. Similarly, its Navigating the Clean Energy Transition program has also benefited from extensive partnerships in both developing and updating the curriculum.

GWO training programs are well established in New York State (see Table 14), with additional programs planned. Courses are offered at CUNY and SUNY campuses, through unions, and by developer-funded organizations such as NOWTC.

Offshore safety training for wind workers, typically lasting around 2 weeks, generally does not significantly delay workforce readiness, provided workers can access it easily. The primary need in New York State regarding GWO training is to ensure sufficient capacity to scale programs efficiently when large numbers of workers are required for installation, commissioning, and O&M roles. Building scalable training programs requires substantial planning, so developing these programs ahead of anticipated demand is important. The importance of scalability is particularly true when installation activity is concentrated within a short period. Successful efforts to scale involve assessing the necessary infrastructure, such as pools, safety equipment, and training facilities, as well as ensuring sufficient instructor capacity to handle varying class sizes.

One of the key challenges in building scalable training programs is the lack of support infrastructure in New York State. For example, GWO training requires a large swimming pool capable of accommodating offshore wind equipment and participants. Such pools are limited and difficult to access, especially in New York City. To address this, Iron Workers Locals 40 and

361 are exploring partnerships with several local colleges, while IBEW Local 3 is repurposing a large facility in Newberg, north of the City, with partial support from a federal grant. Encouraging and supporting partnerships like these is important to expand and improve access to appropriate training facilities.

Another key challenge, highlighted by multiple stakeholders, is the availability of certified instructors. Addressing this is critical because increasing the number of qualified instructors enables training programs to meet peaks in demand and prevents delays in workforce readiness when project activity increases. SUNY Maritime College also reported that the cost of certified trainers exceeded expectations and that instructors were required to travel to obtain their certifications, which reduced interest and willingness to participate. In response to project delays, SUNY Maritime plans to keep its GWO program in a "dormant state," maintaining instructor certifications so the program can quickly scale up when industry demand rises. To support rapid scaling, continued investment in training certified instructors is essential, including offering financial incentives, covering travel or certification expenses, and providing ongoing professional development opportunities.

Expanding GWO training at certain institutions may not be effective because certifications are valid for only 2 years. SUNY Maritime's experience shows that training is more successful when focused on currently employed workers within the relevant roles. Training individuals too far in advance is generally ineffective and should be guided by employer demand.

7.3 Training Grants and Funding Access

Funding and training grants are critical to workforce development, particularly for reducing financial risk for training providers and supply chain companies. NYSERDA's OWTI and other rounds of offshore wind workforce funding provide strong examples of State-led support. Grant mechanisms and delivery should be inclusive and account for the current industry environment.

To better support small and midsized training providers, application processes should be streamlined to reduce documentation, reporting, and compliance burdens. Streamlining will help smaller organizations apply independently, without requiring partnerships with large institutions. Increased access to State funding would enable a broader range of training providers to participate in workforce development, expand training capacity, and support a faster, more flexible response to industry needs.

Another key recommendation focused on shortening the request-for-proposal (RFP) timelines. Long timelines, as noted in Section 6, create uncertainty for providers and can delay hiring staff, securing space, or investing in necessary equipment. Stakeholders suggested reducing RFP timelines to allow programs to respond more quickly to changing industry demand. For example, one provider noted that NYSERDA's reduction of the RFP timeline from 11 months in Round 3 to 4–5 months in Round 5 was particularly helpful.

Grants should be more flexible in what they can fund and for how long. Allowing grants to cover costs such as lab space, equipment, competitive instructor compensation, online course development, and recruitment or outreach would enable providers to deliver higher-quality programs and better align their offerings with the industry's evolving needs. Pairing this with long-term funding assurances would support hiring and retaining staff, especially at universities, helping ensure programs run at full capacity and funding is fully utilized.

Many administrators noted that current success metrics do not fully capture program impact or progress. This is partly because many offshore wind workers enter the sector only after several years of experience in other industries, making immediate job placement unrealistic. Expanding measures of success beyond placement and retention would provide a more accurate picture of program effectiveness and allow providers to adapt and improve over time. For example, metrics could include training completion rates, employer feedback on content, and participation from underrepresented groups.

One of the key challenges with the current funding landscape is its heavy reliance on federal sources that may no longer be available. Several NYS programs, such as SUNY Maritime and IBEW Local 3, have relied on grants from agencies including the DOL and the DOE. However, under the Trump administration, many of these funding streams are no longer being offered, particularly for offshore wind workforce development and programs serving underrepresented workers. In this context, strengthening alternative funding pathways is important for stabilizing training capacity built to date and reducing vulnerability to federal policy shifts.

In addition to supporting training providers, grants could be directed to supply chain companies, which have a clear understanding of the skills their workforce requires. When these companies have certainty about demand and are aware of qualified training providers, they can invest and drive workforce development. Certainty also positions suppliers to compete more effectively as market demand grows. Supplier training grants are most effective when timed appropriately and delivered during periods of sufficient confidence and stability in the offshore wind market.

7.4 Accessibility

The recommendations in this section apply statewide and are designed to increase workforce capacity and expand the pool of skilled workers. Ensuring that any actions taken reach a wide audience is important because, over time, this will create a larger and more diverse range of people able to work in the industry.

Accessibility can be achieved by partnering with nonprofits and CBOs that work with workers from DACs. Farmingdale State College is successfully partnering with place-based CBOs, including Spin the Yard and the Central Brooklyn Economic Development Corporation, to recruit MWBEs for its Sustainable Business and Technology workshops. These nonprofits are trusted messengers and an important bridge for businesses that could benefit from participating in the offshore wind supply chain. Awareness of the process for becoming a qualified bidder, including insurance requirements and the measurement of their sustainability practices, is key to achieving New York State’s goal of a diverse and local supply chain. The college also plans to leverage local CBOs to help them build bridges with high school students. Similarly, Suffolk County Community College leveraged high schools, public libraries, the United Way, and community centers to recruit participants and host presentations during its offshore wind career exploration workshops.

Another key component to serving workers from DACs is having wraparound services available. These services, such as transport assistance, financial counseling, and basic skills support, are important for enabling sustained engagement with the industry and its opportunities. Locating workforce development initiatives or basing activity within these communities is an effective way to improve accessibility and strengthen participation outcomes for underserved groups.

Workforce professionals with experience serving workers from DACs believe significant resources are needed to help these individuals access certain offshore wind jobs. For instance, a low-income student will likely need both a scholarship and a living stipend to complete a 4-year engineering degree that could lead to a sustainable career in offshore wind. Stipends may also be necessary for shorter or trade programs. One example of a program well designed for workers from DACs is the Seafarers International Union’s Unlicensed Apprenticeship Program in Maryland. It is tuition-free and offers free room and board (Seafarers International Union n.d.).

On the other hand, several OWTI administrators noted that offering programs for free has not proven effective because attendance rates have been low. For example, a welding course on a SUNY campus saw robust student recruitment except among students from DACs. Although the class is free for students who complete it, its reimbursement-based model may deter students from DACs who cannot afford the upfront cost. Another example is a free, noncredit welding course offered at a community college, available only to residents of DACs, which struggled significantly with both recruitment and retention. Additionally, 40% of students registered for a free summer course funded by OWTI did not attend, leading administrators to believe their resources might be better used elsewhere, despite the ongoing goal of engaging students in the industry as early as possible.

Finally, attracting high school students to courses proved a persistent challenge. To address this, the University at Buffalo considered offering a small stipend to high school students to support recruitment for its career exploration seminar, which was designed to reach 400 participants. (NYSERDA n.d.a.) Suffolk County Community College encountered similar difficulties with recruitment for its high school summer boot camp.

7.5 Coordination

Increasing coordination among workforce development stakeholders will ensure that the ecosystem can provide the necessary workers for the offshore wind industry in the future and that resources are spent efficiently. This will help address some of the key challenges identified, including a lack of visibility into employer needs, limited exposure to career opportunities in offshore wind, and alignment with offshore wind training programs and other clean energy training programs.

Training programs must be closely aligned with industry demand to ensure that skills development results in meaningful employment opportunities. Providing training without clear job prospects can undermine confidence in the sector and discourage people from entering the sector. Amid current uncertainty, maintaining an open dialogue between industry, unions, training providers, and State-led organizations is crucial. Maintaining connection, coordination, and dialogue will help ensure that training is appropriately timed and program capacity is aligned.

As outlined in Section 6, a major challenge for program administrators was a lack of understanding of employment demand. Their feedback stressed the need for employment projections to be provided by the relevant suppliers and developers involved in the NYS offshore wind supply chain. This concern was raised in particular by unions, which reported difficulty in gaining visibility from Tier 1 and Tier 2 suppliers regarding the number of workers needed, the hiring timeline, and the specific skills required.

One effective way for employers to signal workforce demand is by sponsoring training cohorts with the intention of hiring participants. Employers can also host on-site programs, providing hands-on experience that aligns closely with job requirements. For example, Alfred State College successfully conducted welding training at Ljungström's facility for incumbent workers seeking additional skills. This approach works best for skills that can be learned quickly. For more complex skills that require years of training and on-the-job experience, employers and training providers should develop longer-term pathways.

Unions and community colleges that offer trade skills courses would benefit significantly from clear communication from manufacturers regarding the specific skills and certifications their employees will need. This information would enable these institutions to expand recruitment, training programs, and facilities more strategically. Manufacturers working together to standardize these skill and certification requirements would further support efficient scaling of the entire U.S. offshore wind supply chain workforce. Addressing the current lack of communication and coordination between workforce programs and NYS-based manufacturers would help advance the State's goal of becoming a regional supplier of offshore wind components. Because NYSERDA administers the incentive programs for Tier 1 and Tier 2 suppliers to locate in New York State, it may be well positioned to convene the manufacturers and facilitate this coordination and communication.

Labor market studies are also very important as program administrators increasingly design programs for transferable skills rather than just the offshore wind industry. Understanding the employment needs of industries associated with or adjacent to offshore wind, such as storage and transmission, will help keep the context of key fundamental skills relevant to the current job landscape.

Many stakeholders were attempting to increase exposure to offshore wind careers among high school and early college students. Administrators at the CUNY Grove School of Engineering, which recently launched an offshore wind student club, noted that pre-apprenticeships, apprenticeships, and internships are all key components of a system engaging new students in offshore wind. Drawing on lessons learned from other workforce pipelines, such as those in the biotech industry, they hope to create a progression in which students start with courses focused on general skills, then move into more specialized programs, and are placed in internships at the end of their academic learning. They believe that having multiple entry and exit points along an academic path will make it accessible to most students, as will incorporating interdisciplinary work.

Interest also emerged in creating in-person interactions for high school students. One stakeholder commented that high school students, particularly those from DACs, need exposure to successful role models, suggesting that bringing MWBEs into schools would be a valuable long-term investment in the offshore wind workforce. Higher education instructors also expressed interest in involving high school seniors from DACs in their courses to provide direct exposure to offshore wind career paths. Additionally, to strengthen the development of transferable skills for the offshore wind sector, funders and trainers should coordinate all clean energy workforce programs so that graduates can be hired even when development pipelines in a particular clean energy sector are uncertain.

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Appendix A Literature Review Summaries

This appendix provides the summaries of the 20 studies, reports, and plans reviewed. These summaries highlight notable connections among studies, such as instances in which the results of one analysis informed a subsequent study) and detail key findings.

A.1 ‘The Workforce Opportunity of Offshore Wind in New York’

The “The Workforce Opportunity of Offshore Wind in New York” report is one of the 20 studies conducted by the New York State Energy Research and Development Authority in support of the Master Plan 1.0, which considers two primary market scenarios for offshore wind development (NYSERDA 2017b):

1. High market scenario: 2.4 GW of offshore wind capacity in New York State and an additional 5.6 GW in the Northeastern U.S. by 2030
2. Low market scenario: 2.4 GW of capacity in New York State and an additional 1.6 GW in the Northeastern U.S. by 2030

A.1.1 Methodology

The methodology used included:

- Supply chain analysis:
  - Assessed New York State’s existing supply chain capabilities and its suitability to support offshore wind development, in three key areas: manufacturing, port infrastructure, and workforce skills
  - Based the analysis on industry interviews, desktop research, and recent reports and databases
  - Used these findings to inform the development supply chain narratives covering four periods through 2030
- Demand for NYS workers:
  - Quantified demand for NYS workers for each narrative using an in-house economic model tailored to the unique characteristics and supply chain requirements of offshore wind projects
  - Used bespoke multipliers informed by BVG Associates’ (BVGA) extensive experience and global offshore wind sector data, unlike conventional economic models that rely on standard multipliers from broader industrial sectors

A.1.2 Findings

The study identified significant economic and job-creation opportunities for New York State, including:

- Creation of approximately 2,250 manufacturing jobs
- Creation of approximately 2,000 operations and maintenance (O&M) jobs
- Generation of up to $6.3 billion in in-state expenditure under a high local-content scenario

Workforce recommendations include:

- Focus on long-term O&M jobs:
  - Prioritize training for O&M roles because these represent the most significant long-term employment opportunity.
  - Develop local training programs for technicians to maintain and service offshore wind turbines over their 25-year lifespan.
- Training and certification programs:
  - Expand existing training programs to cover offshore wind-specific skills, particularly in areas such as composite technology, advanced welding, and safety training for offshore work.
  - Highlight the need for certifications such as Certified Composites Technician and Global Wind Organization safety training.
  - Identify opportunities to establish new educational programs at community colleges, technical institutes, and universities to support the specific needs of the offshore wind industry.
- Leveraging existing skills:
  - Develop targeted retraining and upskilling programs to help transition workers from other industries, such as land-based wind or traditional manufacturing, into offshore wind roles.
- Collaboration and partnerships:
  - Foster collaboration among the State, educational institutions, labor organizations, and industry stakeholders to ensure that training and certification programs align with industry needs.
  - Suggest partnerships with established offshore wind players in Europe to help transfer knowledge and best practices to New York State's workforce.

A.2 'New York State Offshore Wind Master Plan'

Directed by the Governor, NYSERDA completed a comprehensive planning report, "New York State Offshore Wind Master Plan," outlining how to achieve the State's goal of developing 2.4 GW of offshore wind by 2030 (NYSERDA 2017a).

A.2.1 Methodology

The report was based on the compilation of 20 other studies covering specific topics relevant to offshore wind development, including the "Workforce Opportunity" study (NYSERDA 2017b) discussed in this report. Key steps and objectives include:

- Extracting key information from each report to address the following objectives related to offshore wind development:
  - Identify a favorable development area
  - Describe economic and environmental benefits
  - Assess mechanisms to minimize ratepayer impact
  - Analyze cost and cost-reduction pathways
  - Investigate development impacts and mitigation pathways
  - Identify infrastructure needs
  - Identify workforce opportunities
- Drawing on public outreach efforts that, in total, solicited feedback from more than 500 participants

A.2.2 Findings

The report produced the following findings and next steps:

- Achieving the State's 2.4 GW goal would:
  - Result in $1.9 billion in economic benefits (based on the social cost of carbon)
  - Create demand for 5,000 clean energy jobs by 2028
  - Generate $6 billion of in-state expenditure
- The next steps outlined for NYSERDA include:
  - Continuing public engagement sessions
  - Convening several offshore wind working groups
  - Undertaking additional studies to support offshore wind (e.g., a recommended study to collect baseline data on the environmental and ecological factors impacting offshore wind development)

    - Establishing the Jobs and Supply Chain Technical Working Group, comprising unions and other labor groups, government entities, and representatives of New York State's college and university system.
- To maximize the skill set of local workers and facilitate cost-efficient development, the State will need to:
    - Ensure that the training and certification requirements of the offshore wind energy industry are clear and readily available to the labor and educational communities
    - Engage with Tier 1 and Tier 2 manufacturers (because a large portion of offshore wind energy jobs relates to the manufacturing, assembly, and installation of Tier 1 components) to attract new facilities and expand the technical capabilities of existing infrastructure

A.3 'New Jersey Offshore Wind Strategic Plan'

The estimates developed in the "New Jersey Offshore Wind Strategic Plan" were based on New Jersey's goal of achieving 7.5 GW of offshore wind installed by 2035. The report focused on five aspects of offshore wind development, including supply chain and workforce development (NJBPU and Interagency Taskforce on Offshore Wind 2020).

A.3.1 Methodology

The methodology for this report included multiple steps to ensure a comprehensive evaluation:

- Explored two scenarios, with a primary focus on a scenario that balances cost and New Jersey–based content
- Evaluated "the likelihood that New Jersey will capture parts of the supply chain for New Jersey projects or projects for other states" (NJBPU and Interagency Taskforce on Offshore Wind 2020).
- Used stakeholder engagement regarding the offshore wind supply chain and workforce development
- Incorporated input from an Offshore Wind Strategic Planning (OWSP) roundtable discussion, which included representatives from offshore wind developers, supply chain companies, educational institutions, and labor unions

A.3.2 Findings

The findings of the analysis highlighted the following key supply chain and workforce insights:

- Found that supply chain elements, such as substation structure, substation electrical components, subsea cables, and turbine nacelle, tower, and hub, were projected to have limited or no local content from New Jersey.
- Found that supply chain elements, including project management and development, turbine blades, foundations, onshore works, and wind farm O&M were projected to have high local content from New Jersey.
- Projected that approximately 68,000 job- years would be created from 2020 to 2035, with:
    - Approximately 43% of these in production operations
    - 16% in management operations
    - 13% in installation, O&M, and repair occupations
- Identified access to an estimated 90,000 highly skilled workers in offshore wind–adjacent industries and more than 150 higher education institutions positioned to train a robust talent pool for the offshore wind sector.

Recommendations provided in this report included:

- Engage the best available experts at the Wind Innovation & New Development (WIND) Institute to collaborate with turbine suppliers, developers, educational institutions, and labor unions in delivering workforce training and recruitment programs, positioning New Jersey as a hub for the offshore wind O&M industry.
- Leverage the New Jersey Offshore Wind Supply Chain Registry, which connects offshore wind companies with potential partners in New Jersey, and the Supply Chain Technical Assistance Program, which supports local companies in developing the skills and competencies needed to participate in the industry, to catalyze local workforce development.
- Establish programs to retrain and credential existing workers in adjacent industries to meet the needs of the offshore wind industry.
- Develop and communicate clear health and safety training standards for offshore wind industry workers, including the creation of a Global Wind Organisation (GWO) certification program.
- Offer incentives, such as tax credits, grants, and low-interest loans, to encourage private investment in offshore wind infrastructure, supply chain, and workforce. Provide support for community-based meetings and funds to assist with retraining, including for fisheries workers.

A.4 '2019 New Jersey Energy Master Plan: Pathway to 2050'

The suggestions outlined in the "2019 New Jersey Energy Master Plan: Pathway to 2050 Plan" report were based on New Jersey's goal of 7.5 GW of offshore wind installed by 2035. It "outlined a roadmap with seven main strategies to reach the goals of 100% clean energy and 80% emissions reductions from 2006 levels by 2050" (NJBPU 2020).

A.4.1 Methodology

The methodology for this report included:

- Developed suggestions and recommendations for workforce development without using models, scenarios, or other data-driven approaches.
- Collected input and recommendations from the following coauthoring entities:
- New Jersey Department of Environmental Protection (NJDEP)
- New Jersey Economic Development Authority (NJEDA)
- New Jersey Department of Community Affairs (NJDCA)
- New Jersey Department of Labor and Workforce Development (NJDOL)
- New Jersey Department of Transportation (NJDOT)
- New Jersey Department of the Treasury

A.4.2 Findings

The findings of the report identified the following key actions and needs for workforce development in offshore wind and clean energy industries in New Jersey:

- Directed the U.S. Department of Labor (DOL) to develop a workforce needs assessment for long-term employment projections for relevant clean energy industries, and found that the offshore wind industry's talent demand will require a coordinated effort among universities, unions, and other training providers.
- Planned to expand established workforce pipelines, including:
    - County Apprentice Coordinators
    - Pre-Apprenticeship in Career Education (PACE)
    - Growing Apprenticeship in Nontraditional Sectors (GAINS)
    - Industry Partnerships initiative
- Charged the WIND Institute with "ensur[ing] coordination across state government agencies . . . continually requir[ing] industry input related to curriculum development, requisite competencies, credentials, and certifications" (NJBPU 2020).

A.5 'Power Sector, Supply Chain, Jobs, and Emissions Implications of 30 Gigawatts of Offshore Wind Power by 2030'

The "Power Sector, Supply Chain, Jobs, and Emissions Implications of 30 Gigawatts of Offshore Wind Power by 2030" report assessed the near-term (2030) and long-term (2050) implications and impacts on power sector evolution, offshore wind supply chain and infrastructure, and offshore wind workforce needs in the U.S., based on the assumed achievement of the Biden administration's goal of 30 GW of offshore wind by 2030 (NREL 2021).

A.5.1 Methodology

The methodology for this report included two main approaches:

- Modeled supply chain impacts by:
    - Applying results from the Regional Energy Deployment System (ReEDS) model to estimate supply chain impacts using the National Renewable Energy Laboratory's (NREL) Wind-Plant Integrated System Design and Engineering Model (WISDEM) for wind turbine costs and materials and Offshore Renewables Balance-of-System Installation Tool (ORBIT) for balance-of-system costs
    - Estimating the number of wind turbine installation vessels (WTIVs) needed, based on vessel tracking data from offshore wind installations in Europe
- Modeled workforce impacts by:
    - Using the Jobs and Economic Development Impact (JEDI) model to estimate jobs and economic impacts for the primary scenario (30 GW by 2030)

A.5.2 Findings

The findings of the analysis included the following:

- Projected that the 30-GW-by-2030 target (primary scenario) would:
    - Employ 77,300 workers offshore wind or in jobs induced by offshore wind activity by 2030
    - Employ more than 135,000 by 2050
- Projected for the period 2023–2030:
    - Construction-period installation and supply chain jobs would employ 31,300 workers per year on average
    - By 2030, O&M activities would employ 13,400 workers

    - Construction-period-induced jobs in retail, food service, and child-care sectors would average 22,800 during this time frame
    - By 2030, O&M-period-induced jobs would total 9,800 workers
- Projected for the period 2041–2050:
    - Construction-period installation and supply chain jobs would employ 40,800 workers per year on average
    - By 2050, O&M activities would employ 36,700 workers
    - Construction-period-induced jobs during this time frame would average nearly 30,800 workers
    - By 2050, O&M-period-induced jobs would total 26,800
- Projected wages for offshore wind jobs are as follows:
    - Average $66,000 for construction and $55,000 for O&M, with a range of $53,000–$132,000 across all job categories (2020 dollars)
    - Wages for induced jobs average $43,000 for the construction period and $39,000 for the O&M period

Table A-1. Offshore Wind Job Impacts by Decade

Table values in thousand FTEs per year, period average for construction; FTEs at year-end for O&M.

Impact	2023–2030	2031–2040	2041–2050
Construction Period			
Installation, manufacturing, and supply chain jobs	31.3	16	40.8
Induced jobs	22.8	12.1	30.8
Operating Period			
O&M technicians, management, and supply chain jobs	13.4	19.4	36.7
Induced jobs	9.8	14.2	26.8

A.6 'Building North Carolina's Offshore Wind Supply Chain: The Roadmap for Leveraging Manufacturing and Infrastructure'

The "Building North Carolina's Offshore Wind Supply Chain: The Roadmap for Leveraging Manufacturing and Infrastructure" report aimed to help maximize economic benefit from offshore wind and position the state as a top choice for supply chain development of offshore wind. The study was commissioned by the North Carolina Department of Commerce (2021) and resulted from the SMART-POWER Memorandum of Understanding with neighboring states.

A.6.1 Methodology

The methodology for this study included several key components, including:

- Used market projections with three inputs:
    - Number of executed offtake agreements
    - State-legislated targets
    - Direct data obtained from interviews with developers and stakeholders
- Divided the development of offshore wind into three waves:
    - First wave (2023–2026): Projects with an offtake agreement (~6 GW)
    - Second wave (2026–2028): Projects in the process of getting an offtake agreement
    - Third wave (2028–2035): Future projects that can be developed in existing lease areas
- Developed and sent a questionnaire to companies with offshore wind supply chain capabilities
- Conducted a readiness assessment of ports and marine terminals by:
    - Interviewing port facility staff
    - Conducting site visits
    - Performed desktop research
- Included a representative (not exhaustive) list of ports and marine terminals to illustrate the effort needed to prepare marine facilities for offshore wind activities

A.6.2 Findings

The findings of the study highlighted North Carolina's readiness and made the following recommendations for growth:

- Found that North Carolina is well-positioned for offshore wind supply-chain development because much of the required infrastructure and policies are already in place, including:
    - A manufacturing-friendly environment and a readiness to host businesses that manufacture major offshore wind components
    - Congestion-free waterways and strong transport links are advantageous for supply chain development.
- Provided six recommendations:
    - Solicit "anchor company" suppliers to North Carolina, focusing on major component manufacturing
    - Accelerate the North Carolina offshore wind project development strategy
    - Support the multistate (with Virginia and Maryland) regional supply chain cluster

    - Actively support and grow the business opportunity to support offshore wind development
    - Promote workforce development for offshore wind jobs
    - Strengthen and prepare existing port facilities and strategic coastal properties to handle offshore wind development
- Recommended specific workforce development actions:
    - Conduct a job skills analysis to understand needed skills and, together with SMART-POWER partners, develop wind-specific training options that leverage existing strengths in the region's maritime and construction industries
    - Assess offshore wind skills requirements and survey providers to match their offerings and identify gaps
    - Establish a wind energy technician training program and a training partnership with the Mid-Atlantic Wind Training Alliance
    - Support the expansion of programs by providing new infrastructure, equipment, and curriculum development grants, as well as funding for community colleges, University Energy Center workforce development programs, and technical institutes specific to offshore wind workforce needs; funding could come from established workforce grant programs administered by the state or new appropriations to the University of North Carolina (UNC) system and the North Carolina Community College System
    - Encourage industry- and product-specific training delivered by equipment suppliers

A.7 '2021 New York State Disadvantaged Communities Barriers and Opportunities Report'

The "2021 New York State Disadvantaged Communities Barriers and Opportunities Report" was mandated by the Climate Leadership and Community Protection Act of 2019 (Climate Act). It assesses the causes of disproportionate impacts from climate change and air pollution on disadvantaged communities (DACs) (NYSERDA 2021).

A.7.1 Methodology

The methodology for this study included the following activities:

- Coordinated input from other State agencies (including the Departments of Health, Public Service Transportation, Labor, Temporary and Disability Assistance, and Homes and Community Renewal)
- Gathered feedback from the Climate Action Council (CAC) and Climate Justice Working Group

- Reviewed existing reports and previous public input, and conducted a targeted literature review
- Received feedback from focus groups
- Conducted public hearings and comment sessions
- Identified types and categories of barriers facing DACs through multiple activities, treating the assembled focus groups as "tangible examples" of the Service and Commodity Areas described by the Climate Act and are representative of the broader categories defined in the Climate Act.

A.7.2 Findings

The report identified four barriers facing DACs:

- Physical and economic structures and conditions
- Financial and knowledge resources and capacity
- Perspectives and information
- Programmatic design and implementation

These barriers limit access to key energy equity and climate justice programs, including:

- Distributed renewable energy programs
- Energy efficiency, weatherization, and electrification programs
- Clean transportation programs
- Community adaptation of home and infrastructure
- Programs that reduce the risk to climate change impacts (commonly known as resilience projects)

The report made three key recommendations for addressing these barriers:

- Ensure all processes are inclusive
- Streamline access to programs
- Address emerging issues
- Conduct a baseline or gap analysis to identify agencies or entities best positioned to implement other recommendations

Specific workforce recommendations included:

- Expand training capacity and job opportunities for workers with limited job access (e.g., court-involved workers)
- Augment training capacity and funding for DACs

- Engage community input on the development of workforce training programs
- Include workforce provisions in community benefit programs
- Bring energy code education and training to frontline contractors
- Continue support for younger New Yorkers (ages 18–24) in green building and technology training and apprenticeships
- Fund and design training to be accessible in terms of mode or channel, time, and resource commitment, language, education level (e.g., increased online training, abbreviated guidelines, translation, staff resources for live training or support)
- Partner with the Boards of Cooperative Educational Services of New York State to provide training to underserved students in environmental justice communities

A.8 'New Jersey's Offshore Wind Workforce Assessment through 2035'

The estimates developed in the "New Jersey's Offshore Wind Workforce Assessment through 2035" were based on the state's goal of 7.5 GW of offshore wind installed by 2035, as well as supply chain support for 26 GW of offshore wind to be installed in Connecticut, Maryland, Massachusetts, New York, North Carolina, Rhode Island, and Virginia by 2035. The report was produced for the New Jersey Economic Development Authority (NJEDA) and the Governor's Office of Climate Action and the Green Economy (NJEDA 2022).

A.8.1 Methodology

The methodology for this assessment included the following analytical steps:

- Developed custom JEDI models to calculate employment impacts from the development of offshore wind, based on public data
- Used Low, Mid, and High market development scenarios to project job creation, with most analysis conducted using the Mid scenario
- Included a range of job types, including construction, manufacturing, other supply chain, professional services, and induced jobs, defined as "jobs resulting from offshore wind workers spending their wages in New Jersey's economy and creating additional employment impacts in the healthcare, childcare, retail, or food service industries" (NJEDA 2022).

A.8.2 Findings

The findings of the assessment included the following projections and insights:

- Projected job creation for 2030 as follows:
  - Low scenario: approximately 18,800 jobs
  - Mid scenario: approximately 20,100 jobs
  - High scenario: approximately 23,900 jobs
- Projected additional Mid scenario findings as follows:
  - Approximately 4,071 total jobs in 2025, 20,086 in 2030, and 16,959 in 2035
  - Approximately 50% of jobs in 2030 in the manufacturing sector, with about 3,900 from New Jersey and about 6,200 from increased regional exports
  - Approximately 30% of jobs in 2030 as induced jobs

To support workforce development, the report made the following recommendations:

- Make the manufacturing industry a focal point in ongoing offshore wind workforce development efforts through the WIND Institute, given New Jersey's goal to become a regional supplier of offshore wind component parts
- Engage with training providers and employers to develop manufacturing modules and curricula that are in accord with industry and employer needs
- Add contextualized training modules specific to offshore wind for nonmanufacturing jobs
- Expand access to training programs to individuals in overburdened communities by engaging with community-based organizations (CBOs) in these communities to create targeted training programs and working with industry to create paid on-the-job internships
- Develop partnerships with middle and high schools to create a talent pipeline through job fairs or site visits
- Partner with local and regional employers to create on-the-job learning programs for high school students to prepare a pipeline of offshore wind production workers in the next 3 to 5 years

A.9 'Wind Energy: Supply Chain Deep Dive Assessment'

The "Wind Energy: Supply Chain Deep Dive Assessment" is, to some extent, limited by publicly available data; for example, when projecting new facilities that support domestic manufacturing of parts, the analysis considers only publicly announced data (DOE 2022b). The research also reflects the assumptions of the referenced reports and resources.

A.9.1 Methodology

The methodology for this report included the following steps:

- Drew on data from preexisting reports and research
- Solicited information through a request for information (RFI) circulated to stakeholders and industry experts
- Interviewed subject matter experts, including manufacturers
- Issued the report in compliance with Executive Order 14017, America's Supply Chains, which directs investigation into supply chains for the energy sector industrial base

A.9.2 Findings

The report presented the following findings:

- Reported that in 2020, wind power capacity grew by 16.8 GW to about 122 GW, with 3.087 GW added through partial repowering
- Found that low labor costs overseas threaten domestic manufacturing, but demand for a skilled workforce in the U.S. is expected to be high
- Reported that construction has represented the largest sector of growth in wind-related jobs, adding approximately 42,300 jobs in 2020
- Identified that the largest concentration of the workforce is in land-based wind
- Projected that peak job demand is expected in 2026, at 72,000 jobs if all components are produced domestically

The report made the following workforce development recommendations:

- Expand workforce development across all levels of wind deployment, including components manufacturing and assembly, subcomponent manufacturing, processed material production, and raw materials mining and refining.
- Establish training programs at all levels, from welding and design to management and machining
- Foster cooperation among manufacturers, developers, community colleges, and labor unions to create wind-specific training

- Develop additional education and training programs, with scenarios ranging from several hundred new programs to more than 1,000
- Retrain workers for offshore wind facilities, construction, and servicing
- Leverage community colleges and labor unions to address key educational and training requirements for the offshore wind industry, especially for plant-level workers
- Encourage and support close cooperation among unions, other educational and training organizations, and the industry in the context of Project Labor Agreements (PLAs) to facilitate workforce development for specific opportunities, such as manufacturing facilities

A.10 'America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition'

The "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition" report outlined the DOE's response to the February 2021 Executive Order on America's Supply Chains and addressed the challenges and opportunities in securing a resilient and secure energy supply chain as the U.S. transitions to clean energy (DOE 2022a).

A.10.1 Methodology

The methodology for this report was informed by the following approaches:

- Used findings from 13 technology-specific assessments, including the preceding DOE report (2022b)
- Issued an RFI for policy strategies to address supply chain security
- Drew on preexisting research and direct input from stakeholders, gathered through the RFI and DOE leadership's conversations with stakeholders

A.10.2 Findings

The report identified the following key challenges and workforce considerations:

- Found that the U.S. faces "immense" challenges related to raw material availability, manufacturing capacity, dependence on foreign supplies, worker training, global trade practices, cybersecurity, and research and data analysis
- Grouped common risks and vulnerabilities into seven categories, including "attract and support a skilled workforce for the clean energy transition" (DOE, 2022a).
- Determined that to address workforce challenges, the U.S. should work with multiple agencies and strengthen labor standards for organized labor

- Emphasized that a strong workforce is needed to be successful in all seven categories.
- Attributed the lack of skilled workers, in part, to social, economic, technological, and demographic changes, including:
    - An aging workforce
    - Population growth decline
    - Training gaps
    - Rising cost of living
    - Rising cost of labor
- Noted that "many manufacturers . . . relocate back to the United States from other countries . . . as wages rise in developing countries, rather than relocate to other low-wage countries" (DOE, 2022a).

The report made the following specific workforce recommendations:

- Expand manufacturing programs, including apprenticeship programs and academic and trade schools.
- Direct the DOL, in coordination with the U.S. Department of Education, to convene multiple agencies and workforce stakeholders, including federal agencies, regional employers, state and city governments, labor unions, training partners, and non-governmental organizations (NGOs) to advance energy workforce development
- Embed strong labor standards and support for organized labor in federal funding for the Energy Sector Industrial Base
- Appropriate Congressional funds to establish regional and state-level sector partnerships and Registered Apprenticeships to recruit, train, and place workers into careers needed for domestic supply chains

A.11 'New York State Offshore Wind Workforce Gap Analysis'

The findings outlined in the "New York State Offshore Wind Workforce Gap Analysis" were based on the assumption of a 9 GW increase in offshore wind capacity in New York State (NYSERDA 2022a).

A.11.1 Methodology

The methodology for this analysis included the following steps:

- Analyzed projected supply gaps for specific occupations within the offshore wind industry, classified into mild, moderate, or severe based on the difference between projected need or demand from baseline economic conditions, plus offshore wind-specific industry demand
- Detailed key wind energy-specific training programs
- Examined two separate policy and investment scenarios from the "2021 New York State Climate Action Council Draft Scoping Plan," Scenario 1: Low Carbon Fuels, and Scenario 2: Accelerated Transition (CAC 2022b).

A.11.2 Findings

The report presented the following workforce projections and insights:

- Estimated approximately 14,300 offshore wind jobs in 2030 and approximately 18,700 in 2040 under Scenario 1
- Estimated approximately 14,700 offshore wind jobs in 2030 and approximately 23,800 in 2040 under Scenario 2.
- Projected that in 2030, the top occupations by number of jobs would be management/professional (34.5%), installation/repair (28.8%), and production/manufacturing (19.7%)
- Identified the top three Regional Economic Development Council (REDC) areas with the most offshore wind jobs as New York City (46.5%), Long Island (13.9%), and Mid-Hudson (9.7%)
- Identified four occupations with the most severe workforce gaps: plant and system operators, hoist and winch operators, continuous mining machine operators, and wind turbine service technicians
- Found that roughly 73% of offshore wind occupations require either a bachelor's degree or an apprenticeship or postsecondary training.
- Identified 24 training programs, most of which are geared toward engineering; many are not offshore wind–specific, but offer training that could be transferable or leveraged for the offshore wind industry

A.12 'U.S. Offshore Wind Workforce Assessment'

The "Offshore Wind Workforce Assessment" estimated national workforce needs (current and future) based on the assumed achievement of the Biden administration's goal of 30 GW of offshore wind by 2030 (NREL 2022b). It provided estimates based on 25% and 100% domestic-content scenarios to account for uncertainty in the share of labor and materials sourced from the U.S. The assessment used the assumed offshore wind facility deployment pipeline and workforce needs assessment methodology in "The Demand for a Domestic Offshore Wind Energy Supply Chain" Report (NREL 2022a).

A.12.1 Methodology

The methodology for the assessment included two main analytical components:

- Assessed workforce needs by:
  - Focusing on direct and indirect jobs in five key industry segments: project development, manufacturing and supply chain, ports and staging, maritime construction, and O&M
  - Estimating national workforce needs using:
    - A custom input-output economic model based on the JEDI model
    - The Offshore Wind Vessel Workforce Estimator, a model that leverages detailed installation strategies and process times from NREL's ORBIT model to forecast workforce demand over time for different vessel types
- Assessed workforce gaps by:
  - Evaluating relevant occupations and their associated educational and training requirements through analysis of job postings and interviews with industry experts
  - Identifying existing educational and training programs contributing to offshore wind workforce development and qualitatively evaluating their alignment with workforce needs by industry subsegment

A.12.2 Findings

The assessment presented the following findings and recommendations:

- Found that required average annual employment levels from 2024–2030 range between 15,000 (25% domestic content scenario) and 58,000 (100% domestic content scenario) full-time equivalents (FTEs)

- Made several recommendations to address workforce gaps, including:
    - Increasing regional and industry coordination by:
        - Coordinating regional approaches among state and local governments and industry to meet peaks of demand for workers during installation
        - Developing programs together with planned facilities
    - Understanding and standardizing workforce needs to optimize planning by:
        - Standardizing types of roles and requirements, and communicating the needs for each type among stakeholders
        - Standardizing safety certifications for people working at sea
        - Understanding overlapping skills needs of other industries to project bottlenecks, particularly for skilled workers influenced by industries outside of offshore wind
    - Augmenting and accelerating key trainings by:
        - Creating upskilling training for workers from adjacent industries, including workers in maritime, oil and gas, and other industries
        - Addressing key gaps in union-led and community college training courses for the most needed roles during installation, including access to training
        - Accelerating or supporting training programs with on-the-job training to avoid increased reliance on foreign workers
        - Engaging primary and secondary students, particularly in coastal communities, in offshore wind career pathways
    - Focusing on local and diverse workforce readiness by:
        - Expanding partnerships with unions that supply diverse local workers into their training programs
        - Implementing mechanisms to assess and track participation of diverse and local workers

A.13 'The Demand for a Domestic Offshore Wind Energy Supply Chain'

"The Demand for a Domestic Offshore Wind Energy Supply Chain" report estimated annual material (i.e., component, port, and vessel) and workforce needs based on an assumed U.S. offshore wind facility deployment pipeline that would achieve the Biden administration's goal of 30 GW of offshore wind by 2030 (NREL 2022a). It provided estimates based on 25% and 100% domestic-content scenarios, as well as their average, to account for uncertainty about how much labor and materials are sourced from the U.S. The report also listed required Tier 1, 2, and 3 components (finished components, subassemblies, and subcomponents, but not raw materials) and discussed critical path items that represent "a significant challenge, bottleneck, or risk for a future domestic supply chain" (NREL 2022a).

A.13.1 Methodology

The methodology for this report included the following key components:

- Developed a hypothetical deployment pipeline based on publicly available data on offshore wind lease areas and wind energy areas (WEAs) awarded by the Bureau of Ocean Management (BOEM)
- Incorporated state-level offshore wind policies and targets, proprietary information from project developers, technology assumptions, and consultation with key regulatory agencies and other stakeholders
- Assessed material needs by:
    - Estimating demand for port berths for fixed-bottom and floating projects and assessed that demand against the technical parameters of existing ports
    - Estimating demand for vessels and assessing that demand against available Merchant Marine Act of 1920 (Jones Act) compliant WTIVs, as listed in DNV's vessel database
    - Compiling a list of Tier 1, 2, and 3 component requirements based on a literature review as well as interviews and follow-up communications with internal and external component-specific subject matter experts and industry representatives
- Assessed workforce needs by:
    - Estimating direct and indirect manufacturing and supply chain jobs (at the component level) using a custom input-output economic model, based on the JEDI model
    - Using sensitivity analyses to model varying degrees of supply constraints

A.13.2 Findings

The report presented the following key findings:

- Found that achieving the 30 GW goal by 2030 is a feasible target
- Recommended continuing investments in the supply chain only if expanded leasing generates consistent deployment post-2030
- Estimated that requiring average annual employment levels from 2023–2030 would range between 12,300 (25% domestic content scenario) and 49,000 (100% domestic content scenario) FTEs

- Identified several offshore wind turbine components that cannot currently be manufactured in the U.S., representing an opportunity for first movers
- Recommended making major investments in workforce training initiatives to jump-start the domestic offshore wind supply chain
- Emphasized developing local infrastructure and workforce capabilities to create resources and jobs dedicated to the domestic market and less sensitive to global supply chain bottlenecks
- Preferred state-level or domestic sourcing of Tier 1 components, signaling the need for the offshore wind energy industry to support domestic workforce and training programs
- Recommended leveraging community colleges and labor unions to address many of the key educational and training requirements for the offshore wind industry, especially for plant-level workers
- Encouraged close cooperation among unions, other educational and training organizations, and the industry to support job pathways, training programs, and respect for workers' labor rights, thereby helping spur workforce development in manufacturing facilities

A.14 'Clean Energy Industry Report'

The "Clean Energy Industry Report" is the second-to-latest in a series of yearly reports (since 2017) that analyzed data on clean energy jobs, employer needs, and existing assets in New York's clean energy sector. The 2023 report provided data and results through December 2022 (NYSERDA 2023a).

A.14.1 Methodology

The methodology for this report included the following key steps:

- Collected data from the U.S. Energy and Employment Report (USEER) as well as from two additional surveys: one survey of employers and one of workers in clean energy
- Included approximately 1,790 businesses participating in the USEER, with 163 employees and 81 workers responding to the additional surveys
- Classified new job data as either in-scope or out-of-scope, and as either direct or indirect
- Adjusted data based on a weighted scale reflecting each business's participation in clean energy
- Completed analysis using the Impact Analysis for Planning (IMPLAN) model to estimate the contribution of clean energy companies to the Gross State Product

- Implemented a process to avoid double counting data by running the IMPLAN model for each subindustry, comparing results to combined sector results, and excluding (if applicable) jobs from other subindustries in that sector

A.14.2 Findings

The report presented the following findings regarding New York State's clean energy workforce:

- Reported that the entire clean energy workforce grew by 3.5% (5,800 new jobs) in 2022, and by 21% (nearly 30,000 jobs) since 2015
- Found that the clean/alternative transportation, building decarbonation/efficiency sectors, and renewable power generation had the largest increases of new jobs, with 2,223, 2,000, and 1,200, respectively
- Reported that the clean energy industry had the third largest growth of all industries in New York State, following the food/accommodations and healthcare industries
- Found that New York State had the third largest growth in the clean energy industry compared to other states
- Reported that the clean energy industry had 170,857 jobs in New York State, with 159,706 of those jobs filled by NYS residents
- Found that clean energy spending increased to $2.3 billion in 2022, up from $1.4 billion in 2021
- Reported that traditional energy jobs decreased by 11%

Specific workforce development findings included:

- Reported that workforce diversity increased between 2021 and 2022, although further progress is needed; ongoing monitoring, funding, and support for diversification programs remains crucial
- Found that geography affects access to clean energy jobs for potential workers
- Reported that distribution of clean energy jobs shows 31% are located within DACs, while 36% of the State's population lives in DACs, with most DACs having a lower share of clean energy workers living within them
- Identified that availability of training programs is greatest among private employers (often through apprenticeships), unions (also through apprenticeships), and community colleges, with nonprofit organizations, vocational technical schools, and 4-year colleges also offering relevant training

- Reported that scarcity of clean energy training programs in rural regions highlights the need to strengthen ties between training providers, unions, and employers to resolve equity and job-matching challenges that arise through using online resources or word-of-mouth to connect workers and employers
- Found that significant challenges reported by workers include "a lack of basic information about clean energy careers early in their education," "finding employment opportunities near where [they] live," and "getting relevant work and/or industry experience" as the most significant challenges to their career advancement (NYSERDA, 2023a).
- Reported that participation in multiple clean energy workforce programs is common among survey respondents
- Found that attraction of clean energy talent primarily involves highlighting available jobs, connecting job seekers to relevant training opportunities, and leveraging existing experience

A.15 'New York State Offshore Wind Skills Analysis'

The suggestions outlined in the "New York State Offshore Wind Skills Analysis" were based on New York State's goal of 70% renewable electricity by 2030 (NYSERDA 2023b). At the time of the report, 4.2 GW of offshore wind was under development with an additional 10–20 GW projected in the coming years. This analysis was conducted to determine the offshore wind workforce gap in the manufacturing and construction sectors identified in previous publications.

A.15.1 Methodology

The methodology for this report included the following key steps:

- Focused specifically on skills and certifications needed for in-demand offshore wind occupations in four project phases:
  - Ports and infrastructure development
  - Manufacturing and assembly
  - Construction and installation
  - Operations and maintenance
- Analyzed the certifications most commonly required or preferred occupations, including the Occupational Safety and Health Administration (OSHA 10-Hour Construction Safety and Health Training, OSHA 30-Hour Construction Safety and Health Training), GWO certifications, Project Management Professional (PMP) certifications, Certified Welder certification from the American Welding Society (AWS), and Professional Engineer license

A.15.2 Findings

The report presented the following findings:

- Identified three critical population pools for workforce development:
  - Workers in adjacent industries who could transition into offshore wind
  - Incumbent workers in fossil energy sectors
  - Individuals from priority or DACs

  Connecting these groups to the appropriate training and credentialing programs will help New York State quickly and effectively capitalize on the economic benefits of offshore wind.
- Emphasized the necessity of a strategic approach to reaching new offshore wind workers by understanding the specific barriers faced by these populations
- Expected that many anticipated jobs will be high-quality unionized positions, with union apprenticeships and pre-apprenticeship and apprentice-readiness programs crucial to ensuring workforce diversity
  - Indicated that 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
- Projected that New York State's Supply Chain Investment Plan may exacerbate gaps in manufacturing occupations due to reliance on in-state manufacturing and supply chains, as well as the potential for export of wind equipment and components outside the State
- Recognized that regions with rapid offshore wind employment demand will require the ability to bring new workers onboard quickly
  - Indicate that the pace of this transition will be critical to fully leverage the opportunity
  - Noted that guiding each group into offshore wind work, especially under time constraints, will require intentional focus and a clear understanding of how to address their unique challenges and barriers
- Outlined strategies for catalyzing workforce participation from DACs, including:
  - Recruiting individuals from DACs into offshore wind roles is critical to meeting New York State's equity and inclusion goals and labor demand; this requires addressing specific barriers and developing a comprehensive strategy, including varying investments and incentives for education and training, wraparound services, career and job placement services, and other supports
  - Supporting entry into jobs with lower initial barriers as a near-term pathway, with several entry-level and mid-tier occupations identified

- Provide or enhance wraparound supports for disadvantaged workforces by focusing on existing organizations that offer these services and increasing funding to help them support individuals seeking to enter offshore wind occupations, rather than duplicating efforts or creating multiple systems
- Engaging priority populations in union programs by overcoming barriers, such as lack of awareness about union opportunities, concerns about cultural fit, and difficulty meeting apprentice entry requirements
  - Addressing these barriers through pre-apprenticeships or apprentice-readiness programs operated in partnership with labor unions, targeted outreach, community partner involvement, adult basic education and basic skills training, and exposure to specific unions

- Reported that the most frequently mentioned required certifications across in-demand occupations are OSHA 10, OSHA 30, GWO certifications, PMP certification, Certified Welder American Welder Society, and Professional Engineer license
- Identified the most frequently mentioned skill requirements across in-demand occupations are Microsoft Office, forklift operation, power tools, Autodesk AutoCAD, and blueprint reading

A.16 'A Supply Chain Road Map for Offshore Wind Energy in the United States'

"A Supply Chain Road Map for Offshore Wind Energy in the United States" (NREL 2023) builds on "The Demand for a Domestic Offshore Wind Energy Supply Chain" (NREL 2022a) by discussing key considerations for planning and investing in offshore wind industry supply chain resources, describing a hypothetical "complete" 2030 domestic supply chain scenario and a potential pathway to get there, analyzing the potential impacts of such a supply chain, and discussing potential solutions to overcome barriers to supply chain investment.

A.16.1 Methodology

The road map's findings were informed by a literature review and interviews with "dozens" of offshore wind industry professionals as well as several analyses, including:

- Conducted a Python-based simulation based on NREL's ORBIT model to identify the actual installation windows and accrued delays for each project in the East Coast deployment pipeline
- Performed a state-by-state assessment of market opportunity based on an average of three metrics:

    - Existing industry capabilities
    - Proximity to scenario facilities
    - State adjacent industry manufacturing scale (AIMS) levels, the latter of which reflects the interest and capabilities of individual companies in the Oceantic Network's Supply Chain Connect database

A.16.2 Findings

The road map presented the following key findings and recommendations:

- Identified a "complete" 2030 domestic supply chain scenario with the following parameters:
    - Fixed-bottom wind marshaling ports: 8
    - Floating wind integration ports: 2
    - Dedicated wind turbine installation vessels: 4–6
    - Dedicated heavy-lift vessels: 4–6
    - U.S.-flagged specialized feeder barges: 4–8
    - Manufacturing facilities: 34
    - Development time frame: 6–9 years
    - Total investment: $22.4 billion
- Found that this chain scenario would create approximately 10,000 FTE jobs in major manufacturing facilities by 2030, with an additional approximately 50,000 FTE jobs in supplier facilities producing subassemblies, subcomponents, and raw materials

Workforce development findings include:

- Established that a standard curriculum for offshore wind energy workers, acceptable to all major offshore wind manufacturers, is needed, and recommended committing funds sufficient to open training centers and train an initial cohort
- Emphasized the importance of training a sufficiently specialized workforce to support manufacturing of offshore wind components in the U.S., noting that component manufacturing facilities and their suppliers have the potential to be the largest contributors of employment in the offshore wind industry
    - Addressed worker availability challenges due to training time, existing workforce shortages in some trades, worker preferences, and uncertainty about necessary skills for next-generation components

- Recommended developing and expanding training programs at community colleges, labor unions, and universities, prioritizing institutions that serve higher proportions of low-income students and women, black, indigenous, and people of color (BIPOC) students, as the manufacturing industry ramps up

- Recommended increasing incentives to incorporate equity and sustainability into supply chain decision-making and applying best practices to incorporate community feedback to ensure justice for host communities
- Identified that the supporting supply chain presents a greater market opportunity than major manufacturing facilities
- Recommended increasing education and outreach to communicate the role that existing businesses can play in the industry, helping justify the time and financial commitment required to enter the offshore wind supply chain, given that manufacturers and project developers have extensive supplier vetting processes that are time-consuming and potentially confusing for small businesses to navigate
- Developed a series of metrics to estimate the state-by-state market opportunity for supplier jobs associated with the domestic supply chain, accounting for states' existing manufacturing capabilities, proximity to the prescribed major manufacturing facilities, and ongoing offshore wind energy planning activities
- Recommended expanding pre-apprenticeship programs to attract and train underserved populations, and using joint labor-management programs, noting the relative scarcity of apprenticeship programs in manufacturing compared to construction
  - Noted that developing quality labor union training programs for manufacturing may require additional effort because most apprenticeship programs in that sector are employer-sponsored
- Recommended developing community college programs to support facility-level management, quality and safety, and factory-level workers in parallel with planned manufacturing facilities, such as those at Hudson Valley Community College in coordination with manufacturing facilities at the Ports of Albany and Coeymans.
- Suggested implementing employer-led train-the-trainer programs for vocational school instructors to build strong workforce development programs
- Encourages incorporating offshore wind-specific coursework into university programs focused on professional-level workers, while recognizing that developing programs for a skilled trade workforce is more critical given the transferable skills of existing professional degrees

- Recommended considering the expansion of programs like Helmets to Hardhats, which leverages veterans' technical skills developed in military service for offshore wind component manufacturing, through partnerships between labor unions and construction industry contractor associations
- Stressed aligning facility operational dates with training program development to ensure facilities can meet production requirements with a domestic workforce, and increasing transparency and visibility into plans for manufacturing facilities so that labor unions and community colleges can expand recruitment and training strategically
- Supported increasing on-the-job training to accelerate training timelines if needed
- Encouraged engaging students in renewable energy from an early age and including offshore wind, particularly in coastal communities, in workforce development efforts
- Recommended establishing ambassadorship programs to minority-owned businesses to ensure awareness of upcoming opportunities and access to the offshore wind supply chain as it expands
- Recommended auditing diversity within union ranks to ensure diversity goals are being met
- Suggested using qualitative data to understand how to involve and consider Indigenous communities in developing the offshore wind supply chain because many projects and facilities are proximate to coastal Indigenous communities

A.17 '2021 Jobs Study: March 2023 Vintage Update'

The "2021 Jobs Study: March 2023 Vintage Update" was conducted with support from the New York State Energy Research and Development Authority (NYSERDA), New York State Department of Labor (NYSDOL), Department of State (NYSDOS), Department of Environmental Conservation (NYSDEC), and BW Research (Just Transition Working Group 2023). The study assessed the labor market, specifically employment numbers and training needs, resulting from the transition to low- or no-carbon emissions in New York State.

A.17.1 Methodology

The methodology for this report included the following key steps:

- Reran the 2021 employment forecast model using updated 2022 input data, with baseline data from the "2019 New York Clean Energy Industry Report" (NYSERDA 2023a) and new data CAC's "Integration Analysis: Technical Supplement to the Draft Scoping Plan" (2022b)

- Used two submodels: IMPLAN, analyzing overall employment impacts for New York State, and NREL's JEDI model, estimating the local economic impacts of power generation construction and operation
- Considered two scenarios from the CAC's "Integration Analysis," Scenario 2, strategic use of low-carbon fuels (S2: LCF), and Scenario 3, accelerated transition away from combustion (S3: AT) (2022a)
- Analyzed four primary sectors: electricity, fuel, buildings, and transportation
    - For each sector, provided Initial Employment Outputs (IEO) projecting job changes to 2050, and Secondary Employment Output (SEO) estimating changes by industry, occupation, wage, and geographic distribution

A.17.2 Findings

Key findings from the study included:

- Projected that between 2019 and 2030, under both scenarios, at least 189,000 new jobs would be added across all sectors (more than a 38% increase), while displaced jobs totaled only 14% (approximately 22,000 jobs), with new jobs outpacing losses by 20 to 1
- Found the buildings sector accounted for more than half of the new jobs, particularly in heating, ventilation, and air conditioning (HVAC) and building shell installations; over 40% of displaced jobs came from fueling stations
- Projected that between 2019 and 2050, at least 257,000 new jobs would be added across all sectors (a 52% increase)
- Found the largest net employment growth in construction and manufacturing; projected every region in New York State to gain at least 10,000 jobs by 2030
- Reported that job growth would span all wages: low wage (<$28/hr.), middle wage ($28–$38/hr.), high wage (>$37/hr.), with increases between 28% and 37%
- Recommended workforce development strategies, including upskilling through stackable credentials, developing a fund for gas worker retention and transition, and coordinating among unions, public agencies, firms, and workers
- Identified PLAs with local communities or targeted hire provisions as the most commonly successful initiatives to support DACs in entering the clean energy workforce

A.18 ‘Clean Energy Investing in America,’ 2023 and 2024

The “Clean Energy Investing in America” report, released in August 2023 and updated in August 2024, identified clean energy-related investment announcements made following the passage of Public Law 117-169, the Inflation Reduction Act of 2022 (IRA) in August 2022 (ACP 2023, 2024).

A.18.1 Methodology

The reports’ methodology included:

- Collected information from ACP members and publicly available sources

A.18.2 Findings

Key findings from the reports included:

- Identified six announced offshore wind turbine component manufacturing facilities in 2023, representing an estimated 2,060 direct jobs across Maryland, New York, and Rhode Island, and one facility under construction in Kentucky.
- Identified 11 announced facilities in 2024 across California, Maine, Massachusetts, New York, Texas, and Virginia, and two facilities under construction, one in Maryland and the other in New York.

A.19 ‘New York State’s 10-Point Action Plan to Expand a Large-Scale Renewable Industry’

The suggestions outlined in “New York State’s 10-Point Action Plan to Expand a Large-Scale Renewable Industry” report are based on the State’s goal of 70% renewable electricity by 2030 and provided high-level overviews of 10 action items that the State could undertake to further develop its renewable energy industry, including offshore wind (NYSERDA 2023c).

A.19.1 Methodology

The report’s methodology:

- Provided qualitative, experienced-based recommendations rather than model-, scenario-, or other data-based approaches.
- Described workforce development actions taken by NYSERDA and the State to date
- Outlined plans for workforce development and future funding

A.19.2 Findings

Key findings from the report included:

- Committed over $170 million for workforce development and coordinated the allocation of over $100 million in renewables workforce training with private industry, academic institutions, and training centers
- Planned, beginning in 2024, to commit $25 million annually to NYSDOL for renewable energy training

A.20 ‘Clean Energy Industry Report’

The latest “Clean Energy Industry Report” (NYSERDA 2024) in a series of yearly reports (since 2017) analyzed data on clean energy jobs, employer needs, and existing assets in New York State’s clean energy sector. The report provided data and results through December 2023.

A.20.1 Methodology

The report’s methodology included:

- Used data from the USEER, employer surveys, worker surveys, and economic impact analysis.
- Surveyed approximately 1,670 businesses for the USEER, with 258 employers and 226 workers responding to targeted surveys
- Conducted economic impact analysis using the IMPLAN model to estimate the contribution of clean energy companies to the Gross State Product
- Implemented a process to avoid double counting data by running the IMPLAN model for each subindustry, comparing results to combined sector results, and excluding overlapping jobs as needed

A.20.2 Findings

Key findings from the report included:

- Found the entire clean energy workforce grew by 5% (7,700 new jobs) in 2023, the greatest increase since tracking began in 2016
- Reported the building decarbonization and energy efficiency sector added nearly 4,000 jobs, and clean/alternative transportation grew at the fastest rate of any technology (16%, 2,100 new jobs)
- Noted electric vehicle (EV) charging jobs grew significantly (27%) and included a deep dive on EV charging employment

Specific workforce development findings included:

- Found union membership for clean energy workers in New York State was higher (12%) than the national average (9%), indicating that more high-quality, family-sustaining jobs may exist within clean energy
- Reported median wages and healthcare benefits for clean energy workers were higher than their peers in other industries, with entry-level employees earning a 12% average wage premium and 77% of occupations offering wage premiums
- Identified more than 1,900 training and education programs for clean energy jobs, with the most common areas in electrical, construction, engineering, and O&M
- Found clean energy workers were more satisfied with their careers and more confident about receiving a promotion in the next 12 months compared to non–clean energy workers
- Reported clean energy employment growth in New York State was more than double the statewide employment growth rate, with nearly 7,700 new clean energy jobs created in 2023, 3,200 indirect jobs in the supply chain, and 3,700 induced jobs in other industries, adding over $2 billion to Gross State Product
- Found that almost all clean energy employers reported some difficulty in hiring, but severity decreased since 2022, the first decrease since 2019
- Reported clean energy employment increased in 40 out of 52 counties with DACs, with nearly 55,000 clean energy jobs in DACs, accounting for 31% of the clean energy jobs, nearly reaching parity with the 35% of the population in DACs
- Noted that 33% of workers from non-priority populations used word of mouth to find opportunities, compared to 20% from priority populations, indicating less access to social networks for priority populations
- Identified the most significant challenges to career advancement for priority populations as gaining relevant work experience, finding time to focus on career goals, and having the right academic qualifications; also reported that workers from priority populations had less access to relevant training opportunities and faced greater distance to training providers
- Reported increased interest in the clean energy industry, with 30% of survey respondents having considered the clean energy industry compared to 24% in 2022

Appendix B Project Labor Agreements

B.1 Empire Wind 1

The Project Labor Agreement (PLA) for South Brooklyn Marine Terminal (SBMT) Project was between Empire Offshore Wind LLC and SBMT Asset, LLC (developers), in partnership with GE Grid Solutions, Bond Civil & Utility Construction, Skanska SBMT Builders, and Nexans Norway (prime contractors), together with the Building and Construction Trades Council of Greater New York and its member unions. The agreement covers onshore construction, electric substations, power export, interconnection cables, and associated raceways.

A second PLA was established for the Offshore Wind Turbine Generator (OWTG) preinstallation work. This PLA was between Empire Offshore Wind LLC (developer), Vestas-American Wind Technology, Inc. (prime contractor), and the Building and Construction Trades Council of Greater New York and its member unions. The scope covers onshore preinstallation of OWTGs and associated components.

B.2 Sunrise Wind

A PLA was established for OWTG preinstallation work between Sunrise Wind (developer), Vestas-American Wind Technology, Inc. (prime contractor), and the Building and Construction Trades Council of Greater New York and its member unions. The PLA covers onshore preinstallation of offshore wind turbine generators and associated components and is similar in structure and scope to Empire Wind 1's OWTG PLA.

Another PLA was established between Consigli Construction Co., Inc., and the Building and Construction Trades Council of Nassau and Suffolk Counties. The PLA covers construction of the O&M building at 22 Research Way, East Setauket, NY.

A third PLA between Haugland Energy Group LLC and the Building and Construction Trades Council of Nassau and Suffolk Counties. It covers construction of the onshore cable route and converter station.

Appendix C Economic Impact Methodology

Conventional modeling of economic impacts for most industrial sectors relies on government statistics (e.g., those based on North American Industry Classification System, or NAICS, codes) and uses input-output tables and other production and employment ratios (e.g., those produced by the Bureau of Labor Statistics).

NAICS code data can be appropriate for traditional industries at the national level, but developing new codes for a maturing sector takes time. As a result, conventional NAICS analyses of offshore wind must map existing NAICS data to offshore wind activities, a process that is challenging and error-prone. Analyses using NAICS codes also rely on generalized data.

Offshore wind is better suited to a more robust approach that considers the current and future capability of local supply chains. This is because:

- Projects tend to be large and have distinct procurement processes from one another
- Projects tend to use comparable technologies and share supply chains

This approach enables a realistic analysis of the local, regional, and national content of projects, even where data gaps exist.

The methodology used here was developed by BVGA and has been applied for a series of major clients. The first input is the cost of the supply chain categories at the time of wind farm completion.

The remaining expenditure is analogous to the direct and indirect Gross Value Added (GVA) created. (Investopedia N.d.) GVA is the aggregate of labor costs and operational profits. Modeling FTE employment from GVA requires understanding of some key variables. In this economic impact methodology, employment impacts are calculated using the following equation:

Equation C.1

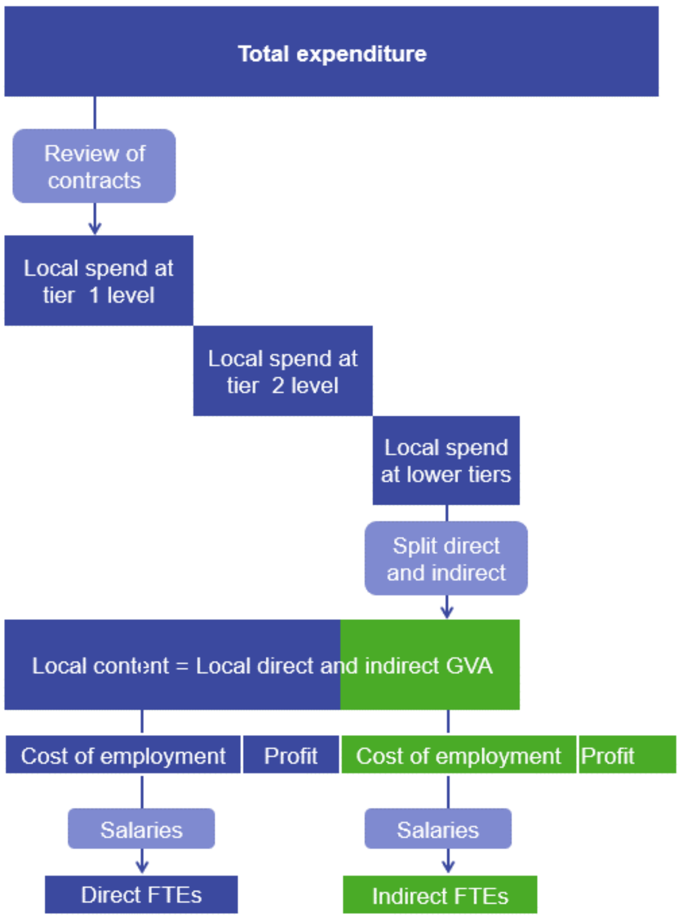
$$FTE_a = \frac{(GVA - M)}{Y_a + W_a}$$

Where:

- FTEa = Annual FTE employment
- GVA = Gross Value Added ($)
- M = Total operating margin ($)
- Ya = Average annual wage ($)
- Wa = non-wage average annual cost of employment ($)

To make robust assessments, each major component of the offshore wind supply chain is considered, and typical salary levels, employment costs, and profit margins are estimated. This approach combines BVGA's specific sector knowledge and research into typical labor costs for the work undertaken in each supply chain Tier 2 category.

Figure C-1. Flow of Expenditures in Each Supply Chain Tier 2 Category



Appendix D Expected Job Creation: 5 GW Offshore Wind

Table D-1. Direct and Indirect Full-Time Equivalents in New York State Created by 5 GW of Offshore Wind

Figures are rounded, and some columns and rows may not total exactly.

Employment Type	Full-Time-Equivalent Years			
	New York City and Long Island	Mid-Hudson and Capital regions	Other NYS Regions	Total
Direct	16,290	1,060	1,150	18,500
Indirect	7,230	790	560	8,580
Total	**23,520**	**1,850**	**1,710**	**27,080**

Table D-2. Direct and Indirect Full-Time Equivalents in New York City and Long Island Created by 5 GW of Offshore Wind

Figures are rounded, and some columns and rows may not total exactly.

Project Activity	Full-Time-Equivalent Years		
	Direct	Indirect	Total
Development and project management	820	690	1,510
Manufacturing and assembly	—	—	—
Installation and commissioning	3,180	2,800	5,980
O&M	10,890	3,510	14,400
Decommissioning	1,390	240	1,630
Total	**16,280**	**7,240**	**23,520**

Table D-3. Direct and indirect Full-Time Equivalents in Mid-Hudson and Capital Regions Created by 5 GW of Offshore Wind

Figures are rounded, and some columns and rows may not total exactly.

Project Activity	Full-Time-Equivalent Years		
	Direct	Indirect	Total
Development and project management	100	80	180
Manufacturing and assembly	120	50	170
Installation and commissioning	850	660	1,510
O&M	—	—	—
Decommissioning	—	—	—
Total	**1,070**	**790**	**1,860**

Table 11. Direct and Indirect Full-Time Equivalents in other New York State Regions Created by 5 GW of offshore Wind

Figures are rounded, and some columns and rows may not total exactly.

Project Activity	Full-Time-Equivalent Years		
	Direct	Indirect	Total
Development and project management	100	80	180
Manufacturing and assembly	860	360	1,220
Installation and commissioning	190	120	310
O&M	—	—	—
Decommissioning	—	—	—
Total	**1,150**	**560**	**1,710**

Appendix E Workforce Needs: Critical Job Demand by Region

Table E-1. New York State

No.	Job Role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
1.	Captain	1.1	0.5	3.4	2.5
2.	Design and Certification Package Manager	1.1	0.5	3.4	2.5
3.	Ecologists	1.1	6.0	40.8	30.0
4.	Electrical Engineer	1.1	1.5	10.2	7.5
5.	Electrical Network Lead	1.1	1.5	10.2	7.5
6.	Engineering and Design Manager	1.1	1.5	10.2	7.5
7.	Engineering Package Lead	1.1	1.5	10.2	7.5
8.	EPC Director	1.1	1.5	10.2	7.5
9.	Foundation Engineer	1.1	1.5	10.2	7.5
10.	Geophysicists	1.1	6.0	40.8	30.0
11.	Geotechnical Engineer	1.1	0.5	3.4	2.5
12.	Geotechnical Manager	1.1	0.5	3.4	2.5
13.	Grid Commercial Lead	1.1	1.5	10.2	7.5
14.	Grid Connections Lead	1.1	1.5	10.2	7.5
15.	Grid Technical Lead	1.1	1.5	10.2	7.5
16.	IAC Engineer	1.1	0.7	5.1	3.7
17.	Logistics Package Engineer	1.1	1.5	10.2	7.5
18.	Logistics Package Lead	1.1	1.5	10.2	7.5
19.	Marine Biologist	1.1	0.5	3.4	2.5
20.	Noise Specialist	1.1	0.5	3.4	2.5
21.	Offshore Substation Electrical Engineer	1.1	1.5	10.2	7.5
22.	Onshore Substation Electrical Engineer	1.1	1.5	10.2	7.5
23.	Ornithologist	1.1	0.5	3.4	2.5
24.	Senior Geotechnical Engineer	1.1	1.0	6.8	5.0
25.	Specialist Wind Analyst	1.1	4.5	30.6	22.5
26.	Certification Manager	1.2	1.1	7.5	5.5

Table E-1. (continued)

No.	Job Role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
27.	Commercial and Procurement Director	1.2	1.1	7.5	5.5
28.	Commercial/LCOE Business Case Manager	1.2	0.8	5.6	4.1
29.	Construction Commissioning Manager	1.2	0.8	5.6	4.1
30.	Construction Manager	1.2	0.8	5.6	4.1
31.	DCO Consultation Manager	1.2	0.8	5.6	4.1
32.	Decommissioning Package Manager	1.2	0.8	5.6	4.1
33.	Development and Consents Director	1.2	1.1	7.5	5.5
34.	EPCI Director	1.2	0.8	5.6	4.1
35.	Fabrication Manager	1.2	0.8	5.6	4.1
36.	Finance Director	1.2	1.1	7.5	5.5
37.	Foundation Package Manager	1.2	0.8	5.6	4.1
38.	Grid and Power Offtake Manager	1.2	1.1	7.5	5.5
39.	Grid Commercial Lead	1.2	1.1	7.5	5.5
40.	Grid Connections Lead	1.2	1.1	7.5	5.5
41.	Grid OFTO Lead	1.2	1.1	7.5	5.5
42.	Grid Policy and Regulation Lead	1.2	1.1	7.5	5.5
43.	Grid Technical Lead	1.2	1.1	7.5	5.5
44.	HSE Director	1.2	1.9	13.1	9.6
45.	HSE Manager	1.2	0.8	5.6	4.1
46.	IAC Package Manager	1.2	0.8	5.6	4.1
47.	Lead advocate (Examination Hearings)	1.2	0.8	5.6	4.1
48.	Legal Counsel	1.2	1.1	7.5	5.5
49.	Legal Counsel Internal	1.2	1.1	7.5	5.5
50.	O&M Director	1.2	0.8	5.6	4.1
51.	O&M Engineer	1.2	0.8	5.6	4.1
52.	O&M Package Manager	1.2	0.8	5.6	4.1
53.	Offshore Substation Package Manager	1.2	0.8	5.6	4.1

Table E-1. (continued)

No.	Job Role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
54.	Onshore Substation Package Manager	1.2	0.8	5.6	4.1
55.	Project CEO	1.2	1.1	7.5	5.5
56.	Project CFO	1.2	0.8	5.6	4.1
57.	Project Director	1.2	1.1	7.5	5.5
58.	Risk Lead	1.2	0.8	5.6	4.1
59.	Risk Manager	1.2	0.8	5.6	4.1
60.	SCADA Engineer	1.2	0.8	5.6	4.1
61.	SCADA Package Commercial Contracts Manager	1.2	1.1	7.5	5.5
62.	SCADA Package Manager	1.2	1.1	7.5	5.5
63.	Senior Risk Manager	1.2	0.8	5.6	4.1
64.	Technical Director	1.2	1.1	7.5	5.5
65.	WTG Engineer	1.2	0.8	5.6	4.1
66.	WTG Package Manager	1.2	0.8	5.6	4.1
67.	Civil Engineer	2.3	1.4	9.8	7.2
68.	Commercial Manager	2.3	0.2	1.0	0.7
69.	Construction Manager	2.3	0.2	1.4	1.0
70.	Fabrication Manager	2.3	0.2	1.6	1.2
71.	Machine Operatives	2.3	1.4	9.2	6.7
72.	WTG Engineer	2.3	0.2	1.6	1.2
73.	WTG Package Manager	2.3	0.2	1.6	1.2
74.	WTG Package Technical Manager	2.3	0.2	1.6	1.2
75.	Civil Design Manager	2.6	0.2	1.4	1.0
76.	Civil Engineering Manager	2.6	0.2	1.4	1.0
77.	Commercial Manager	2.6	0.1	0.8	0.6
78.	Fabrication Manager	2.6	0.2	1.4	1.0
79.	Foundation Package Manager	2.6	0.2	1.4	1.0
80.	Foundation Package Technical Manager	2.6	0.2	1.4	1.0
81.	Geotechnical Engineer	2.6	0.2	1.4	1.0
82.	Onshore Installation Manager	2.6	0.4	2.4	1.7
83.	Structural Engineer	2.6	0.8	5.1	3.7
84.	Commercial Manager	2.8	0.4	2.5	1.9
85.	Construction Manager	2.8	0.5	3.6	2.6

Table E-1. (continued)

No.	Job Role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
86.	Electrical Engineer	2.8	0.4	2.5	1.9
87.	Electrical Technician	2.8	4.5	30.6	22.5
88.	Fabrication Manager	2.8	0.6	4.1	3.0
89.	Onshore Installation Manager	2.8	1.1	7.1	5.2
90.	Onshore Works Package Commercial Contracts Manager	2.8	0.6	4.1	3.0
91.	Onshore Works Package Manager	2.8	0.6	4.1	3.0
92.	Structural Engineer	2.8	2.3	15.3	11.2
93.	Captain	3.1	1.5	10.2	7.5
94.	Commercial Manager	3.1	0.4	2.5	1.9
95.	Commissioning Engineer	3.1	0.9	6.1	4.5
96.	Commissioning Manager	3.1	0.9	6.1	4.5
97.	Design Manager	3.1	0.9	6.1	4.5
98.	Electrical Engineer	3.1	0.4	2.5	1.9
99.	Electrical Technician	3.1	4.5	30.6	22.5
100.	Offshore Installation Manager	3.1	0.8	5.1	3.7
101.	OSS Package Manager	3.1	0.9	6.1	4.5
102.	Captain	3.2	2.5	17.0	12.5
103.	Commercial Manager	3.2	0.6	4.2	3.1
104.	Electrical Engineer	3.2	0.6	4.2	3.1
105.	Electrical Technician	3.2	7.5	51.0	37.5
106.	HSE Manager	3.2	1.3	8.5	6.2
107.	IAC Package Manager	3.2	1.5	10.2	7.5
108.	IAC T&I Manager	3.2	1.5	10.2	7.5
109.	Offshore Installation Manager	3.2	0.9	5.9	4.4
110.	Commercial Manager	3.3	1.3	8.5	6.2
111.	Construction Manager	3.3	1.8	11.9	8.7
112.	Electrical Engineer	3.3	1.3	8.5	6.2
113.	Electrical Technician	3.3	15.0	102.0	75.0
114.	Grid Connection Package Manager	3.3	3.0	20.4	15.0
115.	Onshore Installation Manager	3.3	3.5	23.8	17.5
116.	66 kV Senior Authorised Person	3.4	6.4	43.5	32.0
117.	Captain	3.4	4.0	27.2	20.0

Table E-1. (continued)

No.	Job Role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
118.	Commercial Manager	3.4	1.0	6.8	5.0
119.	Design Manager	3.4	2.4	16.3	12.0
120.	Electrical Engineer	3.4	1.0	6.8	5.0
121.	Electrical Technician	3.4	12.0	81.6	60.0
122.	HSE Manager	3.4	2.0	13.6	10.0
123.	Offshore Installation Manager	3.4	2.0	13.6	10.0
124.	WTG Package Manager	3.4	2.4	16.3	12.0
125.	WTG T&I Manager	3.4	2.4	16.3	12.0
126.	Captain	3.5	3.5	23.8	17.5
127.	Commercial Manager	3.5	0.9	5.9	4.4
128.	Design Manager	3.5	2.1	14.3	10.5
129.	Foundation Package Manager	3.5	2.1	14.3	10.5
130.	HSE Manager	3.5	1.8	11.9	8.7
131.	Offshore Installation Manager	3.5	1.8	11.9	8.7
132.	Commercial Manager	3.6	1.8	12.2	9.0
133.	Commissioning engineer	3.6	1.8	12.2	9.0
134.	Construction Manager	3.6	1.8	12.2	9.0
135.	Termination And Testing Technicians	3.6	18.0	122.4	90.0
136.	Asset Manager	4.1	25.4	172.8	127.0
137.	Chief engineer	4.1	25.4	172.8	127.0
138.	Control Room Manager	4.1	72.3	491.2	361.1
139.	Deputy Supervisor	4.1	51.8	352.4	259.1
140.	Head of Legal	4.1	10.2	69.4	51.0
141.	Head of Operational Support	4.1	25.4	172.8	127.0
142.	Integration Manager	4.1	25.4	172.8	127.0
143.	Production Manager	4.1	25.4	172.8	127.0
144.	Project Controls Head	4.1	25.4	172.8	127.0
145.	SCADA engineer	4.1	72.2	491.2	361.1
146.	Service Manager	4.1	25.4	172.8	127.0
147.	Balance of plant technician	4.2 and 4.3	25.4	172.8	127.0
148.	Blade repair technician	4.2 and 4.3	25.4	172.8	127.0

Table E-1. (continued)

No.	Job Role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
149.	CTV Captain	4.2 and 4.3	149.5	1016.3	747.2
150.	HV technicians	4.2 and 4.3	98.7	670.7	493.1
151.	Rope access and blade repair technician	4.2 and 4.3	51.8	352.4	259.1
152.	ROV technician	4.2 and 4.3	51.8	352.4	259.1
153.	Wind turbine technician	4.2 and 4.3	25.4	172.8	127.0
Total demand			**1,035.1**	**7,036.6**	**5,173.4**

Table E-2. New York City and Long Island

No.	Job role	Supply Chain Category	Demand for 1 GW (FTE-Years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-Years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-Years)
1.	Captain	1.1	0.4	2.7	2.0
2.	Design and Certification Package Manager	1.1	0.4	2.7	2.0
3.	Ecologists	1.1	4.8	32.6	24.0
4.	Electrical Engineer	1.1	1.2	8.2	6.0
5.	Electrical Network Lead	1.1	1.2	8.2	6.0
6.	Engineering and Design Manager	1.1	1.2	8.2	6.0
7.	Engineering Package Lead	1.1	1.2	8.2	6.0
8.	EPC Director	1.1	1.2	8.2	6.0
9.	Foundation Engineer	1.1	1.2	8.2	6.0
10.	Geophysicists	1.1	4.8	32.6	24.0
11.	Geotechnical Engineer	1.1	0.4	2.7	2.0
12.	Geotechnical Manager	1.1	0.4	2.7	2.0
13.	Grid Commercial Lead	1.1	1.2	8.2	6.0
14.	Grid Connections Lead	1.1	1.2	8.2	6.0
15.	Grid Technical Lead	1.1	1.2	8.2	6.0
16.	IAC Engineer	1.1	0.6	4.1	3.0

Table E-2. (continued)

	Job role	Supply chain category	Demand for 1 GW (FTE years)	Pipeline demand 2.2 GW Nuclear Variant (FTE years)	Pipeline demand 3.3 GW Nuclear Variant (FTE years)
17.	Logistics Package Engineer	1.1	1.2	8.2	6.0
18.	Logistics Package Lead	1.1	1.2	8.2	6.0
19.	Marine Biologist	1.1	0.4	2.7	2.0
20.	Noise Specialist	1.1	0.4	2.7	2.0
21.	Offshore Substation Electrical Engineer	1.1	1.2	8.2	6.0
22.	Onshore Substation Electrical Engineer	1.1	1.2	8.2	6.0
23.	Ornithologist	1.1	0.4	2.7	2.0
24.	Senior Geotechnical Engineer	1.1	0.8	5.4	4.0
25.	Specialist Wind Analyst	1.1	3.6	24.5	18.0
26.	Certification Manager	1.2	0.9	6.1	4.5
27.	Commercial and Procurement Director	1.2	0.9	6.1	4.5
28.	Commercial/LCOE Business Case Manager	1.2	0.7	4.6	3.4
29.	Construction Commissioning Manager	1.2	0.7	4.6	3.4
30.	Construction Manager	1.2	0.7	4.6	3.4
31.	DCO Consultation Manager	1.2	0.7	4.6	3.4
32.	Decommissioning Package Manager	1.2	0.7	4.6	3.4
33.	Development and Consents Director	1.2	0.9	6.1	4.5
34.	EPCI Director	1.2	0.7	4.6	3.4
35.	Fabrication Manager	1.2	0.7	4.6	3.4
36.	Finance Director	1.2	0.9	6.1	4.5
37.	Foundation Package Manager	1.2	0.7	4.6	3.4
38.	Grid and Power Offtake Manager	1.2	0.9	6.1	4.5
39.	Grid Commercial Lead	1.2	0.9	6.1	4.5
40.	Grid Connections Lead	1.2	0.9	6.1	4.5
41.	Grid OFTO Lead	1.2	0.9	6.1	4.5
42.	Grid Policy and Regulation Lead	1.2	0.9	6.1	4.5
43.	Grid Technical Lead	1.2	0.9	6.1	4.5
44.	HSE Director	1.2	1.6	10.7	7.9
45.	HSE Manager	1.2	0.7	4.6	3.4
46.	IAC Package Manager	1.2	0.7	4.6	3.4
47.	Lead advocate (Examination Hearings)	1.2	0.7	4.6	3.4
48.	Legal Counsel	1.2	0.9	6.1	4.5
49.	Legal Counsel Internal	1.2	0.9	6.1	4.5

.**Table E-2. (continued)**

No.	Job role	Supply chain category	Demand for 1 GW (FTE years)	Pipeline demand 2.2 GW Nuclear Variant (FTE years)	Pipeline demand 3.3 GW Nuclear Variant (FTE years)
50.	O&M Director	1.2	0.7	4.6	3.4
51.	O&M Engineer	1.2	0.7	4.6	3.4
52.	O&M Package Manager	1.2	0.7	4.6	3.4
53.	Offshore Substation Package Manager	1.2	0.7	4.6	3.4
54.	Onshore Substation Package Manager	1.2	0.7	4.6	3.4
55.	Project CEO	1.2	0.9	6.1	4.5
56.	Project CFO	1.2	0.7	4.6	3.4
57.	Project Director	1.2	0.9	6.1	4.5
58.	Risk Lead	1.2	0.7	4.6	3.4
59.	Risk Manager	1.2	0.7	4.6	3.4
60.	SCADA Engineer	1.2	0.7	4.6	3.4
61.	SCADA Package Commercial Contracts Manager	1.2	0.9	6.1	4.5
62.	SCADA Package Manager	1.2	0.9	6.1	4.5
63.	Senior Risk Manager	1.2	0.7	4.6	3.4
64.	Technical Director	1.2	0.9	6.1	4.5
65.	WTG Engineer	1.2	0.7	4.6	3.4
66.	WTG Package Manager	1.2	0.7	4.6	3.4
67.	Captain	3.1	1.0	6.8	5.0
68.	Commercial Manager	3.1	0.3	1.7	1.2
69.	Commissioning Engineer	3.1	0.6	4.1	3.0
70.	Commissioning Manager	3.1	0.6	4.1	3.0
71.	Design Manager	3.1	0.6	4.1	3.0
72.	Electrical Engineer	3.1	0.3	1.7	1.2
73.	Electrical Technician	3.1	3.0	20.4	15.0
74.	Offshore Installation Manager	3.1	0.5	3.4	2.5
75.	OSS Package Manager	3.1	0.6	4.1	3.0
76.	Captain	3.2	2.5	17.0	12.5
77.	Commercial Manager	3.2	0.6	4.2	3.1
78.	Electrical Engineer	3.2	0.6	4.2	3.1
79.	Electrical Technician	3.2	7.5	51.0	37.5
80.	HSE Manager	3.2	1.3	8.5	6.2
81.	IAC Package Manager	3.2	1.5	10.2	7.5
82.	IAC T&I Manager	3.2	1.5	10.2	7.5
83.	Offshore Installation Manager	3.2	0.9	5.9	4.4

Table E-2. (continued)

No.	Job role	Supply chain category	Demand for 1 GW (FTE years)	Pipeline demand 2.2 GW Nuclear Variant (FTE years)	Pipeline demand 3.3 GW Nuclear Variant (FTE years)
84.	Commercial Manager	3.3	0.6	4.2	3.1
85.	Construction Manager	3.3	0.9	5.9	4.4
86.	Electrical Engineer	3.3	0.6	4.2	3.1
87.	Electrical Technician	3.3	7.5	51.0	37.5
88.	Grid Connection Package Manager	3.3	1.5	10.2	7.5
89.	Onshore Installation Manager	3.3	1.8	11.9	8.7
90.	66 kV Senior Authorised Person	3.4	6.4	43.5	32.0
91.	Captain	3.4	4.0	27.2	20.0
92.	Commercial Manager	3.4	1.0	6.8	5.0
93.	Design Manager	3.4	2.4	16.3	12.0
94.	Electrical Engineer	3.4	1.0	6.8	5.0
95.	Electrical Technician	3.4	12.0	81.6	60.0
96.	HSE Manager	3.4	2.0	13.6	10.0
97.	Offshore Installation Manager	3.4	2.0	13.6	10.0
98.	WTG Package Manager	3.4	2.4	16.3	12.0
99.	WTG T&I Manager	3.4	2.4	16.3	12.0
100.	Captain	3.5	3.5	23.8	17.5
101.	Commercial Manager	3.5	0.9	5.9	4.4
102.	Design Manager	3.5	2.1	14.3	10.5
103.	Foundation Package Manager	3.5	2.1	14.3	10.5
104.	HSE Manager	3.5	1.8	11.9	8.7
105.	Offshore Installation Manager	3.5	1.8	11.9	8.7
106.	Commercial Manager	3.6	1.2	8.2	6.0
107.	Commissioning engineer	3.6	1.2	8.2	6.0
108.	Construction Manager	3.6	1.2	8.2	6.0
109.	Termination And Testing Technicians	3.6	12.0	81.6	60.0
110.	Asset Manager	4.1	25.4	172.8	127.0
111.	Chief engineer	4.1	25.4	172.8	127.0
112.	Control Room Manager	4.1	72.3	491.2	361.1
113.	Deputy Supervisor	4.1	51.8	352.4	259.1
114.	Head of Legal	4.1	10.2	69.4	51.0
115.	Head of Operational Support	4.1	25.4	172.8	127.0
116.	Integration Manager	4.1	25.4	172.8	127.0
117.	Production Manager	4.1	25.4	172.8	127.0

Table E-2. (continued)

No.	Job role	Supply chain category	Demand for 1 GW (FTE years)	Pipeline demand 2.2 GW Nuclear Variant (FTE years)	Pipeline demand 3.3 GW Nuclear Variant (FTE years)
118.	Project Controls Head	4.1	25.4	172.8	127.0
119.	SCADA engineer	4.1	72.3	491.2	361.1
120.	Service Manager	4.1	25.4	172.8	127.0
121.	Balance of plant technician	4.2 and 4.3	25.4	172.8	127.0
122.	Blade repair technician	4.2 and 4.3	25.4	172.8	127.0
121.	CTV Captain	4.2 and 4.3	149.5	1016.3	747.2
122.	HV technician	4.2 and 4.3	98.7	670.7	493.1
123.	Rope access and blade repair technician	4.2 and 4.3	51.8	352.4	259.1
124.	ROV technician	4.2 and 4.3	51.8	352.4	259.1
125.	Wind turbine technician	4.2 and 4.3	25.4	172.8	127.0
Total demand			**977.9**	**6,647.5**	**4,887.4**

Table E-3. Mid-Hudson and Capital Regions

No.	Job role	Supply chain category	Demand for 1GW (FTE years)	Pipeline demand 2.2 GW Nuclear Variant (FTE years)	Pipeline demand 3.3 GW Nuclear Variant (FTE years)
1.	Captain	1.1	0.1	0.3	0.2
2.	Design and Certification Package Manager	1.1	0.1	0.3	0.2
3.	Ecologists	1.1	0.6	4.1	3.0
4.	Electrical Engineer	1.1	0.2	1.0	0.7
5.	Electrical Network Lead	1.1	0.2	1.0	0.7
6.	Engineering and Design Manager	1.1	0.2	1.0	0.7
7.	Engineering Package Lead	1.1	0.2	1.0	0.7
8.	EPC Director	1.1	0.2	1.0	0.7
9.	Foundation Engineer	1.1	0.2	1.0	0.7
10.	Geophysicists	1.1	0.6	4.1	3.0
11.	Geotechnical Engineer	1.1	0.1	0.3	0.2
12.	Geotechnical Manager	1.1	0.1	0.3	0.2
13.	Grid Commercial Lead	1.1	0.2	1.0	0.7
14.	Grid Connections Lead	1.1	0.2	1.0	0.7

Table E-3. (continued)

No.	Job role	Supply Chain Category	Demand for 1GW (FTE-years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-years)
15.	Grid Technical Lead	1.1	0.2	1.0	0.7
16.	IAC Engineer	1.1	0.1	0.5	0.4
17.	Logistics Package Engineer	1.1	0.2	1.0	0.7
18.	Logistics Package Lead	1.1	0.2	1.0	0.7
19.	Marine Biologist	1.1	0.1	0.3	0.2
20.	Noise Specialist	1.1	0.1	0.3	0.2
21.	Offshore Substation Electrical Engineer	1.1	0.2	1.0	0.7
22.	Onshore Substation Electrical Engineer	1.1	0.2	1.0	0.7
23.	Ornithologist	1.1	0.1	0.3	0.2
24.	Senior Geotechnical Engineer	1.1	0.1	0.7	0.5
25.	Specialist Wind Analyst	1.1	0.5	3.1	2.2
26.	Certification Manager	1.2	0.1	0.7	0.5
27.	Commercial and Procurement Director	1.2	0.1	0.7	0.5
28.	Commercial/LCOE Business Case Manager	1.2	0.1	0.5	0.4
29.	Construction Commissioning Manager	1.2	0.1	0.5	0.4
30.	Construction Manager	1.2	0.1	0.5	0.4
31.	DCO Consultation Manager	1.2	0.1	0.5	0.4
32.	Decommissioning Package Manager	1.2	0.1	0.5	0.4
33.	Development and Consents Director	1.2	0.1	0.7	0.5
34.	EPCI Director	1.2	0.1	0.5	0.4
35.	Fabrication Manager	1.2	0.1	0.5	0.4
36.	Finance Director	1.2	0.1	0.7	0.5
37.	Foundation Package Manager	1.2	0.1	0.5	0.4
38.	Grid and Power Offtake Manager	1.2	0.1	0.7	0.5
39.	Grid Commercial Lead	1.2	0.1	0.7	0.5
40.	Grid Connections Lead	1.2	0.1	0.7	0.5
41.	Grid OFTO Lead	1.2	0.1	0.7	0.5
42.	Grid Policy and Regulation Lead	1.2	0.1	0.7	0.5
43.	Grid Technical Lead	1.2	0.1	0.7	0.5
44.	HSE Director	1.2	0.2	1.2	0.9
45.	HSE Manager	1.2	0.1	0.5	0.4

Table E-3. (continued)

No.	Job role	Supply Chain Category	Demand for 1GW (FTE-years)	Pipeline demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline demand 3.3 GW Nuclear Variant (FTE-years)
46.	IAC Package Manager	1.2	0.1	0.5	0.4
47.	Lead advocate (Examination Hearings)	1.2	0.1	0.5	0.4
48.	Legal Counsel	1.2	0.1	0.7	0.5
49.	Legal Counsel Internal	1.2	0.1	0.7	0.5
50.	O&M Director	1.2	0.1	0.5	0.4
51.	O&M Engineer	1.2	0.1	0.5	0.4
52.	O&M Package Manager	1.2	0.1	0.5	0.4
53.	Offshore Substation Package Manager	1.2	0.1	0.5	0.4
54.	Onshore Substation Package Manager	1.2	0.1	0.5	0.4
55.	Project CEO	1.2	0.1	0.7	0.5
56.	Project CFO	1.2	0.1	0.5	0.4
57.	Project Director	1.2	0.1	0.7	0.5
58.	Risk Lead	1.2	0.1	0.5	0.4
59.	Risk Manager	1.2	0.1	0.5	0.4
60.	SCADA Engineer	1.2	0.1	0.5	0.4
61.	SCADA Package Commercial Contracts Manager	1.2	0.1	0.7	0.5
62.	SCADA Package Manager	1.2	0.1	0.7	0.5
63.	Senior Risk Manager	1.2	0.1	0.5	0.4
64.	Technical Director	1.2	0.1	0.7	0.5
65.	WTG Engineer	1.2	0.1	0.5	0.4
66.	WTG Package Manager	1.2	0.1	0.5	0.4
67.	Commercial Manager	2.8	0.1	0.8	0.6
68.	Construction Manager	2.8	0.2	1.2	0.9
69.	Electrical Engineer	2.8	0.1	0.8	0.6
70.	Electrical Technician	2.8	1.5	10.2	7.5
71.	Fabrication Manager	2.8	0.2	1.4	1.0
72.	Onshore Installation Manager	2.8	0.4	2.4	1.7
73.	Onshore Works Package Commercial Contracts Manager	2.8	0.2	1.4	1.0
74.	Onshore Works Package Manager	2.8	0.2	1.4	1.0
75.	Structural Engineer	2.8	0.8	5.1	3.7
76.	Captain	3.1	0.5	3.4	2.5
77.	Commercial Manager	3.1	0.1	0.8	0.6
78.	Commissioning Engineer	3.1	0.3	2.0	1.5

Table E-3. (continued)

No.	Job role	Supply Chain Category	Demand for 1GW (FTE-years)	Pipeline demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline demand 3.3 GW Nuclear Variant (FTE-years)
79.	Commissioning Manager	3.1	0.3	2.0	1.5
80.	Design Manager	3.1	0.3	2.0	1.5
81.	Electrical Engineer	3.1	0.1	0.8	0.6
82.	Electrical Technician	3.1	1.5	10.2	7.5
83.	Offshore Installation Manager	3.1	0.3	1.7	1.2
84.	OSS Package Manager	3.1	0.3	2.0	1.5
85.	Commercial Manager	3.3	0.6	4.2	3.1
86.	Construction Manager	3.3	0.9	5.9	4.4
87.	Electrical Engineer	3.3	0.6	4.2	3.1
88.	Electrical Technician	3.3	7.5	51.0	37.5
89.	Grid Connection Package Manager	3.3	1.5	10.2	7.5
90.	Onshore Installation Manager	3.3	1.8	11.9	8.7
91.	Commercial Manager	3.6	0.3	2.0	1.5
92.	Commissioning engineer	3.6	0.3	2.0	1.5
93.	Construction Manager	3.6	0.3	2.0	1.5
94.	Termination And Testing Technicians	3.6	3.0	20.4	15.0
Total demand			**31.8**	**216.3**	**159.1**

Table E-4. Other NYS regions

No.	Job role	Supply Chain Category	Demand for 1 GW (FTE-years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-years)
1.	Captain	1.1	0.1	0.3	0.2
2.	Design and Certification Package Manager	1.1	0.1	0.3	0.2
3.	Ecologists	1.1	0.6	4.1	3.0
4.	Electrical Engineer	1.1	0.2	1.0	0.7
5.	Electrical Network Lead	1.1	0.2	1.0	0.7
6.	Engineering and Design Manager	1.1	0.2	1.0	0.7
7.	Engineering Package Lead	1.1	0.2	1.0	0.7
8.	EPC Director	1.1	0.2	1.0	0.7

Table E-4. (continued)

No.	Job role	Supply Chain Category	Demand for 1 GW (FTE-years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-years)
9.	Foundation Engineer	1.1	0.2	1.0	0.7
10.	Geophysicists	1.1	0.6	4.1	3.0
11.	Geotechnical Engineer	1.1	0.1	0.3	0.2
12.	Geotechnical Manager	1.1	0.1	0.3	0.2
13.	Grid Commercial Lead	1.1	0.2	1.0	0.7
14.	Grid Connections Lead	1.1	0.2	1.0	0.7
15.	Grid Technical Lead	1.1	0.2	1.0	0.7
16.	IAC Engineer	1.1	0.1	0.5	0.4
17.	Logistics Package Engineer	1.1	0.2	1.0	0.7
18.	Logistics Package Lead	1.1	0.2	1.0	0.7
19.	Marine Biologist	1.1	0.1	0.3	0.2
20.	Noise Specialist	1.1	0.1	0.3	0.2
21.	Offshore Substation Electrical Engineer	1.1	0.2	1.0	0.7
22.	Onshore Substation Electrical Engineer	1.1	0.2	1.0	0.7
23.	Ornithologist	1.1	0.1	0.3	0.2
24.	Senior Geotechnical Engineer	1.1	0.1	0.7	0.5
25.	Specialist Wind Analyst	1.1	0.5	3.1	2.2
26.	Certification Manager	1.2	0.1	0.7	0.5
27.	Commercial and Procurement Director	1.2	0.1	0.7	0.5
28.	Commercial/LCOE Business Case Manager	1.2	0.1	0.5	0.4
29.	Construction Commissioning Manager	1.2	0.1	0.5	0.4
30.	Construction Manager	1.2	0.1	0.5	0.4
31.	DCO Consultation Manager	1.2	0.1	0.5	0.4
32.	Decommissioning Package Manager	1.2	0.1	0.5	0.4
33.	Development and Consents Director	1.2	0.1	0.7	0.5
34.	EPCI Director	1.2	0.1	0.5	0.4
35.	Fabrication Manager	1.2	0.1	0.5	0.4
36.	Finance Director	1.2	0.1	0.7	0.5
37.	Foundation Package Manager	1.2	0.1	0.5	0.4
38.	Grid and Power Offtake Manager	1.2	0.1	0.7	0.5
39.	Grid Commercial Lead	1.2	0.1	0.7	0.5
40.	Grid Connections Lead	1.2	0.1	0.7	0.5
41.	Grid OFTO Lead	1.2	0.1	0.7	0.5

Table E-4. (continued)

No.	Job role	Supply Chain Category	Demand for 1 GW (FTE-years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-years)
42.	Grid Policy and Regulation Lead	1.2	0.1	0.7	0.5
43.	Grid Technical Lead	1.2	0.1	0.7	0.5
44.	HSE Director	1.2	0.2	1.2	0.9
45.	HSE Manager	1.2	0.1	0.5	0.4
46.	IAC Package Manager	1.2	0.1	0.5	0.4
47.	Lead advocate (Examination Hearings)	1.2	0.1	0.5	0.4
48.	Legal Counsel	1.2	0.1	0.7	0.5
49.	Legal Counsel Internal	1.2	0.1	0.7	0.5
50.	O&M Director	1.2	0.1	0.5	0.4
51.	O&M Engineer	1.2	0.1	0.5	0.4
52.	O&M Package Manager	1.2	0.1	0.5	0.4
53.	Offshore Substation Package Manager	1.2	0.1	0.5	0.4
54.	Onshore Substation Package Manager	1.2	0.1	0.5	0.4
55.	Project CEO	1.2	0.1	0.7	0.5
56.	Project CFO	1.2	0.1	0.5	0.4
57.	Project Director	1.2	0.1	0.7	0.5
58.	Risk Lead	1.2	0.1	0.5	0.4
59.	Risk Manager	1.2	0.1	0.5	0.4
60.	SCADA Engineer	1.2	0.1	0.5	0.4
61.	SCADA Package Commercial Contracts Manager	1.2	0.1	0.7	0.5
62.	SCADA Package Manager	1.2	0.1	0.7	0.5
63.	Senior Risk Manager	1.2	0.1	0.5	0.4
64.	Technical Director	1.2	0.1	0.7	0.5
65.	WTG Engineer	1.2	0.1	0.5	0.4
66.	WTG Package Manager	1.2	0.1	0.5	0.4
67.	Civil Engineer	2.3	1.4	9.8	7.2
68.	Commercial Manager	2.3	0.2	1.0	0.7
69.	Construction Manager	2.3	0.2	1.4	1.0
70.	Fabrication Manager	2.3	0.2	1.6	1.2
71.	Machine Operatives	2.3	1.4	9.2	6.7
72.	WTG Engineer	2.3	0.2	1.6	1.2
73.	WTG Package Manager	2.3	0.2	1.6	1.2
74.	WTG Package Technical Manager	2.3	0.2	1.6	1.2

Table E-4. (continued)

No.	Job role	Supply Chain Category	Demand for 1 GW (FTE-years)	Pipeline Demand 2.2 GW Nuclear Variant (FTE-years)	Pipeline Demand 3.3 GW Nuclear Variant (FTE-years)
75.	Civil Design Manager	2.6	0.2	1.4	1.0
76.	Civil Engineering Manager	2.6	0.2	1.4	1.0
77.	Commercial Manager	2.6	0.1	0.8	0.6
78.	Fabrication Manager	2.6	0.2	1.4	1.0
79.	Foundation Package Manager	2.6	0.2	1.4	1.0
80.	Foundation Package Technical Manager	2.6	0.2	1.4	1.0
81.	Geotechnical Engineer	2.6	0.2	1.4	1.0
82.	Onshore Installation Manager	2.6	0.4	2.4	1.7
83.	Structural Engineer	2.6	0.8	5.1	3.7
84.	Commercial Manager	2.8	0.3	1.7	1.2
85.	Construction Manager	2.8	0.4	2.4	1.7
86.	Electrical Engineer	2.8	0.3	1.7	1.2
87.	Electrical Technician	2.8	3.0	20.4	15.0
88.	Fabrication Manager	2.8	0.4	2.7	2.0
89.	Onshore Installation Manager	2.8	0.7	4.8	3.5
90.	Onshore Works Package Commercial Contracts Manager	2.8	0.4	2.7	2.0
91.	Onshore Works Package Manager	2.8	0.4	2.7	2.0
92.	Structural Engineer	2.8	1.5	10.2	7.5
93.	Commercial Manager	3.6	0.3	2.0	1.5
94.	Commissioning engineer	3.6	0.3	2.0	1.5
95.	Construction Manager	3.6	0.3	2.0	1.5
96.	Termination and Testing Technicians	3.6	3.0	20.4	15.0
Total demand			**25.4**	**172.7**	**127.0**

Endnotes

[1] As of December 1, 2025, the U.S. Department of Energy (DOE) renamed the National Renewable Energy Laboratory (NREL) in Golden, CO, to the National Laboratory of the Rockies (NLR). This new name removes ”renewable energy” to reflect a broader focus on applied energy research.

[2] NYSERDA offers a complete description of priority populations at NYSERDA Workforce Development and Training Definitions

[3] These programs include courses at New York City College of Technology (City Tech), CUNY Grove School of Engineering, Kingsborough Community College, LaGuardia Community College, and the College of Staten Island.