Project Veer

Southwest Virginia Offshore Wind Supply Chain Readiness

Final Report

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REV	DATE	DESCRIPTION	ISSUED	CHECKED	APPROVED	CLIENT
R02	28/04/2022	Final Report	DW/NC	DW/EM	JT	
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1 INTRODUCTION

1.1 Overview

The federal government has announced a target of 30 GW of offshore wind (OSW) capacity by 2030. With an estimated project pipeline in excess of 28 GW in awarded lease areas and 14 projects, equating to over 9 GW in capacity currently expected to be operational by 2026, the US now represents a sizeable portion of the global OSW market.

Virginia has set an agenda to realize the economic opportunities of the emerging OSW industry along the East Coast. With the high capacity 2.6 GW commercial scale Coastal Virginia Offshore Wind (CVOW) project following on the success of the 12 MW CVOW pilot project, and with the ~2.5 GW Kitty Hawk project following right behind, OSW presents economic development opportunities for VA businesses, creating thousands of jobs for VA residents. These economic benefits have the potential to extend beyond the coastal regions and into the interior of the Commonwealth as supporting industries and companies are brought into the fold.

While at this early stage in the US OSW industry's development the majority of the primary OSW farm components will be imported from overseas, there still exist opportunities to support staging, finishing and installation activities, project development, onshore construction, operations and maintenance, and support sector services. Southwest Virginia (SWVA) has supported the coal mining industry for more than a century and has developed a wealth of experience in heavy equipment, operating and manufacturing precision manufacturing, and management of large-scale industrial operations. Many of the supporting products and services that can be delivered to the US market US can be sourced in SWVA.

To support this ambition, Project Veer has contracted the support and insights from Xodus Group in order to learn more about supply chain needs and the specific supply chain capabilities that exist in SWVA. The objective is to use these deeper supply chain insights to inform future strategic, state-level investments, initiatives and policies that will enable companies throughout the supply chain to make more targeted and meaningful connections that lead to fruitful partnerships. In order to achieve this, a clear path must be found for SWVA companies to build on their existing strengths and capabilities and identify new ways to apply their experience in this burgeoning industry.

1.2 Objective

This project has been undertaken with the objective of putting forth an initial OSW supply chain assessment and gap analysis for the SWVA region. The Southwest Virginia region is comprised of the following areas: Bristol, Galax and Norton as well as the counties of Bland, Buchanan, Carroll, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, Washington, Wise and Wythe. The above are aligned with GO Virginia (GO VA) Region 1, as shown in Figure 1.1.

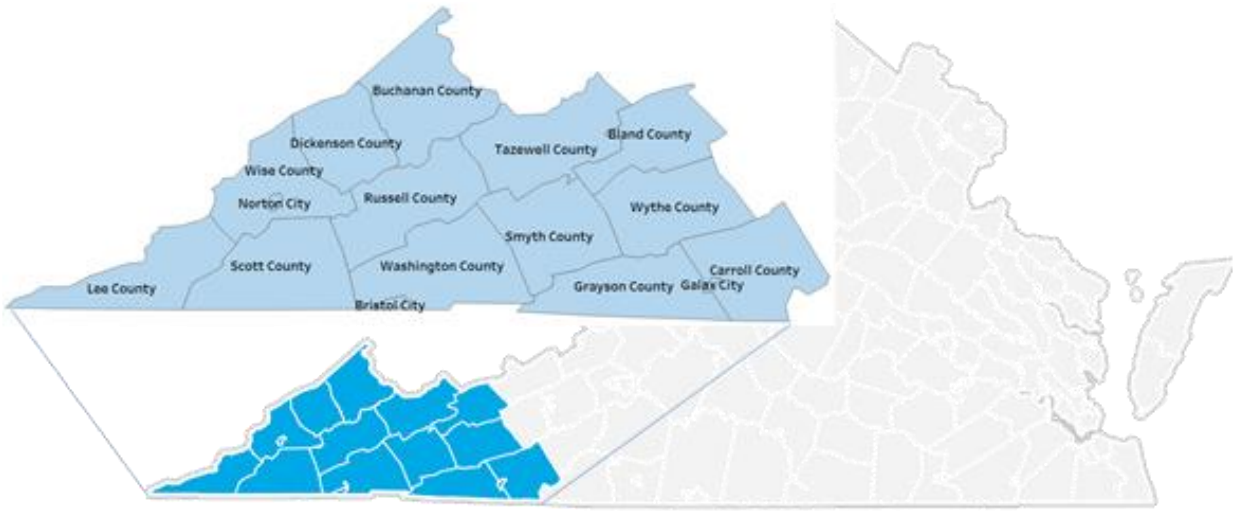

Figure 1.1 - Southwest Virginia - GO Virginia Region 1

This study identifies SWVA's supply chain assets from both a technical and volumetric position and uncovers supply chain gaps to help SWVA in its economic development efforts by highlighting the potential of this inshore region to support an offshore industry. The ultimate goal of this analysis is to provide a set of recommendations for SWVA for a measurable, strategically focused OSW development plan based on available strengths and market forces.

Xodus is following an agreed upon workflow (Figure 1.2) during this assessment with this being the final deliverable.

Figure 1.2 - Project Veer/Xodus Workflow

1.3 Scope of Document

This report is comprised of the analysis carried out in the preliminary report, in addition to the remaining scope for the project, detailed in Figure 1.2. An overview of the OSW industry in the United States is given, with a focus on projects and activities in the Mid-Atlantic region to demonstrate the scale of the serviceable available market for region. Following this, a summary of typical contracting strategies employed in the OSW industry is then given for context. A description of the methodology applied in this supply chain categorization and gap analysis

is then provided, followed by the results of a first pass analysis of companies in SWVA. The results of this analysis are given alongside a description of the various work scopes or "packages" that make up the OSW taxonomy presented in the Methodology section. Discussion of the results of this initial supply chain analysis will follow, including initial impressions of supply chain strengths and gaps.

Following this, a full job role analysis for the OSW industry is carried out, discussing which job roles are required during the project development cycle and anticipating when the greatest volume of job roles will be required. A workforce overview for the region is then given with the goal of determining whether sufficient workforce exists in the region to support OSW efforts. Finally, recommendations are given that will allow the region to capitalize on economic development opportunities in supporting OSW based on the results of the various analyses.

2 US OFFSHORE WIND MARKET OUTLOOK

The US OSW industry is nascent, but development is expected to rapidly accelerate with a significant volume of projects in planning and development stage as of Q1 2022. To date, the majority of activity in the US OSW market has taken place on the East Coast although there are plans in place to develop the West Coast, Gulf of Mexico, Great Lakes and Hawaii. Figure 1.3 gives current state capacity targets, as well as the value of OSW generation capacity that is covered by an offtake agreement (i.e., "under contract"). As can be seen below, Virginia has a target of 5.2 GW of OSW capacity, and has set 2034 as their target date for meeting that milestone.

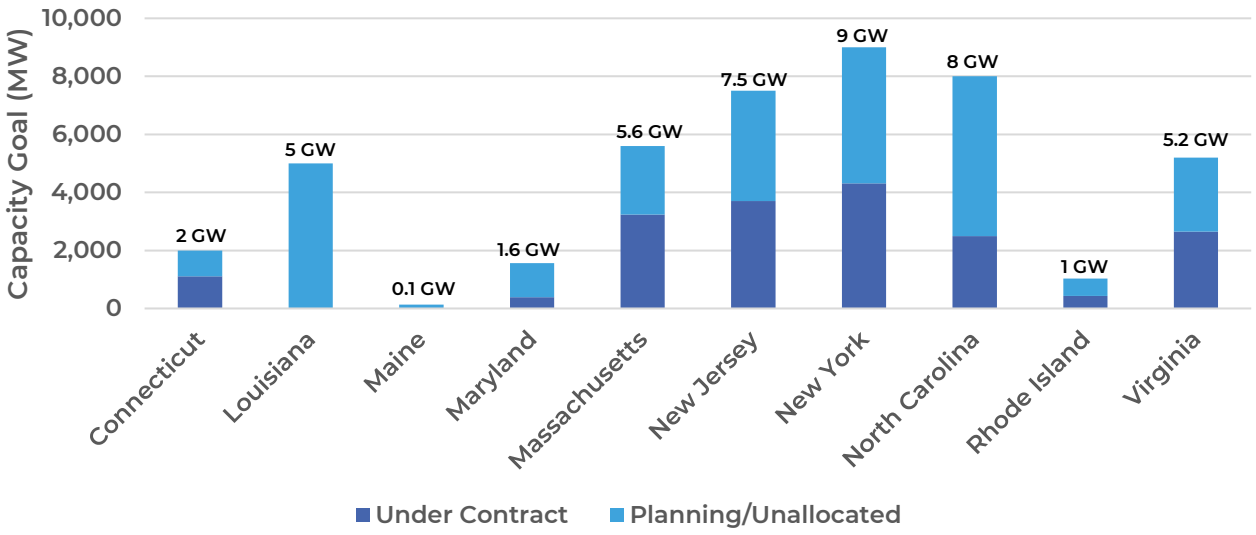

Figure 1.3 - State Capacity Target for Offshore Wind

The regions where the majority of planning and development are occurring along the East Coast, as shown in Figure 1.4, are grouped here to facilitate discussion, as follows:

- Northeast
- Mid-Atlantic
- Southeast

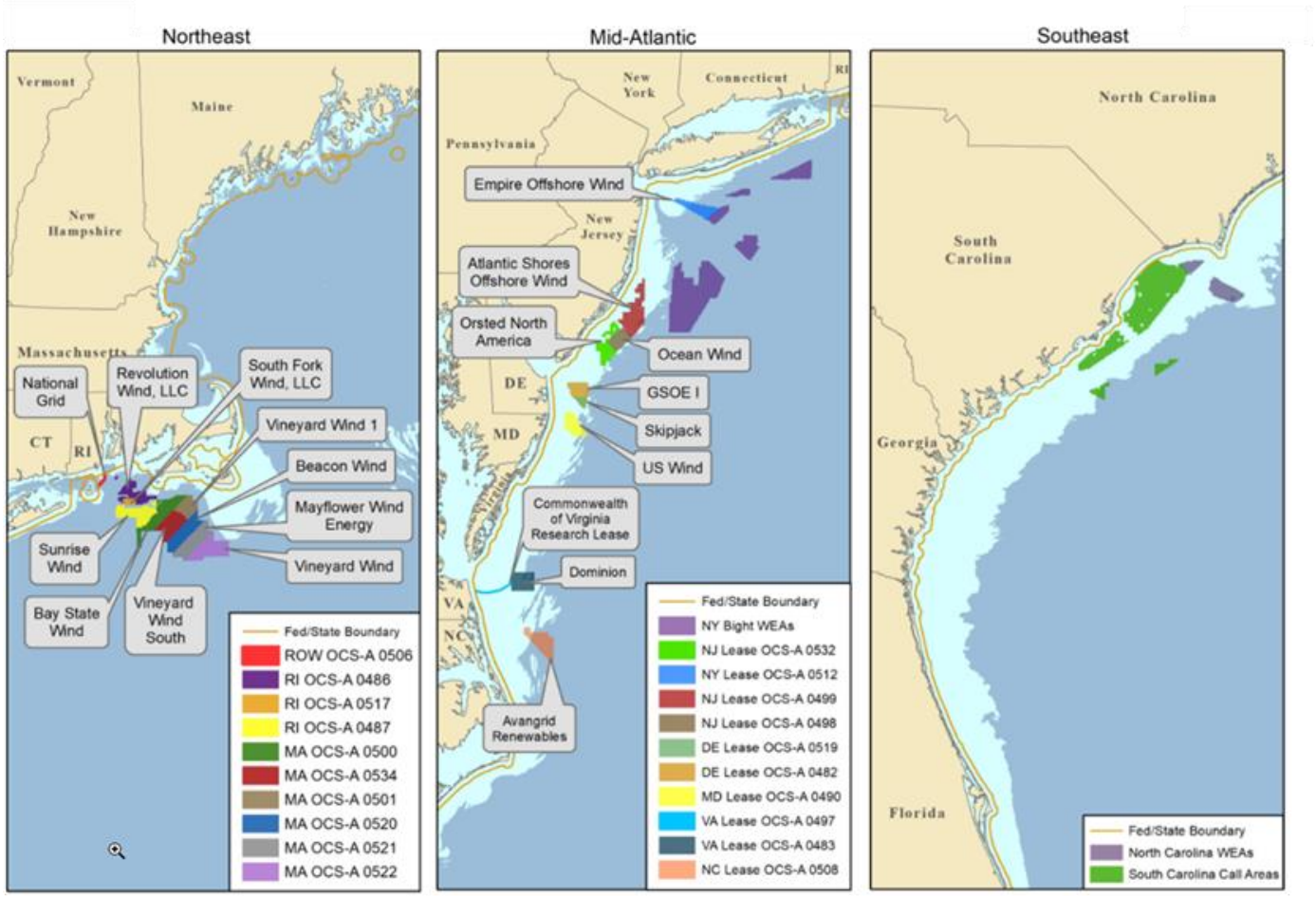

Figure 1.4 - US Planned Offshore Wind Project Pipeline (Source: BOEM)

2.1 Project Pipeline

To view the timeline of capacity development on the East Coast, Figure 1.5 shows the projected OSW market through 2034. Cumulative installed capacity is anticipated to exceed 25 GW by 2030. The forecast has been informed by known project developments, lease area potential and internal market insights.

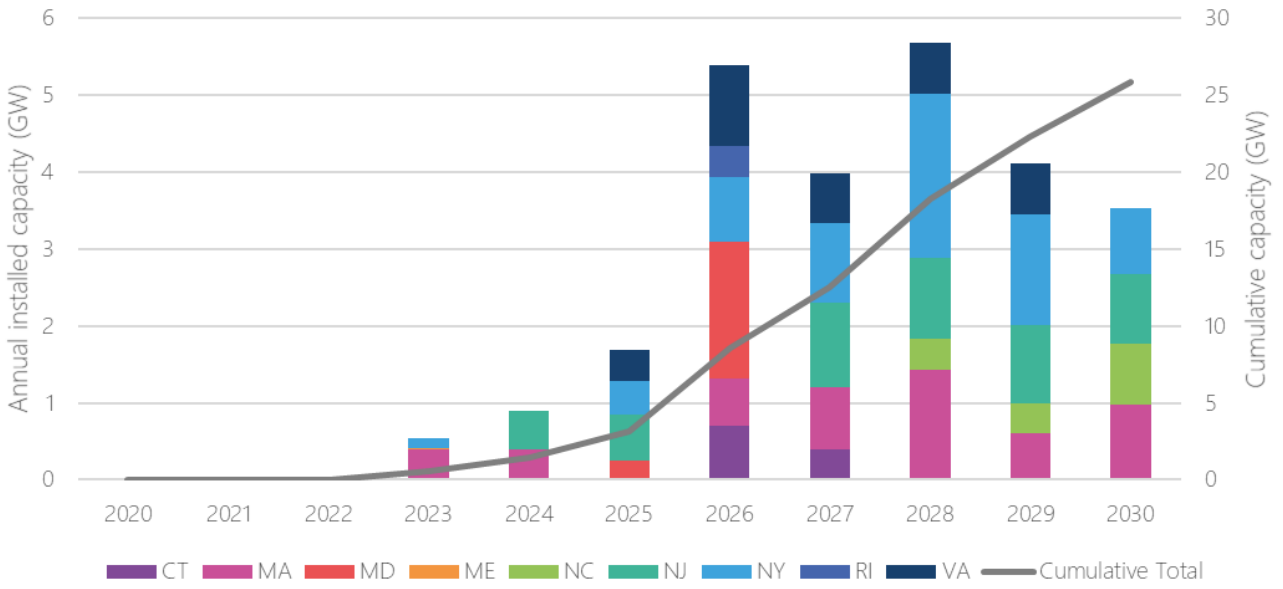

Figure 1.5 - East Coast States Offshore Wind Capacity Pipeline (Source: ForeSEE, BNOW)

2.2 Regulatory Activity

BOEM applies a multi-phase process in the authorization of an OSW development which occurs in four distinct phases: planning and analysis, leasing, site assessment, and construction and operations, as shown in Figure 1.6. The site assessment phase can be a time-consuming process, lasting up to 5 from the approval of a Site Assessment Plan (SAP), to the submission of a Construction Operations Plan (COP). The approval of the COP can take between 0-2 years, after which the project must reach financial close prior to beginning construction.

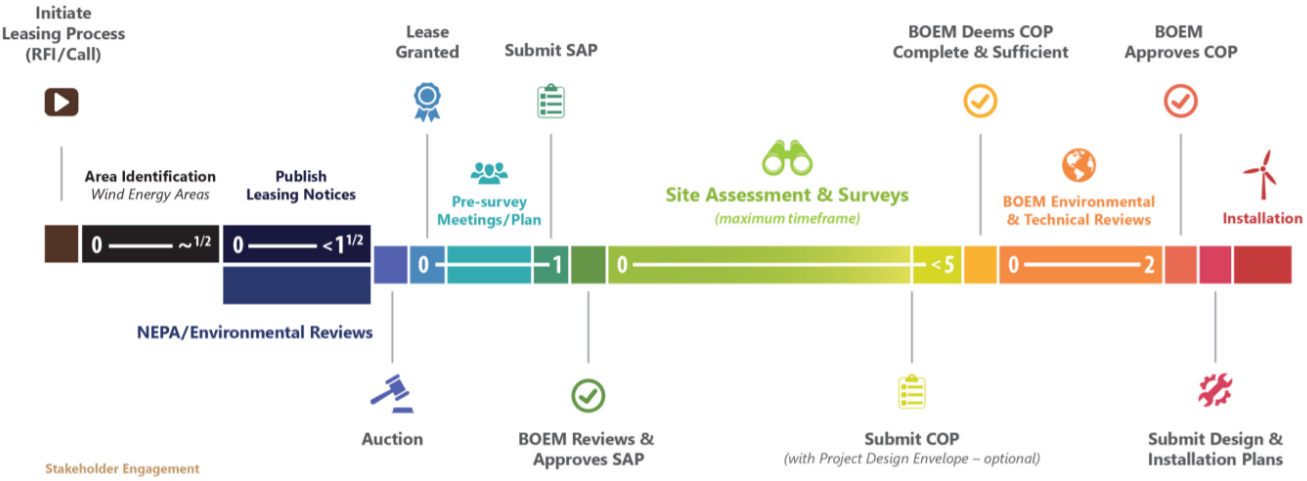

Figure 1.6 – Offshore Wind Project Development Process (Source: BOEM)

BOEM has issued two Records of Decisions (ROD) thus far, for the Vineyard Wind 1 (MA) and South Fork (NY) projects, both of which are now under construction.

Along the East Coast there are currently 13 projects with signed offtake agreements, for a total of 17.5 GW. All of the aforementioned projects are in various phases of development. Negotiating an offtake agreement to sell electricity is a crucial step in developing a profitable project. The project name, size, state, project phase and estimated Commercial Operations Date (COD) are provided in Table 1.1. Note that the Kitty Hawk project that will be constructed in NC has not yet signed an offtake agreement for the power generated.

STATE	PROJECT NAME	PHASE	PERMIT STATUS	ESTIMATED COD	SIZE (MW)
ME	Aqua Ventus	Financial close	n/a		11
MA	Commonwealth Wind	Permitting	COP – under review	TBD	1232
	Mayflower Wind 1	Permitting	COP – under review	2027	804
	Mayflower Wind 2	Permitting	COP – under review	2028	400
	Vineyard Wind 1	Under construction	Approved	2023	800
RI	Block Island Wind Farm	Operating	Approved	2016	30
	Revolution Wind	Permitting	COP – under review	2023	400
CT	Park City Wind	Permitting	COP – under review	2025	804
	Revolution Wind	Permitting	COP – under review	2023	304
NY	Beacon Wind	Permitting	SAP - approved	2026	1230
	Empire Wind I	Permitting	COP – under review	2024	816
	Empire Wind II	Permitting	COP – under review	2028	1260
	South Fork	Financial close	Approved	2023	130
	Sunrise Wind	Permitting	COP – under review	2024	880
NJ	Atlantic Shores Offshore Wind 1	Permitting	COP – under review	2027	1510
	Ocean Wind	Permitting	COP – under review	2024	1100
	Ocean Wind 2	Permitting	COP – under review	2027	1148
MD	MarWin	Permitting	SAP – approved	2023	248
	Skipjack	Permitting	SAP – approved	2026	120
	Momentum Wind	Permitting	SAP – approved	2026	808
	Skipjack 2	Permitting	SAP – approved	2026	864
VA	Coastal Virginia Offshore Wind - C	Permitting	COP – under review	2025	2640
	Coastal Virginia Offshore Wind - P	Operating	Approved	2020	12

Table 1.1 - Status of US Projects with Financial Mechanism Secured

2.3 Mid-Atlantic Region

Delaware, Maryland, Virginia, North Carolina and South Carolina are considered the Mid-Atlantic region. In 2020 the states of Virginia, North Carolina and Maryland signed the Southeast and Mid-Atlantic Regional Transformative Partnership for Offshore Wind Energy Resources (SMART-POWER), a Memorandum of Understanding (MOU) to *"cooperatively promote, develop, and expand offshore wind energy generation and the accompanying industry supply chain and workforce"*. With a combined OSW capacity target of 14.8 GW, this MOU puts the Mid-Atlantic Region in direct competition with heavy-hitting regions like NY/NJ (combined target of 16.5 GW) and New England (combined target of 8.7 GW). On March 25, 2022, the Department of the Interior announced that BOEM had completed its environmental review of the Carolina Long Bay area will be holding an offshore wind energy auction for two lease areas in May 2022.

Hampton Roads in VA is becoming a well-established supply chain cluster with strong port assets for staging activities and a Siemens Gamesa Renewable Energy (SGRE) blade finishing plant planned for Portsmouth. The region will also be home to the first ever Jones Act compliant Wind Turbine Installation Vessel (WTIV), to be built by Dominion Energy. The Baltimore, MD region is home to Sparrow's Point Steel and Tradepoint Atlantic—a 3,300 acre industrial site being developed to support staging and additional OSW manufacturing activities. North Carolina has an impressive 8 GW target for OSW capacity development by 2040 and the NC Kitty Hawk project, which is awaiting an offtake pathway, is likely going to be at least a 2.5 GW project. On March 25, 2022, the Department of the Interior announced that BOEM had completed its environmental review of the Carolina Long Bay area of NC and will be holding an offshore wind energy auction for two lease areas in May 2022. South Carolina has ambitions for OSW and has been estimated to possess the second greatest OSW resource in the US. It is also home to a Nexans subsea cable plant that will supply the OSW industry, including export cables for the South Fork OSW farm in New York in 2022/2023.

2.4 U.S. Offshore Wind Supply Chain Implications for Southwest Virginia

With the first two OSW projects in the US having achieved a Record of Decision (ROD), and with an additional 13 projects whose Construction and Operations Plans (COPs) are under review with the Bureau of Offshore Energy Management (BOEM), the US OSW industry presents ample opportunity for a wide variety of companies and jurisdictions. It is anticipated that up to 300 wind turbines will be installed by 2027 in US waters, and given that materials are currently being supplied from Europe and elsewhere, it is feasible to look at the entire East Coast of the US as a potential market for VA. OEMs and Tier 1s have indicated that supply chain logistics have minimal impact on overall project costs – performing lifting and transfer operations for large components increase cost and risk, not transportation activities. Given that local content creation is a major focus of the OSW industry, this encourages companies to look beyond the quayside to meet their supply chain needs. The volume of work that is going to take place in building the OSW industry in the US means that developers and Tier 1 suppliers are currently seeking to onboard supply chain partners to support current and future activities.

Southwest Virginia is well positioned to capitalize on this generational opportunity. Given its position in the Mid-Atlantic region and the strength of mining, agricultural and high-precision manufacturing sectors, SWVA stands to benefit from the estimated $100B USD CAPEX spend anticipated in the industry by 2030, provided the region

is able to accurately identify and pivot to meet the opportunities. Based on an evaluation of North American Industry Classification System (NAICS) codes, the following was determined for the region:

- 12.1% of workforce is in manufacturing
- 5.1% of workforce is in construction
- 3.3% of population is in transportation/warehousing

Among the benefits of doing work in VA are access to low industrial electricity rates and labor rates for trades that are in high demand in the OSW industry compared to other states that are engaged in OSW development. See Figure 1.7 and Figure 1.8 for industrial electricity rates and labor rates, respectively. This, plus the fact that VA is a right to work state, makes the region attractive to potential manufacturing operations.

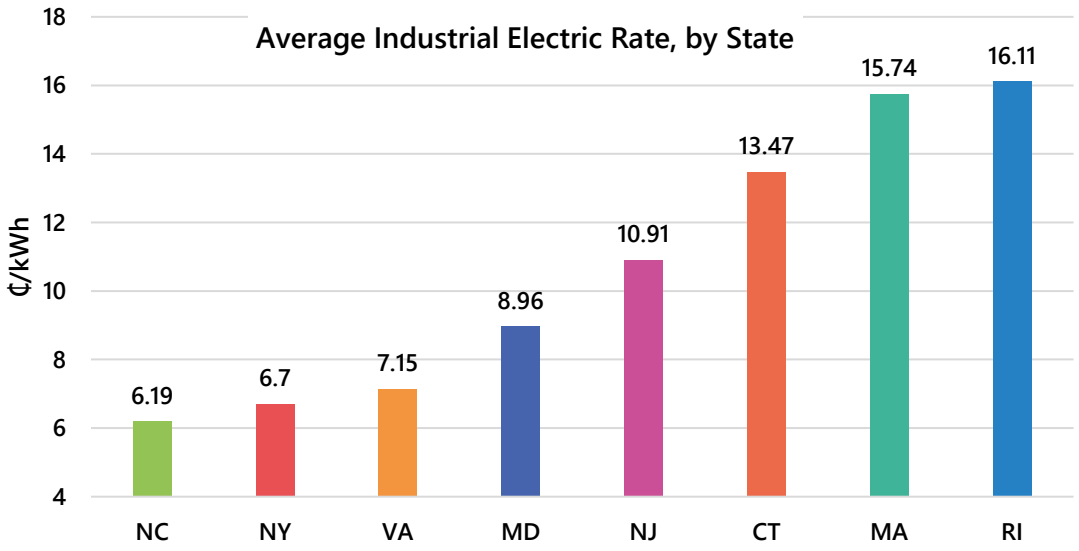

Figure 1.7 - Average Industrial Electricity Rate, by State (US Energy Information Administration, 2021)

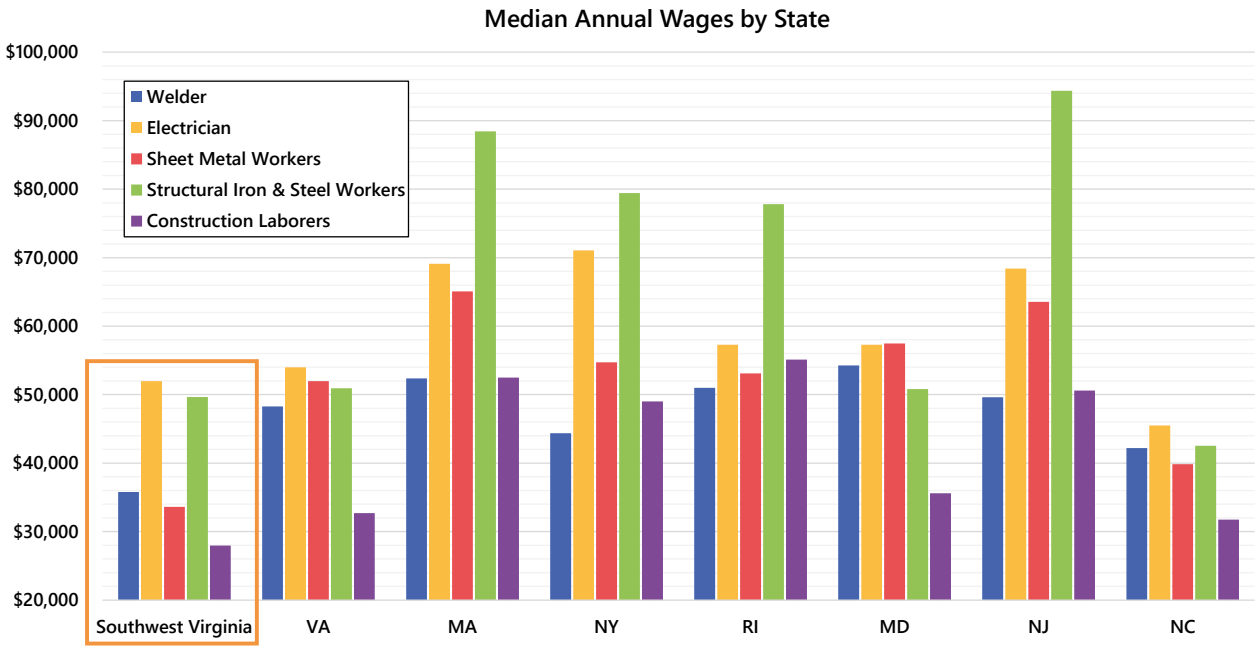

Figure 1.8 - Median Annual Labor Rates for Trades by State, including Southwest Virginia (U.S. Bureau of Labor Statistics, May 2020)

Additionally, the Jones Act provides increased opportunity for SWVA. The Jones Act requires that goods being transported between US ports of call must be transported on US built, owned and crewed vessels. This logistical challenge means that many early projects will use transport barges to bring OSW materials to the installation site where a foreign WTIV will be waiting to perform installation activities. Having the home base for the first American WTIV, the Charybdis, within the Commonwealth of VA bodes well for SWVA in terms of providing supporting activities, as this vessel will be highly sought after once construction is complete in 2026.

A further observation based on initial research is that larger local companies tend to be owned by larger, national/multi-national companies. These companies will likely have an easier time pivoting to enter the OSW industry given greater access to resources and a more diversified product/service offering. However, smaller companies also have a significant role in building supply chain capacity as they have the ability to specialize, and to partner with other organizations that are directly involved in OSW already.

3 CONTRACTING STRATEGIES

Complex procurement practices can be difficult to navigate at the best of times. This is compounded when discussing nascent supply chain environments. A lack of awareness of opportunities and how these deals are contracted creates a barrier to securing contracts.

Standardized and simpler procurement processes are considered key to solving some of these issues. In practice this can be difficult due the variety of contracting strategy combinations available to the Developers and OEM/Tier 1s sub-contracting. Therefore, providing support to local industry to help navigate the current commercial landscape is critical.

The approach to contracting strategies in the OSW industry is generally influenced by multiple variables:

- Size and complexity of the project to be executed;
- Internal strength, experience and capabilities of the OSW farm developer;
- Influence of project financing availability and;
- Maturity of the local supply chain.

In the development of an OSW farm the developer usually prefers one of the below strategies (discussed in further detail in the following sections):

- A multi-contract strategy;
- An engineering, procurement, construction, and installation (EPCI) strategy;
- A hybrid/multi-contract/EPCI strategy.

Historically in the US, companies developing and operating solar, wind, and other renewable energy projects often work onshore. The contracting structures and forms used in such projects are very similar to other onshore infrastructure projects and often take the form of turnkey, 'one-stop' contracts. The type of contracts applied to onshore projects do not consider the specific risks and challenges of operating in an offshore marine environment, and we have seen this to be a key obstacle in project finance. The increased risk of cost and schedule overrun from multiple project interfaces currently presents too large of an unknown to banks/lenders (in the US) when the added challenges of an immature local supply chain and the Jones Act are also posing key project risks, the appetite for investment may not be as high.

3.1 Multi-Contract Strategy

For a multi-contract strategy, the owner operator/developer will typically award separate contracts for the key elements of the wind farm (for example turbine supply, foundation supply, turbine installation, cable installation and foundation installation) see Figure 1.9. It has been seen that typically 9-10 main contracts can be awarded covering the main components of an OSW farm.

The multi-contract approach offers the greatest control over project development and the best opportunities for cost reduction, but it requires an owner operator/developer with very strong in-house engineering expertise, commercial skills, and experienced personnel. A multi-contracting approach requires the developer to play a greater role in managing interface risk and coordination between the various contractors. It is therefore often more suitable and preferred by large utilities or Developers with extensive experience in executing OSW projects

(such as Equinor, Ørsted and Avangrid). These large utilities/Developers may be less likely to be reliant on project finance and as such can take this risk internally rather than pay a (perceived) premium for an EPCI solution.

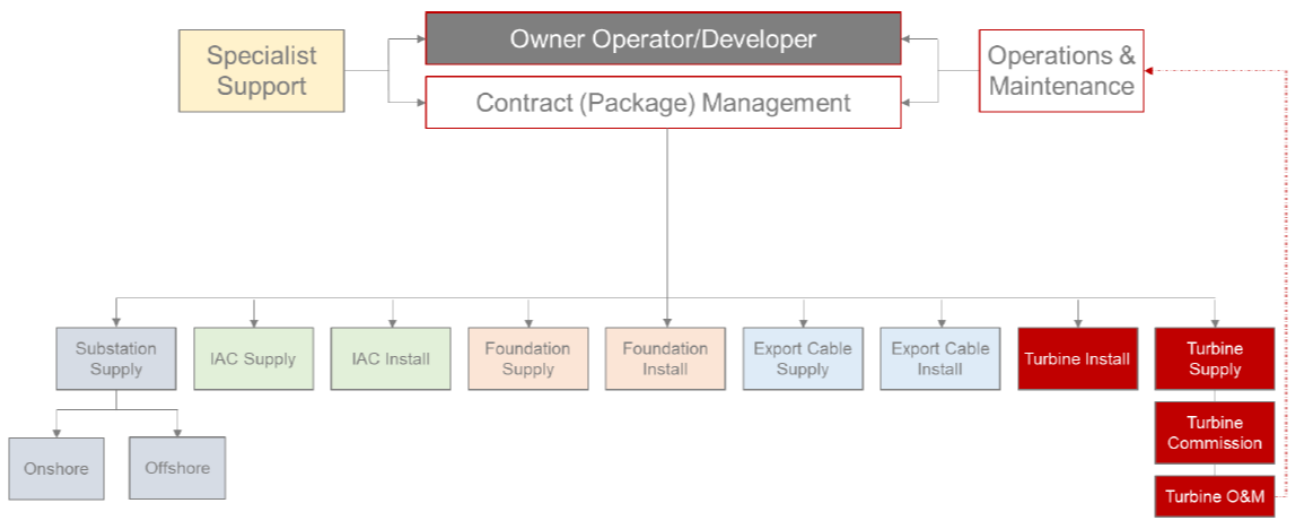

Figure 1.9 - Typical Multi-Contract Solution

3.2 Engineering, Procurement, Construction and Installation (EPCI) Strategy

An EPCI strategy has generally fewer (2-4) contracts covering larger scopes of work, see Figure 1.10, for example:

- Turbines: the supply/installation/operation of turbines under one contract;
- Balance of Plant: Supply/installation of foundations and cables under another;
- Transmission and Distribution: Supply/installation of substations (onshore and offshore) and export cables under another.

This strategy is viewed as a turnkey solution of the entire contractual scope, which would typically mean that the contractor takes on the cost, schedule and interface risk including coordination with sub-contractors.

This generally means that the EPCI contractor will 'price-in' these additional risks to allow for contingency due to any project issues, although most contractors are now more willing to accept these risks, having seen the development of other OSW projects. Through the lens of independent developers, less experienced utilities and/or their investors/financiers, the risk profile under an EPCI contract may be preferable.

A complicating factor with respect to the above is that whilst the offshore oil and gas industry follow a well-established division of work scopes, banks/lenders, developers and EPCI contractors involved in OSW EPCI projects may have different expectations as to what constitutes a reasonable division of risk.

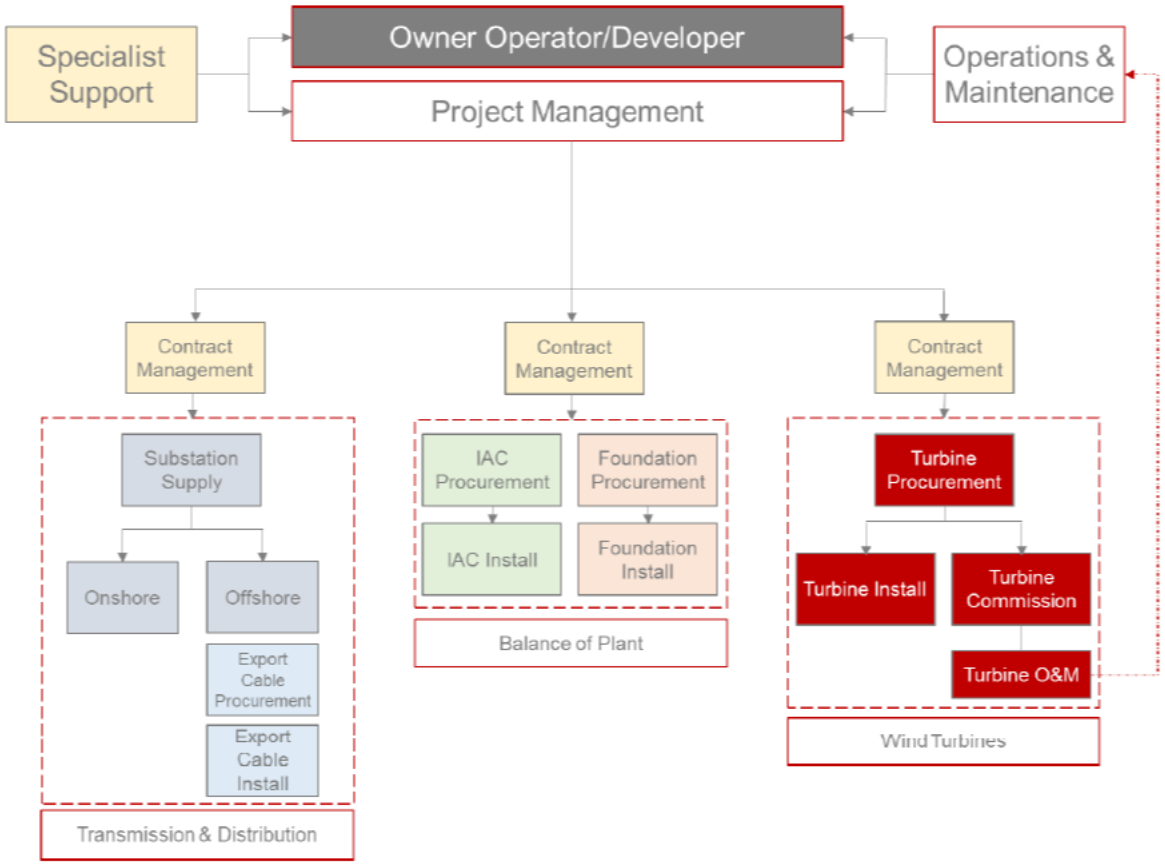

Figure 1.10 - Typical EPCI Contract Solution

One example of a project that shows the shift in the UK and Europe toward this model includes Seagreen, Scotland's largest planned OSW farm (as of the date of writing). This project has taken a 4 contract EPCI approach (as detailed in Figure 1.11). Here, companies such as Subsea 7, Nexans and others have taken on much of the work for each of the packages from design to completion.

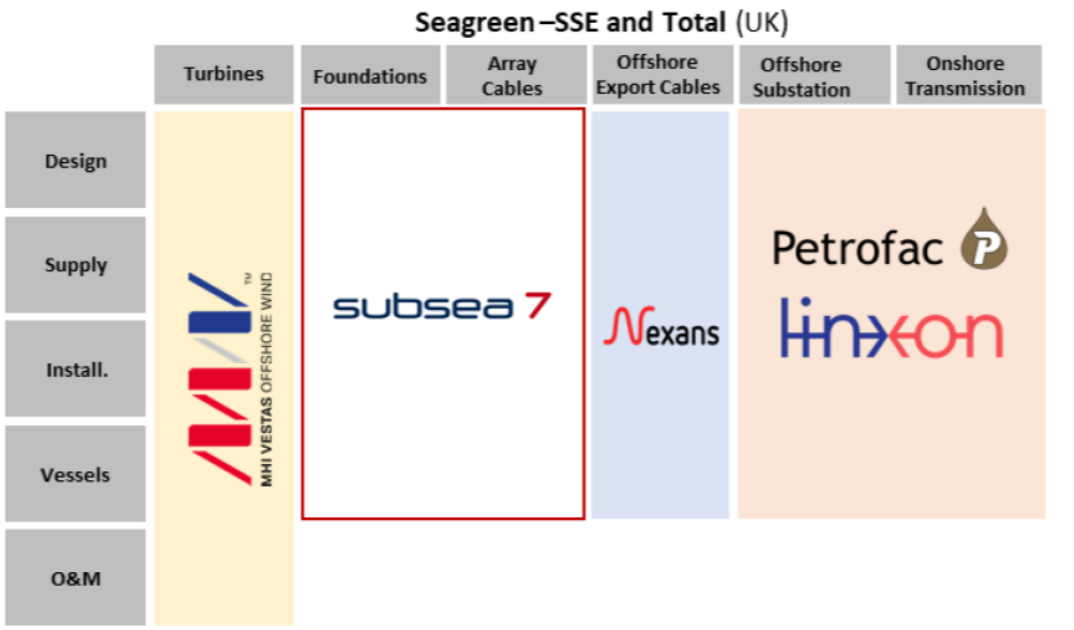

Figure 1.11 - Seagreen EPCI Contract Solution

As previously mentioned, one of the two projects in the United States that is currently operational is the CVOW pilot project, which consists of two 6 MW turbines installed 27 miles off the coast of Virginia Beach, VA. This project is owned and operated by Dominion Energy, the public utility company in the state of VA, and is the precursor to the 2.6 GW CVOW commercial-scale project. This initial portion of the project was constructed under an EPCI contracting scheme where the OSW developer Ørsted was contracted to carry out the engineering, procurement, construction and installation of virtually all the major packages. The CVOW pilot project and the CVOW commercial project are unique in that they are the only projects in the US to be owned/operated solely by a company that serves as the local utility.

3.3 Hybrid Strategy

In some cases, a hybrid approach between multi-contracting and EPCI has been adopted. This involves combining certain major packages to reduce construction risk while balancing the amount of project oversight. A general framework of this strategy is outlined in Figure 1.12.

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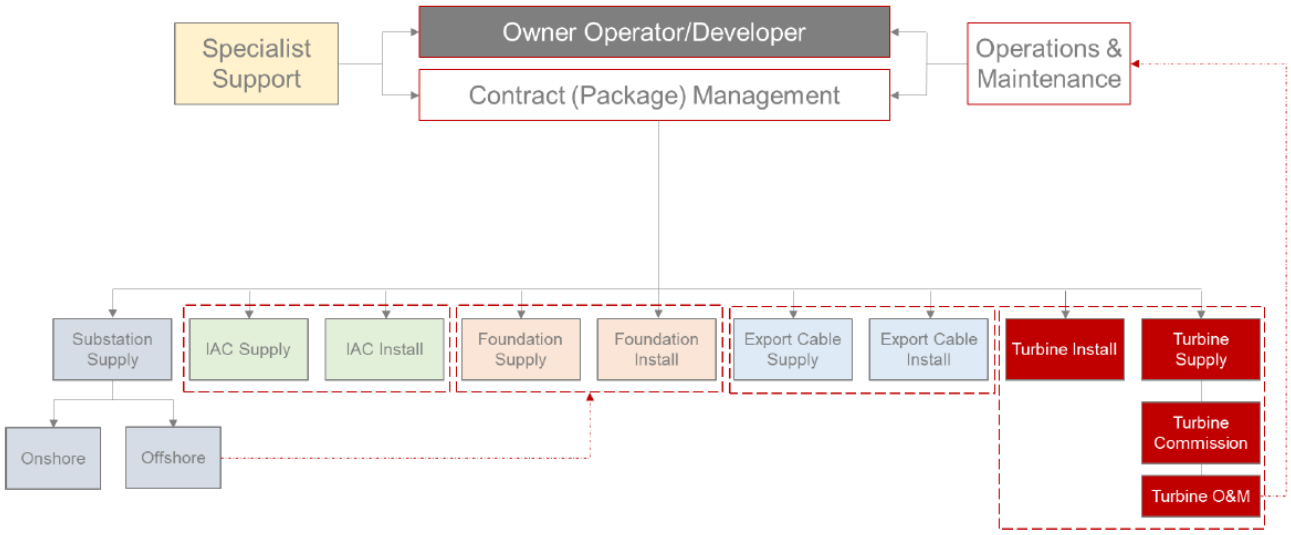

Figure 1.12 - Typical Hybrid Contract Solution

The trade-off between project risk and oversight across the varying contracting strategies is detailed in Figure 1.13.

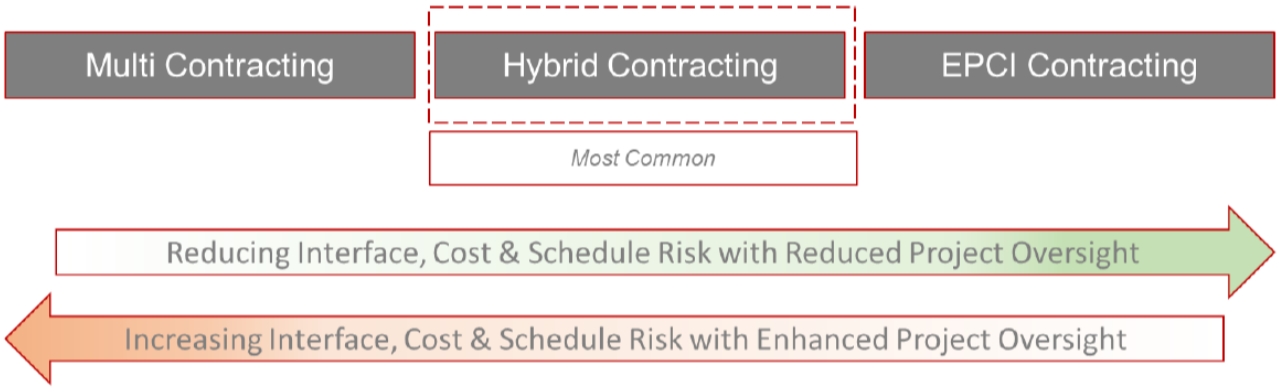

Figure 1.13 - Project Risk vs. Project Oversight Across Varying Contract Strategies

4 METHODOLOGY

In this initial supply chain gap analysis, companies in the SWVA region are analyzed and categorized according to an OSW taxonomy, as shown in Table 4.1. This is a necessary task in assessing regional capabilities given that the US OSW industry is in its infancy, and very few local companies have direct experience supporting this industry and hence would have a difficult time placing themselves within the project development cycle. Additionally, NAICS and SOC codes are often insufficient to fully describe the potential to enter the OSW supply chain.

Supply Chain Area	Supply Element
Project development	Development and permitting
	Surveys
	Engineering & design
	Project management
Wind turbine supply	Nacelle
	Rotor
	Electrical and auxiliary systems
	Tower
Balance of plant supply	Foundations
	Export cables
	Array cables
	Offshore substation
	Onshore infrastructure
Installation and commissioning	Turbine installation
	Foundation installation
	Subsea cable installation
	Offshore substation installation
	Onshore construction
	Ports and logistics
Operations and maintenance	Operations
	Turbine inspection and maintenance
	BoP inspection and maintenance
Sector support	Training provider
	R&D and academia
	Trades, labor and workforce organizations
	Sector support - other

Table 4.1 - Offshore Wind Industry Taxonomy Categorization

Assessing a company's operations and then categorizing them according to which OSW project "packages" they are potentially able to support gives a clearer picture of the strengths and weaknesses of the region, viewed through an offshore wind lens as opposed to using standard definitions such as NAICS or SOC codes. The

taxonomy applied in this analysis is given in Table 4.1, broken out into major project "Supply Chain Areas" or packages, and then further defined by "Supply Element".

5 RESULTS

A total of 385 companies were analyzed as part of this preliminary supply chain gap analysis. Data sources that provided a list of companies for this analysis were as follows:

- City of Bristol, VA
- InvestSWVA
- Southwest Virginia Alliance for Manufacturing
- Virginia Coalfield Economic Development Authority
- Virginia Economic Development Partnership
- Virginia's Industrial Advancement Alliance
- Washington County, VA
- Wise County, VA

Companies were categorized according to offshore wind industry taxonomy (Table 4.1) using a desk-based research approach. As very few companies in the region have direct OSW industry experience, the overall capabilities of each company and their potential to support similar activities in OSW were considered. These companies are referred to as adjacent industry companies. Further analysis and research will be carried out to determine the ability of these companies to pivot and support OSW in their operations.

As part of the OSW taxonomy categorization exercise, any companies that showed no adjacency potential were discounted, leaving a total of 196 companies. The remaining companies were assigned categories for potential to support OSW taxonomy sectors, resulting in the distribution reported in Figure 4.1. Note that companies were often classified in multiple categories, and thus may appear multiple times in the figure below. A full listing of companies and their categorization can be found in Appendix A.

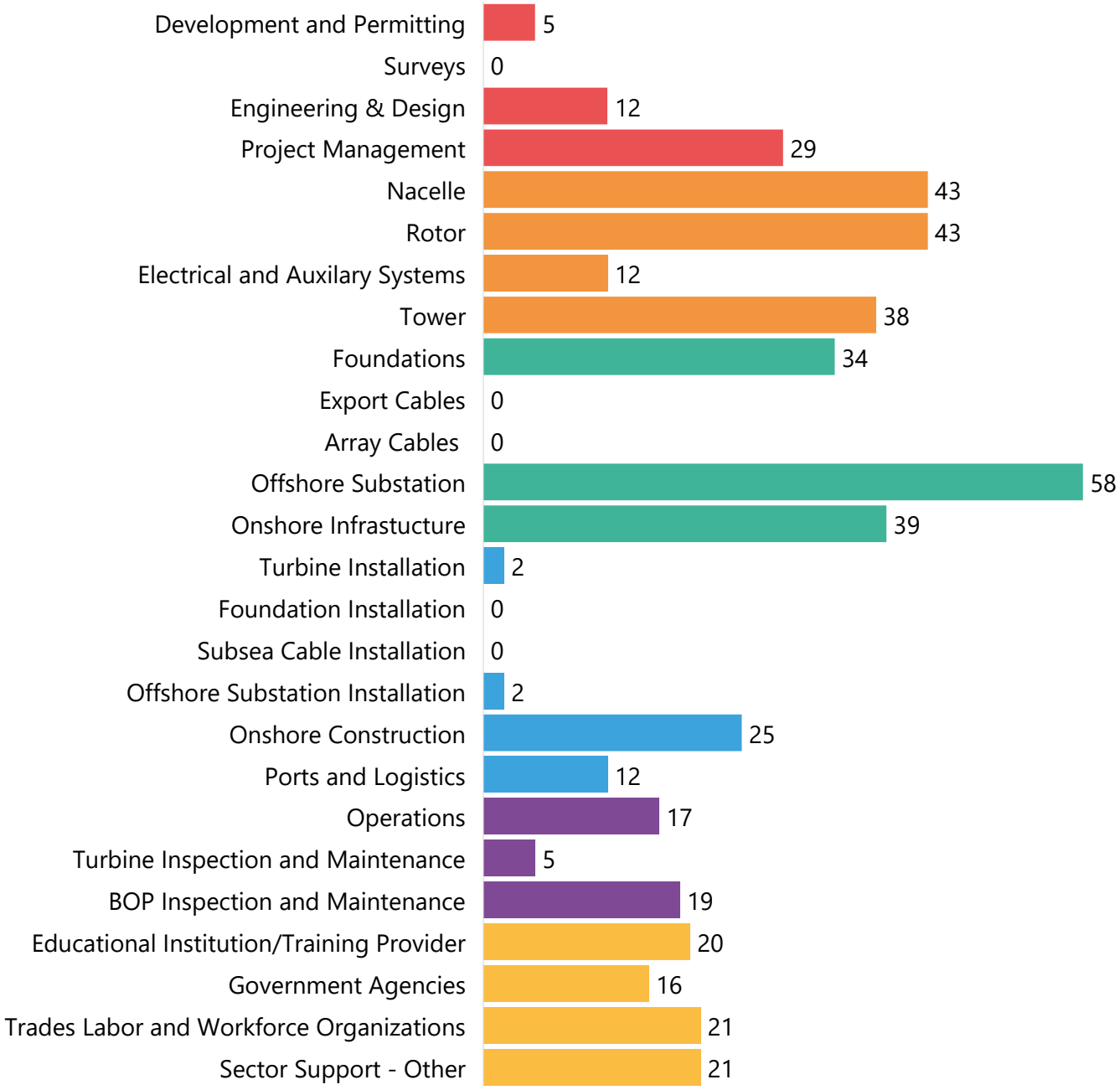

Figure 4.1 - Offshore Wind Taxonomy Distribution for Southwest Virginia Companies

5.1 Project Development

The Project Development package of the offshore wind industry consists of front-end engineering and design (FEED), project financing, legal activities, internal/external advisor costs, meteorological monitoring, environmental surveys, seabed surveys, construction management, insurance services, etc. Many of these services are required across land-based large-scale construction industries such as mining, hence it is unsurprising that SWVA has relative strengths in the "Engineering & Design" and "Project Management" categories. As surveying is exclusively a

marine activity, there were no companies in the list that fit into this category, however some (particularly in the military/aerospace sector) may have the capacity to supplement this sector.

5.2 Wind Turbine Supply

The nacelle and rotor, including blades, of a wind turbine generator (WTG) contain thousands of mechanical, electrical and structural components, many requiring very precise tolerances and specialty materials. Blades, for instance, require high-strength, flexible composites, and the nacelle requires a wide array of gears, bearings, shafts and motors. It also requires specialized electronics and monitoring equipment like sensors and controllers. The tower of a WTG requires large quantities of steel, and internally require ladders, lighting, elevators, specialized coating, etc.

Southwest Virginia is not in a position to host a wind turbine nacelle, rotor, blade or tower manufacturing facility. Due to its geographic position away from the coast, and due to the scale and mass of these components, it is not feasible to fabricate them in the interior of the Commonwealth and transport them to the coast for staging. However, the region has many companies that could supply high-precision components, mechanical equipment, heating/cooling systems, specialty materials, electrical and auxiliary systems, and secondary steel components. The SWVA region has definite strengths in supporting this package due to the numerous machine shops and mechanical/electrical component suppliers that support the mining industry.

5.3 Balance of Plant Supply

Balance of Plant (BOP) refers to all physical assets that go into an offshore wind farm beyond the WTG, including the transition piece, the foundations, inter-array/export cables, onshore/offshore substations, and other onshore infrastructure. For this package, secondary steel, cable accessories, scour protection, corrosion protection, onshore infrastructure, offshore substation facilities, transportation, etc. are all sought. The greatest number of potential supporting supply chain companies in SWVA falls into the Offshore Substation category with 58 companies identified for potential adjacency, showing strong capabilities in the Foundations (including Transition Piece) and Onshore Infrastructure categories as well. Again, this is a result of the high concentration of machine and welding shops, suppliers of specialty electrical components and equipment, and availability of steel plate/bar. There are no companies with potential adjacency in the export/array cable categories.

5.4 Installation and Commissioning

Installation and Commissioning refers to all onshore construction, ports and logistics operations, installation of all offshore and onshore infrastructure and commissioning activities. As the majority of installation and commissioning work is done either at sea or on the coast, there is limited ability for SWVA to support this package, as reflected in the numbers given in Figure 4.1. There were 25 companies identified with the ability to support Onshore Construction and an additional 12 that could support Ports and Logistics primarily through heavy-lift capabilities, fuel provisioning and transportation services, but the ability of these companies to participate in OSW activities would rely on their being able to relocate to the coast for the duration of their work scope.

5.5 Operations and Maintenance

The Operations and Maintenance (O&M) stage of an offshore wind farm refers to the period after commissioning when the WTGs are generating electricity and transferring it on an ongoing basis to the onshore electrical grid. This stage of an OSW project can last in excess of 25 years. During this phase of the project, in addition to operations related tasks, inspection and maintenance is carried out regularly on all physical assets. Repairs are made as required and services are typically supplied by a nearby O&M hub, therefore SWVA is not well positioned to support this package. There are companies with potential capacities related to O&M activities in the region, but due to the physical distance from the coast it would likely be difficult for such companies to participate directly. Instead, companies could potentially provide support through providing specialized tools and equipment.

5.6 Sector Support

Sector Support refers primarily to services that are in direct support of the OSW farm's project development lifecycle. This includes training and educational institutions, workforce organizations, R&D activities and governmental agencies. The category "Sector Support - Other" is included here to represent business support services such as printing/copying, media and advertising agencies, PPE providers, etc. Sector Support companies have moderate strength in SWVA, demonstrating that if OSW industry work were to commence in the region, support sector services should be sufficient to support and benefit financially from that work.

5.7 Results Summary

Initial research demonstrates that the SWVA region has definite strengths in the production of high-precision components, mechanical equipment, heating/cooling systems, specialty materials, electrical and auxiliary systems, and secondary steel components. It lacks capacity in supporting cable and installation packages, however there is a potential to support cable manufacturing operations in North Carolina, as will be explored further in future work.

Due to the physical distance to the coast, unless companies are willing to relocate, or to travel to support operations, installation and port logistics support is not a focus for SWVA. Now is the time for SWVA to identify potential supply chain companies and prepare them to enter the OSW industry as partnerships formed with OEMs, Tier 1s and Tier 2 suppliers at this stage of industry development will pay dividends into the future as the amount of project activity ramps up.

6 WORKFORCE ANALYSIS

6.1 Job Roles

Supply chain package delineation is unique in the OSW industry. Due to the nascency of the industry job roles in OSW do not always match established North American Industry Classification System (NAICS) or Standard Occupational Classification (SOC) codes. To allow for a more realistic assessment of job requirements in the OSW industry in the SWVA region, this study assesses job functions by supply chain area. By taking a granular approach to job role definition, it is possible to make better estimates on workforce readiness, gauge the timeline for engaging with the workforce, and determine when the greatest number of workers will be required based on project schedule.

Job roles were considered in terms of supply chain elements as given in Table 4.1. The decommissioning and sector support functions were excluded from this list based on timing and relevance, respectively. The industry sectors that are likely to see indirect and induced economic benefits were also considered. A total of 119 distinct job roles were identified in this exercise across the OSW project development life cycle. A full listing of job roles resulting from this exercise is given in Appendix B.

The job roles were then categorized according to area of expertise and minimum duration of training and certification required. The categories and minimum training and certification values are given in Table 4.2.

Category	Minimum Training/Certification/Experience Required
Manager	Formal education/combination of education and experience (5+ years)
Engineer	Engineering degree from university (4+ years)
Scientist	Science degree from university (4+ years)
Other University Degree	University degree other than engineering/science (4+ years)
Support staff	Requires some formal training (2+ years), e.g., admin, HR, etc.
Skilled trade - Specialist	Requires training and apprenticeship plus additional experience or specialization, e.g., senior vessel crew, supervisory roles, etc. (5+ years)
Skilled trade - Standard	Requires training/certification/apprenticeship (1+ years)
Non-skilled labor	Requires no formal training, only on-the-job experience

Table 4.2 - Job Role Categories

6.1.1 Job Categories by Supply Chain Area

The job role categories that were generated are represented in Figure 4-2 to demonstrate in which project stage the various categories of workforce will be required. Here we see that science-based jobs are predominantly required in the project development phase, and that installation and commissioning has the broadest requirements, needing a significant range of skilled and specialist trade workers. The preliminary supply chain analysis established that the greatest opportunity for SWVA companies and hence, workforce, is in the WTG and BOP project packages. As can be seen, workforce in these categories requires a higher percentage of standard skilled trades than the other categories. Where specialist skilled trades are required, it is an indication that additional training or specialization may be required. Note that this representation does not show the volume of jobs that exist in each sector, rather the number of various job roles accounted for in each supply chain area.

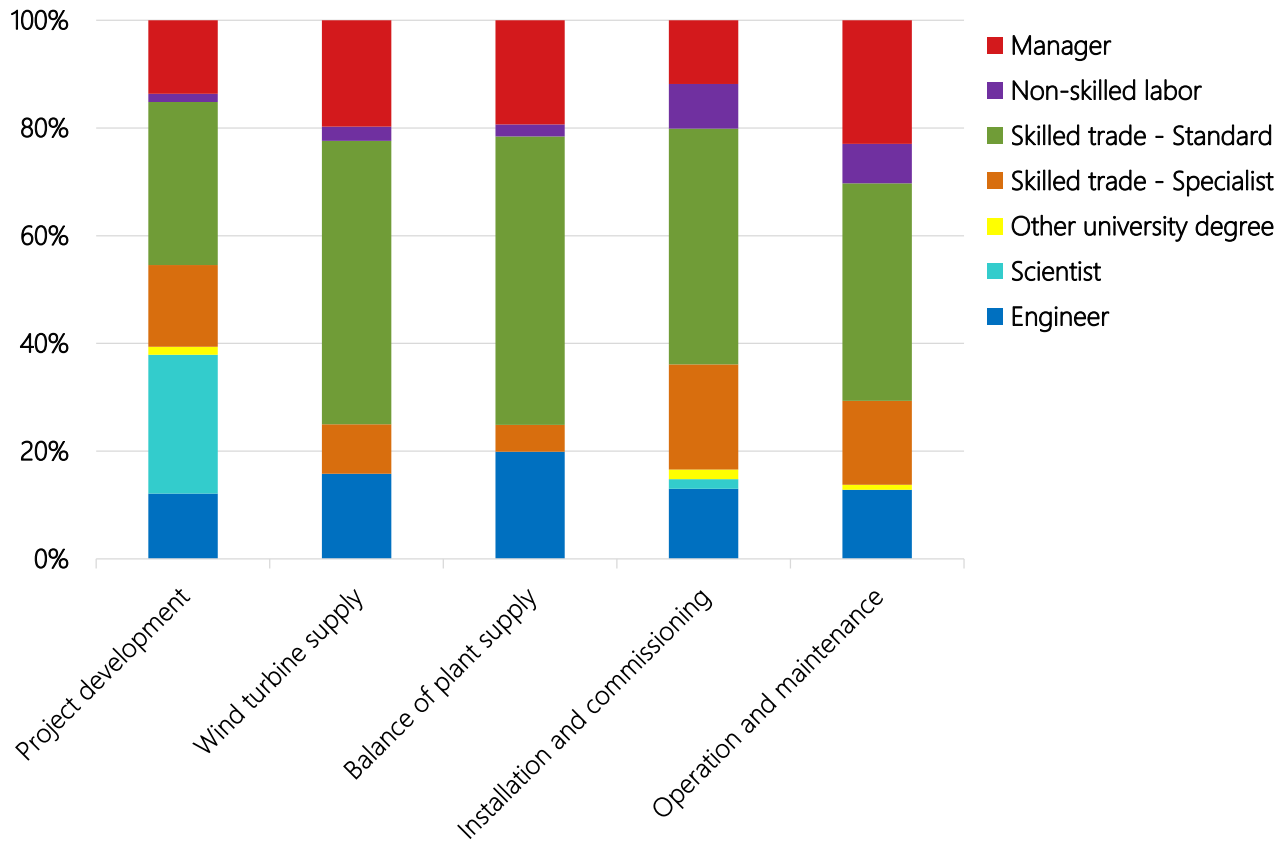

Figure 4-2 Supply Chain Area Job Roles Requirement

6.1.2 Job Categories and Project Timeline

Using the commercial CVOW project as a guide, and assuming that the project will be operational in 2026, the timeline given in Figure 4.3 was established. It is further assumed that the project will be fully commissioned by 2027. The timeline draws no conclusions beyond 2030 as requirements during the operations phase are consistent, and decommissioning is excluded due to its late appearance on the timeline and lack of relevance for the current exercise.

	Project development/manufacturing/installation					Operation				
Supply element	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030+
Development and permitting										
Surveys										
Engineering and design										
Project Management										
Nacelle										
Rotor										
Tower										
Foundation										
Offshore substation										
Onshore substation										
Export cables										
Array cables										
Foundation installation										
Offshore substation installation										
Subsea cable installation										
Turbine installation										
Ports and logistics										
Onshore construction										
Operations										
Turbine inspection and maintenance										
BoP inspection and maintenance										
Port development										

Figure 4.3 - Project Timeline by Supply Chain Element

By taking the cumulative job roles assigned to each supply chain area and applying them to the project timeline, inferences can be made regarding when greatest workforce need will occur. The result of this exercise is shown in Figure 4.4. By considering the minimum duration of training/certification or experience required for each job role, it is then possible to plan a timeline for engagement with workforce and labor organizations to ensure that personnel are available when they will be needed. This mitigates risk related to mismatch in training and job availability, which was identified as a challenge by OEM/Tier 1s. Please note again that Figure 4.4 does not refer to job numbers with respect to volume, but the independent number of job roles identified per supply chain area.

Figure 4.4 shows that the "Skilled trade – Standard" job roles will have broad demand leading up to the operations phase, and peaking at this point. Now is the time for this category of workforce to be identified and adequately trained

for when maximum demand occurs. Further analysis and cross-referencing of job titles, timeline distribution, and training needs would provide additional insights into workforce readiness and preparation.

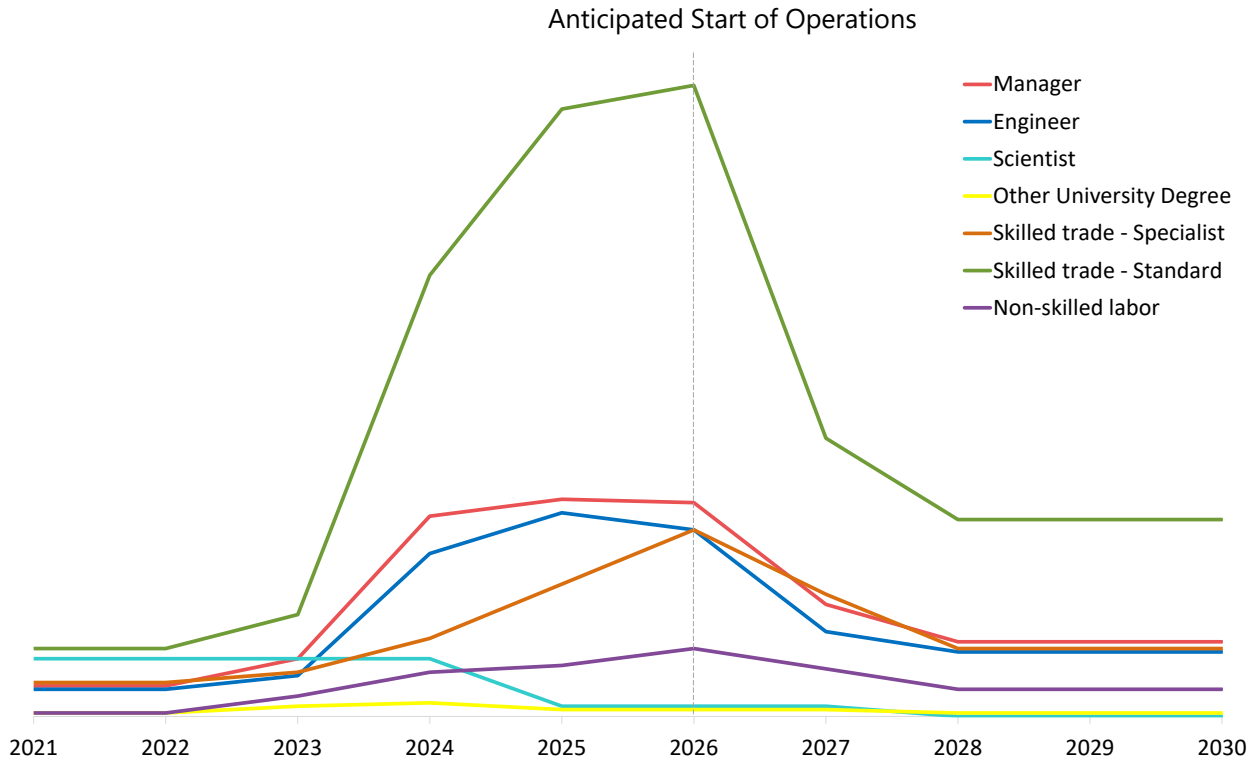

Figure 4.4 - Cumulative Job Roles and Project Timeline

6.2 Existing Workforce

6.2.1 Current Workforce Landscape

Southwest Virginia is rural with the Appalachian Mountains running through the region, resulting in a distributed population.

The natural resources provided by the mountains have made coal mining one of the most lucrative industries in the region, with the industry targeting both thermal and metallurgical coal. The coal produced in the region is generally of high quality, meaning low-sulfur and low-ash content, resulting in between one-third and one-half of SWVA's coal production being used in steelmaking[1]. Declining reserves, increasing competition from lower-cost, western-US coal producers and cheaper natural gas, paired with federal government decarbonization efforts have resulted in a

[1] *Virginia Coal | vept.energy | Virginia Tech (vt.edu)*

major contraction in the industry. Many mining firms have moved to increase automation and technological advances in extraction which have served to limit the needed workforce in the industry. In 2012 there were 96 mines in SWVA producing approximately 19 million short tons of coal. In 2019, the tonnage dropped to 12.3 million short tons—a reduction of approximately 35%.

One major impact of the coal mining industry in the region, paired with a strong agricultural sector, is a regional strength in manufacturing and heavy-industry technology. The key sectors in SWVA are advanced manufacturing, food and beverage manufacturing, energy, and information technology. Advanced manufacturing is defined here as a combination of four sectors:

1) Chemical manufacturing,
2) Transportation equipment manufacturing,
3) Plastics and rubber products manufacturing, and
4) Electrical equipment, appliance, and component manufacturing

The advanced manufacturing sector provides above average wages and accounts for a significant share of regional employment. According to GO Virginia Region One (2021) statistics, the following is observed:

- 12.1% of workforce in manufacturing
- 5.1% of workforce in construction
- 3.3% of population in transportation/warehousing

While a decline of about 2,500 manufacturing jobs is anticipated in the next decade, over 12,000 jobs in the sector will need to be filled due to attrition. Due to above average wages, relative regional strengths, and export potential, advanced manufacturing has been highlighted as a target by economic developers for expansion and attraction of target industries.

6.2.2 Labor Shed Analysis

A region's labor shed reflects the geographic area from which firms attract their workers. Consequently, when attracting firms to the region it is important to include the skills of all potential workers even if they reside outside the region. Compared to the population of SWVA, the SWVA labor shed's population is more than three times larger, is continually growing, and has generally higher educational attainment. All localities in the labor shed have at least a combination of 600 people commuting to or from SWVA. In this section, labor shed workforce statistics are compared to GO VA Region 1 statistics to ensure an accurate representation of available workforce is presented. The labor shed considered in this analysis is comprised of the following localities, shown in Figure 4.5:

- City of Roanoke, Virginia
- City of Salem, Virginia
- Hawkins County, Tennessee
- Mercer County, West Virginia
- Montgomery County, Virginia
- Pike County, Kentucky

- Pulaski County, Virginia
- Radford City, Virginia
- Roanoke County, Virginia
- Sullivan County, Tennessee
- Surry County, North Carolina
- Washington County, Tennessee

Figure 4.5 - Labor Shed Region Considered in this Report

The term location quotient (LQ) measures the degree to which an industry is concentrated or specialized in a region relative to the nation and is calculated by taking the ratio of the share of an industry's employment in a region to that same industry's share nationally. This measure can help assess to what degree clustering, or a geographic concentration of interrelated industries, occur. According to the GO VA Region 1 Quantitative Data Analysis (2021), an LQ of greater than 1.25 indicates that an industry cluster possesses a competitive advantage making it easier to attract like firms to the region. This is because suppliers, skilled labor and training providers are more likely to reside in the area, allowing for logistical benefits and cost efficiencies. The advanced manufacturing industry was given an LQ of 1.44 overall in Q1 2021.

A snapshot of LQs for various industry clusters that are relevant to the OSW industry in SWVA is given in Table 4.3 (industry clusters listed are defined in Appendix B). Looking at the labor shed region, both chemical and electric/electronics manufacturing show a competitive advantage with respect to attracting like businesses to the region. Other industry clusters relevant to OSW do not exhibit such an advantage, demonstrating that it may be more difficult to attract similar operations to the region based on cluster-related benefits alone.

INDUSTRY GROUP	LQ (GO VA REGION 1)	LQ (GO VA REGION 1 LABOR SHED)
Chemical	2.02	3.48
Electric/Electronics Mfg.	1.10	1.31
Machinery Mfg.	0.96	0.77

INDUSTRY GROUP	LQ (GO VA REGION 1)	LQ (GO VA REGION 1 LABOR SHED)
Metal & Product Mfg.	0.93	1.15
Construction	0.89	0.92
Freight Tran.	0.86	0.97

Table 4.3 - GO VA Region 1 Industry Clusters with Location Quotient, Q1 2021

An indicator of ample availability of workforce for a given occupation is a ratio of at least 50:1 of potential candidates (both employed and unemployed) to new employer demand. Extended employment considers the number of individuals in alternative occupations that could be trained for an occupation that has a gap in workforce availability, in addition to new graduates that possess the required skills. The Regional and Workforce Ratios given in Table 4.4 are defined as follows:

$$Region\ 1\ Ratio = \frac{Regional\ Employed + Regional\ Unemployed}{New\ Employer\ Demand}$$

$$Labor\ Shed\ Ratio = \frac{Local\ Workforce\ Employed + Local\ Workforce\ Unemployed}{New\ Employer\ Demand}$$

Some of the key occupations for offshore wind from each sector of advanced manufacturing are show in Table 4.4 using these standard industry measures for workforce availability. When ratios are highlighted green it indicates that that there is sufficient availability to support the occupation. If ratios are highlighted red that demonstrates that current levels are insufficient to support the given occupation.

While Table 4.4 shows that there is a potential workforce availability gap for GO VA Region 1 for a number of occupations (highlighted in red), when the labor shed region is considered, there appears to be adequate workforce supply. All other occupations in the advanced manufacturing sector related to OSW that were included in the GO VA analysis showed adequate workforce availability as well; however, note that only a selection of occupations is shown in Table 4.4.

TITLE	ADVANCED MANUFAC. SECTOR	NEW EMPLOYER DEMAND	REGION 1 EMPL.	REGION 1 LABOR SHED EMPL.	REGION 1 UNEMP.	LABOR SHED UNEMP.	REGION 1 AVG WAGE	REGION 1 EMPL.	REGION 1 RATIO	LABOR SHED RATIO
Welders, Cutters, Solderers and Brazers	Transportation Equipment Manufacturing	4	636	1,670	59	159	$38,800	5,368	174	457
Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	Plastics and Rubber Products Manufacturing	11	266	743	11	32	$35,700	671	25	70
Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	Plastics and Rubber Products Manufacturing	5	111	344	8	27	$37,500	65	24	74
Electrical, Electronic, and Electromechanical	Electrical Equipment, Appliance,	19	326	1,253	14	55	$34,600	64	18	69

TITLE	ADVANCED MANUFAC. SECTOR	NEW EMPLOYER DEMAND	REGION 1 EMPL.	REGION 1 LABOR SHED EMPL.	REGION 1 UNEMP.	LABOR SHED UNEMP.	REGION 1 AVG WAGE	REGION 1 EMPL.	REGION 1 RATIO	LABOR SHED RATIO
Assemblers, Except Coil Winders, Tapers, and Finishers	and Component Manufacturing									
Machinists	Electrical Equipment, Appliance, and Component Manufacturing	3	355	1,190	22	77	$41,000	1,348	126	422
Electrical and Electronic Engineering Technologists and Technicians	Electrical Equipment, Appliance, and Component Manufacturing	2	128	472	7	27	$58,900	806	68	250

Table 4.4 - Condensed Table of Advanced Manufacturing Employment Demand

There are a number of occupations with high applicability in the manufacturing sector that have been identified as having a high potential for ex-coal miners. These jobs offer similar or higher wages than in the coal industry and the required training is available in the region. The top ten occupations identified by GO VA for Region 1 are given in Table 4.5.

Manufacturing Occupations that Transfer from Prevalent Coal Mining Jobs in the GO VA Region 1 Labor Shed					
		Current		Forecast Over the Next 10 Years	
SOC	Title	Employment 2021Q1	Avg. Annual Wages 2020	Total Separations	Total Growth Demand
51-1011	First-Line Supervisors of Production and Operating Workers	2,982	$64,600	2,922	-236
51-4121	Welders, Cutters, Solderers, and Brazers	1732	$41,000	1,837	-118
17-3023	Electrical and Electronic Engineering Technologists and Technicians	473	$58,800	442	-35
49-9043	Maintenance Workers, Machinery	426	$51,800	380	-16
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	205	$41,500	212	-26
51-4051	Metal-Refining Furnace Operators and Tenders	52	$43,700	60	-3
51-4052	Pourers and Casters, Metal	27	$40,500	30	-4
Source: JobsEQ Note: occupation wages should be taken as the average for all covered employment					

Table 4.5 - High-potential Occupations for Ex-coal Miners in Manufacturing Sector (GO VA Region 1 Quantitative Economic Workforce Data Analysis, 2021)

All jobs listed in Table 4.5 have direct applicability in supporting the OSW industry. While the table shows growth demand is anticipated to be negative over the next ten years, many of the current jobs in these sectors will continue to employ locals due to attrition, while efforts to grow the manufacturing sector in the region—including efforts to attract OSW industry manufacturing—will serve to increase demand.

6.2.3 Training and Educational Institutions

There are a variety of training and educational institutions in the SWVA region providing various levels of certification that are applicable to the OSW industry. A full listing of these institutions, including their relevant offerings, the number of certifications awarded per year are given in Appendix D. A map of where these institutions are located is given in Figure 4.6.

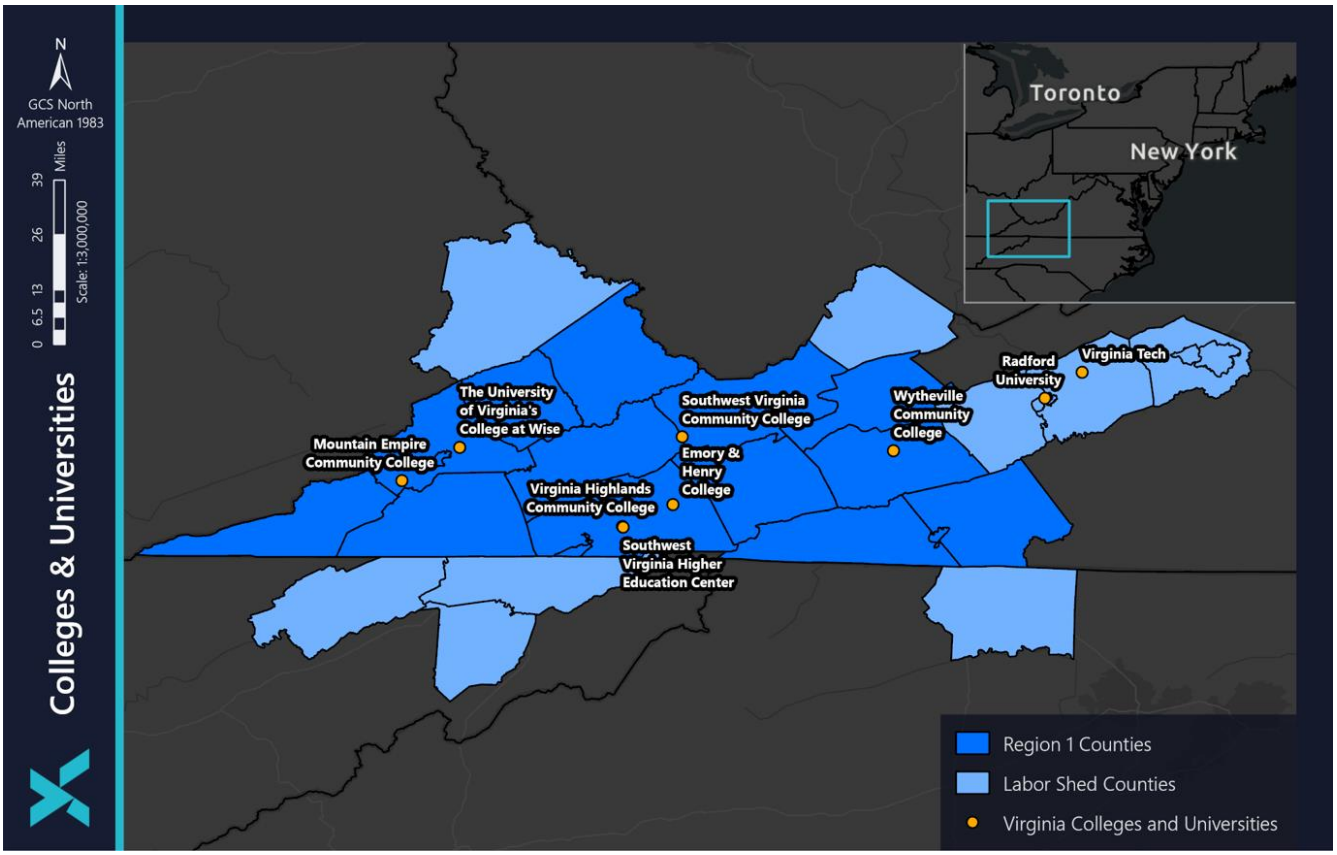

Figure 4.6 - Academic Institutions in SWVA

The academic institutions in the region serve to form a strong network to support training and growth of workforce development of manufacturing to support the OSW industry. An example of this is the Southwest Virginia Higher Education Center in Abingdon, the first multi-college and university institution in the Commonwealth, which provides a number of educational options as well as a shared campus that also acts as a meeting and event space.

While engineers and project managers are required in the OSW supply chain pipeline, the majority of occupations in advanced manufacturing and in OSW project development are in the trades. Community colleges are most applicable to support growth in the OSW sector in the region. Mountain Empire Community College, Virginia Highlands Community College, Southwest Virginia Community College, and Wytheville Community College all have strong programs to support manufacturing for OSW. Combined, their graduates earned 1440 certifications and 1107 associates degrees in fields like Industrial Technology and Precision Machining, among others, in the 2019-2020 academic year.

Based on the number of academic institutions in the region and the programs they offer, there will be a continuous flow of new graduates capable of supporting advanced manufacturing in the region. With almost 34,000 certifications awarded in the 2019-2020 academic year, the region's education system is capable of supporting economic growth, and is particularly well suited to support advanced manufacturing.

7 WILLINGNESS ASSESSMENT

A survey campaign was carried out amongst companies located in SWVA by BW Research Partnership to determine their current capabilities and their level of willingness to enter the OSW industry. A total of 19 companies responded, although not all companies answered all questions. While this represents a small sample size, some inferences are still able to be made. The full survey including the results is available in Appendix E.

Of the companies that responded to the survey 83.7% said they were not yet involved with OSW related work while 21.1% said that they were. When asked to select their industry sector, 44.4% stated their company is part of "Manufacturing and Fabrication Services" offering services in blasting, machining, mechanical components, milling, welding, coating, electrical components/electronics, painting and rolling. Approximately 16.7% of companies said they were engaged in "Construction and Logistics Management," while the same percentage said they were in the "Professional and Consulting Services" category. This confirms that the survey reached companies in industries capable of supporting secondary component manufacturing in OSW. Of particular note, 71.4% of companies that responded signaled that they have excess production capacity, meaning they would be able to scale up operations with additional investments of capital, with 40% of those stating they could double current production levels even without additional capital investment.

The responses to several of the survey questions is presented in Table 4.6. While 50% of respondents were uncertain about the potential economic opportunity presented by OSW, 56.3% were interested in the opportunity. While only 38.5% of companies said their current product/service offering could serve OSW, the same percentage stated that they did not agree or disagree, that they did not know, or that the question was not applicable. This appears to highlight that details of the opportunity presented in OSW are not clearly understood.

With regards to workforce 46.2% of respondents said their staff would need additional training to support OSW, while 30.8% said they would not. A majority of companies surveyed felt there was sufficient local talent to support growth into this industry. These responses indicate that that the companies surveyed do not anticipate workforce related challenges if they were to expand and/or pivot their operations to support the OSW industry, but that there may be a need for some degree of additional training. When asked if there was sufficient market demand to grow a profitable business in OSW, 62.5% of companies agreed, while only 12.5% disagreed. The combined results signal that while the opportunity for supplying the OSW industry may not be fully understood with respect to which components are required, there is faith that the industry has the potential to create financial growth for companies seeking to enter.

	STRONGLY AGREE	SOMEWHAT AGREE	NEITHER AGREE NOR DISAGREE	SOMEWHAT DISAGREE	STRONGLY DISAGREE	DK/NA
A. Our company is uncertain about the potential economic opportunity that offshore wind presents	37.5%	12.5%	12.5%	12.5%	12.5%	12.5%
B. We are interested in the opportunity offshore wind presents for our business.	37.5%	18.8%	37.5%	0.0%	0.0%	6.3%
C. Our current offering of goods and/or services can be used by the offshore wind industry.	38.5%	0.0%	23.1%	7.7%	15.4%	15.4%
D. Our company would need to make significant capital investments to serve the OSW industry.	7.7%	15.4%	30.8%	7.7%	23.1%	15.4%
E. Our staff would need additional training to serve the OSW industry.	23.1%	23.1%	15.4%	15.4%	15.4%	7.7%
F. There is sufficient local qualified talent to grow a profitable business in the OSW industry.	31.3%	25.0%	25.0%	0.0%	0.0%	18.8%
G. There is sufficient market demand to grow a profitable business in the OSW industry.	37.5%	25.0%	12.5%	12.5%	0.0%	12.5%

Table 4.6 - Company Interest in Participating in OSW Supply Chain (BW Research Partnership)

8 DISCUSSION AND OBSERVATIONS

The decline of the coal industry in Virginia's southwest region has had a negative impact on local employment and the distributed population means that there is no clearly defined industrial center. The pandemic has exacerbated industrial decline as jobs in the manufacturing sector were lost due to shuttered businesses and further declining demand. Young worker retention has also been signaled as a point of concern.

However, the long history of coal mining and agriculture in SWVA has resulted in a higher than average number of companies specialized in advanced manufacturing operations, including high-precision manufacturing and electrical component production, both of which could support the growing OSW industry in VA and beyond. A classification and analysis exercise of existing companies in the region highlighted particularly strong capabilities in supporting the WTG and BOP scopes in the OSW project development lifecycle.

SWVA is inland, and hence not an obvious choice for providing support to an offshore industry; however, strengths in advanced manufacturing give the region a number of competitive advantages, including below average industrial electricity rates, competitive wages in relevant trades, a transportation system directly serving the coast, and a strong supporting workforce. VA is home to a number of US firsts: the highest capacity commercial-scale wind project currently planned, a Jones Act compliant WTIV, and a WTG blade finishing plant. While being away from the coast means that SWVA cannot fabricate major OSW components (E.g., nacelles, towers, blades, etc.), it is ideally positioned to contribute local content to the CVOW project through leveraging its existing strengths in secondary component manufacturing. While CVOW/VA's local content regulations are not as strict as other jurisdictions, maximizing local content is important for public support of OSW, and serves to create supply chain efficiencies and lower costs over the long term.

Location quotient analysis shows that while there is a concentration of advanced manufacturing in the region, there is no evidence of geographical clustering, making it more likely to attract like businesses. While this is a weakness of the region, there are several major companies that could expand their operations into OSW, and many smaller companies that could provide supporting operations to establish the region as a hub of OSW secondary component manufacturing activity. Attracting a major OSW player to the region and/or identifying an existing SWVA company to act as an anchor would have a similar impact on clustering and would also serve to provide additional revenue streams to other companies. It is well established that like businesses often co-locate in order to benefit from economies of scale and improved logistics.

There are quite a few educational and training institutions in the region, supplying over 36,000 certifications in 2020. With respect to workforce availability, ratios comparing potential candidate supply versus demand considering both SWVA and its labor shed indicate that there is sufficient workforce to support such a focus. GO VA has identified advanced manufacturing as a target for development in the region due to higher than average wages and regional strengths. Where labor shortfalls exist, the training facilities in the region are sufficient to fill the gaps, offering programs in all required fields needed to support the recommended target operations.

The SWVA region has the companies, capabilities, and workforce required to support the OSW industry, however it was necessary to understand the level of willingness of companies to make this move. Following the survey campaign by BW Research Partnership it was determined that a strong majority of companies are interested in the industry and offer goods and services that can be used in OSW. Furthermore, 80% of companies indicated that they have additional capacity that could be filled by operations supporting OSW. This survey also demonstrated a lack of knowledge surrounding the opportunities presented in OSW, highlighting the need to provide education and increased awareness.

While advanced manufacturing operations supporting secondary component manufacturing in the OSW region represent a tangible opportunity for economic growth in SWVA, there are challenges. Framing the region as an ideal location to support OSW is not a clear narrative, and hence must be carefully strategized. There are many economic development organizations in SWVA that will need to band together in support of this new industry, and several have indicated that only a "home-grown" approach will yield traction in the region. Unpredictable global geopolitical/economic forces and the potential for skepticism among the local workforce mean that in order for SWVA to be successful in growing this industry, correct regional positioning will be critical. Building partnerships, leveraging existing connections, and forging new ones are essential to make use of best practices, ensure public support, and build momentum.

While the CVOW and Kitty Hawk projects represent a sizeable market for secondary components manufactured in SWVA, there are significant export opportunities to serve the rapidly expanding east coast OSW industry. Being a signatory of the tri-state SMART-POWER MOU would further position and promote SWVA products within the OSW market. Demonstrating these competitive advantages and representing the scale of this opportunity will help to unlock significant funding and investment in transitioning into this industry. The formation of partnerships and joint development activities will serve to increase the amount of funding that can be attained. Growth in support of OSW in SWVA will have other knock-on effects as well, likely leading to an increase of workers commuting to the region and stimulating the economy in other ways. The proliferation of OSW in the US will increase the demand for domestically produced steel and hence metallurgical coal, the primary type of coal mined in SWVA. Finally, diversification into the OSW industry will send positive signals to SWVA and young workers and students in the area. It will demonstrate that the region is open to new opportunities and is not constrained to rely only on historical industries, creating a sense of hope for the future and potentially increasing youth retention.

9 RECOMMENDATIONS

The following recommendations provide opportunities for Southwest Virginia to act on becoming part of the OSW supply chain in Virginia and beyond. The region is very well positioned to support secondary component manufacturing operations in support of OSW, particularly in the WTG and BOP packages. The region has extensive capability in high-precision manufacturing, electric/electronic component manufacturing, machinery manufacturing, machining, and support activities. It has been determined that there is sufficient workforce and ample training opportunities to grow the advanced manufacturing space, and that this sector is a focus of economic growth for the region.

However, it has also been ascertained that attracting OSW secondary manufacturing operations to the region will require deliberate actions and focus as it is not obvious, especially given the nascent nature of the industry in the US, that inland regions can provide such support to what is considered an offshore industry. As a result, Xodus offers a number of recommendations to aid in economic growth in the region resulting from activities in support of the OSW industry. These recommendations will require funding and resources to implement, as well as additional strategic planning, and are presented in order of priority starting with the highest. It is not required for all recommendations to be fully implemented, but to guide intention and action as additional strategic planning is undertaken.

9.1.1 Supply Chain: Establish a Major Tier 2/3 OSW Supplier

SWVA possesses a wealth of companies that can support the WTG and BOP packages in OSW project development. It is a well-established observation that when an "anchor" company establishes itself in an area, similar and supporting companies are likely to cluster in that region to benefit from logistical and cost economies. Bolstered by the fact that advanced manufacturing is a target growth industry of GO Virginia, the development of OSW in the Commonwealth provides a unique opportunity to highlight the competitive advantages of SWVA to establish a more robust advanced manufacturing cluster in the region.

While OEMs and Tier 1 suppliers are not a target for the region given the distance from the port, Tier 2 and Tier 3 suppliers that directly support their operations would be the ideal target for attraction/development efforts. Given the region's concentration of advanced manufacturing activities and a transportation sector that readily serves the coast, the case can easily be made for a Tier 2 or Tier 3 company to locate to the region. As SGRE is already building a blade finishing facility in Portsmouth, VA targeting the WTG sector for manufacturing support is a good first approach. Establishing relationships with other major suppliers for CVOW will identify other high potential companies that may consider locating in the region.

Additionally, there are a number of large-scale industrial and manufacturing operations that already exist in the region that could add OSW to the list of industries they service, becoming a major industry player and similarly stimulating the formation of an OSW advanced manufacturing cluster in the SWVA. A central positioning entity (see point 9.1.5) could work closely with any company identified having this potential to assist in their market entry activities and help to facilitate development efforts.

Outcome: Having an anchor manufacturer in the region will help SWVA to establish itself as a hub for secondary manufacturing operations in OSW for VA and beyond. Once manufacturing begins in the region, local companies will then be able to support these operations in turn, building a cluster of OSW operations in the region.

Timeline: Q3 2023

9.1.2 Workforce: Formalize Collaboration between Local Community Colleges on OSW

The SWVA region has a number of community colleges and educational institutions that offer programs that are needed in the advanced manufacturing sector. As demonstrated in Figure 4.4, now is the time to begin assessing the workforce in the region to prepare for a potential increase in advanced manufacturing jobs, given that most require at least one year of formal education plus some duration of on-the-job training. Given that construction for the commercial CVOW project is slated to begin in 2024, and that the demand for skilled/specialized and non-skilled labor will be ramping up starting in 2023, training institutions must begin to assess their readiness and begin to prepare to support OSW industry development.

In order to approach workforce development in an efficient way that makes best use of resources and avoids duplication of efforts, it is recommended that four of the region's top community colleges formally commit to collaboration on workforce readiness in support of OSW advanced manufacturing. Given the nature of the programs they offer, including Industrial Technology, Precision Manufacturing, Welding, etc., the following community colleges have been identified as good candidates for such an agreement:

- Mountain Empire Community College
- Southwest Virginia Community College
- Virginia Highlands Community College
- Wytheville Community College

It is recommended that this collaboration is formalized by jointly signing a memorandum of understanding (MOU) committing to promote, develop and expand the training and development of workforce to support an OSW manufacturing sector in SWVA. Together, these institutions will be able to meet with industry groups/top tier OSW companies to ascertain workforce skill and timeline requirements, then determine how best to support such developments in the region through upskilling, program development and allocation of grants/industrial investment funds.

Outcome: Formally establishing a collaborative approach to workforce development will not only ensure that workforce needs will be met with a sense of urgency but will send strong market signals to the OSW industry that the region is serious about attracting advanced manufacturing operations to the region. These signals will serve to lower risk levels for potential private investment in the region and will strengthen the competitiveness of SWVA in attracting manufacturing companies. This will also provide a valuable sign to workforce that they are supported and that this opportunity is real given potential scepticism surrounding the industry.

Timeline: MOU signed by Q2, 2022

9.1.3 Supply Chain: Formal Partnership with Hampton Roads Alliance

The Hampton Roads Alliance (HRA) has been making significant progress in building the OSW supply chain in Virginia. They established the Offshore Wind Landing at their office in Norfolk and they were instrumental in efforts to attract a major OEM to the region (SGRE). A formal partnership with HRA would help to put SWVA on the map with respect to OSW activities in the Commonwealth and would allow for the central organization to leverage their network of major OSW industry players. The relationship would be mutually beneficial as HRA could promote the competitive advantages of SWVA to companies looking to break into VA's OSW market, and would assist in creating local content, which is a major goal for the industry. This would also provide for a collaborative approach to developing consistent messaging on the industry across the state, and would limit duplicative activities, as well as allowing organizations to partner on funding opportunities. This partnership could eventually assist in leveraging the SMART-POWER MOU between Virginia, Maryland and North Carolina, expanding the market potential for products manufactured in SWVA. Finally, partnering with HRA allows the central organization to access additional funding streams.

Outcome: Partnering with HRA would add legitimacy to the development efforts in SWVA as they are well-known in the OSW industry across the eastern seaboard. The central organization would benefit from best practices and lessons learned, saving time and energy in building up the advanced manufacturing sector in SWVA in support of OSW.

Timeline: Q3 2022

9.1.4 Workforce: Coordinated Approach to Regional Retention of Youth

SWVA has been grappling with the challenge of a reliance upon one primary industry, the change in which has resulted in wage decline and the out-migration of youth. This generation does not see a future for itself in the region for various reasons. This has the compounded impact of limiting the ability of the region to thrive in the future as a "brain-drain" and lack of young workforce limits the ability of companies both to start up or establish operations in the region. Integrating OSW activities in the SWVA region has the potential to send a strong message to the youth of the region: SWVA is future-facing and in a position to diversify industrially.

A collaboration among academic, business, government and regulatory partners, led by the central organization, focused on highlighting the advantages of a career in OSW, should incorporate the following logic:

- Signal a modernization of business activities to youth in the region, incorporating renewables into legacy energy strengths.
- Demonstrate the ability of SWVA to contribute meaningfully to improving domestic energy security.
- Highlight the relatively high wages available in the OSW industry especially as competitive with coal industry wages.

- Discuss how OSW proliferation increases demand for metallurgical coke, having knock-on positive effects on the region's economic growth.
- Give an overview of what jobs will be available, what the training requirements/timelines are for those jobs, and what support is available to youth in a path towards OSW job obtention.

Outcome: This is a positioning effort that aims to increase youth workforce retention in the SWVA region while priming these workers and other stakeholders to support advanced manufacturing in the OSW industry. The goal is to create enthusiasm and excitement around the future of the region while providing clear direction to this demographic on how to use its strengths to capitalize on these opportunities.

Timeline: Q1 2023

9.1.5 Positioning: Central Organization to Coalesce OSW Business Development Efforts in Southwest Virginia

In order for SWVA to realize the full economic development potential inherent in the US OSW industry, it is essential that an organizing body be assigned to provide central coordination and oversight of development activities. The attraction of OSW industry investment and attention must be deliberate and targeted, which will require an organization to act as a clearinghouse, establishing strategic priorities and implementing action plans. This organization will be a central point of contact for industry building activities and fielding inquiries and will have a broad enough network to be able to respond in a timely and productive manner. An example of one such organization is the Offshore Wind branch of the Hampton Roads Alliance, which has been instrumental in growing the industry in their region. The body recommended to take on this role in the SWVA region is InvestSWVA.

While one major role of the central organization is coordination, another incredibly important role will be strategic positioning and shaping the messaging around OSW industry growth in SWVA. The following initiatives should be carried out in promoting OSW within the region, and promoting the region to the OSW industry:

- Positioning Plan: Establishing the rationale and consistent messaging around the opportunities in OSW in the region will be essential in obtaining public support, and in identifying and attracting potential new business entrants in the region. This plan will need to consider both internal and external audiences and communicating and promoting to each of them. This plan will serve as a reference document on themes and messaging in the industry.

  For the local audience, messaging should address local concerns and skepticism (E.g. renewable energy is a fleeting industry, it will destroy what is left of coal mining in SWVA) and identifying positive outcomes (E.g. many of the skill sets used in advanced manufacturing of OSW already exist in the region and wages are either on par or higher than coal mining jobs; OSW will drive demand for metallurgical coke which is the predominant type of coal mined in VA). For the external business audience, it will focus on the strengths and competitive advantages of the region. These themes will be repeated frequently and in consistent language in communication.

  A robust and targeted campaign will need to amplify the communications plan so that all major stakeholder groups are included. This would likely include a website, social media presence, newsletter, etc.

- Meet the Buyer Events: The central organization would host or facilitate one-on-one meetings between top tier suppliers and local potential supply chain entrants to build awareness of opportunities in OSW and existing capabilities in the region. These events are commonplace in the industry and serve to make important and meaningful business connections. The central organization is recommended to leverage the experience of other organizations with experience in hosting such events, but it is essential that the event take place in the SWVA region.
- Asset Inventory: It is recommended that a list of existing land/industrial facilities (green and brown-field, office space, etc.) with details on size, physical infrastructure and transportation options be compiled with the intention of promoting the region to potential new entrants. This would be a comprehensive list of the relevant infrastructure across all counties in SWVA.

Outcome: A central organization acting as a clearinghouse for OSW development in SWVA will ensure that efforts are streamlined, and will make it easier for potential industry entrants to get the information they need quickly and easily. This will also allow for facilitated introductions, intentional network building and consistent messaging. This signals to the industry that the region is serious about OSW development and demonstrates a level of professionalism and interest that will accelerate industry growth.

Timeline: Q1 2022 for designation of central organization leading charge in OSW economic development. This organization can then determine the timeline and strategic priorities for additional initiatives.

APPENDIX A SOUTHWEST VIRGINIA COMPANIES WITH OFFSHORE WIND TAXONOMY APPLIED

Company	Town/City	State	OSW Taxonomy
A&A Security Service	Norton	VA	Sector Support
ABB Inc	Roanoke	VA	Electrical and Auxillary Systems, Nacelle, Tower, Rotor, Offshore Substation, Onshore Infrastucture
ABB Inc	Bland		Electrical and Auxillary Systems, Nacelle, Tower, Rotor, Offshore Substation, Onshore Infrastucture
Allegheny Brokerage Company	Dublin	VA	Operations, Ports and Logistics
AMR Pemco	Rocky Gap	VA	Electrical and Auxillary Systems, Nacelle, Tower, Rotor, Offshore Substation, Onshore Infrastucture
AMR Pemco	Bluefield	VA	Electrical and Auxillary Systems, Nacelle, Tower, Rotor, Offshore Substation, Onshore Infrastucture
Appalachian Council for Innovation	Norton	VA	Trades Labor and Workforce Organizations
Appalachian Environmental Resources	Johnson City	TN	Educational Institution/Training Provider, Development and Permitting, Decommissioning, Operations
AQ Transformer Solutions Inc	Wytheville	VA	Offshore Substation Installation, Turbine Installation, Turbine Inspection and Maintenance, BOP Inspection and Maintenance, Electrical and Auxillary Systems
Atsumi Car Equipment, Inc.	Wytheville	VA	Operations
B.A. Bartlett INC. AireServ	Wise	VA	Nacelle, Onshore Infrastucture, Offshore Substation
Ball Construction Company	Norton	VA	Onshore Construction
Barker Microfarads	Hillsville	VA	Electrical and Auxillary Systems, Offshore Substation, Onshore Infrastucture
Becker Global	Bristol	VA	Nacelle, Tower, Foundations
Belcher Insurance Agency of Wise Co.	Norton	VA	Project Management
Better Air Heating & Cooling	Appalachia	VA	Nacelle, Onshore Infrastucture, Offshore Substation
BolWell Financial Consultants, Ltd.	Norton	VA	Project Management
Brown Edwards & Company, L.L.P.	Bristol	VA	Project Management
Buchanan Pump Services & Supply Co.	Pound	VA	Ports and Logistics, Operations, BOP Inspection and Maintenance
Card Isle	Blacksburg	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
Ceramic Technology, Inc.	Cedar Bluff	VA	Tower, Foundations, Offshore Substation, BOP Inspection and Maintenance
CGI Russell County	Lebanon	VA	Sector Support
Charlatte America	Bluefield	VA	Ports and Logistics, Onshore Construction
City of Norton	Norton	VA	Government Agencies
Clarke Precision Machine	Wytheville	VA	Tower, Foundations, Offshore Substation, BOP Inspection and Maintenance
Clerk of the Court	Wise	VA	Government Agencies
Coalfield Services, Inc.	Wytheville	VA	Ports and Logistics, Onshore Construction
Coger Manufacturing	Pearisburg	VA	Tower, Foundations, Offshore Substation, BOP Inspection and Maintenance
Consolidated Steel, Inc.	Cedar Bluff	VA	BOP Inspection and Maintenance, Ports and Logistics
Coperion	Wytheville	VA	Operations
County of Wise	Wise	VA	Government Agencies
Crossroads Institute	Galax	VA	Sector Support
CSE Insurance Agency	Wise	VA	Project Management
Cumberland Airport Commission	Wise	VA	Government Agencies
Custom Manufacturing Services/East River Metals	Princeton	WV	Tower, Foundations, Offshore Substation
Darco Southern, Inc.	Independence	VA	Nacelle, Rotor
Dickenson County Board Of Supervisors	Clintwood	VA	Government Agencies
Dominion Aquaculture Tazewell County			Ports and Logistics, Operations
Dominion (VA City Hybrid Energy)	Glen Allen	VA	Project Management, Operations
Eastern Kentucky University Regional Campuses	Corbin KY	VA	Educational Institution/Training Provider
Eastman Credit Union	Kingsport TN	VA	Project Management
Edward Jones Investments	Pennington Gap	VA	Project Management
Electro-Mechanical Corporation	Bristol	VA	Engineering & Design, Electrical and Auxillary Systems, Onshore Infrastucture, Offshore Substation
Emisshield, Inc	Blacksburg	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation
Emory & Henry College	Emory	VA	Educational Institution/Training Provider
Engineering Services, Inc.	Wise	VA	Engineering & Design
Environmental Monitoring, Inc.	Norton	VA	Project Management, BOP Inspection and Maintenance, Turbine Inspection and Maintenance, Operations, Decommissioning
Fat Glass Productions	Pound	VA	Sector Support
Federal Pacific	Bristol	VA	Engineering & Design, Electrical and Auxillary Systems, Onshore Infrastucture, Offshore Substation
Fig Enterprises, LLC	Wise	VA	Sector Support
First Bank & Trust Company	Norton	VA	Project Management
Flatwoods Job Corps Center	Coeburn	VA	Educational Institution/Training Provider
Fort Chiswell Machine Tool Products, Inc.	Max Meadows	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation
Funk Drilling	Coeburn	VA	Operations
Gap Development Corp	Big Stone Gap	VA	Sector Support
General Dynamics Mission Systems	Marion	VA	Rotor
General Engineering Company	Abingdon	VA	Nacelle, Rotor
Hansen Turbine	Galax	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation
Hapco	Abingdon	VA	Tower, Foundations, Offshore Substation
HCE System, Inc.	Norton	VA	Offshore Substation Installation, Turbine Installation, Turbine Inspection and Maintenance, BOP Inspection and Maintenance, Electrical and Auxillary Systems, Onshore Infrastucture, Offshore Substation
Heritage TV	Norton	VA	Sector Support
Hitachi Energy Inc.	Bland	VA	Electrical and Auxillary Systems, Nacelle, Tower, Rotor, Offshore Substation, Onshore Infrastucture

Hollingsworth & Vose Company	Floyd	VA	Electrical and Auxillary Systems, Offshore Substation, Onshore Infrastucture, Onshore Construction, Nacelle, Rotor
Humphreys Enterprises (was Greater Wise)	Norton	VA	Project Management
Hurberries, Inc.	Coeburn	VA	Nacelle, Rotor
Hutchinson Sealing Systems	Wytheville	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation
Impressions	Wise	VA	Sector Support
Inmotion US, LLC	Blacksburg	VA	Nacelle, Rotor, Onshore Construction
Innovative Graphics & Design, Inc.	Norton	VA	Sector Support
Issues and Answers Buchanan County	Grundy	VA	Project Management, Sector Support, Engineering & Design
Jennmar JM Construction	Bristol	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation,
JM Conveyors	Lebanon	VA	Nacelle, Rotor
Joint IDA Of Wythe	Wytheville	VA	Trades Labor and Workforce Organizations
King University	Bristol	VA	Educational Institution/Training Provider
Kingsport Imaging Systems, Inc.	Kingsport TN	VA	Sector Support
Kollmorgen Corporation	Radford	VA	Nacelle, Rotor, BOP Inspection and Maintenance,
Komatsu Mining Corp.	Duffield	VA	Onshore Construction, Development and Permitting, Engineering & Design, Project Management
Komatsu Mining Corp.	Norton	VA	Onshore Construction, Development and Permitting, Engineering & Design, Project Management
Komatsu Mining Corp.	Abington	VA	Onshore Construction, Development and Permitting, Engineering & Design, Project Management
Komatsu Mining Corp.	Bluefield	VA	Onshore Construction, Development and Permitting, Engineering & Design, Project Management
Larry Sturgill P.C., C.P.A.	Wise	VA	Project Management
Lawrence Brothers	Bluefield	VA	Nacelle, Rotor, Tower, Foundations, Onshore Infrastucture, Offshore Substation, Onshore Construction
Lebanon Apparel Corp.	Lebanon	VA	Sector Support
Lee Law Firm	Wise	VA	Project Management
Legacy Creations	Wise	VA	Sector Support
Lenzkes Clamping Tools, Inc	Christiansburg	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
Line Power	Bristol	VA	Offshore Substation, Onshore Infrastucture, Electrical and auxiliary systems
Longwall Associates	Chilhowie	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
Luttrell Staffing Group	Duffield	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Norton	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Abingdon	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Marion	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Hillsville	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Fairlawn	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Roanoke	VA	Trades Labor and Workforce Organizations
Luttrell Staffing Group	Wytheville	VA	Trades Labor and Workforce Organizations
Machine Tech Inc (Mazak Corp)	Charlotte	NC	Nacelle, Rotor, Tower, Foundations, Offshore Substation
Maco Tool	Christiansburg	VA	BOP Inspection and Maintenance, Onshore Infrastucture, Offshore Substation
Maine Five Buchanan County	Clintwood	VA	Sector Support
Manufacturing Technology Center	Wytheville	VA	Educational Institution/Training Provider, Project Management, Engineering & Design
Mar-Bal, Inc	Dublin	VA	Rotor
Marion Mold & Tool	Marion	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
McAllister Mills Thermal Composites	Independence	VA	Onshore Construction, Sector Support
Melvin's Machine and Die	Tazewell	VA	BOP Inspection and Maintenance, Onshore Infrastucture, Offshore Substation
Micronic Technologies	Bristol	VA	Operations, Onshore Construction
Mid-Mountain Heating & Cooling	Big Stone Gap	VA	Operations, Onshore Construction, Onshore Infrastucture, Offshore Substation
Miners Exchange Bank	Coeburn	VA	Project Management
Mitsubishi Chemical Advanced Materials	Wytheville	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction, BOP Inspection and Maintenance, Turbine Inspection and Maintenance
Moog Components Group	Galax	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Contruction
Moog Components Group	Blacksburg	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Contruction
Moog Components Group, Aspen Motion Technologies Inc	Radford	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Contruction
Motion Control Systems, Inc	New River	VA	Onshore Infrastucture, Offshore Substation
Mountain Empire Community College	Big Stone Gap	VA	Educational Institution/Training Provider
Mountainview Productions	St. Paul	VA	Sector Support
New Peoples Bank	Norton	VA	Project Management
New River/Mount Rogers Workforce Development Area Consortium Board	Radford	VA	Trades Labor and Workforce Organizations, Educational Institution/Training Provider
Nippon Pulse America, Inc.	Radford	VA	Electrical and Auxillary Systems, Offshore Substation, Onshore Infrastucture, Onshore Construction, Nacelle, Rotor
Norris Screen and Manufacturing/Elgin Separation Solutions	Tazewell	VA	Engineering & Design, Nacelle, Rotor, Tower, Foundations, Onshore Infrastucture, Offshore Substation, Onshore Construction
NorrisBuilt Fabrication & Welding	Norton	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation
Northrop Grumman Russell County	Lebanon	VA	Nacelle, Rotor
Norton IDA	Norton	VA	Government Agencies
Old Dominion Power/LG&E/KU	Norton	VA	Operations
Pascor Atlantic	Bland	VA	Onshore Infrastucture, Offshore Substation, Operations
Paul's Fan Company	Grundy	VA	Onshore Infrastucture, Offshore Substation
Paul's Fan Company	Big Rock	VA	Onshore Infrastucture, Offshore Substation

PBE Group	North Tazewell	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Contruction, Project Management, Sector Support
People Inc	Abingdon	VA	Trades Labor and Workforce Organizations, Educational Institution/Training Provider
Pioneer Center for Business Oppt.	Duffield	VA	Government Agencies
Pioneer Machine	Austinville	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
Powell Valley National Bank	Wise	VA	Project Management
PowerHub Systems	Blacksburg	VA	Operations
Print Distribution Services	Jonesborough TN	VA	Sector Support
Quesenberry's Inc.	Big Stone Gap	VA	Onshore Construction
Radford University	Radford	VA	Educational Institution/Training Provider
RH Sheppard	Wytheville	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
Ridgeview Heating & Cooling	Norton	VA	Operations, Onshore Construction, Onshore Infrastucture, Offshore Substation
Rodefer Moss & Co., PLLC	Norton	VA	Project Management
Rogers Foam Scott County	Duffield	VA	Rotor
Samuel Pressure Vessel Group	Lebanon	VA	BOP Inspection and Maintenance
Sandvik Management LLC	Bristol	VA	Nacelle, Rotor, Tower, Foundations, Offshore Substation, Onshore Infrastucture, Onshore Construction
Schaffner	Wytheville	VA	Offshore Substation, Onshore Infrastucture, Electrical and auxiliary systems
Sentek Instrument, LLC	Blacksburg	VA	Onshore Infrastuctures, Offshore Substations, Operations, BOP Inspection and Maintenance, Turbine Inspection and Maintenance
Serco Dickenson County	Herndon	VA	Sector Support
Simmons Equipment Co.	Pounding Mill	VA	Ports and Logistics
Skyline Fabricating Inc.	Oakwood	VA	Nacelle, Tower, Foundations, Offshore Substation, BOP Inspection and Maintenance
Smart Machine Technologies	Ridgeway	VA	Nacelle, Rotor
Smyth County Chamber Of Commerce	Marion	VA	Government Agencies
Smyth County Machine	Atkins	VA	Nacelle, Tower, Foundations, Offshore Substation, Rotor
Somic America, Inc.	Wytheville	VA	BOP Inspection and Maintenance
South-West Insurance Agency	Norton	VA	Project Management
South-West Insurance Agency, Inc.	Big Stone Gap	VA	Project Management
Southwest Tool Rental	Norton	VA	Ports and Logistics, BOP Inspection and Maintenance
Southwest VA Chapter of SHRM	Wise	VA	Trades Labor and Workforce Organizations
Southwest Virginia Community College/PTAC	Richlands	VA	Educational Institution/Training Provider
Southwest Virginia Higher Education Center	Abingdon	VA	Educational Institution/Training Provider
Southwest Virginia Workforce Development Board	Lebanon	VA	Trades Labor and Workforce Organizations
St. Paul IDA	St. Paul	VA	Government Agencies
State Farm Insurance	Coeburn	VA	Project Management
Strongwell	Bristol	VA	Ports and Logistics, BOP Inspection and Maintenance
Suburban Propane, LP	Norton	VA	Ports and Logistics
SunCoke Energy Buchanan County	Vansant	VA	Tower, Foundations, Offshore Substation
SWCC's Procurement Technical Assistance Center	Cedar Bluff	VA	Educational Institution/Training Provider
Sykes Enterprises, Inc.	Wise	VA	Project Management
Tadano Mantis Corp.	Lexington	SC	Ports and Logistics,
TDEC Russell County	Lebanon	VA	Trades Labor and Workforce Organizations
The Coalfield Progress	Norton	VA	Sector Support
The Lane Group	Big Stone Gap	VA	Engineering & Design
The University Of Virginia's College At Wise	Wise	VA	Educational Institution/Training Provider
Thomas Automation	Woodland	VA	Project Management
Thomas Industrial Fabrication	Floyd	VA	Nacelle, Rotor, Foundations
Thompson & Litton, Inc.	Wise	VA	Engineering & Design
Thomson Linear Motion	Radford	VA	Rotor
Town of Big Stone Gap	Big Stone Gap	VA	Government Agencies
Town of Coeburn	Coeburn	VA	Government Agencies
Town of St. Paul	St. Paul	VA	Government Agencies
Town of Wise	Wise	VA	Government Agencies
UVA-WISE Office Of Economic Development	Wise	VA	Educational Institution/Training Provider
VFP, Inc.	Duffield	VA	Tower, Foundations, Offshore Substation
Virginia Employment Commission	Norton	VA	Trades Labor and Workforce Organizations
Virginia Employment Commission	Bristol	VA	Trades Labor and Workforce Organizations, Educational Institution/Training Provider
Virginia Highlands Community College	Abingdon	VA	Educational Institution/Training Provider
Virginia Steel	Bastian	VA	Tower, Foundations, Offshore Substation
Virginia Tech	Blacksburg	VA	Educational Institution/Training Provider
VPT Inc	Blacksburg	VA	Onshore Infrastuctures, Offshore Substations, Operations
Washington County IDA	Abingdon	VA	Government Agencies
Wells Fargo Advisors	Norton	VA	Project Management
West River Conveyors	Oakwood	VA	Ports and Logistics, BOP Inspection and Maintenance
Wise Business Association	Wise	VA	Trades Labor and Workforce Organizations
Wise County Commonwealth's Attorney	Wise	VA	Government Agencies
Wise County Dept. of Social Services	Wise	VA	Government Agencies
Wise County Education Assoc.	Wise	VA	Trades Labor and Workforce Organizations
Wolf Hills Fabricators	Abingdon	VA	Tower, Foundations, Offshore Substation

Wolverine Advanced Materials	Blacksburg	VA	Nacelle, Rotor
Workforce Development Area	Wytheville	VA	Trades Labor and Workforce Organizations, Educational Institution/Training Provider
Wytheville Community College	Wytheville	VA	Educational Institution/Training Provider
Wytheville-Wythe-Bland Chamber Of Commerce	Wytheville	VA	Trades Labor and Workforce Organizations

APPENDIX B JOB ROLES IDENTIFIED FOR OSW PROJECT DEVELOPMENT PACKAGES

Project Development Job Roles

Supply element	Job roles in supply of element	Job role category
Development and permitting	Environmental consultant	Scientist
	GIS analyst	Scientist
	Project manager	Manager
	Purchasing manager	Manager
	Contracts manager	Manager
	Finance manager	Manager
	HSE manager	Manager
Surveys	Marine ecologist	Scientist
	Ornithologist	Scientist
	Protected species observer (PSO)	Scientist
	Passive Acoustic Monitor (PAM)	Scientist
	Ecologist	Scientist
	Geologist	Scientist
	Environmental scientist	Scientist
	Field scientist	Scientist
	Data scientist	Scientist
	Aerial survey operator (pilot)	Skilled trade - Specialist
	Aerial survey technician	Skilled trade – Standard
	Data analyst	Skilled trade – Standard
	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
	Site supervisor	Manager
	Production Manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Specialist
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard

	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Calibration technician	Skilled trade - Specialist
	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
	Geotechnical engineer	Engineer
	Geophysicist	Scientist
	Hydrographer	Scientist
	Oceanographer	Scientist
	Environmental scientist	Scientist
	Data scientist	Scientist
	Data analyst	Skilled trade – Standard
	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
Engineering and Design	Mechanical engineer	Engineer
	Electrical engineer	Engineer
	Process engineer	Engineer
	Structural engineer	Engineer
	Control engineer	Engineer
	Architect	University Degree
	Drafter (CAD technician)	Skilled trade - Standard
	Operations engineer	Engineer
	HSE manager	Manager
	Wind analyst	Scientist
	Reliability engineer	Engineer
Project Management	Project manager	Manager
	IT	Support staff
	HR	Support staff
	Document control	Support staff

	Sales and marketing	Support staff
	Administration	Support staff
	Recruitment	Support staff

Turbine Supply Job Roles

Supply element	Job roles in supply of element	Job role category
Nacelle	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Skilled trade - Standard
	Production operative	Skilled trade - Standard
	Calibration technician	Skilled trade - Specialist
	Industrial electrician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
Rotor	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager

	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Production operative	Skilled trade – Standard
	Calibration technician	Skilled trade - Specialist
	Industrial electrician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
Tower	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard

	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Production operative	Skilled trade – Standard
	Structural Engineer	Engineer
	Process Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard

Balance of Plant Supply Job Roles

Supply element	Job roles in supply of element	Job role category
Foundation	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Production operative	Skilled trade – Standard
	Structural Engineer	Engineer
	Process Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist

	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Production operative	Skilled trade – Standard
	Structural Engineer	Engineer
	Process Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
Offshore substation	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Production operative	Skilled trade – Standard
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Geotechnical Engineer	Engineer

	Civil Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
	HVAC technician	Skilled trade – Standard
	Elevator technician	Skilled trade – Standard
	Industrial electrician	Skilled trade - Specialist
	Plumber	Skilled trade - Standard
Onshore substation	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Protective coating technician	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Production operative	Skilled trade – Standard
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Geotechnical Engineer	Engineer
	Civil Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
	HVAC technician	Skilled trade – Standard
	Elevator technician	Skilled trade – Standard
	Industrial electrician	Skilled trade - Specialist
	Plumber	Skilled trade - Standard

Export cables	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Machine operator	Engineer
	Cable jointer	Skilled trade - Standard
	Cable test and termination engineer	Engineer
	Carousel and tensioner operator	Skilled trade – Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Protective coating technician	Skilled trade – Standard
	Hoist and winch operator	Skilled trade - Standard
	Fibre optics technician	Skilled trade – Standard
	Electrical Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard
	Lineman	Skilled trade - Standard
Array cables	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Machine operator	Skilled trade - Standard
	Cable jointer	Skilled trade - Standard
	Cable test and termination engineer	Engineer
	Carousel and tensioner operator	Skilled trade – Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Machinist	Skilled trade - Standard

	Millwright	Skilled trade - Standard
	Protective coating technician	Skilled trade – Standard
	Hoist and winch operator	Skilled trade - Standard
	Drafter (CAD technician)	Skilled trade - Standard
	Fibre optics technician	Skilled trade – Standard
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Geotechnical Engineer	Engineer
	Civil Engineer	Engineer
	Process Engineer	Engineer
Export cables	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	NDT technician	Skilled trade - Standard
	Machine operator	Skilled trade - Standard
	Cable jointer	Skilled trade - Standard
	Cable test and termination engineer	Engineer
	Carousel and tensioner operator	Skilled trade – Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Protective coating technician	Skilled trade – Standard
	Hoist and winch operator	Skilled trade - Standard
	Fibre optics technician	Skilled trade – Standard
	Electrical Engineer	Engineer
	Geotechnical Engineer	Engineer
	Civil Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	Drafter (CAD technician)	Skilled trade - Standard

Installation Job Roles

Supply element	Job roles in supply of element	Job role category
Foundation installation	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
	Cook	Skilled trade - Standard
	Sanitation services provider	Non-skilled labor
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	HSE supervisor	Skilled trade - Standard
	Elevator technician	Skilled trade – Standard
	Plumber	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Geotechnical Engineer	Engineer
	Certification Engineer	Engineer
	ROV operator	Skilled trade - Specialist
	ROV technician	Skilled trade - Standard
	ROV vessel crew	Skilled trade - Standard
Offshore substation installation	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
	Cook	Skilled trade - Standard
	Sanitation services provider	Non-skilled labor
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	HSE supervisor	Skilled trade - Standard
	Hoist and winch operator	Skilled trade - Standard
	Elevator technician	Skilled trade – Standard
	Plumber	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Mechanical Engineer	Engineer

	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Geotechnical Engineer	Engineer
	Civil Engineer	Engineer
	Controls Engineer	Skilled trade - Standard
	Certification Engineer	Skilled trade - Standard
	Calibration technician	Skilled trade - Specialist
	ROV operator	Skilled trade - Specialist
	ROV technician	Skilled trade - Standard
	ROV vessel crew	Skilled trade - Standard
	HVAC technician	Skilled trade – Standard
Subsea cable installation	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
	Cook	Skilled trade - Standard
	Sanitation services provider	Non-skilled labor
	Crane operator	Skilled trade - Standard
	HSE supervisor	Manager
	Elevator technician	Skilled trade – Standard
	Plumber	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Geotechnical Engineer	Engineer
	Certification Engineer	Skilled trade - Standard
	Calibration technician	Skilled trade - Specialist
	ROV operator	Skilled trade - Specialist
	ROV technician	Skilled trade - Standard
	ROV vessel crew	Skilled trade - Standard
	Machine operator	Skilled trade - Standard
	Cable jointer	Skilled trade – Standard
	Cable test and termination engineer	Engineer
	Carousel and tensioner operator	Skilled trade – Standard
	Fibre optics technician	Skilled trade – Standard
Turbine installation	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist

	Cook	Skilled trade - Standard
	Sanitation services provider	Non-skilled labor
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	HSE supervisor	Manager
	Hoist and winch operator	Skilled trade - Standard
	Elevator technician	Skilled trade - Standard
	Plumber	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Civil Engineer	Engineer
	Process Engineer	Skilled trade - Standard
	Controls Engineer	Skilled trade - Standard
	Certification Engineer	Skilled trade - Specialist
	Wind turbine technician	Skilled trade - Specialist
Ports and logistics	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	Port engineer	Skilled trade - Standard
	Captain of the port	Skilled trade - Specialist
	Stevedore/longshoreman	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Warehouse manager	Skilled trade - Specialist
	Fuel bunkering	Skilled trade – Standard
	Operations Manager	Manager
	Security Guard	Non-skilled labor
	Painter	Non-skilled labor
	Sandblaster	Non-skilled labor
	Welder	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Millwright	Skilled trade - Standard

	Construction manager	Manager
	Laborer	Non-skilled labor
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	Marine warranty surveyor	University Degree
	Master (Captain)	Skilled trade - Specialist
	Deck Officer	Skilled trade - Standard
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Specialist
	Cook	Skilled trade - Specialist
	Sanitation services provider	Non-skilled labor
	Diver	Skilled trade - Specialist
	ROV operator	Skilled trade - Specialist
	ROV technician	Skilled trade - Standard
	ROV vessel crew	Skilled trade - Standard
	Protected species observer (PSO)	Scientist
	Passive Acoustic Monitor (PAM)	Scientist
	AUV Operator	Skilled trade - Specialist
	Data analyst	Skilled trade – Standard
	Embedded systems engineer	Engineer
	Software engineer	Engineer
	Meteorologist	Scientist
Onshore construction	Site supervisor	Manager
	Construction manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Manager
	Crane operator	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Operations Manager	Manager
	Laborer	Non-skilled labor
	Sanitation services provider	Non-skilled labor
	Architect	University Degree
	Civil engineer	Engineer
	Structural engineer	Engineer

	Electrical engineer	Engineer
	Mechanical engineer	Engineer
	Plumber	Skilled trade - Standard

Operations and Maintenance Job Roles

Supply element	Job roles in supply of element	Job role category
Operations	Software engineer	Engineer
	Embedded systems engineer	Engineer
	IT technician	Skilled trade – Standard
	Data analyst	Skilled trade – Standard
	Operations Manager	Manager
	HSE supervisor	Manager
	Training instructor	Skilled trade - Standard
	HSE supervisor	Manager
	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	Marine warranty surveyor	University Degree
	Port engineer	Skilled trade - Standard
	Captain of the port	Skilled trade - Specialist
	Stevedore/longshoreman	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Warehouse manager	Manager
	Fuel bunkering	Skilled trade – Standard
	Operations Manager	Manager
	Security Guard	Non-skilled labor
	Painter	Non-skilled labor
	Sandblaster	Non-skilled labor
	Welder	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Construction manager	Manager

	Laborer	Non-skilled labor
	Sanitation services provider	Non-skilled labor
	Pilot	Skilled trade - Specialist
	Helicopter repair technician	Skilled trade - Specialist
	Fueling service	Non-skilled labor
	Ground control	Skilled trade – Standard
	Emergency response personnel	Skilled trade – Standard
Turbine maintenance and service	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	Master (Captain)	Skilled trade - Standard
	Deck Officer	Skilled trade - Specialist
	Deck Cadet	Skilled trade - Standard
	Marine Engineer	Skilled trade - Standard
	Cook	Skilled trade - Specialist
	Sanitation services provider	Non-skilled labor
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Hoist and winch operator	Skilled trade - Standard
	Elevator technician	Skilled trade - Standard
	Plumber	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	HVAC technician	Skilled trade – Standard
	Calibration technician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Electrical Engineer	Engineer
	Controls Engineer	Engineer
	Certification Engineer	Engineer
	NDT technician	Skilled trade - Standard
	Protective coating technician	Skilled trade – Standard
	Rope access technician	Skilled trade - Specialist
	Wind turbine technician	Skilled trade - Specialist
Balance of plant maintenance and service	HSE supervisor	Manager
	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Skilled trade - Specialist
	HVAC technician	Skilled trade - Standard

	Elevator technician	Skilled trade – Standard
	Industrial electrician	Skilled trade - Specialist
	Plumber	Skilled trade - Standard
	Calibration technician	Skilled trade - Specialist
	Mechanical Engineer	Engineer
	Structural Engineer	Engineer
	Electrical Engineer	Engineer
	Geotechnical Engineer	Engineer
	Civil Engineer	Engineer
	Process Engineer	Engineer
	Controls Engineer	Engineer
	NDT technician	Skilled trade - Standard
	Plater	Skilled trade - Standard
	Welder	Skilled trade - Standard
	Ironworker	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Rigger	Skilled trade - Standard
	Scaffolder	Skilled trade - Standard
	Laborer	Non-skilled labor
	Protective coating technician	Skilled trade – Standard
	Cable jointer	Skilled trade - Standard
	Cable test and termination engineer	Engineer
	Carousel and tensioner operator	Skilled trade – Standard
	Fibre optics technician	Skilled trade – Standard
	Diver	Skilled trade - Specialist
	ROV operator	Skilled trade - Specialist
	ROV technician	Skilled trade - Standard
	ROV vessel crew	Skilled trade - Standard

Port Development Job Roles

Supply element	Job roles in supply of element	Job role category
Port development	Site supervisor	Manager
	Production manager	Manager
	HSE supervisor	Manager

	Logistics coordinator	Manager
	Purchasing manager	Manager
	QC inspector	Manager
	Port engineer	Skilled trade - Specialist
	Captain of the port	Skilled trade - Specialist
	Stevedore/longshoreman	Skilled trade - Standard
	Crane operator	Skilled trade - Standard
	Heavy equipment operator	Skilled trade - Standard
	Industrial electrician	Skilled trade - Specialist
	Warehouse manager	Skilled trade - Standard
	Fuel bunkering	Skilled trade – Standard
	Operations Manager	Manager
	Security Guard	Non-skilled labor
	Painter	Non-skilled labor
	Sandblaster	Non-skilled labor
	Welder	Skilled trade - Standard
	Machinist	Skilled trade - Standard
	Millwright	Skilled trade - Standard
	Construction manager	Manager
	Laborer	Non-skilled labor
	Sanitation services provider	Non-skilled labor
	Architect	University Degree
	Naval architect	University Degree
	Civil engineer	Engineer
	Structural engineer	Engineer
	Electrical engineer	Engineer
	Mechanical engineer	Engineer
	HVAC technician	Skilled trade – Standard
	Plumber	Skilled trade - Standard

Indirect and Induced Job Roles

Supply element	Sectors in supply of element	Job role category
Indirect and induced job roles	Accommodation	Support staff
	Real Estate	Support staff
	Laundry Services	Support staff
	Restaurant	Support staff
	Catering	Support staff

	Transportation	Support staff
	Recruitment Services	Support staff
	Vehicle Rental Agency	Support staff
	Health and emergency services	Support staff

APPENDIX C DEFINITION OF GO VA INDUSTRY CLUSTERS

Chemical

3251 Basic Chemical Manufacturing
3252 Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing
3255 Paint, Coating, and Adhesive Manufacturing
3256 Soap, Cleaning Compound, and Toilet Preparation Manufacturing
3259 Other Chemical Product and Preparation Manufacturing
3261 Plastics Product Manufacturing
3262 Rubber Product Manufacturing
3271 Clay Product and Refractory Manufacturing
3272 Glass and Glass Product Manufacturing
3274 Lime and Gypsum Product Manufacturing
3279 Other Nonmetallic Mineral Product Manufacturing

Electric/Electronics Manufacturing

3332 Industrial Machinery Manufacturing
3333 Commercial and Service Industry Machinery Manufacturing
3341 Computer and Peripheral Equipment Manufacturing
3342 Communications Equipment Manufacturing
3343 Audio and Video Equipment Manufacturing
3344 Semiconductor and Other Electronic Component Manufacturing
3345 Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
3351 Electric Lighting Equipment Manufacturing
3352 Household Appliance Manufacturing
3353 Electrical Equipment Manufacturing
3359 Other Electrical Equipment and Component Manufacturing

Machinery Manufacturing

3322 Cutlery and Handtool Manufacturing
3325 Hardware Manufacturing
3327 Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing
3329 Other Fabricated Metal Product Manufacturing
3331 Agriculture, Construction, and Mining Machinery Manufacturing
3334 Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing
3335 Metalworking Machinery Manufacturing
3339 Other General Purpose Machinery Manufacturing
3346 Manufacturing and Reproducing Magnetic and Optical Media
3364 Aerospace Product and Parts Manufacturing

3365 Railroad Rolling Stock Manufacturing
3366 Ship and Boat Building
3369 Other Transportation Equipment Manufacturing
3391 Medical Equipment and Supplies Manufacturing
3399 Other Miscellaneous Manufacturing

Metal and Product Manufacturing

2122 Metal Ore Mining
3311 Iron and Steel Mills and Ferroalloy Manufacturing
3312 Steel Product Manufacturing from Purchased Steel
3313 Alumina and Aluminum Production and Processing
3314 Nonferrous Metal (except Aluminum) Production and Processing
3315 Foundries
3321 Forging and Stamping
3323 Architectural and Structural Metals Manufacturing
3324 Boiler, Tank, and Shipping Container Manufacturing
3326 Spring and Wire Product Manufacturing
3328 Coating, Engraving, Heat Treating, and Allied Activities

Construction

2361 Residential Building Construction
2362 Nonresidential Building Construction
2371 Utility System Construction
2372 Land Subdivision
2373 Highway, Street, and Bridge Construction
2379 Other Heavy and Civil Engineering Construction
2381 Foundation, Structure, and Building Exterior Contractors
2382 Building Equipment Contractors
2383 Building Finishing Contractors
2389 Other Specialty Trade Contractors
3273 Cement and Concrete Product Manufacturing

Freight Transportation

482 Rail Transportation
483 Water Transportation
484 Truck Transportation
488 Support Activities for Transportation
491 Postal Service
492 Couriers and Messengers

APPENDIX D TRAINING AND EDUCATIONAL INSTITUTIONS AND CERTIFICATIONS AWARDED, 2019-2020 ACADEMIC YEAR

Academic Institution	Relevant Programs	Certificates	Associates	Bachelors	Postgraduates	Total
Mountain Empire Community College	Engineering and Construction Associates of Science (A.S.) [2 years]	444	273	0	0	717
	Industrial Technology Program A.S. [2 years]					
	Manufacturing Program A.S. [2 years]					
Wytheville Community College	Computer Science A.S. [2 years]	386	322	0	0	708
	Engineering A.S. [2 years]					
Virginia Highlands Community College	Industrial Electricity Certificate [1 year]	351	257	0	0	608
	Electrical Technology A.S. [2 years]					
	Precision Machining Certificate [1 year]					
Southwest Virginia Community College	Engineering A.S. [2 years]	259	255	0	0	514
	Renewable Energy and Energy Efficiency Certificate [1 year]					
	Welding Certificate [1 year]					
Emory and Henry College	Engineering Science Bachelor of Science (B.S.) [4 years]	0	0	259	114	373
	Environmental Studies B.S./B.A. [4 years]					
	Master Programs Available, but not relevant subjects					
The University of Virginia's College at Wise	Software Engineering B.S. [4 years]	0	0	237	0	237
	Computer Science B.S. [4 years]					
Radford University	Physics B.S. [4 years]	20	31	1,935	499	2,485
	Chemistry B.S. [4 years]					
Virginia Polytechnic Institute and State University (Virginia Tech)	Engineering B.S./M.S./PhD [4/6/8 years]	0	55	7136	2353	9544
	Chemistry B.S./M.S./PhD [4/6/8 years]					
	Physics B.S./M.S./PhD [4/6/8 years]					
Total:		1,460	1,303	23,839	7,672	34,274

APPENDIX E BW RESEARCH PARTNERSHIP SURVEY AND RESULTS

Southwest Virginia
OSW Supply Chain Survey
March 2022
Preliminary Toplines 1.0
n=19

Southwest Virginia Potential Offshore Wind Employer Survey

BW Research, an independent research organization, has contacted you in order to assess the capabilities, qualifications, and interest of companies in Southwest Virginia to meet the needs of the offshore wind industry. The state of Virginia is committed to expanding offshore wind energy generation and providing opportunities and supports for local organizations and workers throughout the supply chain. **All firms, whether currently involved in offshore wind or not, are encouraged to complete the survey.**

Your individual responses will not be published; only aggregate information will be used in reporting the survey results. The survey should take approximately 10 to 20 minutes of your time. Your participation will help determine the preparedness of Virginia to meet the needs and requirements of the offshore wind industry.

Screener Questions

A. Does [pull in NAICS title] accurately describe your organization's focus?

0.0%	**Yes**
0.0%	**No**
0.0%	**Not sure**

B. Is your business located in Virginia?

100.0%	**Yes**
0.0%	**No**

C. For this survey, please answer the following questions based only on your current primary business location. What county is your primary current business located in?

[RANDOMIZE]

31.6%	**Washington County**
21.1%	**Tazewell County**
15.8%	**Wythe County**
10.5%	**Wise County**
10.5%	**Montgomery County**
5.3%	**Smyth County**
5.3%	**Bristol County**
0.0%	**Norton County**
0.0%	**Bland County**
0.0%	**Galax County**
0.0%	**Dickenson County**
0.0%	**Giles County**
0.0%	**Russell County**
0.0%	**Scott County**
0.0%	**Other (please specify)**

D. What is the zip code of your current primary location?

10.5%	**24201**
5.3%	**24060**
5.3%	**24141**
5.3%	**24202**
5.3%	**24210**
5.3%	**24211**
5.3%	**24219**
5.3%	**24273**
5.3%	**24312**
5.3%	**24319**
5.3%	**24368**
5.3%	**24370**
5.3%	**24382**
5.3%	**24605**
5.3%	**24609**
5.3%	**24612**
5.3%	**24614**
5.3%	**24637**

E. Is your company involved with work related to wind energy project development, construction, manufacturing, operations, maintenance, or other professional service?

21.1%	**Yes**
83.7%	**No**
5.3%	**Not sure**

IF E= “Yes” ASK F & G otherwise SKIP

F. Thinking of your organization’s wind energy work, on what type of project does your organization currently work? (n=4)

50.0%	**Land-based**
0.0%	**Offshore**
25.0%	**Both**
25.0%	**Don't know/ Refused**

G. How would you describe your organization’s focus as it relates to wind work? (Select all categories in which your organization works directly) (n=3)

100.0%	**Installation and commissioning**
66.7%	**Project development**
66.7%	**Operations and maintenance**
33.3%	**Balance of plant supply**
33.3%	**Sector Support**
0.0%	**Wind turbine supply**
0.0%	**Decommissioning**
0.0%	**Other**

If G = “Project development”, ask H

H. What role does your organization take in project development? (Select all that apply) (n=2)

100.0%	**Engineering & design**
100.0%	**Project management**
50.0%	**Development and permitting**
50.0%	**Surveys**
0.0%	**Other**

If G = “Wind turbine supply”, ask I

I. What part does your organization assemble or manufacture? (Select all that apply) (n=0)

If G = “Balance of plant supply”, ask J

J. What part does your organization assemble or manufacture? (Select all that apply) (n=1)

100.0%	**Export cables**
100.0%	**Array cables**
100.0%	**Onshore substation**
100.0%	**Foundations**
0.0%	**Offshore substation**
0.0%	**Other**

If G = “Installation and commissioning”, ask K

K. What does your organization install? (Select all that apply) (n=3)

66.7%	**Foundation installation**
66.7%	**Onshore construction**
33.3%	**Subsea cable installation**
33.3%	**Ports and logistics**
0.0%	**Turbine installation**
0.0%	**Offshore substation installation**
0.0%	**Other**

If G = “Operations and maintenance”, ask L

L. What role does your organization take in operations and maintenance? (Select all that apply) (n=2)

100.0%	**Operations**
100.0%	**Balance of Plant inspection and maintenance**
50.0%	**Turbine inspection and maintenance**
0.0%	**Other**

If G = “Sector support”, ask M

M. What sector support role does your organization take? (Select all that apply) (n=1)

100.0%	**Government Agencies**
100.0%	**Trades, Labor and Workforce Organizations**
0.0%	**Educational Institution/ Training Provider**
0.0%	**Other**

N. How would you describe your organization's industry sector? (Select all categories in which your organization works directly) - *Multiple responses permitted; percentages may not sum to 100%* (n=18)

44.4%	**Manufacturing and Fabrication Services**
16.7%	**Construction, Installation, and Operations/Maintenance Services**
16.7%	**Professional and Consulting Services**
11.1%	**Trades, Labor, and Workforce Organization**
11.1%	**Retail trade**
5.6%	**Environmental, Engineering, Geological, & Testing Services**
5.6%	**Equipment, Supplies, Materials, and Associated Services**
5.6%	**Offshore Wind Original Equipment Manufacturing (OEM)**
5.6%	**Finance**
5.6%	**Non-Profit**
0.0%	**Education/Training**
0.0%	**Government**
0.0%	**Marine Facilities, Transport, Logistics, and Safety**
0.0%	**Offshore Wind Development**
11.1%	**Other**

[IF more than one selected ask O otherwise SKIP and set SMPRIME to N]

O. In which industry sector does your organization *primarily* work? (n=2)

50.0%	**Manufacturing and Fabrication Services**
50.0%	**Trades, Labor, and Workforce Organization**
0.0%	**Construction, Installation, and Operations/Maintenance Services**
0.0%	**Education/Training**
0.0%	**Environmental, Engineering, Geological, & Testing Services**
0.0%	**Equipment, Supplies, Materials, and Associated Services**
0.0%	**Government**
0.0%	**Marine Facilities, Transport, Logistics, and Safety**
0.0%	**Offshore Wind Development**
0.0%	**Offshore Wind Original Equipment Manufacturing (OEM)**
0.0%	**Professional and Consulting Services**
0.0%	**Other**

[Set SNPRIME to O]

SECTION 1 – Technical Capabilities

For the purposes of this survey, we would like you to answer questions based **only** on operations in your primary location in Virginia.

1. Which of the following services is your organization currently capable of providing? (Select all that apply) - *Multiple responses permitted; percentages may not sum to 100%* (n=2)

IF SNPRIME = “Construction, Installation, and Operations/Maintenance Services”

50%	**Construction and Logistics Management**
50%	**Pile Driving**
50%	**Site Development and Excavation**
0.0%	**Crane Lift Operations**
0.0%	**Diving**
0.0%	**Dredging**
0.0%	**Electrical and Cable Installation**
0.0%	**Electrical Services**
0.0%	**Engineering Procurement, Construction and Installation (EPCI)**
0.0%	**Jacket Installation**
0.0%	**Land-Based Construction**
0.0%	**Marine Construction**
0.0%	**Mechanical Services**
0.0%	**Monopile and Transition Piece Installation**
0.0%	**Pre-Assembly**
0.0%	**Wind Turbine Generator Installation**
0.0%	**Other**

IF SNPRIME = “Education/Training” (n=0)

IF SNPRIME = “Environmental, Engineering, Geological, & Testing Services” (n=0)

IF SNPRIME = “Equipment, Supplies, Materials, and Associated Services” (n=0)

IF SNPRIME = “Manufacturing and Fabrication Services” (n=7)

57.1%	**Welding**
42.9%	**Machining**
28.6%	**Blasting**
28.6%	**Mechanical Components**
28.6%	**Milling**
28.6%	**Rolling**
14.3%	**Coating**
14.3%	**Electrical Components/Electronics**
14.3%	**Painting**
14.3%	**Fiberglass**
0.0%	**Casting**
0.0%	**Other**

IF SNPRIME = “Marine Facilities, Transport, Logistics, and Safety” (n=0)

IF SNPRIME = “Offshore Wind Development” (n=0)

IF SNPRIME = “Offshore Wind Original Equipment Manufacturing (OEM)” (n=0)

IF SNPRIME = "Trades, Labor, and Workforce Organization” (n=1)

100.0%	**Recruitment and Staffing Services**
100.0%	**Workforce Provider**
0.0%	**Labor Association**
0.0%	**Non-Government Organization**
0.0%	**Trade or Industry Association**
0.0%	**Other**

SECTION 2 – Volumetric Capabilities

2. Including all full-time and part-time **permanent** employees at your organization, how many primary location-based workers support the [SNPRIME] portion of your business? (Please note that your response should include administrative staff supporting the [SNPRIME] portion of your business.) (n=18)

0.0%	**0 employees**
11.1%	**1 to 4 employees**
0.0%	**5 to 9 employees**
16.7%	**10 to 24 employees**
11.1%	**25 to 49 employees**
22.2%	**50 or more employees**
38.9%	**Don't know/ Refused**

IF Q2 = “Record # of employees”, ask Q3

3. Thinking of your [TAKE Q7 #] primary location-based [SNPRIME] employees, how many do you estimate belong to a union? (n=18)

55.6%	**0 employees**
0.0%	**1 to 4 employees**
0.0%	**5 to 9 employees**
0.0%	**10 to 24 employees**
5.6%	**25 to 49 employees**
5.6%	**50 or more employees**
33.3%	**Don't know/ Refused**

[Build in check – Q3 may not exceed Q2]

IF SNPRIME = “Manufacturing and Fabrication Services, Marine Facilities, Transport, Logistics, and Safety, Offshore Wind Original Equipment Manufacturing (OEM)” ASK Q4-9 otherwise skip

4. Do any of your employees have any of the following certifications or licenses? (Please select all that apply) - *Multiple responses permitted; percentages may not sum to 100%* (n=7)

57.1%	**Lean Six Sigma**
57.1%	**Certified Welder (CW)**
42.9%	**Quality Control Inspector**
28.6%	**Occupational Safety and Health Administration / OSHA**
28.6%	**Certified Composties Technician (CCT)**
14.3%	**National Commission for the Certification of Crane Operators (NCCCO)**
14.3%	**Certified Production Technician**
14.3%	**Journeyman’s Card**
0.0%	**Global Wind Organization / GWO**
0.0%	**Helicopter Underwater Escape Training (HUET)**
0.0%	**US Coast Guard Standards of Training, Certification, and Watchkeeping / STCW**
0.0%	**US Coast Guard Captain’s License**
0.0%	**Other**
14.3%	**None**
0.0%	**DK/NA**

5. Approximately how much of your organization’s work at your current location, in terms of total gross revenue, is related to [SNPRIME]? (n=7)

0.0%	**Less than $100,000**
14.3%	**$100,000 to $499,999**
0.0%	**$500,000 to $999,999**
0.0%	**$1.0M to $4.9M**
0.0%	**$5.0M to $9.9M**
0.0%	**$10.0M to $20.0M**
42.9%	**$20.0M or more**
42.9%	**Don't know/ Refused**

6. Does your organization currently have excess production capacity? (In other words, could your organization produce more widgets with additional investments of capital?) (n=7)

71.4%	**Yes**
0.0%	**No**
28.6%	**Don't know / Refused**

IF Q6 = “Yes” ASK Q7

7. Roughly how much excess capacity does your organization *currently* have, as a percent of current production? (For example: if you can produce 20 percent more widgets without additional capital investment, write 20.) (n=5)

20.0%	**Less than 10.0%**
0.0%	**10.0% to 19.9%**
20.0%	**20.0% to 29.9%**
20.0%	**30.0% to 39.9%**
0.0%	**40.0% to 49.9%**
40.0%	**50.0% to 59.9%**
0.0%	**60.0% or more**

8. Thinking about your organization’s energy related suppliers and vendors, what percent are located (Use numbers to indicate percentages, for instance 20=20%): (n=5)

Average	
74.0%	**In Virginia**
43.3%	**Outside Virginia but in the United States**
0.0%	**Outside of the United States**

IF Q8 “Outside of the United States” > 0, ASK Q9

9. What components do you source from suppliers and vendors outside of the United States? (n=0)

SECTION 3 – Interest in participating in OSW supply chain

10. For each of the following statements, please indicate if you agree, disagree or neither? (n=13)

RANDOMIZE

	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	DK/NA
A. Our company is uncertain about the potential economic opportunity that offshore wind presents	**37.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**
B. We are interested in the opportunity offshore wind presents for our business.	**37.5%**	**18.8%**	**37.5%**	**0.0%**	**0.0%**	**6.3%**
C. Our current offering of goods and/or services can be used by the offshore wind industry.	**38.5%**	**0.0%**	**23.1%**	**7.7%**	**15.4%**	**15.4%**
D. Our company would need to make significant capital investments to serve the OSW industry.	**7.7%**	**15.4%**	**30.8%**	**7.7%**	**23.1%**	**15.4%**
E. Our staff would need additional training to serve the OSW industry.	**23.1%**	**23.1%**	**15.4%**	**15.4%**	**15.4%**	**7.7%**
F. There is sufficient local qualified talent to grow a profitable business in the OSW industry.	**31.3%**	**25.0%**	**25.0%**	**0.0%**	**0.0%**	**18.8%**
G. There is sufficient market demand to grow a profitable business in the OSW industry.	**37.5%**	**25.0%**	**12.5%**	**12.5%**	**0.0%**	**12.5%**
H. There is sufficient availability of necessary equipment to grow a profitable business in the OSW industry.	**31.3%**	**37.5%**	**18.8%**	**0.0%**	**0.0%**	**12.5%**
I. There is sufficient supply of affordable raw materials to grow a profitable business in the OSW industry.	**37.5%**	**25.0%**	**18.8%**	**0.0%**	**0.0%**	**18.8%**
J. There is sufficient supply of affordable component parts to grow a profitable business in the OSW industry.	**37.5%**	**25.0%**	**18.8%**	**0.0%**	**0.0%**	**18.8%**
K. There are policy challenges inhibiting growth of a profitable business in the OSW industry.	**18.8%**	**25.0%**	**31.3%**	**0.0%**	**6.3%**	**18.8%**
L. There are permitting delays inhibiting growth of a profitable business in the OSW industry.	**12.5%**	**31.3%**	**37.5%**	**0.0%**	**6.3%**	**12.5%**

IF 10A = “Strongly agree or Somewhat agree”, ask Q11, OTHERWISE SKIP

11. Which aspect(s) of offshore wind’s potential economic benefits is your company **most uncertain** about? - *Multiple responses permitted; percentages may not sum to 100%* (n=8)

75.0%	**The demand for components or services resulting from offshore wind**
62.5%	**Whether offshore wind projects in Virginia will move forward**
50.0%	**The components or services your company could provide**
50.0%	**The cost of upskilling your workforce**
37.5%	**The cost of upgrading your physical capital to create new products or goods**
25.0%	**Whether domestically produced goods will be competitive in an international market**
0.0%	**Other**

IF 10B= “Strongly agree, Somewhat agree, or Neither agree nor Disagree” ask Q12-14

12. Has your organization estimated the approximate capital required to offer goods and services to the offshore wind industry? (n=15)

33.3%	**Yes**
40.0%	**No**
26.7%	**Don't know / Refused**

IF Q12= “YES” ask Q13-14, OTHERWISE SKIP

13. Approximately how much capital would be required? (n=5)

60.0%	**Less than $100,000**
0.0%	**$100,000 to $499,999**
0.0%	**$500,000 to $999,999**
0.0%	**$1.0M to $4.9M**
40.0%	**$5.0M to $9.9M**
0.0%	**$10.0M to $20.0M**
0.0%	**$20.0M or more**
0.0%	**Don't know/ Refused**

14. How likely is your organization to invest in the required capital to participate in the offshore wind industry? (n=5)

60.0%	**Very Likely**
40.0%	**Somewhat Likely**
0.0%	**Not likely**
0.0%	**DK/NA**

15. When do you think your organization will be prepared to provide goods or services to the offshore wind industry? (n=9)

33.3%	**Less than 6 months from now**
44.4%	**More than 6 months but less than a year**
11.1%	**More than one year but less than 2 years**
0.0%	**More than 2 years**
11.1%	**Don't know / Refused**

16. Please provide any other factors that make it difficult for your company to profitably participate in the offshore wind industry not included above, including any specific policy challenges. - *Multiple responses permitted; percentages may not sum to 100%* (n=13)

23.1%	**Proximity to the shore**
15.4%	**Politics/ Policy**
7.7%	**Networking with suppliers**
7.7%	**Uncertainty of long term work**
7.7%	**Training/ Certifying employees**
7.7%	**Other**
38.5%	**Don't know/ Refused**

SECTION 4 – Organization Practices

IF SNPRIME = “Manufacturing and Fabrication Services, Marine Facilities, Transport, Logistics, and Safety, Offshore Wind Original Equipment Manufacturing (OEM)” ASK Q17-18 otherwise skip

17. Is your organization or any of your employees affiliated with one or more unions? (n=7)

0.0%	**Yes**
100.0%	**No**
0.0%	**Don't know / Refused**

18. Is your organization certified in any of the following International Organization for Standardization (ISO) standards? (Select all that apply.) (n=7)

42.9%	**ISO 9001: Quality management systems**
14.3%	**ISO 14001: Environmental management systems**
0.0%	**ISO 27001: Information security management**
0.0%	**ISO 29400: Ships and marine technology — Offshore wind energy — Port and marine operations**
0.0%	**Other**
42.9%	**Not currently certified by ISO**
0.0%	**DK/NA**

SECTION 5 – Occupations

For the purposes of this survey, we would like you to answer questions based only on your primary location.

19. Which of the following occupations (excluding management and administrative roles) does your organization *directly* employ? (Select all that apply) - *Multiple responses permitted; percentages may not sum to 100%*

IF SNPRIME = “Construction, Installation, and Operations/Maintenance Services OR Trades, Labor, and Workforce Organization” (n=3)

100.0%	**Construction Laborers**
66.7%	**Cement Masons, Concrete Finishers, and Terrazzo**
66.7%	**Misc. Installation, Maintenance, and Repair Workers**
66.7%	**Wind Turbine Service Technician**
66.7%	**Hoist and Winch Operator**
66.7%	**Welder**
66.7%	**Inspectors, Testers, Sorters, Samplers and Weighers**
66.7%	**Laborers and Freight Stock and Material Movers, Hand**
33.3%	**Electrician**
33.3%	**Material Moving Machine Operator**
33.3%	**Ironworker / Steelworker**
33.3%	**Rigger**
33.3%	**Metal Furnace Operator, Tender, Pourer, and Caster**
33.3%	**Crane Operator**
33.3%	**Industrial Machinery Installation, Repair, and Maintenance Workers**
33.3%	**Electrical and Electronic Equipment Mechanics, Installers and Repairers**
33.3%	**Reinforcing Iron and Rebar Workers**
33.3%	**Construction Equipment Operators**
33.3%	**Assemblers of Electrical and Electromechanical Equipment**
0.0%	**Subsea Cable Installer**
0.0%	**Elevator Installer & Repairer**
0.0%	**Other**

IF SMPRIME = “Environmental, Engineering, Geological, & Testing Services, Offshore Wind Development, OR Professional and Consulting Services” (n=0)

IF SMPRIME = “Manufacturing and Fabrication Services OR Offshore Wind Orignal Equipment Manufacturing (OEM)” (n=7)

85.7% Welders
85.7% Shipping Clerks
85.7% Inspectors, Testers, Sorters, Samplers and Weighers
71.4% Machinists
71.4% Assemblers
71.4% CNC Operator
71.4% Metal Fabricators and Filters
57.1% Machine Setters, Operators, and Tenders
57.1% Sand Blasters
57.1% Mechanical Installation, Repair, and Maintenance Workers
57.1% Electricians
42.9% Stock Clerks
42.9% Material Moving Workers
42.9% Electrical Installation, Repair, and Maintenance Workers
0.0% Metal Furnace Operators, Tenders, Pourers, and Casters
14.3% Other

IF SMPRIME = “Marine Facilities, Transport, Logistics, and Safety” (n=0)

SECTION 6 – Permission and Other Questions

21. Would you be willing to be contacted by the researcher team to participate in a follow up interview regarding this research? (n=16)

62.5% Yes
37.5% No

22. Can Coalfield Strategies follow up with you regarding future offshore wind opportunities? (n=16)

62.5% Yes
37.5% No

23. Lastly, since it sometimes becomes necessary for the project manager to call back and verify responses to certain questions, please enter your contact information.

First Name _____
Last Name _____
Company _____
Title _____
Phone _____
Email _____