Baltic
InteGrid

Integrated Baltic Offshore
Wind Electricity Grid Development

Baltic offshore grid SME business cases

A report for the Baltic InteGrid project

February 2018

Interreg
Baltic Sea Region

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

Baltic offshore grid SME business cases
A report for the Baltic InteGrid project

By BVG Associates

Cover photo: EnBW / Detlef Gehring

Published by: Baltic InteGrid

www.baltic-integrid.eu

Content

List of figures

List of tables

List of Abbreviations

BSR	Baltic Sea region
HVAC	High voltage alternating current
HVDC	High voltage direct current
OWE	Offshore wind energy
SME	Small and medium-sized enterprise

Summary

The Baltic InteGrid project is exploring the potential of a meshed offshore electricity transmission grid for the Baltic Sea region. The offshore wind market in the region could increase from 1.8GW installed at the end of 2017 up to 9.5GW at the end of 2030. This increase in capacity offers opportunities for small and medium-sized enterprises (SMEs) looking to enter into the offshore wind transmission market through work packages in development, manufacture, installation and maintenance.

This study was tasked with identifying the various business cases for regional SMEs to become involved in the supply chain for offshore wind electricity transmission. The study identifies 37 packages of work awarded by contractors that could be delivered by an SME across the lifecycle of offshore wind transmission assets.

This study identified the following main conclusions:

- Demand will increase in work packages that can be undertaken by an SME (such as crew services and crew transfer vessel services), however this may not result in increased demand for SME services
- Competition from rival businesses is the biggest challenge to SMEs entering the market
- There are significant opportunities to transition from, or diversify into, similar markets such as oil and gas, telecommunications and interconnectors
- There are advantages to SMEs being capable of providing multiple work packages
- There are opportunities for SMEs to serve markets outside of the Baltic Sea region
- Strong relationships with large supply chain contractors may be necessary for SMEs
- SMEs can exploit advantages of proximity to the customer
- Investment may be required for both capital assets and skills, and
- There are opportunities for SMEs to demonstrate their innovative capabilities.

1. Introduction

Offshore wind energy (OWE) plays an increasingly important role in a diversified and sustainable future energy mix. Offshore wind capacity in Europe totals 15.8GW (2017), the vast majority of which is located in the North Sea.[1] The Baltic Sea Region (BSR) offers good conditions for offshore wind development: compared with the North Sea, waters are relatively shallow, wave height is lower, tides are less pronounced and potential sites are close to shore, resulting in lower manufacturing, installation and grid infrastructure costs. By 2030, the BSR could have 9.5GW in offshore wind capacity[2], of which only about 1.8GW has been installed by the end of 2017.[3]

The Baltic InteGrid project is exploring the potential of a meshed offshore electricity transmission grid for the BSR. It aims to contribute to sustainable electricity generation, to integrate the regional electricity markets further, and to enhance the security of supply around the BSR. The Baltic InteGrid project supports research efforts to equip its stakeholders with insights on the development of a regional meshed grid across a range of fields, including market and supply chain analysis.

The purpose of this study is to identify the various business cases for regional small and medium-sized enterprises (SMEs) to become involved in the supply chain for OWE electricity transmission. The study identifies the packages of work awarded by contractors that could be delivered by an SME across the lifecycle of OWE transmission assets. The study then describes challenges for SMEs entering these markets and provides recommendations for SMEs on how to prepare for entry to the OWE transmission supply chain.

[1] WindEurope, *Offshore Wind in Europe - Key trends and statistics 2017* (online, 2018), 17-20. https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Offshore-Statistics-2017.pdf

[2] Baltic InteGrid, *Internal document* (2018).

[3] WindEurope, *Offshore Wind in Europe*, 20.

2. Methodology

The OWE transmission market is considered across a four stage lifecycle: development, manufacture, installation and maintenance. Three supply chain elements are considered as shown in Table 1.

Element	Description
Export cables	High voltage (HV) cables that connect the offshore and onshore substations. HV alternating current (HVAC) export cables have typically been rated between 132kV and 245kV. HV direct current (HVDC) export cables are typically rated upwards of 300kV.[4]
Substation structure	Offshore substation structures include the offshore platform and associated arrangements for access and accommodation, and the substation foundation.
Substation electrical	The electrical systems are composed of transformers, reactors, switchgear, power electronics, cables within the substation and the control and auxiliary systems. This includes both HVAC and HVDC technology.

Table 1 Offshore wind transmission supply chain elements.

Packages of work across the OWE transmission market awarded by the main contractor were considered. For these contracts the subcontracts that could be delivered by an SME were identified. The largest contract that an SME could bid for (having 250 or fewer employees) is likely to be about €10 million.5

Generic subcontract packages common to many sectors (such as stationary, catering, utilities and IT) were excluded from the study.

From the main OWE transmission contracts, 37 potential subcontracted work packages were identified that could be delivered by SMEs. For each package the following were considered:

- **Scope:** Describing the subcontracted work.
- **Growth in demand:** Identifying growth in demand for the package based on future OWE deployment.
- **Challenges for market entry:** Assessment of the ability of companies to move into the new sector across five primary citeria.
- **Recommendations:** Actions for an SME to take to enter this market.

The criteria used to assess the challenges for market entry for each package were:

- **Investment size:** The level of capital investment in infrastructure, tools, equipment, people or certification required.

[4] BVG Associates internal project database.

[5] BVG Associates professional estimation. The turnover of a company with 250 employees could be up to €25 million and a single contract of more than €10 million would probably be considered a significant risk by the buyer.

- **Synergies with other sectors:** The ability to perform a similar scope of work in another industry.
- **Competition:** Rival businesses capable of winning the subcontract.
- **Complexity of interface:** The difficulty of interaction with other aspects of the larger contract of work.
- **Proximity of customers:** The relevance of geographical proximity to client.

Each criteria was scored on a scale 1-5, where a score of 1 represents a low level of challenge for market entry and a score of 5 represents a high challenge.

Case studies of SMEs in the BSR that have won contracts in the OWE transmission market were developed to show how companies used existing skills and experience to provide a solution to a challenge faced by the industry.

3. SME work packages

The 37 work packages identified by the study that could be delivered by SMEs are summised in Table 2 and further described in following chapters. Some packages (such as diving services, crewing services and crew transfer vessel services) are described only once but are contracted across several supply chain elements or lifecycle stages.

	Export cables	Substation structure	Substation electrical
Development	Cable design	Structural design analysis	System design
	Cable ancillaries design	Logistics analysis	
	Cable route engineering	Sea fastening design	
Manufacture	Factory jointing	Architectural steel	Busbars
	Cable ancillaries manufacture	Secondary steel	Heating, ventilation and air conditioning
	Equipment servicing	Signage	Fire detection and suppression
	Transport and storage	Sea fastening manufacture	Lighting
		Cable routes and trays	
		Cranes	
Installation	Cable protection	Port services	Electrical services
	Route clearance and pre-lay grapnel run	Crewing services	
	Unexploded ordnance survey and removal	Crew transfer vessel services	
	Remotely operated vehicle services		
	Diving services		
	Cable termination and testing		
	Cable surveying		
	Trenching tools		
Maintenance	Repair jointing	Asset inspection services	Safety checks
	Fault monitoring		

Table 2 The 37 SME work packages considered in the study.

4. Export cable work packages

4.1 Export cable development

4.1.1 Cable design

Scope of package

During front-end engineering design (FEED) studies, the design of cables will be within the overall electrical design, including consideration for cable installation.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is low but it is a highly specialist area of work and contractors will employ people who are highly experienced in cable design.
Synergies with other sectors: Design of submarine cables may be needed in oil and gas or interconnectors. It is a highly specialist activity.
Competition: This comes mainly from the in-house teams of cable manufacturers.
Complexity of interface: The cable's design needs to reflect site conditions and ideally reflect foundation and installation design.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. There are several cable manufacturers in the BSR, each of which is a potential customer.

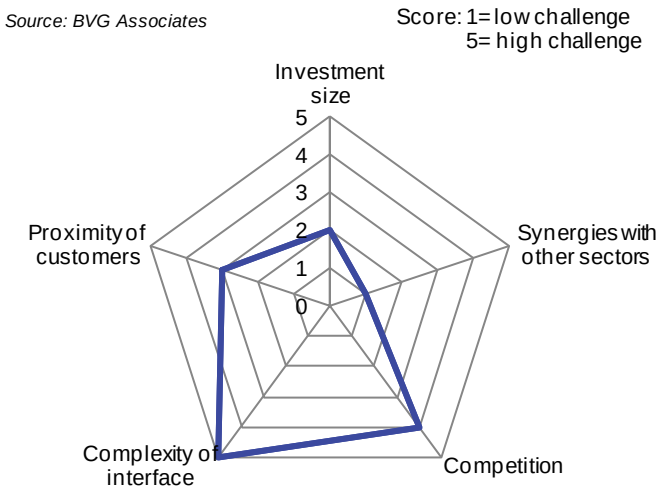

Figure 1 SME challenge assessment scores for cable design.

Recommendations

Cable design is a highly technical area and difficult for an SME to enter the sector without lengthy experience. It may be possible to enter sector by recruiting key individuals from within cable manufacturers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.1.2 Cable ancillaries design

Scope of package

A number of specialised ancillaries are necessary, including pulling heads, armour clamps, repair joints, hang-offs and terminations. Cable ancillaries can be designed away from the site of cable design by a different compnay.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is not significant for design but it is a highly specialist area of work and contractors will employ people who are highly experienced in cable manufacture.
Synergies with other sectors: Cable ancillary design for submarine cables may be needed in oil and gas, or interconnectors.
Competition: This will come mainly from the in-house teams of cable manufacturers.
Complexity of interface: Ancillary design should reflect the design of the cable entry design and installlation method.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. There are several cable manufacturers in the BSR, each of which is a potential customer.

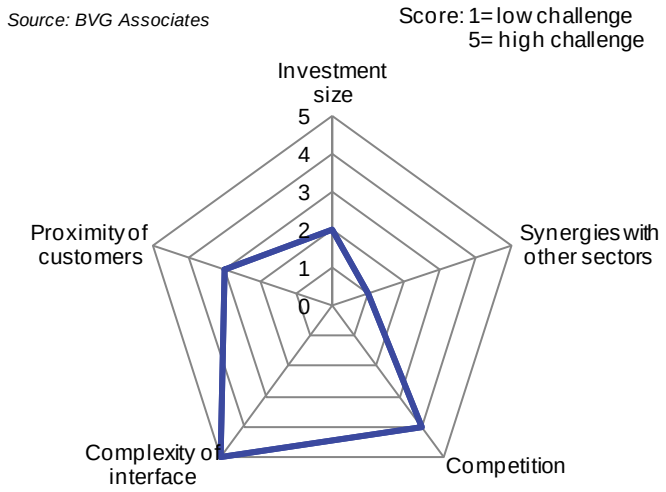

Figure 2 SME challenge assessment scores for cable ancillaries design.

Recommendations

Cable ancillary design is a highly technical area and difficult for an SME to enter the sector without lengthy experience. It may be possible to enter sector by recruiting key individuals from within cable manufacturers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.1.3 Cable route engineering

Scope of package

During front-end engineering design (FEED) studies, detailed planning of export cable routes between the on- and offshore substations is undertaken. It also includes cable burial studies and design of suitable installation processes to inform cable installation tendering. The studies include desk-based analysis, geophysical surveys and geotechnical surveys.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is low (if not integrating survey work) but it is a highly specialist area of work and contractors will employ people who are experienced in cable route engineering. If the SME is looking to combine survey work with engineering, the capital investment required will be more significant.

Synergies with other sectors: There are strong synergies with other industries that require cable route engineering, such as oil and gas, interconnectors and telecommunications, and synergies with industries that require surveys, such as oil and gas, and dredging.

Competition: This will come mainly from larger contractors which offer both survey and engineering solutions or highly experienced engineering consultancies.

Complexity of interface: There is modest complexity in interfacing with the project consent team and engineering team.

Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. The contractor will typically be the wind farm owner or cable installation contractor.

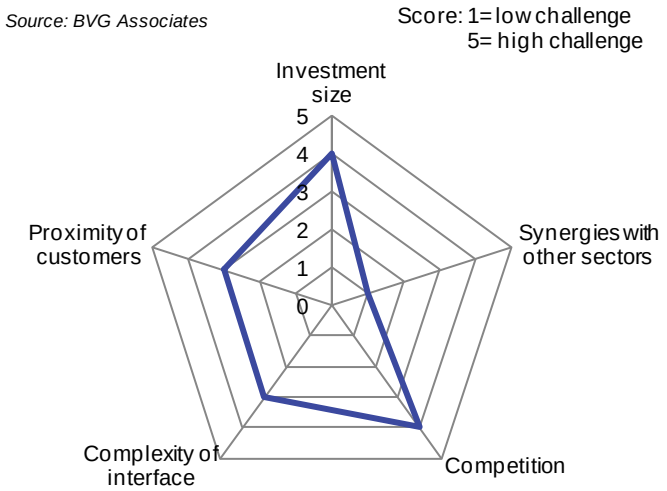

Figure 3 SME challenge assessment scores for cable route engineering.

Recommendations

Cable route design is a highly technical area and difficult for an SME to enter without lengthy experience in the sector. It may be possible to enter sector by recruiting key individuals. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.2 Export cable manufacture

4.2.1 Factory jointing

Scope of package

Some cable manufacturers can only produce cable cores or cables in short lengths. They may subcontract jointing services to a specialist SME.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is generally low but the development of cables at voltages not usually used in other sectors will require updated jointing methods that need certfification. It is a highly specialist area of work and contractors will employ people who are highly experienced in cable manufacture.
Synergies with other sectors: Cable jointing for submarine cables may be needed in oil and gas or interconnectors.
Competition: This will come mainly from the in-house teams of cable manufacturers.
Complexity of interface: While the joint should have the same thermal, electrical and mechnical qualities as the manufactured cable, jointing method may need to reflect the conditions on the cable route and how it will be installed.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. There are several cable manufacturers in the BSR, each of which is a potential customer.

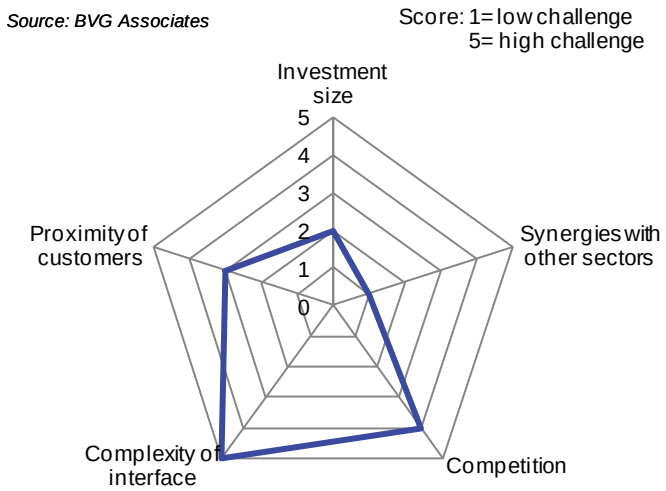

Figure 4 SME challenge assessment scores for factory jointing.

Recommendations

Cable jointing is a highly technical area and difficult for an SME to enter without lengthy experience in the sector. It may be possible to enter sector by recruiting key individuals from within cable manufacturers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.2.2 Cable ancillary manufacture

Scope of package

A number of specialised ancillaries are necessary, including pulling heads, armour clamps, repair joints, hang-offs and terminations. Cable ancillaries can be manufactured away from the site of cable manufacturing by a different company.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is likely to be modest for manufacture but it is a specialist area of work and contractors will employ people who are highly experienced in cable ancillary manufacture.
Synergies with other sectors: Cable ancillary manufacture for submarine cables may be needed in oil and gas or interconnectors. It is a highly specialist activity.
Competition: This will come from the specialist cable ancillary manufacturers.
Complexity of interface: Manufacture of cable ancillaries will reflect the design of the cable entry and installlation method.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. There are several cable manufacturers in the BSR, each of which is a potential customer.

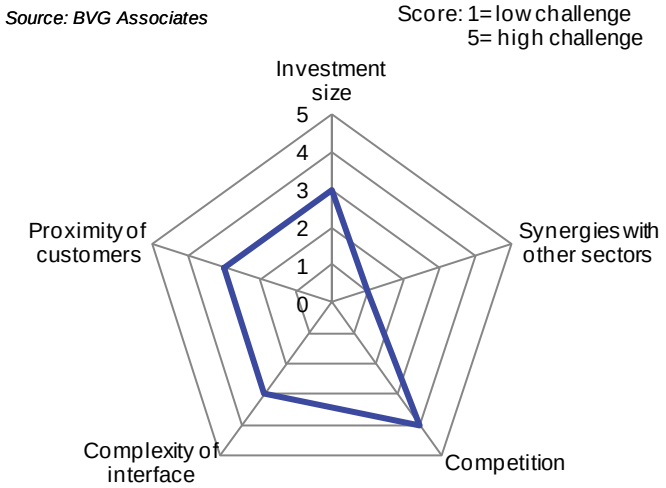

Figure 5 SME challenge assessment scores for cable ancillary manufacture.

Recommendations

There are modest barriers for an SME to enter cable ancillary manufacture. It may be possible to enter sector by recruiting key individuals from within cable manufacturers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.2.3 Equipment servicing

Scope of package

Specialist machines, equipment and tools for manufacturing cables must be maintained, serviced and calibrated to ensure a high standard of specialised cable supply.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Capital investment is not significant but it is a specialist area of work and contractors will employ people with track record and accreditation in equipment servicing and calibration.
Synergies with other sectors: Equipment servicing is required in large manufacturing industries.
Competition: This will come from the equipment suppliers and specialist equipment servicing companies with established relationships.
Complexity of interface: There are no significant interfaces.
Proximity of customers: It would be advantageous to be close to the site of cable manufacturing. There are several cable manufacturers in the BSR, each of which is a potential customer.

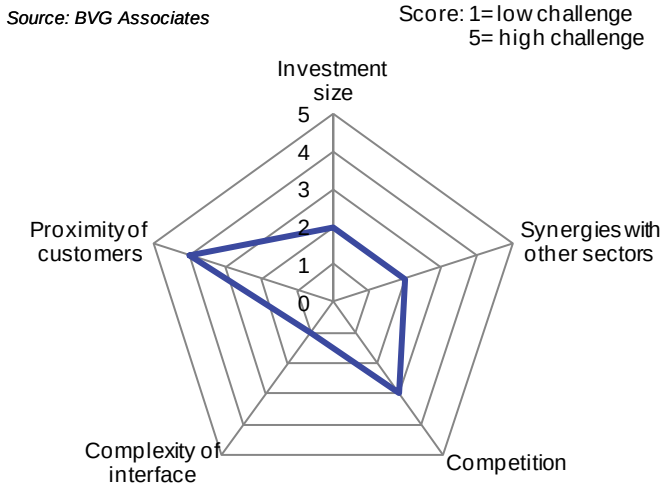

Figure 6 SME challenge assessment scores for equipment servicing.

Recommendations

An experienced SME could transition into the offshore wind sector. An understanding of the machinary, equipment, tools and processes of cable manufacturing would be required. New entrants should focus on Baltic customers because of the benefits in having local contractors.

4.2.4 Transport and storgae

Scope of package

Cables need to be transported from the manufacturing site to the installation port. During transport, cables are loaded onto cable reels or carousels and secured with sea fastenings. Safe handling of the cables is essential to prevent damage. The storage of cables and related components is generally carried out at either the manufacturing facility or near to the installation port before installation, although some manufacturers that are not well located may use an additional logistics facility.

Growth in demand

A Baltic offshore grid could lead to an increase in demand, although the storage capacity of existing Baltic cable manufacturers is likely to be sufficient.

Assessment of challenges

Investment size: Modest capital investment is needed in cable transport, storage and handling equipment.
Synergies with other sectors: Cable transport and storage for submarine cables may be needed in oil and gas, telecommunications or interconnectors.
Competition: This will come mainly from the in-house teams of cable manufacturers or cable installation contractor.
Complexity of interface: There are interfaces required in the timing of cable delivery between the cable manufacturer and the cable installer.
Proximity of customers: There is a need to have storage facilities geographically close to the installation port but not necessarily to the customer. There are several cable manufacturers in the BSR, each of which is a potential customer.

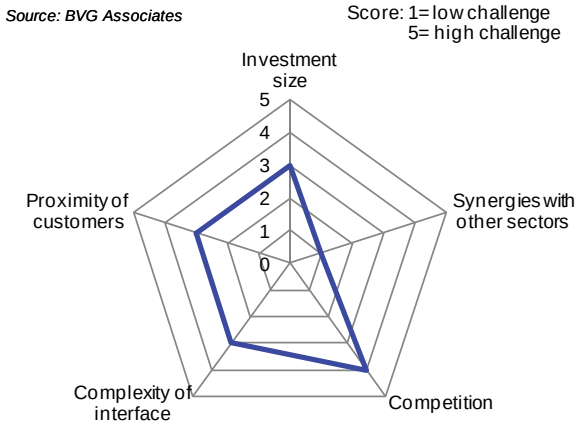

Figure 7 SME challenge assessment scores for cable transport and storage.

Recommendations

Cable transport and storage requires specialist equipment, but not highly specialised skills. Opportunities for transport and storage will be focused on projects located within the BSR.

4.3 Export cable installation

4.3.1 Cable protection

Scope of package

Cable protection systems are used to protect subsea cables from mechanical loads from sea bed movements and to avoid damage during installation. Protection can include cable burial, rock dumping, bend restrictors and cable mattressing.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment will be significant for a company that is not currently operating in cable protection. Companies are highly specialist.
Synergies with other sectors: Cable protection may be needed in oil and gas, telecommunication or interconnectors.
Competition: There will be strong competition from specialist cable protection companies.
Complexity of interface: There will be some complex interfacing with the cable manufacturer and cable installation contractor.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. The client will be the cable installation contractor. Many of these contractors are located in Belgium, Germany and the Netherlands.

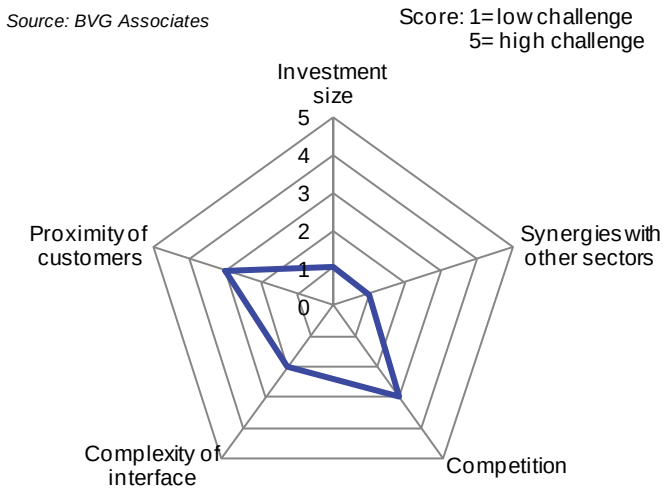

Figure 8 SME challenge assessment scores for cable protection.

Recommendations

Cable protection is a highly technical area and difficult for an SME to enter the sector without experience. It may be possible to enter the sector by recruiting key individuals from competitors. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.3.2 Route clearance and pre-lay grapnel run

Scope of package

Cable route clearance and pre-lay grapnel run takes placed before cable installation. It involves the removal of end-of-life cables identified during marine surveys and clears any obstacles that could obstruct cable ploughs used during cable installation.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: There is a high investment cost associated with surveying equipment and vessels.
Synergies with other sectors: There are synergies with other marine sectors such as oil and gas, interconnectors and telecommunications.
Competition: Cable route clearance and pre-lay grapnel run can be completed by the cable installation contractor. These are typically large, experienced and highly specialised companies.
Complexity of interface: There is some interfacing required with the cable installation contractors, due to the timing required between route clearance, pre-lay grapnel run and cable installation.
Proximity of customers: There is no significant need to be close but contractors will need to build up relationships to secure customer trust.

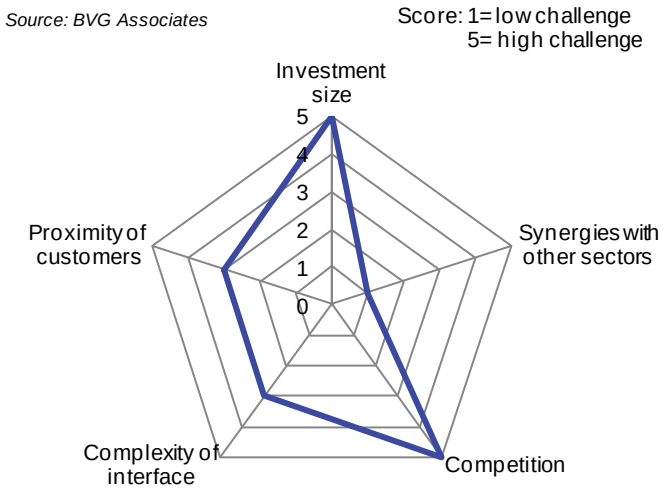

Figure 9 SME challenge assessment scores for route clearance and pre-lay grapnel run.

Recommendations

Cable route clearance and pre-lay grapnel run is a highly technical area and difficult for an SME to enter without lengthy experience in OWE or parallel sectors. It may be possible to enter the sector by recruiting key individuals from cable installation contractors. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.3.3 Unexploded ordnance survey and removal

Scope of package

Unexploded ordnance (UXO) are derelict explosives. Usually bathymetric surveys and desktop studies will be completed during project development to identify UXO locations. UXO surveys can often be combined with the geotechnical and geophysical surveys. Further detailed UXO surveys are undertaken along the cable route before installation. When potential UXO are detected, companies relocate or remove the items in line with the client's requirements using remotely operated vehicles (ROVs), offshore divers and underwater electromagnets. Sometimes UXO are destroyed at sea, but this is a costly and dangerous operation.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment will be significant for a company that is not currently operating in UXO surveys and removal. Companies are highly specialist.
Synergies with other sectors: UXO surveys and removals are required for other marine industries such as oil and gas, telecommunications and interconnectors.
Competition: There will be strong competition from specialist companies.
Complexity of interface: The requirements for UXO surveys and removal will be co-ordinated within the cable installation programme.
Proximity of customers: The client will be the wind farm operator or an installation contractor. There is no need to be close to customers but knowledge of the wind farm site gained through local proximity may be advantageous.

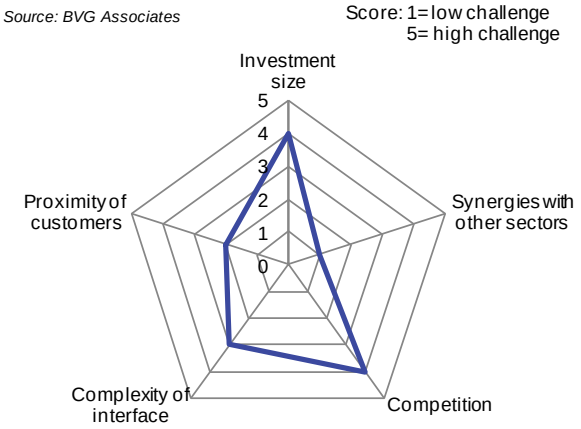

Figure 10 SME challenge assessment scores for unexploded ordnance survey and removal.

Recommendations

UXO surveys and removal is a highly technical area and difficult for an SME to enter the sector without lengthy experience. It may be possible to enter the sector by recruiting key individuals from other suppliers, or engineers with military background. Entrants should not focus only on Baltic customers as the opportunity could be greater outside the BSR.

4.3.4 Remotely operated vehicle services

Scope of package

Remotely operated vehicles (ROVs) may perform pre-lay inspection surveys of the cable route, dig the trench and inspect the trenching equipment as the cable is being laid onto the sea bed. They are also expected to play an increasing role in subsea cable and substation structure inspection in the future during maintenance.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment will be significant for a company that is not currently operating in ROV services. Companies are highly specialist.
Synergies with other sectors: ROV services are required for other marine industries such as oil and gas, telecommunications and innterconnectors.
Competition: There will be strong competition from specialist companies.
Complexity of interface: The requirements for diving services will be closely co-ordinated within the cable installation programme and therefore there is some complex interfacing between the supplier of the diving services and the cable installation contractor.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. The client will be an installation contractor. Many of these contractors are located in Belgium, Germany and the Netherlands. ROV services are also likely to be contracted by the maintenance contractor where proximity to the wind farm site, rather than the customer, may be advantageous.

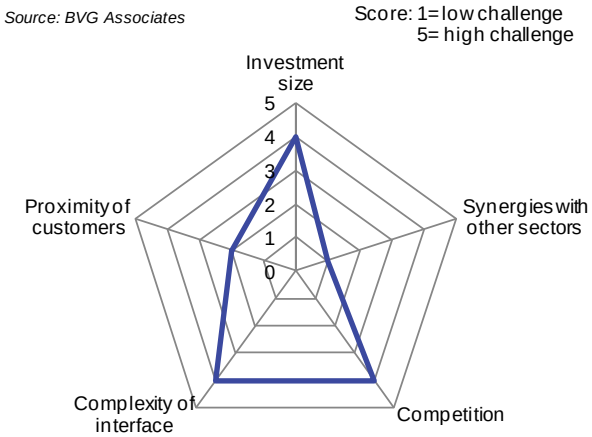

Figure 11 SME challenge assessment scores for remotely operated vehicle services.

Recommendations

ROV services is a highly technical area and difficult for an SME to enter the sector without investment in state of the art equipment. In addition it may be beneficial to recruit key individuals from other suppliers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.3.5 Diving services

Scope of package

Diving services are used during cable installation and cable burial. Services can include: cable guiding, cable security, ROV assistance, minor repair work and re-location of dropped cable. Diving services are also used for cable and structural inspections in the OWE industry.

Growth in demand

There is unlikely to be any significant growth in demand due to declining demand in the oil and gas industry, and a move towards ROV inspections for improved safety due to the risks of diving.

Assessment of challenges

Investment size: Capital investment is moderate for equipment, training and certification.
Synergies with other sectors: There are high synergies with oil and gas, interconnectors, military and police industries who all use the skills of commercial divers.
Competition: There is high competition in the market for commercial divers given the surplus of experienced divers in the oil and gas industry.
Complexity of interface: The requirements for diving services will be closely co-ordinated within the cable installation programme and therefore there is some complex interfacing between the supplier of the diving services and the cable installation contractor.
Proximity of customers: There may be some benefit in being located close to customers for quick response to any required maintenance works or unexpected faults.

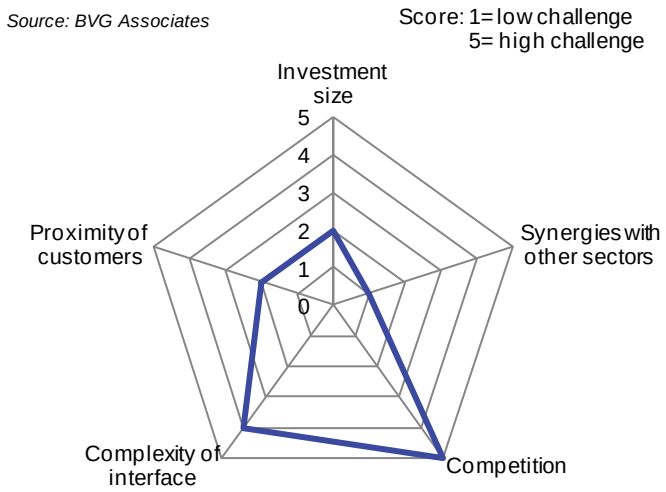

Figure 12 SME challenge assessment scores for diving services.

Recommendations

Commercial diving for cable installation is a highly technical area and difficult for an SME without lengthy track record in the sector. It may be possible to enter sector by recruiting key individuals with experience in commercial diving. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.3.6 Cable termination and testing

Scope of package

Termination provides the mechanical and electrical connection of export cables. Testing verifies that the cables have not been damaged during installation.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment will be moderate for a company that is not currently operating in cable termination and testing. Companies are highly specialist.
Synergies with other sectors: Cable termination and testing is required for other marine industries such as oil and gas, telecommunications and interconnectors.
Competition: There will be strong competition from specialist companies.
Complexity of interface: Cable termination and testing requires interfacing with the cable installation contractors.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. The client will be the cable installation contractor, or the project developer. Many of these contractors are located in Belgium, Germany and the Netherlands.

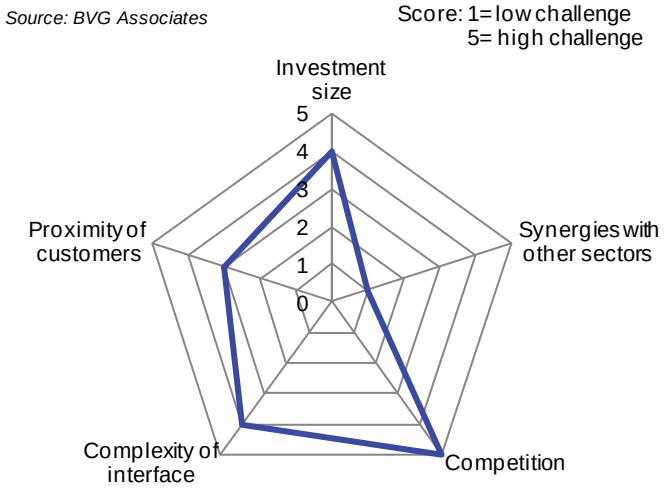

Figure 13 SME challenge assessment scores for cable termination and testing.

Recommendations

Cable termination and testing is a highly technical area and difficult for an SME to enter the sector without experience. It may be possible to enter the sector by recruiting key

individuals from other suppliers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.3.7 Cable surveying

Scope of package

Post-installation surveys are often required by relevant planning authorities to determine that the cable has been laid according to planning conditions, to correct burial depths and to identify any risk of cable exposure.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Significant investment is required in survey vessels and equipment.
Synergies with other sectors: There are synergies with the oil and gas, interconnectors and telecommunications industries.
Competition: Competition is likely to come from in-house surveying teams of cable installation contractors.
Complexity of interface: There is no significant interfacing.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. The client will be the cable installation contractor, or the project developer. Many of these cable contractors are located in Belgium, Germany and the Netherlands.

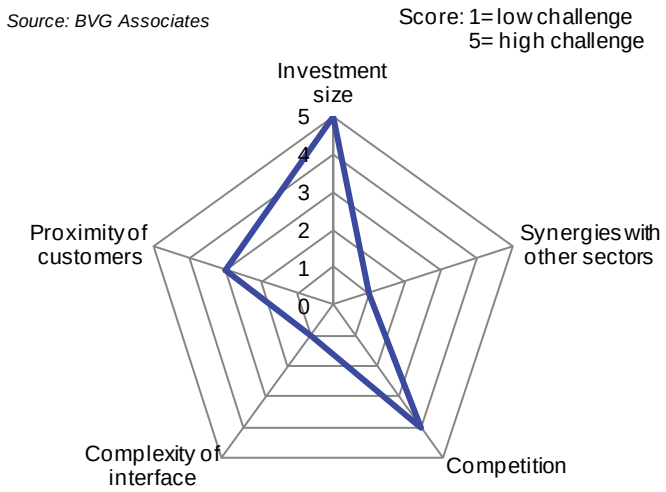

Figure 14 SME challenge assessment scores for cable surveying.

Recommendations

Cable surveys are a highly technical area and difficult for an SME to enter the sector without experience. It may be possible to enter sector by recruiting key individuals from cable installation contractors. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.3.8 Trenching tools

Scope of package

Trenching tools supplied during cable installation includes injectors, rocksaw trenchers, burial sleds and cable ploughs.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Significant investment will be required to manufacture and supply trenching tools to cable installation contractors.
Synergies with other sectors: There are synergies with the oil and gas, interconnectors and telecommunications industries.
Competition: There is likely to be competition from existing specialised companies and the equipment manufacturers.
Complexity of interface: There is modest complexity of interfacing with the cable installation contractor.
Proximity of customers: There is no need to be close to cutomers. The client will be the cable installation contractor, or the project developer. Many of these cable contractors are located in Belgium, Germany and the Netherlands.

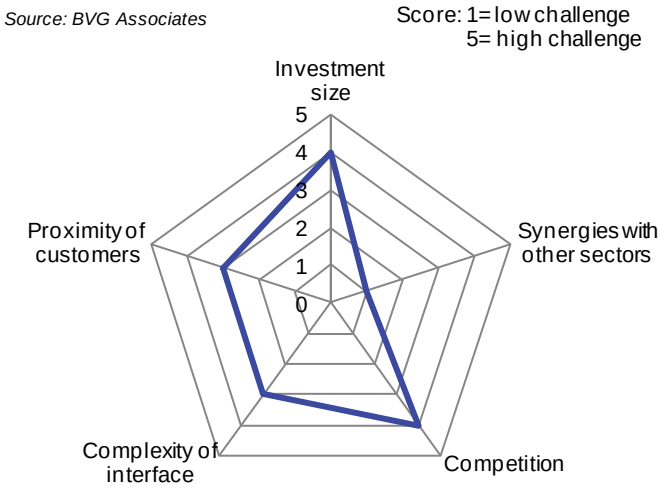

Figure 15 SME challenge assessment scores for trenching tools.

Recommendations

Suppling trenching tools is a moderately technical area and difficult for an SME to enter without experience. It may be possible to enter sector by recruiting key individuals from other suppliers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.4 Export cable maintenance

4.4.1 Repair jointing

Scope of package

When cables are damaged at sea, they are repaired by lifting the section of damaged cable from the sea bed and jointing to a spare cable onboard a cable repair vessel.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is moderate. It is a highly specialist area of work.
Synergies with other sectors: There are synergies with oil and gas, interconnectors and telecommunications.
Competition: Competition will mostly come from in-house repair teams of cable manufacturers, particularly if the cable is under warranty.
Complexity of interface: The jointing manufacturer will be required to interface with the cable repair contractor to ensure joints are supplied in-line with project delivery schedules.
Proximity of customers: There is no significant need for cable jointers to be located close to customers although there may be benefit in being located close to the wind farm site for quick response to any required maintenance works or unexpected faults.

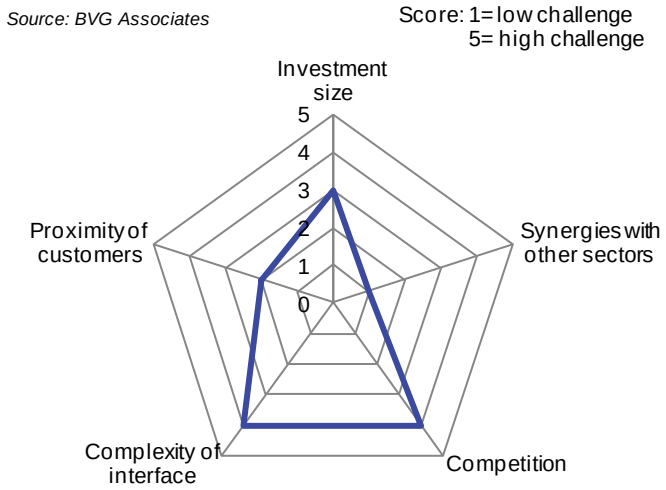

Figure 16 SME challenge assessment scores for repair jointing.

Recommendations

Cable repair jointings is a highly technical area and difficult for an SME to enter the sector without lengthy experience. It may be possible to enter the sector by recruiting key individuals from cable manufacturers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

4.4.2 Cable fault monitoring

Scope of package

Cables are monitored by ROVs along the entire length for physical damage or general degredation. Monitoring alerts owners to faults and allows exact location of the fault to be identified before repair. Fault detection systems are likely to be built into future cables to minimise the time to locate the fault.

Growth in demand

A Baltic offshore grid will lead to an increase in demand, although future innovation in integrated detection systems will negatively impact this.

Assessment of challenges

Investment size: Capital investment will be significant for a company that is not currently operating in ROV services. Companies are highly specialist.

Synergies with other sectors: There are synergies with oil and gas, interconnectors and telecommunications.

Competition: There will be strong competition from specialist companies, or from the in-house maintenance teams of cable manufacturers.

Complexity of interface: There is no significant interfacing.

Proximity of customers: There is no significant need to be close but contractors will need to build up relationships to secure customer trust. There is benefit in being located close to customers for quick response to any required maintenance works or unexpected faults.

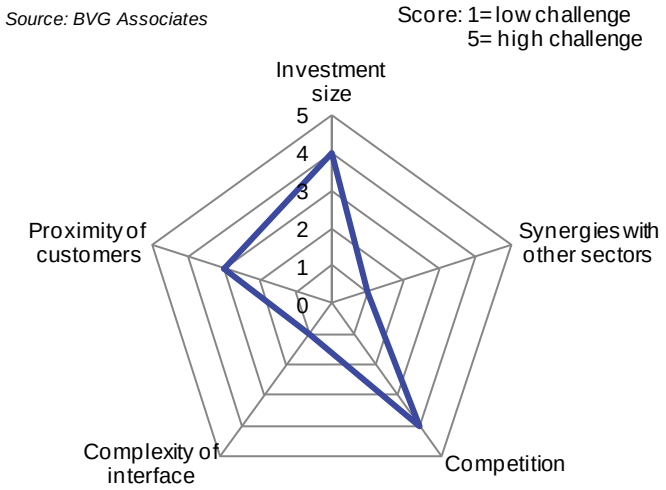

Figure 17 SME challenge assessment scores for cable fault monitoring.

Recommendations

Cable fault monitoring is a highly technical area and difficult for an SME to enter the sector without experience. It may be possible to enter the sector by recruiting key individuals from cable manufacturing and installation. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

5. Substation structure work packages

5.1 Substation structure development

5.1.1 Structural design analysis

Scope of package

Structural design analysis includes the static and dynamic analysis of offshore steel or concrete structures. It analysises the impact of stresses and loads on the structure from transport, installation and operation. Offshore structures are large, complex structures that are subject to harsh environmental conditions, therefore structural analysis is a key design stage during front-end engineering design (FEED). The structural design contract is usually carried out by large companies but subcontracts for defined smaller packages of work such as vibration and loads analysis may be let to SMEs.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Capital investment is not significant for design analysis but it is a specialist area of work and contractors will employ people who are highly experienced.
Synergies with other sectors: There are synergies with the oil and gas and construction industries.
Competition: Competition is likely from large, experienced engineering consultancies.
Complexity of interface: The key interface is with the fabricator, which is likely to undertake additional design for manufacture.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. There are several substation structre manufacturers in the Baltic region, each of which is a potential customer.

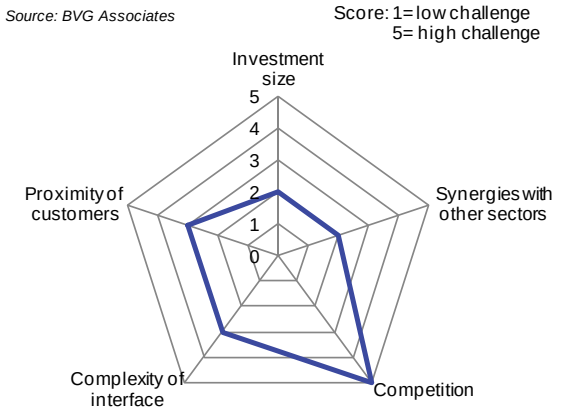

Figure 18 SME challenge assessment scores for structural design analysis.

Recommendations

Structural design analysis is a technical area and difficult for an SME to enter without lengthy experience in the sector. It may be possible to enter the sector by recruiting key

individuals from within experiened engineering consultancies. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

5.1.2 Logistics analysis

Scope of package

Offshore substations are large, complex structures with many components sourced from different suppliers. Logistics analysis determines a logical approach to bring all the components together before installation.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Investment is low.
Synergies with other sectors: There are synergies with the oil and gas and construction industries which require similar logstics analysis.
Competition: Competition is likely to come from the in-house logistics teams of installation contractors.
Complexity of interface: There are high levels of interfacing from the many suppliers required for manufacture of components.
Proximity of customers: The customer is likely to be the supplier of the substation structure or installation contractor. A supplier located in close proximity would be helpful in supporting logistics but is not essential.

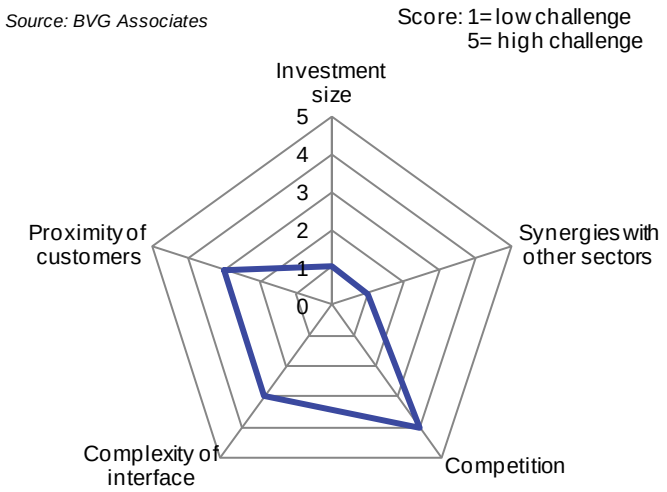

Figure 19 SME challenge assessment scores for logistics analysis.

Recommendations

An SME experienced in logistics analysis for complex structures could enter the sector without significant difficulty, however they would face strong competition from tier one substation structure suppliers or installation contractors. They would be required to have a detailed knowledge of the substation structure, components and suppliers and could

recruit key individuals from larger contractors. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

5.1.3 Sea fastening design

Scope of package

Sea fastening is required during transport and installation of OWE components, such as the substation structure. Sea fastenings are also required for cable ancillaries and cable carousels.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment will be relatively low but it is a specialist area of work.
Synergies with other sectors: Sea fastening design may be needed in the oil and gas, shipping, and logistics industries.
Competition: This will primarily come from existing companies servicing a range of maritime industries.
Complexity of interface: There is some complex interfacing with both component manufacturers and installation contractors to understand the dimensions, mass and load tolerances, and number of components that need to be transported and installed.
Proximity of customers: There is no need to be close to the installation port for sea fastening design. There will be benefits in having a presence if the company also offers manufacturing and installation of sea fastenings during mobilisation of installation vessels.

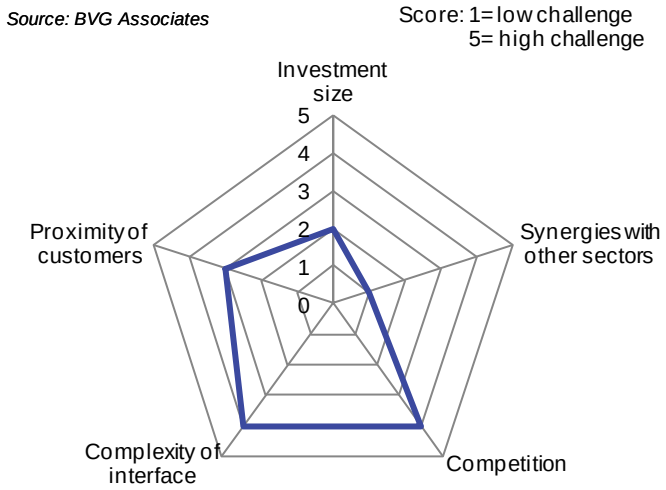

Figure 20 SME challenge assessment scores for sea fastening design.

Recommendations

There are no significant barriers to transition into OWE transmission sea fastening design from other markets. SMEs would be required to understand the installation process for

OWE transmissions and the logistics of component transfer from the installation port to the offshore location. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

5.2 Substation structure manufacturing

5.2.1 Architectural steel

Scope of package

Substation platforms are large complex structures that require a range of steelwork. Architectural steel, for example railings and walkways, can be designed and fabricated off-site from the location of substation topside manufacturing.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Capital investment is low for a company already working in steel fabrication in other sectors.
Synergies with other sectors: Architectural steel may be needed in a range of other industries including oil and gas and construction.
Competition: Competition will mainly come from experienced steel fabricators.
Complexity of interface: There is some complexity of interfacing with the design and fabrication of the components with the offshore substation topside supplier.
Proximity of customers: There is no need to be close to the customer. There are offshore substation topside suppliers in the Baltic region, but potential customers are located across Europe.

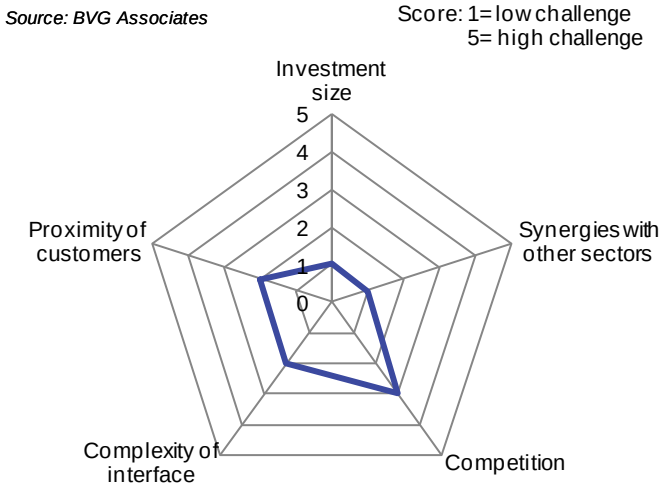

Figure 21 SME challenge assessment scores for architectural steel.

Recommendations

An experienced SME could transition into the OWE transmission sector without signficant difficulty. A detailed understanding of the architectural steel requirements of offshore substation structures would be required.

5.2.2 Secondary steel

Scope of package

Substation platforms are large complex structures that require a range of steelwork. Secondary steel on offshore wind substations can include barriers, rescue support frames, J-tubes (steel tubes protecting and guiding array cables) and boat landing systems. Secondary steelwork can be designed and fabricated off-site from the location of foundation manufacturing.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Capital investment is low for a company already working in steel fabrication.
Synergies with other sectors: Secondary steel may be needed in a range of other industries including oil and gas and construction.
Competition: There will be competition from a large number of secondary steel suppliers active across general construction industries.
Complexity of interface: There is some complexity of interfacing with the design and fabrication of the components with the offshore substation topside supplier.
Proximity of customers: The client is typically the substation foundation or substation topside contractor. There are offshore substation topside suppliers in the Baltic region, but potential customers are located across Europe.There is no need to be close to the customer.

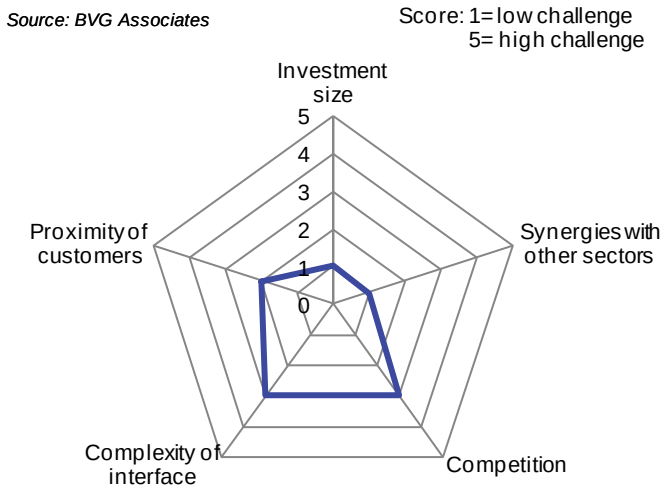

Figure 22 SME challenge assessment scores for secondary steel.

Recommendations

An experienced SME could transition into the OWE transmission sector. A detailed understanding of the secondary steel requirements of offshore substation structures would be required.

5.2.3 Signage

Scope of package

Signage is required on offshore substations. Signs communicate information about safety, navigation, regulations and equipment.

Growth in demand

A Baltic offshore grid will lead to an increase in demand but the volumes are unlikely to be significant.

Assessment of challenges

Investment size: Investment is low.
Synergies with other sectors: There are syngeries with mutiple industries including oil and gas, and construction.
Competition: There will be competition from many other industrial signage companies.
Complexity of interface: There are no significant interfaces.
Proximity of customers: There is no significant need to be close to customers.

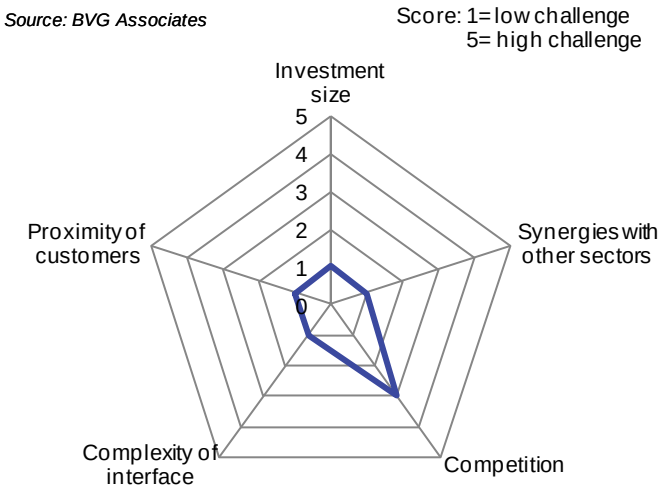

Figure 23 SME challenge assessment scores for signage.

Recommendations

There are no significant barriers to transition into the sector from other markets. An understanding of the signs required on substation structures would be essential. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

5.2.4 Sea fastening manufacture

Scope of package

Sea fastening is required during transport and installation of offshore wind components, such as the substation structure.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Capital investment is likely to be modest for manufacture.

Synergies with other sectors: Sea fastening manufacture may be needed in oil and gas, shipping, and logistics industries.

Competition: This will primarily come from existing companies servicing a range of maritime industries.

Complexity of interface: There is interfacing with component manufacturers and installation contractors.

Proximity of customers: There is no need to be close to the installation contractor or installation port for sea fastening manufacture. There will be benefits in having a presence if the company also offers design and installation of sea fastenings during mobilisation of installation vessels.

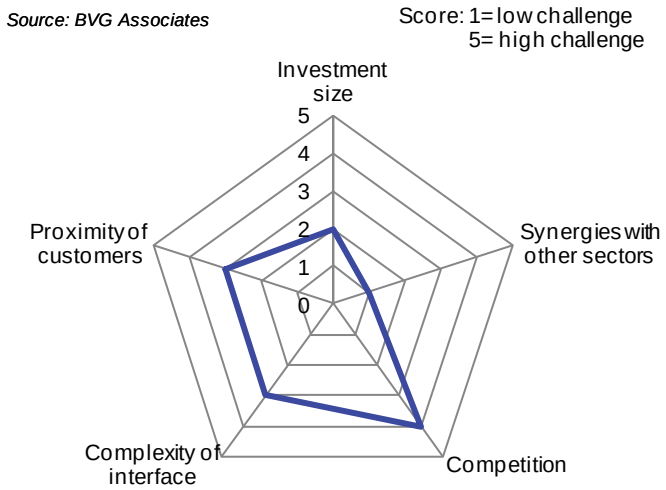

Figure 24 SME challenge assessment scores for sea fastening manufacture.

Recommendations

There are no significant barriers to transition into OWE transmission sea fastening manufacture from other markets. SMEs would be required to understand the installation process for OWE transmission and the logistics of component transfer from the installation port to the offshore location. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

5.2.5 Cable routes and trays

Scope of package

Substation platforms need cable route systems to provide structural support to the cables that connect the electrical components. These can be supplied by manufacturers and specialist distributors to the substation supplier.

Growth in demand

A Baltic offshore grid will lead to an increase in demand but the volumes are unlikely to be significant.

Assessment of challenges

Investment size: Capital investment is needed in tools to cut and form steel.

Synergies with other sectors: Cable routes and trays are needed in a range of other industries including oil and gas and power.

Competition: This will come from existing companies with established realtionships with distributors. Low complexity steelwork supply contracts are often decided by lowest cost.

Complexity of interface: The cable trays need to reflect the mechanical loads of the cable and to ensure that the cable is supported in line with the manufacturer's specification.

Proximity of customers: There is no need to be close to the customer. There are offshore substation topside suppliers in the BSR, but potential customers are located across Europe.

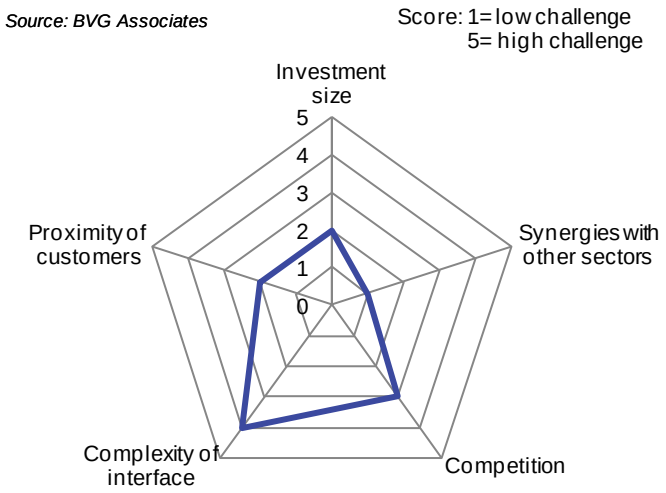

Figure 25 SME challenge assessment scores for cable routes and trays.

Recommendations

An SME could transition into the OWE sector. They will need to be cost competetive against existing suppliers with established distibution networks. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

5.2.6 Cranes

Scope of package

Cranes are required on substation structures for lifting and lowering of equipment and supplies around the substation and from maintenance vessels. Cranes of up to 18t at 25m outreach may be required as well as smaller 3t, 5m outreach cranes for personnel lifting and service of machinery on the platform.

Growth in demand

A Baltic offshore grid will lead to an increase in demand but the volumes are unlikely to be significant.

Assessment of challenges

Investment size: Capital investment is likely to be low for a company experienced in suppliying cranes.

Synergies with other sectors: Cranes are used across multiple industries including construction, oil and gas and shipping.

Competition: There is likely to be competition from existing suppliers operating across a wide range of industries.

Complexity of interface: There are no significant inferaces.

Proximity of customers: There is no need to be close to the customer.

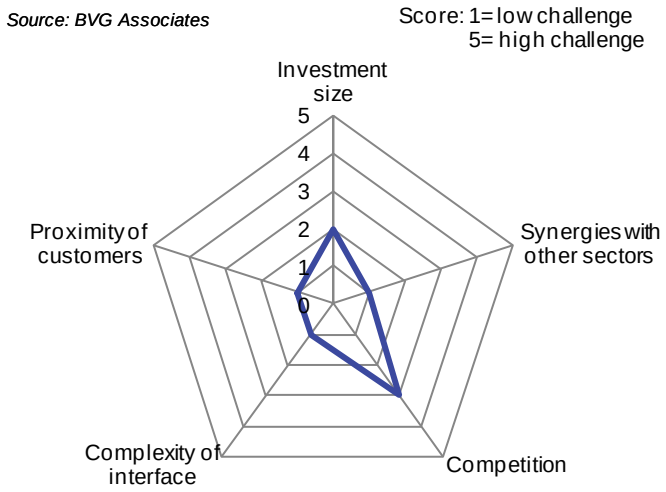

Figure 26 SME challenge assessment scores for cranes.

Recommendations

There are no significant barriers to transition into the sector from other markets. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

5.3 Substation structure installation

5.3.1 Port services

Scope of package

Ports and harbours are used during the installation of OWE transmissions and their operations, maintenance and service. Services include the provision of lay-down and storage land for large components, access to waterways and railways, stevedoring, cranes and lifting equipment and warehouses and workshops for storage or offices.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Investment will largely depend upon the port services required.

Synergies with other sectors: There are synergies with other sectors using port facilities, such as oil and gas, and freight and passenger shipping.

Competition: Competition will mostly come from other local ports and service providers within close proximity to the developments.

Complexity of interface: There is complex interfacing to co-ordinate port services within the delivery programme and co-ordinate with installation and maintenance contractors.

Proximity of customers: There is significant need to be close to customers.

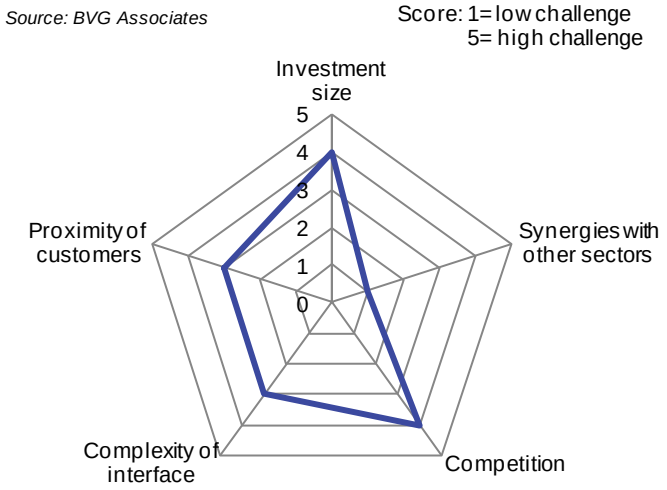

Figure 27 SME challenge assessment scores for port services.

Recommendations

Port services is an area that could create a significant opportunity for an SME looking to enter offshore wind. An understanding of the specific sector requirements would be beneficial. New entrants should focus only on Baltic customers because of the significant need to be geographically close to customers.

5.3.2 Crewing services

Scope of package

Crewing for offshore activities is provided by recruitment companies with specialist knowledge of the skilled and certified personnel required by the offshore wind sector.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Investment is likely to be low.

Synergies with other sectors: There is high synergies with other maritime industries such as oil and gas and shipping.

Competition: There is high competition from other crew providers who are active across Europe.

Complexity of interface: The crewing service provider will be required to interface with mutiple installation contractors to ensure crew are supplied in-line with project delivery schedules.

Proximity of customers: Although not essential, there may be benefit in being close to the customer.

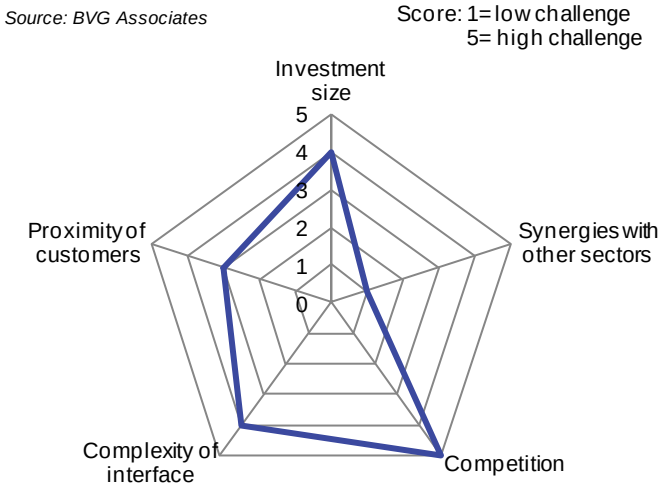

Figure 28 SME challenge assessment scores for crewing services.

Recommendations

There are unlikely to be any significant barriers to a crewing service provider entering the industry. A detailed knowledge of the qualifications and certifications is essential, alongside an understanding of OWE transmission installation and maintenance logistics. An SME could recruit staff from other crewing service providers already active in offshore wind. New entrants should focus on Baltic customers because of the benefits in hiring local contractors.

5.3.3 Crew transfer vessel services

Scope of package

Crew transfer vessels (CTVs) are used to move personnel and spares from shore. The operation of the vessels requires meticulous organisation of crew, spares and consumables. It is necessary to follow a regular vessel maintenance programme, such as inspecting the hull for exterior damage and checking the engine and communication tools are working properly.

Growth in demand

A Baltic offshore grid will lead to a significant increase in demand.

Assessment of challenges

Investment size: Purchasing vessels or upgrading vessels to the specifications required could be a significant investment.

Synergies with other sectors: CTVs are typically specially designed vessels for the offshore wind industry.

Competition: There is high competition from other crew vessel service suppliers who are active across Europe.

Complexity of interface: There is some interfacing to ensure coordination between delivery of spare parts and consumables.

Proximity of customers: There may be an advantage in being in close location to customers.

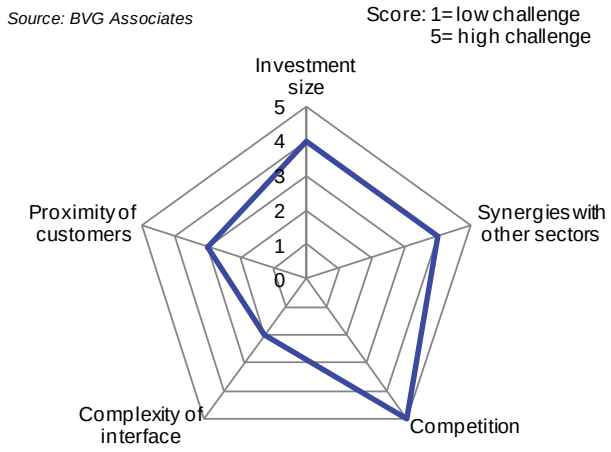

Figure 29 SME challenge assessment scores for crew transfer vessel services.

Recommendations

There could be significant barriers to entering the sector depending on the existing vessel fleet of a crew vessel provider. CTVs are typically state-of-the-art vessels and there could be challenges in investment cost for an SME looking to upgrade existing vessels or purchase new vessels. New SME entrants should focus on Baltic customers because of the benefits in hiring local contractors.

5.4 Substation structure maintenance

5.4.1 Asset inspection services

Scope of package

Substation structures need to be inspected regularly for marine growth, corrosion, paint condition and scour. Inspection can be via pre-planned inspection campaigns or on an as-needed basis. Inspection has typically involved commercial divers however the industry is looking towards more safety-innovative ways of inspecting, repairing and maintenance by using ROVs. Divers tend to complete inspection, repair and maintenance over a three to four month period in the summer when weather conditions are more favourable.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Capital investment for a diver-based assest inspection company is relatively low.

Synergies with other sectors: There are high synergies with oil and gas, interconnectors, military, police and science industries who all use the skills of commercial divers or ROVs.

Competition: There is high competition in the market for commercial divers given the surplus of experienced divers in the oil and gas industry.

Complexity of interface: There is no significant complexity of interfacing.

Proximity of customers: There is benefit in being located close to customers for quick response to any required maintenance works or unexpected faults. Contractors will need to build up relationships to secure customer trust.

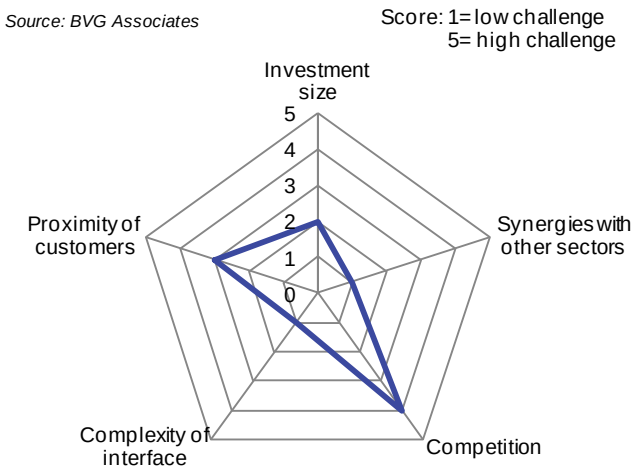

Figure 30 SME challenge assessment scores for asset inspection services.

Recommendations

Commercial diving for asset inspection services highly technical area and difficult for an SME to enter the sector without lengthy experience. It may be possible to enter the sector

by recruiting key individuals with experience in commercial diving. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the Baltic region. The client is normally the developer or maintenance contractor.

6. Substation electrical work packages

6.1 Substation electrical development

6.1.1 System design

Scope of package
Substation electrical system design encompasses design of the high voltage transmission and low voltage power distribution systems within the substation. The electrical design contract is usually carried out by large companies but subcontracts for defined smaller packages of work such as harmonic analysis or validation of designs may be let to SMEs.

Growth in demand
A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges
Investment size: Capital investment is not significant for systems design but it is a highly specialist area of work and contractors will employ people who are highly experienced.
Synergies with other sectors: Systems design for substation electricals may be needed in oil and gas, power generation and transmission industries and in large scale industrial process plant. It is a highly specialist activity.
Competition: There will be competition from the in-house teams of large electrical design companies.
Complexity of interface: Complexities of integrating the complete electical design will be handled by the main design contractor. An SME will likely have a discrete sub-contract for design work with few interfaces.
Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. There are several electrical system design companies in the Baltic region, each of which is a potential customer.

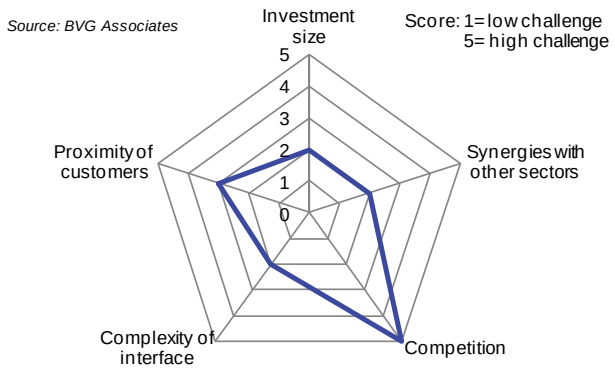

Figure 31 SME challenge assessment scores for system design.

Recommendations

Systems design is a highly technical area and difficult for an SME to enter the sector without experience. It may be possible to enter sector by recruiting key individuals from large electrical design companies. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR

6.2 Substation electrical manufacture

6.2.1 Busbars

Scope of package

Busbars are electrical conductors used for power distribution in large scale power environments. Generally they compraise solid or laminated metallic strips of copper, brass, or aluminum that both transmit electrical energy and provide a safe route to ground under fault conditions.

Growth in demand

A Baltic offshore grid will lead to an increase in demand but the volumes will not be significant.

Assessment of challenges

Investment size: Capital investment in busbar manufacture is likely to be low.

Synergies with other sectors: Busbars are used in a wide variety of electrical power systems including oil and gas extraction and processing, and similar large industrial processes.

Competition: There is likely to be competition from existing suppliers serving a wide range of industries.

Complexity of interface: Busbars form an integral part of the high voltage and low voltage systems of the substation electrical system. Busbars are manufactured to both generic specifications and application specific requirements.

Proximity of customers: There is no need to be close to the customer. Potential customers are located across Europe.

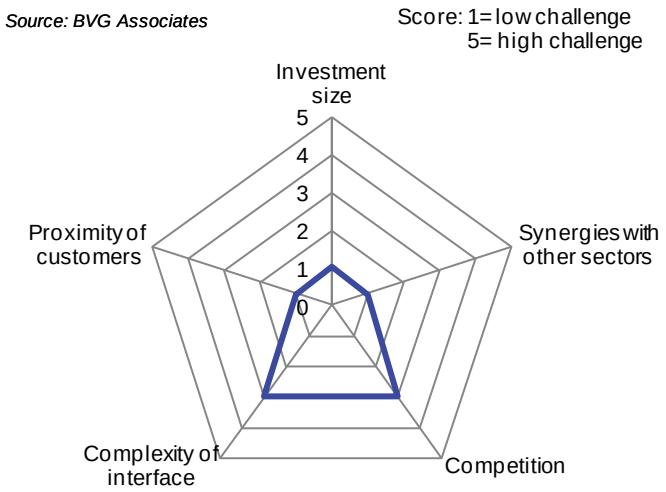

Figure 32 SME challenge assessment scores for busbars.

Recommendations

There are no significant barriers to transition into the OWE sector from supplying other markets. A detailed understanding of the electrical specifications required on substation electrical systems would be essential. New entrants should not only focus on Baltic customers becauce the opportunity could be greater outside the BSR.

6.2.2 Heating, ventillation and air conditioning

Scope of package

Design and supply of heating, ventillation and air conditioning for the substation high and low voltage equipment rooms, standby generators, and any personnel rest rooms or refuges. Technical specifications will normally be defined by the principal substation electrical design contractor.

Growth in demand

A Baltic offshore grid will lead to an increase in demand but the volumes are unlikely to be significant.

Assessment of challenges

Investment size: Capital investment is likely to be low.

Synergies with other sectors: Similar maritime heating, venting and air conditioning systems are supplied to the oil and gas and large scale shipping industries.

Competition: There is likely to be competition from in-house teams of susbstation design contractors and existing suppliers serving a range of industries.

Complexity of interface: The are some complexities in integrating with the high and low voltage systems as well as the physical layout of the substation topside.

Proximity of customers: It is not essential to be near to customers but regional supply close to substation manufacturing may be advantageous.

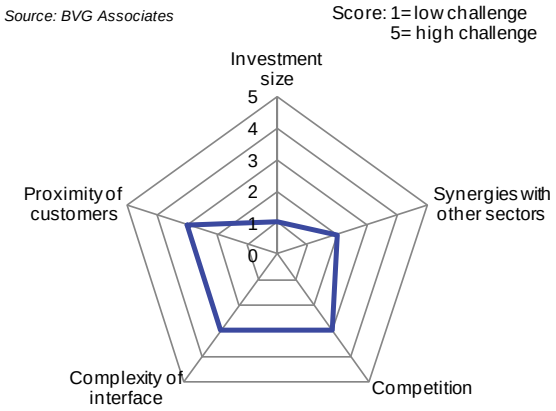

Figure 33 SME challenge assessment scores for heating, ventillation and air conditioning.

Recommendations

There are modest barriers to an SME offering heating, ventillation and air conditioning systems looking to enter the sector. An understanding of substation structures and eletrical equipment that is housed is an advantage when discussing needs with clients. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

6.2.3 Fire detection and suppression

Scope of package

Design and supply of fire detection and suppression systems for the substation high and low voltage equipment rooms, standby generators, and any personnel rest rooms or refuges. Systems will be designed to meet both local building codes and international or Europeans standards.

Growth in demand

A Baltic offshore grid will lead to an increase in demand but the volumes are unlikely to be significant.

Assessment of challenges

Investment size: Capital investment is likely to be low for SMEs that are already in the business of fire detection and suppression.

Synergies with other sectors: Similar maritime fire detection and suppression systems are supplied to the oil and gas, power generation and ship building industries.

Competition: There is likely to be competition from in-house teams of susbstation design contractors and existing suppliers serving a range of industries.

Complexity of interface: The are some complexities in integrating with the high and low voltage systems as well as the physical layout of the substation topside.

Proximity of customers: It is not essential to be near to customers but regional supply close to substation manufacturing may be advantageous.

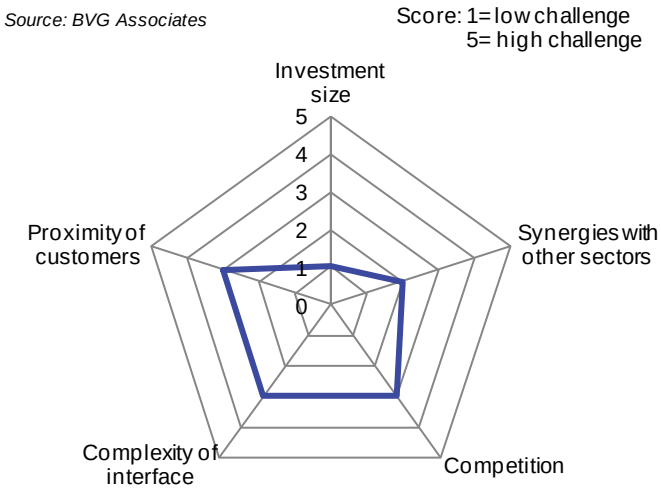

Figure 34 SME challenge assessment scores for fire detection and suppression.

Recommendations

There are modest barriers to an SME offering fire detection and suppression systems looking to enter the sector. An understanding of substation structures and eletrical equipment that is housed is an advantage when discussing needs with clients. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

6.2.4 Lighting

Scope of package

Lighting is used to aid safe navigation at sea and to enable workers to move safely around the substation. Lighting systems are supplied by specialist companies to the substation supplier.

Growth in demand

A Baltic offshore grid will lead to a modest increase in demand.

Assessment of challenges

Investment size: Capital investment is low.

Synergies with other sectors: There are strong synergies with other maritime industries that require safety lighting, such as oil and gas, shipping and construction.

Competition: There will be competition from other established industrial lighting companies.

Complexity of interface: There are no significant interfaces but navigation lighting must meet accredited safety standards.

Proximity of customers: There is no need to be close but contractors will need to build up relationships to secure customer trust. The client will be the substation structure supplier.

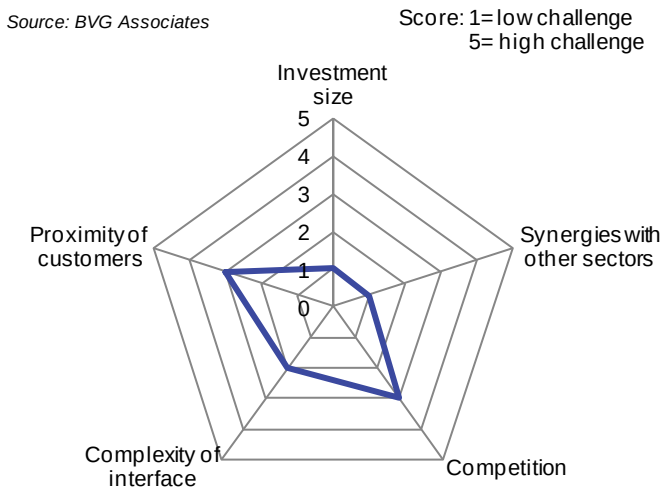

Figure 35 SME challenge assessment scores for lighting.

Recommendations

There are unlikely to be significant barriers for a lighting company looking to enter the sector. An understanding of substation structures and eletrical equipment that is housed is an advantage when discussing needs with clients. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

6.3 Substation electrical installation

6.3.1 Electrical services

Scope of package

Electricals systems are integrated into the substation structure onshore prior to installation at sea. Testing and commisioning is done onshore when possible such as for the low voltage systems. Integration testing and commissioning of the high voltge system is carried out offshore.

Growth in demand

A Baltic offshore grid will lead to a modest increase in demand.

Assessment of challenges

Investment size: Capital investment is significant as it is a highly specialist area of work and contractors will employ people who are have significant track record in electrical services.

Synergies with other sectors: Electrical installation services may be needed in oil and **gas, power generation or process plant industries. It is a highly specialist activity.**

Competition: Competition will mostly come from in-house teams of the large electrical systems suppliers.

Complexity of interface: There are significant interfaces between the various electrical systems installed in an offshore substation.

Proximity of customers: There is a some benefit to being in proximity to the site of substation manufacture or the installation site. Contractors will need to build up relationships with large electrical component suppliers or systems design contractors to secure customer trust.

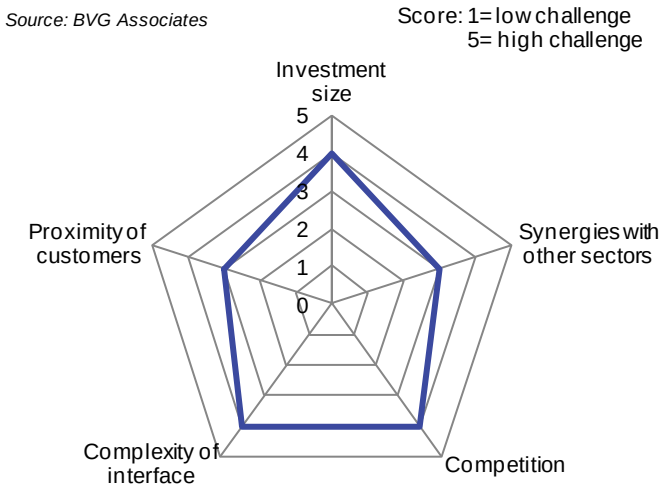

Figure 36 SME challenge assessment scores for electrical services.

Recommendations

Electrical installation is a specialist technical area and difficult for an SME to enter without track record. It may be possible to enter the sector by recruiting key individuals from electrical systems suppliers. New entrants should not focus only on Baltic customers because the opportunity could be greater outside the BSR.

6.4 Substation electical maintenance

6.4.1 Safety checks

Scope of package

Statutory inspections includes the checking, maintenance and repair of electrical equipment, personnel lifts, cranes, lifting equipment and fire safety equipment housed inside the substation. The inspections are completed on a regular basis, for example personnel lifts are checked once every six months, fire safety equipment once a year and lifting equipment once every two years.

Growth in demand

A Baltic offshore grid will lead to an increase in demand.

Assessment of challenges

Investment size: Capital investment will be low.

Synergies with other sectors: Statutory inspections are required for other industries such as oil and gas and onshore power industries.

Competition: There will be strong competition from experienced companies.

Complexity of interface: There will be modest complex interfacing between the original electrical suppliers and the companies underatking safety checks.
Proximity of customers: There is benefit in being located close to customers for quick response to any required maintenance works or unexpected faults.

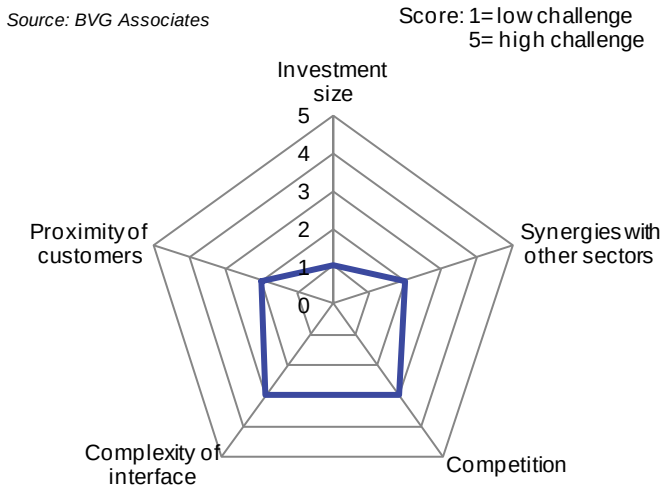

Figure 37 SME challenge assessment scores for safety checks.

Recommendations

Statutory inspections is an area that could create a significant opportunity for an SME looking to enter the OWE tranmission market. It would require a detailed understanding of the electrical systems that are used on offshore wind farms.

7. Case Studies

BSR SMEs have already delivered services in several of the work packages identified in this study. The following case studies show how BSR companies used existing skills and experience to provide a solution to a challenge faced by the OWE transmission industry. Information was provided by the companies themselves.

7.1 A-LEAF

Package
Structural design analysis.

Company background
A-LEAF is a design and management consultancy headquartered in Denmark. The company is founded on over 20 years experience in the wind industry and specialises in:
Design and engineering, including for electrical installations
Project management, and
Quality assurance and quality control.

Task
Substations are an essential part in ensuring efficient transmission of energy from wind farms to national grids. Developers of offshore wind farms need confidence in well-designed structures that comply with quality assurance and control measures.
A-LEAF was subcontracted by Bladt Industries (a major tier one supplier of turbine and substation foundations for offshore wind farms) to support their structural design analysis for an offshore wind substation project in Europe.

Action
A-LEAF used its experience of steel designing and engineering structures to support substation structure design. By collaborating with specialists early in the design phase, they made sure the design met specifications, requirements and demands for steel foundations. Bladt Industries commented that engineers are "highly qualified and have the right attitude to perform from day one".

Outcome
A-LEAF has expanded its business to aid clients globally and worked on several offshore wind projects including providing quality assurance and control on the Beatrice project in

the UK and on the Formosa project in Taiwan. It has also expanded into other service offerings, including offering electrical managers and SCADA engineers to work on Hornsea Project One in the UK.

7.2 Baltic Diver

Package
Diving services, and unexploded ordnance survey and removal.

Company background
Baltic Diver are a diving services company headquartered in Rostock who operate in the North Sea and Baltic Sea. They have over 20 years of diving experience and now specialise in:
UXO inspection and clearance
Air diving services
Inspection & maintenance of subsea structures
Salvage works
Offshore construction support
Civil underwater works
Port construction support, and
ROV services.

Task
Installing the export cable for an offshore wind farm requires the sea bed to be clear of any obstructions such as scrap metal, wrecks and unexploded ordnance. For such vital work, developers prefer to use trusted suppliers with a good track record that understand local sea conditions.

The EnBW Baltic 2 offshore wind farm required 120km of export cable laid to connect the onshore and offshore substations. The cable route passed through an area of sea bed that was known to have been subject to intensive military activity in the 20th century, providing a potentially dangerous environment for cable installation.

Action
Using their local knowledge of the area as a competetive advantage, Baltic Diver were able to win and carry out the work for the Baltic 2 project. They had dive teams working around the clock to deliver the unexploded ordnance survey to meet the client deadline.

Outcome
The offshore substation was installed following the successful unexploded ordnance survey work. As the industry has shifted from the use of divers to remotely operated

vehicles Baltic Diver has since invested in new ROV systems. They have since won further work in the OWE sector.

7.3 NDE Offshore

Package
Asset inspection services, ROV services, diving services, and cable surveys.

Company background
NDE Offshore is an offshore service provider headquartered in Sweden. They have over 12 years experience operating in offshore wind and oil and gas. NDE Offshore specialise in:
Inspection
Repair
Maintenance
Survey, and
Installation of topside and subsea structures.

Task
Substation structures need to be inspected regularly for marine growth, corrosion, paint condition and scour.
In Spring 2016, Siemens Transmission contracted NDE Offshore to provide annual inspections of the helideck substructures for BorWind Beta, HelWin Alpha and SylWin Alpha offshore converter stations in German waters.

Action
NDE Offshore completed the asset inspection services using rope access technicians. The contract was completed on time and on budget.

Outcome
In Autumn 2017, NDE Offshore won a further contract with Siemens Transmission to undertake visual inspections and surveys for the platforms. The contract was extended to include the HelWin Beta platform. They used ROVs and unmanned aerial vehicles (UAVs) to undertake general visual inspections and non-destructive testing of the steel structures.
NDE Offshore's capability to provide a wide range of asset inspection services also helped it win a two years contract (2017 and 2018) covering preparation, installation, inspection, repair and maintenance for the BARD I wind farm.
NDE Offshore has continued to win business in the form of many repeat contracts as well as from new clients. Their clients include many of the biggest global companies in the offshore wind supply chain such as Siemens, ABB and Vattenfall.

7.4 Peter Madsen Rederi

Package

Route clearance and pre-lay grapnel run, cable protection, and diving services.

Company background

Peter Madsen Rederi is a marine construction company headquartered in Denmark. It has over 15 years experience in the offshore wind industry and over 50 years experience in offshore work. It specialises in:

- Sea bed preparation
- Foundation scour protection
- Ballasting
- J-tube installations
- Cable trenching, and
- Diving support.

Task

In 2009, Peter Madsen Rederi was contracted to provide array and export cable trenching and cable burial on the small Danish projects; Sprogø and Rødsand 2.

Action

Peter Madsen Rederi used its experience and client relationships to expand its service offerings beyond cable trenching. It expanded to provide cable route clearance and pre-lay grapnel runs required before cable installation to remove end-of-life cables identified during marine surveys and to clear any obstacles that could obstruct cable ploughs used during cable installation. In 2013, it was awarded its first contracts in cable route clearance and pre-lay grapnel runs for the Amrumbank West and Westermost Rough projects in Germany and the UK.

Outcome

It has since won work from a number of offshore wind farms across Europe and has further expanded its offering into sea bed clearance. It's latest contract was from E.ON Climate and Renewables working on the 400MW Rampion project. It is the largest wind farm that the company has been contracted on to date.

7.5 Sabik Offshore

Package

Lighting, signage.

Company background

Sabik Offshore is a provider of marine lighting aids. It is headquartered in Germany and has over 30 years experience. For offshore structures it specialises in providing:

- Navigation aids
- Aviation obstruction lighting, and
- Signage.

Task

Offshore wind farms are required to have sufficient navigation lights and signage for health and safety purposes. Sabik Offshore is contracted to provide both temporary (during construction and installation) and permanent (during operation) marine lighting aids.

Action

In 2014, Sabik Offshore was the first company to standardise marine aids for offshore wind projects, therefore allowing it to provide a complete permanent marking solution for offshore wind farms including identification signs, floodlights, marine lanterns, fog signals, automatic identification system (AIS) and aviation obstruction lights.

Outcome

In 2016, Sabik Offshore and Orga Aviation (a Dutch provider of aviation obstruction products) signed an agreement to develop integrated marine aids to navigation and aviation obstruction.Sabik Offshore has earned the trust and respect of customers and become a market leader in aids to navigation in offshore wind. It has been involved in every German offshore wind farm to date and has expanded into markets in the UK, Netherlands, Denmark and Taiwan.

Its marine lighting is installed on over 1,800 wind turbines and on 35 offshore platforms.

8. Conclusions

The offshore wind market in the BSR could increase from 1.8GW installed at the end of 2017 up to 9.5GW at the end of 2030. This increase in capacity offers opportunities for SMEs looking to enter into the offshore wind transmission market through development, manufacture, installation and maintenance.

This study identified the following main conclusions:

- Demand will increase in work packages that can be undertaken by an SME, however this may not result in increased demand for SME services.
- Competition from rival businesses is the biggest challenge to SMEs entering the market
- There are significant opportunities to transition from, or diversify into, similar markets
- There are advantages to SMEs being capable of providing multiple work packages
- There are opportunities for SMEs to serve markets outside of the BSR
- Strong relationships with large supply chain contractors may be necessary for SMEs
- SMEs can exploit advantages of proximity to the customer
- Investment may be required for both capital assets and skills
- There are opportunities for SMEs to demonstrate their innovative capabilities

Demand will increase in work packages that can be undertaken by an SME, however this may not result in increased demand for SME services.

Offshore wind developments in the BSR will provide an increase in demand across most of the work pages identified in the study. The size of demand varies across supply chain element and lifecycle stage however, with the greatest growth likely to be in crew services and crew transfer vessel services that are required across both installation and maintenance. While almost all work packages will experience growth to at least a small degree it is unlikely a Baltic SME can form a business case for entering the offshore wind transmission market based on serving this industry alone. Work packages with the lowest barriers to entry for SMEs tend to be ones with lower growth opportunities.

Competition from rival businesses is the biggest challenge to SMEs entering the market

From the criteria used to assess the challenges for SME market entry into each work package, the existing competition in the market presents the highest challenge. Many work packages require highly specialised skills or an established track record which are difficult for SMEs to obtain. These packages are most likely to be kept in-house by the primary fabrication or installation contractors and may only become available to SMEs when the contractor has insufficient in-house capacity to fulfil multiple contracts at once. When subcontracting opportunities do arise they are likely to be won by competitors that may be large companies. An SME looking to enter these highly specialsied areas should look to recruit experienced individuals from competitors.

There are significant opportunities to transition from, or diversify into, similar markets

Companies that have experience supplying similar industries such as oil and gas, telecommunications or inteconnectors are more likely to be able to transition into the OWE transmission market. In order to demonstrate a credible track record within offshore wind and compete with experienced suppliers, SMEs must focus on their technical, commercial and logistical experience in applications that are relevant to offshore wind. Gaining a detailed understanding of the technology, supply chain and contracting approaches is essential to identify key potential customers. For more specialised packages, partnerships with existing offshore wind suppliers can help establish credibility and are often an effective way to enter the sector.

Similarly, an SME considering entering the offshore wind market should consider that its potential customers may also be in parallel sectors due to synergies with other markets being found in all the work packages identified in this study.

There are advantages to SMEs being capable of providing multiple work packages

Many work packages can be contracted as single packages to reduce interfacing complexity and risk to the end client. Some work packages, such as offering both design and manufacturing work, is advantageous to be integrated. SMEs in the BSR who have been successful in entering the offshore transmission sector tend to demonstrate capability in multiple areas.

There are opportunities for SMEs to serve markets outside of the BSR

Although demand will increase significantly in the BSR by the end of 2030, offshore wind will also be installed in significant volumes across the North Sea and moderate levels in the Atlantic and Mediterranean. Contracting across the existing market has shown that offshore wind operates a truly European supply chain. Many work packages have been delivered by suppliers who are not located in close proximity to their sub-suppliers or end client. SMEs should consider their capability to export goods and services to the wider European market. Once some capability and experience has been gained, there may also be opportunities to expand into emerging markets, such as in North America and Asia who will look to European suppliers until their domestic supply chains are established.

Strong relationships with large supply chain contractors may be necessary for SMEs

The scale and importance of offshore transmission assets means that a high level of trust is required in any SME subcontracted to undertake most of the described work packages. An SME that has developed a relationship with a large contractor should look to secure a framework agreement to enhance the likelihood of further opportunities. Some of the advantages of framework agreements include:

- Strengthening the working relationship between client and supplier
- Cost efficencies of delivering multiple contracts
- Increase in company confidence, allowing re-investment into the company, or expansion into other work packages and markets, and
- Standardisation of supply.

Framework agreements often 'split' larger packages into smaller scopes of work, which are more accessible for SMEs with low experience or ability to take on risk to secure. SMEs in the BSR have found success in securing framework agreements with major offshore wind contractors.

SMEs can exploit advantages of proximity to the customer
Some successful Baltic SMEs have utilised their proximity to customers or projects to win work in OWE transmission. In many cases this initial package of work has been used as a platform to demonstrate SME capability that has allowed the company to win further work.

Investment may be required for both capital assets and skills
Many SMEs will have the equipment or infrastructure in place to supply to the OWE transmission market without significant further investment. Expanding capabilities to be able to win additional work packages may require further investment in capital assets but in some cases also in skills development such as training or certification, due to the highly skilled nature of many work packages.

There are opportunities for SMEs to demonstrate their innovative capabilities
Offshore wind faces challenges in deploying larger volumes of more reliable technology whilst maintaining an emphasis on cost reduction. A strong and competent European supply chain has grown to support the offshore wind industry and many companies are exploring innovative ways to reduce costs. An SME that can demonstrate capability and offer an innovative solution that reduces costs in a work package will be attractive to a large client.

References

Baltic InteGrid. *Internal document*. 2018.

WindEurope. *Offshore Wind in Europe - Key trends and statistics 2017*. Online: 2018. https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Offshore-Statistics-2017.pdf .