Scottish Enterprise – Supply Chain Support

Presenter name: Adam Swainbank

Event name: MarramWind – Supply Chain Event

Date: 29th Nov 2023

Supporting the Development of the Scottish Offshore Wind Industry

SE is working with private sector and public sector partners to realise the opportunities that the recent leasing rounds for offshore wind (OW) will provide – unlocking billions of investment in infrastructure, innovation, supply chain and skills, and anchoring jobs and wider benefits throughout Scotland.

SE's focus across 6 areas:

1. Developers & Tier 1's. Working with developers and Tier 1's to understand their requirements, challenges and opportunities.

2. Supply chain. Strengthening Scotland's supply chain companies' capacity & capability

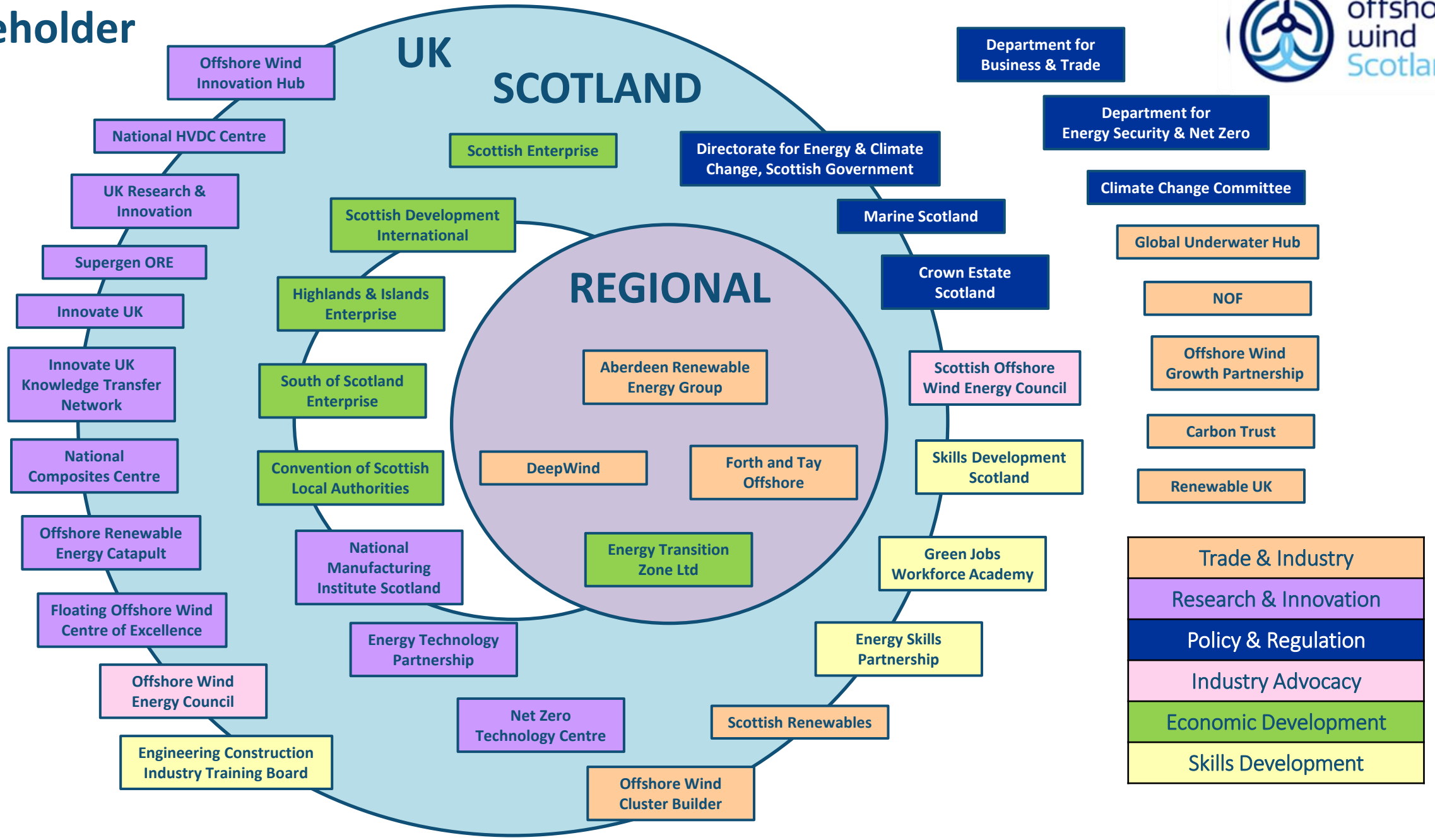
3. Capital investment. Attracting Investment to infrastructure projects, large scale investments and companies

4. Infrastructure. Supporting the expansion and development of Scotland's ports and harbours & large scale manufacturing& marshalling capabilities

5. **Innovation**. Driving innovation, new technologies and new market entrants

6. Attracting Inward Investment

Stakeholder Map



Offshore Wind Delivery Team

David Rennie, Head of Offshore Wind Team

Jamie Sansom, Offshore Wind Team Lead

Nicola Baillie, Offshore Wind Team Administrator

Leonore Frame, Developer Engagement Specialist

John McGinnes, Developer Engagement Specialist

Adam Swainbank, Supply Chain Specialist

Laura Finlay, Supply Chain Specialist

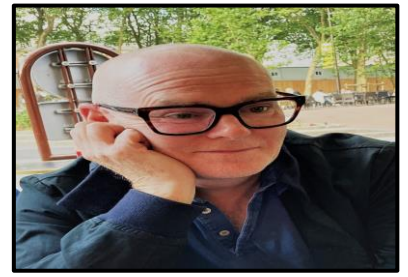
Gregor McDonald, Offshore Wind Specialist

Euan Dobson, Project Manager - Ports

Stuart Wilson, Team Leader - Ports

Simon Wallace, Team Leader - SDI

Gordon McLarnon, Offshore Wind Specialist - SDI



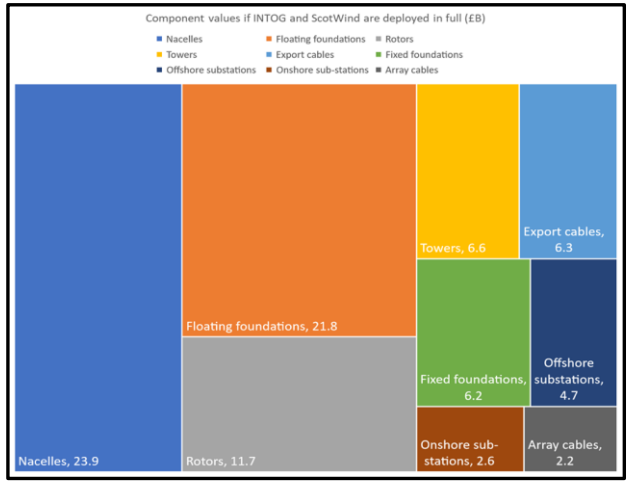
Phil Stirling, Offshore Wind Specialist - SDI

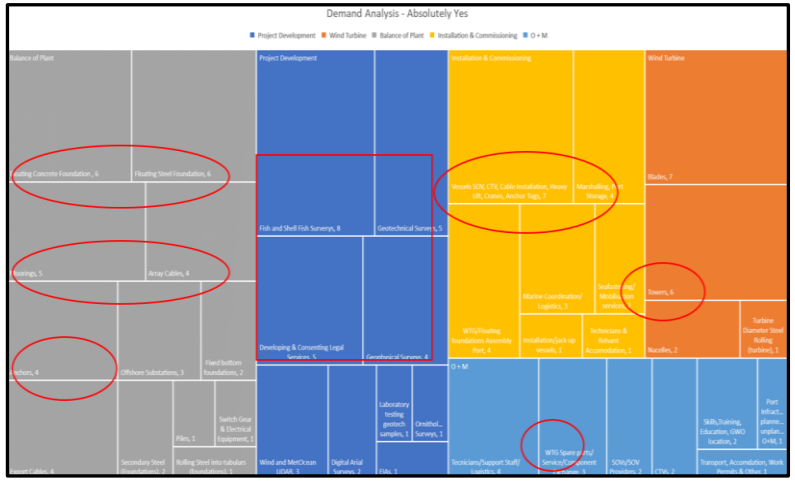
Data and Insights

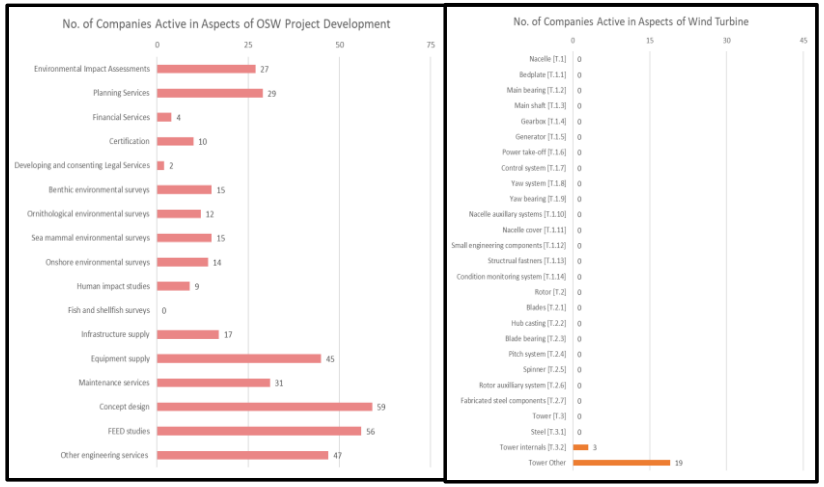
Value analysis
Using publicly available data, SE understands the proportion of spend on major components & total spend if INTOG and ScotWind are built out in full.

Demand analysis
Working with the ScotWind developers, SE understands their aggregated view of the components that they would like to have a Scottish solution for.

Gap analysis
The gap analysis, using 2021 Xodus supply chain survey data, informs us of the Scottish capability in each phase of the project development cycle – it gives us a baseline.



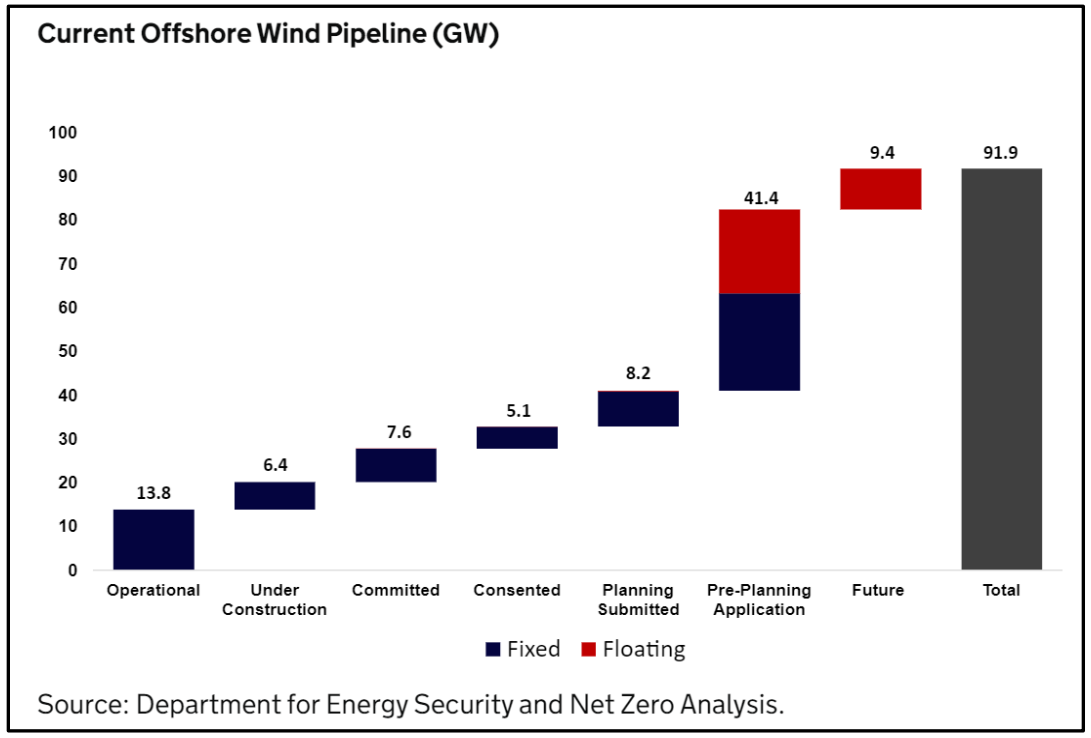




Supply chain development

- “If the UK is to accelerate the deployment of Offshore Wind, the supply chain needs to be able to respond to that challenge” Tim Pick – Offshore Wind Champion - UK GOV

- Early movers such as Germany, Denmark and Spain in onshore wind invested in nacelle, blade and tower manufacturing. Tier 2’s such as castings and forgings companies followed and built around the OEM’s



- UK now has a 70 GW pipeline (40GW Scotland) of projects (FiD, consented, planning, submitted, pre-planning)

- Pipeline is bigger enough for Tier 1 OEM’s to consider UK as a manufacturing destination

Supply chain development

Investor interest

- Sumitomo (Nigg) and XLCC (Hunterston) announcing cable manufacturing sites
- Vestas have announced interest in setting up a turbine manufacturing facility
- Mooreast have expressed interest in establishing a mooring and anchor facility in Aberdeen

SE category manager approach

- Towers
- Cables
- Blades
- Floating sub-structures
- Moorings and Anchors

Demand

Value

Domestic supply chain potential

Exports

Moorings & Anchors

FACTFILE:

Mooring systems and anchors secure floating offshore wind turbines to the seabed, ensuring a fixed location.

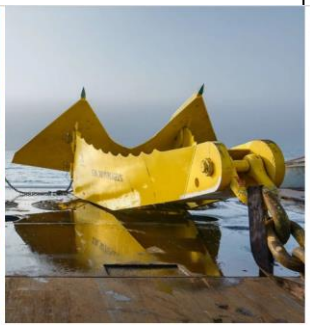
FACTORY:

A factory can produce 100 completed mooring systems per year and 120 completed anchors per year.

Located near quayside for ease of assembly and installation.

Factory site is approximately 10 hectares each .

Examples of anchors: suction pile anchor and a drag embedment anchor



RECOMMENDATION:

There is a high demand for moorings & anchors from developers. Although there are significant existing capabilities in Scotland, a substantial increase in capacity is necessary.

2023 SCDS ANALYSIS:

- Moorings and anchors have been mentioned in 10 SCDS documents, with a focus on boosting local content through assembly and manufacturing opportunities.

VOICE OF THE DEVELOPER:

- Manufacturing present significant manufacturing opportunity in Scotland, with capacity increase required.

Demand

SCOTWIND & INTOG ADDRESSABLE MARKET:

- £0.9bn for anchors and £2.5bn for mooring systems

Value

SUPPLY CHAIN POTENTIAL:

- Existing supply chain from legacy industry in some mooring system components.
- Opportunity to build supply chain around anchor inward investors.

Supply Chain Potential

EXPORT:

- Scottish exporters can leverage opportunities via world renowned capabilities,
- International floating wind markets are of particular significance.

Export

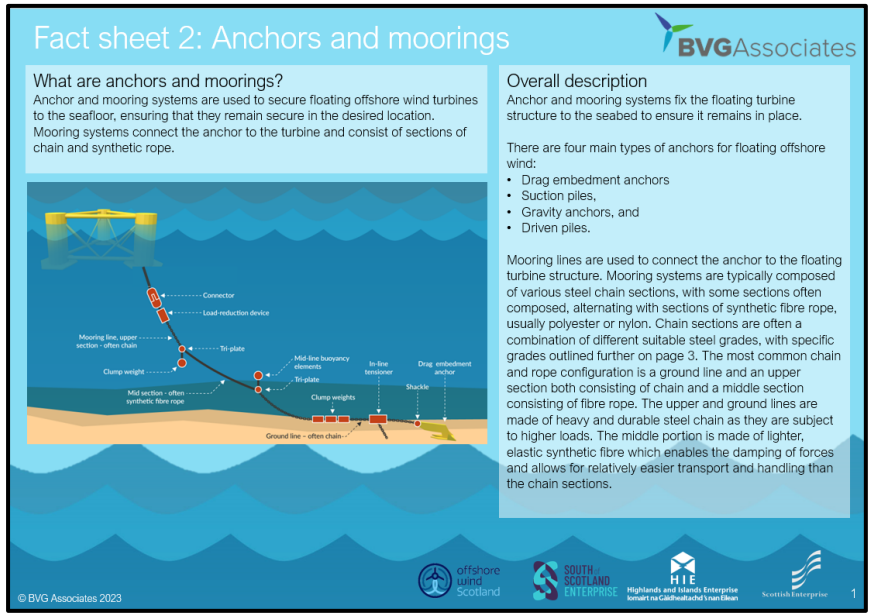
Mooring chain being stored at quayside

CATEGORY MANAGER:

Laura Finlay

Manufacturing opportunities – component breakdown

- 5 manufacturing sheets to be published early next year
- Secondary steel, moorings & anchors, cables & accessories, cable protection systems, corrosion protection
- Webinar 17th January 2024 – delivered by SE & BVG
- Workshop planned at SR conference January



Fact sheet 2: Anchors and moorings

BVGAssociates

What are anchors and moorings?

Anchor and mooring systems are used to secure floating offshore wind turbines to the seafloor, ensuring that they remain secure in the desired location. Mooring systems connect the anchor to the turbine and consist of sections of chain and synthetic rope.

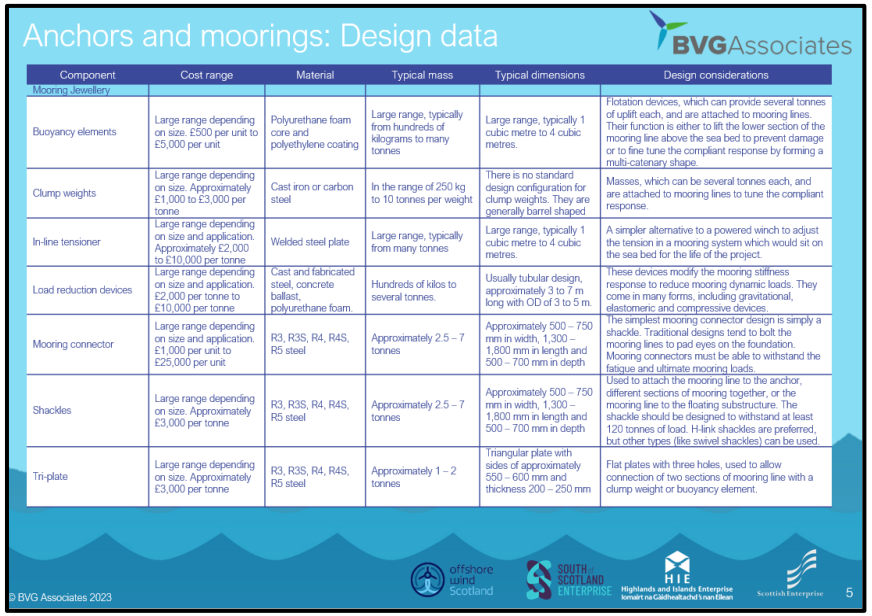
Overall description

Anchor and mooring systems fix the floating turbine structure to the seabed to ensure it remains in place.

There are four main types of anchors for floating offshore wind:

- Drag embedment anchors
- Suction piles,
- Gravity anchors, and
- Driven piles.

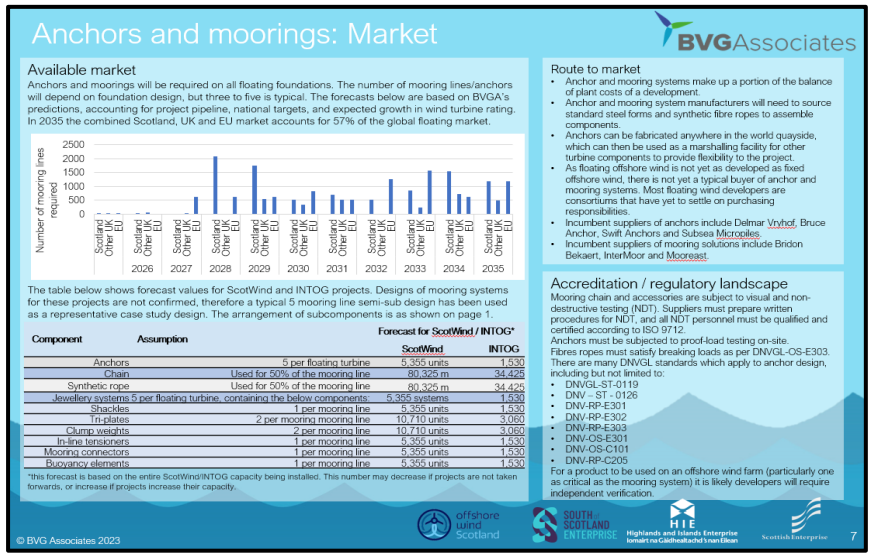
Mooring lines are used to connect the anchor to the floating turbine structure. Mooring systems are typically composed of various steel chain sections, with some sections often composed, alternating with sections of synthetic fibre rope, usually polyester or nylon. Chain sections are often a combination of different suitable steel grades, with specific grades outlined further on page 3. The most common chain and rope configuration is a ground line and an upper section both consisting of chain and a middle section consisting of fibre rope. The upper and ground lines are made of heavy and durable steel chain as they are subject to higher loads. The middle portion is made of lighter, elastic synthetic fibre which enables the damping of forces and allows for relatively easier transport and handling than the chain sections.



Anchors and moorings: Design data

BVGAssociates

Component	Cost range	Material	Typical mass	Typical dimensions	Design considerations
Mooring Jewellery					
Buoyancy elements	Large range depending on size. £500 per unit to £5,000 per unit	Polyurethane foam core and polyethylene coating	Large range, typically from hundreds of kilograms to many tonnes	Large range, typically 1 cubic metre to 4 cubic metres.	Flotation devices, which can provide several tonnes of uplift each, and are attached to mooring lines. Their function is either to lift the lower section of the mooring line above the sea bed to prevent damage or to fine tune the compliant response by forming a multi-catenary shape.
Clump weights	Large range depending on size. Approximately £1,000 to £3,000 per tonne	Cast iron or carbon steel	In the range of 250 kg to 10 tonnes per weight	There is no standard design configuration for clump weights. They are generally barrel shaped	Masses, which can be several tonnes each, and are attached to mooring lines to tune the compliant response.
In-line tensioner	Large range depending on size and application. Approximately £2,000 to £10,000 per tonne	Welded steel plate	Large range, typically from many tonnes	Large range, typically 1 cubic metre to 4 cubic metres.	A simpler alternative to a powered winch to adjust the tension in a mooring system which would sit on the sea bed for the life of the project.
Load reduction devices	Large range depending on size and application. £2,000 per tonne to £10,000 per tonne	Cast and fabricated steel, concrete ballast, polyurethane foam.	Hundreds of kilos to several tonnes.	Usually tubular design, approximately 3 to 7 m long with OD of 3 to 5 m.	These devices modify the mooring stiffness response to reduce mooring dynamic loads. They come in many forms, including gravitational, elastomeric and compressive devices.
Mooring connector	Large range depending on size and application. £1,000 per unit to £25,000 per unit	R3, R3S, R4, R4S, R5 steel	Approximately 2.5 – 7 tonnes	Approximately 500 – 750 mm in width, 1,300 – 1,800 mm in length and 500 – 700 mm in depth	The simplest mooring connector design is simply a shackle. Traditional designs tend to bolt the mooring lines to pad eyes on the foundation. Mooring connectors must be able to withstand the fatigue and ultimate mooring loads.
Shackles	Large range depending on size. Approximately £3,000 per tonne	R3, R3S, R4, R4S, R5 steel	Approximately 2.5 – 7 tonnes	Approximately 500 – 750 mm in width, 1,300 – 1,800 mm in length and 500 – 700 mm in depth	Used to attach the mooring line to the anchor, different sections of mooring together, or the mooring line to the floating substructure. The shackle should be designed to withstand at least 120 tonnes of load. H-link shackles are preferred, but other types (like swivel shackles) can be used.
Tri-plate	Large range depending on size. Approximately £3,000 per tonne	R3, R3S, R4, R4S, R5 steel	Approximately 1 – 2 tonnes	Triangular plate with sides of approximately 550 – 600 mm and thickness 200 – 250 mm	Flat plates with three holes, used to allow connection of two sections of mooring line with a clump weight or buoyancy element.



Anchors and moorings: Market

BVGAssociates

Available market

Anchors and moorings will be required on all floating foundations. The number of mooring lines/anchors will depend on foundation design, but three to five is typical. The forecasts below are based on BVGA's predictions, accounting for project pipeline, national targets, and expected growth in wind turbine rating. In 2035 the combined Scotland, UK and EU market accounts for 57% of the global floating market.

The table below shows forecast values for ScotWind and INTOG projects. Designs of mooring systems for these projects are not confirmed, therefore a typical 5 mooring line semi-sub design has been used as a representative case study design. The arrangement of subcomponents is as shown on page 1.

Component	Assumption	Forecast for ScotWind / INTOG* ScotWind	INTOG
Anchors	5 per floating turbine	5,355 units	1,530
Chain	Used for 50% of the mooring line	80,325 m	34,425
Synthetic rope	Used for 50% of the mooring line	80,325 m	34,425
Jewellery systems 5 per floating turbine, containing the below components:		5,355 systems	1,530
Shackles	1 per mooring line	5,355 units	1,530
Tri-plates	2 per mooring mooring line	10,710 units	3,060
Clump weights	2 per mooring line	10,710 units	3,060
In-line tensioners	1 per mooring line	5,355 units	1,530
Mooring connectors	1 per mooring line	5,355 units	1,530
Buoyancy elements	1 per mooring line	5,355 units	1,530

*this forecast is based on the entire ScotWind/INTOG capacity being installed. This number may decrease if projects are not taken forwards, or increase if projects increase their capacity.

Route to market

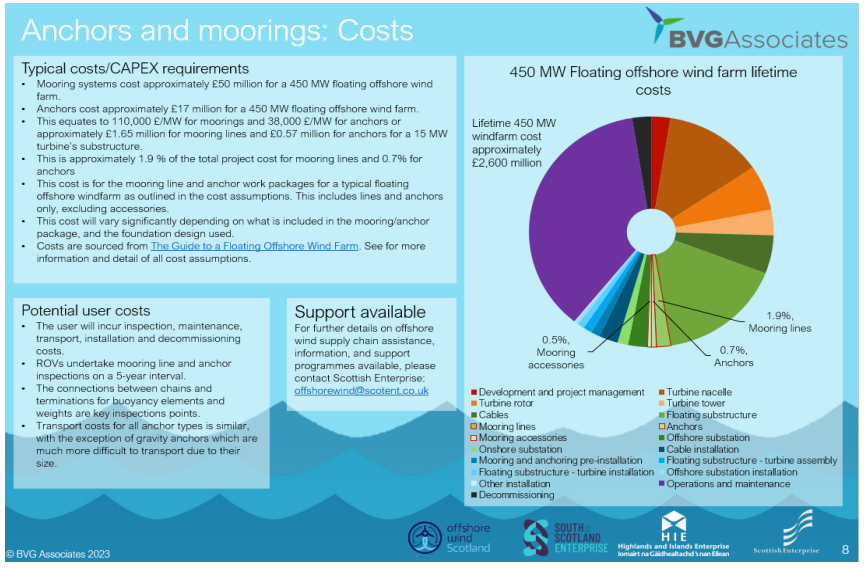
- Anchor and mooring systems make up a portion of the balance of plant costs of a development.
- Anchor and mooring system manufacturers will need to source standard steel forms and synthetic fibre ropes to assemble components.
- Anchors can be fabricated anywhere in the world quayside, which can then be used as a marshalling facility for other turbine components to provide flexibility to the project.
- As floating offshore wind is not yet as developed as fixed offshore wind, there is not yet a typical buyer of anchor and mooring systems. Most floating wind developers are consortiums that have yet to settle on purchasing responsibilities.
- Incumbent suppliers of anchors include Delmar Vryhof, Bruce Anchor, Swift Anchors and Subsea Micropiles.
- Incumbent suppliers of mooring solutions include Bridon Bekaert, InterMoor and Mooreast.

Accreditation / regulatory landscape

Mooring chain and accessories are subject to visual and non-destructive testing (NDT). Suppliers must prepare written procedures for NDT, and all NDT personnel must be qualified and certified according to ISO 9712.
Anchors must be subjected to proof-load testing on-site.
Fibres ropes must satisfy breaking loads as per DNVGL-OS-E303.
There are many DNVGL standards which apply to anchor design, including but not limited to:

- DNVGL-ST-0119
- DNV – ST - 0126
- DNV-RP-E301
- DNV-RP-E302
- DNV-RP-E303
- DNV-OS-E301
- DNV-OS-C101
- DNV-RP-C205

For a product to be used on an offshore wind farm (particularly one as critical as the mooring system) it is likely developers will require independent verification.



Anchors and moorings: Costs

BVGAssociates

Typical costs/CAPEX requirements

- Mooring systems cost approximately £50 million for a 450 MW floating offshore wind farm.
- Anchors cost approximately £17 million for a 450 MW floating offshore wind farm.
- This equates to 110,000 £/MW for moorings and 38,000 £/MW for anchors or approximately £1.65 million for mooring lines and £0.57 million for anchors for a 15 MW turbine's substructure.
- This is approximately 1.9 % of the total project cost for mooring lines and 0.7% for anchors
- This cost is for the mooring line and anchor work packages for a typical floating offshore windfarm as outlined in the cost assumptions. This includes lines and anchors only, excluding accessories.
- This cost will vary significantly depending on what is included in the mooring/anchor package, and the foundation design used.
- Costs are sourced from The Guide to a Floating Offshore Wind Farm. See for more information and detail of all cost assumptions.

450 MW Floating offshore wind farm lifetime costs

Potential user costs

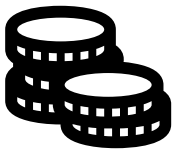
- The user will incur inspection, maintenance, transport, installation and decommissioning costs.
- ROVs undertake mooring line and anchor inspections on a 5-year interval.
- The connections between chains and terminations for buoyancy elements and weights are key inspections points.
- Transport costs for all anchor types is similar, with the exception of gravity anchors which are much more difficult to transport due to their size.

Support available

For further details on offshore wind supply chain assistance, information, and support programmes available, please contact Scottish Enterprise: offshorewind@scotent.co.uk

Scottish Enterprise – Business Support Services

offshore wind Scotland

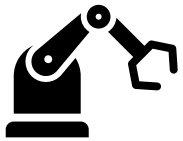


Funding & Grants

Our grants can help you with a wide range of activities, from developing new products to creating jobs or exporting. Available to SMEs and larger companies.

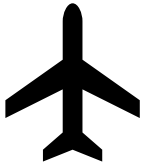
Business Development & Advice

We can work closely with your business to help you achieve your goals – from scaling up to succession planning and collaboration opportunities.



Product & Service Development

If you're looking to develop a new product or service, we can help. Get innovation support from our team of advisors and specialists, access R&D funding and connect to a network of innovation.



Exports & International Markets

Looking to start exporting or expand your international sales? Explore our range of exporting guides, international market research and advisory services.

Productivity and Employee Engagement

Our workplace innovation services will help empower your staff to make your business more efficient, productive and profitable.

External Support Services

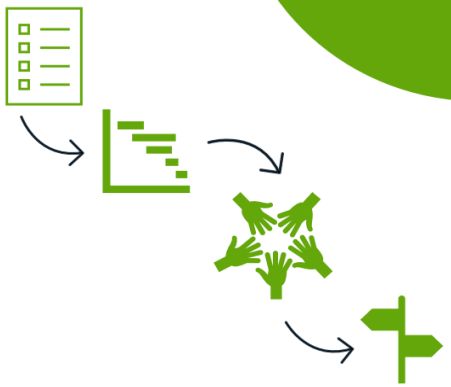
Wind Expert Support Toolkit (WEST) – Aims

Offshore Wind Growth Partnership

WEST is a low intensity intervention within the OWGP's business transformation programme and aims to support growth of supply chain companies entering or already embedded in the offshore wind sector.

WEST is a short-term foundation support activity that will include:

- an assessment of a company's needs
- development of a plan to address company needs
- bespoke and targeted advice and support
- recommendations for next steps and action plans

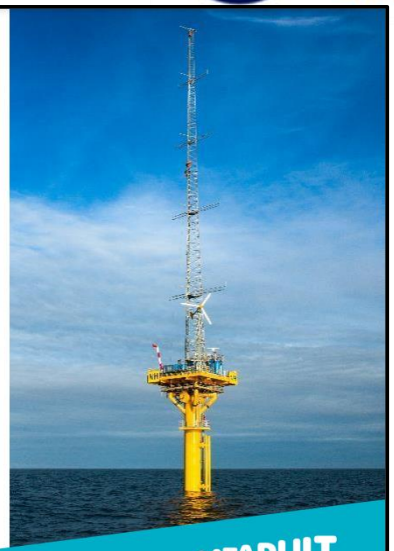


Aim

F4OR Fit For Offshore Renewables

*"To increase the **competence**, **capacity** and **competitiveness** of the UK offshore renewable energy supply chain, **maximising opportunity** for the UK supply chain, both domestically and globally."*

- Identifies "high potential" supply chain organisations, with a strategic interest in the Offshore Wind industry
- Addresses barriers to entry for UK supply chain companies, and increasing UK content by providing **sector specific support, underpinned by business excellence**
- Help companies **build capability, know how to apply it to win business**, and support **sustained continuous improvement**



CATAPULT Offshore Renewable Energy

Who is Sharing in Growth?

Established in 2012, Sharing in Growth is an award winning organisation that has secured over £5bn of contracts to companies in Aerospace, Civil Nuclear and associated sectors, accelerating the companies' growth beyond their peers.

The approach is to work closely with the leadership team, combining Sharing in Growth's benchmark analysis with the companies' strategy to define key business challenges. This results in a wholly bespoke set of intervention 'blocks' with their specific targets.

Typical areas of focus

- A Accelerating profitable growth by focussing on customer need, commercial and sales
- B Galvanising a leadership team, clear deployment of goals, with the management and culture to deliver a strategic aim
- C Reducing the cost of a key product or service
- D Reducing cost of procurement
- E Optimising operations to release working capital
- F Operationalising a new product or service

CASE STUDY: LAUNCH ACADEMY

Launch Academy, established in 2020, is an Offshore Renewable Energy (ORE) Catapult programme set up to support UK-based SMEs entering the offshore wind industry.

CATAPULT Offshore Renewable Energy

Working with Launch Academy sponsors, the programme identifies key technology challenges that represent a market opportunity for new businesses. Previous cohort sponsors include major industry players such as bp, Ørsted, RWE, and Equinor. Together, they identify challenges in the UK supply chain that the cohort's products can overcome. Examples include:

- Developing low-carbon vessel technologies
- Monitoring and protecting cables
- Monitoring and protecting wildlife

The programme concludes with a graduation ceremony where companies have the rare business opportunity to pitch to the sponsors, as well as ORE Catapult's network of investors.

CHALLENGE

SMEs face numerous hurdles when navigating their way into the offshore wind industry. Key technical, commercial, financial, legal, contractual, and risk-based considerations must be made before bringing a technology, product, or service to the offshore wind supply chain. It can be daunting for SMEs to enter a new market, and some fail at an early stage due to a lack of support.

SMEs are vital to make sure the supply chain can support the expected offshore wind industry expansion, and that this delivers economic benefit to the UK on the road to net zero.

SOLUTION

Launch Academy is a nine-month programme for UK SMEs that aims to break down barriers when bringing an innovative technology, service, or product to the offshore wind industry. It recruits up to 10 companies at a time onto the programme, which is delivered by experts at ORE Catapult, key industry players and business growth and professional services, allowing each company to really connect with the energy industry.

ORE Catapult works with each cohort to understand their businesses and help them tackle the challenges they might face through a series of modules focused on specific barriers.

The programme gives companies the chance to proactively engage with the industry and receive valuable and tailored support and guidance that they can use to launch their product.

RESULTS

Since Launch Academy started in 2020, it has had a lasting impact on cohort companies. From the 2022 cohort, Jet Connectivity and MasterFilter are just two of the success stories that have accelerated their entry into the UK offshore wind supply chain due to being part of Launch Academy.

p.01

Source: OWGP & ORE Catapult

Thank you ☺

Any questions?

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