

OFFSHORE WIND INTERNATIONAL EXPORT MARKETS

A Guide for Scottish Exporters



SOWEC
Scottish Offshore Wind Energy Council

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FOREWORD

The 2020s mark the dawn of a new era for Scottish offshore wind.

With no fewer than four commercial-scale projects under construction, a new Contract for Difference (CfD) auction round (AR4) opening in autumn 2021, and ScotWind due to award up to 10 gigawatts of development rights in early 2022, the outlook for offshore wind in Scotland has never looked better. However, the sustenance and growth of a vibrant indigenous supply chain is only possible if Scottish companies can access international markets and compete on the world stage. As the world awakens to the promise of offshore wind, there is a time sensitive window for the Scottish supply chain to capitalise on the UK's market leading position to export niche offshore engineering knowledge and expertise.

The Scottish Offshore Wind Energy Council (SOWEC) brings together government and industry to shape the development and growth of Scotland's offshore wind sector. SOWEC seeks solutions to key industry challenges and advocates change in pursuit of a strong, commercially-attractive offshore wind sector in Scotland that can deliver both domestically and in the global offshore wind market. In 2021, SOWEC will issue a revised vision, updated goals and new roadmaps, informed by a significant programme of research comprising:

- A detailed, independent Scottish Investment Assessment (SIA) covering the whole offshore wind supply chain, which was published in August;
- A suite of five insight reports covering (i) Scottish stakeholder mapping, (ii) a Scottish content baseline and vision for 2030, (iii) an investigation into offshore wind contractual T&Cs, (iv) an investigation into pre qualification for offshore wind tenders, (v) an investigation into the potential for a unified procurement portal; and
- A study of the global offshore wind market opportunity to 2030 and this resultant 'Guide for Scottish Exporters'.

One of the key commitments of the UK Offshore Wind Sector Deal is the realisation of £2.6bn of exports (per year) for UK-based companies by 2030. While international markets will be keen to foster opportunities for indigenous supply chains, there is a strong recognition that the Scottish supply chain has the potential to play an important role in driving offshore wind innovation and deployment on a global basis.

The Scottish offshore wind supply chain has first-rate resources at hand – namely the Department of International Trade (DIT) and Scottish Development International (SDI) – to enable success on the international stage. Authored by Scotia Supply Chain and developed in association with DIT and SDI, this guide is intended to help Scottish offshore wind exporters identify and enter the highest potential markets to 2030.



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SCOTTISH OFFSHORE WIND ENERGY COUNCIL (SOWEC)

ABOUT US

SOWEC is a partnership between the Scottish public sector and industry that works to maximise the benefits to Scotland of offshore wind.

MISSION

To coordinate and grow the sector, ensuring the Scottish offshore wind industry is more sustainable, competitive, and commercially attractive, both domestically and in the global offshore wind market.

VISION

A world-class offshore wind sector that underpins the transition to net zero by 2045 and maximises the value to Scotland.

GOALS

- Deliver 11GW of fixed and floating offshore wind in Scottish waters by 2030;
- Establish Scotland as a world-class offshore wind sector at the leading edge of technology innovation, driving excellence in efficiency, productivity, safety, and sustainability;
- A transformational and rapid increase in economic value, delivering a world-class supply chain in Scotland;
- Develop a highly skilled and diverse workforce, support new entrants, expand apprenticeships and enable transitioning from existing sectors whilst inspiring the future talent pipeline and increasing the representation of women and BAME workers; and
- Champion floating and fixed offshore wind's contribution to achieving Scotland's net-zero commitment by 2045, incorporating the oil and gas transition, hydrogen and wider energy system integration.



Image courtesy of Crown Estate Scotland

INTERNATIONAL CONTEXT – THE OFFSHORE WIND REVOLUTION

The need to rapidly decarbonise the global energy mix is stark and rightly at the centre of the international socio-political agenda. Offshore wind is set to play a pivotal role in these global efforts due to its rapid journey to commercialisation over the past two decades. As a key actor in this story, it is fitting that the eyes of the world will be fixed on Scotland when Glasgow hosts the UN Climate Change Conference in late 2021.

Ten years ago, the UK offshore wind sector was challenged to deliver de-risked, commercially competitive clean energy at scale. Government and industry came together to agree a target to reduce the cost of offshore wind energy to £100 per megawatt hour (MWh) by 2020: a target that was met four years ahead of schedule. In 2019, government and industry came together once again to agree a new ambition for offshore wind within the UK Offshore Wind Sector Deal. Galvanised by the sector's earlier successes in cost reduction and commercialisation, the Sector Deal sets the challenge of building a globally competitive UK offshore wind industry, capable of delivering a four fold increase in UK's offshore wind capacity over the decade to 2030, thus cementing offshore wind's place at the cornerstone of UK clean energy policy for decades to come.

As the UK offshore wind market moves from the early commercialisation phase into maturity, many other nations are just beginning their own offshore wind journey. Global deployment will grow exponentially over the next decade, presenting the experienced Scottish supply chain with a fantastic window of opportunity to help global markets evolve at speed, drawing on the lessons learned in the UK's own trailblazing journey to 10GW of offshore wind by 2020.

The UK Offshore Wind Sector Deal commits to a five fold increase in UK offshore wind exports to reach £2.6 billion per annum by 2030. However, given the rapidly evolving nature of the sector, there is no

one-size-fits-all approach for export success that can be adopted for each geographical market or supply chain sub-element. Scottish companies are already thriving in the international offshore wind market, but in order to sustain and grown this success, a number of logistical, socio-economic, contracting and cultural challenges must be evaluated and understood at a granular geographical level.

At a sectoral level, the 'standard' offshore wind lifecycle will continue to evolve rapidly over the coming decade – development phase cycles are contracting, construction phases are generally staying the same – masking the fact that rates of deployment and asset scale are rising massively and operational phases are extending significantly, with many of the next generation wind farms designed to be in operation for 40 years. Irrespective of market geography, Scottish companies that can stimulate skills, competition and / or innovation levers in offshore wind supply are well placed to succeed.

Scotland is a nation that has always punched above its weight historically in innovation and international trade. Offshore wind presents an opportunity to continue this track record by delivering solutions to meet the growing demands of international markets. With an indigenous roadmap to deploy at least 11 gigawatts (GW) of offshore wind by 2030, and aspirations to become the global centre of excellence for floating wind, the next decade has the potential to facilitate strong growth for Scottish offshore wind specialists across the development, construction and

operational phases of the supply chain lifecycle.

In addition to potential UK deployment of up to 40GW by 2030 (up from 10GW in 2020), seven high potential European countries are expected to achieve deployment of around 62GW of offshore wind by 2030 (up from 29GW in 2020). Three high potential Asian markets expect to raise offshore wind deployment from 0.3GW in 2020 to 27GW by 2030. Offshore wind deployment in North America is expected to rise from less than 0.1GW in 2020 to between 20-30GW by 2030. In short, 11 international markets are projected to achieve a combined capacity of 110-120GW of offshore wind by 2030: 11 times the size of Scotland's deployment over the same time frame.

With an unprecedented number of international developers expected to be active in Scotland following the first round of ScotWind Leasing, the time has never been better for prospective Scottish exporters to leverage opportunities via these multinational entities and their main contractors. By seizing these opportunities, the Scottish offshore wind supply chain can be the vanguard of a new green era in Scottish international trade. This guide aims to help Scottish exporters identify and access international opportunities to 2030 and beyond by forecasting likely deployment, prevalent contracting arrangements, possible technology choices, in-country global supply threats and known Scottish offshore wind competencies.

OFFSHORE WIND INDUSTRY DYNAMICS

This guide aims to appraise current and prospective Scottish exporters of the most likely international offshore wind opportunities to 2030. However, it should be noted that the sector is evolving rapidly, with different countries at different stages of the technology adoption lifecycle, and no two wind farms the same. In order to articulate the prevailing opportunities, a number of broad assumptions have been made.

To provide companies with an international view of demand at a granular sub-element level across the development, construction, operation and decommissioning phases of offshore wind lifecycle, this guide is based upon a likely mid-2020s Scottish 'standard' offshore wind project. Given the

fact that most international markets are behind Scotland in technology adoption terms, it has been deemed that this gives the most appropriate view across global markets for the next decade. Where particular technology choices have not been confirmed for international projects, appropriate assumptions have been

made considering the anticipated sectoral dynamics summarised in the remainder of this section, which looks at the project lifecycle broken down by the development expenditure (DEVEX), capital expenditure (CAPEX), operational expenditure (OPEX) and decommissioning expenditure (DECEX) phases.

STANDARD OFFSHORE WIND LIFETIME SPEND

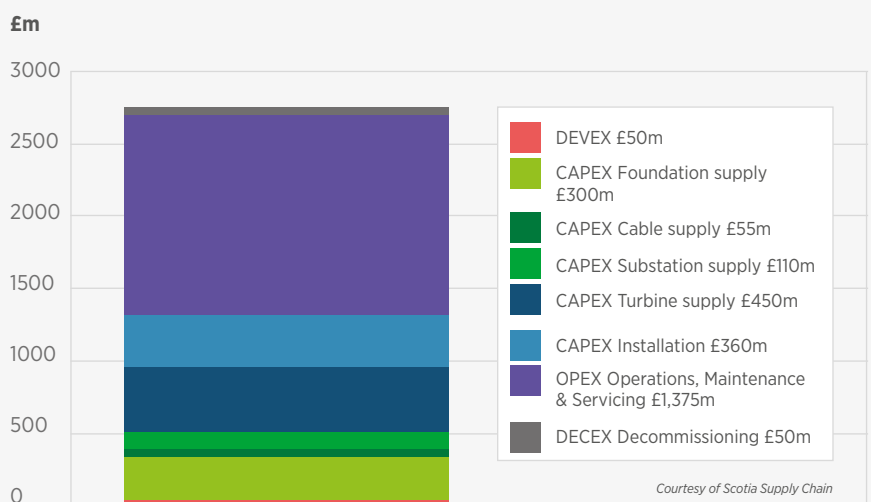
The international market sizing contained within this guide is based on a perceived offshore wind lifecycle spend assumption of around £2.75bn for a 500MW project.

DEVELOPMENT PHASE (DEVEX)

Standard Scottish lifetime 500MW spend assumptions: 6-year developer cycle, no site pre-development. As the offshore wind sector has matured, the standard development phase of an offshore wind project has reduced significantly – early 10-year development cycles have generally halved. Whilst the core consenting, environmental assessment, front end engineering and design (FEED) and survey activities are common across all projects, international market nuances must be considered:

- Scottish exporters may be challenged with development activities that require specialist local market knowledge e.g. access to site-specific condition data or technical information in a foreign language.
- Unlike the UK market, a large proportion of international markets prefer to 'pre-develop' offshore wind zones via state agencies, before

Standard Scottish Lifetime Spend – 500MW



putting out to tender. Scottish exporters should not overlook these early development opportunities and must be mindful that subsequent developer DEVEX phases may be shorter / lower as a result of the early pre-development activity.

- Development cycles are heavily influenced by how advanced the offshore / seabed licensing process is in each country – early international offshore wind adopter lifecycles can be more protracted.

- A number of innovations will increasingly change the nature of early development activities including non-fixed data acquisition solutions, advanced high-definition surveying and dynamic engineering modelling.

PROCUREMENT & CONTRACTING PHASE (CAPEX)

Standard Scottish lifetime 500MW spend assumptions: EPCI contracting via six EPC packages (foundations, export cables, inter-array cables, onshore substation, offshore substation and turbines) and six separate installation packages.

With >95% of lifetime project spend committed after a Financial Investment Decision (FID) is taken, it is important for Scottish exporters to understand the prevalent contracting approaches anticipated in each international market.

Similar to the UK market, international developers use bespoke package procurement strategies that generally split into two broad contracting approaches:

- Multi-contracting: Generally employed by only the biggest international developers with the ability to assume interface and construction risk, this multiple package direct procurement approach will likely be the exception rather than the rule across most international markets. Via this arrangement, Scottish exporters are most likely to contract directly with the project developer (in-country or via global centralised procurement functions).
- Engineer, Procure, Construct, Install (EPCI): Most international projects pre-2030 are likely to be contracted via this approach, where a smaller number of large packages of work are managed by a contractor, generally known as a ‘tier one’ supplier. Packages are likely to be split in different ways with design, manufacturing and installation packaged together or split apart and managed by a tier one contractor with any of these specialisms (e.g. a foundation EPCI package contracted by an installed EPCI contractor where design and / or original equipment manufacturer (OEM) can be subcontracted at a tier two level). Via this arrangement, Scottish exporters most likely to enter the international market via a pre-existing tier one relationship.

CAPEX – FOUNDATION SUPPLY

Standard Scottish lifetime 500MW spend assumptions: 62 non-monopile steel jackets and associated piles, water depth of 40m. Foundation technology will evolve at pace across the 2020s as projects go further from shore, into deeper water and into areas with particularly challenging seabed conditions. Foundation technology choice is generally well known for the majority of international markets to 2025. All projects likely to be deployed in high potential countries to 2030 have been assessed individually within this guide. Where foundation technology choices have not been publicly confirmed, assumptions have been made based on the prevailing site conditions. Foundation technology selection is based on a number of factors, but site water depth is generally the prevailing factor, so the following broad assumptions have been used within this guide:

- 0 - 40m water depths – most likely Monopiles
- 40 - 65m water depths – most likely Jackets
- 65m+ water depths – most likely Floating

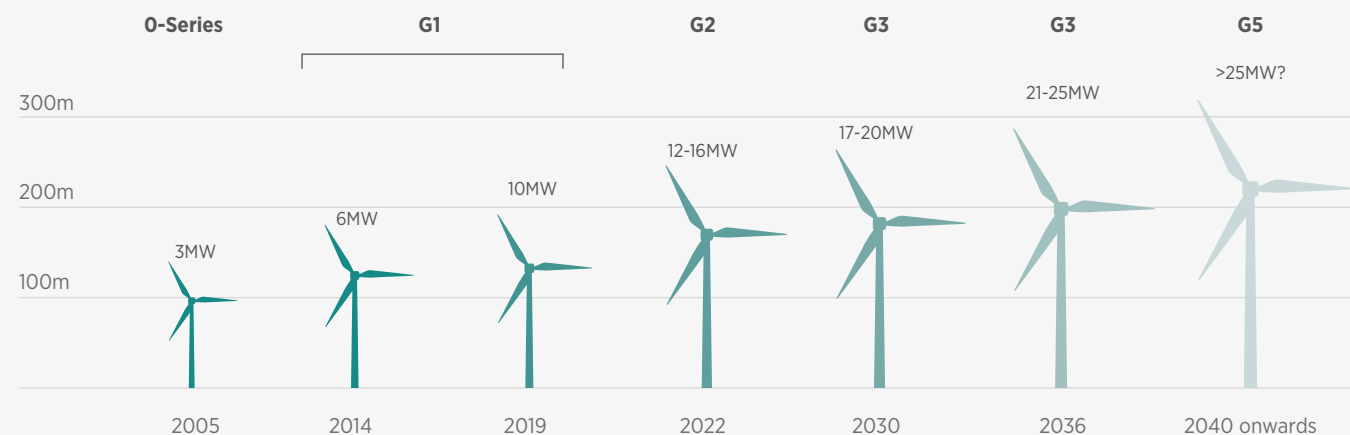
CAPEX – CABLE SUPPLY

Standard Scottish lifetime 500MW spend assumptions: circa 150km of medium voltage alternating current (MVAC) 66kV inter-array cables / circa 60km of offshore high voltage AC (HVAC) 220kV export cables and 20km onshore. Innovation in cable technology is expected across the 2020s as projects go further from shore (increasing the potential for transmission loss) and assets become larger in size (driving the development of high-capacity DC solutions). International markets are likely to evolve by deploying nearer shore sites first, which will most significantly influence export cable requirements. Although design variations exist, offshore wind cables are increasingly becoming a commodity item.

CAPEX – SUBSTATION SUPPLY

Standard Scottish lifetime 500MW spend assumptions: two offshore AC substations / one onshore substation. International substation demand will be heavily influenced by distance to shore and the rate of offshore capacity increase, but markets are largely expected to follow the UK market precedent.

Turbine Capacity Roadmap



CAPEX – TURBINE SUPPLY

Standard Scottish lifetime 500MW spend assumptions: 62 8MW turbines. Turbines will continue to drive innovation and technology advancement across wind farm balance of plant, with larger capacity (upscaled) turbines and improvements in power electronics driving changes to foundation sizing and the optimisation of electrical transmission systems. International market turbine selections are generally known for projects out to 2025; beyond this, assumptions have been made as outlined below.

Fixed foundation projects will likely see one further generational evolution beyond the current 'Generation 2' turbine platforms (~220m rotor diameter), which are due to achieve commercial operation by 2022. The next generation of turbine platform (Generation 3) will feature a rated capacity in the order of 17-20MW (~250m rotor diameter) and could deploy around the middle of the decade. Considering early-stage international markets, Scottish exporters should be aware that Generation 2 turbine platforms may be further industrialised to maintain the viability of larger monopile foundations.

CAPEX – INSTALLATION

Standard Scottish lifetime 500MW spend assumptions: construction / marshalling port for turbine, foundations and installation support services, cables and substations delivered directly to a site circa 30km from shore. Large European vessel contractors are investing heavily in next generation installation resources and are expected to be active in all high potential international markets.

OPEX – OPERATIONS, MAINTENANCE & SERVICING

Standard Scottish lifetime 500MW spend assumptions: small boat crew transfer vessel (CTV) access strategy, 10-year turbine warranty followed by 25-year post-warranty operational servicing. Next generation wind farms are designed to operate for up to 40 years. An increased level of deployment in one geographical concentration or further from shore will increase the need for remote / intervention-less solutions and the use of large service operation vessels (SOV) for economical access.

DECEX – DECOMMISSIONING

Scotland is expected to have a number of competencies in this area, but the international decommissioning market is unlikely to reach critical mass until the turn of the decade.

HIGH POTENTIAL SCOTTISH EXPORT SUB-ELEMENTS

This guide will focus on the size of the international opportunity for high Scottish potential export sub-elements. A simple high / medium / low grading has been applied to perceived general Scottish national competences, areas of strong Scottish offshore wind track record and perceived exportability from a practical, logistical and competitive supply chain threat perspective. High potential international sub-element demand trends will be covered in greater detail in the high potential market deep-dive section.

Project Lifecycle Opportunity Assessment

Spend Phase	Project %	Major sub-element	£m	Scottish capability	Scottish OSW track record	Export suitability	Scottish export dynamics
DEVEX £50m	2%	Consenting, Leasing & Development	37.5	High	High	Low	Healthy deployment and main developer in-country presence has embedded skills. Likely to be supported locally overseas.
		Environmental assessment & Professional services	4	High	High	High	Strong Scottish environmental and socio-economic impact assessment expertise. Perceived overseas need for lessons learned intelligence.
		Subsea survey	3	Medium	Medium	Low	Despite good Scottish expertise, main geophysical and geotechnical surveys likely to be supported by large vessel international surveyors.
		FEED & Advisory services	2	High	High	High	Strong Scottish offshore design and engineering capabilities developed over last 50 years. Perceived demand via established global network.
		Offshore data & Metocean services	2	High	Medium	High	Established Scottish innovative expertise in offshore data collection, servicing & interpretation. Strong perceived international demand.

OFFSHORE WIND INDUSTRY DYNAMICS

DEVEX £50m	2%	Site survey	1.5	High	High	Low	Strong mammal and environmental monitoring capabilities exist. Drive to contract with local contractors likely to be strong.
CAPEX (Foundation OEM) £300m	11%	Jackets	265	High	Medium	Medium	Scotland has a strong offshore fabrication heritage, moderate track record in wind. Perceived competitive and logistical challenges internationally.
		Piles	35	High	High	Medium	Strong fabrication capability has established a good track record in this area. Linked to jacket supply, perceived international logistical challenge.
CAPEX (Cable OEM) £55m	2%	Export	33	Low	Low	Low	Investment required in establishing Scottish cable OEM capacity in order to service wind. Beyond sub-tier support elements, limited export opportunities are likely.
		Inter-array	17	High	Low	Medium	Established national capability but no wind track record. Modest investment and strategic realignment could leverage export opportunities.
		Cable accessories	5	High	High	High	Strong established capabilities regarding cable protection, terminations and connectors. Innovative capabilities likely to leverage export opportunities.
CAPEX (Sub-station OEM) £110m	4%	Onshore	52	High	High	Low	Strong Scottish onshore electrical construction experience has developed a good wind record. Highly likely to be supported by local contractors internationally.
		Offshore	58	High	Medium	Medium	Established tier 1 alternating current (AC) offshore topside capability and experience. There is also potential for direct current (DC) topside fabrication. potential exists. International opportunities possible, particularly if large DC topside demand begins.
CAPEX (Turbine OEM) £450m	16%	Nacelles	330	Medium	Low	Low	Main European turbine OEMs have tended not to establish overseas capability due to strong national electronics capability. Limited export potential.
		Blades	70	High	Low	Medium	World-renowned composites and aerodynamic capabilities but no blade OEM track record. Future inward investment potential could leverage export opportunities.
		Towers	40	High	Medium	High	Strong national fabrication capability and good wind track record. Further investment will leverage very strong export opportunities.
		Assembly	10	High	Medium	High	Industry-leading heavy lift and assembly capabilities already in wind. Strong export opportunities anticipated.

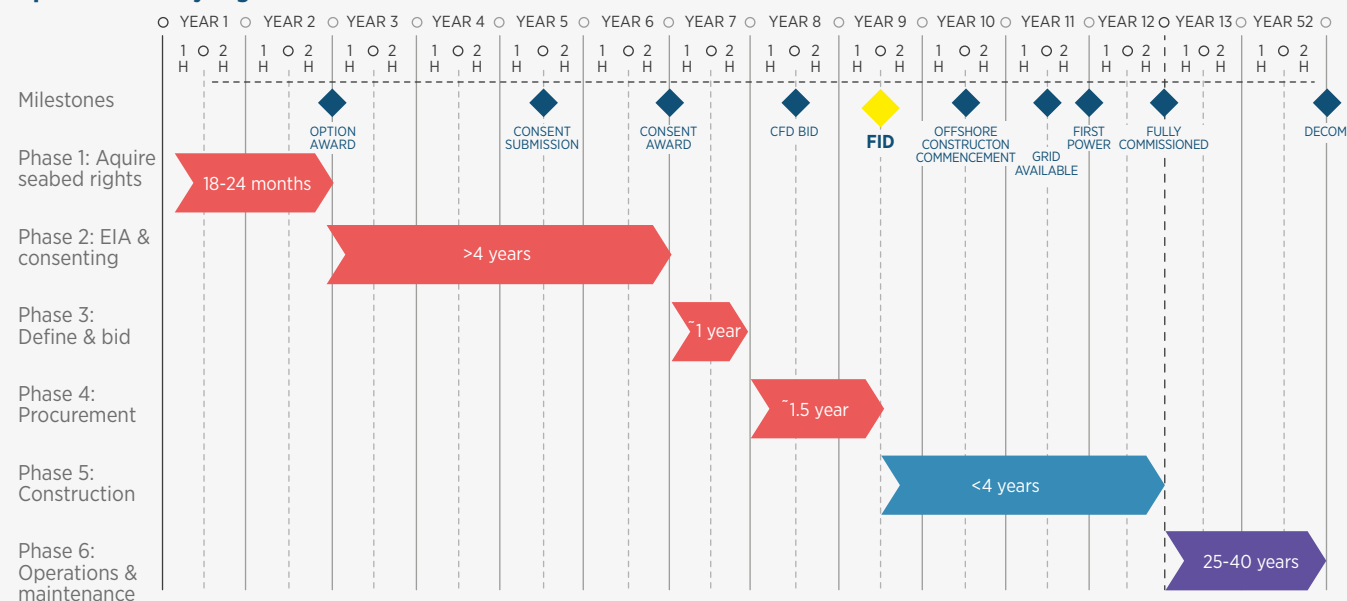
CAPEX (Installation) £360m	13%	Foundations	200	Low	Low	Low	Market dominated by European large vessel specialists. Limited export potential expected.
		Cables	60	Low	Low	Low	Market dominated by European large vessel specialists. Limited export potential expected.
		Cable services	15	High	Medium	High	Well-developed capabilities across installation support areas such as ROVs, jetting and cable burial. Very strong international export potential anticipated.
		Turbine	50	Low	Low	Low	Market dominated by European large vessel specialists. Limited export potential expected.
		Onshore substation	30	High	Medium	Low	Strong Scottish electrical and infrastructure contractors with a growing track record. Highly likely to be supported by local contractors internationally.
		Offshore substation	5	Low	Low	Low	Market dominated by European large vessel specialists. Limited export potential expected.
OPEX (Operations, Maintenance & Servicing) £1,375m	50%	Operations and project management	410	High	High	Low	Numerous Operations, Maintenance & Servicing (OMS) port hubs established across Scotland with associated sub-supply expertise. Developers likely to invest in-country in each overseas market.
		M & S turbine warranty (10 years)	230	High	Medium	Medium	Strong tier 2 expertise developed via subcontract from the main turbine OEMs. European turbine OEMs likely to invest directly in-country, key local content focus.
		M & S turbine post-warranty (25 years)	460	High	Medium	High	Strong tier 2 expertise, multi-disciplinary partnerships evolving. Potential exists internationally in markets where 3rd party ISPs are sought.
		M & S Balance of Plant	275	High	Medium	High	50-year heritage of maintaining offshore assets, strong subsea and topside service providers in wind. Significant export opportunities across cables and foundations.
DECEX £50m	13%	Decommission	50	High	Low	Medium	High synergies with inherent decommissioning capability established to service the North Sea oil & gas programme. Limited market size in the next decade.

UNDERSTANDING EXPORT MARKET PROJECT LIFECYCLES

Projects will be developed at different rates in different countries, depending largely on market maturity. Therefore Scottish exporters need to consider project and procurement cycles carefully. For the purposes of this guide, the graphic below has been assumed as the most likely standard project lifecycle applicable for international markets to 2030.

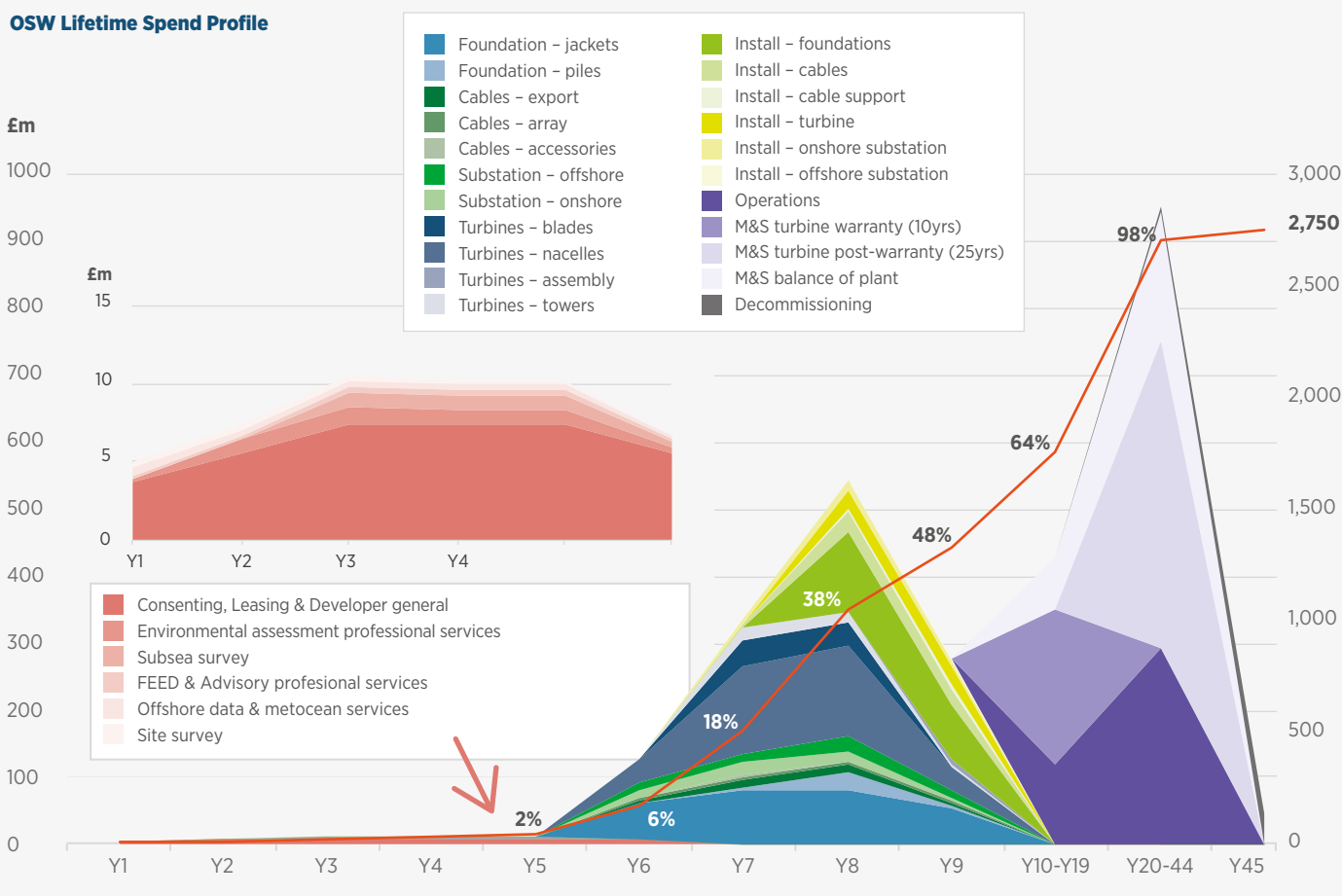
Scottish exporters must approach international markets mindful that significant procurement activity is undertaken well before the point of financial investment decision on a project. This is of particular significance when seeking to access international opportunities via established European tier one contractors.

Export market lifecycle gantt



The graphic below provides Scottish exporters a view of how international projects will be contracted across the full lifecycle:

OSW Lifetime Spend Profile



FLOATING WIND

Home to the largest floating offshore wind project in the world and considerable research and development (R&D) activity, Scotland is rightly at the forefront of the drive to commercialise this offshore wind technology variant. A number of countries will, in the main, seek to go straight to this technology due to a lack of nearshore shallow water

sites. The Scottish supply chain has a number of world-renowned capabilities in offshore dynamic engineering, moorings and anchoring, therefore, international floating wind markets are of particular significance. This will be highlighted, where appropriate, in the subsequent high potential market deep-dive section.

INTERNATIONAL ATTRACTIVENESS MATRIX

Having identified likely international project timescales, spend profiles and perceived high potential Scottish export sub-elements in the previous section, a number of influencing factors affect the perceived attractiveness of any given international market.

MARKET SCALE TO 2030

Size is everything. International wind markets have been graded on relative market size to 2030; this is clearly the strongest influencing factor for a country's perceived attractiveness from a Scottish export standpoint. International deployment to 2025 is well understood – and likely to be relatively fixed – but most international markets now have stated 2030 deployment aspirations. The grading below and in the next section of this guide assess how mid-term market size aspirations are likely to be realised on a country-by-country basis.

APPETITE FOR IMPORTING EXPERTISE

International markets are likely to have varying degrees of appetite for accepting imported Scottish goods and services, based on a number of factors such as domestic supply chain strength, gaps in expertise, price competitiveness and political pressure. The perceived appetite within high potential key markets is considered in greater depth in the next section of this guide.

EARLY-STAGE SUPPLY CHAIN DEVELOPMENT

International markets at an early stage of maturity are perceived as good export markets as there is likely to be greater appetite for Scottish expertise and insight from lessons learned. The level of supply chain development has been assessed in key markets in order to highlight where Scottish exporters may be able to exert more influence.

LOW CULTURAL / LOGISTICAL BARRIERS

Language, culture and geographical proximity are important factors that impact the relative attractiveness of goods and services supplied by Scottish companies. Markets closer to Scotland, where a strong trading precedence exists, will understandably score higher in this area.

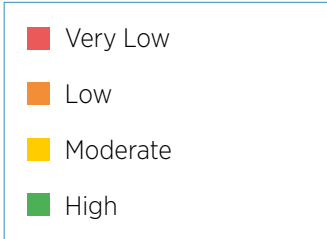
POLITICAL SUPPORT / MIX CHANGE URGENCY

International markets have varying levels of political support and offshore wind enabling mechanisms in place (e.g. leasing and auctioning) which is often linked to a nation's need to change its energy mix and deploy offshore wind. Markets with a high grading in this area are likely to be the most solid mid-term regions for Scottish exporters to consider.

Scottish attractiveness index

Influence weighting		50%	15%	15%	10%	10%
		Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
High potential export markets to 2030	Europe					
	Germany	Green	Yellow	Red	Green	Green
	Netherlands	Green	Yellow	Orange	Green	Green
	Denmark	Green	Yellow	Orange	Green	Yellow
	France	Yellow	Orange	Yellow	Green	Yellow
	Belgium	Yellow	Yellow	Orange	Green	Yellow
	Poland	Yellow	Yellow	Green	Green	Green
	Ireland	Yellow	Green	Green	Green	Green
	Asia Pacific					
	Taiwan	Green	Green	Orange	Yellow	Green
	Japan	Green	Green	Yellow	Yellow	Green
	South Korea	Yellow	Green	Green	Yellow	Yellow
	Americas					
	USA	Green	Orange	Green	Yellow	Yellow

Medium potential export markets to 2030	Europe					
	Norway	Low	Low	Moderate	High	Low
	Sweden	Low	Moderate	High	High	Low
	Asia Pacific					
	China	High	Very Low	Low	Very Low	Moderate
	Vietnam	High	Very Low	Moderate	Very Low	Moderate
	Australia	Low	Moderate	High	Low	Very Low
	Americas					
	Brazil	Moderate	Moderate	High	Low	Moderate
	Low potential export markets to 2030	Europe				
Estonia/Latvia		Very Low				
Lithuania		Very Low				
Italy		Very Low				
Finland		Very Low				
Spain		Very Low				
Faroe Islands		Very Low				
Asia						
India		Very Low				
Saudi Arabia		Very Low				
Americas						
Canada		Very Low				



HIGH POTENTIAL MARKET DEEP-DIVE

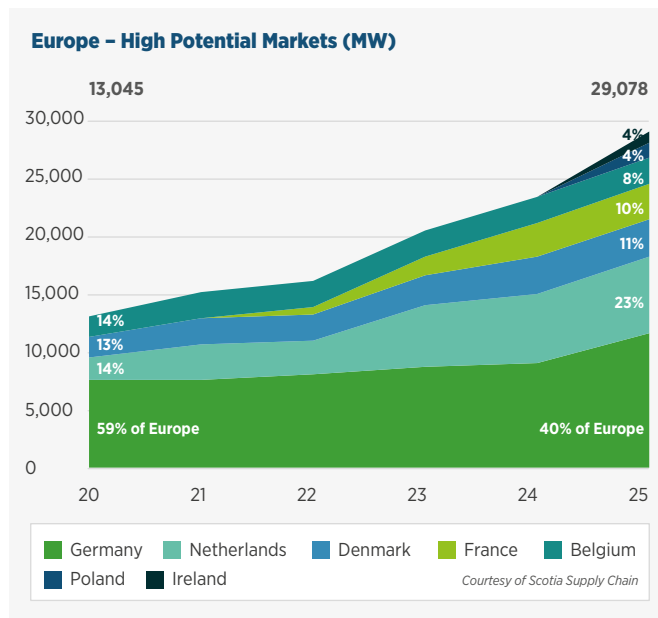
EUROPE TOP-LEVEL SUMMARY – SHORT-TERM MARKET (FORECAST – 29GW)

Based on relative market scale, technology maturity and geographical proximity to Scotland, Europe is undoubtedly a key region, offering Scottish exporters the greatest supply opportunities to 2030.

At the time of writing, a post-2020 trade deal between the UK and the European Union has been agreed but it is too early to assess the impact on supply from Scotland. Whilst some form of trade deal will facilitate supply opportunities, there are potential risks around increased levels of local protectionism.

Seven high potential markets will account for 97% of the total European deployed capacity to 2025; these nations will increase deployed capacity by around 16GW in the next five years, more than doubling the 13GW already in the water at the end of 2020.

Germany and Netherlands are the largest near-term markets by some margin (likely to account for 63% of total deployment in Europe by 2025), but a re-engaged Danish market, along with strong new entrants such as France, Poland and Ireland, will drive demand for almost 7GW of new capacity.



EUROPE TOP-LEVEL SUMMARY – MID-TERM MARKET (FORECAST - 61.9GW)

Installed and commissioned capacity across the high potential European export markets is expected to more than double again from 2026 to 2030, rising from 29.1GW in 2025 to 61.9GW by 2030 (an increase of circa 32GW). This is significantly more than the 10-20GW UK deployment target for the same period.

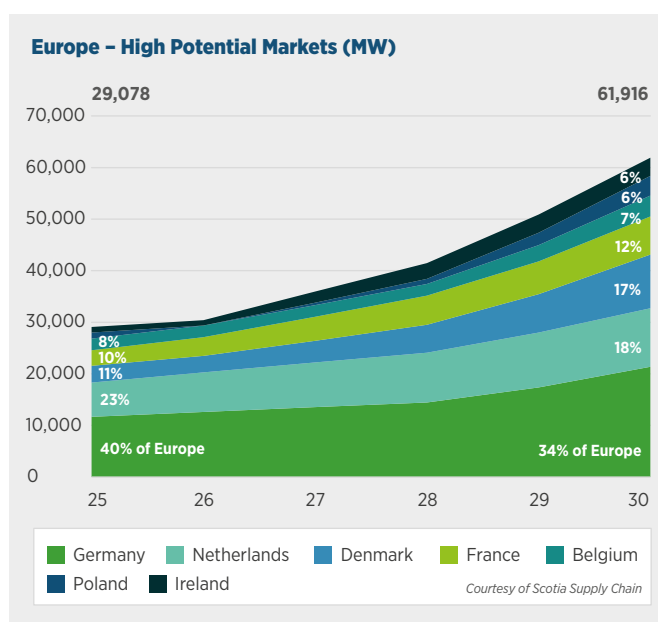
Germany and Netherlands will continue to be the largest markets (contributing 52% of the European total) but Denmark, France, Poland and Ireland will show accelerated growth, ultimately contributing a further 41% of the total European opportunity.

MARKET SIZING NOTES

In order to articulate the potential market outlook, a number of assumptions have been made in this section. It should be clearly understood that this has been done for illustrative purposes and is not a statement of fact:

Turbines: Turbine model and OEM is stated where selection has been confirmed; where unknown, assumptions have been made on the possible rating based on where the market is perceived to be on the turbine technology roadmap.

Foundations: Foundation technology is stated where selection has been confirmed; where unknown, assumptions have been made on possible technology based on site water depth, known seabed conditions and perceived market preferences.



Project status – each project has been categorised into three broad classifications in order to provide an indication of where a given project is within the standard project lifecycle:

- **Green** – Projects are generally fully consented, have been auctioned and/or have a power purchase route to market and have achieved or are approaching financial investment decision.

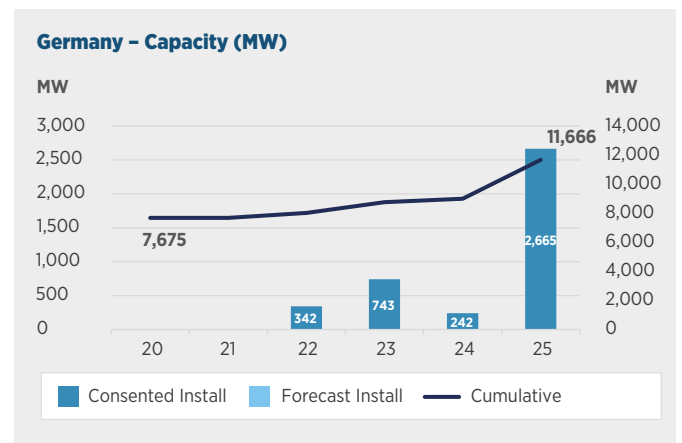
- **Amber** – Projects are significantly through the consenting process but are generally pre-auction / pre-FID.
- **Red** – Projects are generally in the early development phase and consents may or may not be in place.

Forecast online – this is the date assumed for the project being fully commissioned. This is based on known developer aspirations and perceived market readiness, but is an illustrative forecast only.

GERMANY DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 11.7GW)

DEPLOYMENT AND DEVELOPERS

- Germany saw 1.1GW of offshore capacity commissioned in 2020 via OWP Albatross, Hohe Se, Deutsche Bucht and Borkum West. Further deployment will be low before ramping up dramatically in 2025;
- Similar to the UK, Germany is transitioning to a new CfD-type auction mechanism, therefore, the short-term deployment outlook is relatively fixed, with only circa 1,300MW of new capacity expected to deploy by 2024;
- German market demand is expected to upturn strongly in 2025 in line with recent government commitments to increase the 2030 deployment target from 15GW to 20GW (WindSeeG act, 2020);
- A small amount of project attrition / delay to 2025 deployment forecasts is expected. Industry consensus suggests that German deployment by 2025 is likely to be around 10.8GW;
- The country has almost 4GW of well-advanced projects nearing construction that are highly likely to be deployed by 2025. Activity in the short-term expected to focussed around the Baltic Sea zone;



- Orsted, RWE and Iberdrola are expected to have 50% of the short-term deployment market. All developers have a strong existing UK presence that could be leveraged by Scottish exporters.

Project	Capacity (MW) Total 3,992	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
Kaskasi	342	RWE (100%)	38 x 8.0MW SGRE	Monopile	North Sea	Pre-construction (FID '20)	35	2022
Arcadis Ost 1	256	Parkwind (100%)	27 x 9.5MW MVOW	Monopile	Baltic Sea	Consented (FID forecast '21)	19	2023
Baltic Eagle	476	Iberdrola (100%)	27 x 9.5MW MVOW	Monopile	Baltic Sea	Consented (pre-FID)	30	2023
Wikinger Sud	10	Iberdrola (100%)	TBC	Likely Monopile	Baltic Sea	Consented (pre-FID)	40	2023
Gode Wind 3	242	Orsted (100%)	22 x 11.0MW SGRE	Likely Monopile	Baltic Sea	Consented (pre-FID)	42	2024
Borkum Riffgrund 3	900	Orsted (100%)	82 x 11.0MW SGRE	Likely Monopile	Baltic Sea	Consented (pre-FID)	75	2025
Gennaker	865	wpd (100%)	82 x 11.0MW SGRE	Likely Monopile	Baltic Sea	Consented (pre-FID)	15	2025
He Dreht 1	900	EnBW (100%)	TBC	Likely Monopile	Baltic Sea	Consented (pre-FID)	20	2025

PREVALENT CAPEX CONTRACTORS / OEMS

Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Borkum Riffgrund 2	464	Orsted (50%) / Gulf Int (50%)	2018	MVOW 8MW	Fred. Olsen (NOR)	Steelwind (GER)	Steelwind (GER)	ST3 (POL)	Jan de Nul (LUX) / Geosea (NED)
Wikingen	350	Iberdrola (100%)	2018	Adwen 5MW	Boskalis (NED)			Bladt (DEN) / Navantia (ESP)	Fred. Olsen (NOR)
Arkona	385	E.ON (50%) / Equinor (50%)	2019	SGRE 6MW	Geosea (NED)	EEW (GER)	Bladt (DEN)		Van Oord (NED)
Merkur Offshore	396	APG (64%) / TRIG (36%)	2019	GERE 6MW	Fred. Olsen (NOR)	Steelwind (GER)	Idesa (ESP)		Geosea (NED)
Borkum West 2.2	203.2	EWE (37.5%) / Trianel (37.5%)	2020	Senvion 6MW	Fred. Olsen (NOR)	Steelwind (GER)	SIF / Smulders (NED/BEL)		Seaway7 (UK)
Deutsche Bucht	269	Northland (100%)	2020	MVOW 8MW	Van Oord (NED)	EEW (GER)	Idesa / Windar (ESP)		Seajacks (UK)
Hohe See	497	EnBW (50.1%)	2020	SGRE 7MW	Fred. Olsen (NOR)	SIF (NED)	Smulders (BEL)		Geosea (NED)
Albatros	112	EnBW (50.1%)	2020	SGRE 7MW	Fred. Olsen (NOR)	SIF (NED)	Smulders (BEL)		Geosea (NED)

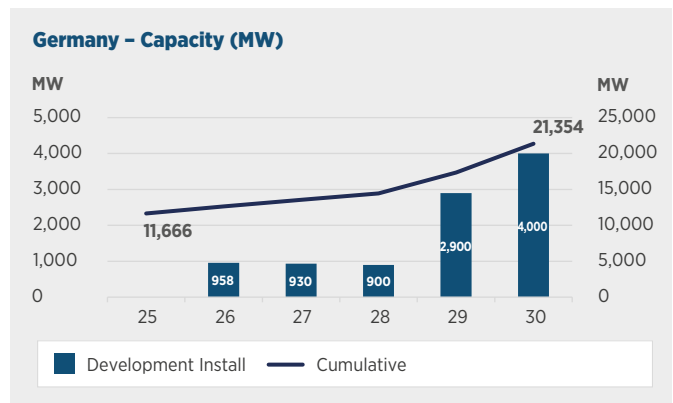
Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Borkum Riffgrund 2	464	Orsted (50%) / Gulf Int (50%)	Multi-contract	HSM (NED)		Nexans (FRA)	Van Oord (NED)	ST3 (POL)	Van Oord (NED) / Jan de Nul (LUX)
Wikingen	350	Iberdrola (100%)	EPCI	Navantia (ESP)		Prysmian (ITA)	Sub - Global Marine (UK)	Prysmian (ITA)	
Arkona	385	E.ON (50%) / Equinor (50%)	Multi-contract	STX (FRA)		Nexans (FRA)	Boskalis (NED)	Prysmian (ITA)	
Merkur Offshore	396	APG (64%) / TRIG (36%)	EPCI	Engie (UK) / Smulders (BEL)		Prysmian (ITA)	Geosea (NED)	NSW (GER)	Deepocean (UK)
Borkum West 2.2	203.2	EWE (37.5%) / Trianel (37.5%)	EPCI			NSW (GER)	Siem (NOR)	Hellenic (GRE)	Jan de Nul (LUX)
Deutsche Bucht	269	Northland (100%)	EPCI	Van Oord (NED) /	Sub - Smulders (BEL)	Sub - NSW (GER)	Van Oord (NED)	Prysmian (ITA)	
Hohe See	497	EnBW (50.1%)	EPCI	Engie (UK)	Siemens (UK)	JDR (UK)	Boskalis (NED)	ZTT (CHI)	Van Oord (NED)
Albatros	112	EnBW (50.1%)	EPCI	Engie (UK)	Siemens (UK)	TKF (NED)	Boskalis (NED)	ZTT (CHI)	Van Oord (NED)

- Outside of the UK, Germany has one of the most developed offshore wind supply chains globally. Analysis of the German supply market (for projects deployed in the last three years) shows that there are a number of trends emerging:
 - **Turbines:** The German turbine supply market has been much more dispersed than the UK market duopoly in terms of OEMs. Fred Olsen have a leading position in terms of installation;
 - **Foundations:** The German foundation market has leaned heavily towards monopiles, with only one recent project deploying a jacket / suction bucket typology. Foundation supply has been a truly international effort in Germany from an OEM perspective. Geosea are the most successful installer to date;

- **Substations:** With most projects connecting to the grid offshore, the German onshore market has been much smaller than traditionally seen in the UK. Offshore substation topside / offshore transmission module (OTM) supply has historically been supported by a diverse international OEM base;
- **Array cables:** Often contracted via an EPCI arrangement, array cables have historically been covered mainly by three OEMs (Nexans, Prysmian and NSW). Boskalis and Van Oord have historically been the largest installers;
- **Export Cables:** Often contracted via an EPCI arrangement, Jan de Nul and Van Oord have been strong historical players.

GERMANY DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 21.4GW MAXIMUM)

- The German Government has set new targets for 20GW deployment by 2030. Project attrition is likely, but if all of the development zones are tendered as planned to 2025, the 9.7GW German pipeline could raise deployment to 21.4GW by 2030;
- All post-2025 German deployment will draw from 14 tender zones (where a timeline of leasing and commissioning has been drawn up) predominately in the North Sea. Three 2021 project auctions (totalling 958MW) were initiated earlier this year.

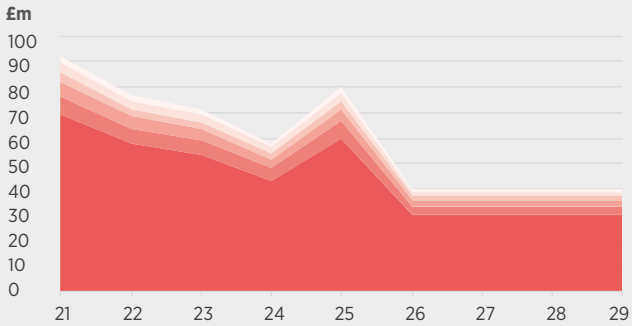


Germany – Tender Zone Pipeline

Zones	Capacity (MW)	Water depth / Assumed foundations	Location	Tender / Install
N-3.7 (Tender Zone)	225	31-35m / Likely Monopiles	North Sea	2021 / 2026
N-3.8 (Tender Zone)	433	up to 35m / Likely Monopiles	North Sea	2021 / 2026
O-1.3 (Tender Zone)	300	43-45m – Likely Jacket	Baltic Sea	2021 / 2026
N-7.2 (Tender Zone)	930	to 40m / 50% Monopile: 50% Jacket	North Sea	2022 / 2027
N-3.5 (Tender Zone)	420	25-35m / Likely Monopiles	North Sea	2023 / 2028
N-3.6 (Tender Zone)	480	25-35m / Likely Monopiles	North Sea	2023 / 2028
N-6.6 (Tender Zone)	630	up to 40m / Likely Monopiles	North Sea	2024 / 2029
N-6.7 (Tender Zone)	270	up to 40m / Likely Monopiles	North Sea	2024 / 2029
N-9.1 (Tender Zone)	1,000	to 30m / Likely Monopiles	North Sea	2024 / 2029
N-9.2 (Tender Zone)	1,000	40-42m / Likely Jacket	North Sea	2024 / 2029
N-9.3 (Tender Zone)	1,000	to 30m / Likely Monopiles	North Sea	2025 / 2030
N-9.4 (Tender Zone)	1,000	to 30m / Likely Monopiles	North Sea	2025 / 2030
N-10.1 (Tender Zone)	1,000	30m to 50m / 50% Monopile: 50% Jacket	North Sea	2025 / 2030
N-10.2 (Tender Zone)	1,000	30m to 50m / 50% Monopile: 50% Jacket	North Sea	2025 / 2030

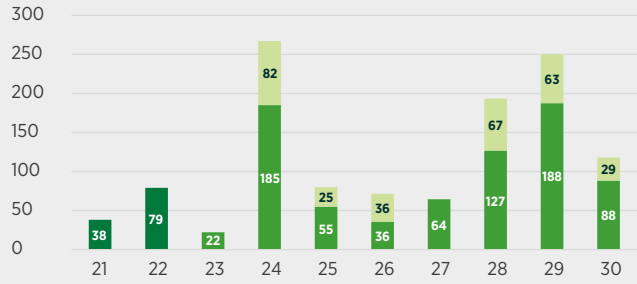
EXPORT MARKET SIZING – SUB-ELEMENT DEMAND

DEVEX – Germany



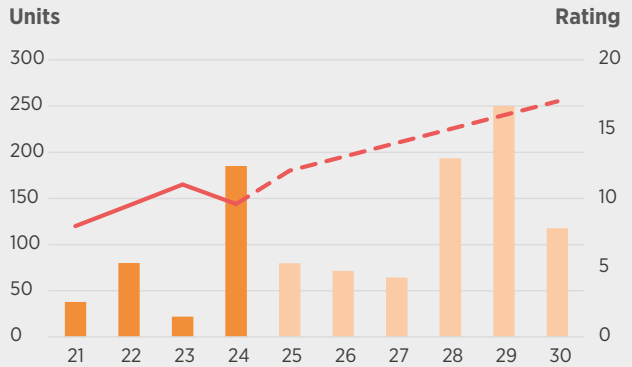
- Consenting, leasing & developer general
 - Environmental assessment professional services
 - Subsea survey
 - FEED & advisory professional services
 - Offshore data & metocean services
 - Site survey
- Courtesy of Scotia Supply Chain*

Foundations – Germany



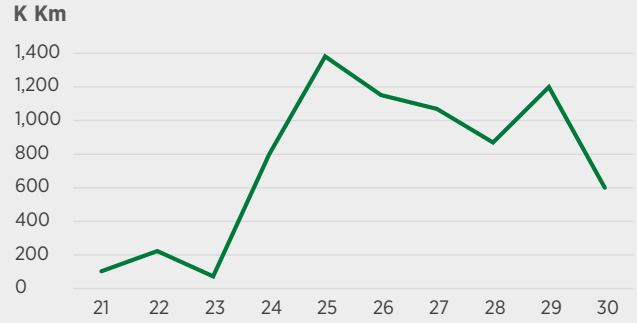
- Monopiles & TP
 - Monopiles & TP (Possible)
 - Jackets (Possible)
- Courtesy of Scotia Supply Chain*

Turbines – Germany



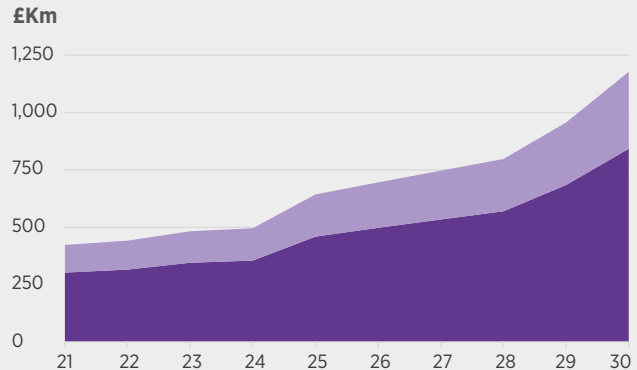
- Turbines (Towers) – Forecast
 - Turbines (Towers) – Confirmed
 - Average turbine rating (MW) – Confirmed
 - Average turbine rating (MW) – Forecast
- Courtesy of Scotia Supply Chain*

Array cables – Germany



- Array Cable – Forecast
- Courtesy of Scotia Supply Chain*

Offshore OMS – Germany



- Turbine OMS
 - Balance of Plant OMS
- Courtesy of Scotia Supply Chain*

IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Germany					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- With over 12GW of new capacity expected in the 2020s and a further 20GW in the 2030s, Germany is clearly one of the largest target markets for Scottish exporters. Government support for offshore wind is strong and consenting and auction processes are well-developed and streamlined;
- The recently adopted German Climate Protection Plan and new CfD-type auction mechanisms do not drive a local content protectionist agenda. Analysis of recently deployed projects shows that companies from a very wide international mix are trading effectively in this market;
- German projects will mostly be deployed in the North Sea therefore the logistical cost burden associated with goods imported from Scotland will be much less than for many overseas markets;
- Scottish offshore wind capabilities are well-renowned in-country. Scottish companies have been involved in most of the German offshore projects to date, providing goods and services across array cables, export cables, foundations, metocean masts, vessel provision, transformers and substations;
- The German Wind Association has identified a number of technical challenges in areas where Scottish capabilities are strong. Required solutions include corrosion protection, noise mitigation for installation and innovative / cost-competitive OMS solutions.

Challenging

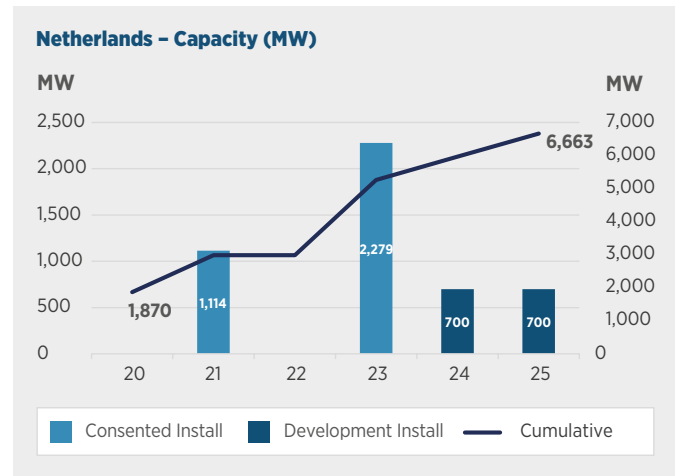
- An advanced indigenous supply chain means there is little scope for Scottish exporters to leverage first-mover advantages. Experience gained in the advanced UK sector may count for less in this market;
- Germany has a strong tier one and sub-tier supply chain and an abundance of developed manufacturing and quayside infrastructure in place. Similar to the UK market, project 'strike prices' are low therefore Scottish exporters will need to offer solutions that can challenge incumbents through improved quality, innovation or cost-competitiveness;
- Whilst English is commonly spoken, some administrations and agencies such as BSH (Bundesamt für Seeschifffahrt und Hydrographie - the German equivalent of Marine Scotland) operate in German only, making it important for Scottish companies to either hire German speakers or to partner with local companies to overcome the language barrier.

IN-COUNTRY ENGAGEMENT

- Partnerships are actively promoted and are the cornerstone of the German market. The German energy landscape is dominated by a strong culture of regional networks and clusters. The Wind Energy Network North-Rhine Westphalia, for example, has over 2,000 members across the entire value chain;
- Scottish exporters are well-advised to consider engaging in-country via the established supply chain networks:
 - **WAB (www.wab.net)**
With over 250 members, this energy industry cluster focusses on the north-west in-country region and is one of the most progressive supply chain collaboration initiatives. A collaboration agreement is in place with the Scottish DeepWind cluster which can be leveraged by Scottish exporters for in-country positioning;
 - **Renewable Energy Hamburg (www.erneuerbare-energien-hamburg.de)**
This networks has around 200 members and a strong offshore wind focus;
 - **Wind Energy Network (www.wind-energy-network.de)**
A leading network for wind energy in the north-east of Germany and a contact point for offshore wind interests;
 - **Maritime Cluster Northern Germany (www.maritimes-cluster.de)**
A strong network of the five in-country coastal states with around 350 members.
- Scottish exporters should monitor the very public tenders that are often issued in-country:
 - Development and consenting – TenneT and BSH;
 - Turbine components and installation support – developers such as EnBW and Trianel;
 - Operations & Maintenance – in-country asset owners for turbines and TenneT for balance of plant.
- Work is often tendered via the following portals:
 - www.evergabe-online.de
 - www.bsh.de
 - www.tender24.de
 - www.ted.europa.eu

NETHERLANDS DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 6.7GW) DEPLOYMENT AND DEVELOPERS

- The commissioning of Borssele 1&2 in 2020 signalled the start of the Dutch next generation wind farm deployment programme. 2021 will see the first offshore wind project to be deployed for three years and installation will remain spikey until the deployment of the second and third auction zones by 2023;
- Dutch authorities are planning to release zones for auction on a regular basis. There is a broad in-country assumption that projects will be commissioned three years after auction (nb - this suggests that significant site pre-development is done prior to tender);
- The Dutch Government roadmap provides a clear pathway for a further two zones to be commissioned by 2025; cumulative deployment of 6.7GW is highly likely;
- The fourth tender zone (Hollandse Kust West 1&2) is expected to be auctioned across 2021 and 2022. The short-term pipeline of 4.8GW of additional capacity is expected to be online by 2025.



Project	Capacity (MW) Total 4,793	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
Borssele 3 & 4	731	Blauwwind (100%)	77 x 9.5MW MVOW	Monopile	North Sea	In construction	22	2021
Friesland Wind Park	383	Windpark Friesland (100%)	89 x 4.3MW SGRE	Monopile	North Sea	In construction	6	2021
Hollandse Kust Zuid 1 & 2	760	Vattenfall (100%)	70 x 11.0MW SGRE	Monopile	North Sea	Pre-construction (post-FID)	30	2023
Hollandse Kust Zuid 3 & 4	760	Vattenfall (100%)	70 x 11.0MW SGRE	Monopile	North Sea	Pre-construction (post-FID)	26	2023
Hollandse Kust Noord	759	Eneco (50%) / Shell (50%)	70 x 11.0MW SGRE	Likely Monopile	North Sea	Pre-construction (pre-FID)	19	2023
Hollandse Kust West I	700	Auction 2021	TBC	Likely Monopile	North Sea	Development	53	2024
Hollandse Kust West II	700	Auction 2022	TBC	Likely Monopile	North Sea	Development	53	2025

PREVALENT CAPEX CONTRACTORS / OEMS

Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Luchterduinen	129	Eneco Group (50%) / MHI (50%)	2015	MVOW - 3MW	Van Oord (NED)	SIF / Smulders (NED/ BEL)		Jacket OEM	Van Oord (NED)
Westermeer-wind	144	Westermeer-wind (100%)	2016	SGRE - 4MW	Van Oord (NED)	SIF (NED)	Smulders (BEL)	Jacket OEM	Van Oord (NED)
Gemini	600	Northland (60%)	2017	SGRE - 3MW	Van Oord (NED)	SIF (NED)			Van Oord (NED)
Borssele 1&2	752	Orsted (100%)	2020	SGRE - 8MW	Geosea (NED)	SIF (NED) / EEW (GER)			EEW (GER) / Bladt (DEN)

Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Luchterduinen	129	Eneco Group (50%) / MHI (50%)	EPCI	CG Power (IND)		LS Cable (KOR)	NKT (GER)	LS Cable (KOR)	Boskalis (NED)
Westermeer-wind	144	Westermeer-wind (100%)	EPCI		Siemens (UK)	Boskalis (NED)			
Gemini	600	Northland (60%)	EPCI	Engie (UK) / Iemants (BEL)		Van Oord (NED)		NKT (GER)	Van Oord (NED)
Borssele 1&2	752	Orsted (100%)	Multi-contract	HSM (NED)		Nexans (FRA)	Van Oord (NED)	NKT (GER)	Boskalis (NED)

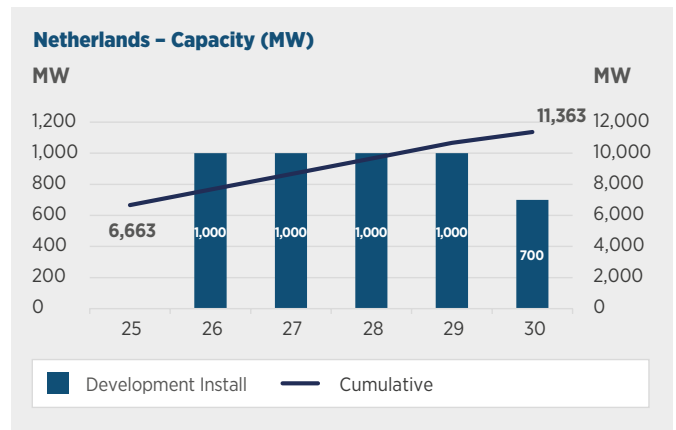
- Analysis of the Dutch supply market (for projects deployed since 2015) shows that there are some definite trends emerging. It is evident that the level of local content across the balance of plant supply chain is generally very high:
 - **Turbines:** The Dutch turbine supply market is similar to the UK market whereby Siemens Gamesa Renewable Energy (SGRE) and MHI Vestas Offshore Wind (MVOW) are the dominant OEMs. Dutch installers Van Oord and Geosea have dominated turbine installation;
 - **Foundations:** The Dutch foundation market is solely comprised of monopiles and transition pieces. Foundation manufacture has historically been dominated by SIF and Smulders, but Orsted introduced a more international supply mix on Borssele 1&2 and broke the Van Oord installation

monopoly via the introduction of Geosea. Given the relatively shallow waters and softer seabed conditions, there is low expectation of a demand for jackets or floating foundations in the short to medium-term;

- **Substations:** Historical supply has tended to be much more internationally focussed;
- **Array cables:** The historical supply chain is very similar to other European markets with the large tier one OEMs / installers dominating;
- **Export cables:** Whilst manufacture supply has been historically very international, installation activities have exclusively been undertaken by Dutch contractors.

NETHERLANDS DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 11.4GW)

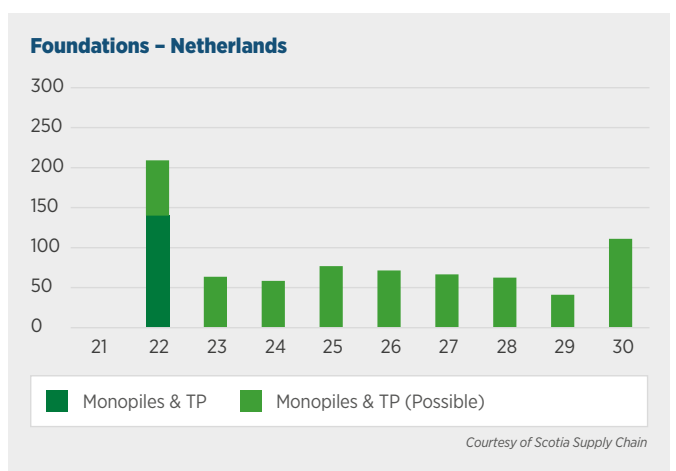
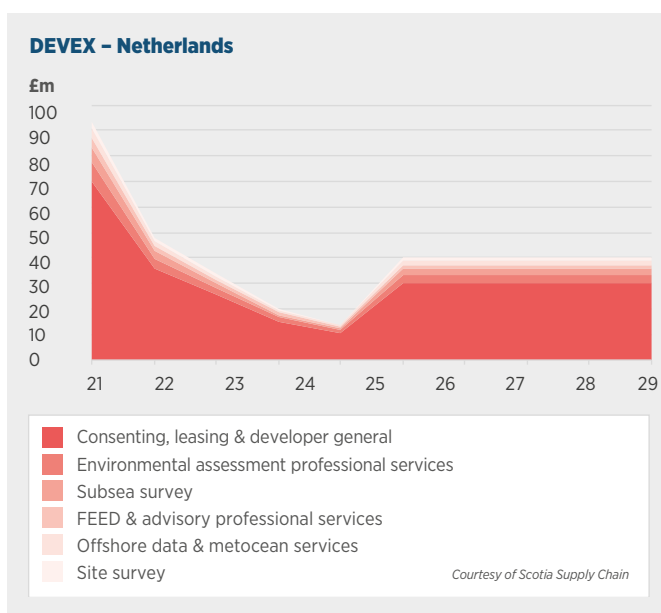
- The Dutch Government has announced an offshore wind deployment target of 11.5GW by 2030, with a longer-term aspiration of an additional 20-40GW by 2050. There is a programme being mooted to extend the lifetime of operating assets, as the Government strives to hit 2030 commitments;
- Further zonal tenders totalling 6.1GW are expected across the first half of the 2020s with the intention of projects being online by 2030. With no project attrition, this could deliver a maximum of 12.7GW by 2030, but for the purposes of this guide, 11.4GW has been assumed;
- Of the 6.1GW tenders mooted, a roadmap across five zones exists for 4.7GW of capacity to be deployed by 2030. This roadmap will bring Netherlands to 11.4GW by 2030 (very close to the government target of 11.5GW).



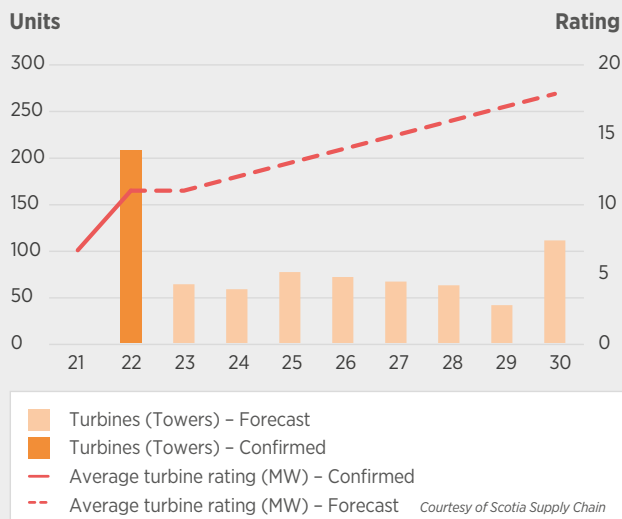
Netherlands - Tender Zone Pipeline

Zones	Capacity (MW)	Water depth / Assumed foundations	Location	Tender / Install
Ijmuiden Ver I	1000	to 38m / Likely Monopiles	North Sea	2023 / 2026
Ijmuiden Ver II	1000	to 38m / Likely Monopiles	North Sea	2024 / 2027
Ijmuiden Ver III	1000	to 38m / Likely Monopiles	North Sea	2025 / 2028
Ijmuiden Ver IV	1000	to 38m / Likely Monopiles	North Sea	2026 / 2029
Ten Noorden van de Waddeneilanden	700	to 38m / Likely Monopiles	North Sea	2026 / 2030

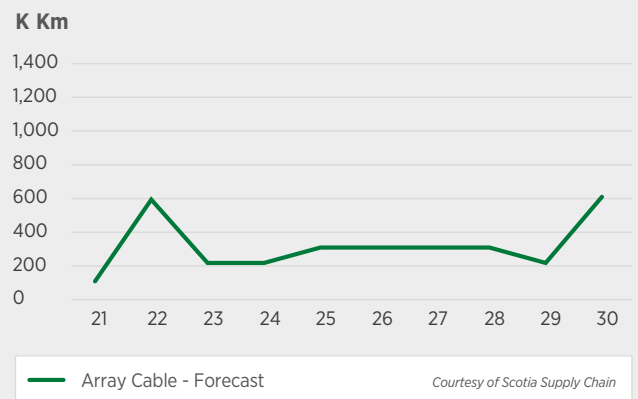
EXPORT MARKET SIZING



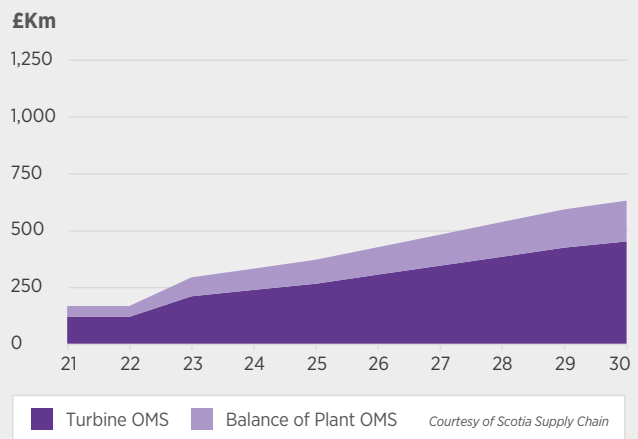
Turbines – Netherlands



Array cables – Netherlands



Offshore OMS – Netherlands



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Netherlands	High	Medium	High	High	Low

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- With around 9GW of new capacity expected in the 2020s and a further 20-40GW by 2050, the Netherlands is clearly one of the largest international target markets for Scottish exporters. Government support for offshore wind is strong and a well-publicised auction roadmap, with regular auctions, means that market certainty is high;
- Dutch projects will mostly be deployed in the North Sea therefore the logistical cost burden associated with goods imported from Scotland will be much less than for many overseas markets. Only one pre-2030 development zone is sited in the Baltic Sea;
- The main installation contractors expected to be active in this market include Van Oord, DEME, Seaway 7, Boskalis and Heerema; HSM Offshore, SIF and Smulders

- are expected to be strong OEM players. With a well-defined auction pipeline in place, Scottish exporters have the opportunity to proactively engage with these organisations on a non-project specific basis;
- Given the strong historical Scottish-Dutch trading relationship established via sectors such as oil & gas, perceived trading and cultural barriers are low, with English predominately the first business language nationwide. Therefore, minimal communication barriers are anticipated.

Challenging

- A relatively advanced indigenous supply chain means there is limited scope for Scottish exporters to leverage first-mover advantages; experience gained in the advanced UK sector may count for less in this market;

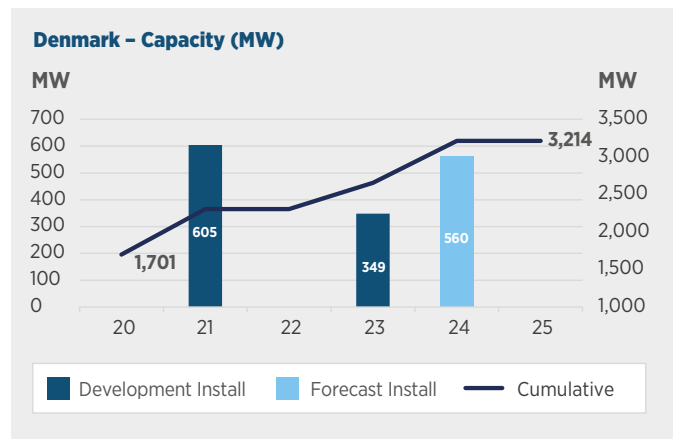
- The Dutch policy and auction mechanism does not drive a local content protectionism agenda, however, early Dutch projects have exhibited a very high level of local content at a tier one contractor level. The Dutch have a strong tier one and sub-tier supply chain and an abundance of developed manufacturing and quayside infrastructure in place. Similar to the UK market, project 'strike prices' are low therefore Scottish exporters will need to offer solutions that can challenge incumbents through improved quality, innovation or cost-competitiveness.

IN-COUNTRY ENGAGEMENT

- The Netherlands Wind Energy Association (www.nwea.nl). This association has over 300 members and is a useful touch point in-country;
- There are two main offshore wind membership / supply chain organisations in-country; Scottish exporters may be able to leverage opportunities via both:
 - Northern Netherlands Offshore Wind (www.nnow.nl)**
With a specific focus on offshore wind and a mainly Dutch membership, this association is a useful forum for engaging with key indigenous companies;
 - Association of Dutch Suppliers in the Offshore Energy Industry (www.ipo.nl)**
With a wider offshore energy interest, this is a very progressive supply chain network with a wide membership.

DENMARK DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 3.2GW DEPLOYMENT AND DEVELOPERS)

- One of the first countries to deploy offshore wind, Denmark has only increased deployed capacity by 1GW - via two projects - in the last decade. Denmark is set to ramp up its deployment of offshore wind dramatically across the next decade, via a 1.5GW pipeline of projects that will likely raise deployed capacity to 3.2GW by 2025;
- The Danish Government recently announced renewable energy targets for 2030, which will see a 6.8GW uplift in offshore wind deployment over the next decade. None of the new tenders are expected to result in construction pre-2025;
- Deployment will continue in both the Danish North Sea and Baltic Sea zones, with Vattenfall the dominant near-term developer. Demand is generally sporadic pre-2025.



Project	Capacity (MW) Total 1,513	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
Kriegers Flak	605	Vattenfall (100%)	72 x 8.4MW SGRE	Monopile	Baltic Sea	In construction	15	2021
Vesterhav Nord	170	Vattenfall (100%)	20 x 8.4MW SGRE	Monopile	North Sea	Pre-construction (FID '18)	9	2023
Vesterhav Syd	178	Vattenfall (100%)	21 x 8.4MW SGRE	Monopile	North Sea	Pre-construction (FID '18)	9	2023
Jammerland Bugt	240	European Energy (100%)	TBC	Likely Monopile	North Sea	Consented (pre-FID)	8	2024
Omo Syd	320	European Energy (100%)	TBC	Likely Monopile	North Sea	Consented (pre-FID)	8	2024

PREVALENT CAPEX CONTRACTORS / OEMS

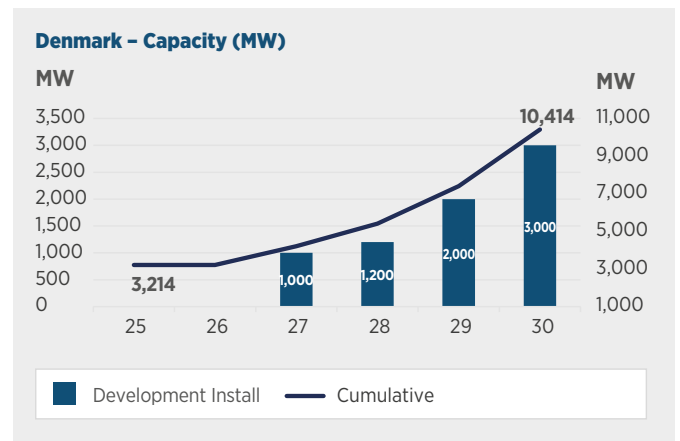
Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Anholt	399.60	Orsted (50%)	2013	SGRE – 3.6MW	A2Sea (UK)	Bladt (DEN)			Ballast Nedam (NED)
Horns Rev 3	406.7	Vattenfall (100%)	2019	MVOW – 8MW	Fred. Olsen (NOR)	Bladt (DEN) /	Smulders (BEL)		Geosea (NED)

Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Anholt	399.60	Orsted (50%)	Multi-contract	Bladt (DEN)		Nexans (FRA)	Boskalis (NED)	NKT (GER)	
Horns Rev 3	406.7	Vattenfall (100%)	EPCI	Hollandia (NED)		Prysmian (ITA)	Boskalis (NED)	NKT (GER)	Energinet (DEN)

- Little has been deployed in a decade therefore likely supply chain trends for the 2020s are largely unknown:
 - Turbines:** The Danish turbine supply market is similar to the UK market, whereby SGRE and MVOW are the dominant OEMs;
 - Foundations:** The Danish market has been exclusively monopiles / transition pieces. Danish OEM Bladt is likely to be very strong in this area going forward;
 - Array & export cables:** The supply chain is very similar to other European markets, whereby, the large tier one specialists are dominant, irrespective of country of origin.

DENMARK DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 10.4GW)

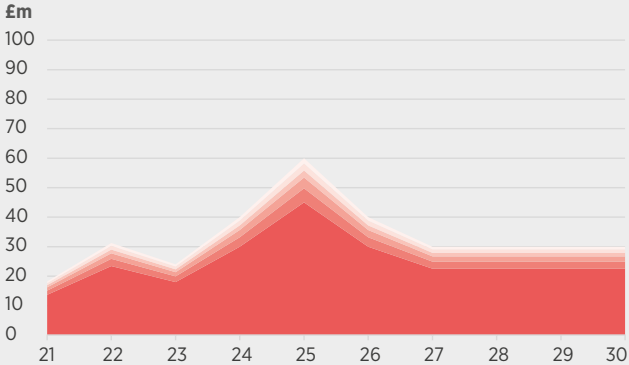
- Although the Danish Government does not have specific offshore wind targets for 2030, roadmaps suggest that deployment will pick up pace from 2027. The market is essentially expected to treble in size by 2030, reaching 10GW, via a number of zonal auctions that began in 2020;
- The Danish authorities recently launched the North Sea Thor tender and are expected to tender the Baltic Sea Hesselø zone in 2021. Two newly identified offshore island zones will be tendered in the mid-2020s in order to target deployment by 2030;
- The near-term auction roadmap plans to release projects in four zones (x1 North Sea and x3 Atlantic Sea), which will contribute to deployed capacity in the early 2030s.



Zones	Capacity (MW)	Water depth / Assumed foundations	Location	Tender / Install
Thor	1,000	Likely Monopiles	North Sea	2027
Hesselø	1,200	Likely Monopiles	Baltic Sea	2028
Island Zone	3,000	Likely Monopiles	North Sea	2029 / 30
Island Zone	2,000	Likely Monopiles	Baltic Sea	2029 / 30

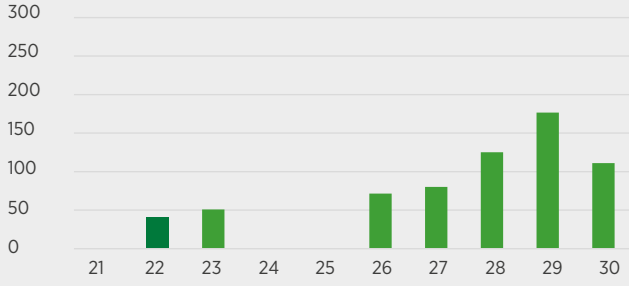
EXPORT MARKET SIZING

DEVEX - Denmark



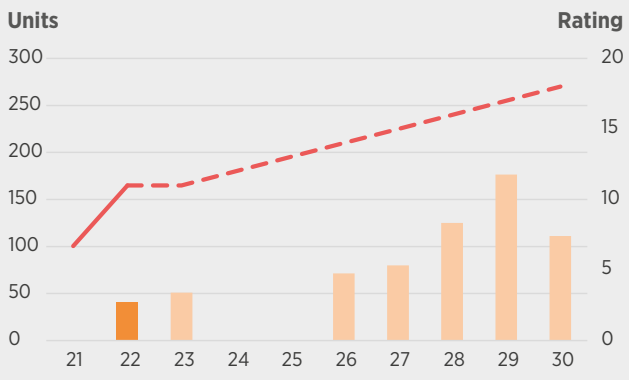
- Consenting, leasing & developer general
 - Environmental assessment professional services
 - Subsea survey
 - FEED & advisory professional services
 - Offshore data & metocean services
 - Site survey
- Courtesy of Scotia Supply Chain

Foundations - Denmark



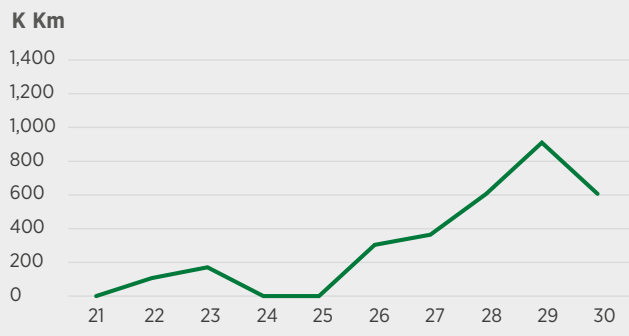
- Monopiles & TPs
 - Monopiles & TPs (Possible)
- Courtesy of Scotia Supply Chain

Turbines - Denmark



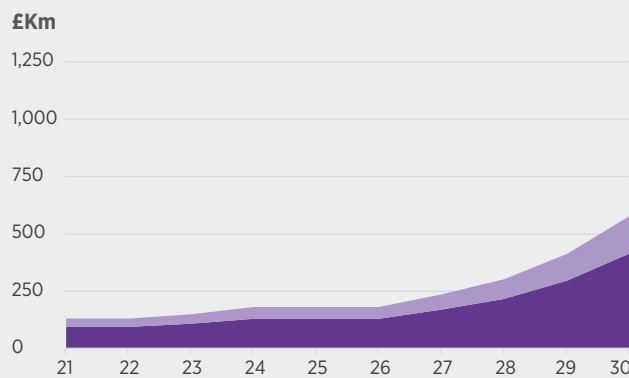
- Turbines (Towers) - Forecast
- Turbines (Towers) - Confirmed
- Average turbine rating (MW) - Confirmed

Array cables - Denmark



- Array Cable - Forecast
- Courtesy of Scotia Supply Chain

Offshore OMS - Denmark



- Turbine OMS
 - Balance of Plant OMS
- Courtesy of Scotia Supply Chain

IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Denmark					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- With over 8GW of new capacity expected in the 2020s and a further mid-term pipeline, Denmark is clearly one of the largest international target markets for Scottish exporters later in the decade. With an abundance of alternative energy sources, the national need to expedite offshore wind deployment is less than in other nations, but governmental support for offshore wind is strong;
- With many of the larger next generation projects at an early stage of development, the window of opportunity across the whole project lifecycle is largely open for Scottish exporters;
- A significant proportion of Danish projects will be deployed in the North Sea, therefore, the logistical cost burden associated with goods imported from Scotland will be much less than for many overseas markets;
- Given the strong historical Scottish-Danish trading relationship already established via sectors such as oil & gas, perceived trading and cultural barriers are low.

Challenging

- A relatively advanced indigenous supply chain means there is limited scope for Scottish exporters to leverage first-mover advantages; experience gained in the advanced UK sector may count for less in this market;
- The Danish policy and auction mechanism does not drive a local content protectionism agenda. However, Denmark has a strong developer, tier one and sub-tier supply chain and an abundance of developed manufacturing and quayside infrastructure in place, with Esbjerg being the largest offshore wind hub in Europe. Scottish exporters will need to offer solutions that can challenge incumbents through improved quality, innovation or cost-competitiveness.

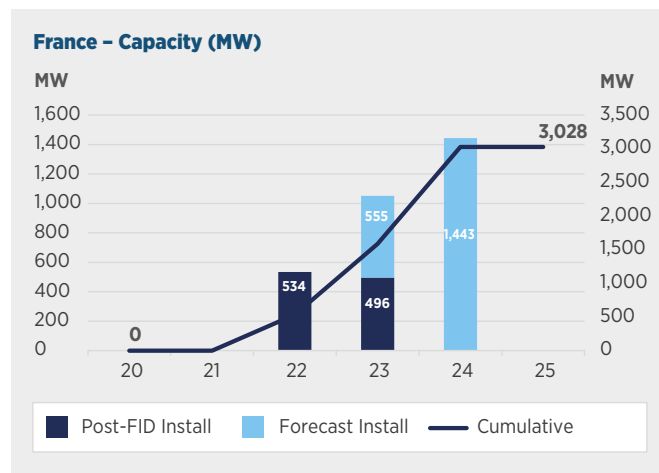
IN-COUNTRY ENGAGEMENT

- Danish companies have a strong record in developing local supply chain clusters:
 - **Wind Denmark (www.winddenmark.dk)**
Wind Denmark brings together companies, wind turbine owners and private individuals interested in wind and has around 2,700 members.

FRANCE DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 3GW)

DEPLOYMENT AND DEVELOPERS

- Offshore wind has had a number of false starts in France, but with re-negotiated 'strike prices' now in place, deployment will begin in earnest with the first tranche of projects totalling 3GW – across 10 wind farms – likely to deploy between 2022 and 2024;
- It is significant for Scottish exporters that developers EDF, Ocean Winds and Iberdrola, which have a strong existing presence, are amongst the first movers in the French market. Given the level of interaction in Scotland, opportunities in France can most certainly be leveraged in this way;
- Offshore wind 'strike prices' in France are higher than in other parts of Europe; governmental expectations for high local content are consequently very strong and very visible.



Project	Capacity (MW) Total 3,028	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
Saint-Nazaire	480	EDF (50%)	80 x 6MW GE	Monopile	Bay of Biscay	In construction	15	2022
EFGL Floating Wind	30	Ocean Winds (80%)	3 x 10MW MVOW	Floating (Windfloat)	Mediterranean	Pre-construction (FID '20)	16	2022
PGL Floating Wind	24	EDF (100%)	3 x 8MW SGRE	Floating (TLP)	Mediterranean	Approved (pre-FID)	14	2022
Saint-Brieuc	496	Iberdrola (100%)	62 x 8MW SGRE	Jacket	English Channel	Pre-construction (FID '20)	16	2023
Le Treport	496	Ocean Winds (60.5%)	62 x 8MW SGRE	Likely Jacket	English Channel	Consented	17	2023
EolMed	30	Qair (80%)	3 x 10MW MVOW	Floating (Damping Pool)	Mediterranean	Consented	15	2023
Groix	28	CGN (50%); Eolfi (Shell) (50%)	4 x 9.5W MVOW	Floating (Naval Energy Float)	Bay of Biscay	Consented	30	2023
Noirmoutier	496	Ocean Winds (60.5%)	62 x 8MW SGRE	Likely Jacket	Bay of Biscay	Consented	29	2024
Fecamp	497	EDF (35%) / wpd (30%)	71 x 7MW SGRE	Likely Monopile	English Channel	Consented (FID '21)	22	2024
Courseulles sur Mer	450	EDF (42.5%)	75 x 6MW GE	Likely Monopile	English Channel	Consented (FID '21)	10	2024

PREVALENT CAPEX CONTRACTORS / OEMS

Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Saint-Nazaire	480	EDF (50%)	2022	GERE - 6MW	Jan de Nul (LUX)	SIF (NED)	SIF / Smulders (NED/BEL)		DEME (BEL)
EFGL Floating Wind	30	Ocean Winds (80%)	2022	MVOW - 10MW		Ideol (FRA)			
PGL Floating Wind	24	EDF (100%)	2022	SGRE - 8MW		SBM Offshore (NED)			
Saint-Brieuc	496	Iberdrola (100%)	2023	SGRE - 8MW			Navantia / Windar (ESP)	Van Oord (NED)	

Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Saint-Nazaire	480	EDF (50%)	EPCI	DEME (BEL)		Prysmian (ITA)		Prysmian (ITA)	
EFGL Floating Wind	30	Ocean Winds (80%)	EPCI			JDR (UK)	DEME (BEL)		
PGL Floating Wind	24	EDF (100%)	EPCI			Prysmian (ITA)			
Saint-Brieuc	496	Iberdrola (100%)	EPCI	Eifage (FRA)	GE Grid (FRA)	Prysmian (ITA)		Nexans (FRA)	

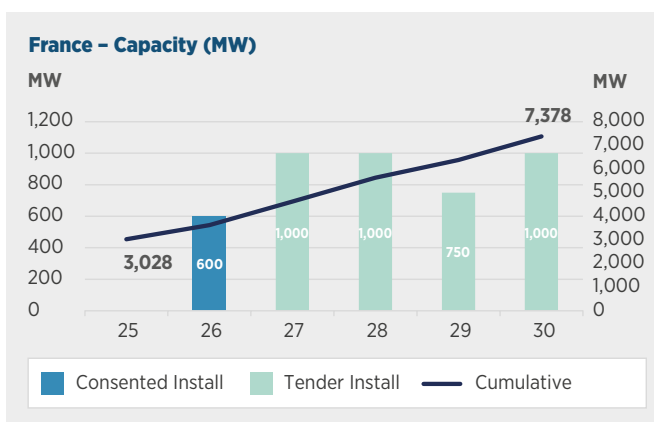
- The French market is still at an early stage, but some interesting trends are emerging:
 - **Turbines:** The short-term French turbine supply market is extremely diverse, with each of the three main OEMs scoring early in-country success. Both GE Renewable Energy (GERE) and Siemens Gamesa have manufacturing facilities in the country;
 - **Foundations:** The early market is similarly diverse in terms of technology selection. With development zones in the English Channel, Bay of Biscay and Mediterranean Sea, France is expected to be a very diverse market going forward. Encouragingly, early OEM supply has a strong international flavour

indicating that technology trumps local content, to some extent. Like Scotland, France is seeking to be an early floating wind adopter;

- **Substations:** Supply is likely to be heavily focussed on the local supply chain going forward;
- **Array cables:** Prysmian are the early market EPCI force in-country and have a large cable OEM capability in France;
- **Export cables:** Prysmian and Nexans have scooped early EPCI awards suggesting that a cable-led tier one arrangement may be the preferred in-country arrangement going forward.

FRANCE DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 7.4GW)

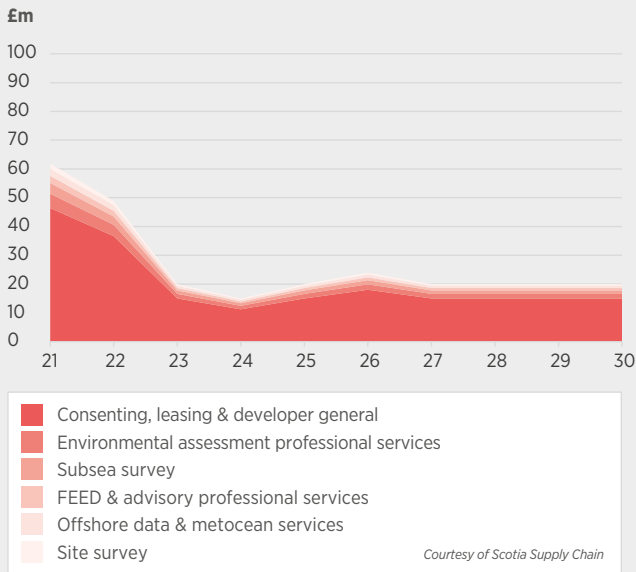
- The French Government finalised offshore wind targets in 2020 via the publication of its 2030 National Energy and Climate Plan (NECP). With plans to tender 8.75GW of additional capacity by 2028 leading to a cumulative award of 12.4GW, a 2030 deployed target of around 7.4GW makes France one of the fastest growing global markets throughout the 2020s;
- With 3.6GW of awards already made and 8.75GW of new tenders by 2028, a 2030 cumulative deployment of 7.4GW means that circa 5GW of capacity will be awarded for deployment in the early 2030s.



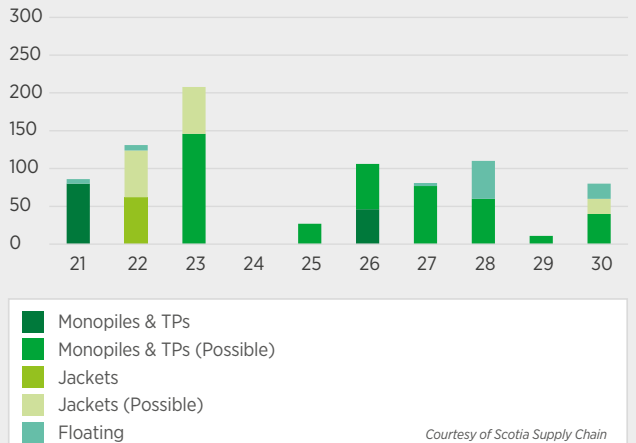
Zones	Capacity (MW)	Water depth / Assumed foundations	Location	Tender / Install
Dunkirk Offshore Wind Farm (EDF / Enbridge / RWE)	600	Monopiles	North Sea	Complete / 2027
Manche Est Mer du Nord (Fixed Wind)	1,000	Likely Monopiles	North Sea	2021 / 2027
Oleron (Fixed Wind)	1,000	Likely Monopiles	Atlantic Sea	2022 / 2028
Floating Zones x3	750	Floating	Atlantic Sea	2022 / 2028/29
South Atlantic (Fixed wind)	1,000	Likely Monopiles	Atlantic Sea	2023 / 2029

EXPORT MARKET SIZING

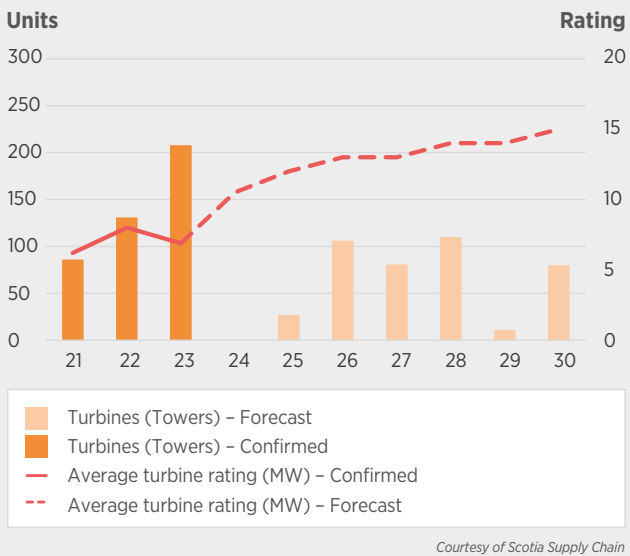
DEVEX - France



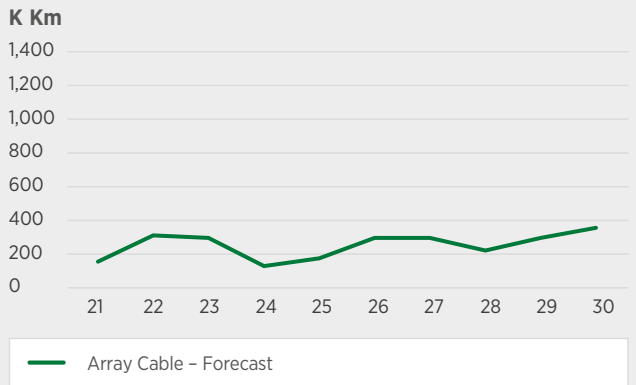
Foundations - France



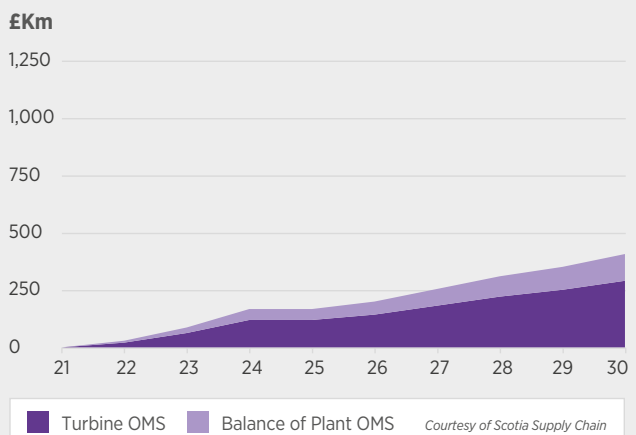
Turbines - France



Array cables - France



Offshore OMS - France



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
France	Yellow	Orange	Yellow	Green	Yellow

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- With around 7GW of new capacity expected in the 2020s, a significant proportion of which may be floating wind, France is a very interesting market for Scottish exporters. Government support for offshore wind is now relatively strong – after a long period where this was not the case – with a clear roadmap into the 2030s;
- The majority of mid-term projects will mostly be deployed in the North Sea, therefore the logistical cost burden associated with goods imported from Scotland will be much less than for many overseas markets;
- Despite a strong push for prioritising local content, there is in-country realisation that French tier two and three companies lack experience in the offshore wind sector; offering to share lessons learned is an important card to play for Scottish companies seeking future large scale opportunities in the country;
- Scotland and France have a long trading history and business and cultural barriers are perceived to be low. Scottish exporters are well positioned to approach the leading French developers via existing Scottish linkages;
- Scotland's DeepWind cluster, as part of its international development strategy, is working with SDI to develop strong links with French clusters to facilitate collaboration between Scottish and French companies. Scottish companies have a strong in-country reputation in subsea engineering and have already fostered opportunities across mooring systems, anchor technology, dynamic cables and ancillary product supply and expert consultancy;

- SDI in Paris, in collaboration with the Scottish Government, are developing research and innovation linkage between Scotland and France. The Scottish Government issued a tender in November 2020 for a study to identify collaboration opportunities between Scotland and France for the production of green hydrogen from offshore wind.

Challenging

- Although the market is relatively early-stage, the French supply chain is developing quickly. With such strong European tier one presence already evident, there is limited scope for Scottish exporters to leverage first-mover advantages by approaching the market directly;
- Whilst there is little evidence that French policy and auction mechanisms expressly require local content commitments, it is well-understood that local supply is likely to be prioritised. Without existing in-country footprint presence or access to partnerships with French suppliers, Scottish exporters may struggle to gain traction in this market. An ability to converse technically in French is likely required;
- France has a strong track record of investing heavily in infrastructure at a national level; with extensive quayside investment already committed and a strong tier one offshore wind OEM presence, Scottish exporters may find it challenging to compete commercially in France.

In-country engagement

- There is an extensive network of in-country membership and enabling entities in-country:

Name	Region	Description	Collaboration with Scotland	Comments
Wind'Occ	Occitanie	Wind'Occ brings together key players in the offshore renewable energy sector in Occitanie. It is supported by Région Occitanie, l'agence AD'OCC, CEMATER and the Pôle Mer Méditerranée.	Working with SDI on the organisation of a hydrogen learning expedition as part of an event in December '21. The development of a collaboration strategy between DeepWind and Wind'Occ is ongoing.	Occitanie is the most important French region for the development of floating wind farms with two of the four pilot projects being developed there. SDI has built strong relationships with the region including the organisation of events and the development of collaboration between Scotland and Occitanie.
Pôle Mer Méditerranée	Greater Occitanie region	Offshore industries cluster that includes a focus on floating offshore wind. Co-organisers of the annual French floating wind event FOWT.	Collaboration at previous FOWT events, including organisation of side activities and networking activities.	Very influential organisation covering the Mediterranean floating wind projects (3 pilot farms under development).
Pôle Mer Bretagne Atlantique	Brittany	As per Pôle Mer Méditerranée, this organisation offers a full range of support services from identifying early projects to bringing products and services to market.		Pôle Mer Bretagne Atlantique has been involved in its specific projects, including Winflo: a deep water offshore wind turbine on a semi-submersible floating platform. The cluster encourages the development of transnational collaborative projects. The cluster provides SMEs with the support to export their products and strives to ensure its members benefit from its international collaborations and its capacity to act on a European level.
Neopolia	Pays de la Loire	A more generalist organisation, this cluster covers six business areas: Aerospace, Land Mobility, Marine, Nuclear, Oil & Gas and Renewable Marine Energy. This cluster has played a key role in supporting the use of local content in offshore wind projects in Pays de la Loire (St Nazaire and Noirmoutier) and is also focused on supporting future floating projects of Brittany.	Collaboration for the organisation of activities as part of the Seanergy event in June 2021. Ongoing collaboration effort with SDI and DeepWind.	The organisation is involved in the development of fixed bottom offshore wind projects in the local region.
Bretagne Ocean Power	Brittany	Established by the Bretagne Regional Council, this organisation brings together stakeholders from the marine renewable energy sector to: <ul style="list-style-type: none"> Facilitate access to industrial know-how for commissioning authorities; Facilitate skills development and market access for Brittany businesses; Attract national and international players who wish to develop marine renewables; Promote local know-how under a single banner. 	Meeting planned in November 2020 to discuss collaboration on floating wind and hydrogen. History of jointly developing meet-and-greet with SDI.	A key organisation for collaboration between Scotland and Brittany in the field of floating wind.

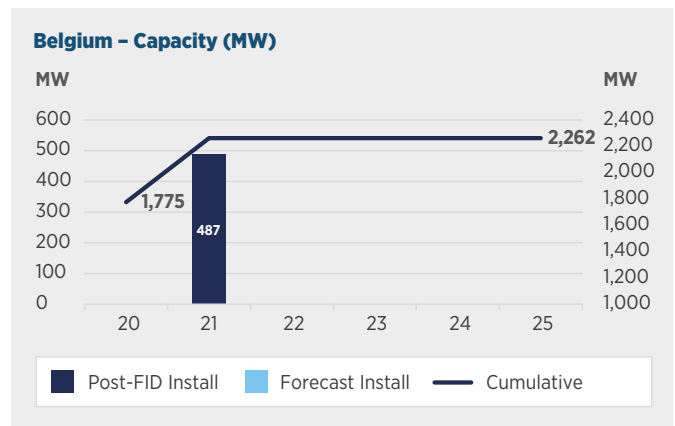
France Energies Marines	France	<p>Established to provide, enhance and feed into a scientific and technical environment necessary to remove the obstacles facing the offshore renewable energy sector. Focus on three main activities:</p> <ul style="list-style-type: none"> • Stimulating the competitiveness of the sector; • Highlighting the capability of the French regions; • Providing support to regional and national authorities. 		
Weamec	Pays de la Loire/West Atlantic	Enabling organisation for the marine renewable energy (MRE) ecosystem of "Pays de la Loire" in the fields of research, innovation and training.		

- Scottish exporters are advised to familiarise themselves with the following regional bodies and tender portals, which play an important role in the development of offshore wind projects and their local supply chains in France, including facilitating tenders, enabling project investment and promoting the skills agenda:
 - **AD'OCC (www.agence-adocc.com)**
Economic development agency for Occitanie region
 - **Bretagne Development Innovation (www.bdi.fr)**
Economic development agency for Brittany

- **Solutions&Co (www.solutions-eco.fr)**
Economic development agency for Pays de la Loire
- **AD Normandie (www.adnormandie.fr)**
Economic development agency for Normandy
- **Syndicat des energies renouvelables (www.syndicat-energies-renouvelables.fr)**
- **France Energie Eolienne (www.fee.asso.fr)**

BELGIUM DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 2.3GW) DEPLOYMENT AND DEVELOPERS

- The commissioning of Northwester 2 in 2020 (Belgium's 7th offshore farm) takes installed capacity to 1.8GW. There is only one offshore project now in the 'live' planning process, therefore, a 2025 capacity of 2.3GW is virtually certain;
- The Belgian market is unlikely to be a key short-term focus international market for Scottish CAPEX exporters given the lack of 'active' pipeline; installed capacity is relatively large therefore OPEX opportunities exist in the country;
- The two SeaMade projects, currently in construction, will be the only projects to deploy pre-2025.



Project	Capacity (MW) Total 487	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
SeaMade (Mermaid)	235	Otary (70%)	28 x 8.4MW SGRE	Monopile	North Sea	In construction	54	2021
SeaMade (SeaStar)	252	Otary (70%)	28 x 8.4MW SGRE	Monopile	North Sea	In construction	40	2021

PREVALENT CAPEX CONTRACTORS / OEMS

Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Rentel	309	Otary	2019	SGRE - 7.3MW	DEME (BEL)	SIF (NED)	Smulders (BEL)		Geosea (NED)
Norther	369.6	Elicio (50%)	2020	MVOW - 8.4MW	Van Oord (NED)	SIF (NED)	Smulders (BEL)		Van Oord (NED)
Northwester 2	224	Parkwind (70%)	2020	MVOW - 9.5MW	Van Oord (NED)	Bladt (DEN)			Jan de Nul (LUX)
Seamade	487	Otary (70%)	2021	SGRE - 8MW	DEME (BEL)	SIF (NED)	Smulders (BEL)		DEME (BEL)

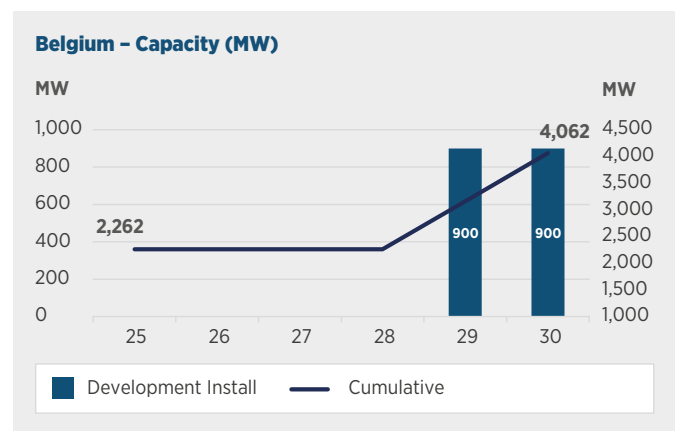
Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Rentel	309	Otary	Multi-contract	STX (FRA)		Prysmian (ITA)	DEME (BEL)	ABB (SUI)	
Norther	369.6	Elicio (50%)	EPCI	Engie (BEL)		LS Cable (KOR)	Van Oord (NED)	LS Cable (KOR)	Van Oord (NED)
Northwester 2	224	Parkwind (70%)	Multi-contract	Bladt (DEN)		Prysmian (ITA)	Jan de Nul (LUX)	Nexans (FRA)	Jan de Nul (LUX)
Seamade	487	Otary (70%)		Engie / DEME / Smulders (BEL)		JDR (UK)	DEME (BEL)	Hellenic (GRE)	DEME (BEL)

- Analysis of the Belgian supply market (for projects deployed in the last three years) shows that a clear pattern is emerging in-country:
 - Turbines:** Siemens Gamesa and Mitsubishi Vestas have shared the full OEM supply market to date; DEME and Van Oord are the strong tier one installers;
 - Foundations:** The Belgian foundation market is all about monopiles; with all Belgian offshore projects

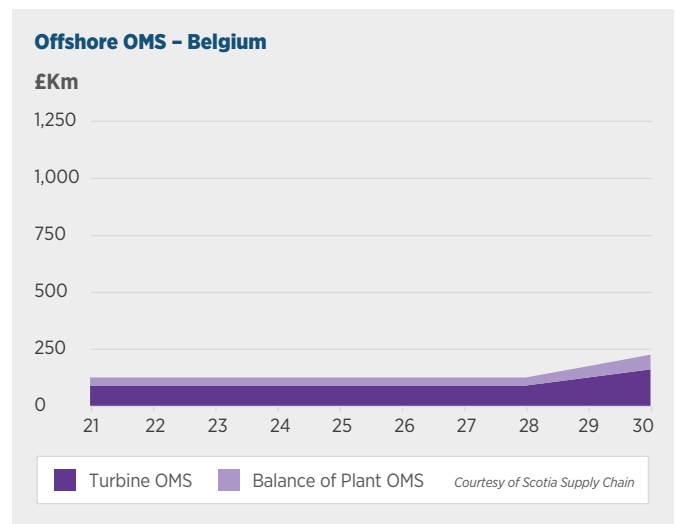
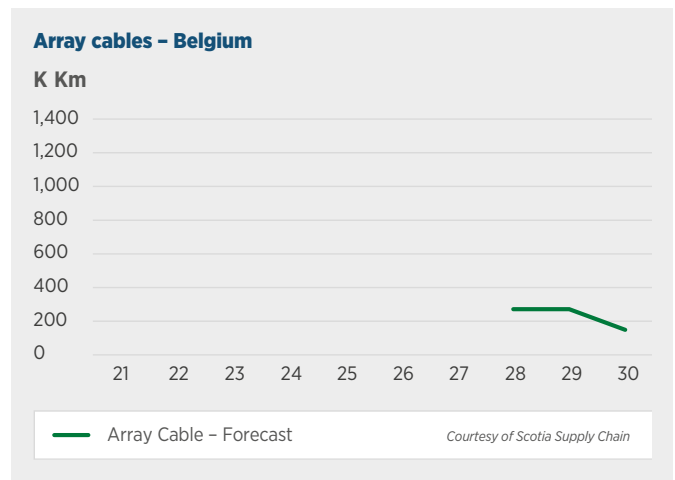
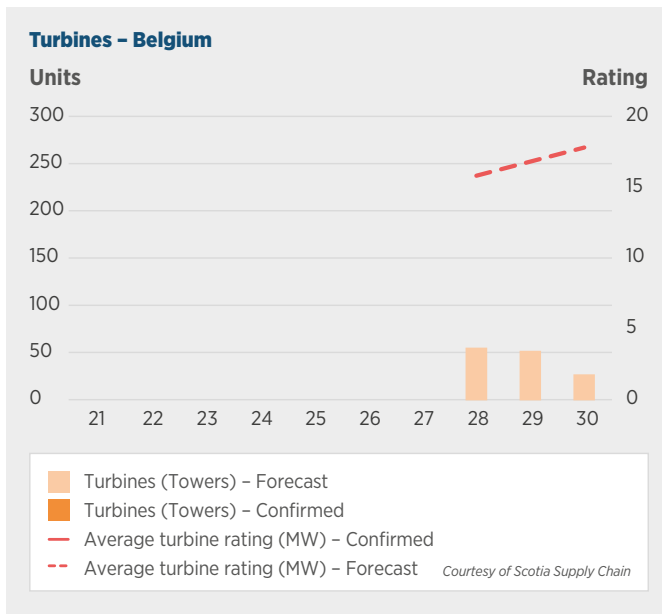
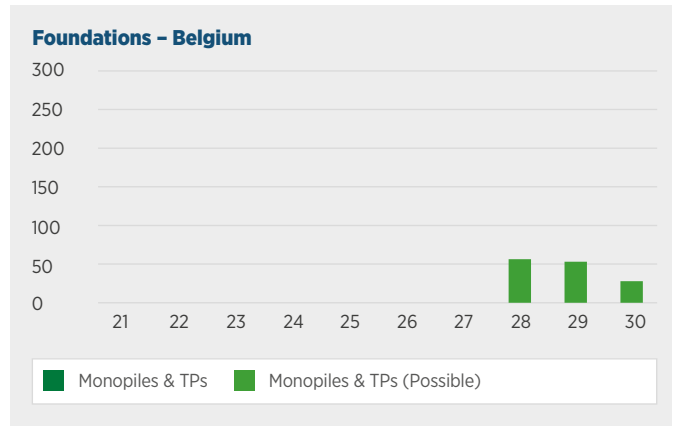
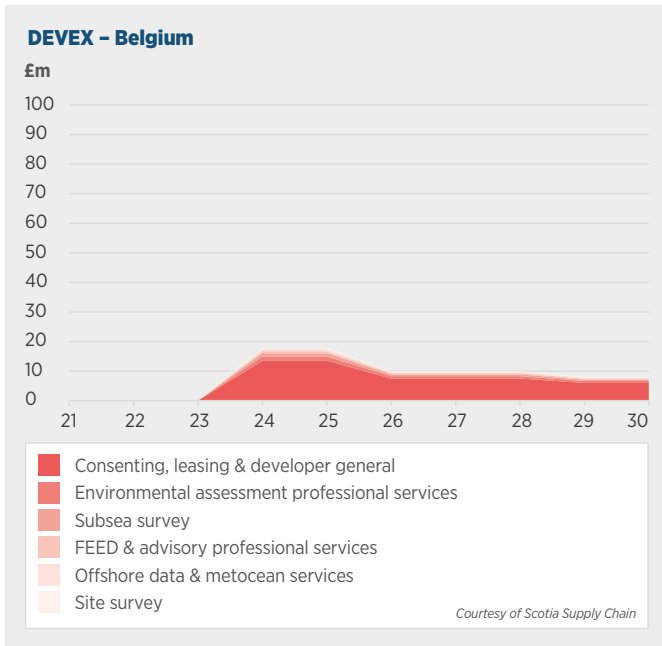
- due to be deployed in close geographical proximity, deviation from this foundation type is unlikely;
 - Substations:** Supply has been historically dispersed but a strong Belgian content exists;
 - Array and export cables:** Similar to most other European markets, supply has historically been supported by the large European tier one contractors.

BELGIUM DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 4GW)

- The Belgian Government has mooted plans to target 4GW of deployment by 2030 but no zones have been identified for this additional 1.7GW at this stage. Additional deployment not expected until later in the decade.



EXPORT MARKET SIZING



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Belgium					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- Belgian projects have been / will be deployed in the North Sea therefore the logistical cost burden associated with goods imported from Scotland will be much less than for many overseas markets. The largest in-country opportunity for Scottish exporters in the short-term is likely to be OPEX rather than CAPEX related;
- With large parts of the supply chain under the control of the large tier one EPCs, entry to the market can be achieved via relationships with these contractors in the UK rather than directly in-country;
- No major cultural or logistical barriers perceived.

Challenging

- With no real project pipeline, a limited deployable offshore area and only a modest 2030 target (at >50% achievement by 2021), Belgium is not expected to be one of the higher priority markets for Scottish exporters;

- A relatively advanced indigenous supply chain means there is limited scope for Scottish exporters to leverage first-mover advantages. Experience gained in the advanced UK sector may count for less in this market;
- The Belgians have a strong tier one and sub-tier supply chain and an abundance of developed manufacturing and quayside infrastructure in place. Scottish exporters will need to offer solutions that can challenge incumbents through improved quality, innovation or cost-competitiveness;

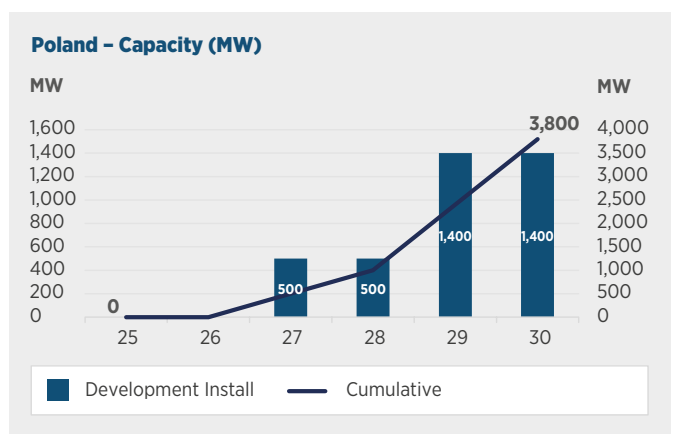
In-country engagement

- Scottish exporters seeking to engage in-country should consider the following membership organisation:
 - **Belgian Offshore Platform** (www.belgianoffshoreplatform.be)
The BOP brings together key players in the Belgian offshore wind sector, with members including in-country developers, upper tier contractors as well as a number of indigenous local supply chain companies.

POLAND DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 3.8GW)

DEPLOYMENT AND DEVELOPERS

- It is unlikely that Poland will have any offshore wind deployment pre-2025 having just awarded the first CfD contracts in April 2021. The following chart shows a smoothed forecast of how 3.8GW could be achieved by 2030 – although a number of developers have stated an aspiration to deploy by 2025, this was a pre-pandemic position and projects are more likely to be looking at full commissioning by 2026/7;
- The recently approved ‘Offshore Wind Act’ will see offshore wind become a central part of the Polish energy mix across the next 20 years. A deployment roadmap has been established targeting 3.8GW by 2030, 10GW by 2040 and 28GW by 2050 making it one of the largest markets in Europe centred around the Baltic Sea (which is estimated to have total offshore wind deployment potential of 93GW);
- Poland has adopted a CfD auction mechanism similar to the UK market arrangement;



- The Polish Energy Regulatory Office is seeking to award a first tranche of CfDs up to a maximum of 5.9GW. Three projects were awarded contracts in April 2021 with a total capacity of 2.8GW. Developers of these projects have not been specific regarding deployment beyond stating their expectations to be generating before 2030;

- The remaining 8.5GW pipeline – which is anticipated to contribute the remaining 1GW balance towards the national 3.8GW capacity target by 2030 – is likely to be the same pool of projects that will deliver the 10GW by 2040 target. Grid connections have been agreed with

a number of projects and some are awaiting results from the ongoing CfD auction. PKN Orlen and Equinor / Polenergia have intimated that projects could be online from the mid-2020s but this will very much depend on their respective ability to secure a CfD in a timely manner.

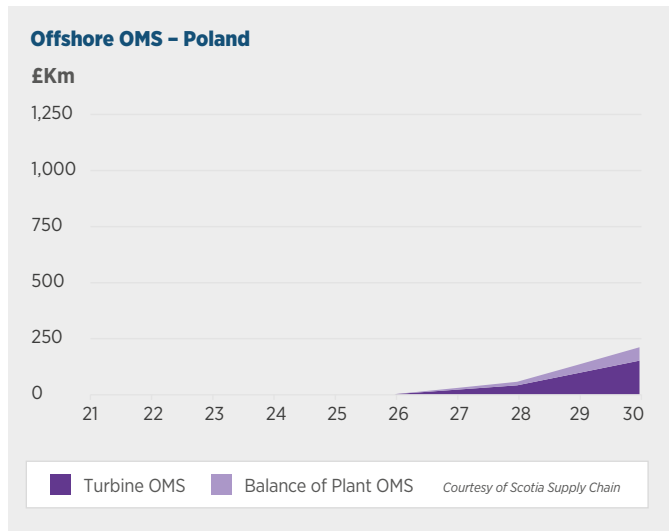
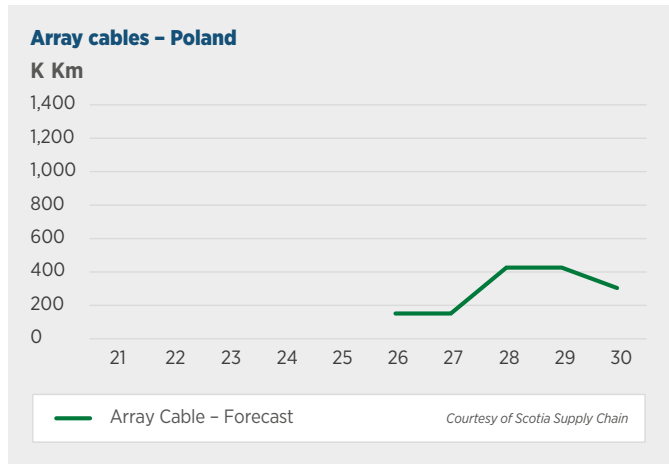
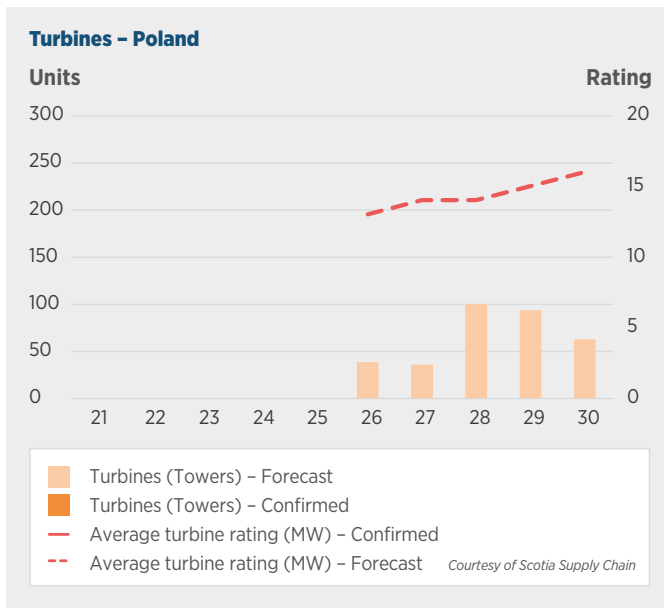
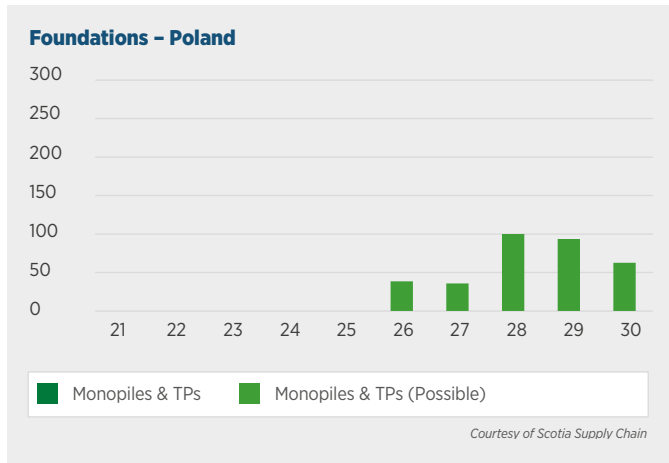
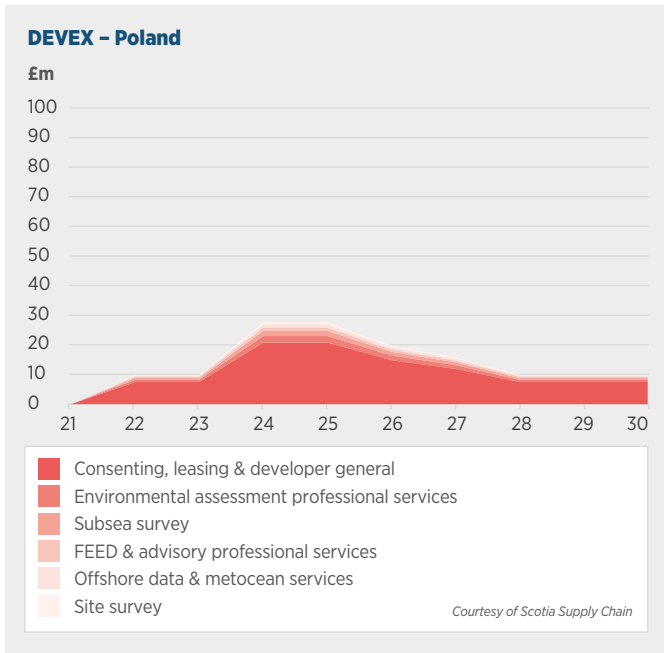
Project	Capacity (MW)	Developer	Turbines	Turbine rating	Turbine OEM	Foundations (forecast)	Location	Project status	Km from shore	Fcst Online
Baltica 2	1500	Orsted (50%) / PGE (50%)	150	10.00	TBC	Likely Monopiles	Baltic Sea	CfD awarded ('21) & Grid awarded	25	by 2030
Baltica 3	1050	Orsted (50%) / PGE (50%)	105	10.00	TBC	Likely Monopiles	Baltic Sea	CfD awarded ('21) & Grid awarded	25	by 2030
F.E.W. Baltic II	350	RWE (100%)	TBC	TBC	TBC	Monopiles	Baltic Sea	CfD awarded ('21) & Grid awarded	50	TBC
Baltic Power	1200	PKN Orlen (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – CfD applied	23	2026
Baltyk III	1440	Equinor (50%); Polenergia (50%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – CfD applied	30	2026
Baltyk II	1440	Equinor (50%); Polenergia (50%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – CfD applied	30	2027
B-Wind	200	Ocean Winds (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – CfD applied	23	TBC
C-Wind	200	Ocean Winds (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – CfD applied	23	TBC
Baltica 1	896	PGE (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – development	80	post-2030
Baltyk I	1560	Equinor (50%); Polenergia (50%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Grid awarded – development	85	by 2030
Sharco II	500	RWE (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Development	30	TBC
Sharco IV	500	RWE (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Development	30	TBC
Sharco V	500	RWE (100%)	TBC	TBC	TBC	Likely Monopiles	Baltic Sea	Development	30	TBC

PREVALENT CAPEX CONTRACTORS / OEMS

As the market is still at an early auction award stage, how the Polish supply chain will develop is largely unknown at this juncture. However, Poland has a strong coastal

fabrication capability in place and it is highly likely that the large European tier one contractors active around Europe will have a similar presence in Poland going forward.

EXPORT MARKET SIZING



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Poland					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- Although the level of mid-term deployment to 2030 is modest in international terms, the size of the market into the 2030s makes Poland one of the most interesting international export markets for Scottish exporters. Government support for offshore wind is strong and the urgency to change the Polish energy mix (circa 70% fossil fuels in 2019) is high, deployment forecasts are highly likely to be realised and may be exceeded;
- Polish projects will be solely deployed in the Baltic Sea therefore the logistical cost burden associated with goods imported from Scotland will be moderate compared to many overseas markets;
- The Polish market is at an early stage of evolution therefore there is a perceived opportunity for Scottish exporters to provide input from lessons learned in the advanced UK market; this is a proposition that Scottish companies should seek to develop and communicate now that the first CfDs have been allocated;
- Poland and Scotland have strong cultural connections, perceived inter-country trading barriers are low. Scottish companies will likely need Polish language capabilities for dealing with national and technical considerations in-country.

CHALLENGING

- The Polish Wind Energy Association (PWEA) and the Polish Offshore Wind Energy Society (PTMEW) are driving the adoption of a UK-style Sector Deal – this multilateral Declaration of Cooperation (to be signed by the government, developers and supply chain) will push a Polish local content and indigenous export facilitation

agenda. Scottish exporters must be aware of this, and approach the market accordingly, potentially being willing to establish indigenous partnership relationships;

- Although the Polish sub-tier supply chain has a limited offshore wind track record, there are a number of very strong fabricators with excellent quayside infrastructure. Scottish exporters will need to be able to compete on cost, quality and delivery to succeed in-country;
- Investment in grid infrastructure is required in order to ensure that deployed offshore wind capacity can be brought online. Although no specific risk exists, timely execution of this investment will be required in order to realise such a rapid offshore wind deployment plan.

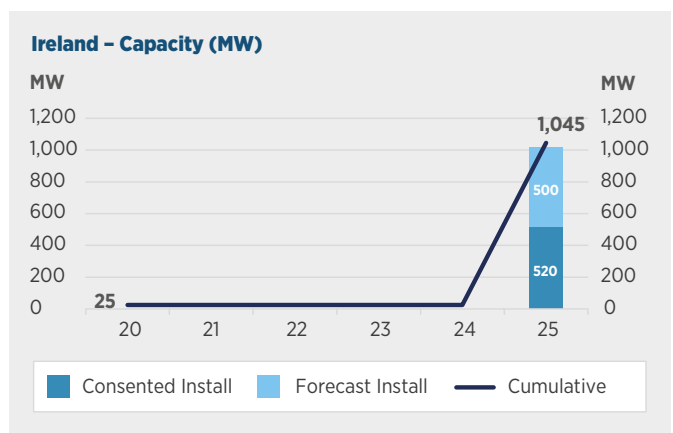
IN-COUNTRY ENGAGEMENT

- Scottish exporters should seek to engage with the following well-connected in-country resources:
 - **Polish Wind Energy Association (www.psew.pl)**
PWEA is an association of the leading companies active within the wind energy market in Poland, connecting investors, developers, and OEMs from Poland and internationally. PWEA estimate that over 140 companies are already active within the Polish offshore wind sector.
 - **Polish Offshore Wind Energy Society (www.ptmew.pl)**
With a strong membership in place, PTMEW organises conferences and seminars, carries out conceptions and analysis and is involved in international and national projects that concern the development of offshore wind in the Baltic Sea.
 - **Marketplanet portal (www.marketplanet.pl)**
In-country developers such as PGE Capital Group often publicise tender opportunities via portals such as this.

IRELAND DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 1GW)

DEPLOYMENT AND DEVELOPERS

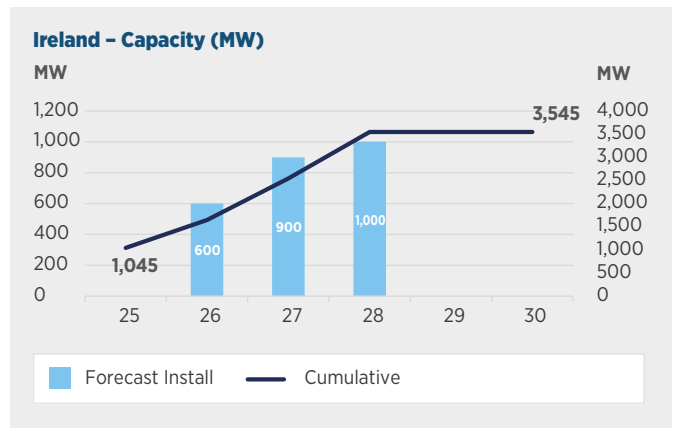
- Although the Irish Government has yet to announce how auctions will be run and there are issues regarding foreshore licensing still to be resolved, there is an aspiration within the country to deploy 1GW by 2025;
- Seven ‘relevant’ projects were identified in 2020, which are expected to be ‘fast tracked’ in order to hit Ireland’s 5GW 2030 deployment commitment. The SSE Arklow 2 project is likely to be first to deploy as it is proceeding as an extension to the earlier Arklow 1 deployment;
- If 1GW is to be deployed by 2025, one of the other six relevant projects will need to be progressed. Some of the developers have expressed aspirations to deploy in the mid-2020s, but this may be a challenge given the current state of auctioning and consenting in the country.



Project	Capacity (MW) Total 3,028	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
Arklow Bank 2	235	SSE (100%)	TBC	Monopile	Irish Sea	Consented	10	2025

IRELAND DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 3.5GW)

- The following deployment forecast to 2030 – based on developer-stated timelines – is optimistic and it is possible that project timelines will slip. It is unclear at this stage which projects will likely progress first until details are announced about the proposed in-country auction mechanism.
- The mid-term Irish market to 2030 is likely to be a mix of shallow and deep-water sites. The shallow water Irish Sea projects are likely to deploy early as the economics around monopile foundations have already been proven.
- Industry estimates suggest that 70% of the 33GW long-term Irish pipeline is in water depths >60m, therefore, presenting a strong floating opportunity in the South Irish Sea and Western Atlantic Sea in the 2030s. Given Scotland’s similar focus on floating wind, it is perceived that synergy will exist across both supply chains.



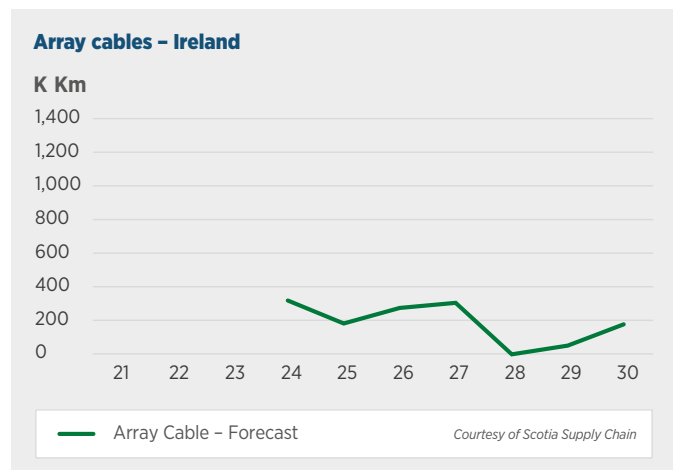
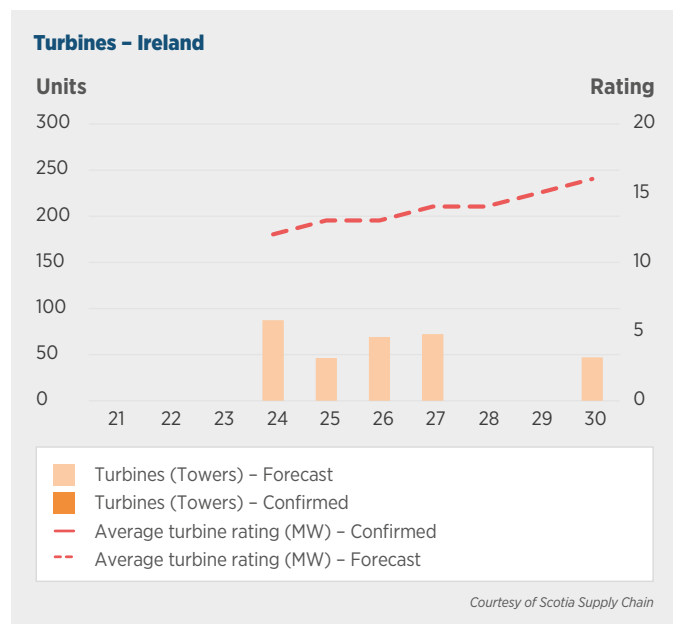
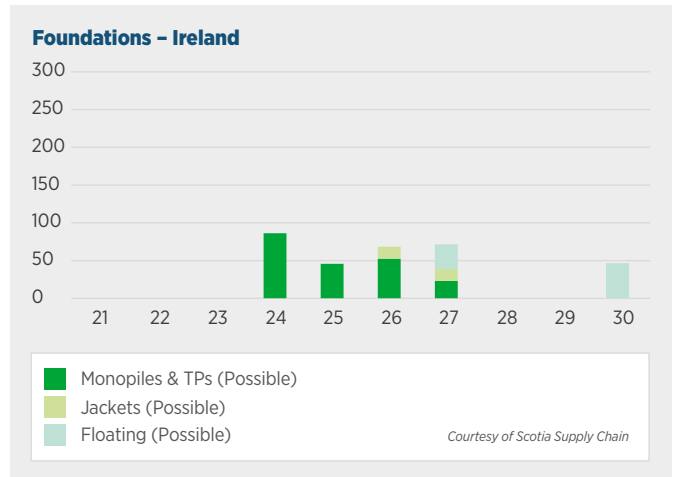
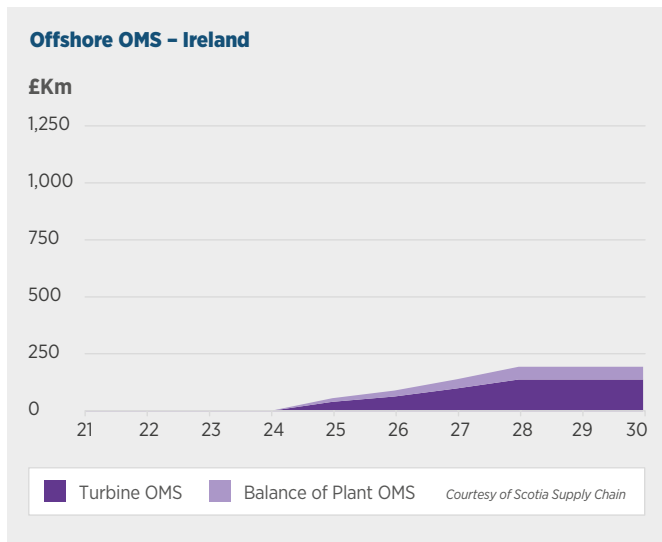
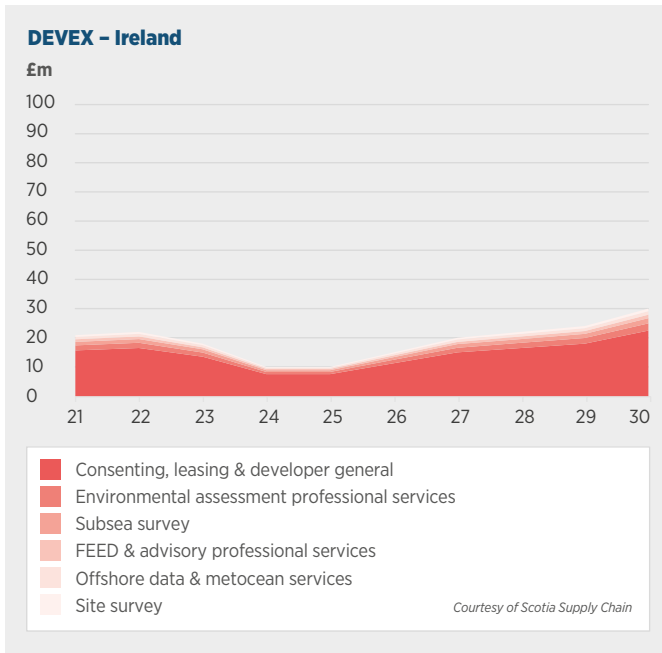
Project	Capacity (MW)	Developer	Turbines	Turbine rating	Turbine OEM	Foundations (forecast)	Location	Project status	Km from shore	Fcst Online
Codling Bank	600	EDF (50%) / Fred. Olsen (50%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development – Relevant Project	10	2026
Dublin Array	900	RWE (50%) / Saorgus Energy (50%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development – Relevant Project	10	2027
Codling Bank 2	1000	EDF (50%) / Fred. Olsen (50%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development – Relevant Project	13	2028
Oriel	330	Parkwind (65%) / ESB (35%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development – Relevant Project	8	TBC
North Irish Sea Array	530	Statkraft (100%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development – Relevant Project	7	TBC
Skerd Rocks	392	Fuinneamh Sceirde Teoranta (100%)	TBC	TBC	TBC	Likely Monopiles	West – Atlantic Sea	Development – Relevant Project	5	TBC
Braymore Point	800	SSE (100%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development	12	TBC
Celtic Sea	800	SSE (100%)	TBC	TBC	TBC	Likely Floating	South – Irish Sea	Development	25	TBC
Clogher Head	500	ESB (65%) / Parkwind (35%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development	5	TBC
Cooley Point	500	ESB (100%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development	12	TBC
Emerald Floating Windfarm	100	Simply Blue Energy (100%)	TBC	TBC	TBC	Floating	South – Irish Sea	Development	35	TBC
Helvick Head	1000	Energia (100%)	TBC	TBC	TBC	Likely Jacket	South – Irish Sea	Development	10	TBC
Kilmichael Point	500	ESB (100%)	TBC	TBC	TBC	Likely Monopiles	East – Irish Sea	Development	5	TBC
TBC	1400	ESB / Equinor	TBC	TBC	TBC	Floating	West – Atlantic Sea	Development	TBC	by 2031

PREVALENT CAPEX CONTRACTORS / OEMS

With a less established large-scale offshore engineering and fabrication track record and in-country capability, there is general acceptance that supply from overseas will be required for early Irish projects. With a number of the

early developers also active in Scotland (particularly SSE and EDF), opportunities may exist for Scottish companies active on Scottish projects in the mid-2020's to offer economy of scale benefits for early Irish projects.

EXPORT MARKET SIZING



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Ireland					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- Although the level of mid-term deployment to 2030 is limited and yet to be enabled by a clear auction and licensing framework, the size of the market into the 2030s makes Ireland an international market of interest for Scottish exporters. Government support for offshore wind is strong and the urgency to change the Irish energy mix is high.
- The geographical proximity of Irish projects to Scotland is significant; Scottish exporters are ideally placed to supply Irish projects. Logistical advantages may be leveraged, particularly regarding the early projects in the Irish Sea.
- Similar to Scotland, Ireland sees its long-term offshore wind opportunity in floating wind, therefore, significant opportunities exist for the Scottish and Irish supply chains to collaborate for greater global success.
- The Irish market is at the start of its offshore wind journey and indigenous supply gaps are expected and accepted. Scottish exporters have a fantastic opportunity to impart lessons learned from the UK and have a strong influence on how the Irish supply chain develops. Given the strong commonality of active developers in both countries, Scottish exporters are ideally placed to leverage supply opportunities.
- Given the early stage of the Irish market, a wide range of export opportunities exist across the whole offshore wind supply lifecycle, including development and early site characterisation. It is generally accepted that early DEVEX-stage market presence increases the probability of success in the subsequent CAPEX and OPEX phases.
- Ireland and Scotland have very strong trading and cultural links and it is expected that Scottish companies will have no problems navigating the Irish regulatory and technical landscape. The Irish and Scottish governments have recently announced a number of green recovery initiatives, where joint collaboration in offshore wind is a specific priority.

Challenging

- With auction and regulatory policy largely still work in progress, the specific nature and timelines around Irish offshore wind deployment are largely unknown.
- None of the Irish developers have pre-nominated tier one contractors therefore it is difficult for Scottish CAPEX exporters to leverage existing tier one relationships at this time.

IN-COUNTRY ENGAGEMENT

- Scottish exporters seeking to engage in-country should consider approaching the following enablers:
 - **Irish Wind Energy Association (www.windenergyireland.com)**
With a membership of 150+, the Irish Wind Energy Association has strong linkages across the whole supply chain and has published wind capability assessments.
 - **Enterprise Ireland (www.enterprise-ireland.com)**
Currently working on the launch of an Irish offshore wind cluster, Enterprise Ireland is very active within the UK offshore wind sector from a supply chain enabling perspective.
 - **Údarás na Gaeltachta (www.udaras.ie)**
A regional authority operating mainly in the west of Ireland, keen to facilitate the creation of an Atlantic Sea offshore wind hub.

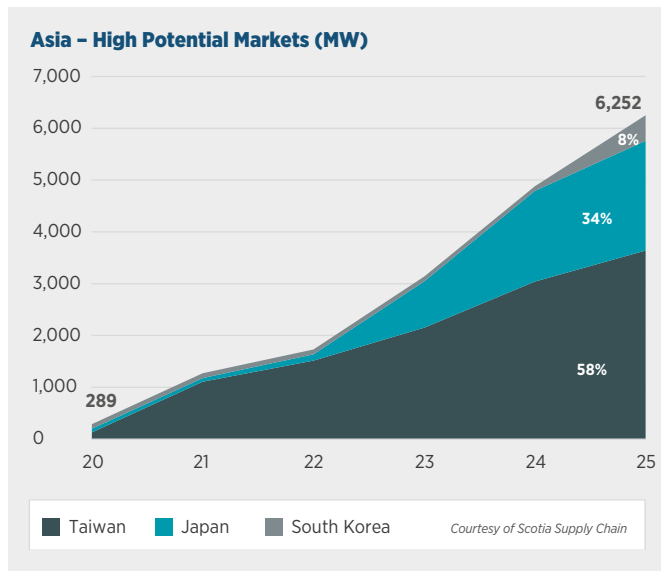
ASIA TOP-LEVEL OVERVIEW – SHORT-TERM MARKET (FORECAST – 6.3GW)

The Asian market (excluding China and Vietnam – covered in a later section) will ramp quickly in the next four years, but is still significantly smaller than the UK and European demand across the same period (6GW versus 10GW and 16GW respectively).

Specialist Scottish companies are already trading successfully in these early-stage markets but Scottish exporters may encounter a number of additional cultural, logistical and indigenous OEM competitive threats within this region.

Installed and commissioned capacity in the three key Asian markets (Taiwan, Japan and South Korea) will rise rapidly in the first half of the 2020s, growing from 0.3GW in 2020 to 6.3GW by 2025.

Taiwan is undoubtedly the most advanced Asian offshore wind market, however, a strong Japanese market emerges in the next two to three years ahead of a burgeoning floating market in South Korea towards the end of the decade.

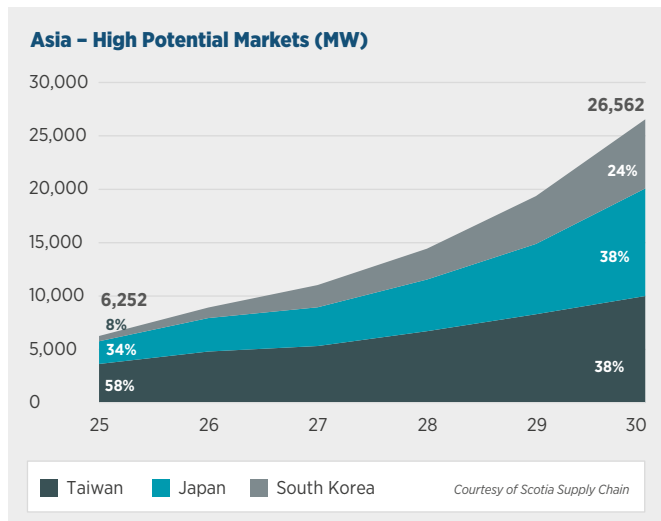


ASIA TOP-LEVEL SUMMARY – MID-TERM MARKET (FORECAST – 26.6GW)

From 6.3GW by 2025, deployment in the three high potential Asian countries is expected to rise by around 20GW from 2026-30; although this is some way behind the 32GW planned for Europe across the same period, it is comparable with the 20GW expected to deploy in the UK across the same period (assuming the UK meets its 40GW deployment target for 2030).

The Asian high potential markets will grow, however, on a faster trajectory than Europe and UK in the second half of the decade.

Japan is expected to reach deployment parity with Taiwan by 2030. South Korea is likely to grow quickly later in the decade as floating wind is available at commercial scale.

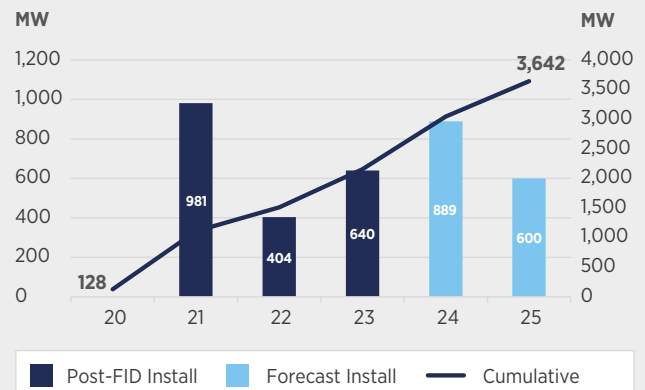


TAIWAN DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 3.6GW)

DEPLOYMENT AND DEVELOPERS

- Outside of China, Taiwan is the most developed Asian market, where a significant number of consents have been given to several international developers and a feed in tariff (FiT) mechanism is in place. Eleven projects were identified by the Taiwanese Government in 2018 for short-term deployment.
- As the sector gears up to deploy in scale from 2021, a pathway exists for 3.6GW to be deployed by 2025; this is broadly in line with the governmental mid-decade target of 4GW.
- Five projects (2GW) have entered the construction phase and are followed by a further five consented projects (1.5GW) that are targeting deployment by 2025.
- Nine out of the ten projects have already nominated the wind turbine manufacturer – SGRE have won five, MVOW three and Hitachi one.
- Similar to the Scottish market, the early Taiwanese market will be dominated by jacket foundations; only wpd's Yunlin has confirmed the use of monopiles and transition pieces.

Taiwan - Capacity (MW)



Project	Capacity (MW) Total 3,514	Developer (Expected lead)	Turbines	Foundations (Forecast)	Project status	Km to shore	Forecast online
Formosa 2	376	Swancor (50%) / JERA (49%)	47 x 8MW SGRE	Jacket	In construction	10	2021
Changhua 1	605	Orsted (100%)	74 x 8MW SGRE	Jacket	In construction	35 - 60	2022
Changhua Pilot	109	Taiwan Power (100%)	21 x 5MW Hitachi	Jacket	In construction	35 - 60	2022
Changhua 2a	295	Orsted (100%)	37 x 8MW SGRE	Jacket	In construction	8	2022
Yunlin	640	wpd (48%)	80 x 8MW SGRE	Monopile	In construction	16	2023
Changfang	541	CIP (87.5%)	57 x 9.5MW MVOW	Jacket	Post-FID / Consented	10	2024
Xidao	47	CIP (87.5%)	5 x 9.5MW MVOW	Jacket	Post-FID / Consented	10	2024
Zhong Neng	300	CIP (87.5%)	32 x 9.5MW MVOW	Jacket	Pre-FID / Consented	11	2024
Changhua 2	300	Taiwan Power Company (100%)	TBC	Likely Jacket	Pre-FID / Consented	50 - 70	2025
Hai Long 2 - Phase 1	300	Northland (60%) / Mitsui (20%)	21 x 14MW SGRE	Likely Jacket	Pre-FID / Consented	50 - 70	2025

PREVALENT CAPEX CONTRACTORS / OEMS

Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Formosa 2	376	Swancor (50%) / JERA (49%)	2021	SGRE – 8MW	Seajacks (UK)		Saipem (ITA)	EEW (GER)	Jan de Nul (LUX) / Seaway7 (UK)
Changhua 1	605	Orsted (100%)	2022	SGRE – 8MW	Seajacks (UK)		China Steel / M&T & Hyundai (KOR)	CWP & FHI (TWN) / EEW (GER)	Heerema (NED)
Changhua Pilot	109.2	Taiwan Power (100%)	2022	Hitachi – 5.2MW	Jan de Nul (LUX)		Samkang (KOR)	Edgen Murray (UK) / SeAH (KOR)	Jan de Nul (LUX)
Changhua 1	605	Orsted (100%)	2022	SGRE – 8MW	Seajacks (UK)		China Steel / M&T & Hyundai (KOR)	CWP & FHI (TWN) / EEW (GER)	Heerema (NED)
Yunlin	640	wpd (48%)	2022	SGRE – 8MW	Fred. Olsen (NOR)	Steelwind (GER) / FHI (TWN)			Van Oord (NED) / Jumbo (NED)
Changfang	541.5	CIP (87%)	2023	MVOW – 9.5MW	DEME (BEL)		Bladt (DEN) / CWP (TWN)	CTCI (TWN)	Boskalis (NED)
Xidao	47.5	CIP (87%)	2024	MVOW – 9.5MW	DEME (BEL)		Bladt (DEN) / CWP (TWN)	CTCI (TWN)	Boskalis (NED)
Zhong Neng	300	CIP (87%)	2024	MVOW – 9.5MW				CTCI (TWN)	DEME (BEL)
Changhua 2	300	Taiwan Power (100%)	2025						
Hai Long 2 – Phase 1	300	Northland (60%) / Mitsui (20%)	2025	SGRE – 14MW					

Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Formosa 2	376	Swancor (50%) / JERA (49%)	EPCI		Fortune Electric (TWN)	JDR (UK)	Jan de Nul (LUX)	LS Cable (KOR)	Jan de Nul (LUX)
Changhua 1	605	Orsted (100%)	Multi-contract		TCC (TWN)		Van Oord (NED)	LS Cable (KOR)	Van Oord (NED)
Changhua Pilot	109.2	Taiwan Power (100%)	EPCI			JDR (UK)	Jan de Nul (LUX)	JDR (UK)	Jan de Nul (LUX)
Changhua 2a	295	Orsted (100%)	Multi-contract		TCC (TWN)		Van Oord (NED)	LS Cable (KOR)	Van Oord (NED)
Yunlin	640	wpd (48%)	EPCI			LS Cable (KOR)	Seaway7 (UK)	LS Cable (KOR)	Seaway7 (UK)
Changfang	541.5	CIP (87%)	EPCI		TECO / Pacific (TWN)	LS Cable (KOR)	Fred. Olsen (NOR)		Fred. Olsen (NOR)
Xidao	47.5	CIP (87%)	EPCI		TECO / Pacific (TWN)	LS Cable (KOR)	Fred. Olsen (NOR)		Fred. Olsen (NOR)
Zhong Neng	300	CIP (87%)	EPCI						
Changhua 2	300	Taiwan Power (100%)	EPCI						
Hai Long 2 – Phase 1	300	Northland (60%) / Mitsui (20%)	EPCI						

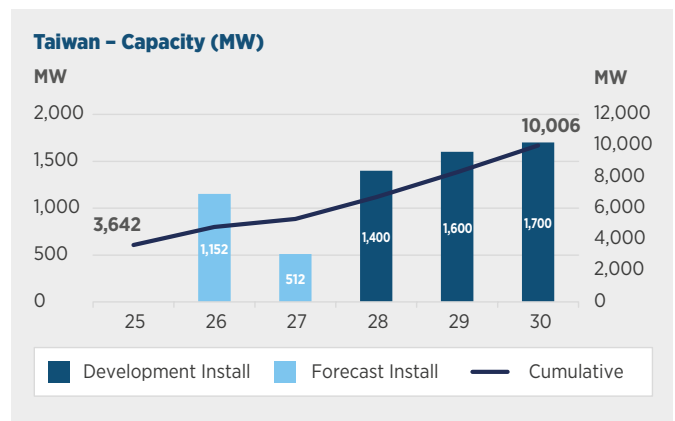
- Whilst some of the mid-decade projects have not yet fully confirmed their procurement supply strategies, sufficient projects have already committed to a number of tier one / two contracts for the following trends to emerge:
 - **Turbines:** Siemens Gamesa and Mitsubishi Vestas are again expected to be dominant players in-country, but Asian OEMs are likely to enter this sector going forward. Unsurprisingly, turbine installation is dominated by the specialist European vessel contractors. The OEMs have put in place a number of local framework agreements for the supply of towers, components and assembly services.
 - **Foundations:** Similar to the Scottish market, the early Taiwanese market will be heavily focussed

around jackets, with only one project confirming monopile foundations. Jacket manufacturing has a heavy Asian flavour, with a number of European OEMs establishing local footprint and capability with indigenous fabricators. As with turbines, the specialist European vessel contractors are heavily involved in the installation market.

- **Substations:** The early projects are focussing heavily on substation capacity onshore; all works, as expected, will most likely be contracted with local companies.
- **Array and export cables:** LS Cables has taken an early dominant OEM position although UK-based JDR has had some success. The specialist European vessel contractors will largely support installation.

TAIWAN DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 10GW)

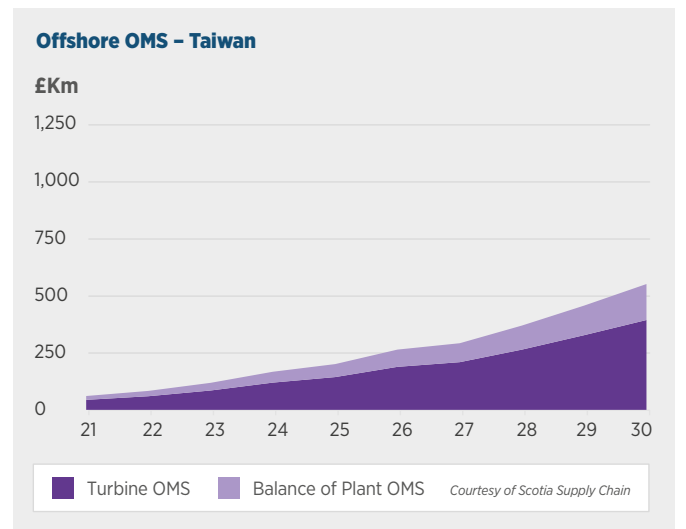
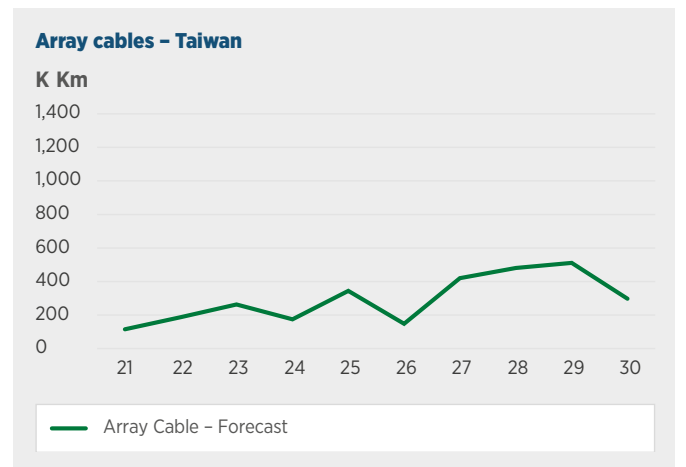
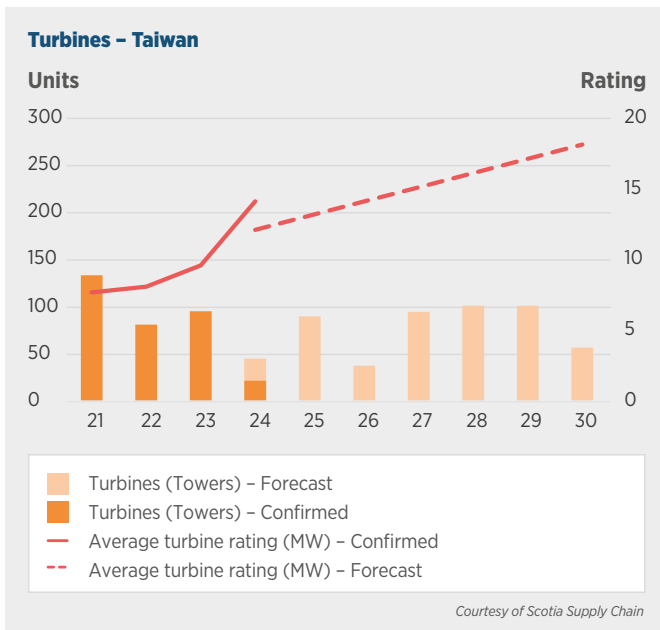
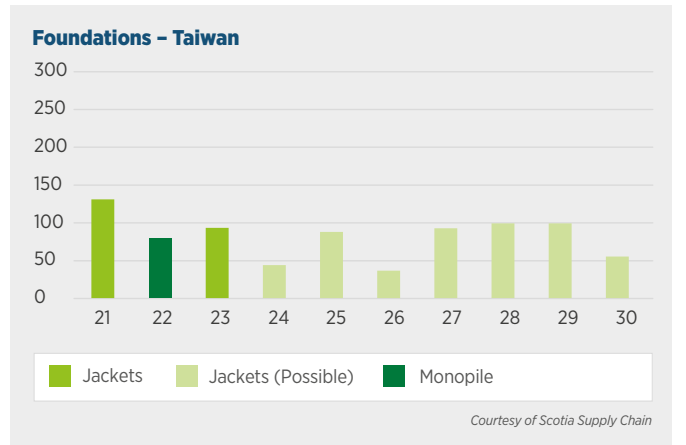
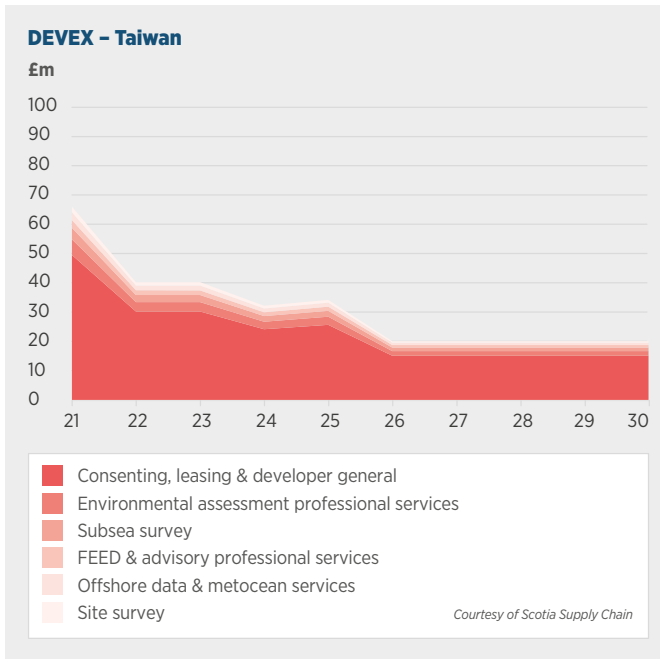
- The remainder of the eleven consented projects (1.7GW) from 2011 will likely be deployed 2026-27; national targets of 10GW by 2030 and 15GW by 2035 are in place.
- With an established Power Tariffs (FiT) mechanism in place a strong mix of domestic and international developers are expected to be active in this market.
- Project capacity of around 4.7GW, that is currently not consented, is required for deployment between 2028 and 2030 to realise 10GW aspirations; this will most likely pull from the 9.5GW development pipeline.
- Although mid-term projects have yet to nominate selected foundation technology, the seabed conditions around Taiwan are likely to be most suited to jackets. There is likely to be a floating wind opportunity towards the turn of the decade, as the technology commercialises.



Project	Capacity (MW)	Developer	Turbines	Turbine rating	Turbine OEM	Foundations (forecast)	Location	Project status	Km from shore	Fcst Online
Greater Changhua NW (Changhua 4)	582.9	Orsted (100%)	39	15	TBC	Likely Jacket	Pre-FID / Consented	40	2026	2026
Greater Changhua SW (Changhua 2b)	337	Orsted (100%)	22	15	TBC	Likely Jacket	Pre-FID / Consented	40	2026	2027
Hai Long 2 – Phase 2B	232	Northland Power (60%) / Mitsui (20%)	15	15	TBC	Likely Jacket	Pre-FID / Consented	35	2026	2028
Hai Long 3	512	Northland Power (60%) / Mitsui (20%)	32	16	TBC	Likely Jacket	Pre-FID / Consented	35	2027	TBC
Chu Feng	448	RWE (50%)	TBC	TBC	TBC	Likely Jacket	Development	3	TBC	TBC
Formosa 3 – Haiding 1	552	JERA / GIG / EnBW	TBC	TBC	TBC	Likely Jacket	Development	40	TBC	TBC
Formosa 3 – Haiding 2	732	JERA / GIG / EnBW	TBC	TBC	TBC	Likely Jacket	Development	40	TBC	TBC
Formosa 3 – Haiding 3	720	JERA / GIG / EnBW	TBC	TBC	TBC	Likely Jacket	Development	40	TBC	TBC

Formosa 4 - 1	1,467	Swancor (100%)	TBC	TBC	TBC	Likely Jacket	Development	20	TBC	TBC
Formosa 4 - 2	1,467	Swancor (100%)	TBC	TBC	TBC	Likely Jacket	Development	20	TBC	TBC
Formosa 4 - 3	1,467	Swancor (100%)	TBC	TBC	TBC	Likely Jacket	Development	20	TBC	TBC
Greater Changhua NE (Changhua 3)	570	Orsted (100%)	TBC	TBC	TBC	Likely Jacket	Development	40	TBC	TBC
Guanyin	360	wpd (50%)	TBC	TBC	TBC	Likely Jacket	Permit denied	3	TBC	TBC

EXPORT MARKET SIZING



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Taiwan					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- Taiwan's 10GW deployment plan across the next decade makes the county an attractive target market for Scottish exporters. With strong governmental support, an auction and consenting mechanism in place and a long-term deployment target, Taiwan is very likely to hit its mid-term deployment forecasts.
- Similar to the Scottish market, the proportion of jacket foundations used for near-term projects is likely to be extremely high - very few international markets are likely to be so similar. With one of the largest domestic jacket project pipelines in place, Scottish companies can likely leverage lessons learned in this specialism.
- Similar to Scotland, Taiwan has lofty ambitions for the deployment of deep-water floating offshore wind projects, therefore, significant opportunities exist for Scottish innovation effort to leverage opportunities in the country.
- Given the high level of European tier one / two involvement in Taiwan to date, Scottish exporters can potentially bid for work from home without necessarily having to make an early in-country direct commitment.
- Taiwan has been very receptive to overseas contractors so far, but creating indigenous capability is a key mid-term priority for the country. The Taiwanese Government has been clear that it will welcome overseas contractors so long as there is a long-term plan for creating local capability. There is a clear premium on stimulating in-country skills in offshore wind and a need exists for specific areas of supply. Developers have indicated that the provision of EIA and OMS services is a perceived area where gaps exist in the indigenous supply chain.
- Government to government relations are strong and annual trade talks continue to contribute to a positive perception of UK expertise and the value that its supply brings to the Taiwanese economy. The FiT and auction systems are very similar to the UK CfD model, therefore, Scottish exporters have a good appreciation of how the supply chain operates under such conditions.

- In March 2021, all in-country developers with existing projects joined forces to set up a new group focusing on floating offshore wind. It remains to be seen how influential this body becomes as the developers are of course inherently competitive to one another. However, the British Chamber of Commerce's UK Renewables Committee is evolving into a recognised enabler and Scottish companies serious about Taiwan are encouraged to join.
- Taiwan has one of highest performing education systems globally and research and development capabilities are extremely advanced. An opportunity exists for leading Scottish efforts to be jointly developed in-country.
- Compared to other markets in Asia, Taiwan is generally considered to be among the easiest and cheapest markets to do business for Scottish companies. Several Scottish and UK supply chain companies have already set up local entities in Taiwan and are using it as an operating base for expansion into other APAC markets.

Challenging

- Similar to the evolution of the UK market, upcoming round three site auctions are seeking local content commitments up to 60%. There is little doubt that developers and tier one contractors offering higher levels of local content will ultimately succeed in a competitive auction situation.
- The logistical cost burden associated with shipments from Scotland is likely to be high. This will be a highly competitive market and Scottish exporters may need to consider in-country partnering as a route to entry. International tier two OEMs like Danish tower supplier Welcon have already committed to developing an in-country presence via partnerships with local OEMs.
- The Taiwanese supply chain has been developing for quite some time; multiple European, Japanese, Malaysian, Australian and US companies are operating in the Taiwan market and all looking to influence future buying decisions. Scottish exporters face a very competitive in-country international challenge.

IN-COUNTRY ENGAGEMENT

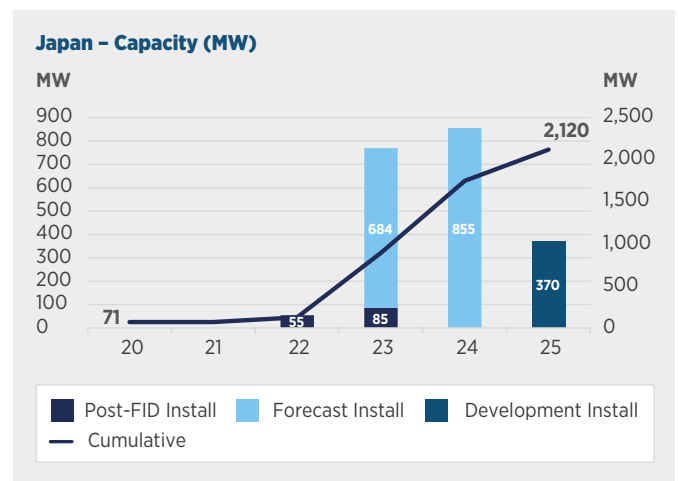
- Several Scottish companies are reluctant to re-export their equipment after current campaigns finish and are exploring ways to keep assets within Taiwan in order to bid for future work. SDI is supporting companies to rent storage and workshop space in Taichung (Taiwan’s main offshore wind port hub) and assist with other in-country trading needs.
- There are a handful of trade associations relevant to offshore wind in-country, but the focus is more technical and academic than commercial in nature. Scottish exporters seeking to engage in-country should consider approaching the following enablers:
 - **Taiwan Offshore Wind Turbine Foundation and Marine Engineering Association (www.clustercollaboration.eu)**
The UK Foreign Office signed an MOU with this group that aims to integrate the industry of offshore wind turbine foundation and marine engineering across surveying, general engineering, corrosion protection, OMS, vessels, design, installation and certification.

- **Taiwan Offshore Wind Industry Association (TOWIA)**
An alliance launched in March 2021 by the main in-country developers (Orsted, Northland, CIP, wpd, Macquarie, GIG, Swancor, Yushan and JERA), TOWIA seeks to facilitate green energy discussions among government officials, private companies and the public and help build a sustainable wind power supply chain in Taiwan by encouraging a deeper cooperation between industry and academia.
- **Metal Industries Research & Development Centre (www.mirdc.org.tw)**
Orsted and the other European developers / tier one contractors are establishing offshore wind initiatives with technical centres such as MIRDC, which has significant funds in place to drive in-country innovation.

JAPAN DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 2.1GW)

DEPLOYMENT AND DEVELOPERS

- Marubeni’s Akita / Noshiro 140MW project – Japan’s first commercial-scale development – is entering construction and will be online by 2022.
- Despite national aspirations to deploy 1GW p.a. every year throughout the 2020s, deployment pre-2025 is expected to be modest from a standing start.
- Japanese bathymetry and soil conditions are very different from Europe; early characterization phase deployment will be via fixed foundation developments on narrow bands of seabed, close to the shore.
- Foundation selection has not yet made beyond the Marubeni projects (confirmed monopiles), but a 50:50 split has been assumed between jackets and monopiles, given the known nearshore geography challenges that will drive jacket demand.



Project	Capacity (MW) Total 2,049	Developer (Expected lead)	Turbines	Foundations (Forecast)	Project status	Km to shore	Forecast online
Akita	55	Marubeni (51%)	13 x 4MW MVOW	Monopile	In Construction	5	2022
Noshiro Port	85	Marubeni (51%)	20 x 4MW MVOW	Monopile	In Construction	2	2023
Hibikinada	229	Obayashi Corporation (100%)	24 x 9.5MW MVOW	Monopile or Jacket	Pre-FID	2	2023
Norther Akita	455	RENOVA (25%)	57 x 8MW SGRE	Monopile or Jacket	Pre-FID	2	2023
Yurihonjo	700	ENEOS (33.3%) / JERA (33%)	70 x 10MW TBC	Monopile or Jacket	Pre-FID	2	2024
Happo Noshiro	155	Tepco (51%) / Orsted (49%)	22 x 8MW TBC	Monopile or Jacket	Pre-FID	2	2024
Choshi	370	Tepco (51%) / Orsted (49%)	TBC	Monopile or Jacket	Development	3	2025

PREVALENT CAPEX CONTRACTORS / OEMS

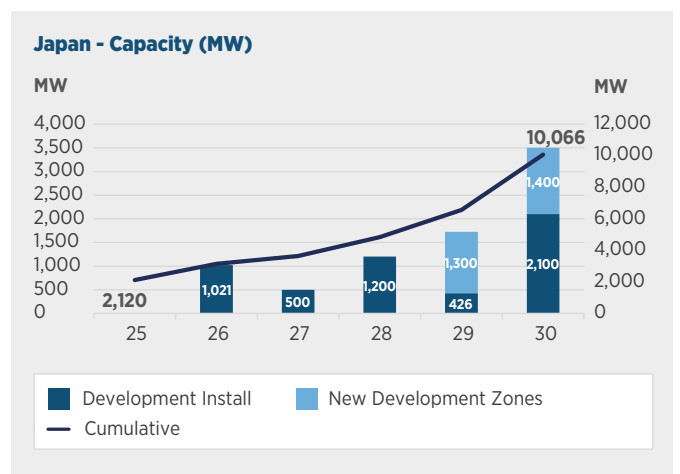
Project	Capacity (MW)	Developer	Online	Turbines		Foundations (Forecast)			
				OEM	Installer	Monopile OEM	Transition Piece	Jacket OEM	Installer
Akita	55	Marubeni	2022	MVOW – 4.2MW	Seajacks (UK)	Kajima (JPN) – EPCI / SIF (NED)	Smulders (BEL)		Seajacks (UK)
Noshiro Port	85	Marubeni	2023	MVOW – 4.2MW	Seajacks (UK)	Kajima (JPN) – EPCI / SIF (NED)	Smulders (BEL)		Seajacks (UK)

Project	Capacity (MW)	Developer	Contracting	Substation		Array Cable		Export Cable	
				Offshore	Onshore	OEM	Installer	OEM	Installer
Akita	55	Marubeni	EPCI			Sumitomo (JPN) – EPCI			
Noshiro Port	85	Marubeni	EPCI			Sumitomo (JPN) – EPCI			

- Given the fact that only one project is currently in the construction cycle, the emergence of a prevalent OEM supply chain model has not yet occurred, so only top-level assertions can be drawn at this stage:
 - Turbines:** MVOW have entered their 'home' market strongly, but other turbine OEMs are expected to play an active role going forward. UK-based Seajacks is undertaking turbine installation in-country.
 - Foundations:** The SIF/Smulders JV will supply the monopiles and transition pieces for the Marubeni projects from Europe, as there is no indication of any short-term localisation of OEM supply at this stage. Again, Seajacks will undertake installation activities.
 - Array & Export cables:** Japan has a strong in-country cable OEM capability, with Sumitomo being handed the first full cable EPCI scope in-country.

JAPAN DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 10GW)

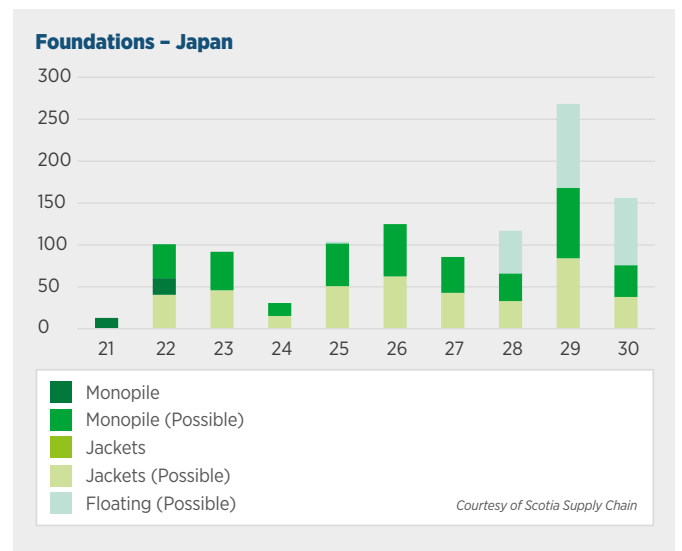
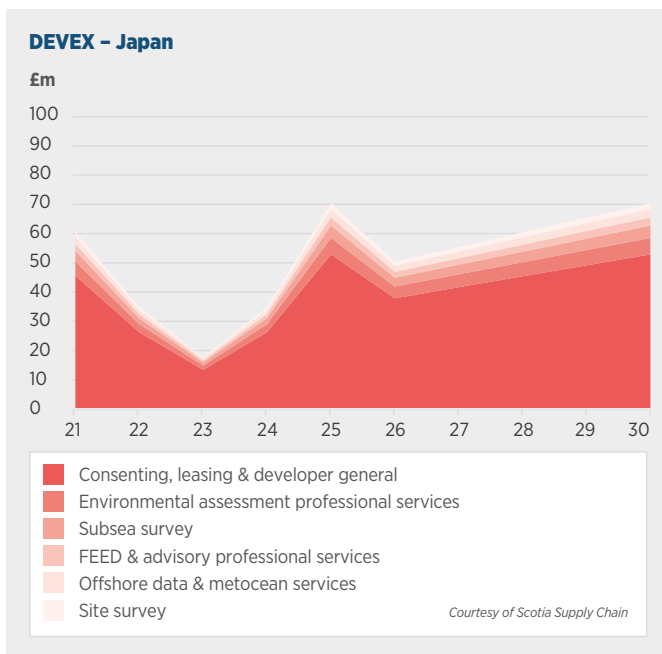
- Japan has intimated a 2030 deployment target of 10GW, circa 8GW of which is likely to be installed over the period 2026-30. However, the country's deployment profile is likely to be a little spikey as the market ramps up to increased levels of deployment through the 2030s in order to meet the Japanese mid-term 2040 capacity target of 45GW (i.e. 10GW of deployments in 2020s / 35GW in 2030s). Japan has an estimated offshore wind seascape to support 128GW of fixed and 424GW of floating wind capacity.
- As there is insufficient pipeline of projects to deploy 10GW by 2030, new sites will need to be identified and tendered. In 2020, the Japanese Government announced 10 'promising zones' around Japan suitable for offshore wind deployment, four of which were identified as particularly attractive.
- With an established Power Tariffs (FiT) mechanism in place and recently extended offshore wind licenses, Japan is likely to attract a number of big names to the domestic offshore wind sector.
- Developers have been allocated for around 4.7GW of the 7.9GW pipeline. This includes Iberdrola, which recently partnered to acquire 3.3GW across six projects. Please note that the foundation types listed against the Iberdrola projects are for illustrative purposes only, as it is not clear which projects will be fixed and which will be floating. It has been reputed that around 50% of the current Japanese pipeline will deploy floating foundations, possibly using the Ideal Dampening Pool concept.



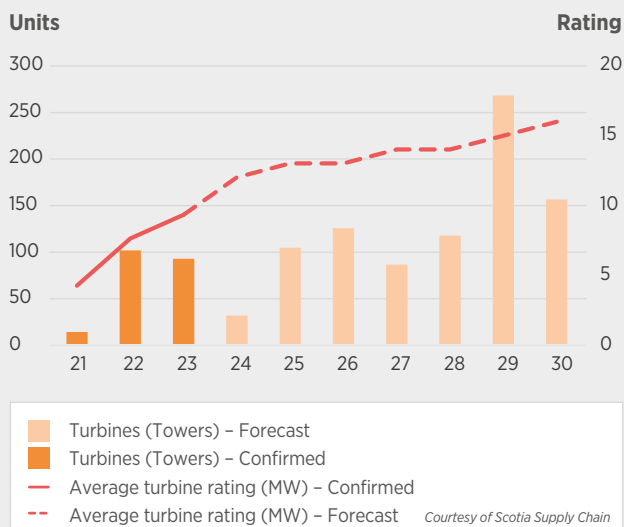
- There are four areas in the tender cycle: Goto floating (application closed), Noshiro-Mitane-Oga, Yurihonjo (North/South) and Choshi; all are part of the first promotional areas selected by the government in 2019.
- Sites suitable for monopile deployment are likely to deplete over time. Assumptions have been made, for the purpose of this analysis, that the proportion of jackets versus monopiles will increase towards 2030.
- Of the 2.7GW of new sites required to hit the 10GW 2030 target, assumptions have been made, for the purposes of this guide, that this will be split between fixed and floating; the market will likely lean heavily towards the former.

Project	Capacity (MW)	Developer	Turbines	Turbine rating	Turbine OEM	Foundations (forecast)	Status	Fcst Online
Goto Floating Wind	21	TBC	TBC	TBC	TBC	Floating	Out to tender	2026
Noshiro-Mitane-Oga	480	Various	TBC	TBC	TBC	Monopile or Jacket	Development	2026
Ishikari Bay	520	JERA (100%)	65	8	TBC	Monopile or Jacket	Development	2026
Nishikita (Aomori North West)	500	Eco Power (50%) / Hitachi Zosen (50%)	125	4	TBC	Monopile or Jacket	Development	2027
Saga Karatsu City	600	Iberdrola (50%) / Macquarrie (50%)	TBC	TBC	TBC	Monopile or Jacket	Development	2028
Satsuma	600	Iberdrola (25%) / Mitsui (25%)	TBC	TBC	TBC	Monopile or Jacket	Development	2028
Hokkaido (Ishikari Bay New Port)	112	Green Power (50%) / Hokkaido (50%)	TBC	TBC	TBC	Monopile or Jacket	Development	2029
Ibaraki 1 (Kashima Port)	94	Wind Power Energy (100%)	18	5.2	Hitachi	Monopile or Jacket	Development	2029
Murakami City (Iwafune Offshore)	220	Hitachi (33.4%) / Mitsubishi HI (33%)	40	5.5	TBC	Monopile or Jacket	Development	2029
Fukui Konpira	525	Iberdrola (50%) / Macquarrie (50%)	TBC	TBC	TBC	Monopile or Jacket	Development	2030
Nanao Shika	525	Iberdrola (50%) / Macquarrie (50%)	TBC	TBC	TBC	Floating	Development	2030
Shiroishi Kosugo	525	Iberdrola (50%) / Macquarrie (50%)	TBC	TBC	TBC	Floating	Development	2030
Tono	525	Iberdrola (50%) / Macquarrie (50%)	TBC	TBC	TBC	Monopile	Development	2030
Floating Estimate	700	TBC	TBC	TBC	TBC	Floating	Pre-development	2030
Fixed Estimate	2,000	TBC	TBC	TBC	TBC	Monopile	Pre-development	2030

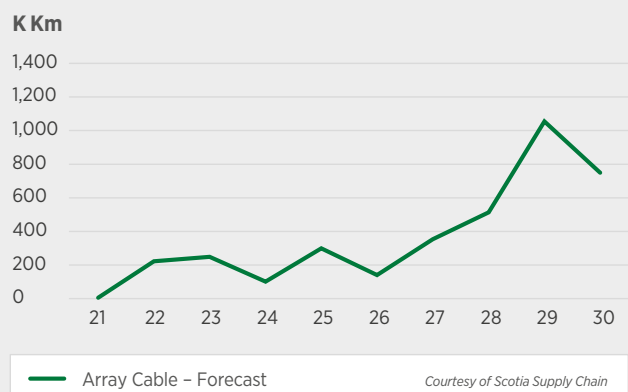
EXPORT MARKET SIZING



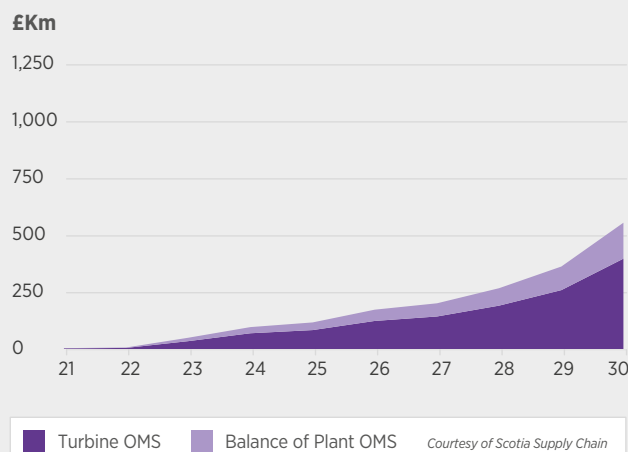
Turbines - Japan



Array cables - Japan



Offshore OMS - Japan



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Japan	High	Low	High	High	High

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- A 10GW deployment plan across the next decade followed by a long-term commitment to offshore wind makes Japan an attractive target market for Scottish exporters. With strong governmental support, an auction and consenting mechanism in place and a strong aspiration to reduce the country's reliance on nuclear, Japan is very likely to hit its mid-term deployment forecast.
- Japan has a number of very capable OEMs and technical specialists that are likely to target the offshore wind sector going forward, however, Japan is known to be keen to seek European specialist partners in order

to develop local capability in this new sector. The early stage of the market (and as a consequence the supply chain) means that the market is likely to be receptive to importing goods and services, certainly in the short-term, given the rapid growth in deployment expected.

- Developers anticipate there will be short-term gaps in supply within Japan for a number of floating offshore wind supply sub-elements. Japan will need to start developing capability very soon as suitable shallow water sites are of a premium. Mooring, anchors and dynamic engineering and supply are some of the known areas of capacity gap, where Scottish exporters can leverage opportunities via world-renowned capabilities in these sub-elements.

- It may be possible for Scottish supply chain companies to establish a presence within the APAC region in a cheaper country, such as Taiwan, where operations could service the nearby Japanese market. A number of companies use this model (where equipment and personnel and leased / mobilised to Japan) very effectively to improve price and service competitiveness.

Challenging

- Japanese authorities have set a plan of reaching 60% local content by 2040 in order to promote investment and internal capability stimulation; Scottish exporters will need to navigate these aspirations carefully.
- Japan has a very strong indigenous engineering capability. Most major trading houses with heavy industry, trading and banking divisions are gearing up for the impending offshore wind opportunity. Dominating much of the Japanese economy, these large corporations will be critical partners for all Scottish companies looking to enter Japan.
- Although trading links between Scotland and Japan are strong, Japanese companies tend to prefer having local presence (and communicating in Japanese). If Scottish companies see strong business potential in Japan, having a local representative should be a key consideration, especially in the early stages of market entry.

- While political commitment towards offshore wind is strong, the coal lobby in Japan continues to be a formidable force and may seek to impede the development of offshore wind if it is deemed too costly, especially if projects move into deeper waters and floating offshore wind is regarded as economically unsustainable. Scottish exporters need to be able to positively improve the competitiveness of floating wind technology in order to gain traction in-country.

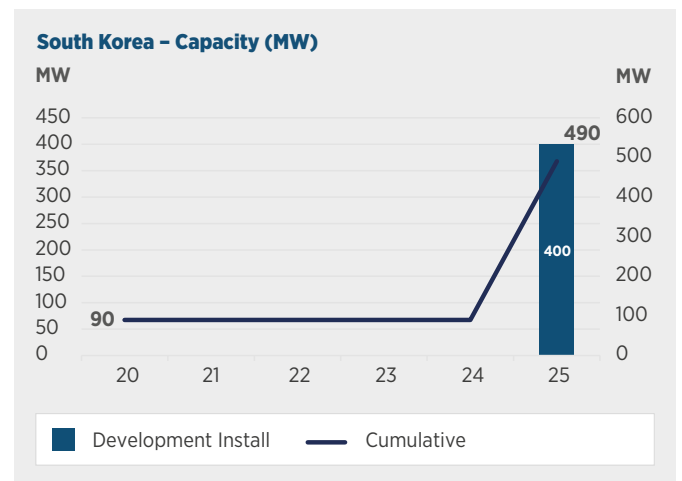
IN-COUNTRY ENGAGEMENT

- The most recent UK-Japan trade deal has limited direct relevance for the offshore wind sector; however, significant in-country resources via the British Embassy and DIT / SDI in Japan are in place to help resolve any market access issues. For example, eight Scottish companies are currently taking part in Scottish Enterprise’s joint funded innovation programme with the Nippon Foundation, which should help them to gain more traction in Japan.
- Scottish exporters seeking to engage in-country should consider approaching the following organisation:
 - **Japanese Wind Power Association (www.jwpa.jp)**
This enabling body is commercially focused and has strong links with SDI.

SOUTH KOREA DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 0.4GW)

DEPLOYMENT AND DEVELOPERS

- South Korea will be one of the first countries to go straight to floating offshore wind; however, given the early commercialisation stage of this technology, extensive deployment pre-2025 seems highly unlikely, despite the suggestions of some industry commentators.
- It has been assumed, for the purposes of this guide, that two projects, totalling 400MW, could be deployed by 2025:
 - **Donghae 1 Floating (200MW):** In a story similar to Hywind II in Scotland, Equinor (in partnership with Korea National Oil) is seeking to deploy the first floating semi-commercial scale project by 2023. Doosan has been selected to supply the turbines (expected to be smaller 8MW assets) and Hyundai has been selected to supply the floating foundations.
 - **Donghae Twin (200MW):** Developed by Shell in partnership with floating foundation OEM Hexicon, the project is reported to be targeting installation by 2024.



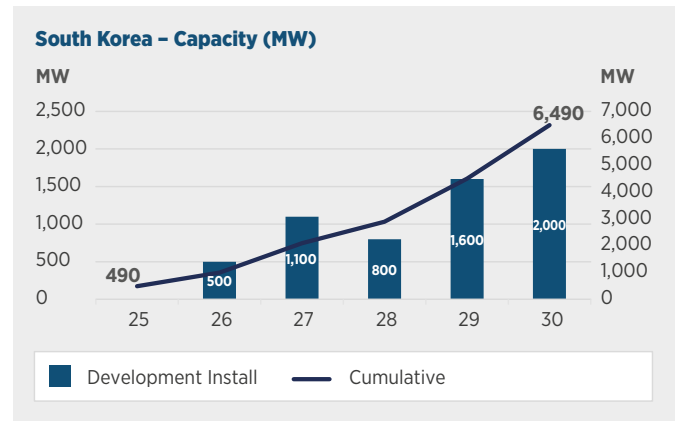
Project	Capacity (MW) Total 400	Developer (Expected lead)	Turbines	Foundations (Forecast)	Project status	Km to shore	Forecast online
Donghae 1 Floating	200	Equinor (33%)	Doosan	Floating	Development	50	2025
Donghae TwinWind Floating	200	CoensHexicon (50%) / Shell (50%)	TBC	Floating	Development	60	2025

PREVALENT CAPEX CONTRACTORS / OEMS

- Given the lack of deployment to date, the emergence of a prevalent OEM supply chain model has not yet happened so only top-level assertions can be drawn at this stage:
 - It is likely there will be a strong national push for the use of domestically produced turbines, nominally via Doosan. Other OEMs are likely to enter the market, providing a floating variant can be offered.
- Given the speciality expertise of floating foundation structures, the main concept companies active in Europe are likely to gain further traction. Domestic OEMs (such as Hyundai) could target foundation manufacturing, but the direction of travel is unclear at this stage.

SOUTH KOREA DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 6.5GW)

- Although the South Korean Government has recently re-committed to their 2018 aspiration to deploy 12GW by 2030, meeting this target will likely prove a challenge. This is because the bulk of the country's capacity is anticipated to be floating and it is unlikely this technology will be commercially viable at scale until the late 2020s. The government announced in 2020 that it planned to deploy at least 6GW of floating wind from 2023, so this has been assumed for the purposes of this guide.
- Industry commentators suggest that 9GW may be achievable by 2030, but this guide assumes that 6.5GW would be more realistic. 7.6GW is probably the true maximum if it assumed that the Orsted 1.6GW project plus the 6GW floating aspiration are added together.
- South Korea has a total project pipeline of 6.1GW so clearly new sites will need to be released for deployment from 2030.

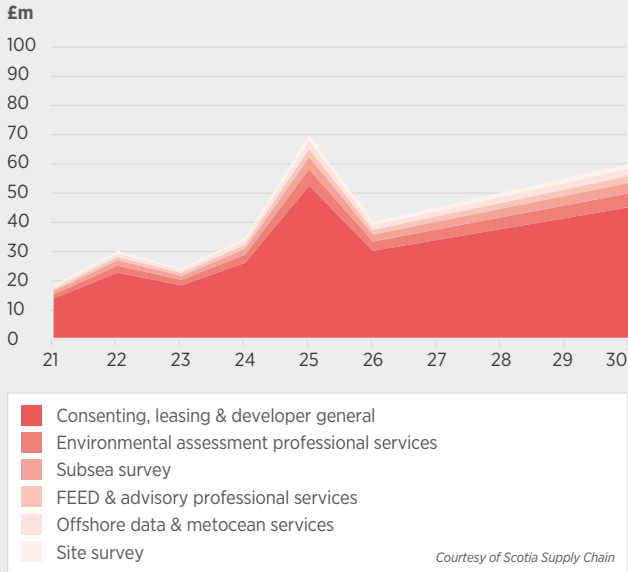


- Other than the Incheon shallow water site, virtually all deployment in the late 2020s is likely to be via floating projects. Developers have intimated that turbines in the range of 7-10MW are likely to be used.

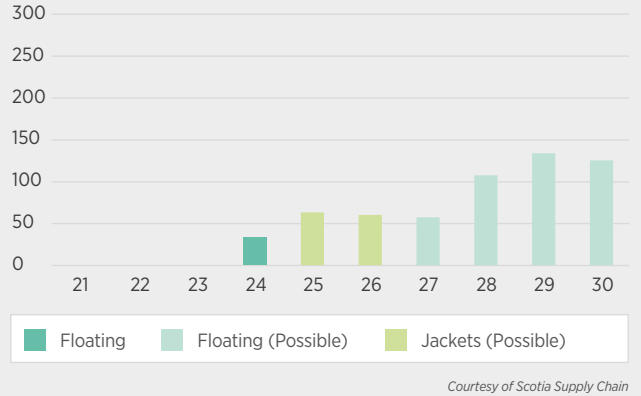
Project	Capacity (MW)	Developer	Turbines	Turbine rating	Turbine OEM	Foundations (forecast)	Status	Fcst Online
Incheon (TBC)	1,600	Orsted	100	TBC	TBC	Likely Jacket	Development	2026/7
South Jeolla Floating	800	GIG / Total	TBC	TBC	TBC	Floating	Development	2028
Ulsan Floating	1,500	GIG / Total	TBC	TBC	TBC	Floating	Development	2029
Ulsan City Floating	500	EDPR / Aker	60	TBC	TBC	Floating	Development	TBC
White Heron Floating	200	CIP / SK E&S	25	TBC	TBC	Floating	Development	TBC
Incheon	600	Korea South-East Power	60	TBC	TBC	Likely Floating	Development	TBC
KOEN Wando Island	600	Korea South-East Power	60	TBC	TBC	Likely Floating	Development	TBC
Jeju Island (Daejeong)	84	KOSPO / Samsung	12	TBC	TBC	Likely Floating	Development	TBC
Saemangeum	99	SOWP	28	TBC	TBC	Likely Floating	Development	TBC
Hanlim	100	KEPCO	TBC	TBC	TBC	Likely Floating	Development	TBC

EXPORT MARKET SIZING

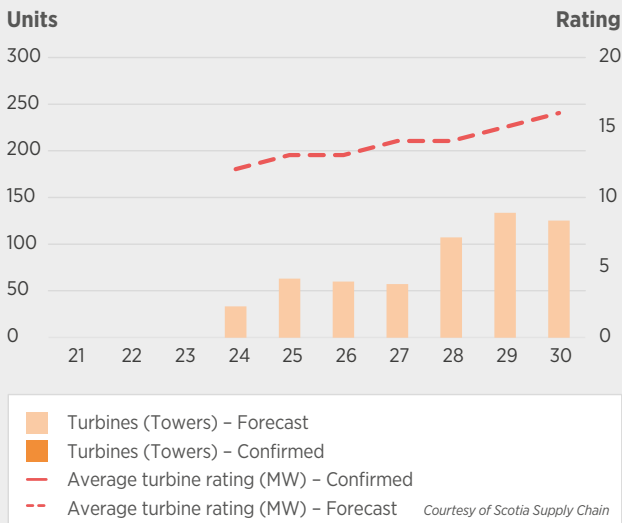
DEVEX – South Korea



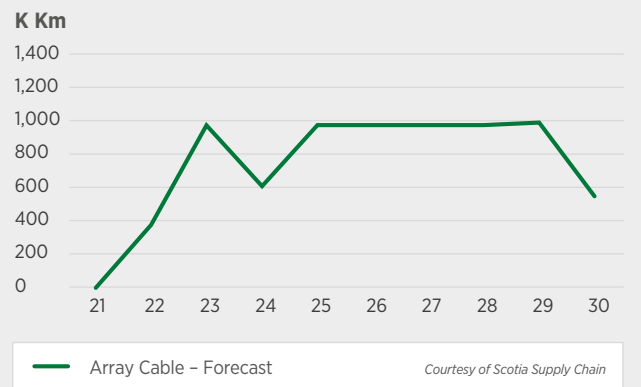
Foundations – South Korea



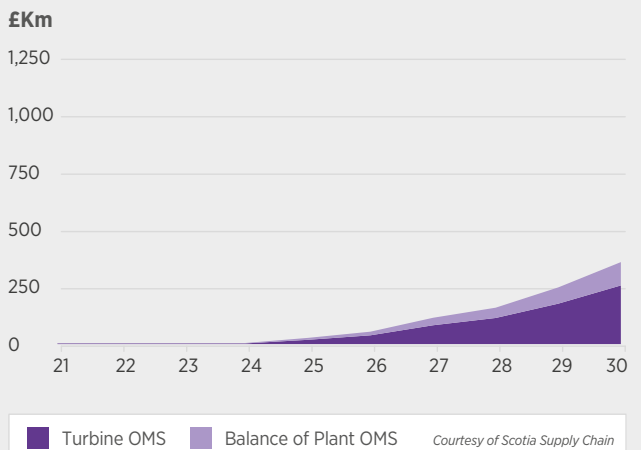
Turbines – South Korea



Array cables – South Korea



Offshore OMS – South Korea



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
South Korea					

PERCEIVED MARKET ATTRACTIVENESS

Opportunistic

- Although South Korea will be a slow-burner in numerical terms to 2025, deployment of floating wind will ramp at pace in the second half of the decade. Government support is strong, but auction and consenting mechanisms are still at an early stage. In-country deployment is likely to be intrinsically linked to the commercialisation / the levelised cost of energy (LCoE) reduction profile of floating wind.
- At this stage, South Korea appears to be an open market for most Scottish expertise as there is limited domestic track record by way of offshore energy development. Renowned Scottish floating wind capabilities are likely to be a strong in-country enabler. This market offers Scottish exporters access to the full supply lifecycle, including early site characterisation development works.

Challenging

- South Korea has a strong domestic equipment manufacturing and shipbuilding industry, which it is seeking to revitalise through offshore wind, having lost order book share to China and Vietnam over the last two years. Scottish CAPEX exporters are likely to face extremely stiff in-country competition.
- Culturally, South Korea has historically been a tough places for overseas companies to do business - a situation that is unlikely to change, despite the fact that South Korea needs Scottish offshore wind expertise. Partnering with local companies or hiring a local representative may be required.

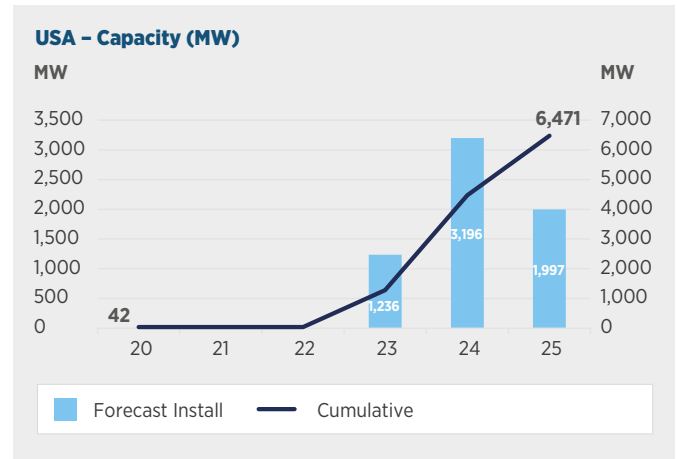
- Scottish exporters should be mindful of local politics, which will likely influence central government decisions regarding the deployment of offshore wind. There is a strong fishing lobby in South Korea (the same is true in Japan and Taiwan) that can exert extensive political pressure. Scottish exporters have a role to play showing how multiple industries can co-exist else project delays may become commonplace.
- The logistical burden surrounding CAPEX supply from Scotland to South Korea may inhibit competitiveness.
- Politically, South Korea is one of the UK's strongest trading partners in the APAC region and was among the first to sign a continuity agreement with the UK following Brexit.
- The Ministry of Foreign Affairs has a Global Energy Cooperation Center that enjoys a strong relationship with the British Embassy in Seoul. To this end, SDI contributed to its latest journal with an article on Scotland's hydrogen strategy. There is a nascent offshore wind community, with European developers still waiting to see how the South Korean government wants to guide them on investing in-country. It is still unclear if there will be a requirement to develop a local-international partnership model (as in the case of Taiwan), or a more hybrid model (as in the case of Japan).

US DEEP-DIVE – SHORT-TERM MARKET (FORECAST – 6.5GW)

DEPLOYMENT AND DEVELOPERS

Although Canada is considering the deployment of offshore wind in the Atlantic Sea, it is unlikely that any deployment of scale will occur before 2030 so has therefore been excluded from this guide. Similarly, deployment on the western seaboard is being discussed, but deployment pre-2030 will likely be minimal (due to its deep-water conditions), so this region has likewise been excluded from the guide.

- In 2020, US policy makers tabled proposals to push for 12.5GW of deployment by 2025; for the purposes of this guide, realisation of 50% of this aspiration has been assumed.
- Managed at a state rather than federal level, numerous auctions have taken place over the last three years up and down the eastern seaboard. It has been assumed that deployment of 6.4GW of the consented projects (with a stated developer intent of deployment by 2025) is likely to be the maximum achievable, given the US currently has less than 100MW installed.
- A number of US projects have specified turbine ratings and manufacturers. Significantly, three projects (Skipjack, Vineyard Wind and Ocean Wind) are proposing to use large GE 12MW designs.
- Foundation selection has not yet been clarified on any project, so broad assumptions can only be made



at this stage. Large swathes of seabed conditions are currently unknown and significant survey works are ongoing / planned.

Project	Capacity (MW) Total 6,428	Developer (Expected lead)	Turbines	Foundations (Forecast)	Location	Project status	Km to shore	Forecast online
Deepwater 1 – South Fork	132	Eversource Energy (50%); Orsted (50%)	15 x 8.6MW TBC	Likely Jacket	Massachusetts	Transmission consented	26	2023
Revolution Wind	304	Eversource Energy (50%); Orsted (50%)	38 x 8MW SGRE	Likely Monopile	Connecticut	PPA consented	31	2023
Vineyard Wind	800	Avangrid (50%) / Copenhagen Infrastructure Partners (50%)	67 x 12MW GE	Likely Monopile	Massachusetts	Transmission consented	25	2023
Empire Wind – Phase 1	816	BP (50%); Equinor (50%)	82 x 10MW TBC	Likely Gravity Based Structure	New York	Consent application made	23	2024
Ocean Wind	1,100	Orsted (100%)	92 x 12MW GE	Likely Monopile	New Jersey	Consent application made	24	2024
Revolution Wind	400	Eversource Energy (50%) / Orsted (50%)	67 x 6MW TBC	Likely Monopile	Rhode Island	PPA consented	24	2024
Sunrise Wind	880	Eversource Energy (50%) / Orsted (50%)	110 x 8MW SGRE	Likely Monopile	New York	PPA consented	48	2024
Mayflower Wind	804	Ocean Winds (50%) / Shell (50%)	TBC	Likely Jacket	Massachusetts	Long term contract approved	105	2025
Park City	804	Avangrid (50%) / Copenhagen Infrastructure Partners (50%)	80 x 10MW TBC	Likely Monopile	Connecticut	Consent application made	37	2025
Marwin	269	US Wind (100%)	TBC	Likely Monopile	Maryland	Consent application made	32	2025
Skipjack	120	Orsted (100%)	10 x 12MW GE	Likely Monopile	Maryland	Awaiting permit	30	2025

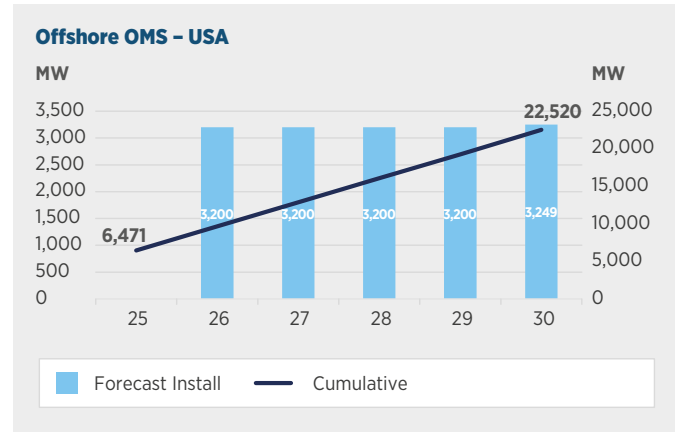
PREVALENT CAPEX CONTRACTORS / OEMS

- Beyond turbines, very little of the main supply chain contracts have been nominated. European tier one contractors are likely to play a significant role in early

projects, but the Jones Act is likely to complicate the use of non-US installation vessels.

USA DEEP-DIVE – MEDIUM-TERM MARKET (FORECAST – 22.5GW)

- Despite announcements in March 2021 that the new US administration is seeking to ‘fast track’ 30GW of deployment by 2030, a 2030 deployment of 22.5GW has been assumed for the purposes of this guide. With state-level offshore wind targets totalling around 23GW by 2035 from Maine to Virginia, this may even be a little on the high side.
- European vessel contractors and OEMs will likely be required to deliver a growth rate of this magnitude. Given the demand from growth markets in Europe and Asia, the US deployment rate is likely to be constrained to around 3GW of deployment per annum towards the end of the decade.
- The US has a development pipeline of around 16GW, of which 6.5GW is likely to be deployed by 2025. This creates a natural pipeline ceiling of 22.5GW. There is currently very little clarity around the expected deployment order of projects in the planning and development cycle.

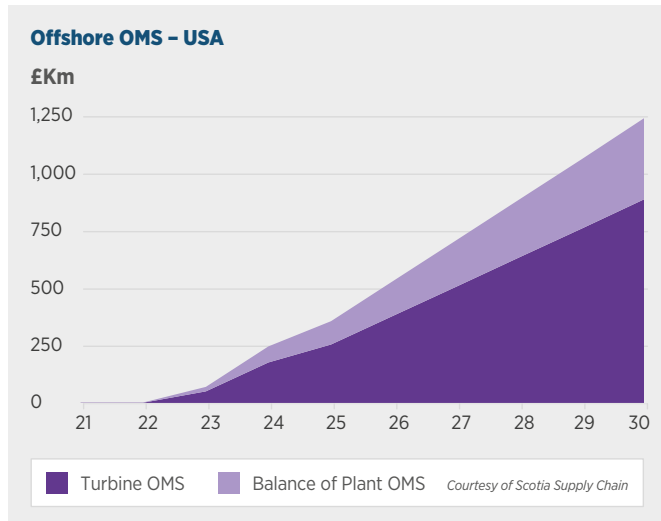
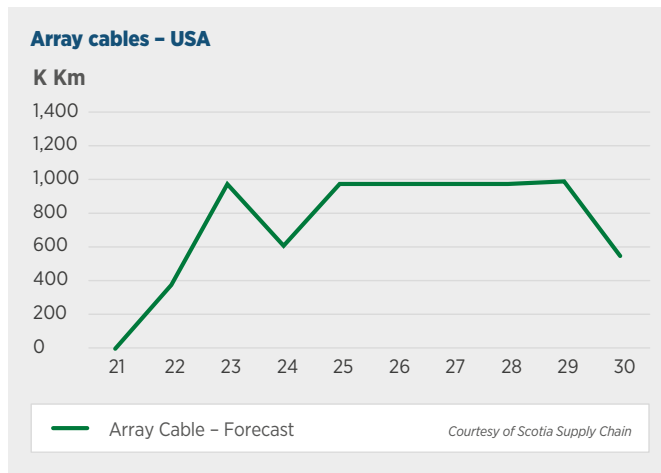
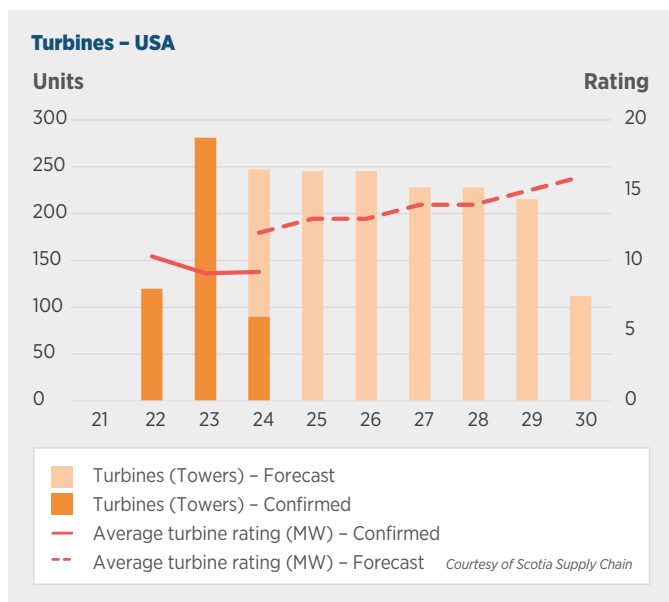
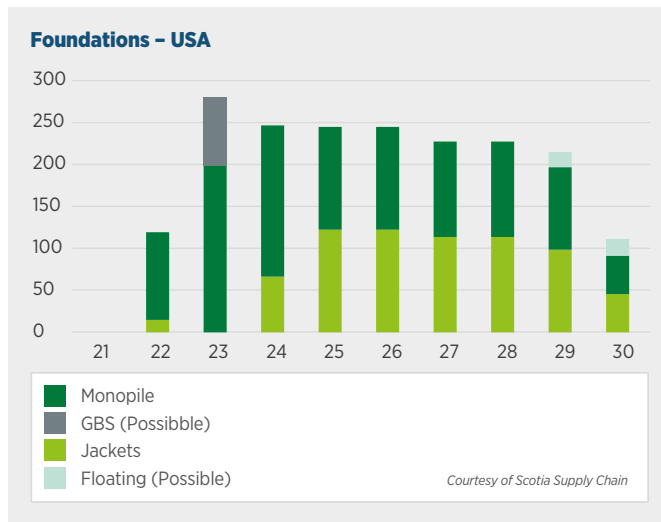
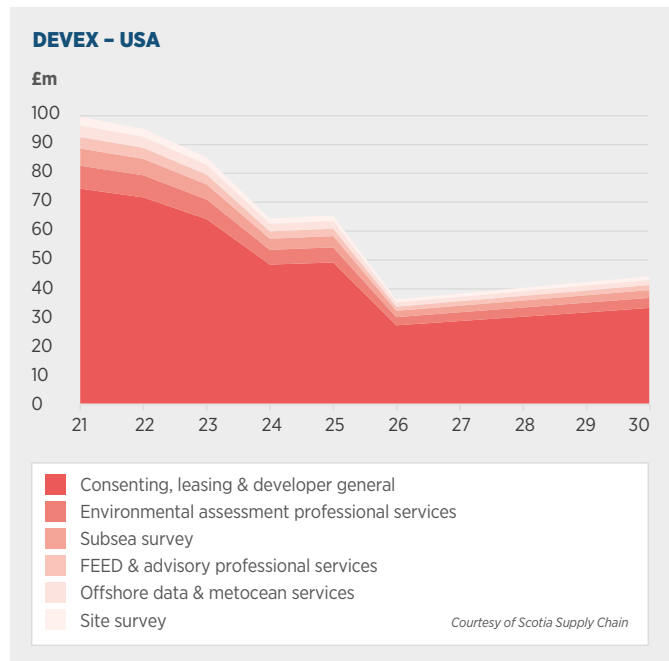


- For the purposes of this guide, a 50:50 split has been assumed between jacket and monopile foundations; this will need to be validated going forward.

Project	Capacity (MW)	Developer	Turbines	Turbine rating	Turbine OEM	Foundations (forecast)	Status	Fcst Online
Virginia Wind - Phase 1	880	Dominion (100%)	63	14	TBC	Likely Monopile or Jacket	In planning	26 - 30
Virginia Wind - Phase 2	880	Dominion (100%)	63	14	TBC	Likely Monopile or Jacket	In planning	26 - 30
Virginia Wind - Phase 3	880	Dominion (100%)	63	14	TBC	Likely Monopile or Jacket	In planning	26 - 30
North Carolina (Kitty Hawk)	1,500	Avangrid (100%)	TBC	TBC	TBC	Likely Monopile or Jacket	In planning	26 - 30
Atlantic Shores	2,500	EDF (50%) / Shell (50%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30
Bay State Wind	2,000	Eversource (50%) / Orsted (50%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30
Beacon Wind	2,400	BP (50%) / Equinor (50%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30
Boardwalk Wind	1,000	Equinor (100%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30
Empire Wind - Phase 2	1,184	BP (50%) / Equinor (50%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30
Garden State	1,000	Orsted (50%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30

Humboldt Floating Wind	150	Ocean Winds (35%) / Principle Power (25%)	18	8	TBC	Floating	Development	26 - 30
Liberty Wind	1,300	Avangrid (50%) / CIP (50%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30
Maryland Wind Zone South	375	US Wind (100%)	TBC	TBC	TBC	Likely Monopile or Jacket	Development	26 - 30

EXPORT MARKET SIZING



IN-COUNTRY SUPPLY CHAIN DYNAMICS

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
USA					

Opportunistic

- Although initial US growth projections may be a little ambitious from a standing start, there is no doubting the huge potential of the US market, which is unquestionably one of the key export market opportunities for Scottish offshore wind exporters. Deployment of 22.5 – 30GW by 2030 puts this market on a par with the top three high potential Asian markets combined.
- Beyond fixed, there is huge floating wind potential into the 2030s as deployment in deeper water east sites increases and the western seaboard starts to deploy. Scottish supply chain capabilities in floating wind technologies are likely to be a strong in-country enabler. Notably, the Scottish Government has signed a number of collaboration agreements for floating wind development in the western states.
- Trading links between the US and Scotland are extremely strong, with no perceived cultural or language barriers anticipated. Given the early stage of US supply chain development, Scottish exporters have a window of opportunity to excerpt some influence in-country by offering solutions from lessons learned in the developed UK market.
- Imports of raw materials and perceived low integrity items will likely be scrutinised in the US to check the availability of local available alternatives; however, a significant amount of project technical and procurement activity will be resourced overseas. Opportunities therefore exist for Scottish companies to support US projects without physically entering the country.

Challenging

- Understandably, the US is keen not to simply import a whole supply chain en masse from Europe and is confident of establishing strong indigenous supply lines for early US wind farms. Although offshore wind is a new industry in the US, the country already boasts a large and very competent onshore wind supply chain.
- The US has a strong domestic OEM and shipbuilding industry that is looking to revitalise through offshore wind. With a high level of unionisation in US ports and legislation such as the Jones Act restricting the activity of non-US vessels, importing offshore wind into the US from Scotland will not be without its challenges. A number of coastal states have already commissioned supply chain surveys to identify strengths and weaknesses at a local state level, therefore, Scottish exporters should be prepared to consider the results of these surveys when developing a US proposition. Early developers are known to be bidding for projects with varying levels of local content commitment.
- With activities very much organised at a state rather than federal level, Scottish exporters may face challenges around duplication of effort. Entering the US via established relationships with European tier one contractors will be one route, but for companies seeking direct entry, picking a state may be a challenge. Many US states are offering attractive enticements and support for perceived offshore wind specialists seeking to set up in the US, so Scottish exporters should validate the different options.
- The logistical cost burden associated with shipments from Scotland may be a challenging factor for Scottish exporters; whilst there will undoubtedly be a market for key Scottish specialisms and the provision of expert services, generic CAPEX supply may be competitively challenging.
- Scotland has established very strong links with the US in offshore engineering, particularly in the oil & gas sector. Whilst this is a valuable linkage, Scottish exporters should be mindful that early offshore wind projects will be deployed in the north / eastern states, where an oil & gas track record does not hold such strong sway as in the southern US and a number of cultural trading differences will likely exist.
- Despite the recent drastic change in direction at a US federal level regarding support for renewable energy, there is always a risk that the cyclical nature of US politics could lead to a boom and bust market evolution. Scotland has learned from experience that mid-term government support is required to build a successful offshore wind sector.

IN-COUNTRY ENGAGEMENT

- Given the early stage of the sector, there are presently no nation-wide offshore wind membership / supply chain organisations in the US. Scottish exporters should seek to engage directly at a state level, many of which are already mapping out the local supply chain and providing good clarity of local project development. There are a number of strong enabling entities of note:
 - **Bureau of Ocean Energy Management (www.boem.gov)**
A federal state organisation responsible for the deployment of offshore wind in federal waters, extremely influential in-country regarding policy, strategy and supply chain development.
 - **Business Network for Offshore Wind (www.offshorewindus.org)**
With a membership of over 1800 companies, a business network that brings together developers, policymakers, academia, global experts and US supply chain companies via facilitated networking.
 - **American Clean Power Organisation (www.cleanpower.org)**
A membership organisation that works with manufacturers, construction companies, developers, utilities, financial firms, and corporate purchasers in the clean energy space.

MEDIUM POTENTIAL MARKET OVERVIEW

(I) EUROPE

NORWAY OVERVIEW TO 2030 (FORECAST – 2 TO 3.5GW)

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Norway					

Norway has only one project in the construction phase - Equinor's 88MW Hywind Tampen floating offshore wind farm. With a development pipeline of several gigawatts, the Norwegian Government is considering putting a

couple of zones out to tender that could be deployed by 2030. Given the geographical proximity and likely floating wind focus, this would be a good prospective market for Scottish exporters.

SWEDEN OVERVIEW TO 2030 (FORECAST – 1 TO 2.5GW)

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Sweden					

Likely to be the largest European new market entrant in the 2020s, Sweden's focus is set to turn from onshore to offshore wind. Developers such as Vattenfall and Cloudberry are actively progressing projects in the early

development phase. Although the Swedish Government has not set an offshore wind deployment target for 2030, it is possible that up to 2.5GW of nearshore Baltic Sea could be commissioned by the end of the decade.

Project	Capacity (MW)	Developer	Turbines	Turbine rating	WTM	Location	Status
Galatea-Galene	1,250	OX2 (100%)	83	15	TBC	Kattegat	In planning
Kattegat Syd	1,200	Vattenfall AB (100%)	TBC	TBC	TBC	Kattegat	Development
Kriegers Flak II (Sweden)	640	Vattenfall AB (100%)	50	13	TBC	Baltic Sea	In planning
Rewind Vänern	100	Cloudberry Clean Energy AS (100%)	16	6	TBC	Vänern Lake	Consented
Södra Midsjöbanken	1,600	RWE (100%)	120	13	TBC	Kattegat	In planning
Stora Middelgrund	864	Vattenfall AB (100%)	108	8	TBC	Kattegat	Consented
Syd kustens Vind	500	Kustvind AB (95%); Magnora ASA (5%)	TBC	TBC	TBC	Baltic Sea	Development

(II) ASIA

CHINA OVERVIEW TO 2030 (FORECAST – 45 TO 55GW)

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
China					

China will surpass the UK as the world’s largest deployer of offshore wind, but the market is very much growing in isolation of the rest of the global sector. Given this fact, China has not been covered in detail in this guide, as Scottish exporters need to approach this market differently to most other global markets.

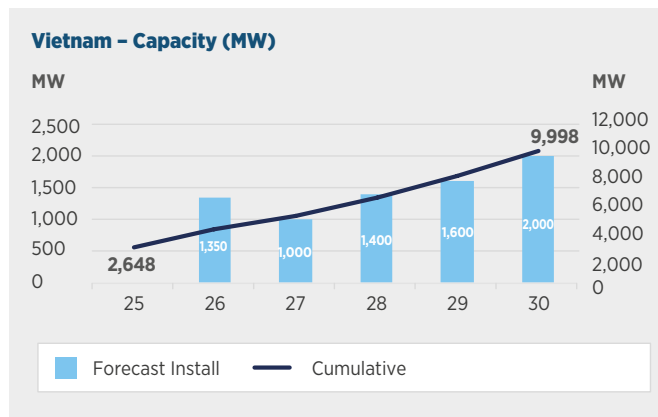
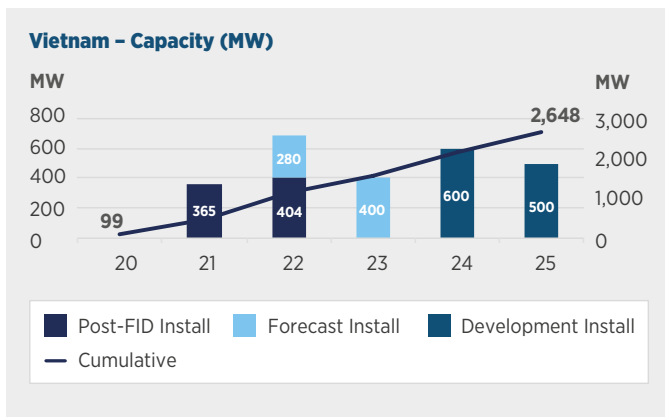
Scottish specialist offshore wind companies are already flourishing within the Chinese market, so it should not be inferred that massive opportunity doesn’t exist. As well as entering via engagement with Chinese entities active in the European sector, Scottish companies interested in the Chinese market are advised to make use of the export resources within DIT and SDI. SDI recently signed an MOU with the Jiangsu Renewable Energy Industry

Association (which represents China’s largest prospective offshore wind region with a focus on floating wind), so is well placed to help Scottish exporters engage in-country, as well as offering support around IP protection and in-country trading.

One of the principle challenges for Scottish exporters is finding secure and profitable routes to market. The UK Offshore Renewable Energy Catapult has developed a joint venture with TUS Holdings that offers landing and incubation support in China, which has already been used by several UK companies as a route into the market.

VIETNAM OVERVIEW TO 2030 (FORECAST – 5 TO 10GW)

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Vietnam					



Although the potential size of the Vietnamese market is extensive and the country has a roadmap to develop 10GW by 2030 (similar to Taiwan and Japan in scale), the Vietnamese supply chain is expected to evolve along the same lines as the Chinese market. Whilst there will be opportunities for specialist Scottish exporters, it is expected to be a difficult market to enter without a pre-established relationship or in-country link. Furthermore, early Vietnamese farms will be very close to shore, intertidal projects, the expertise for which can largely be met by local and Asian players. However, once projects move into deeper waters, more opportunities may emerge for Scottish exporters.

No official governmental target has been set for offshore wind in Vietnam, but industry commentators suggest that deployment could be in the order of 5-10GW by 2030. The market remains in its early stages, with the government still to announce official FiT support and specify the site auction process, so deployment may be lower than anticipated.

There is currently a project pipeline of circa 10GW, but new sites will likely be identified and auctioned before 2030. Beyond turbine OEMs, the table below shows that there is very little commonality between the ways in which offshore wind markets are developing internationally.

Project	Capacity (MW)	Developer	Turbines	Turbine rating	WTM	Status	Fcst Online
Bac Lieu – Phase III	142	Cong Ly (50%); Super Wind (50%)	47	3.3	Goldwind	Under construction	2021
Dong Hai 1 – Phase 1	50	Bac Phuong Joint Stock Company (100%)	13	4.2	Vestas	Under construction	2021
Hoa Binh 1 – Phase 1	50	Phuong Anh Group (100%)	13	4.2	Vestas	Under construction	2021
Tan Thuan	75	Power Engineering Consulting 2 JSC (100%)	15	5	SGRE	Under construction	2021
Tra Vinh	48	Climate Fund Managers (50%); ST International (50%)	12	4.2	Vestas	Under construction	2021
Ben Tre V1-3	29	Ben Tre Renewable Energy Joint Stock (100%)	7	4.2	Vestas	Pre-construction (FID)	2022
Binh Dai 1 – Phase 1	30	Gulf Energy Development (95%); Gia Lai Electricity (5%)	6	5	SGRE	Pre-construction (FID)	2022
Dong Hai 1 – Phase 2	50	Bac Phuong Joint Stock Company (100%)	13	4.2	Vestas	Pre-construction (FID)	2022
Hiep Thanh	78	Climate Fund Managers (37.5%); ST International (37.5%)	18	5	SGRE	Pre-construction (FID)	2022
Hoa Binh 1 – Phase 2	50	Phuong Anh Group (100%)	13	4.2	Vestas	Pre-construction (FID)	2022
Soc Trang 7	29	Soc Trang Energy Joint Stock Company (100%)	7	4.2	Vestas	Pre-construction (FID)	2022
Thai Hoa	90	Pacific Corporation (100%)	18	5	SGRE	Pre-construction (FID)	2022
Tra Vinh V1-3	48	REE Corporation (100%)	12	4	Vestas	Pre-construction (FID)	2022
Binh Dai 1 – Phase 2	49	Gulf Energy Development (95%); Gia Lai Electricity (5%)	10	5	SGRE	Consented	2022

MEDIUM POTENTIAL MARKET OVERVIEW

Binh Dai 1 – Phase 3	231	Gulf Energy Development (95%); Gia Lai Electricity (5%)	46	5	SGRE	Consented	2022
Phu Cuong Soc Trang – Phase 1	400	Mainstream Renewable (50%); Phuong Anh Group (50%)	TBC	TBC	TBC	Consented	2023
Thanglong Wind – Phase 1	600	Energize Energy (100%)	64	9.5	TBC	Development	2024
Ben Tre	500	Advance Info Tech (50%); Mainstream Renewable (50%)	TBC	TBC	TBC	Development	2025
Ca Mau 1 – A	87	China Gezhouba Group Company Limited (100%)	TBC	TBC	TBC	In planning	TBC
Ca Mau 1 – B	87.5	China Gezhouba Group Company Limited (100%)	TBC	TBC	TBC	In planning	TBC
Ca Mau 1 – C	87.5	China Gezhouba Group Company Limited (100%)	TBC	TBC	TBC	In planning	TBC
Ca Mau 1 – D	87.5	China Gezhouba Group Company Limited (100%)	TBC	TBC	TBC	Development	TBC
La Gan	3,500	Asia Petro (33.33%); CIP (33.33%); Novasia Energy (33.33%)	TBC	TBC	TBC	Development	TBC
Phu Cuong Soc Trang – Phase 2	1,000	Mainstream Renewable (50%); Phuong Anh Group (50%)	TBC	TBC	TBC	In planning	TBC
Thanglong Wind – Phase 2	600	Energize Energy (100%)	64	9.5	TBC	Development	TBC
Thanglong Wind – Phase 3	600	Energize Energy (100%)	64	9.5	TBC	Development	TBC
Thanglong Wind – Phase 4	600	Energize Energy (100%)	64	9.5	TBC	Development	TBC
Thanglong Wind – Phase 5	600	Energize Energy (100%)	64	9.5	TBC	Development	TBC
Thanglong Wind – Phase 6	400	Energize Energy (100%)	42	9.5	TBC	Development	TBC

AUSTRALIA OVERVIEW TO 2030 (FORECAST – 1 TO 3GW)

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Australia					

With only two projects of note in the development cycle and no real national aspiration yet announced for offshore wind, Australia is a market that Scottish exporters should keep a watching brief over at this stage.

Project	Capacity (MW)	Developer	Turbines	Turbine rating	WTM	Location	Status
Mid West Wind	1,100	Pilot Energy Limited (100%)	78	14	TBC	Indian Ocean	Development
Star of the South	1,200	CIP (50%); offshore Energy Pty Ltd (50%)	250	TBC	TBC	Bass Strait	Development

(III) AMERICAS

BRAZIL OVERVIEW TO 2030 (FORECAST – 1 TO 3GW)

Weighting	50%	15%	15%	10%	10%
Country	Market scale to 2030	Appetite for importing expertise	Early-stage supply chain development	Low cultural / logistical barriers	Political support / mix change urgency
Brazil					

The offshore wind market in Brazil is at an embryonic stage, with licensing and FiT support mechanisms still to be determined.

There are currently 14 live applications for environmental licences, but developers are still awaiting clarity around the legal framework. Notwithstanding this, the mid to long-term deployment potential in Brazil is considerable, therefore, it is without doubt a key market for Scottish exporters in the 2030s. Brazil has a development cycle pipeline of around 16GW.

Established European developers Equinor and Iberdrola (via Neoenergia) will take a leading role in country; Scottish exporters may be able to leverage opportunities via relationships developed in Europe. Both developers are known to be initiating in-country site characterisation and EIA works. Scottish companies have a very strong Brazilian

presence via the oil & gas sector, with manufacturing taking place in Scotland and product shipped to Brazil, so there is no reason that similar success cannot be replicated within in offshore wind. ABE Eolica is a useful in-country supply chain membership organisation.

The Brazilian Energy Planning Officer (EPE) recently published an offshore wind roadmap for the country, which in addition to highlighting Brazil's 700GW deployment potential (<50m water depth), also identifies early stage supply chain gaps and opportunities.

DIT has excellent connections in-country and are planning to bring a Brazilian delegation to COP26 in Glasgow in November 2021. This may be a good opportunity for prospective early phase DEVEX Scottish suppliers to demonstrate their offshore wind credentials.

Project	Capacity (MW)	Developer	Turbines	Turbine rating	WTM	Status
Aguas Claras	3,000	Neoenergia (100%)	200	15	TBC	Development
Aracatu I	2,000	Equinor (100%)	167	12	TBC	Development
Aracatu II	2,000	Equinor (100%)	167	12	TBC	Development
Camocim	1,200	BI Energia Ltd (100%)	100	12	TBC	Development
Jangada	3,000	Neoenergia (100%)	200	15	TBC	Development
Maravilha	3,000	Neoenergia (100%)	200	15	TBC	Development
Rio Grande do Norte	624	BI Energia Ltd (100%)	52	12	TBC	Development
Vestus Winds I	480	Vestu Winds (100%)	48	10	TBC	Development
Vestus Winds II	480	Vestu Winds (100%)	48	10	TBC	Development
Vestus Winds III	480	Vestu Winds (100%)	48	10	TBC	Development

EMERGING MARKET SUMMARY

A further 7GW of development phase projects exist in emerging offshore markets, including some projects that are likely to be deployed before 2030. However, these markets are largely devoid of a defined offshore wind market strategy, funding mechanisms and/or mandated growth plans.

Region	Country	Project	Capacity (MW)	Developer	Turbines	Turbine rating	WTM	Location	Status
Europe – 5.1GW	Finland (0.5GW)	Tahkoluoto Extension	495	Suomen Hyötytuuli Oy (100%)	45	11	TBC	Baltic Sea	Development
	Estonia / Latvia (2.4GW)	Gulf of Riga	1,000	Enefit Green (100%)	160	6	TBC	Gulf of Riga	In planning
		Saaremaa	1,000	Saare Wind (50%) / Van Oord (50%)	100	10	TBC	Baltic Sea	Development
		Tuuletraal	380	Tuuletraal OÜ (100%)	76	5	TBC	Gulf of Riga	In planning
	Italy (1.1GW)	7Seas Med Floating	250	CIP (100%)	25	10	TBC	Mediterranean Sea	In planning
		Beleolico	30	Belenergia (100%)	10	3	Senvion	Mediterranean Sea	Consented
		Rimini	330	Energia Wind 2020 srl (100%)	51	6.45	TBC	Adriatic Sea	In planning
		Romagna I	120	AGNES (33%) / QINT'X (33%) / Saipem (33%)	15	8	TBC	Adriatic Sea	Development
		Romagna II	330	AGNES (33%) / QINT'X (33%) / Saipem (33%)	41	8	TBC	Adriatic Sea	Development
	Lithuania (0.7GW)	Baltic Sea	700	To be auctioned (in 2023)	TBC	TBC	TBC	Baltic Sea	Development
	Spain (0.5GW)	Cardon Floating Windfarm	50	Greenalia (100%)	4	12.5	TBC	North Atlantic	In planning
		DemosATH	2	RWE (50%); Saitec Offshore (50%)	1	2	TBC	Bay of Biscay	Consented
		Dunas Floating Windfarm	50	Greenalia (100%)	4	12.5	TBC	North Atlantic	In planning
		Gran Canaria Floating Wind	200	Equinor (100%)	TBC	TBC	TBC	Atlantic Ocean	Development
		Guanche Floating Windfarm	50	Greenalia (100%)	4	12.5	TBC	North Atlantic	In planning
		Mojo Floating Windfarm	50	Greenalia (100%)	4	12.5	TBC	South Atlantic	In planning
		Parque Eolico GOFIO Floating	50	Greenalia (100%)	4	12.5	TBC	Atlantic Ocean	In planning
Faroe Isl (0.1GW)	Faroe Islands	120	SEV (100%)	TBC	TBC	TBC	North Sea	Development	

Asia - 1.2GW	India (0.7GW)	Gujarat (Bay of Kutch)	600	Suzlon Energy (100%)	TBC	TBC	TBC	Indian Ocean	Development
		Gujarat Demo	100	To be auctioned	TBC	TBC	TBC	Indian Ocean	Development
	S Arabia (0.5GW)	Plambeck Floating Wind Farm	500	Plambeck Emirates LLC (100%)	TBC	TBC	TBC	Red Sea	Development
Americas - 0.6GW	Canada (0.6GW)	Naikun Offshore Wind Energy	396	Northland Power (100%)	99	4	Siemens	Pacific Ocean	Consented
		St George's Bay	182	Beothuk Energy Inc (50%); CIP (50%)	26	7	Siemens	Gulf of St Lawrence	Development

POSITIONING FOR SUCCESS

Scottish exporters will likely need to take a nuanced approach to each international market, as there is no one-size-fits-all formula for succeeding on the global stage. The supply chain dynamics are likely to vary from country to country, so Scottish exporters will need to be agile, capable of identifying and exploiting opportunities, and capable of mitigating challenges.

THINKING OPPORTUNISTICALLY

- **'Saudi Arabia of Renewables'? The UK is the most developed offshore wind market in the world, with the most advanced auction process, FiT mechanism and road-tested supply chain.**

A number of international markets may replicate elements of the UK system, so Scottish exporters should leverage this experience where possible. Irrespective of market, variations of the UK skills, innovation and competition focus will pervade all markets and subsequent sourcing decisions.

- **Small nation, big ambitions - Scottish offshore wind suppliers are succeeding in every international market, across all phases of the offshore wind lifecycle.**

Prospective Scottish exporters should learn from those that go before us, identify the companies that have succeeded, understanding what makes them special and leveraging their success through mentoring, partnering or replicating their approach.

- **If you've got it, flaunt it – Track record is everything in offshore wind.**

The Scottish supply chain has developed an offshore wind track record surpassed by few. In an offshore wind world where risk aversion in the face of rapid innovation is the norm, Scottish experience is a real differentiator.

- **#SCOTLANDISNOW – Scotland's offshore wind(ow) of opportunity will narrow over time.**

Scottish exporters are uniquely placed to help early international markets develop, drawing on lessons learned in the UK. Markets are moving quickly, so speed is of the essence when seeking first-mover advantage.

NAVIGATING CHALLENGES

- **Making an offer that's too good to refuse – Effective proposition communication.**

With a multitude of early market challenges, international players do not have the time or inclination to shop internationally for all their goods and services. Scottish exporters must articulate their USPs clearly and concisely via the correct in-country industry forums.

- **Its not what you say, its how you say it – Responsibly adding value internationally.**

Like the UK, virtually every market will seek to protect the local supply chain and promote domestic content commitments. Scottish exporters should be sympathetic to such aspirations – complement rather than compete, partner rather than preach, trade experience for market exposure. Being visible and giving a little to the sector in-country is key. Get involved with in-country industry technical challenges, offer opinion at industry events and seek to help with establishing indigenous long-term capability.

- **Spending an extra penny to save pounds – Articulation of lifetime benefit.**

The downward cost pressure throughout the offshore wind supply chain is well documented. In order to mitigate perceived cost and logistic disadvantages, Scottish exporters must articulate cost, quality and/ or delivery of lifetime LCoE reduction benefits or other practical terms.

There are a number of support mechanism in place to help Scottish exporters enter and succeed on the international stage, which are summarised within the Appendix section.

APPENDIX – EXPORT SUPPORT MECHANISMS

SCOTTISH DEVELOPMENT INTERNATIONAL



Scottish Development International (SDI) is Scotland's trade and foreign direct investment agency. It serves as a single point of contact for all international business development needs, working in close partnership with Scotland's local authorities, Business Gateway, Skills Development Scotland, Visit Scotland and the Scottish Funding Council.

SDI is committed to boosting Scotland's exports in sectors and markets that have the highest potential for growth. Exports from Scotland are varied and growing - for example, Scotland's professional, scientific and technical industries boast exports of £3.4 billion. Scottish companies are constantly exploring new markets - Scotland's textiles industry alone exports to over 150 countries.

SDI staff are based in over 50 offices around the world and have in-depth knowledge of local market and the export opportunities for Scottish companies. SDI can support Scottish exporters to:

- Identify market opportunities and provide market intelligence;
- Develop international market strategies;
- Prepare to trade internationally;
- Identify business partners and finance support options;
- Facilitate connections and business relationships.

As the global race toward net-zero emissions intensifies, international customers are increasingly taking advantage of Scotland's well-established expertise in offshore renewable energy projects. Scotland has considerable experience in planning, developing and operating some of the world's most advanced offshore wind farms, including floating offshore wind.

Within Scotland's offshore energy supply chain are specialist businesses at the forefront of developing world leading technologies. They are grounded in decades of subsea expertise and supported by academics and researchers from world-class institutions.

To find out more about how SDI can help your company tap into opportunities in the global offshore wind sector, please contact us at www.sdi.co.uk/about-us/contact-us

UK EXPORT FINANCE



UK Export Finance (UKEF) is the UK Government's export credit agency (ECA). Its mission is to ensure that no viable UK export fails for lack of finance or insurance from the private sector, while operating at no net cost to the taxpayer.

Established in 1919 as the world's first export credit agency, UKEF helps exporters access finance and insurance when there is a lack of private sector risk appetite or capacity. This keeps them exporting, boosts business and protects jobs, especially in economic downturns when access to finance is constrained.

It helps UK companies:

- Win export contracts by providing attractive financing terms to their buyers;
- Fulfil contracts by supporting working capital and trade finance;
- Get paid by insuring against buyer default.

To help the UK build back greener from the pandemic, the UK Government has outlined a Ten Point Plan for a Green Industrial Revolution supporting the UK's offshore wind sector as a key part of its strategy. That's why UKEF is actively seeking out renewable energy projects to support overseas, with £2 billion of direct lending dedicated to financing clean growth. UKEF also offers generous repayment terms to renewable projects to make financing them more attractive. As a result, UKEF has now provided £500 million worth of financing for three offshore wind projects in Taiwan alone since late 2019, helping UK based offshore wind suppliers win contracts overseas.

UKEF also has 26 Export Finance Managers located around the UK and we work closely with local bank representatives, industry bodies and businesses in our geographical areas to ensure the right support is provided where needed. Alistair McMillan is one of UKEF's local representatives in Scotland, and is specifically focused on renewable and clean tech to ensure that UKEF can fully support the Clean Growth Transition and help UK exporters exploit overseas opportunities.

UKEF's export finance specialists are helping UK businesses fulfil green contracts, like PCT group in Glasgow. UKEF helped PCT win a multi-million pound contract to supply cranes used to service wind turbines for an offshore wind farm off the Fife coast – the company's first ever renewable energy contract.

UKEF now has more flexible working capital support for exporters through its Export Development Guarantee and General Export Facility. These facilities can also enable businesses to access the funds they require to deliver on export opportunities in these sectors, allowing UKEF to provide working capital support for your general business needs instead of for a specific export contract.

To find out more please contact us at www.great.gov.uk/contact

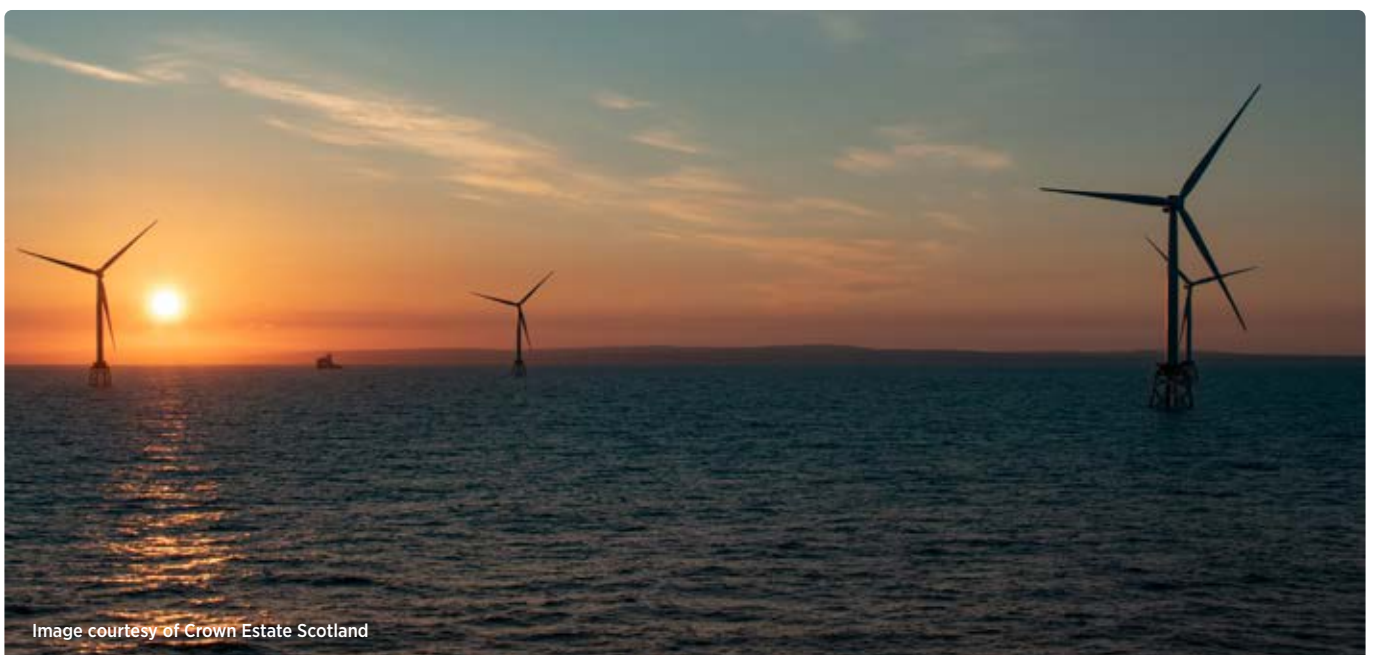


Image courtesy of Crown Estate Scotland

DEEPWIND



The DeepWind supply chain cluster is now the largest offshore wind representative body in Scotland with over 560 members drawn from industry, academia and the public sector. Its main purpose is to help its members achieve greater benefit from the current and future development of offshore wind in the UK and internationally. As the name suggests, it specialises in fixed and floating offshore wind in deeper waters, usually considered to be greater than a 40m depth.

CLUSTER MAP

The DeepWind Cluster covers a geographical area that stretches along the Scottish coastline from Wick in the far north to Montrose in the North East. This geography is based on the offshore wind projects that are currently covered by the DeepWind offshore wind developers who are the core members of the cluster. This includes Ocean Winds, SSE Renewables, Equinor and KOWL (Kincardine Offshore Wind Limited). Due to the introduction of the ScotWind offshore wind leasing round, which opened in 2020, DeepWind's ports and harbour members now extend around the North Coast, Northern Isles, Western Isles and West Coast as far south as Campbeltown in Argyll & Bute and across to Hunterston PARC (Port and Resource Centre) in North Ayrshire. This now encompasses 25 port and harbour members and represents coverage of over 70% of the Scottish coastline.

Membership of the cluster is not limited to any geographical area and therefore covers the whole of Scotland. The cluster has a hub and spoke appearance to reflect the other major supply chain elements - both companies and infrastructure - that are part of the cluster.

CLUSTER MEMBERSHIP

The 31 member strong developer group within the cluster is now the largest of any supply chain cluster in the UK and, besides the above four core members, includes Scottish Power Renewables, Vattenfall, RWE Renewables, Mainstream Renewable Power, Red Rock Power, Simply Blue Energy, Quaybridge, RIDG, wpd Offshore, Univergy International, ESB, Sumitomo Corporation, Total E&P UK, Shell New Energies subsidiary EOLFI, Aker Offshore Wind, EnBW, BP, Flotation Energy, Copenhagen Infrastructure Partners, Orsted, Floating Wind Alliance, Invenergy, EDF Renewables, Cerulean Winds, Blue Float Energy, Falck Renewables, Baywa r.e. and our newest developer member, Fred Olsen Renewables.



Image courtesy of Crown Estate Scotland

FORTH & TAY OFFSHORE



Forth and Tay is ideally-placed to serve the next generation of offshore wind farms in the North Sea and beyond.

OUR MISSION

The Forth & Tay Offshore Cluster's mission is to accelerate and further the growth of the offshore energy sector on the east coast of Scotland through a series of activities designed to support innovation, collaboration, investment in skills, and market awareness amongst relevant businesses.

It will also work to attract inward investment from leading developers and suppliers and to make the Forth and Tay the location of choice for supply chain investments. Forth & Tay Offshore is supported by developers and public organisations including Angus, Dundee, East Lothian, Fife, Perth & Kinross, Scottish Borders Councils, as well as EDF Renewables, SSE Renewables and Red Rock Power, and Scottish Enterprise.

With a world-leading supply chain and coastal infrastructure, Forth & Tay Offshore is geographically positioned to meet full lifecycle needs of the offshore renewables sector.

- Five of the UK's leading offshore developers are based in central Scotland with a global offshore wind pipeline in excess of 25GW in UK, North America, Germany, France, Belgium, Ireland and Portugal.
- Home to key elements of the supply chain, with expertise in offshore wind and large, complex offshore engineering projects.

- A strong knowledge base – across education, training and expert consultancy. An environment where collaboration flourishes – close links between developers, suppliers, enterprise agencies, academia, training institutions and local authorities.
- World-class infrastructure – a diverse range of ports suitable for manufacturing, construction and asset maintenance.
- With more than 3GW of projects in development potentially rising to 6GW+, Forth & Tay is one of the fastest growing offshore deployment regions anywhere in the world.

MEMBERSHIP BENEFITS

- Business development and advice;
- Access to business support;
- Best practice and knowledge sharing;
- Collaboration & partnership forming;
- Skills & training;
- Investment opportunities;
- Access to prospective customers;
- Promotion; and
- Influencing.

