FLOATING OFFSHORE WIND CENTRE OF EXCELLENCE

Delivered by CATAPULT Offshore Renewable Energy

FLOATING OFFSHORE WIND DEVELOPMENT AND CONSENTING PROCESS – RISKS AND OPPORTUNITIES

In partnership with

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NOMENCLATURE

AA	Appropriate Assessment
AEOSI	Adverse Effect On Site Integrity
AIAA	Areas of Intense Aerial Activity
AIS	Automatic Identification System
ASACS	Air Surveillance And Control System
BEIS	Department for Business, Energy and Industrial Strategy
CapEx	Capital Expenditure
CCS	Carbon Capture and Storage
CES	Crown Estate Scotland
CfD	Contract for Difference
CoE	Centre of Excellence
CRM	Collision Risk Modelling
CTV	Crew Transfer Vessels
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EMF	Electro-Magnetic Field
EPS	European Protected Species
ES	Environmental Statement
FEED	Front-End Engineering and Design
FLOWW	Fishing Liaison with Offshore Wind and Wet Group
FOW	Floating Offshore Wind
FPO	Fish Producers Organisation
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVA	Gross Value Added
GW	Gigawatts
HDD	Horizontal Directional Drilling
HIFG	Holderness Fishing Industry Group
HRA	Habitats Regulations Assessment
HVDC	High Voltage Direct Current
ICES	International Council for the Exploration of the Sea
ITPE	ITPEnergised
JIP	Joint Industry Project

JNCC	Joint Nature Conservation Committee
KIS-ORCA	Kingfisher Information Service – Offshore Renewable Cable Awareness
kV	Kilovolt
LCoE	Levelised Cost of Energy
LNG	Liquefied Natural Gas
LPA	Local Planning Authority
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MMO	Marine Management Organisation
MoD	Ministry of Defence
MPA	Marine Protected Area
MPS	Marine Policy Statement
MSP	Marine/Maritime Spatial Planning
MSY	Maximum Sustainable Yield
MS-LOT	Marine Scotland-Licensing Operations Team
MW	Megawatt
NERC	Natural Environment Research Council
NFFO	National Federation of Fishermen's Organisations
NGO	Non-Governmental Organisations
NI	Northern Ireland
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
OFTO	Offshore Transmission Owner
OGA	Oil and Gas Authority
OpEx	Operating Expenditure
ORE	Offshore Renewable Energy
ORJIP	Offshore Renewables Joint Industry Project
OSW	Offshore Wind
OWGP	Offshore Wind Growth Partnership
OWIC	Offshore Wind Industry Council
O&G	Oil and Gas
O&M	Operation and Maintenance
PDZ	Pembrokeshire Demonstration Zone
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PMF	Priority Marine Features

PO	Plan Option
RA	Resource Area
RAF	Royal Air Force
RLG	Regional Locational Guidance
Ro-Ro	Roll-on Roll-off
RSPB	Royal Society for the Protection of Birds
RUV	Remote Underwater Video
R&D	Research and Development
SA	Sustainability Appraisal
SAC	Special Area of Conservation
SCC	Submarine Communication Cable
ScotMER	Scottish Marine Energy Research
SEA	Strategic Environmental Assessment
SEIA	Socio-Economic Impact Assessment
SFF	Scottish Fishermen's Federation
SLG	Sectoral Locational Guidance
SMP	Sectoral Marine Plan
SNH	Scottish Natural Heritage (now NatureScot)
SNMP	Scottish National Marine Plan
SOV	Service Operation Vessels
SPA	Special Protection Areas
SPC	Submarine Power Cable
SRA	Strategic Resource Area
SSEN	Scottish and Southern Electricity Networks
SWFPA	Scottish White Fish Producer's Association
SWMP	South West Inshore and Offshore Marine Plan
TAC	Total Allowable Catch
TCE	The Crown Estate
TLP	Tension Leg Platform
TNUoS	Transmission Network Use of System
TraC-MImAS	Transitional and Coastal waters Morphological Impact Assessment System
T&CP	Town and Country Planning
UNESCO	United Nations Educations, Scientific and Cultural Organisation
UXO	Unexploded Ordnance
WES	Wave Energy Scotland
WFD	Water Framework Directive
WMPP	Wales Marine Planning Portal
WNMP	Welsh National Marine Plan

1 BACKGROUND

1.1 PROJECT OBJECTIVES

This document is a summary of an extended report produced for ORE Catapult by Atkins and ABPmer. The full report covering sector-specific aspects and stakeholder input is available to members of the ORE Catapult's Floating Offshore Wind Centre of Excellence.

The broad objective of the study was the consideration, through detailed review, of the development and consenting processes around the UK for the commercial development of floating offshore wind farms (FOW). This included identifying risks and opportunities to commercial projects in UK waters and making recommendations as to how risks could be mitigated, opportunities realised and key evidence gaps filled.

1.2 CONTEXT

The UK Government and Devolved Administrations have set ambitious climate change and carbon reduction targets to achieve 'Net Zero' by 2050. Offshore wind (OSW) is seen as critical in helping to deliver those targets and enable the switch from fossil fuels across domestic, industrial and transportation energy use. The development of FOW is vital if the UK is to achieve the overall offshore wind growth targets needed to deliver the UK Government's ambition of 40 gigawatts (GW) by 2030[1], contribute to as much as 70GW of floating wind being installed globally by 2040[2] and meet the Committee on Climate Change's recommendation of 100GW or more by 2050[3]. As a result, the number of FOW projects are expected to increase significantly in the UK and around the world over the next 20 years.

To meet the targets, deployment of OSW will have to go beyond its current locations in relatively shallow waters in the North Sea and Irish Sea. Locating FOW in deeper waters, further offshore, brings the potential of accessing waters with more consistent, powerful and predictable wind resources. Despite being perceived by some as being less environmentally constrained, these sites will still have their own challenges. FOW can learn from the fixed bottom OSW sector to understand and deal with potential risks and mitigations but there are notable differences in terms of possible locations, foundation design, construction activities, receptors and sectors that may be affected as a result. The consenting processes for offshore developments and for related land-side infrastructure such as ports, will have to be fit-for-purpose to enable the necessary works in appropriate timescales.

The project was undertaken at a fast-moving time for industry interests, as the initial workstreams from the Offshore Wind Sector Deal, announced in 2019 as a collaboration between industry and government as a catalyst for the long term development of the sector, were being progressed. The Crown Estate's Round 4 leasing process concluded in early 2021 with the announcement that six areas around England and Wales had been selected by competitive tender for new fixed offshore wind projects. Following on from the Round 4 experience, the ScotWind leasing process, overseen by Crown Estate Scotland, had its deadline for applications extended to July 2021 with an increased top option fee per km^2 and an uplifted threshold of supply chain development commitments.

1 https://www.offshorewind.biz/2020/10/06/uk-prime-minister-offshore-wind-to-power-every-home-by-2030/#:~:text=UK%20Prime%20Minister%20Boris%20Johnson,GW%20target%20to%2040%20GW

2 https://protect-eu.mimecast.com/s/PP8xC59LOS0ZYZ7CyAwKQ?domain=carbontrust.com

3 Climate Change Committee, December 2020. Sixth Carbon Budget. https://www.theccc.org.uk/publication/sixth-carbon-budget/

In March 2021, as the Prime Minister announced plans to modify the way offshore wind farms connect to the grid, the Department for Business, Energy and Industrial Strategy (BEIS) announced the imminent launch of the Floating Offshore Wind Demonstration Programme, as part of the Net Zero Innovation Portfolio. This has the intention of providing £20m funding to support the development and demonstration of new FOW technologies such as mooring/anchoring solutions for challenging seabed conditions, dynamic high voltage cables and floater/foundations. Further investment has also been announced for port infrastructure on the east coast of England, associated with the development of next-generation offshore wind installations . The project, therefore, delivers its conclusions into a dynamic market environment with much expected of the sector.

1.3 PROJECT APPROACH

The project drew on the joint experience of the consultant's team, the ORE Catapult staff and a Focus Group of Floating Offshore Wind Centre of Excellence (CoE) partners. A desk-top review was undertaken with work identifying risks in the project lifecycle, i.e. feasibility, consenting and post consenting stages, as well as considering opportunities for activities to support the sector and supply chain growth. A programme of dedicated stakeholder consultation accompanied the research. The outputs provide greater understanding of the development and consenting processes for FOW in the context of the wider OSW sector.

1.4 SCALE AND TIMEFRAMES

The UK government has recently stated that to be considered a FOW project in relation to the Contracts for Difference (CfD) framework process, all turbines within a generating station will need to be floating and situated in offshore water depths of at least 45m[4] in addition to meeting the existing requirements for offshore wind. Fixed bottom OSW technology can utilise depths up to ~60m, so there is a crossover in the areas that can be used by both floating and fixed technology from 45-60m. Providing the seabed is suitable, this depth range is likely to be adopted in the short to medium term by the currently cheaper fixed bottom technology.

The review considered the commercial scale development and potential implementation of FOW in the short and medium terms, i.e. during the 2020s and 2030s (see Table 1). The majority of FOW projects in the medium term are expected to be installed in water depths of 75-150m but, in the longer term and with technological innovation, they may be deployed in depths beyond this range.

It should be noted that the timeframe definitions outlined in Table 1 should not be regarded as definitive industry deployment projections. Rather, these timeframes were developed in order to support stakeholder discussions and provide a consistent framework for the project's outputs.

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/937634/cfd-proposed-amendments-scheme-2020-ar4-government-response.pdf

Timeframe	Years	Scale
Short term	Up to 2030	Small scale projects – full sized turbines with the potential to generate up to 100MW in small arrays/ 'test and demonstration' projects in waters of at least 45m deep. Current examples include Hywind and Kincardine.
Medium term	From c. 2030 onwards	Medium scale arrays up to 100 turbines with generating potential of 12-20MW each[5] in waters of at least 45m deep (majority of projects likely to be in depths of 75-150m).
Long term	Up to 2050	Large scale arrays >100 turbines, with the potential to generate >1GW. Likely to exploit waters >150m deep.

Table 1: Definition of scale and timeframes for commercial FOW developments

1.5 GEOGRAPHIC AREAS

The project identified and reviewed the geographic areas around the UK considered to have the greatest potential for FOW development and most likely to experience growth up to mid-2030s. They were defined as 'high priority' and encompassed waters to the north east and east of Scotland (Scottish High Priority Area) and within the Celtic Sea (known as the South West High Priority Area), along with an additional area for medium priority development in the North Sea. As these were geographically distinct and spread across Welsh, English and Scottish administrations, there was an opportunity to consider differences between consenting regimes and incorporate a range of stakeholder views and experiences from around the UK. Figure 1 shows the areas identified for this project.

The **Scottish High Priority Area (SHPA)** aligns with the North East and East regions, as defined by the Scottish Sectoral Marine Plan for Offshore Wind Energy (SMP) and encompasses the 10 Plan Options (PO) areas designated within these regions. These PO areas, along with others around Scotland, were offered via the 2020/21 ScotWind offshore wind leasing round, which was intended to grant property rights for up to 8,600km^2 seabed in Scottish waters for new commercial scale offshore wind project developments[6]. The SMP states that approximately 2,000km^2 of seabed would need to be leased and operationally developed to deliver up to 10GW of generating capacity, based on an assumption of an average deployment density of 5MW/km^2. Although it is anticipated that over the medium term there may be some refinement of the PO areas, it is likely that the SMP will be the primary guide for future ScotWind leasing rounds for OSW and FOW in the short-to-medium term, possibly in 2023 and beyond.

The **South West High Priority Area (SWHPA)** overlaps with waters encompassed by the Welsh National Marine Plan (WNMP) and Draft South West Inshore and Offshore Marine Plan, both of which recognise the need and opportunity for OSW development, including FOW. The area is derived from the outputs of the ITPEnergised Floating Offshore Wind Constraint Mapping in the Celtic Sea report[7]. Its landward boundary is delineated by the 50m depth contour, as that is currently considered the shallowest depth for the deployment of floating wind semi-submersible substructures (although it should be noted that not all floating wind substructure types can be deployed in waters this shallow)[8].

5 https://www.thecrownestate.co.uk/media/3642/broad-horizons-offshore-wind-key-resource-area-summary-report.pdf
6 Crown Estate Scotland, June 2019. ScotWind leasing launch summary. https://www.crownestatescotland.com/what-we-do/marine/asset/offshore-wind/section/scotwind-leasing
7 https://ore.catapult.org.uk/?orecatapultreports=floating-offshore-wind-constraint-mapping-in-the-celtic-sea
8 https://www.thecrownestate.co.uk/media/3642/broad-horizons-offshore-wind-key-resource-area-summary-report.pdf

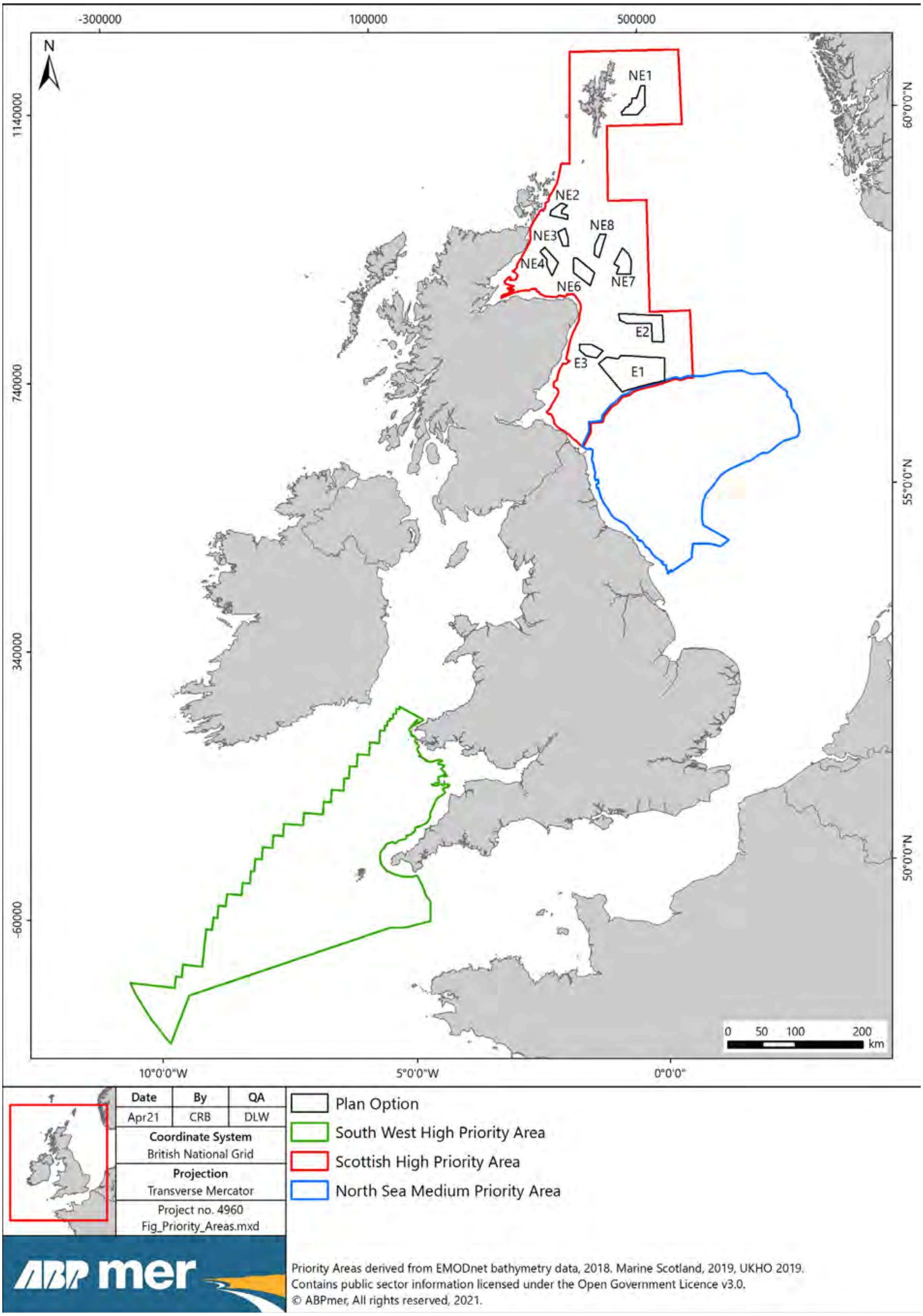

Figure 1: Priority areas for development of FOW

The project also identified the **North Sea Medium Priority Area (NSMPA)**. Work commissioned by TCE[9] and ORE Catapult[10] indicated a large expanse of seabed off the north east coast of England as being suitable for FOW due to depth, seabed geology and wind resource, and attractive to developers in the early 2030s due to a comparatively low Levelised Cost of Energy (LCoE). The boundary of the medium priority area is also delineated by the 50m depth contour with the shore and around Dogger Bank. The Round 4 process resulted in two sites in the Dogger Bank Bidding Area being secured by RWE Renewables and one in the Southern North Sea obtained by Green Investment Group/Total partnership.

In both the NSMPA and the SWHPA, the leasing process driven by TCE is the only mechanism for large-scale project leasing in the region. Any arrangements for FOW will have to be undertaken as part of a future offshore wind leasing round.

The UK administrations' consenting systems for offshore energy developments have similarities in their overall approaches, e.g. the pre-application, determination and post-consenting phases, but also have significant differences in the mechanisms and organisations involved. A summary of each area's different processes is outlined in Table 2 and is also dealt with in Section 2.4.

Further information on the Welsh consenting regime for marine renewable energy projects is included in Appendix 1[11]. A video outlining the Planning Inspectorate's (PINS) process for Nationally Significant Infrastructure Projects (NSIPs), which includes offshore wind farms in English waters and offshore Welsh waters, is available at: **https://infrastructure.planninginspectorate.gov.uk/application-process/the-process/**. The MMO's role, also in conjunction with the Planning Inspectorate, is explained at: **https://www.gov.uk/government/collections/marine-licensing-nationally-significant-infrastructure-projects**.

Figure 2 shows a schematic based on the different elements and broad timescale for Marine Scotland's approach to consenting, which largely illustrates the processes that developers have to work through, from pre-development spatial planning and screening of proposals by regulatory bodies to preferred development areas selected by regulatory bodies and the bidding and award for leased areas for development. It also covers the Environmental Impact Assessment (EIA) process, which can take several years to gather the required data, development of project design, consent applications, consenting considerations (including possible Public Inquiry) and the final investment decision in the post-consenting period leading to construction.

9 https://www.thecrownestate.co.uk/media/3642/broad-horizons-offshore-wind-key-resource-area-summary-report.pdf

10 https://ore.catapult.org.uk/wp-content/uploads/2021/01/FOW-Cost-Reduction-Pathways-to-Subsidy-Free-report-.pdf

11 Additional information on the Welsh regime, including how the scale of developments is addressed by it, is available at: https://www.marineenergywales.co.uk/wp-content/uploads/2020/11/NRW-MEW-meets-conservation-09112020.pdf

Aspect of Process	England	Scotland	Wales
Licensing and enforcement authority	Marine Management Organisation (MMO) responsible for licensing in English waters and in Northern Ireland's offshore waters. Planning Inspectorate responsible for the Development Consent Order (DCO) process for Nationally Significant Infrastructure Projects (NSIPs).	Scottish Ministers responsible for licensing in Scottish territorial waters and, by executive agreement, in Scottish offshore waters. MS-LOT is licensing and enforcement authority.	Welsh Ministers are licensing and enforcement authority in the Welsh Inshore Region. Majority of licensing and environmental permitting functions delegated to Natural Resources Wales. DCO process undertaken for NSIPs in Welsh offshore area.
Seabed ownership and development area leasing process	The Crown Estate awards leases for sites in English waters. Subject to outcome of a plan-led HRA, successful developers granted leases for their chosen sites.	Crown Estate Scotland awards leases in Scottish waters once all key consents and permissions have been obtained from relevant regulatory authorities. Plan-level HRA undertaken for sites made available for development via ScotWind.	The Crown Estate awards leases for sites in Welsh waters. Subject to outcome of a plan-led HRA, successful developers granted leases for their selected sites.
Pre-development spatial planning and screening	A screening and/or scoping opinion can be requested at any time before submission of a planning application.	Applications for renewable energy structures that exceed 10,000 square metres should carry out a public pre-application consultation with 6 weeks' notice of event.	NRW's bespoke pre-application service is open to all users to allow the agreement of requirements in advance of an application.
Environmental Impact Assessment ***Data gathering***	MMO aims to issue screening opinions on need for EIA for Marine Licence applications within 8 weeks of application and scoping opinions on the extent and content (i.e. scope) within 13 weeks. DCO process has its own timescales.	Screening and scoping opinions require 28 day periods of public consultation. The consultation period for the Environmental Report is 42 days and can occur simultaneously with that for the Marine Licence.	Screening and scoping opinions are considered on a case-by-case basis with the option to consult further to inform NRW's opinion. The process is not subject to public consultation. The DCO process for proposed projects in Welsh waters has its own timescales.

Aspect of Process	England	Scotland	Wales
Marine Licence application	Although no statutory timescale for determining marine licence applications, MMO aims for a decision within 13 weeks of receiving all relevant information and fee. DCO process has its own timescales.	MS-LOT aims for 14 weeks from application submission.	No statutory timescales for determining Marine Licence applications for ORE projects, which are considered as 'Band 3' projects, i.e. complex applications, and will be decided on a case-by-case basis. DCO process has its own timescales.
Additional consents that may be required	Wildlife licence, seabed survey licence, SSSI consent, Harbour Works licence from relevant authorities, EPS licence.	Other approvals and consents may be needed from Transport Scotland, Scottish Environmental Protection Agency, Harbour Authorities and NatureScot.	Wildlife licence, seabed survey licence, SSSI consent, Harbour Works licence from relevant authorities.

Table 2: Summary of development and consenting processes for OSW in each of the UK's administrations

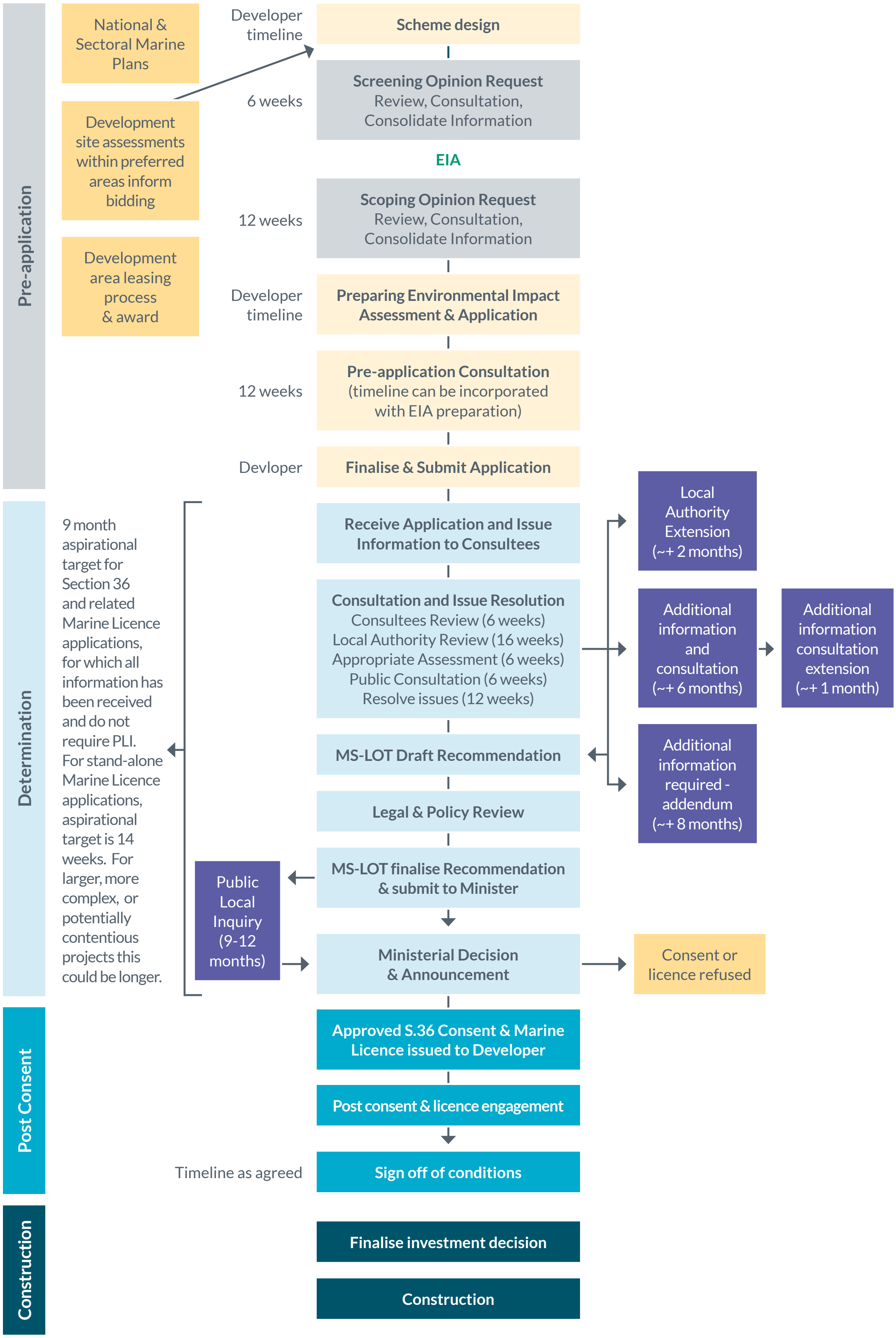

Figure 2: Development and consenting timeline (based on Marine Scotland's Consenting & Licensing Guidance for Offshore Wind, Wave & Tidal Energy Applications, 2018)

1.6 ENVIRONMENTAL RECEPTORS

As part of the leasing and consenting processes for developments in the marine environment, consideration is given to the effects proposed developments might have on features that have been designated as being of European importance for nature conservation. This process is known as a Habitats Regulations Assessment (England and Wales), or a Habitats Regulations Appraisal (Scotland). This project considered those environmental receptors that would be subject to an HRA, i.e. would be addressed in the environmental assessment for an OSW and highlighted where there were particular aspects to those receptors that would be relevant for FOW developments (summary in Table 3).

The result has been the identification of **key issues**, relevant to each of the parameters, which were then used to populate a matrix covering the **potential risks** to advancements in the FOW sector. Understanding the potential risks led to a set of **prioritised recommendations**, aided by stakeholder engagement, suggested to mitigate the risk.

Receptor	Potential Challenges with FOW Development
Aviation, Radar, Military and Telecommunications	• Interference with infrastructure and operations • Whether some FOW foundations, which allow for movement up and down vertically, will impact upon radar in a different ways to fixed foundations (NERC et al, 2016) • Engagement with UK military reported as being challenging as result of lack of resources within relevant departments[12].
Benthic Ecology	• Direct loss of habitats and species • Changes to benthic habitats and species • Micro-siting of anchors and moorings systems may minimise impact on benthos, along with use of novel anchoring technologies with very low surface expression • Underwater noise.
Coastal and Marine Infrastructure and Other Users	• Interference with infrastructure and operations • Displacement • Co-location opportunities • Search and Rescue lanes to be clearly delineated with optimum array spacing to allow traffic movements for SAR purposes.
Commercial Fisheries	• Loss or restricted access to fishing grounds • Displacement of fishing activities • Obstruction of navigation/steaming routes to fishing grounds • Effects on commercial fish and shellfish species • Potential risk of ghost nets becoming attached to mooring lines and underwater cables, causing instability to floating platforms and habitat to trap fish.

12 From 'Environmental and Consenting Barriers to Developing Floating Wind Farms Including Innovative Solutions' – NERC, Carbon Trust, Catapult & Arup, December 2016. See: **https://ore.catapult.org.uk/app/uploads/2018/02/Floating-Wind-Farms-Workshop-Dec-2016.pdf**

Receptor	Potential Challenges with FOW Development
Cultural Heritage and Archaeology (Offshore)	• Direct and indirect damage to the marine archaeological resource (shipwrecks and associated aspects, e.g. graves) • Unexploded Ordnance (UXO).
Fish and Shellfish Ecology	• Underwater noise disturbance • Loss and change to fish foraging, spawning and nursery habitats • Potential for Electro-Magnetic Fields (EMF) to be generated from cables deployed within the water column, between turbines, unlike conventional offshore wind where export cables would be buried.
Landscape and Seascape	• Visual presence on the seascape • Not all FOW sites will be in remote locations offshore – possible visual impact of structures in deep water harbours close to communities.
Marine and Coastal Processes including Metocean, Seabed and Marine Water Quality	• Effects on sediment transport • Effects on particular mobile bedforms • Effects on suspended sediment concentrations.
Marine Mammals and Turtles	• Underwater noise disturbance • Displacement effects • Risk of entanglement in subsea infrastructure, e.g. cables, mooring lines and lost fishing gear.
Ornithology	• Collison risk; lack of night-time information; consequences of a floating moving platform on bird behaviour may vary with different species • Potential benefit if birds use floating foundations for roosting or increased feeding (for EIAs) • Noise and visual disturbance • Displacement effects.
Shipping and Navigation	• Development construction risk, transit risk and new Operations and Maintenance (O&M) traffic routes • Development displacement of shipping routes • Vessel collision/allision • Aids to Navigation placement and agreement • Offshore wind platform mooring/breakaway/recovery • Emergency preparation for FOW structures losing anchors • HM Coastguard search and rescue requirements.

Table 3: Environmental receptors relevant to FOW and scoped into the review process

2 CONTEXT

2.1 MARINE PLANNING POLICY

In the last 10-15 years there has been a significant change in the approaches taken around the UK to the planning and management of offshore resources. Driven by the development of OSW technology and the need to accommodate it in areas already well-used by other activities, marine planning has emerged as a means of facilitating a better understanding of sectors' requirements and, potentially, a way of enabling co-location where possible.

The Scottish and Welsh administrations have had devolved powers to plan and consent some activities in their territorial waters for over a decade. Along with the MMO receiving the same responsibilities for English inshore waters, processes have been developed to reflect the priorities for each of the UK's sea areas. The key pieces of legislation are:

- UK Marine and Coastal Access Act (MCAA), 2009
- Marine (Scotland) Act, 2010
- The Well-Being of Future Generations (Wales) Act (WFGA), 2015
- Wales Act, 2017 (amending Part 4 of the MCAA in relation to Marine Licensing in Welsh waters)
- Planning Act, 2008 (Development Consent Order)[13].

As the prime piece of UK-wide legislation, the UK Marine and Coastal Access Act (MCAA) set the overall framework for new approaches to planning for, and licensing, marine activities as well as setting out the system as it would apply in English waters. Legislation taken forward by the devolved administrations applies to their territorial waters. In Scotland, under an executive agreement with the UK Government, Scottish Ministers are responsible for consenting from the mark of Mean High Water Springs (MHWS) to the 200 nautical mile (nm) limit, although consents for activities in the area between the limit of territorial seas at 12nm and the 200nm limit have to be agreed by the UK Government's Secretary of State for the Environment.

National Marine Plans have been drafted for Scottish and Welsh waters. In Scotland, a Sectoral Marine Plan for Offshore Wind Energy was produced in October 2020, augmenting the National Marine Plan (2015) with specific approaches for the development of OSW in Scottish waters out to 200nm. In June 2021, the Secretary of State approved the four remaining Marine Plans for Inshore and Offshore waters around England, complementing the existing Inshore and Offshore Marine Plans for the East and South areas and providing comprehensive marine planning coverage for English waters.

2.2 ENERGY POLICY AND THE DECARBONISATION AGENDA

The Energy Act 2013 put in place the framework and measures needed to invest in replacements for generating capacity, upgrades to the grid and enable the forecast rising demand for electricity to be met from low carbon sources. It included provision for the Contracts for Difference (CfD) regime, by which long term contracts provide stable and predictable incentives for companies to invest in low-carbon generation, including OSW.

13 As amended for Wales by the Wales Act, 2017.

In June 2019, the UK became the first major economy to commit to a 100% reduction in greenhouse gas emissions (GHG) by 2050; i.e. the 'net-zero' target. The UK Government's subsequent Energy White Paper identifies FOW as being a major element in enabling achievement of this goal. A key commitment in the Energy White Paper is to target 40GW of offshore wind by 2030, including 1GW floating wind[14]. This commitment is reflected in the Devolved Administration's efforts in developing FOW and their own net zero targets.

The Sixth Carbon Budget[15], published in 2020 by the Committee for Climate Change, also puts the expansion of low-carbon energy supplies at the centre of its recommendations. It proposes that UK electricity production is zero carbon by 2035 and offshore wind becomes the backbone of the whole country's energy system. It raises the anticipated 40GW of OSW by 2030 target to 100GW, or more, by 2050. To meet this, offshore wind developments will have to deployed at scale in deeper waters, where FOW technology takes over from fixed. The development of FOW offers the prospect for economic growth in areas of the UK that would not otherwise benefit from the success of fixed offshore wind[16] and the chance to transfer expertise from more established offshore energy sources, e.g. oil and gas, for the benefit of renewable power. With the significant prospects that UK waters provides, both terrestrial and marine plans and policies around the UK are evolving to include commitments on FOW.

2.3 LEASING

Despite the variations across UK administration relating to OSW development, there is a common approach in that applications for seabed leases can only be made to the respective authority when leasing rounds are open. For sites in English, Welsh or Northern Irish waters, the authority is The Crown Estate (TCE); for sites in Scottish waters it is Crown Estate Scotland (CES).

Following identification of a site by a developer, an application for a seabed lease is made through one of the leasing rounds. Once awarded, a lease provides a developer with the rights required from TCE or CES to construct and operate an OSW farm over or on an area of the seabed. A lease will only be awarded once all the key consents and permissions have been obtained from all the relevant regulatory authorities.

However, under the Scottish SMP process, there is a difference in approach that relates to the timing of the plan-level HRA for OSW proposals and how this affects the developer.

Under the Scottish SMP process, marine planning activities have, for the most part, been carried out before the leasing round opens. Thus, developers are able to select/bid for areas being put forward during a ScotWind leasing round with the knowledge that consideration has already been given to resource availability along with transmission, installation, Operations & Maintenance (O&M) and supply chain issues. This approach is perceived to direct developers to where potential wind farms are feasible, rather than just possible.

During 2019-21, the Round 4 leasing process was open for commercial scale OSW sites around England and Wales. The bidding areas extended out to the 60m depth contour, in light of the potential for fixed platform technology to be deployed up to this depth. It is anticipated that future leasing rounds will capture FOW through the leasing of areas of greater depth with suitable resource, such as those identified in targeted studies.

14 UK Government, 2020. Energy White Paper; Powering our Net Zero Future. **https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future**

15 **https://www.theccc.org.uk/publication/sixth-carbon-budget/**

16 Scottish Renewables, 2019. Floating Wind the UK Industry Ambition. **www.scottishrenewables.com**

In Scotland, the PO areas outlined in the SMP were the focus of the ScotWind leasing round, launched by CES in June 2020 and concluded in July 2021. Many of the PO areas exclude fixed platform OSW because of water depth (>60 m) and are, therefore, well suited for FOW. These areas have been refined following plan-level HRA and public consultation, which has been welcomed by stakeholders for the greater certainty it offers developers.

2.4 CONSENTING

Before a wind farm lease is granted and construction can commence, developers are required to obtain all necessary consents in relation to their project. There are four potentially relevant consents – a consent under section 36 Electricity Act 1989; a Development Consent Order (DCO) under the Planning Act 2008; a marine licence under the MCAA and planning permission. The UK consenting process for OSW varies across the UK's administrations and is dependent on the location (offshore/inshore) and the energy generation capacity of the proposal. From pre-application to final determination of the necessary consents, the process is estimated to take from between 3-5 years for commercial wind farms[17].

Consent	Scotland	Wales	England
Development Consent Order	N/A	>350MW	>100MW
S36 consent	>1MW (to 12 nm) >50MW (beyond 12 nm)	1MW – 350MW	1MW – 100MW
Marine licence	Always required	Always required	Always required (can be deemed in DCO)
Planning permission (onshore grid)	Always required (can be deemed in S36 consent)	Always required	N/A (included automatically within DCO)

Table 4: Summary of OSW consents needed for OSW across the UK administrations

A Section 36 consent (under S.36 of the Electricity Act 1989) gives a developer permission to construct and operate an electricity generating station. Whether a Section 36 consent is required depends on the location and generating capacity of the proposal.

The Planning Act 2008 applies to England and Wales. Under it, a DCO is required to develop projects that fall within certain thresholds known as Nationally Significant Infrastructure Projects (NSIPs)

The Planning Act 2008 is applied differently in England and Wales. A DCO can include a number of other consents including planning permission and marine licences. In England, the DCO process deems the marine licence with agreement from the Marine Management Organisation. In Wales, the marine licence must be applied for separately, through Natural Resources Wales. The DCO can also authorise consent for development associated with a NSIP, for example onshore connections. In England, this means that that separate planning permission from the local planning authority (LPA) is not required. In Wales, only some associated development can be included in the DCO and planning permission from the relevant LPA is very often required as well.

17 https://www.thecrownestate.co.uk/media/3378/tce-r4-information-memorandum.pdf

In Scotland, any offshore deployment of FOW devices and/or infrastructure (i.e. beyond 12nm) would require a marine licence under Part 4 of the MCAA. Within the territorial limits, project components of the FOW (i.e. export cable) will require a marine licence under either Part 4 of the Marine (Scotland) Act 2010 in Scottish waters, or under Part 4 of the MCAA 2009 for elsewhere around the UK.

Onshore works will require planning permission. This can be included within a S.36 consent in Scotland, or a DCO in England and Wales as associated development, but otherwise is obtained from the LPA.

2.5 ENGINEERING

A floating structure must provide sufficient buoyancy to support the weight of the turbine infrastructure and to restrain pitch, roll and heave motions within acceptable limits[18]. A project's economic viability will be affected as the costs of constructing, operating and maintaining a floating structure further offshore, along with associated power distribution systems, are balanced against the benefits of higher offshore winds and greater public acceptance due to lower visual impacts.

Floating foundations are moored or anchored to the seabed, rather than being permanently fixed to it. This has implications for other activities seeking to make use of the same sea area, e.g. fishing and shipping, as a FOW turbine's footprint is greater than that of a fixed OSW installation.

Early in the development process, an outline concept of the project will be presented to define the consent envelope and start to inform studies on environmental impacts. Front End Engineering Design (FEED) work will address system design and develop what will be required to inform procurement, contracting and construction. The choice of substructure and system depends on many factors, including the site's water depth, wave environment and geotechnical properties. Different configurations will cater for ranges of technical requirements and the nature of the site conditions. This means there may be risks and challenges from differing wind farm footprints with a range of potential impacts on, and interactions with, environmental receptors and other users of localised sea areas.

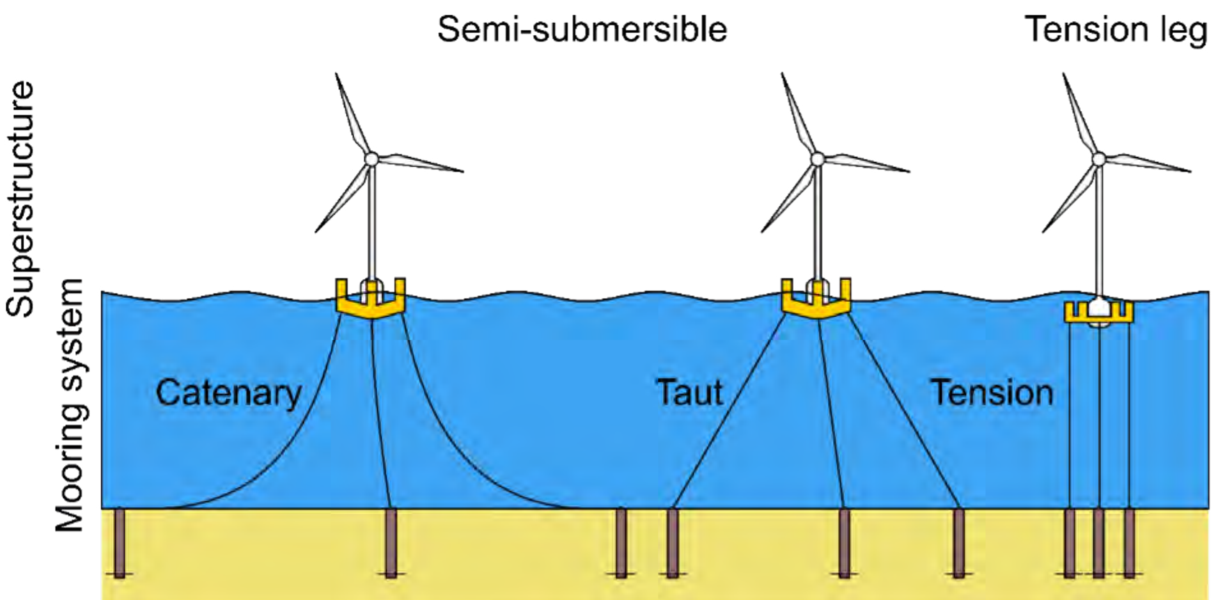

Figure 3: Three different types of mooring used for FOW. Source: Cordis[19]

18 Butterfield et al, NREL conference paper 2005. Engineering Challenges for Floating Offshore Wind Turbines. **https://www.nrel.gov/docs/fy07osti/38776.pdf**

19 **https://cordis.europa.eu/project/id/753156/reporting/es**

2.6 CONSTRUCTION

Construction of FOW structures can take place in different locations depending on the technology involved. Modular steel units that involve the welding of joints are likely to require lay-down onshore areas, before being floated out to site on specialist vessels. Semi-submersible and barge configurations can be fabricated in dry docks or specialist facilities and are relatively easy to install as vessels are only needed for towing. The limited number of port facilities available for the construction, assembly and floating of foundations has been identified as a potential pinch point in the process if the FOW sector grows rapidly and the port infrastructure does not keep pace with requirements.

2.7 CABLES AND GRID CONNECTION

Subsea Power Cables (SPCs) are required for all offshore wind installations. Inter-array cables connect individual wind turbines together and export cables transmit generated power to the grid. In 2018, the UK's operational offshore wind farms used over 1,806km of inter-array cables and 62 export cables totalling a length of 1,499km. The voltage levels of these cables range from 33kV for nearshore wind farms without offshore substations, and up to 132kV, 150kV and 220kV for sites further offshore with one or two substations. Future wind farms that are further offshore and have a higher capacity for generation will require robust cables that are greater in length and higher in voltage.

2.8 SECTORAL INTERACTIONS

The project considered in detail the nature of interactions between FOW and different sectors, both in a generic sense and with particular reference to the geographic areas identified as being of High and Medium Priority for the development of floating offshore wind. This work benefitted from the input given by a range of sectoral representatives as part of the stakeholder engagement work programme. The full report provides substantial detail in relation to the scoped-in sectors and different areas.

20 Hannon et al, Strathclyde University, 2019. **https://strathprints.strath.ac.uk/69501/13/Hannon_etal_2019_Offshore_wind_ready_to_float_global_and_uk_trends_in_the_floating_offshore_wind_market.pdf**

21 ORE Catapult, September 2018. Offshore Wind Subsea Power Cables: Installation, Operation and Market Trends. **https://ore.catapult.org.uk/app/uploads/2018/09/Offshore-Wind-Subsea-Power-Cables-Charlotte-Strang-Moran-and-Othmane-El-Mountassir-AP-0018.pdf**

3 RISKS AND OPPORTUNITIES ASSOCIATED WITH DEVELOPING AND CONSENTING PROCESS

3.1 CONTEXT

This project considered risks and opportunities in relation to the consenting processes for FOW around the UK, which were identified as a result of the review process and stakeholder input. As working definitions of the terms, the following were used:

- **Risks** – events or circumstances that have the potential to prevent or adversely affect an activity or development from going ahead, e.g. not receiving the necessary consents or insufficient grid infrastructure to enable offshore opportunities to be realised.
- **Opportunities** – where a solution may be found for a challenging situation , either through technical or other means; where there is a chance for different sectors or activities to work together to develop and secure matters/approaches of mutual benefit.

The project acknowledges that there are generic issues relating to the broader OSW sector, which are valid for both fixed and floating proposals. While there is a clear cross-over between fixed OSW and FOW sectors, the differences experienced from the physical environment (increased water depth, sites further offshore) and technology (movements of turbines, inter-array cables in water column) mean some of the FOW requirements raise specific challenges.

Importantly, some of the risks faced are at levels that cannot be resolved without significant public investment and support. Grid infrastructure is generally well recognised as a risk across the broader OSW sector, although the degree of challenge may vary at a regional/geographic level.

Other important considerations for FOW development have the potential to be addressed through smaller packages of investment, focused work outputs, engagement with particular stakeholders and, in some instances, the adoption of a different engineering approach. These opportunities are relevant because significant benefits to the sector may be achieved through measures such as directed research, targeted guidance, early stakeholder consultation and choice of technology.

3.2 RISKS TO FOW DEVELOPMENT AND CONSENTING

The UK consenting process for OSW varies across the different administrations and is dependent on the location (offshore/inshore) and the energy generation capacity of the proposal. Although there may be multiple generic risks associated with the processes involved in FOW development and deployment, the more relevant risks for FOW may be those associated with the regime under which consenting takes place for a given area or where different technologies may lead to significant differences in a risk or opportunity. Appendix C in the full project report provides a comprehensive assessment of the risks and opportunities across the lifecycle of a FOW project, encompassing the feasibility, consenting and post-consenting phases and considering geographic specificity and timeframes. Table 5 summarises key points from the focused research and stakeholder engagement, with the beige shaded lines identifying those aspects that are specific to FOW.

Risk	Lifecycle Stage			Topics	Regional variation	Short term	Technology dependent
	F	C	P				
1. No specific provision for FOW in current leasing – to date, TCE leasing rounds have not provided for FOW	Y	Y	N	Process, programme, costs	Y	Y	N
2. Duration of decision-making processes – lack of alignment between the timings of CfD rounds and TCE leasing processes, combined with a consent decision process for offshore wind taking several years, may affect ability for OSW proposals to be constructed in time to meet policy deadlines for achieving UK's Net Zero and decarbonisation ambitions. DCO process timescales are perceived by stakeholders to be clearer than other consenting processes (e.g. S.36, Transport & Works Act or the MS-LOT licensing regime) but mis-match with terrestrial planning regime for supply chain infrastructure, e.g. ports, may hold up development opportunities.	Y	Y	Y	All	N	N	N
3. Insufficient regulatory resource to process applications/for casework – under-resourced regulators can increase timescales for consent decision, particularly with complex applications Relevant skills in a wide range of disciplines such as engineering, environmental, H&S, logistics, management and regulatory aspects are needed to support the growth of FOW and other offshore renewable sectors. In the short and medium terms, some of these demands may be met from other sectors (e.g. O&G) but a longer term focus on, and investment in, skills and training will be needed.	Y	Y	Y	Programme, costs, stakeholder engagement	Y	N	N
4. Uncertainty how FOW can compete for financial support – project pipeline requires market visibility and viability to encourage investment but current commercial pipeline is small.	Y	N	N	Process	N	Y	N
5. Understanding of wind resource in areas further offshore/with greater depth of water – wind resource in remote locations needs to offset additional engineering and infrastructure costs; may determine ultimate project viability.	Y	N	Y	All	N	Y	N

Risk	Lifecycle Stage			Topics	Regional variation	Short term	Technology dependent
	F	C	P				
6. Lack of strategic and spatial planning in all geographic areas – varied marine planning processes across UK nations; competition for sea space indicted the need for greater spatial planning in offshore areas and potential prioritisation of activities, which would involve a substantial evolution in how marine planning is undertaken in all areas around the UK.	Y	Y	Y	All	Y	Y	N
7. Technology requirements for FOW – engineering limitations due to environmental conditions and innovative FOW technology but unproven at fully-developed commercial scale, which may be a funding risk for developers seeking backing and aligns with concerns over wider economic costs for deploying in deeper waters. Risks to future programme, at least in the short term, are more likely to come from FOW technology than the regional locations of installations. Semi-submersible is the most advanced of the technologies. Spar buoys have been deployed (e.g. Hywind) but require specialised heavy lift vessels and deep waters for assembly. TLP is relatively untested for FOW with potentially complex installation. If commercially viable it could reduce some of the consenting risks associated with the extensive mooring requirements of other technologies (e.g. commercial fisheries displacement).	Y	Y	Y	Process, programme, costs, data gaps	N	N	Y
8. Lack of suitable grid infrastructure in coastal areas close to potential sites – prime locations for FOW may be distant from suitable grid connectivity: additional costs and environmental impacts arise from increased cabling to grid connection points. Grid infrastructure and integration is a recognised challenge to future OSW developments[22]. Public investment and government assistance is needed for infrastructure. FOW may benefit from actions to support fixed OSW.	Y	Y	Y	Process, programme, costs	Y	N	N
9. Maintain/reduce transmission costs – large variation in transmission tariffs across UK makes some Scottish OSW/ FOW sites unviable; 5-year view indicates large increases in some regions.	Y	N	Y	Process, costs	Y	N	N

22 https://www.thecrownestate.co.uk/media/3515/offshore-wind-operational-report-2019.pdf

Risk	Lifecycle Stage			Topics	Regional variation	Short term	Technology dependent
	F	C	P				
10. Evolving evidence base, uncertainty, precautionary approach – as an emerging technology there are uncertainties around environmental impacts, which may result in increased costs and time taken for consenting.	Y	Y	Y	All	N	Y	Y
11. Consenting complexity - regional differences, multiple jurisdictions – varied consenting requirements dependent on jurisdiction; projects may straddle multiple jurisdictions with lack of understanding about how transboundary consenting and post-consenting will operate.	Y	Y	N	All	Y	N	N
12. Consenting complexity - project definition, Rochdale envelope – complexity of consenting will increase with size of development causing uncertainties.	Y	Y	Y	All	N	N	Y
13. Timing of HRA/environmental assessment process – difference in leasing process between Scotland and rest of UK. Scotland applies constraints assessments and opportunities analysis, public consultation and stakeholder engagement, plan-level HRA, SEA and SEIA in advance of sites being made available for leasing bids. Sites are where wind farms should be feasible rather than just possible. In England and Wales these matters have not been considered in a similar level of detail, placing greater risk on the developers.	Y	Y	N	All	Y	Y	N
14. Increased difficulty of survey/data collection in locations further offshore – characterisation and monitoring of environmental features is more difficult to achieve in highly exposed, deep water locations, increasing time required to gather suitable data for design/engineering, EIA and other consent/post-consent requirements.	N	Y	Y	All	N	N	N
15. Potential footprint of FOW may cause displacement of established sectors in development areas – mooring and cabling requirements may displace fishing and certain navigation activities; despite mitigating efforts at co-location, sharing of resources may not be achievable leading to conflicts and risking viability of projects. Stakeholder feedback suggests this may require compensation although it is unclear how it would be determined.	Y	Y	Y	All	Y	N	Y

Risk	Lifecycle Stage			Topics	Regional variation	Short term	Technology dependent
	F	C	P				
16. Lack of suitable landside/port and other infrastructure to support commercial delivery – A supply chain capable of meeting the needs of FOW (e.g. manufacture, assembly, installation, O&M etc.) is vital. The UK Government's recent announcement of a Freeport on Teesside, focused on the requirements of the offshore wind energy sector may be a step towards this. Delays in availability of specialised parts/equipment/vessels can significantly impact programmes. There is a need for increased supply to meet the demand to support FOW.	Y	N	Y	Process, programme, costs	Y	N	Y
17. Understanding scale of potential effects, including cumulative, especially for seabirds – impacts on seabird populations (collision, displacement, loss of prey resource) are already a considerable consenting risk for OSW development in certain areas around the UK. While FOW has the capacity to be much further offshore, there are various uncertainties regarding the potential impact on seabirds (e.g. avoidance of floating turbines; displacement from foraging areas etc.) which will lead to added consenting risks.	Y	Y	N	All	Y	N	Y

Key
Lifecycle Stage: F = Feasibility; C = Consenting; P = Post-consenting
Short term = up to 2030
Shaded lines indicate FOW specific issues
All = Process, programme, socio-economic/environmental constraints, data gaps, stakeholder engagement, costs

Table 5: High level risks and opportunities identified across the FOW lifecycle stages

3.3 STAKEHOLDER EXPERIENCE OF DEVELOPMENT AND CONSENTING

When asked to consider the risks associated with future FOW development in the waters around the UK the responses from stakeholders overlapped with many of those previously identified through the review, indicating the same risks were perceived from multiple viewpoints. Relevant risks communicated by stakeholders have been incorporated into Table 5.

Stakeholders also reflected on their experiences of the different UK consenting regimes and offered a number of more general comments on the risks to FOW development over the next 10-20 years:

- HRAs will continue to be an issue for FOW and OSW – birds will remain a concern, especially in relation to cumulative impacts, along with the lack of understanding around the risk of entanglement of marine mammals. The gathering of baseline data for sites much further offshore is likely to be expensive and could be challenging but may offer opportunities for innovative new techniques or equipment to be developed and deployed;
- Securing 'as built' parameters for FOW may be challenging – developers and regulators will have to account for what might happen to the marine environment over time with an installation that moves in its space instead of being fixed, e.g. erosion of seabed as a result of chains anchoring floating wind farms to seabed;
- Hazard from large amounts of biomass fouling on the substructure, e.g. growths on chains and cables – marine licences may have caveats limiting growth on substructure; further marine licences may be needed for the deposition of any detritus in the marine environment, meaning that self-cleaning or remote cleaning technologies may be an opportunity for innovation;
- Resourcing for licensing and consenting in general – there is a perceived lack of human resources for servicing applications in general, which is made worse by the turnover of experienced staff within regulators during the time it takes to secure consents;
- New areas are being opened up for FOW but without sufficient data about all the issues that need to be taken into account – more information will be needed for the marine planning process to function satisfactorily, including the juxtaposition (and prioritisation) of multiple activities wanting to use them;
- Loss of EU funding puts stress on other/replacement sources of investment in new technology, which may impair ability to develop innovative features/techniques for survey, monitoring, construction, and O&M.

Those stakeholders with a pan-UK interest, operating across the multiple jurisdictions, noted that being aware of the differences in approach between them was an additional demand on their resources. Although the consenting processes themselves were largely seen as being fit for purpose, both now and for the future, there was room for improvement. Across all regimes, the feeling was that early planning stages need enhancement to look at constraints, opportunities and needs with other users.

Overall, risks to environmental receptors are acknowledged as being well-covered in the EIA process but it was emphasised that the consenting process itself is not just about environmental information. It was felt that chances to resolve issues between development and other sea users can be overlooked at pre-consent stage and not considered again until post-consenting considerations are reviewed.

The Scottish, English and Welsh consenting systems each had positive and negative points mentioned. Within the NSIP process in England and Wales, progressing the DCO and Marine Licence at the same time is considered to work well for navigation interests and it won plaudits for its incremental and time-focused approach, which facilitates a decision in a fixed time period.

The PINS' Statement of Common Ground was also highlighted as a positive aspect of the DCO system but its benefits may be compromised by a lack of follow-on regulatory processes to address the issues raised. For example, the Statement of Common Ground encourages applicants and stakeholders to consider where there may be areas of alignment of interests but the management of cables, both SPC and SCC, is an issue without a regulatory process for resolving concerns over liability to vessels, fishing nets or the cables themselves. The disjointed nature of the English marine planning system (i.e. multiple Marine Plans instead of a single plan-led approach covering all waters around England) is also a cause of some considerable frustration to stakeholders.

Non-Scottish stakeholders commented that that Marine Scotland's SMP process seemed to be more structured and cohesive than its counterparts in England and Wales, involving sectors at an earlier stage. The biggest difference between the approaches across the UK was that a more comprehensive constraints analysis was carried out under the SMP system, giving a higher level of assurance to developers that the sites eventually selected for leasing are worth having. It was highlighted that the English/Welsh system does not provide that same confidence, so developers may end up over-bidding for sites that subsequently under-deliver when a more comprehensive analysis of constraints and the HRA process is eventually undertaken.

Other concerns were raised about the possibility of developers being confused about the requirements of different consenting systems if FOW proposals straddled separate jurisdictions in due course. Commitment to, and delivery of, clear and efficient engagement between all involved parties early in the process, offering an opportunity for improvement in engagement to bottom-out differences, could be taken on board as an example of an easy win for all participants.

3.4 OPPORTUNITIES FOR FOW DEVELOPMENT AND CONSENTING

The FOW sector has the advantage of learning from the experiences of fixed OSW in aspects related to the feasibility, consenting and post-consenting stages. The more mature fixed OSW sector has already identified some of the generic challenges to future commercial development such as supply chain and grid infrastructure, as outlined above. Opportunities can be realised through the tackling of these challenges and others as they relate to OSW's push into deeper waters, e.g. the development of innovative Remotely Operated Vehicle (ROV) equipment to satisfy requirements of surveying benthic environments further offshore. As these are addressed to facilitate the deployment of more and larger fixed OSW arrays, they will also benefit the emerging FOW sector.

Until suitable technological innovations are available, the installation and O&M requirements for FOW are more likely to be affected by the environmental criteria than those for fixed OSW. In the short term, these will lead to greater risk but, over the medium term, the currently recognised need for such technologies is anticipated to be fully delivered.

Table 5 identifies the risks for FOW and Table 6 considers some of the opportunities that will arise from addressing these risks. It considers opportunities that may be realised in the short term (up to 2030) and identifies the areas of the UK that may provide those opportunities. The points were raised by stakeholders or were identified through the review process.

Opportunity	Lifecycle Stage			Topics	Regional variation	Short term	Technology dependent
	F	C	P				
Unlocking resource/increasing capacity – FOW has potential to unlock additional offshore sites	Y	N	Y	Process, costs	Y	N	N
Regional differences in planning process facilitating development (e.g. Scottish Sectoral Marine Plan)	Y	Y	N	All	Y	Y	N
Sharing grid infrastructure – would provide potential for multiple energy developments if investment and innovation can be secured	Y	N	Y	Process, programme, costs	N	Y	N
Utilisation of existing marine infrastructure and technology from other sectors (e.g. O&G) and fixed OSW – e.g. ports	Y	N	Y	All	Y	Y	N
Utilisation of transferable skills and resource from other sectors (e.g. O&G) and fixed OSW – e.g. offshore maintenance and project management skills in regional areas	Y	Y	Y	All	Y	Y	N
Develop FOW-specific supply chain – taking advantage of crossover from well-developed supply chain for other interests, including R&D opportunities	Y	Y	Y	Process, programme, costs, data gaps	Y	N	Y
Some environmental impacts will reduce in scale and uncertainty relative to fixed OSW – e.g. reduction in visual impacts, minimal piling reducing underwater noise and may be less impact on bird foraging grounds.	Y	Y	Y	All	Y	Y	N

Key
Lifecycle Stage: F = Feasibility; C = Consenting; P = Post-consenting
Short term = up to 2030
All = Process, programme, socio-economic/environmental constraints, data gaps, stakeholder engagement, costs

Table 6: Key opportunities relating to commercial development of FOW

Some of the greatest opportunities are likely to come from the transferable resources and skills provided by fixed OSW and well-established sectors such as oil and gas. In some cases, these will be directly transferable but in others there will be a degree of evolution needed to make elements like HV export cables, inter-array cables and SOVs suitable for deployment in the FOW environment.

Other opportunities will come from addressing impacts on environmental receptors, which are already associated with OSW but which take on a different magnitude and dimension in relation to FOW because of the novel infrastructure involved. The potential effects from underwater noise on marine mammals will be comparatively small, while siting the FOW array far offshore has potential to negate visual impact concerns and even reduce the level of consenting risk in relation to seabird collisions.

The grid connection required for FOW does not differ from that required for fixed OSW and is a constraint for all OSW developers. Under the current system, developers are required to finance and build transmission assets to bring the energy onshore, either choosing to construct the transmission assets themselves (“generator build”) or opting for an Offshore Transmission Owner to do so (“OFTO build”). If developers construct the assets themselves, then the generator must transfer the assets to an OFTO post-construction and installation. OFTOs are selected on a competitive basis through a tender process run by Ofgem. This was originally seen as a way of de-risking offshore wind projects but it means that each developer is effectively looking at their own connection in isolation. As the number of offshore wind farms rises, constructing individual point-to-point connections for each one is inefficient and increases impacts on both the environment and local communities.

Opportunities exist to share grid connection infrastructure between several offshore renewable energy generators. This more strategic approach is, however, difficult to coordinate with multiple developers and timescales and determining an equitable way of sharing the costs of such an approach. Both BEIS[23] and National Grid are actively considering how a more strategic approach could work and how the cost savings and other benefits (e.g. reduced conflict, smaller environmental impact) could be realised. The over-riding predicament for the industry, regulators and government is the uncertainty regarding which solution will become the optimum for each of the elements – structure, mooring, connection, storage. Thus, planning ahead to either provide support or remove obstructions is incredibly challenging.

On the whole, the Welsh and Scottish approaches of having single National Marine Plans were perceived to be more conducive to ultimately accommodating the different marine activities and interests seeking to make use of available resources across inshore and offshore areas. Plan-led processes were considered to be more flexible bringing together developers and statutory bodies early on to see where there might be common ground in approach and, ultimately, in delivering positive outcomes. The Scottish system is not perfect and one who was familiar with it commented that it “could go faster”. However, on the whole, it seems to be viewed favourably by those who operate elsewhere in UK waters. The SMP and the leasing, licensing and consenting processes are perceived as providing an element of ‘joined-up thinking’ that should bode well for future development of OSW, and FOW interests. Streamlining the consenting process and sharing data between developers, where appropriate or possible, may lighten the load for MS-LOT.

23 National Grid ESO, 2020, Offshore Coordination Project, **www.nationalgrideso.com/document/177296/download**

The lack of an overtly spatial approach to marine planning in any of the UK systems was seen as a drawback, as was a lack of ranking of marine activities for certain resources or areas. It was suggested that future iterations of marine plans around the UK would be more useful if they were more spatial in nature, prioritised different activities for certain areas and considered the cases for, and facilitated, co-location between sectors and interests. Greater spatial influence in planning was considered to create much more certainty for both sides on what could and could not take place, along with where it might happen. It was suggested that this approach could include the strategic identification of available resources contributing to the potential of an area for energy generation, along with geographic or spatial considerations of areas and habitats. With the right processes for planning and consenting, this would allow an appropriate scale of opportunity and would facilitate the consenting regimes in managing the environmental impacts and interactions of sites.

The lack of a consent determination timetable in Wales was mentioned as potentially being a risk to the timely construction and deployment of OSW, including FOW, to respond to the climate emergency and Net Zero targets. There was also a call for better alignment on the Welsh statutory bodies' HRA methodologies for ornithology and marine mammals, which would lead to greater certainty for developers. Such feedback is acknowledged by the relevant regulators, who are looking to "sharpen" the Welsh marine consenting process and improve it for opportunities in offshore marine renewable energy. Unless a DCO approach is used, it was noted that Wales lacks the formal, mandatory pre-application process present in Scotland but encourages early engagement with stakeholders to resolve objections, contribute to robust applications, and avoid delays to consenting.

A view was offered that, post-Brexit, the UK Government may face pressure to find a "workable solution" on offshore development and amend or replace the Regulations that implement the requirements of the EU's Habitats Directive over time. Since the devolved administrations have their own implementing regulations, they will also have to amend or replace the relevant legislation. Whilst it was thought that their existing provisions were unlikely to be done away with completely, there may be some flexibility within the existing process to make it work smarter. In turn, this may reduce costs associated with data gathering in environments further offshore.

4 MITIGATION MEASURES TO ADDRESS RISKS AND ENABLE OPPORTUNITIES

4.1 SUGGESTIONS FOR MITIGATION MEASURES

The project considered mitigation measures as part of a comprehensive assessment of risks carried out during a review of the full lifecycle of the FOW process. Table 7 outlines a summary of broad mitigation measures that may address identified generic risks and enable opportunities. The full set of data is available in Appendix C of the main report, published by ORE Catapult.

A high priority can be assigned to those measures which could be applied in the immediate short term, many of which may be achieved with comparatively low cost. Successful application of these measures will assist the FOW sector at the smaller scale, which in turn will facilitate medium and large-scale developments from 2030 onwards, provided that the bigger challenges are addressed alongside.

Some of the low-cost measures would be expected to be primarily regulator led, such as developing guidance aimed at developers and regulatory authorities (e.g. licensing requirements in a given region; which assessment approach to use for specific receptors, etc.).

Initiating short term measures should be a priority. Broadscale site characterisation and constraints mapping activities are relevant to all regions, as are ecological survey programmes. While the Scottish POs have already been identified, additional work at these POs would support project proposals and assessment. Elsewhere, carrying out this evidence gathering work in areas of suitable resource (South West and North Sea) would help support TCE future leasing rounds. In the South West region, a recent report provided high level constraints mapping[24] but did not consider many of the potential constraints in detail (e.g. grid connection, port suitability, ecological constraints etc.). Detailed consultation with interested stakeholders, representing sectors such as shipping and fisheries, is also required to support planning outputs.

High level consideration of the potential effects of FOW on socio-economic and environmental receptors indicated that different FOW technologies may potentially result in different levels of impact on certain receptors. Although the potential impacts would be site specific, the selection of TLP, over semi-submersible or spar technologies, may have a reduced impact on features such as fisheries, shipping and seabirds. Thus, selection of a certain type of FOW technology in the pre-application phase may be considered as embedded or inherent mitigation.

24 https://ore.catapult.org.uk/?orecatapultreports=floating-offshore-wind-constraint-mapping-in-the-celtic-sea

Broad mitigation measure(s) applied	Risk addressed (Table 5)	Priority	Potential lead	Delivery	Cost	Notes
Change in marine planning policy Adopt an more overtly spatial approach to marine planning and/or include an element to reflect prioritisation of marine activities in an area. This could benefit FOW but is likely to result in significant disruption to other maritime activities, e.g. shipping and fishing.	1, 2, 3, 6, 9, 10, 12, 13	High	Government	Short	Medium	Would require significant political leadership to put into effect and a fundamental change in the nature of marine planning across the UK. May not be acceptable to all sea users.
Changes to leasing processes Amend policy for leasing rounds in England & Wales so that FOW is considered alongside OSW or FOW has dedicated leasing round.	1, 2, 3, 12	Medium	Government (England/ Wales)	Short	Medium	A Round 5 for FOW is expected for English & Welsh waters in 2022.
Broad-scale site characterisation Undertaking work to identify potential areas of search, including constraints mapping, before they are released as part of leasing rounds gives greater certainty to developers that sites bid for will be feasible and likely to give a return on investment.	2, 4, 6, 9, 10, 11, 12, 13, 14	High	Government /Private	Short	Medium	Would require significant change in policy and approach within English and Welsh waters. Govt. has been unwilling to pay for this to date. Could stretch available regulatory resource further.
Technology innovation Learning lessons from existing FOW pilots on where current technology could be improved in its deployment and where new approaches could help to better harness wind resource in areas further offshore, potentially reducing costs.	5, 6, 7, 8	High	All	Short/ Medium	Medium /High	Builds the supply chain for FOW, invests in recycling transferable skills from O&G and OSW for benefit of FOW.

Broad mitigation measure(s) applied	Risk addressed (Table 5)	Priority	Potential lead	Delivery	Cost	Notes
Developing/investment in supply chain and infrastructure Consider all elements of FOW supply chain and infrastructure in terms of facility or service provided, geographic proximity and economic investment needed.	7, 14, 15	High	Private/ Government	Short/ Medium	High	Time taken to secure planning permission for improvement to port facilities needs to be accounted for.
Cost standardisation/tariffs Would enable areas of good FOW potential, e.g. north of Scotland, to compete more effectively with generation areas closer to end market users.	7, 8, 14	High	Government	Short	Medium	Existing tariffs are substantially lower in the SWHPA than in Scottish HPA. Work under way to address Transmission Network Use of System (TNUoS) tariff challenges.
Grid connectivity and infrastructure Single biggest limiting factor to taking advantage of opportunities around the UK. Investment in necessary grid connectivity required as driving force to enable all other elements to work.	6, 7, 8, 14	High	Government	Short/ Medium	High	Not restricted to FOW but of benefit to OSW and other ORE projects around UK.
Lessons learnt from fixed OSW and other sectors Build on existing data sets, evidence of innovative technology, areas for collaboration between OSW and FOW interests relating to methods of construction, O&M, assessment techniques, etc.	9, 10, 11, 12, 15	High	All	Immediate	Low	Quick wins available with communication and collaboration across sectors, including O&G subject to commercial considerations.

Broad mitigation measure(s) applied	Risk addressed (Table 5)	Priority	Potential lead	Delivery	Cost	Notes
Focused research – understand impacts Opportunities to work with universities and other research institutes to broaden knowledge base still further in relation to FOW.	9, 12, 14, 15	High	All	Immediate	Low/ Medium	Creates a virtuous cycle of learning-through-doing and invests in FOW supply chain.
Focused research – testing technologies Innovative technology will be developed to overcome challenges of offshore environments; testing ideas in real-world scenarios as projects are developed and refining results.	5, 9, 11, 15	High	Private/ Developer	Immediate	Medium	Builds an indigenous R&D supply chain with opportunities to deploy results in UK waters and export globally.
Adaptive management/ monitoring Use 'learning by doing and adapting as you learn' approach to secure best available scientific evidence from focused monitoring at site and from expert groups. Maintain existing initiatives such as FLOWW, NOREL (navigation), ScotMER fisheries and ornithology groups, and post-consenting advisory groups in Forth, Tay and Moray Firth. Set up FOW Technical Working Group with Welsh Government to mirror successful initiative for wave and tidal energy.	9, 11, 12, 14, 15	Medium /High	Developer/ Regulator	Immediate	Low	Use all stages of project lifecycle to plan strategically, consider cumulative impacts and learn from experiences. Adapt examples that work for different regions.
Development of guidance and outreach Capture the evidence and experience from mature consenting processes to educate those involved with it, either as a developer or member of a regulator's consenting team.	9, 10, 11, 12, 14, 15	High	Regulator	Immediate	Low	Create or update information that makes the FOW sector's case for regulators and stakeholders.

Broad mitigation measure(s) applied	Risk addressed (Table 5)	Priority	Potential lead	Delivery	Cost	Notes
Effective consultation Identify areas for collaboration and build on existing communication between industry, regulators and other marine sectors, e.g. for lighting requirements on FOW rigs when towed to/from location and when in situ.	13, 15	High	Regulator	Immediate	Low	Regulators and other marine sector interests noted that it is never too early for developers to start communication on proposals. Use examples of good practice between areas.

Key
Numbers in *Risk Addressed* column correspond to those identified in Table 5.
All = Government, Private, Regulator and Developer
The level of *priority* for delivering a specific measure was assigned as low, medium or high depending on the perceived benefit that addressing the challenge may have on the growth of the FOW sector.
It is assumed that all measures would ideally be delivered, wholly or in part, during the short term (up to 2030). However, recognising that some measures may not be fully implemented within that timeframe, an indication of broad differences in their delivery timescale is given. The minimal cost of delivering the mitigation is broadly divided into low (<£100 k), medium (£100 k – 1 m) and high (> £1 m).

Table 7: Suggestions for mitigation measures

5 CONCLUSIONS

5.1 REFLECTIONS FROM THE PROJECT

This project has identified risks, challenges and opportunities for the FOW sector from a review of current information and as a result of significant stakeholder engagement. These elements were considered across all stages of the project lifecycle, acknowledging regional differences and with consideration of the commercial scale of potential developments.

Administrations across the UK have set ambitious targets for offshore wind deployment by 2030 and 2050. The successful delivery of those targets relies on a development and consenting process that enables offshore infrastructure, including FOW, to play its part.

Small scale FOW arrays currently operate in Scotland with several proposals for offshore FOW arrays in Welsh waters. However, **to meet the UK Government's ambition to deliver 1GW of FOW by 2030, along with other targets set by devolved administrations, growth of this sector requires stimulation** especially with much of the current attention at a commercial level focused on fixed OSW.

To increase the rate and scale of FOW deployments, it is recognised that confidence in the market and, therefore, a visible FOW project pipeline is needed. It is likely that in the short term (up to 2030), big challenges specific to FOW (e.g. supply chain) may not be addressed sufficiently to provide 'scaling-up' from small scale arrays unless focus is first given to addressing those challenges which could be tackled now or in the very near future. **The requirements of FOW are such that specific innovation and investment are required for this sector's growth. It is not enough to expect that fixed OSW will provide all the necessary resource, skills and experience**.

There is a dichotomy at the heart of marine planning in the UK: by devolving responsibility for planning in the territorial waters of Scotland and Wales to address political requirements, the UK Government set in train a series of events that led to the current different approaches for consenting. The marine planning and consenting processes that have been developed across the UK in the last decade already recognise FOW as an important element for the future but **the timescales for the sector's development are out of alignment**. The Round 4 leasing process for England and Wales did not include FOW, so a Round 5 will be needed to cater for the future sector's involvement. The ScotWind process, by comparison, has enabled FOW to be considered alongside fixed OSW installations and via a process where strategic environmental assessments and significant stakeholder engagement have already been undertaken. This offers developers a greater level of certainty that the sites they pursue for leases will be feasible for offshore wind development both in terms of available resource and effects on other material interests.

The FOW sector seems to be well aware of the requirements of the regimes for the areas in which they wish to develop and are content to work with The Crown Estate and Crown Estate Scotland, along with the Marine Management Organisation, Marine Scotland's Licensing Operations Team and Natural Resources Wales, to progress and secure the necessary consents and licences. From the stakeholder engagement undertaken there were **no overt calls to substantially reconfigure the marine planning and licensing systems that are in place in the UK** but it is identified as an issue for further consideration. If elements of the Scottish example were introduced elsewhere, e.g. the undertaking of plan-level HRAs for prospective sites for leasing, the development of the FOW sector around the UK may be facilitated.

There also seems to be little appetite to back the recent calls from a policy think-tank to create a new UK Sea Authority[25] with responsibility for creating marine plans across entire sea basins, particularly the North Sea, and to coordinate development across the UK's offshore zone. However, this may change if the idea gains traction at the UK Government level.

Suggestions that did relate to the offshore regimes included **that marine planning may have to prioritise activities in certain areas**, instead of continuing to try and accommodate all uses as at present. **A greater degree of *spatial* planning was suggested as being necessary if the targets for offshore wind are to be met**. This requirement was even acknowledged by representatives of those activities that may expect to be displaced, such as shipping and fishing.

From a practical perspective, there were pleas for **all consenting regimes to be better resourced so that there was consistency in personnel throughout the lifespan of an application process and, in Scotland, a clearer idea of the timing of milestones along the lines of the DCO process**. If there were to be wholesale change in licensing regimes for the whole of the UK, the impression from stakeholders is that a system that combines the best elements of the Scottish and DCO approaches, would be acceptable.

Existing opportunities for the sector are currently considered to be greatest in Scottish waters, in the Scottish HPA, where POs within the SMP have acknowledged the potential for FOW to take advantage of the excellent offshore wind resource and some of the supply chain requirements that are already in place. **There are also opportunities for FOW in the South West High Priority Area.** All of these opportunities will need to be exploited if the UK is to meet its 'Net Zero' target by 2050. In so doing, the sector will also support wider economic and social development, which meets additional government targets for the post-COVID agenda.

25 The Policy Exchange, 2020. The Future of the North Sea: Maximising the contribution of the North Sea to Net Zero and Levelling Up. **https://policyexchange.org.uk/wp-content/uploads/Future-of-the-North-Sea.pdf**

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APPENDIX WELSH GOVERNMENT INFOGRAPHICS

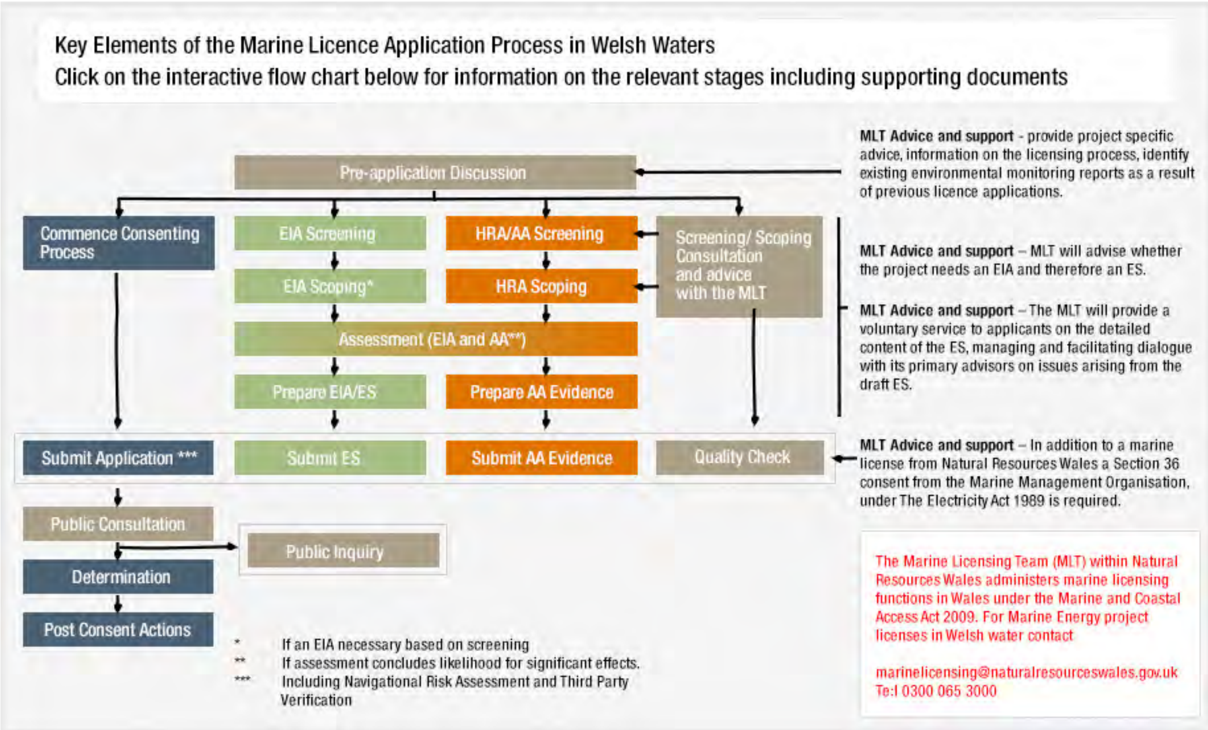

Figure A-1: Key Elements of the Welsh Marine Licence Application process. Source: Marine Energy Wales

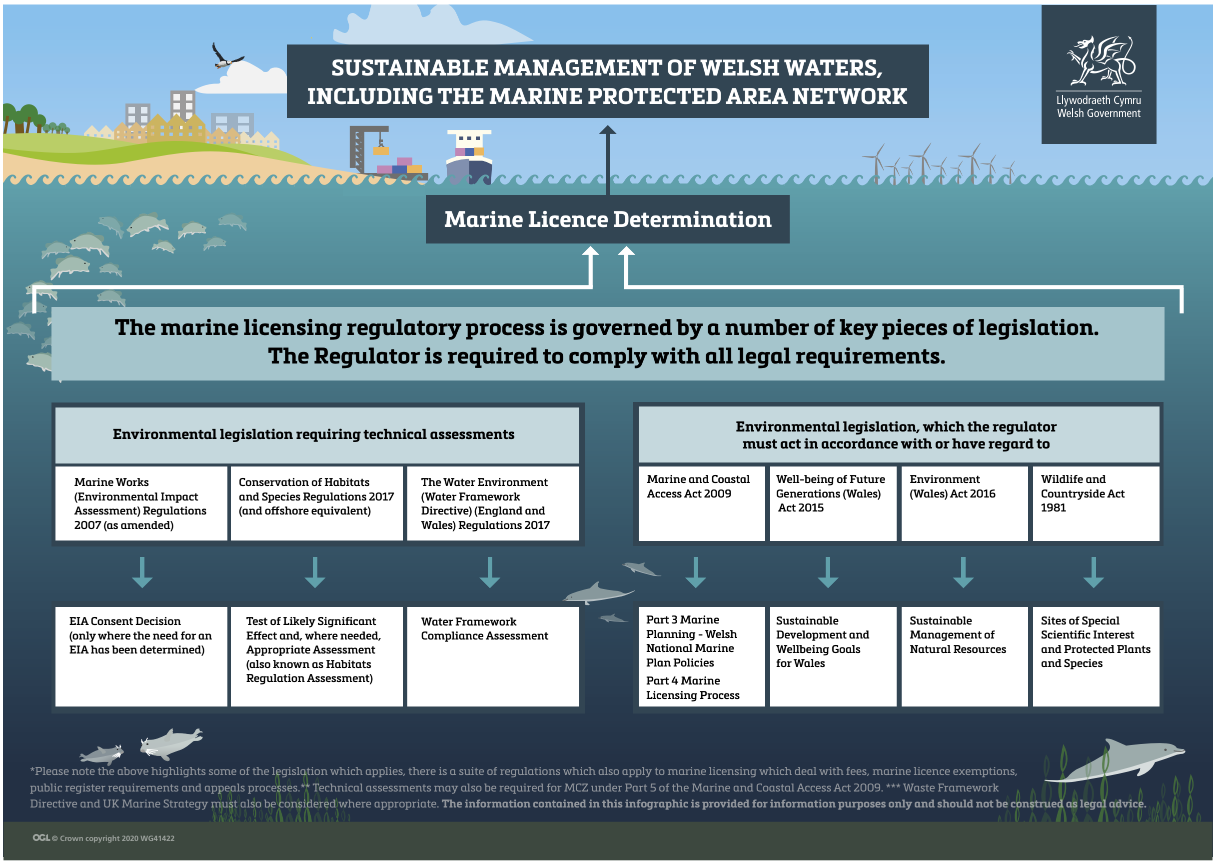

Figure A-2: Welsh marine licensing regulatory process. Source: Welsh Government, October 2020

OVERVIEW OF MARINE RENEWABLE ENERGY CONSENTING IN WELSH WATERS

Llywodraeth Cymru
Welsh Government

Primary consents for an energy project between 1MW - 350MW in Welsh waters (inshore or offshore)

Consent	Jurisdiction	Licensing / Consenting Authority	Discharging Authority Marine Works (post decision)	Enforcement Authority (Wales only)
Marine Licence (Pt4 of Marine and Coastal Access Act 2009) (as amended by the Wales Act 2017)	Welsh Waters	Natural Resources Wales	Natural Resources Wales	Welsh Ministers
Section 36 Energy Consent under the Electricity Act	Welsh Waters	Welsh Ministers, following recommendation by Planning Inspector	Welsh Ministers	The Crown (summary conviction)

Primary consents for an energy project above 350MW wholly within Welsh inshore or offshore waters

Consent	Jurisdiction	Licensing / Consenting Authority	Discharging Authority Marine Works (post decision)	Enforcement Authority (Wales only)
Development Consent Order (Planning Act 2008) (as amended by Wales Act 2017)	Welsh Waters	Secretary of State, following a recommendation from the National Infrastructure Planning Inspector	Natural Resources Wales (Welsh waters), Secretary of State, Local Planning Authority (whoever is specified to discharge the specific provisions in the Order)	The Crown (summary conviction or on conviction on indictment), or whoever is specified in the provisions of the Order
Marine Licence (Pt 4 of Marine and Coastal Access Act 2009) (as amended by the Wales Act 2017)	Welsh Offshore	Secretary of State, following a recommendation from the National Infrastructure Planning Inspector may 'deem' a marine licence if the project infrastructure is wholly within offshore waters, or Natural Resources Wales, if developers choose not to include a 'deemed' marine licence as part of the DCO process	Natural Resources Wales (Welsh waters)	Welsh Ministers (Welsh waters)
	Welsh Inshore	Natural Resources Wales		

Primary consents for an energy project above 350MW straddling Welsh/English waters

Consent	Jurisdiction	Licensing / Consenting Authority	Discharging Authority Marine Works (post decision)	Enforcement Authority (Wales only)
Development Consent Order (Planning Act 2008) (as amended by Wales Act 2017)	Welsh and English waters	Secretary of State, following a recommendation from the National Infrastructure Planning Inspector	Natural Resources Wales (Welsh waters only), Marine Management Organisation (English waters only), Secretary of State, Local Planning Authority (whoever is specified to discharge the specific provisions in the Order)	The Crown (summary conviction or on conviction on indictment) or, whoever is specified in the provisions of the Order
Marine Licence (Pt 4 of Marine and Coastal Access Act 2009) (as amended by the Wales Act 2017)	Welsh Waters	Natural Resources Wales (marine licence cannot be 'deemed')	Natural Resources Wales	Welsh Ministers
	English Waters	Marine Management Organisation or the Secretary of State, following a recommendation from the National Infrastructure Planning Inspector (if marine licence is 'deemed')	Marine Management Organisation	Marine Management Organisation

Figure A-3: Welsh marine renewable energy consenting process. Source: Welsh Government, October 2020

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