



Celtic Sea Floating Offshore Wind

An Industrial Response to Supply Chain Opportunity

Workshop Outputs from 6th July 2020



HM Government



European Union
European Regional
Development Fund

The Context – Floating Wind Industry Background

There is significant opportunity for floating offshore wind in UK waters, including the Celtic Sea covering waters around Wales and the South West of England. However, the pilot floating offshore wind projects deployed in Scotland to date have had limited contribution from the UK supply chain, with major fabrication and installation works being undertaken in Spain and Norway.

Under the UK's Industrial Strategy and Clean Growth Strategy, there is an increasing need to demonstrate that public funding of energy generation is giving value to UK taxpayers and energy consumers. Currently the UK supply chain for fixed bottom offshore wind is achieving 48% of the lifetime value of projects. The Sector Deal, between the government and the sector, agreed in March 2019 sets a target of achieving 60% UK content by 2030, including an emphasis on increasing the UK share of capital expenditure ("capex") beyond 29%. This kind of supply chain development, which the region is seeking to encourage, will be critical to the sector delivering on its commitments.

Deployment and UK content targets by region or country within the UK are not specified in the Sector Deal. However, in order to implement the Deal successfully, the sector proposes capitalising on naturally existing clusters and providing sector leadership to create more opportunities for investment and growth in local economies. The sector is committed to continuing to invest in projects that will benefit local communities in the regions in which they operate.

Direct value of regional spend (£m)		Wave Hub	PDZ	300MW Site	500MW Site
Development and Consenting	£m	1	4	31	32
Substructure	£m	5	11	31	45
Wind turbine	£m	-	-	-	-
Anchors	£m	2	-	-	13
Mooring lines	£m	-	-	-	-
Electrical infrastructure	£m	0.1	21	64	68
Ports & Logistics	£m	1	4	6	7
Vessels and subsea engineering	£m	8	77	65	87
Other Capex	£m	5	15	34	45
Total Capex	£m	21	131	232	298
Opex		Wave Hub	PDZ	300MW Site	500MW Site
O&M offshore activities	£m /year	0.7	1.4	4.0	5.8
O&M onshore activities	£m /year	0.9	0.9	1.3	1.5
Other Opex	£m /year	-	-	-	-
Total Opex	£m /year	1.6	2.3	5.3	7.3
Decommissioning		Wave Hub	PDZ	300MW Site	500MW Site
Decommissioning	£m	8	12	17	19

Figure 1 - Value of direct spend in regional supply chain per local project (OREC Wales and South West Supply Chain Report)

Marine-i/ Celtic Sea Cluster Seminars

On 6th July 2020, Marine-i hosted a Zoom based seminar on behalf of the Celtic Sea Cluster. This was one of a series of six seminars which have been held in Cornwall and Wales since 2018 and followed on from the “Supply Chain Opportunities” event held on the 15th May 2020. That event updated SMEs on the Celtic Sea FLOW strategy, identified the pipeline of projects and explained the supply chain requirements for FLOW deployments.

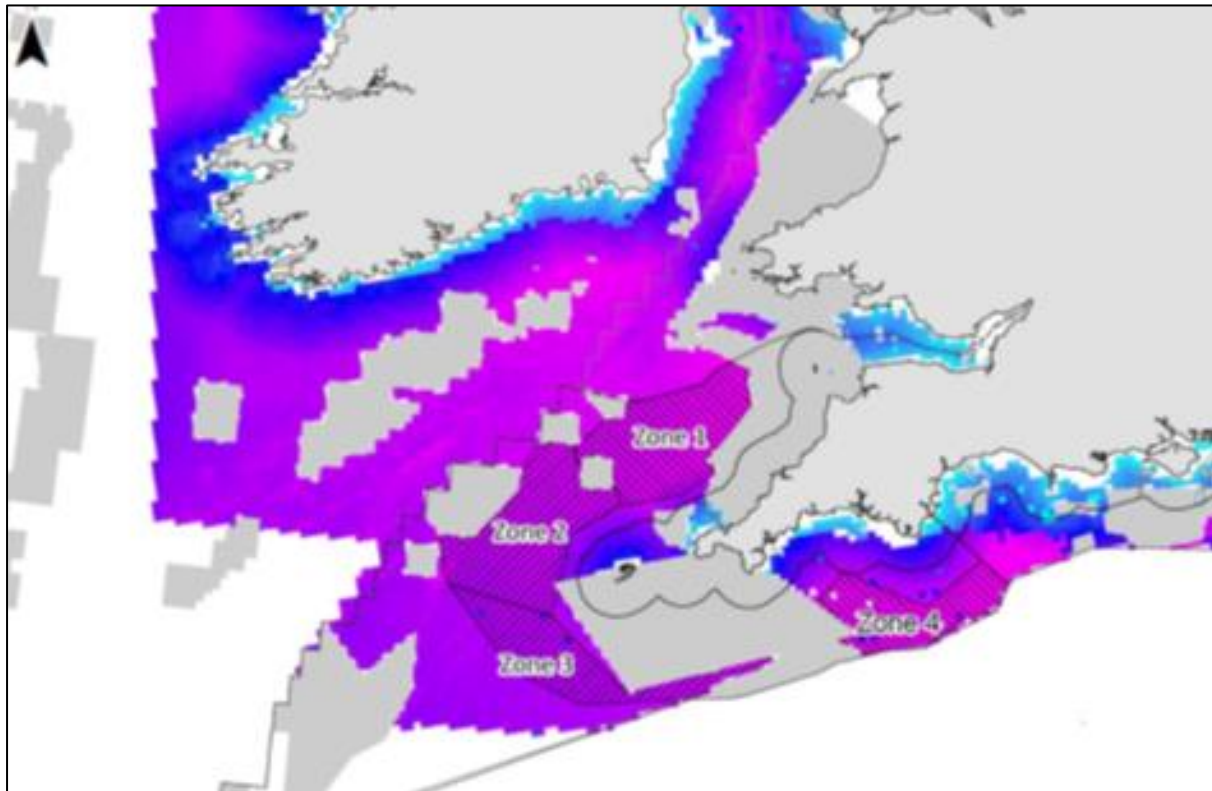


Figure 2 - FLOW Zones in UK Celtic Sea (ITP Energised Geospatial Analysis for OREC)

The objective of this event was to stimulate collaborate engagement within the supply chain and research base by;

- Providing a sense of purpose and urgency around the concept of the Celtic Sea cluster,
- Overviewing the Celtic Sea Cluster Regional Business Plan, including its vision and development process,
- By collaboratively identifying and defining the key research, development and innovation questions, aims and areas essential to deliver multi-GW in the Celtic Sea and beyond.

Part 1 of the day focussed on the regional response to this opportunity and discussed how business can exploit their role in ensuring maximum benefit. Speakers included Helen Donovan, Welsh Government; Mark Duddridge, Chair CIOs LEP; Miriam Noonan, Simon Cheeseman and Neil Farrington, Offshore Renewable Energy (ORE) Catapult; Steve Jermy, Executive Chair, Wave Hub Ltd (WHL).

Part 2 of the session consisted of interactive facilitated workshops intended to draw out key areas of focus. There was an emphasis on those strategic areas; considered essential to the industrialisation of

FLOW, which would benefit from collaborations/ coalescence, would add credibility to the UK's industrial response to the opportunity.

The Workshops

In total, there were 10 workshops, 45 minutes in duration, covering five topic areas twice. Around 120 delegates participated in two workshops each. Each session was hosted by an industry representative, facilitated by a Marine-I team member and supported by a Researcher. Full details can be found in Appendix 1.

The overarching questions that each workshop aimed to answer was **“What do we need to know? What are our research and development questions? How can we be ready by 2023?”**. More specifically, hosts were asked to consider;

- What are the challenges?
- What do we need to know to meet the challenges (RD&I)?
- What are the capacity gaps?
- Where are the skills shortages?

Each workshop was recorded, and notes taken. These have been collated into a series of categorised comments which provide a useful set of contemporaneous data.



Collected Workshop Comments

Key Theme	Sub Theme	Comments
Balance of Plant	Cost reduction	<ul style="list-style-type: none"> • Moorings and dynamic cables are key areas for innovation. • Use of pre-laid mooring can benefit operations (faster and with cheaper vessels).
	Standardisation and Certification	<ul style="list-style-type: none"> • Standardisation of components should be a key focus.
Business Model and Contracts	Contracting Approach	<ul style="list-style-type: none"> • Clear before massive growth opportunity for Floating Wind to look again for ways forward for this sub sector. So EPCI, Multi Contract – or something new • Lot of advantages to Multi Contract, and ability to break up into discrete packages of supply and delivery. Also creates competition. • key is understanding appetite from investors. Price and Risk are drivers. Risk profile has shifted for fixed, FLOW will move this more towards EPCI, but for Celtic Sea you will have to be very cautious about a new framework. FIDIC contracts have been in place for Offshore Wind, but is really relevant to on-shore. Need something tailored and bespoke, see Solar sector for example – Open Solar. Examples of competitors coming together to determine a common approach – to standardize to bring down overall cost.
	Investment	<ul style="list-style-type: none"> • If we had pipeline of EPC or multi-contract into the region, will this kick-start investment into this then becoming available. • Biggest challenge. Considerable amount of established expertise in Cornwall, but not the balance sheets to take a hit if something goes wrong. Can firms come together under a collective with coordination, • We probably know most of the companies in the supply chain, but it's the balance sheet / risk issue. • You will need key owners and large companies in mix cutting up cake. Total will shape and structure it. • Can someone come in and wrap up everything other than turbine supply? • Total could then drive how it should be done, quality considerations etc. • Timing and need to raise finance. Looking out to 2024 and roll of EPC will be different then. There is no EPCI contractor in South West. Construction bit is bigger than for fixed as you build platform. Look over the horizon, where the finance is coming from, where are the contractors basing themselves.



Engineering, Fabrication and Assembly		<ul style="list-style-type: none"> Financial innovation will also be required and investment in what could be a high employment industry should be promoted in the lead up to a post COVID recession.
	Risk	<ul style="list-style-type: none"> Multi contracting is most cost efficient and drives value for project, but there are so many different contacts to engage with – this resource hungry. EPCI with single developer takes away that risk, but this is a young market – are they comfortable taking this risk? Appetite for something new from lenders is a challenge
	Capacity	<ul style="list-style-type: none"> Capacity – restrictions of size of substructure/foundation; there is capacity, challenges are through strategic plan. Substructure – size and price; port capacity; type of steel grade is the issue (no supplier of proper steel grade in Wales & southwest and takes hundreds of millions to develop the capacity). There is core desire of maintain steel manufacture in UK; what extend to face international competition? – fabricators. 2.5GW of FLOW at 15MW per unit is 167 units – serialized production of 25 units at a time on production lines will require 7 years.
	Manufacturing Costs	<ul style="list-style-type: none"> Cost of manufacture – cannot compete like for like with far east or even European countries; cost of fabrication and labour reduced in past 4-5 years; new technology helps with cost reduction; restrictions are not on mill, but fabrication yards. Are we ready for automation – automation can help with safety and efficiency in fabrication, however they need to be commercially viable.
	Methodologies	<ul style="list-style-type: none"> Whilst knowledge can certainly be gleaned from fixed offshore wind, research, development and innovation will also be required in a large number of areas including modular construction techniques, fabrication, buoyancy aided construction, floating docks, adaptable craneage, and increasing efficiencies in all engineering processes to build better and quicker.
	Primary and secondary steel	<ul style="list-style-type: none"> UK has the capacity and capability of delivering steel solutions for FLOW. Challenges are to work closely with fabricators and have a strategic plan. Close engagement and having contact points are essential. UK has capacity to produce steel components, such as steel transition piece to concrete hulls (thick steel plate shaped, welded and assembled to flanges) and chain manufacture (120-200mm bars). Decarbonisation - CN30 project by Liberty Steel Ltd, carbon neutral by 2030.



		<ul style="list-style-type: none"> Recycling of steel – three companies in Wales are in the business; yet to be developed in UK. How far does steel travel? – Transport cost can be substantial. Engage early, design around capability are the key.
	Skills and Training	<ul style="list-style-type: none"> For concrete construction that it is a particularly strong factor, and hence local construction appears to be economically advantageous for the project and also of course, for the local economy; for example, a 750MW project, would require 1500 jobs.
	Standardisation and Certification	<ul style="list-style-type: none"> Engineering complexity is an issue. Platform is half a ship, so shipping based standards are relevant. How to other sectors do this on complex structures? Existing offshore type contracting mechanisms with risk sharing. Design? – no single standardised solution, but certified solution standardised procedure of certification;
Floating / Fixed	Baseline	<ul style="list-style-type: none"> The intention is to install 3GW of floating wind in the Celtic sea by 2030.
	Standardisation and Certification	<ul style="list-style-type: none"> Most immediate solutions are derived from bottom-fixed offshore wind.
Installation, Operations and Maintenance	Baseline	<ul style="list-style-type: none"> UK has the advantage of proximity to the Celtic Sea where 72-hour round trip is well within feasibility, however devices can be towed for long distances, and could be towed, for example, from France.
	Local Content	<ul style="list-style-type: none"> UK proximity to the Celtic sea is an advantage certainly for maintenance, and could support the vessels required if the ports were developed, but whilst we should be looking at where local ports can be beneficial for O&M we should be looking to support construction too.
	Methodologies	<ul style="list-style-type: none"> Long distance from shore -> specific requirements on O&M -> accurate planning tool and condition monitoring instrumentation needed.
	Risk	<ul style="list-style-type: none"> The risk profile of specific tasks also plays a very large role in this decision making.
	Tow to Port v Offshore Maintenance	<ul style="list-style-type: none"> What will be the key differences between "bespoke tow and install" and "production installation"? This means also between demonstration (~10MW) and commercial (~500MW) projects. Need to define solutions for when the devices are disconnected for maintenance. How to manage the tow-to-port strategy effectively with a high number of floating wind devices? -> Need to plan and optimise use of available facilities. A number of differences and new challenges will have to be addressed for the installation and O&M of floating



		wind devices as opposed to their bottom-fixed counterparts.
	Vessels and Plant	<ul style="list-style-type: none"> • Mostly operational challenges: logistics, vessels, equipment and port infrastructure. • Standard vessels are too expensive -> Need for purpose-built vessels for installation and O&M. • Use of helicopters is controversial: use has to be balanced against CTVs. • Could not find one ship year to build 3 turbines for initial roll out of floating wind – so have we got capability in South West. Turbines from Germany and Denmark. Sub structures from Iberian Peninsula. • Current turbine designs are fit to be towed in 50 year return conditions, one limiting factor is the capability of the vessel/tug and the other is the economic factor; towing long distance is very expensive, and it has been shown that cheaper labour costs are negated by long tow costs. • Towing to port is possible in extreme weather and keeps ports with a steady demand, however greater efficiencies are generally achieved from conducting maintenance offshore particularly due to the time and cost of disconnection as well as the cost of towing. • There may however be very specific (e.g. large refits) maintenance operations that must be done onshore and understanding the space and lifting requirements for these operations would be useful.
Logistics	Cost reduction	<ul style="list-style-type: none"> • A number of research areas that should be reviewed in order to make logistics solutions for FLOW more efficient and cost-effective.
Planning and Consenting	Data	<ul style="list-style-type: none"> • Some areas are old charts which need updating. • UKHO are potentially undertaking updates. • CEFAS – mammal survey data? • How are data sets managed/merged? This includes international data (Ireland) as well as UK. • Need industry input as to what data should be gathered and by whom? Public sector/academia vs project developers. Project data driven by banks for making decisions on financial close. • Consider co-location of aquaculture with renewables – data on species etc.
	Design and Engineering	<ul style="list-style-type: none"> • How field resource characterisation feeds into installation and O&M strategies and therefore design – back to data need.



	Stakeholders	<ul style="list-style-type: none"> It is important that planning starts early and stakeholders should be engaged as soon as possible.
Port Infrastructure	Baseline	<ul style="list-style-type: none"> French port developers have said that they need more space and are looking to UK ports to provide this.
Port Infrastructure	Capacity	<ul style="list-style-type: none"> For the project construction phase there is a clear need for land area and quayside length/area. To manufacture all at the same time you need 7 production lines. Each production line will require 10 hectares each. 10 hectares does not include laydown and handling for landing and mobilising which will require a further minimum of 2-3 hectares, depending how many platforms you can transport, land and store. A port would also need quayside where 3 can be moored for outfitting; at 55 x 55m., with a depth of 8-12m minimum. There is also a need for lifting capacity. A&P has a current maximum of 70t/m2 in certain areas. Nacelles masses are 500-600 tonne lifting to approximately 130m above the water.
	Collaboration	<ul style="list-style-type: none"> This will also involve ports collaborating in the region such that they can provide a combined offering, with ports offering different services suitable to their location and characteristics, whilst considering the other demand on ports (fixed wind, Brexit trade route changes). A multiport approach is a practical solution with the possibility for greater expertise and innovative, dedicated equipment for different aspects of construction and maintenance such as foundations, topsides, moorings etc. Collaboration across ports would enlighten developers as well as avoiding internal competition, and a plan for development would allow developers, ship builders, suppliers and investors to be confident. A&P and the LEP are in the process of conducting a feasibility study. Further development of this study should include other ports and specific requirements based on collaborations with partner developers. Ports will need to be adaptable, as the first projects are likely to vary from future projects, and as such this plan needs to be a collaborative 50 year vision between ports surrounding the Celtic sea in partnership with developers. France and Ireland are developing port facilities. Scandinavian and other western European countries will also be looking to develop and to bring existing expertise.



	Contracting Approach	There is a slight catch 22 in that the ports seem to be waiting for a customer and the perception that developers may be looking for a port that is ready.
	Contracting Approach	A potential solution is for ports and developers to partner and develop together, however for developers to want to do this it is important that ports appear to be serious, and it is also important to avoid exclusivity to one developer.
	Design and Engineering	<ul style="list-style-type: none"> Understanding how port infrastructure affects design and engineering.
	Investment	<ul style="list-style-type: none"> French put £200m into Brest and this has creating a working port for tidal and wind. Investment has been made in Pembroke Dock – this infrastructure is lacking, but long lead time. Ports should be mapping out the potential for expansion and investment in the required infrastructure, looking a strengths and weaknesses in the facilities that we already have, as was done in Scotland with the wave and tidal industry. A sensible approach would be to map out and plan, but to hold back on port development until the supply chain is better developed, and this would inevitably develop when CFDs are adjusted.
Regional Solution	Baseline	<ul style="list-style-type: none"> The regional situation should be analysed and used as a starting point to propose future innovation The skills and infrastructure, as well as research an innovation need to be built here for the projects to come, whilst remaining aware of what foreign ports are doing, being realistic about the space left in the market and collaborating amongst the UK ports.
	Capacity	Deploying projects are helpful to build capacity.
	Comparison with N.sea	<ul style="list-style-type: none"> Oil and Gas seems to be more engaged in FLOW than fixed, so will this drive a different approach? Look at the North Sea example and learn from this and take lessons for FLOW here. Fixed wind had luxury of starting small and then growing organically. FLOW will go large from start.
	Data	<ul style="list-style-type: none"> Skills mapping – data base of companies – networks (CMN/MOR Group?).
	Development / Investment	<ul style="list-style-type: none"> Comparison between global and Celtic floating wind development -> to what extent solving global issues in floating wind can support regional development in the Celtic sea? Need to deliver 60% UK content. Could sit back and wait for Oil and Gas majors, or there is opportunity to create our own market place.



		<ul style="list-style-type: none"> All French and Portuguese ports will be busy. Timing is key, because although Celtic Sea opportunity is huge, when do you invest? Risk taking and investment and the need not to be left behind – the Cluster has to come together around this and feed in locally but also into Westminster. Have to be well represented in BEIS so that North Sea focus doesn't predominate.
	Local Content	<ul style="list-style-type: none"> Region should lobby hard with target for local content inclusion. Politically lobbying should be priority to sort this. Whatever can be done to help local supply chain enhance its offering is key. Being most cost efficient under CFD is at odds with using local supply chain. Great opportunity for all to come together and agree common approach. The region used to have a lot of ship building capability. Capability is there, it just needs some support funding to rejuvenate them. Lobbying job to be done. What can we do (as a regional supply chain) to ensure we maximise the opportunity that this brings?
	Port Infrastructure	<ul style="list-style-type: none"> Partners in Cornwall are looking to push the Free ports agenda and we need to be push government to leave the agenda flexible and adaptable.
	Stakeholders	<ul style="list-style-type: none"> At this point we should be lobbying for this change and encouraging developers to start development and to partner with a port at which point investment can begin with a joint route to market.
Skills Training	Local Content	<ul style="list-style-type: none"> There are skills shortages, particularly in engineering (also in marine operations) and the south west should be prepared for at least a 3-5 year development of skills. Keeping in mind the timeframe that we are aiming at this should be happening now. This includes surveying existing skill levels now and being aware of the age demographic of the current skill holders. Schools colleges and universities will then need to develop apprenticeship and degrees to suit the future requirement.
	Regional solution	<ul style="list-style-type: none"> UK should be looking to seize a large portion of the work and not to just focus where it already has skills and infrastructure. But the UK are behind.
Supply Chain	Investment	<ul style="list-style-type: none"> How can smaller firms already producing offshore structures in the region engage in aspects of this opportunity without radical change to existing workshops and procedures?
	Other sectors	<ul style="list-style-type: none"> Investment in supply chain for nuclear with mixed results. Some Nuclear supply chains will also be relevant for Floating Wind.

Appendix 1 – Workshop Details (All ran twice)

Engineering/ Feed/ Design

Industry “Sponsor”: Fran Pitkin, OWC

Facilitator: TBC – MI2 Partner- Neil Farrington

Capture research needs: Alex Whatley, UOP

Primer Questions

1. What key information/ data is needed to understand the strategic requirements of the Celtic Sea?
2. What are the key design/ engineering challenges going to be in order to deliver 2.5GW of FLOW in the Celtic Sea by the 2030's?
3. What can we do (as a regional supply chain) to ensure we maximise the opportunity that this brings?

Fabrication and Primary Steel

Industry “Sponsor”: Iain Sinclair, Liberty Steel UK

Facilitator: TBC – MI2 Partner – Martin Murphy

Capture research needs: Shenshan Cheng, UoP

Primer Questions

4. How do we to capture a significant share of the primary steel and fabrication elements of the FLOW installed in the Celtic Sea?
5. What are the challenges to achieving that? What significant points of difference could set us apart from global competitors
6. What can we do (as a regional supply chain) to ensure we maximise the opportunity that this brings?

Ports and Assembly

Industry “Sponsor”: Drystan Jones, A&P

Facilitator: TBC – MI2 Partner – Simon Cheeseman

Capture research needs: George Crossley, UoE

Primer Questions

7. What are going to be the key port and hinterland activities for 2.5GW of FLOW? What do we need to know to help understand the investment requirement to fully meet the need?
8. What difference will a “tow to port” versus “offshore” O&M strategy mean to Port infrastructure requirements?
9. What can we do (as a regional supply chain) to ensure we maximise the opportunity that this brings?

Installation and O&M

Industry “Sponsor”: Tim Baker, Black and Veatch

Facilitator: TBC – MI2 Partner – Lars Jonanning

Capture research needs: Giovanni Rinaldi, UoE

Primer Questions

10. What will be the key differences between “bespoke tow and install” and “production installation”?
11. What challenges need to be addressed to increase productivity and drive down cost?
12. What can we do (as a regional supply chain) to ensure we maximise the opportunity that this brings?

Contracting and Business Models

Industry “Sponsor”: Campbell Hutcheon, Burgess Salmon

Facilitator: TBC – MI2 Partner – Matt Hodson

Capture research needs: Kevin Forshaw, UoP

Primer Questions

13. What will a holistic FLOW business model look like? EPCI, Multi-Contract, Something New?
14. What are the challenges that need to be addressed to develop a contracting and business model which is fit for purpose and deals with risk in the most effective way?
15. What can we do (as a regional supply chain) to ensure we maximise the opportunity that this brings?