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Floating Offshore wind: Market opportunities, development areas and O&M vessel utilisation.

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FLOATING OFFSHORE WIND: MARKET OPPORTUNITIES, DEVELOPMENT AREAS AND VESSEL UTILISATION

MARINE-I & MEVAGISSEY HARBOUR.

C1/C4 Business Assist Report

AUTHOR // Neil Farrington

DATE // July 2021

Document History

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V1	22/07/2021	Neil Farrington	Brad McKay		
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Disclaimer

Contents

1 Marine-I introduction

Part funded by the European Regional Development Fund,' Marine Innovation 2: Coordinated support for Marine Technology RD&I '(Mi2) is a £5.5m collaboration between the University of Exeter, Plymouth University, The Cornwall College Group, Cornwall Marine Network, Cornwall Development Company and the Offshore Renewable Energy Catapult.

This C1/C26 report is designed to support long-term co-operation between Business Research Fellows/Academics and business enterprises. This Co-operation C1/C26 report covers a short-term co-operation to enable the implementation of a feasibility study, providing a pre-cursor to support the potential establishment of a Marine Challenge Fund (MCF) application if applicable.

2 Project Introduction

This report has been provided to Mevagissey Harbour as part of a 12hr business assist through the Marine-i programme.

The intention is to provide some preliminary information to the Harbour on current and future market opportunities in floating offshore wind (FLOW) across the South West (SW) UK and particularly the likely vessel utilisation rates for FLOW O&M activities that can be cross referenced with prospective SW FLOW development areas.

3 The Global Floating offshore wind market

3.1 The emerging FLOW market

In recent years we have seen the strong emergence of a new FLOW sector. FLOW offers an opportunity to exploit the offshore wind resource available in water depths that cannot be accessed by fixed offshore wind. Key markets have been identified in Europe, the USA and Japan with the potential for 7,000GW (GlobalData 2020[1]) to be deployed globally, generating approximately 30,000TWh/yr which is well in excess of current global electricity demand (23,105 TWh in 2019 - Enerdata.net 2020[2]). Some of the largest potential markets, such as Japan and the United States West Coast, possess few shallow-water sites suitable for offshore wind development. Floating foundations could be game changers in this regard. In 2021 there are 74 MW of FLOW connected to the grid with 16 turbines in 7 countries[3]. Announced pre-commercial FLOW projects in Europe in 2019 are shown at figure 2.

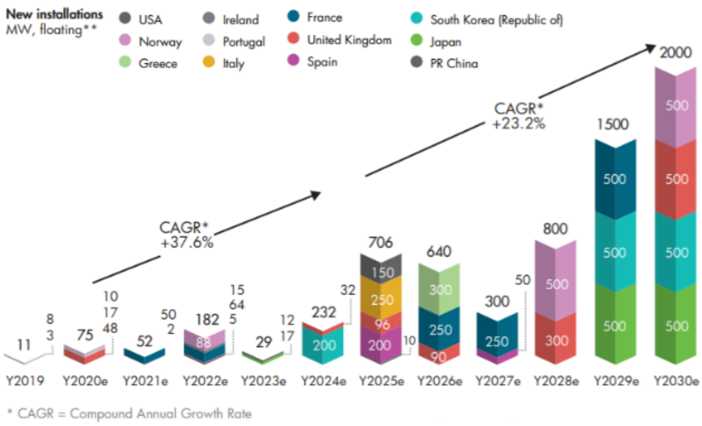

Figure 1 FLOW forecasted deployment. GWEC Market intelligence 2020

Wind Farm Name	Country	Capacity (MW)	Commissioning date
Hywind Scotland	United Kingdom	30	2017 (in operation)
Windfloat Atlantic	Portugal	25	2019
Flocan 5 Canary	Spain	25	2020
Nautilus	Spain	5	2020
SeaTwirl S2	Sweden	1	2020
Kincardine	United Kingdom	49	2020
Forthwind Project	United Kingdom	12	2020
EFGL	France	24	2021
Groix-Belle-Ile	France	24	2021
PGL Wind Farm	France	24	2021
EolMed	France	25	2021
Katanes Floating Energy Park -Array	United Kingdom	32	2022
Hywind Tampen	Norway	88	2022

Figure 2 Announced pre-commercial FLOW projects in Europe (to be commissioned within next 5 years). Wind Europe 2019

More recently announced new UK FLOW developments include projects in the Celtic sea with the 98 MW Erebus project[4] and the >1 GW Emerald project[5] as well as the FLOW/Wave hybrid proposal with Western star wind off Ireland's West Coast at >1.1 GW.[6] Wave Hub in Cornwall has also recently

[1] https://www.energylivenews.com/2020/03/12/floating-wind-potential-across-europe-the-us-and-japan-is-as-high-as-7000gw/
[2] https://yearbook.enerdata.net/electricity/electricity-domestic-consumption-data.html
[3] https://windeurope.org/about-wind/interactive-offshore-maps/
[4] https://www.bluegemwind.com/
[5] https://simplyblueenergy.com/emerald/
[6] https://www.offshorewind.biz/2021/03/05/floating-wind-wave-energy-project-planned-offshore-ireland/

(2021) been purchased by a Floating wind developer[7] for the demonstration of a 30-40 MW FLOW installation whilst the Pembrokeshire demonstration zone is also looking to re-license from wave to FLOW demonstration[8].

At present, the 2030 FLOW forecast ranges from 3 GW to nearly 19 GW, depending on how quickly LCoE can be brought down to an affordable level and its adoption by new markets. Global Wind Energy Council (GWEC) Market Intelligence predicts 6.2 GW of floating wind is likely to be built in the next 10 years.

We have also seen the recent adoption of specific FLOW policies and targets. In 2019 The UK Government, for example, set an ambitious target to deliver 40 GW of Offshore Wind by 2030 with 10 GW coming from FLOW in an effort to reduce greenhouse gas emissions to zero by 2050 whilst offering specific manifesto support to 'enable new floating wind farms'.

4 Potential future SW UK FLOW deployment areas

This section of the report provides information on future potential FLOW deployment areas in the Celtic Sea to help Fowey Harbour to better understand the future FLOW market opportunity and some of the focused development activities in the SW UK.

4.1 The Celtic Sea floating offshore wind opportunity

Supporting reports from the ORE Catapult that may help Fowey Harbour to identify business opportunities include the supply chain report on the 'Benefits of Floating Offshore Wind to Wales and the South West.' (ORE Catapult 2020[9]), which identified FLOW opportunities for the Welsh and SW supply chain. The report includes an assessment of developing and deploying a number of pre-commercial floating offshore wind projects in the mid to late 2020's through a "stepping stones" approach, increasing in size from 32 MW at Wave Hub to 90 MW at Pembrokeshire Development Zone (PDZ) or equivalent site, then 300 MW first commercial scale project and a second commercial scale project of 500 MW. This report also includes an assessment of the potential resource available in the Celtic Sea, suggesting that between 15 – 50 GW of the 150-250 GW total FLOW capacity identified in the Celtic Sea could realistically be developed in the Celtic Sea region between the UK and Ireland. See figure 3.

[7] https://www.hexicon.eu/mfn_news/hexicon-to-acquire-wave-hub-ltd-for-offshore-floating-wind-technology-demonstrator/
[8] https://www.marineenergywales.co.uk/marine-energy-in-wales/demonstration-zones/pembrokeshire-demonstration-zone/
[9] https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2020/01/30090825/8996-OREC-Wales-Report-WEB.pdf

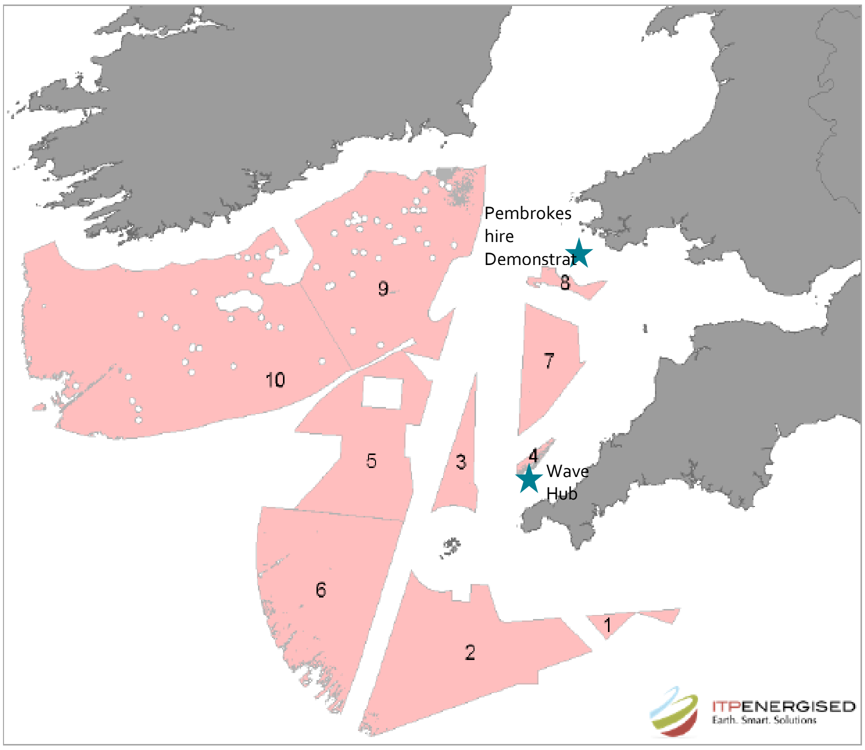

Figure 3 Potential zones of floating wind development as identified by ITP Energised / Simply Blue 2019

In 2020 the ORE Catapult partnered with ITPEnergised to further understand the spatial potential for the deployment of FLOW in the Celtic Sea, seeking to identify potential deployment areas of least constraint and supporting a more strategic approach to the future sustainable development of this sector[10].

A 25,000 km² area of least constraint has been identified in the Celtic Sea, with 5 specific Zones in the SW Marine Plan area and Welsh National Marine Plan area. These are shown in Figure 4 below. The areas do not specifically include the proposed demonstration sites.

Initial potential deployment figures have been generated as a result of the report based on the utilization of a 15 MW floating offshore wind turbine and other known offshore wind turbine packing densities shown below. This has enabled projected deployment ranges to be generated for the investigated areas.

Celtic Sea zones:

Total Area: 25,000 km²

Turbine deployment capacity range:	High (4.8 MW/km²)	- 120 GW
	Mid (3 MW/km²)	- 75 GW
	Low (2 MW/km²)	- 49 GW

[10] https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2020/07/27101910/Final-Version-small.pdf

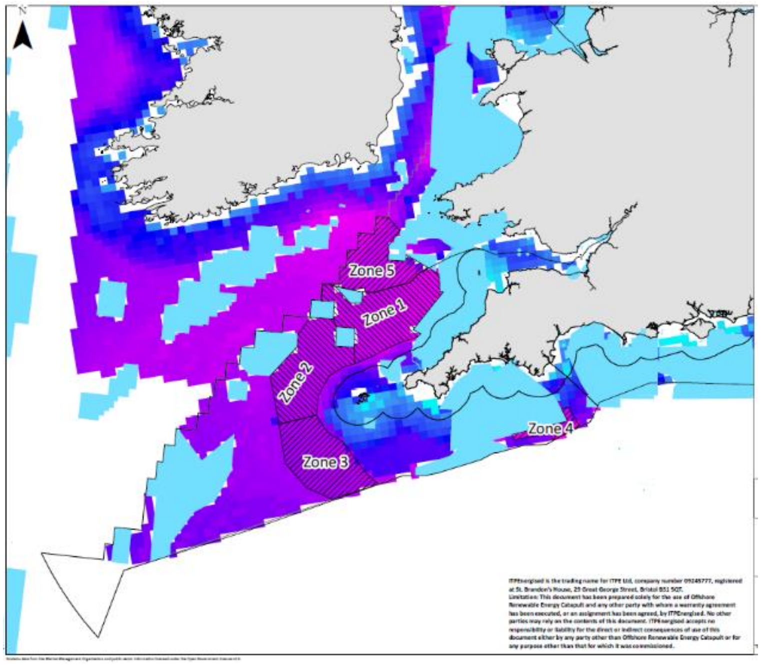

Figure 4 Floating Offshore Wind constraint mapping in the Celtic Sea - ORE Catapult & ITPE 2020

4.1.1 Celtic Sea Zones 1-5 – Physical conditions and floating offshore wind deployment potential

Further information is provided below on some of the physical conditions and useful statistics that can be associated with zones 1-5 in the Celtic Sea. Whilst recognising that these are areas of potential least constraint, rather than specific project development areas, the information can provide an indication of the scale of potential FLOW role out in the Celtic Sea that could be correlated with likely vessel interactions and points of prospective O&M and other operations. Recognising relative distances to shore could also support further analysis of likely vessel use for operations in these locations.

Zone 1

Some Conditions:	**FLOW Deployment Potential**
• Area: **6,300 km²**	• Turbine deployment capacity range: High (4.8 MW/km²) – 30.2 GW Mid (3 MW/km²) – 18.9 GW Low (2 MW/km²) – 12.6 GW
• Annual Average Wind Speed @ 100 m: 10.6-11 m/s	• 15 MW turbine numbers: 840-2,013
• Annual Mean Significant Wave Height ; 1.76-2.5 m	• Annual generation (50% capacity factor): 55,188GWh - 132,276 GWh

• Water Depth Range: -64 to -106 m	• Contribution to UK annual electricity demand (2019): 18% - 43%
• Average Water Depth -89 m	• Approx. 40 km from the shoreline at closest point

Zone 2

Some Conditions:	**FLOW Deployment Potential**
• Area**: 5,588 km²**	• Turbine deployment capacity range: High (4.8 MW/km²) – 26.8 GW Mid (3 MW/km²) – 16.8 GW Low (2 MW/km²) – 11.2 GW
• Annual Average Wind Speed @ 100 m: 10.6-11 m/s	• 15 MW turbine numbers: 746 - 1,786
• Annual Mean Significant Wave Height ; 2.26-2.75 m	• Annual generation (50% capacity factor): 49,056 Gwh - 117,384 GWh
• Water Depth Range: -74 to -133 m	• Contribution to UK annual electricity demand (2019): 16% - 38%
• Average Water Depth: -109 m	• Approx. 56 km from the shoreline at closest point

Zone 3

Some Conditions:	**FLOW Deployment Potential**
• Area**: 5,312 km²**	• Turbine deployment capacity range: High (4.8 MW/km²) – 25.5 GW Mid (3 MW/km²) – 15.9 GW Low (2 MW/km²) – 10.6 GW
• Annual Average Wind Speed @ 100 m:10.1-11 m/s	• 15 MW turbine numbers: 706 - 1,700
• Annual Mean Significant Wave Height ; 2.26-2.75 m	• Annual generation (50% capacity factor): 46,428 Gwh - 111,690 GWh
• Water depth Range: -94 to -136 m	• Contribution to UK annual electricity demand (2019): 15%-36%

• Average Water depth: -122 m	• Approx. 50 km to Isles of Scilly at closest point and 90 km to Cornwall.

Zone 4

Some Conditions:	FLOW Deployment Potential
• Area: **800 km²**	• Turbine deployment capacity range: High (4.8 MW/km²) – 3.8 GW Mid (3 MW/km²) – 2.4 GW Low (2 MW/km²) – 1.6 GW
• Annual Average Wind Speed @ 100 m:10.1-10.5 m/s	• 15 MW turbine numbers: 106 - 253
• Annual Mean Significant Wave Height ; 1.76-2 m	• Annual generation (50% capacity factor): 7,008 GWh - 16,644 GWh
• Water Depth Range: -55 m to -89 m	• Contribution to UK annual electricity demand (2019): 2%-5%
• Average Water Depth: -74 m	• Approx. 45 km from the shoreline at closest point

Zone 5 Wales :

Some Conditions:	FLOW Deployment Potential
• Area: 3,983 km²	• Turbine deployment capacity range: High (4.8 MW/km²) – 19.1 GW Mid (3 MW/km²) – 11.9 GW Low (2 MW/km²) – 7.9 GW
• Annual Average Wind Speed @ 100m: 10.6 -11 m/s	• 15 MW turbine numbers:526 – 1,273
• Annual Mean Significant Wave Height ; 1.9 -2.36 m	• Annual generation (50% capacity factor): 34,550 GWh - 83,636 GWh
• Water Depth Range: -70 - -146.9 m	• Contribution to Welsh annual electricity demand (2018): 231% - 561%
• Average Water Depth: -100.8 m	• 49 km from the shoreline at closest point

UK annual electricity demand 2019 – 306.58 TWh (Statistica.com June 2020)

Wales annual electricity demand 2018 – 14.9 TWh (Gov.Wales June 2020)

5 Wind Farm Service Vessels and usage

Windfarm service vessels, mainly crew transfer vessels (CTVs) and service operation vessels (SOVs), are built to serve offshore wind farms in the construction and O&M phases. These two vessel types will be focused on in this report due to their ability to be hosted by potential SW harbours. Detailed market share statistics are not available here for these types of vessel operators, however a list of some of the largest players is included below:

- C-Wind
- Global Marine Group
- Dalby Offshore Services Ltd
- Gardline
- Manor Renewable Energy
- MPI Workboats
- Njord Offshore Ltd
- Northern Offshore Services AB
- Rix Renewables
- Seacat Services
- Tidal Transit Ltd
- Turbine Transfers Ltd
- Turner Iceni Ltd
- Windcat workboats

Figure 5 Rina C Hull Mach Special Service – Workboat HSC CATAMARAN

CTVs are designed to carry personnel and cargo (e.g. tools and small spare parts) from a port to the wind farm and use a 'push on' method to allow technicians to transfer onto turbines. CTVs can transport a maximum of twelve or twenty-four personnel (depending on vessel size) at any one time. CTVs are typically used for near-shore wind farms. More modern wind farms are being built further from shore, in part to access higher wind speeds, where the use of CTVs can become unfeasible due to the limited working time of personnel.

CTV Vessel specifications are particular to manufacturers. A source for further detailed consideration is provided by 4coffshore in their wind turbine vessels report[11] which contains industry level support and information for the offshore wind sector including specific vessel utilisation support. 4coffshore also hold a wind farm service vessels database[12] which includes information on operators, design and classification, main dimensions, speed and cargo. The website "Offshore Wind Biz" also has some very useful information on vessel operators and the specifications of the vessels they use.

SOVs can be more attractive in situations further offshore, despite the significantly higher cost, as they can carry many more technicians (e.g. 50-200, depending on size) and provide a stable 'walk-to-work' platform for turbine access, therefore increasing wind farm availability and revenue. SOVs also contain crew quarters, so can remain on site for longer maintenance campaigns and service multiple turbines.

Figure 6 Siemens Windea SOV. Ulstein.com

The scale of SOVs is again variable with more precise data available through referenced databases[13]. Ulstein for example offer SOVs for the offshore wind industry[14] at lengths from 69 m to 93 m.

5.1 Analysing vessel use and offshore wind operations

The following information is taken from a recent report by the ORE Catapult on 'Setting a benchmark for decarbonising O&M vessels of Offshore Wind Farms.' [15] Analysis of vessel activity on two simulated offshore wind farms provides an indication of CTV and SOV utilisation in relation to site capacity that can be cross referenced to described potential future offshore wind development areas and potential capacities. This information can support an increased understanding of potential future vessel needs in these areas.

[11] You can view the sample data for the Wind Farm Service Vessel's report HERE.

[12] https://www.4coffshore.com/vessels/wind-farm-service-vessels.html#vessels

[13] https://www.4coffshore.com/vessels/wind-farm-service-vessels.html#vessels

[14] https://ulstein.com/ship-design/offshore-wind

[15] https://ore.catapult.org.uk/analysisinsight/setting-benchmark-decarbonising-om-vessels-offshore-wind-farms/

Two distinct types of offshore wind farms have been considered in the analysis. The first has an O&M strategy centred on CTVs transporting technicians between the port and different turbines. It uses 3.6 MW turbines, representative of some offshore wind projects currently in operation in the UK today. The second scenario is a larger wind farm located further from shore, which utilises one (or more) SOV. It has 12 MW turbines and is intended to be representative of projects due to be deployed in the UK from 2025-2030. Both of these scenarios are assumed to have monopile foundations. Considerations of vessel use for floating offshore wind operations will vary due to the increased distance from shore and floating foundation structure with associated mooring lines and anchors. It will also depend on the O&M strategy employed for major repair and replacements (maintenance at site vs tow back to port). SOV utilisation is likely to outweigh CTV utilisation in this case. Figure 7 summarises the key parameters of the two scenarios.

Parameter	Units	Scenario 1	Scenario 2
Primary O&M Vessel Type	text	CTV	SOV
Turbine Size	MW	3.6	12
Turbine Numbers	#	50	100
Site Capacity	MW	180	1,200
Distance from Port	km	20	130

Figure 7 Key parameters of the two offshore wind farm scenarios modelled

The assumption is that the O&M strategy for the scenario 1 wind farm would be a mixture of 'traditional' (e.g. rope access technicians, divers etc.) and more 'modern' methods, most notably robotics (e.g. remotely operated vehicles, airborne drones etc.). The same O&M activities have been used for scenario 2 in this study. However, it is expected that robotics (i.e. autonomous underwater vehicles, unmanned surface vessels etc.) will be more commonplace in the O&M phase of offshore wind farms when projects such as the one defined in scenario 2 are operating. These methods can speed up O&M activities (e.g. visiting more turbines per day), thereby reducing vessel usage and the associated fuel emissions.

The intention of modelling these two scenarios is to benchmark vessel utilisation for the two distinct types of offshore wind farms and highlight that CTVs and SOVs have different operational behaviours. This also has potential relevance in better understanding prospective vessel wear and tear that could be of interest to Linked Solutions in understanding prospective vessel maintenance needs. It should be noted that an SOV can also utilise 'daughter craft', which are a type of CTV deployed from the 'mothership', allowing personnel to be rapidly transported around the wind farm for the more minor inspection and repair tasks. This concept has not been analysed in this study.

CTVs typically can transport between twelve and twenty-four technicians (depending on vessel size) to site, meaning that more than one turbine could be visited per port-to-site transit. For scenario 1 in this study, it is assumed that one port-to-site transit will see four turbines visited (i.e. ten technicians in total transited where the average team consists of 2.5 technicians). This means that the initial bottom-up estimates from the COMPASS[16] tool for loitering in-field are divided by four. However, there is some time added due to transiting between turbines whilst onsite (assumed to average 2.5 km between turbines for the size of turbines and farm in scenario 1 – i.e. once at site, an extra 15 km is travelled to drop technicians off at all four turbines on that trip and pick them back up). As the wind farm in scenario 2 is bigger and uses larger turbines (therefore has increased spacing between turbines), it is assumed that the SOVs in scenario 2 would travel an average of 10 km between turbine transfers around the wind farm. For the SOV 'loitering' time (i.e. in-field) in scenario 2, we have assumed that the vessel will spend a maximum of one hour at a turbine before becoming available for further work. This time allows for the safe transfer of technicians using walk-to-work platforms. SOVs have a significantly larger personnel capacity than CTVs, so they are more likely to spend time transiting around the wind farm, dropping off and picking up technicians.

5.2 Vessel specification for analysis

Vessel Type	Crew Transfer Vessel (CTV)	Service Operation Vessel (SOV)
Primary Fuel	MFO	MGO[xvi]
Secondary Fuel	N/A	Battery Electric
Fuel Consumption per Hour, Transiting	320 litres/hour[xvii]	1,000 litres/hour[xvii]
Fuel Consumption per Hour, In-field/Loitering	130 litres/hour[xviii]	120 litres/hour[xvi]
Transit speed (average)	23 knots[xvii] (42.6 km/hour)	12 knots[xvii] (22.2 km/hour)

Figure 8 Vessel specification for analysis

5.3 Vessel usage scenario 1

The results for scenario 1 indicate that CTVs are the primary vessel type involved in the O&M phase for the offshore wind farm, as expected, accounting for 3,767 out of 4,948 hours (76%) of annual onsite (i.e. without transit times) activity (Figure 9). They are mainly used to transfer technicians (and associated spare parts and consumables) onto turbines to repair faults (unplanned maintenance) and undertake planned works.

[16] The COMPASS model, developed by engineers at ORE Catapult, is a Python-based O&M simulation tool (see ORE Catapult 2020 for an overview of O&M simulation tools)

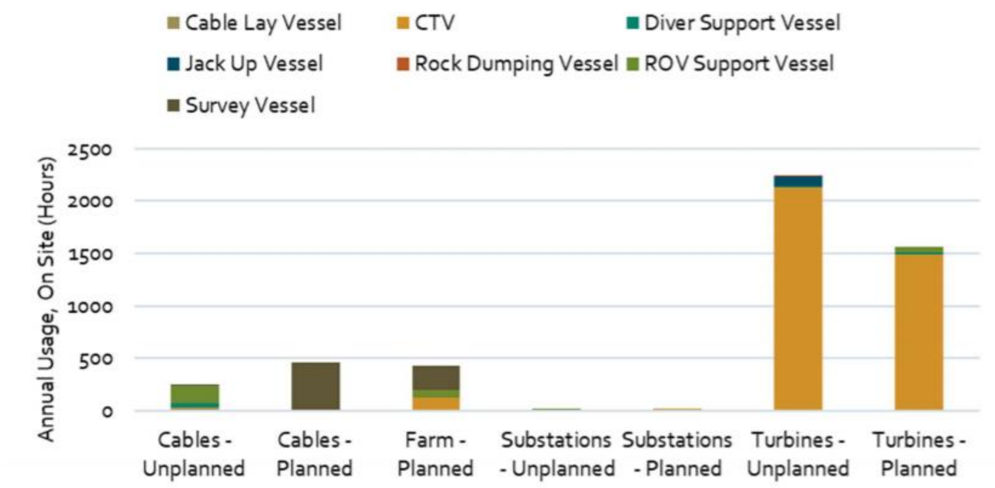

Figure 9 Vessel usage (without transit times) by asset and planned/unplanned maintenance type for scenario 1

Figure 10 shows the breakdown of CTV annual usage, including transit times between port and site, as well as turbine-to-turbine offshore transits (i.e. accounting for the personnel transfer optimisation stated previously). After dropping off all technicians to undertake turbine maintenance, it is assumed that the CTV remains offshore (i.e. in-field) in loiter mode (i.e. still consuming fuel but at a much lower rate than when transiting). From this modelling, it is estimated that CTVs are utilised for a total of 4,295 hours at the offshore wind farm per year. As planned maintenance is typically scheduled to take place in the summer months (i.e. when accessibility is high and lost revenue from downtime is minimised), the wind farm in scenario 1 would likely have one CTV on a permanent lease and another CTV on a summer-only lease.

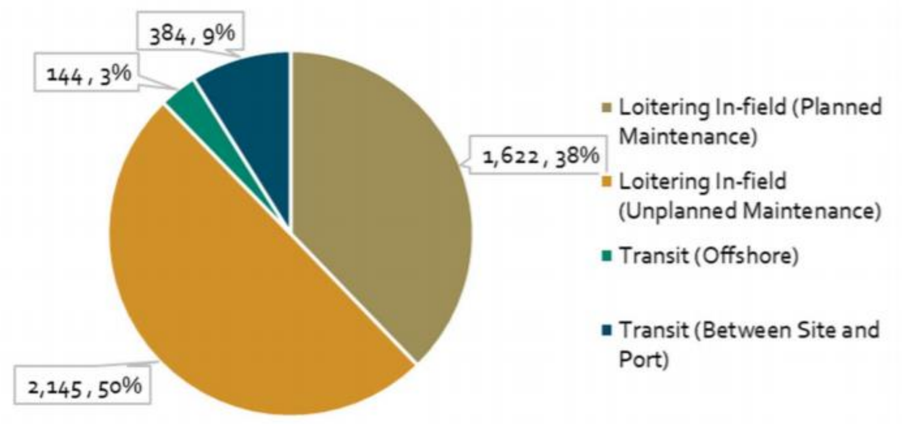

Figure 10 CTV annual usage, including transit times (Hrs) for scenario 1

5.4 Vessel usage scenario 2

The vessel usage results for scenario 2 show that an SOV is the primary vessel for O&M for the larger, further from shore, offshore wind farm (Figure 11), accounting for 3,056 out of 4,339 hours (70%) of annual onsite activities (without transit times). The primary category of tasks involves transferring technicians to turbines for planned maintenance. The breakdown of annual usage for the SOV is shown in Figure 12, which includes time spent transiting both around the wind farm and the fortnightly resupply mission back to port. The modelling estimates a total of 6,305 SOV hours for the offshore wind farm in scenario 2, which equates to one SOV servicing the farm on a full-time basis.

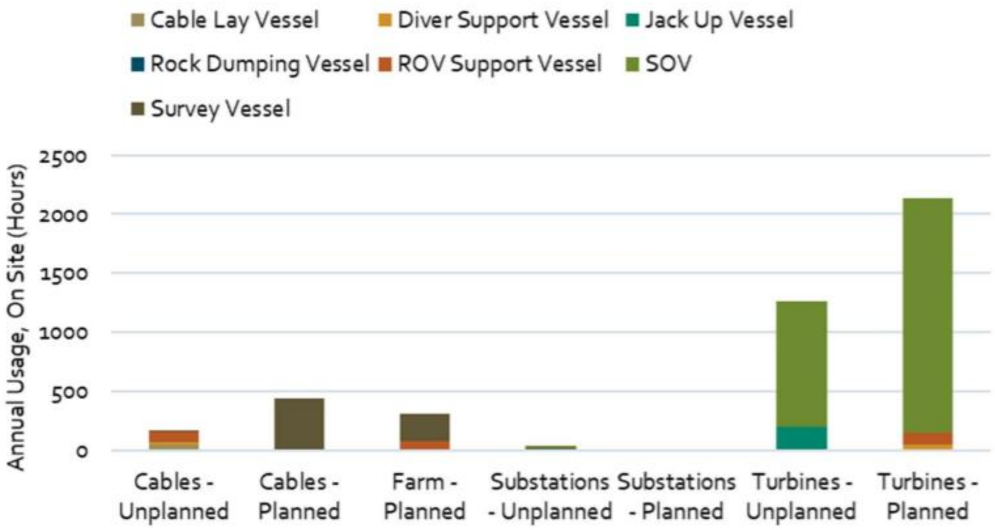

Figure 11 Vessel usage (without transit times) by asset and planned/unplanned maintenance type for scenario 2

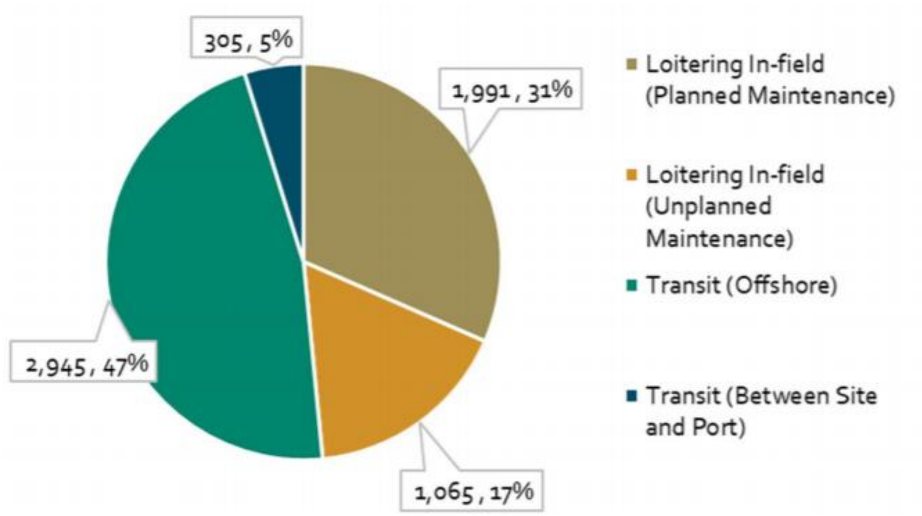

Figure 12 SOV annual usage, including transit time (Hrs) Scenario 2

5.5 Modelling limitations

For further information on the modelling analysis and results please refer to the recent report by the ORE Catapult on 'Setting a benchmark for decarbonising O&M vessels of Offshore Wind Farms'[17]. A

[17] https://ore.catapult.org.uk/analysisinsight/setting-benchmark-decarbonising-om-vessels-offshore-wind-farms/

number of limitations are however worth noting that could affect vessel usage in terms of both time and duration of operations:

- No inclusion of weather downtime – i.e. periods when a vessel is idling and waiting on suitable weather to undertake an operation.
- No inclusion of increased maintenance towards later life.
- No inclusion of the 'mothership' concept, where an SOV operates in conjunction with CTVs.
- No accounting for future vessel emissions reduction strategies that may affect vessel type used.
- No inclusion of more advanced O&M techniques – i.e. autonomous underwater vehicles etc. that may affect future vessel type used.
- Analysis is focused on fixed wind installations with monopile foundations. Floating wind opportunities will rely on different operation patterns of vessel usage and utilisation.

6 Conclusions

The rapidly evolving SW FLOW market offers a significant opportunity for vessel utilisation, construction, servicing and maintenance.


Figure 13. ELA Offshore accomodation container

Evolving floating wind opportunities will rely on different staging areas for O&M operations in closer proximity to prospective development sites. Significant vessel operations will be required but turbine scale, wind farm capacity, deep water deployment areas further from shore and alternative foundations and fixing structures utilising anchoring and mooring will directly affect vessel selection and utilisation. Further research would be needed to quantify these variations in vessel type and utilisation patterns for FLOW.

As noted by 4coffshore 'The last 10 years has seen the crew transfer market expand significantly with a steady evolution in design as the operators work to become more competitive. While new and better vessels keep entering the market, some are leaving as they are no longer fit for purpose.[18]' The increasing scale of offshore wind farms and turbine capacities, which are also moving further offshore, will likely lead to changes in operational strategies for offshore wind O&M support. The requirement for floating offshore wind will also develop as designs are optimised and large commercial projects are installed, with learning gained from experience. SOV and helicopter support is becoming more commonplace, reducing the needs for CTVs. As a result CTV demand is across the fixed and floating wind market is stabilising despite the increasing offshore wind capacity coming online.

[18] https://www.4coffshore.com/support/an-introduction-to-crew-transfer-vessels-aid2.html

The future will also see further variations in offshore wind O&M strategies with the introduction of fixed and floating accommodation platforms which will have a direct impact on vessel selection and levels of utilisation. We are also starting to see the development of offshore multi-purpose service platforms for the offshore wind industry. These could displace or limit a number of CTV and SOV functions, as they would provide on-site accommodation, parts transfer and charging stations as well as a launch base for autonomous systems.[19] The further introduction and evolution of Robotics and Autonomous Systems (RAS) into offshore wind development may also change vessel type and utilisation patterns as we start to see fully autonomous robotic inspection and repair solutions for offshore wind farms, for example[20]. The introduction of RAS could be a strong driver for change in vessel use patterns backed by a strong cost and carbon reduction case as well as the ability to take humans out of hazardous offshore environments. The MIMRee (Multi-Platform Inspection, Maintenance and Repair in Extreme Environments) project for example is expected to save the average wind farm approximately £26 million over the course of its lifetime.

Figure 14 MiMRee, ORE Catapult 2020

It is also worth considering changing vessel servicing and maintenance requirements as we start to see a switch from utilising diesel for the primary propulsion fuel to electric and hydrogen hybrid and full engine systems. This is being driven by climate change commitments and moves to reducing marine pollution. The most recent study by the International Maritime Organisation (IMO) estimates that international shipping accounted for 2% of global CO_2 emissions in 2019.[21] If no further action is taken then estimates from the IMO suggest that the CO_2 emissions from international shipping could grow by between 50% and 250% by 2050[22], and a study for the European Parliament suggests that international shipping could account for 17% of global CO_2 emissions by 2050[23]. The UK Clean

Figure 15 World's first hybrid pilot boat, Port of London 2019

[19] https://www.offshorewind.biz/2021/02/03/fugro-developing-offshore-drone-base-for-wind-farm-maintenance/?utm_source=offshorewind&utm_medium=email&utm_campaign=newsletter_2021-02-04
[20] https://ore.catapult.org.uk/press-releases/mimree-inspection-repair-solution/
[21] International shipping - Fuels & Technologies - IEA
[22] IMO (2015): Third IMO GHG Study 2014: http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/ Pages/Greenhouse-Gas-Studies-2014.aspx
[23] European Parliament (2015) Emission Reduction Targets for International Aviation and Shipping: http://www.europarl. europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU(2015)569964_EN.pdf

Maritime plan 2019[24] is driving ambitions for zero emission shipping to be commonplace globally by 2050 and wants the UK to have taken a proactive role in leading this transition. The plan includes a statement that all new ships for UK waters ordered from 2025 should be designed with zero-emission capable technologies. Whilst a switch in fuel type and propulsion systems may initially create difficulties for servicing and maintenance provision, akin to what we have seen in the electric vehicle sector, it also offers an opportunity for new, proactive businesses to take advantage of this expanding market.

This report has focused on vessel type and utilisation for offshore wind O&M activities. Prior to wind farm construction, extensive project development, consenting and licensing activities require vessel use for surveying, including environmental condition assessments and geotechnical surveys. A number of ongoing monitoring requirements would also require survey vessel use across the project lifetime. Again, vessel sizes vary with manufacturer but could be of interest to Mevagissey Harbour. Fugro for example provide four standard deep-water service vessels under 70 m.[25] Whilst target areas for future offshore floating wind in the SW have been identified earlier in this report, further research would be required to quantify prospective vessel type use and utilisation for surveying and monitoring. In considering future vessel use for this activity it is also again important to understand the prospective use of alternative technologies such as Unmanned Aerial Vehicles (UAV's) and satellite derived data that may displace more traditional vessel use.

Figure 16 Fugro Brasilis, LOA 66.65m

We hope the information contained in this report is useful for Mevagissey Harbour, and we would be happy to discuss any further research considerations that could be supported through the Marine-i programme or other ORE Catapult services.

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24 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

25 https://www.fugro.com/about-fugro/our-expertise/vessels-and-jack-up-barges/survey-vessels

Appendix 1 Extract from 4coffshore wind farm service vessels report

Extract from 4coffshore wind farm service vessels report that is worthy of more consideration. This report analyses the strategies currently utilized and those known for future projects in order to provide insight into the demand for CTVs and SOVs for the period 2015 to 2024.

'4coffshore provide industry level support and information for the offshore wind sector including specific vessel utilisation support. This includes **a new premium service level report for Wind** Farm Service Vessel subscribers which includes access to a highly detailed supply and demand report for Crew Transfer Vessels (CTVs) and Service Operations Vessels (SOVs).

Reports provide a detailed look at the Wind Farm Service Vessel (WFSV) market for offshore wind. The depth of analysis is unrivalled and provides valuable strategic insight for vessel operators, shipbuilders, investors, wind farm operators and other organisations in the wind farm operations supply chain.

The regulations facing CTVs are considered along with the changing designs of vessels and the lengths and types of vessels (classed versus non-classed and hull type, for example) being introduced. Using a database of contracts and vessel activity spanning two years, an analysis of vessel utilisation is provided, identifying the utilisation rates of the leading operators from the 350-strong fleet. The trend in utilisation by Length Overall (LOA) is investigated, with the number of vessel days apportioned by LOA for the past two years. The increasing trend in mean LOA per contracted day is quantified.

As expected, seasonal changes in utilisation of CTVs are apparent and a trend of increasing fragmentation - market share is divided amongst an increasing number of vessel operators. The expected monthly utilisation rate for new vessels entering the market is estimated to be between 15-22 days. The number of WFSV days by country of origin is provided, as is an LOA profile of the vessels active in different countries, plus LOA profiles of different operators. Shipyards are considered, with an overview of those who have successfully entered the market in the last two years.

Recently several operators and a turbine Original Equipment Manufacturer (OEM) have made commitments to using SOVs on several German and UK projects. These vessels offer increased technician productivity at high levels of comfort. An overview of the use of SOVs past and future, the vessels and project characteristics is provided and used as an evidence base for forecasting future SOV demand.

Progress to date in the European offshore wind industry is analysed and compared to projected future growth to 2024 based on 4C's mid-case scenario. Between 2015 and 2024 year on year growth of 12.5% is forecasted with a breakdown given by country. Additionally, the volume of offshore wind capacity in the pipeline for each major market is considered in terms of project demand. All future oriented projections of demand have been carefully estimated through a combination of top down offshore wind policy and contextual analysis plus bottom-up scrutinization of project progress. This provides a credible pipeline of projects scheduled to meet realistic goals.

For each project in this realistic pipeline the number of CTVs and SOV(s) has been modelled using real data on vessel numbers and operations strategies (e.g. CTV, helicopter, platform, SOV) as inputs, thereby providing credible estimates. Demand is classified by year, country of origin and distance from operations port to 2024. CTV supply and demand is compared and the number of classed vessels available at the end of 2014 and 2015 is also provided, allowing for comparisons with country-based CTV demand.

SOV demand shows steady year on year growth to 2024. The report provides details of which projects are likely to require SOVs and highlights further projects that may require SOVs but were narrowly excluded by the selection criteria.' (4coffhsore, 2021)

You can view the sample data for the Wind Farm Service Vessel's report HERE.

Appendix 2 Sample CTV and SOV data sheets

https://www.royalihc.com/-/media/royalihc/products/offshore/offshore-support/datasheet-sov-t3814.pdf - SOV data sheet

https://secureservercdn.net/160.153.138.177/n01.od2.myftpupload.com/wp-content/uploads/2020/10/22083_Bibby-Wavemaster-Horizon-Updated-2020.pdf

https://www.esvagt.com/fleet/wind-service-operations-vessels/njord/

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