4C Offshore Limited,
Orbis Energy Centre,
Lowestoft,
NR32 1XH

T: +44 (0)1502 307 037
E: info@4coffshore.com

# Associated British Ports (ABP)

## Assessment of Trends in the European CTV Market

MHO Esbjerg—new generation CTV on Hornsea Project One © MH-O&Co

# Table of Contents



| | |
|---|---|
| Revision | Draft A2 |
| Changes | |
| Date | April 5th 2019 |
| Prepared | Richard Aukland, Tugce Sahin, Vasilis Markatsalis, Bridget Randall-Smith, Sue Allen |

Checked and approved by Richard Aukland

# 1 Introduction

4C Offshore were engaged by ABP East Anglia to perform a short study into the European Crew Transfer Vessel (CTV) market for offshore wind farms. Specifically this included;

- The growth of the CTV fleet
- Changes in size, length, beam and air draught over time
- Changes in the number of passengers or technicians carried
- Investments in CTVs by year
- Given the nature and distance of the projects off Lowestoft, the largest size of CTVs that would be engaged
- Information on how the sector will grow between 2020-2030, with insights into growth beyond this period.

# 2 Growth and Investment in the CTV Fleet

CTVs are used to transfer personnel and equipment as part of the logistics mix for an offshore wind farm, both during the construction, and the operations phases. More details on the types of activity requiring a CTV are provided below in Figure 1.

| Activity and Frequency | Description |
|---|---|
| Routine inspections of the WTG<br>Weekly, if not daily | Routine servicing, maintenance and fault finding of the turbine. Involves routine lifting operations of tool kits using small platform or vessel mounted cranes. Teams of 2-8 people are deployed to turbines to undertake inspection or works. Inspections can be both internal and external to the turbine or substation.<br>Examples including bolt torqueing, electrical investigative works and exchange of smaller components. |
| Minor repairs, replacements or retrofits not requiring use of a jack-up.<br>*Weekly, if not daily* | Normally such repairs, which do not require specialist lifting or vessels are undertaken as part of routine activities. 95% of electrical and mechanical repairs and replacements are enclosed within the WTG structure. |
| WTG Painting<br>*Full campaign every 10 years, remedial every 5* | Repainting of WTG/substation and transition pieces to prevent corrosion. Boat landings, climbing ladders and push on locations are prone to wear by boat fenders and personnel transfer. Work is performed by rope access specialists. |
| Personnel and equipment transfer during operations<br>*Daily (for periods)* | Transfer of technicians, equipment and consumables between CTVs to turbines or other vessels in support of more significant works. E.g. to cable vessels or jack-ups performing significant repairs such as; replacement of access ladders, replacement of WTG anodes, j-tube repair or replacement, cable protection by rock placement etc., scour protection installation, WTG main component replacement (e.g. generator, main bearing, blade), array cable remedial burial, cable repair and replacement, blade repairs |
| Personnel and equipment transfer during project construction<br>*Daily (for year or more)* | Transfer of technicians, equipment and consumables between CTVs to turbines or other vessels in support of installation. |
| Removal of guano and marine growth<br>*Above water: Every two years*<br>*Subsea: every 10 years* | Physical removal using a brush of bird waste and marine growth from turbines, substations and foundations, both above and below the water line. Performed using pressurised sea water and a brush with CTV support. Below the water line a DP2 vessel, ROV and rope access would be required. |

Figure 1. Uses of CTVs on offshore wind farms

4C Offshore maintains a database of all vessels active or in development for the global offshore wind sector. This database is maintained via regular contact with vessel operators and shipyards. Individual vessels are scrutinized on a regular basis and tracked as they enter and exit the sector. At the end of 2018 a pool of around 350 CTVs were available for work in Europe, with 321 successfully securing work during the year. 120 CTVs that have been positioned within the sector have since retired or are engaged elsewhere. Both operational and retired boats are presented in Figure 2 to demonstrate the scale of continued investment. As shown in Figure 2 over the period 2006 to 2019 the number of CTVs has shown an 18% Compound Annual Growth Rate (CAGR) with a cumulative £1 billion associated investment.

As the industry progresses and projects move further offshore the investment in individual vessels increases. Whereas a 21m LOA CTV will cost around £1.5-2.5 million the longest 30m+ CTVs are costing around £7 million or more. Using a simplified length-cost model the cumulative investments to date are shown in Figure 3.

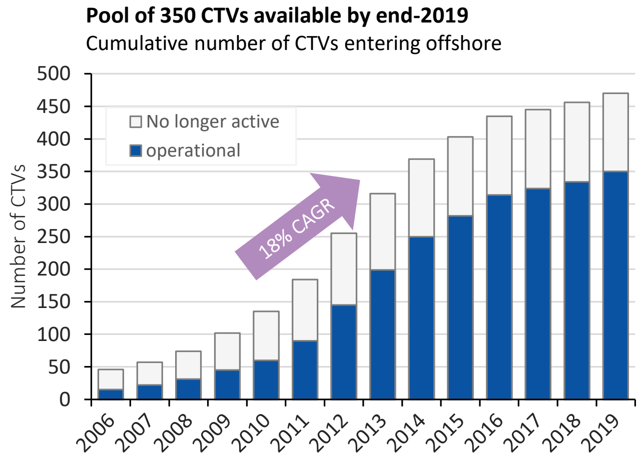



Figure 2. Cumulative number of CTVs entering the European offshore wind market.

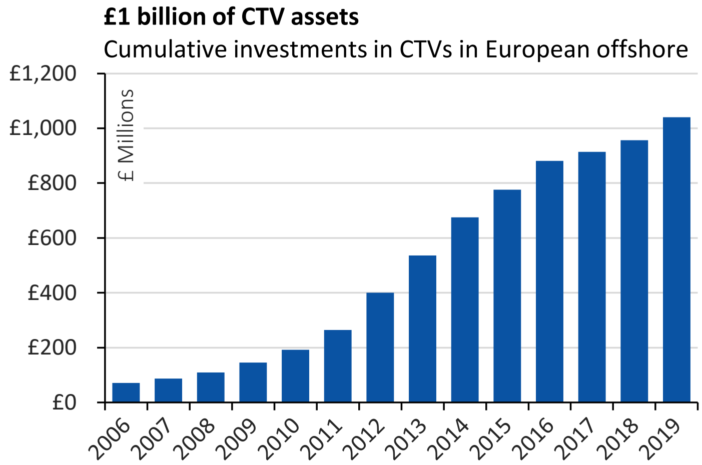



Figure 3. Cumulative investments in CTVs across the European offshore wind sector

# 3 Evolution of CTVs

## 3.1 LOA and Beam

The earliest Round 1 offshore wind farms in the UK are being served by purpose built catamarans, such as the *Eastern Aura* (Figure 4) owned by E.ON and operated by North Sea Services, which has provided long term support to O&M on Scroby Sands, 3km from shore off Great Yarmouth since 2010. The 16.8m LAO aluminium hull CTV has a beam of 6.4m. Sometimes referred to as 1st Generation CTVs, these are typically found at nearer shore, older projects, often with smaller turbines (below 6MW) than those installed on the newest projects.

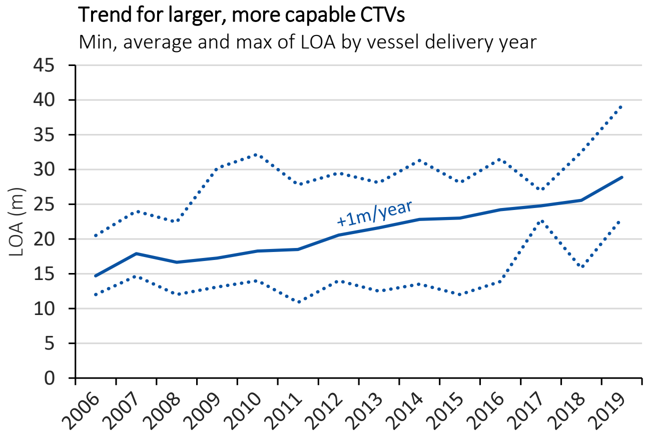
From Round 2, projects have been located further offshore, with associated higher sea states requiring longer, more stable vessels in order for safe transfer of technicians to turbines. Also, as projects grew larger and the industry began to mature and drive down costs, it was necessary to engage larger more capable CTVs during the construction phase to ensure that the capital intensive installation process was not constrained by crew and equipment transfer. Consequently, over time vessels grew to around 26m (Figure 5), with higher bridges to see over on-deck equipment. Sometimes these are referred to as 2nd Generation CTVs. For example, *Seacat Courageous* (Figure 4), introduced in late 2016 is a 23m DNV-GL class CTV designed to carry up to 24 passengers.

Typically, the demands for carry equipment and the preference for capability over economy has meant wind farm developers and installers are more likely to contract larger CTVs during the construction phase (Figure 6)

The very largest, furthest projects from shore in The Crown Estate's current portfolio have recently entered the construction phase. Both East Anglia ONE and Hornsea Project One have secured CfDs (a stable revenue source) and are underway. During 2018 the average LOA for CTVs deployed on these sites was 24m and 27m respectively, showing the projects are engaging the most recent builds. In early 2019 Ørsted engaged new-build *MHO Gurli* on a long-term contract to end-2019 to assist with installation and commissioning. This 39.2m LOA vessel with 13.8m air draft has been designed to allow efficient transfer of technicians and equipment in harsh weather conditions, when other CTVs could be unable to operate. A second identical *MHO Esbjerg* (Figure 4) vessel is currently undergoing sea trials and will also serve at Hornsea Project One.


Figure 4. Examples of CTVs introduced to the offshore wind sector. From left to right; *Eastern Aura (16.8m, 2010), Seacat Courageous (23m, 2016), MHO Gurli (39.2m, 2019)*

30m+ CTVs are new in 2019 to the UK market but have been used on far-shore German North Sea projects for several years. Examples of existing and forthcoming 30m+ CTVs for the German market include; *World Bora*, *World Calima*, *FOB SWATH 7,8,9 and 10, WMO 1 and 2*. As the UK projects are built in further offshore locations such vessels are likely to become increasingly common.



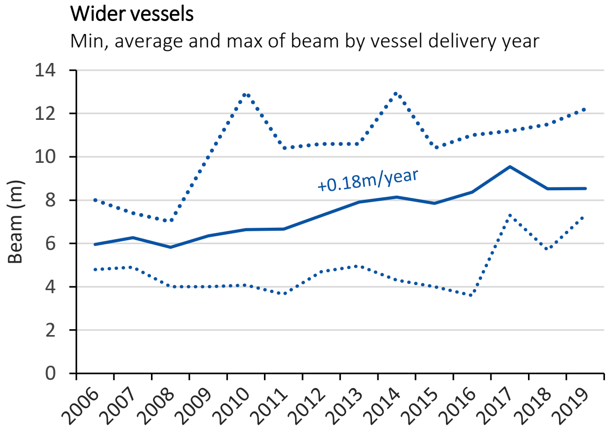




Figure 5 Trends in LOA and Beam for vessels introduced into the offshore wind market

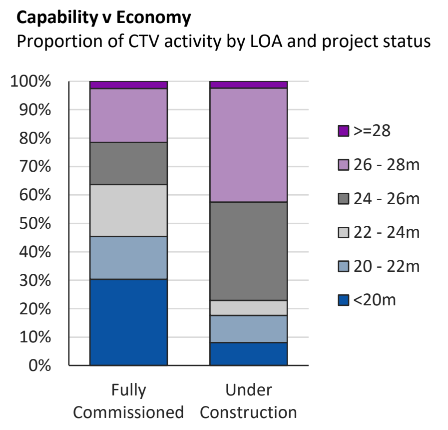



Figure 6. Proportion of CTV activity by LOA; comparing vessels used during operations and maintenance (fully commissioned) and construction stages of a wind farm.

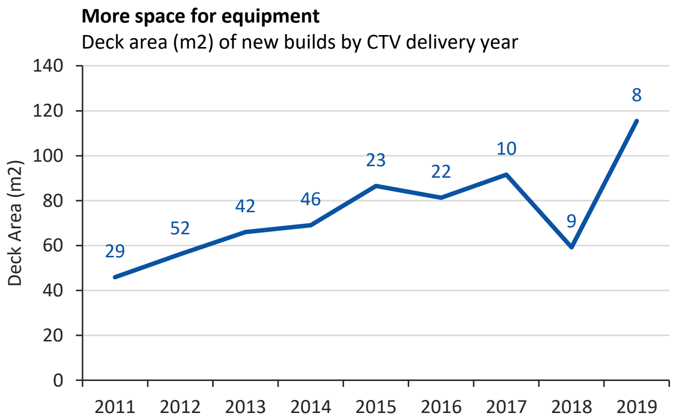



Figure 7. Increasing deck space on new CTVs, showing number of vessels for which deck space data is available.

Whilst there is no clear delineation by which to classify the evolution of CTVs and it is better thought of as a continuum, Figure 8 below shows a scale comparison of the types discussed above, namely a 1st generation CTV designed for early wind farms, a recently introduced 24-pax 2nd generation CTV and the very latest CTV supporting construction at Hornsea Project One.

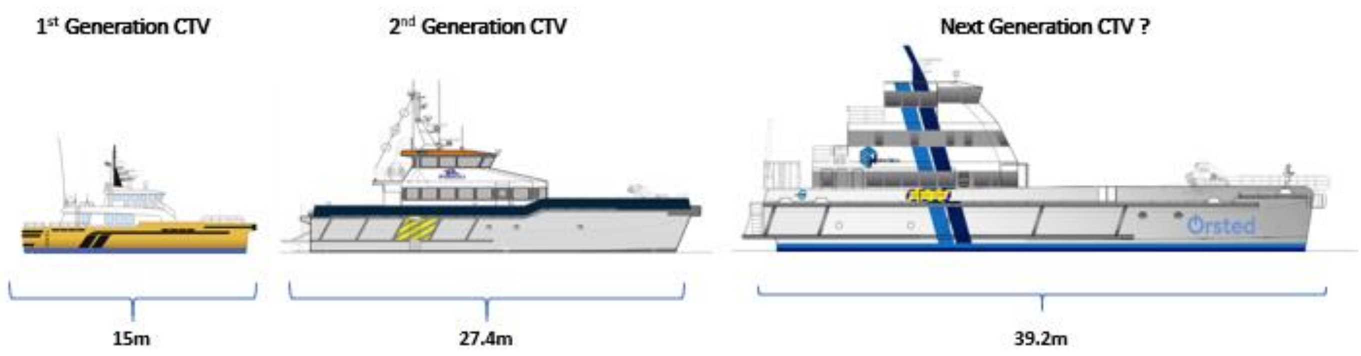



Figure 8. The growth in CTV sizes; a scaled schematic of three generations of vessels operating in UK waters.

## 3.2 Air Draught

The general CTV design has a wheel house as the upper-most structure and a mast, aerial and potentially whip aerials affixed on the top of the wheel house. Details on air-draft are generally not available on published specifications so the following process has been undertaken to collect measurements;

1. Leading CTV operators were contacted and requests made for the air draft of each vessel, notably
    a. The *air draft of the upper most structure,* measured from the waterline to the top of the wheel house when the vessel is not loaded, and
    b. The *maximum air draught* measured from the waterline (when the vessel is not loaded) to the highest point of the vessel, including mast, antenna or aerials.
2. Where information was not forthcoming or unavailable in the time constraint above, or considered erroneous, the maximum air draft has been taken from scale drawings or quality photographs of the vessel, calibrating measurements against known dimensions.

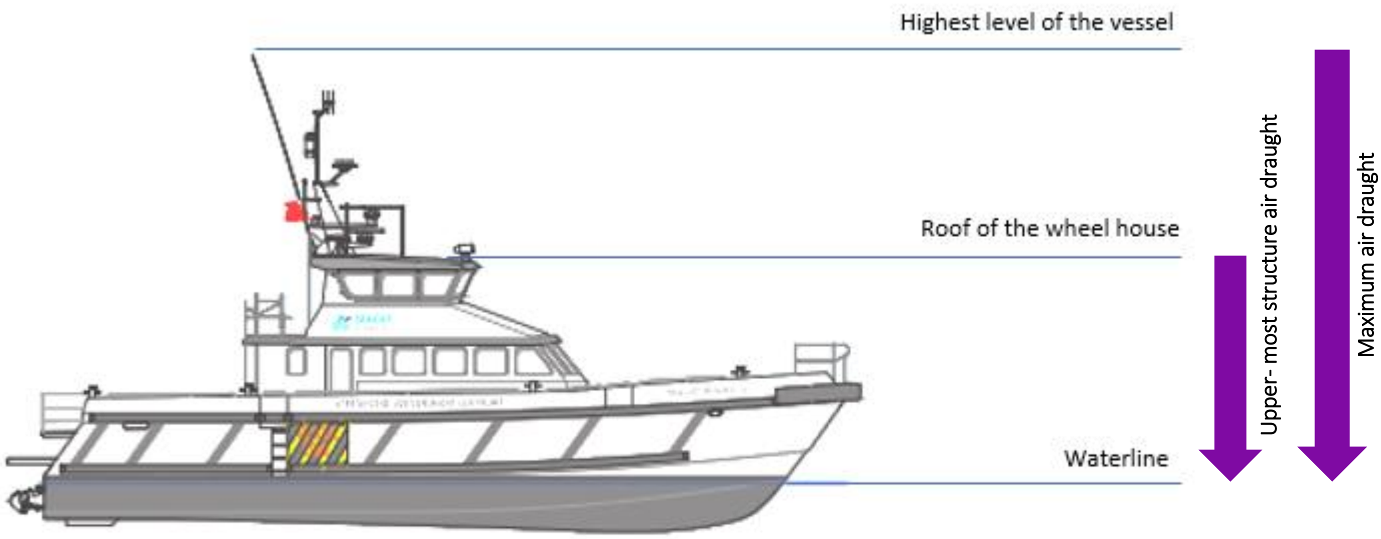



Figure 9. Illustration of CTV air draught measurements obtained

Whilst in discussions with operators they were questioned as to the practicality of folding down protruding aerial, whip aerials or masts so as to reduce the air draft requirements. Similarly, they were questioned as to their expectations of future air draft requirements. Responses are presented below in Figure 9.

| OPERATOR | COMMENT |
|---|---|
| CWIND | Majority of masts and aerials are collapsible/ can be lowered down. Foresee an increase in air draught as vessels get bigger. Their 27m vessel has an air draught of 10-15m, there will be an increase in demand for collapsible masts/aerials as vessel size increases. (9 CTVs) |
| DIVERSE MARINE (Shipyard) | Fully classed vessels are required to have 'whip aerials' to a height of around 10m or more. It is not possible to lower or remove these aerials on a daily basis as it would need crew to work in unsafe conditions and the aerials are heavy needing several people to handle them. The removal or lowering the whip aerials is normally only carried out during a dry docking. The whip aerials could be removed but this would take the vessel out of class. |
| NJORD OFFSHORE | The aerials cannot be folded down. The air draught very much depends on the restrictions on the site but the vessels are getting bigger and the height of the vessels is increasing. There are reasons to increase the height but no reason for reduction. (19 CTVs) |
| NORTHERN OFFSHORE SERVICES | Aerials tend to be fixed so would be an issue to remove or fold down. Mostly the vessels operate in ports where there are bigger ships so air draft has not been a consideration. Future vessels are likely to be bigger so the air draft will probably increase in line with this. (34 CTVs) |
| OFFSHORE WIND SERVICE A/S | The aerials are collapsible and it would not be a problem to fold them down twice a day and would not damage anything. It is an easy thing to do. The air draught of the new 32.5 m vessel is 13 m and not expecting any higher vessel than existing one. It has reached the highest point. (4 CTVs) |
| SEACAT SERVICES | Some of the vessels' aerials can be folded down but they need a crane to lower the aerials which is not favourable to do. Not expecting huge differences but air draught will need to increase slightly. The new boats are designed for 24 passengers which means more room needed for the crew inside the wheel house and upper-most structure needs to go up. Also, the boats are getting longer which triggers the higher air draught. Another important point is visibility; the equipment and containers are getting bigger and restricting the sight. For better visibility higher wheel houses are needed. The new build 24m Chartwell vessel has 11.25 m maximum air draught. (14 CTVs) |

| | |
|---|---|
| TURBINE TRANSFERS LTD | No, it is not easy to fold down anything to reduce the air draught. The movement, the vibration and the acceleration are really high up on a CTV at sea. It means, everything has to be built really solidly and be mounted up. (24 CTVs) |
| TURNER ICENI | Aerials are not collapsible; they have to be removed and then re-installed which is not ideal. Expecting their CTVs to be built similar to existing vessels, does not envisage much change in air draught unless deck increases and additional air draft would be required to sustain visibility. (9 CTVs) |
| VROON OFFSHORE | All the masts are fixed and they cannot be removed. Aerials can be removed but this is not something which could be done every day and air draughts are increasing as vessels within the sector get bigger. (12 CTVs) |
| WINDCAT WORKBOATS | Aerials can be taken down but it is not something that would desirable to do on a daily basis. Not expecting an increase in the future for new vessels as they believe that have found the optimum design for their vessels. (41 CTVs) |
| WORLD MARINE OFFSHORE | The aerials are partly collapsible. The collapsible antenna goes 0.5-1 m above the fixed radar. It is not a hard process to fold it down but it has to be done at the port. That's why not it is not suitable to fold it down several times in a day. Antenna should therefore be considered a fixed structure. In general, the tendency is for bigger and higher boats and there is no foreseen issues associated with this trend. (11 CTVs) |

*Figure 10.Summary of Operator's comments and the number of vessels which contributed the dataset*

Based on the above feedback that the aerials, mast, antenna are generally not collapsible or that it would be unfavourable, the maximum air draught is taken as the reference point when assessing vessel characteristics.

Most service providers responded with expectation that air draught will increase slightly in the future in response to longer vessels for transporting more passengers, requiring a bigger and higher wheel house. Similarly, as the industry introduces larger turbines and foundations, the demand for carrying larger containers on deck is inevitable, restricting the sight and consequently the air draught due to necessity of a higher wheel house. Evidence clearly shows a requirement for increasing deck space in more recent vessels (Figure 7)

4C received responses, or have confidently estimated maximum air draft clearance (i.e. including whip aerials etc.) for a total of 187 CTVs. This includes the top 10 operators plus some easily accessible figures from other operators plus the few 30m+ vessels (in order to understand the top-end of the range). This dataset covers 88% of the CTVs owned by the top 10 operators. For the remaining 12%, no information has been obtained from operators, and no reliable imagery from which to estimate air-draught has been identified.

Results are shown in Figure 11, providing the proportion of CTVs that have less than the specified air draught. Note that no safety margin clearances are included in the assessment; air draught is the maximum vessel air draught.

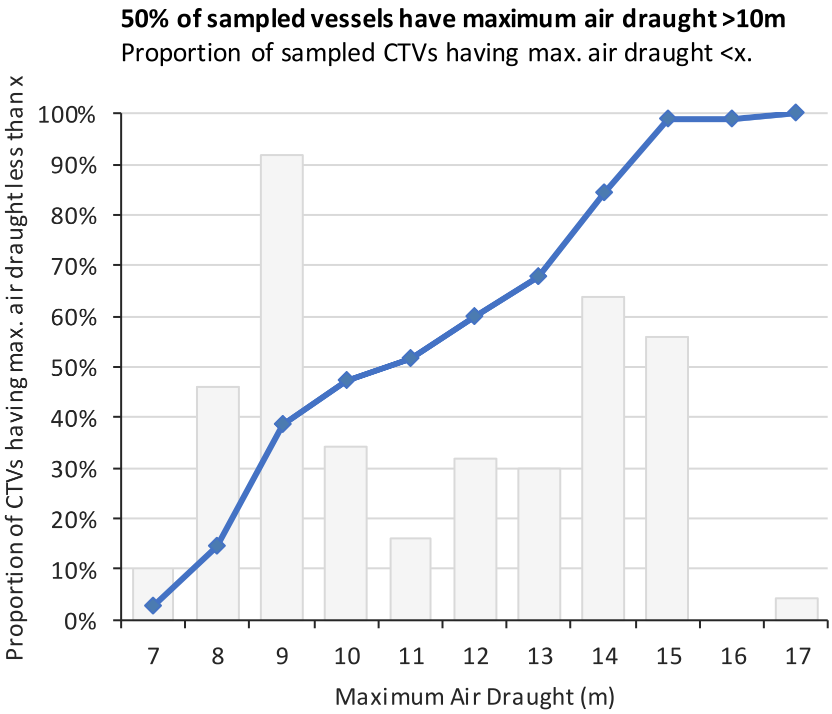



Figure 11. Proportion of CTVs in the sample (n=187) having air draught less than x. For example, around 60% of vessels have a maximum air draught less than 12m. The background histogram shows the shape of the distribution

# 4 Impacts of Changes in the Number of Technicians

Until recently CTV owners providing services in the UK were constrained by the MCA Workboat Code to transporting crew and up to 12 technicians. A vessel with more than 12 passengers was categorised as a passenger ship and was required to comply with more onerous IMO regulations (SOLAS and Load Line conventions for vessels of 24m load line length or longer) covering every aspect of ship construction and operation; a costly process likely to be uneconomic for most crew transfer work. The IMO convention is designed to protect 'passengers' as they are usually referred to in the context of cruise liners, ferries etc., a definition which is less suited to offshore wind technicians who are trained, fit and experienced seafarers with a lower risk profile than normal passengers.

Figure 12 A selection of vessels of 24 pax. From left: *Sure Diamond, Windcat 41, Rix Leopard, MHO Gurli*

In response to industry requests to transport additional technicians, UK's Maritime and Coastguard Agency (MCA) has introduced an HS-OSC Code for high speed offshore service craft of up to 500GT carrying up to 60 persons on board, limited to 36 persons for craft of less than 24m load line length. Based on the existing HSC Code for cargo vessels, the HS-OSC Code provides a set of exemptions for safety in recognition that the windfarm technicians are industrial personnel. Technicians must conform to medical, training and safety equipment requirements before being considered *Industrial Personnel.*

CTV operators wishing to build new, or convert existing vessels to the HS-OSC code can have vessels certified by their Local Marine Office or other MCA Recognised Bodies. The new code has seen several CTVs launched with capacity for 24 industrial personnel (pax). Examples are shown in Figure 12.

Across Europe the number of CTVs qualified to carry more than 12 technicians has increased continuously from 7% of all new builds in 2010 (n=15) to 73% by 2019 (n=14). The length implications of carrying additional technicians is shown clearly in Figure 13 , with the majority having a LOA over 25m. Similarly, there is a clear increase in air draught amongst CTVs carrying more than 12 passengers as shown in Figure 14, where the average air draught in the sampled vessels is 13m compared to 10m for CTVs carrying 12 technicians.

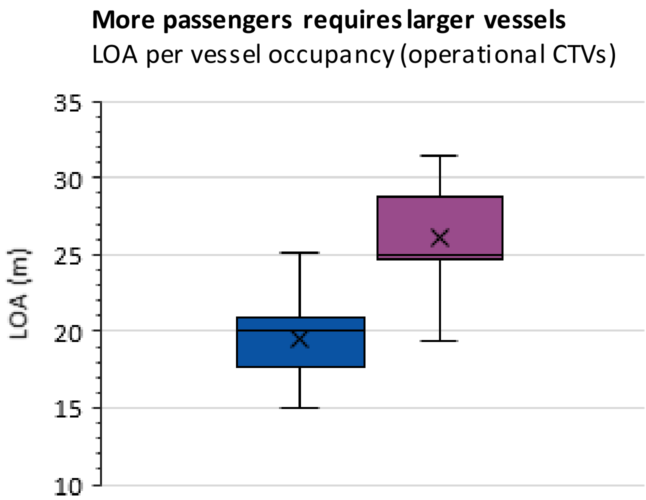



Figure 13 Impact of carrying more than 12 technicians on vessel size. Data summary for the whole operational fleet of 350 CTVs.

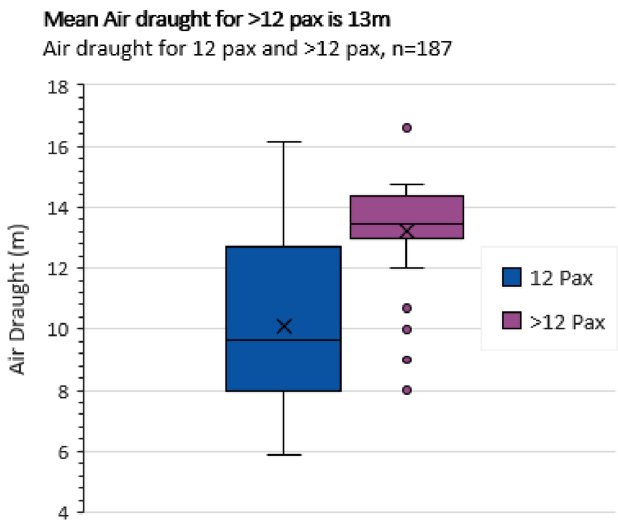



Figure 14 Impact of carrying more than 12 passengers on vessels air draught

# 5 Expected Future Characteristics of CTVs off East Anglia

As discussed above, further offshore projects are using longer, wider and more capable vessels (Figure 5). In 2018 during both construction and operations, the mean CTV LOA for European projects ranged from 20 to 25m (Figure 18). The East Anglian offshore wind projects are located between 32 to 90 km from shore and under today's pattern of deployments would be expected to engage CTVs with an average LOA of between 22 and 25m. As shown, East Anglia One used CTVs with a weighted average LOA of 23.6m in 2018. Also local to Lowestoft, the Galloper project, despite being closer to shore deployed slightly longer vessels, averaging 23.8m.

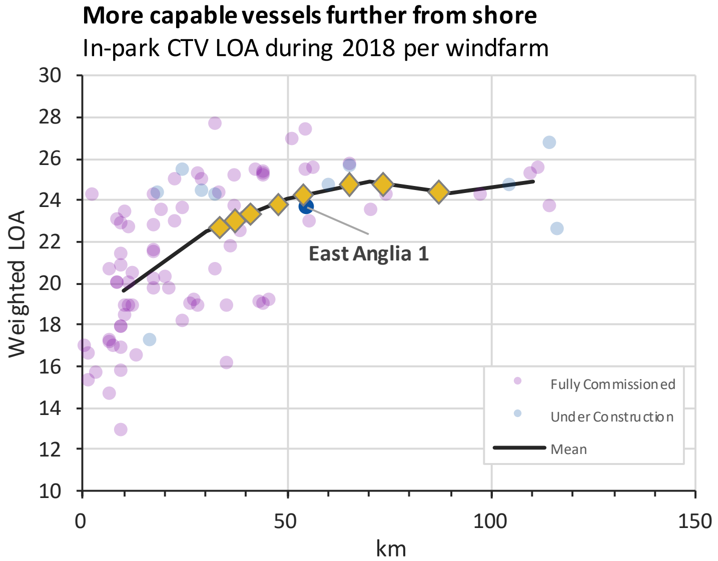



Figure 15.Longer vessels are being used at far-shore sites in 2018. Yellow marks represent the East Anglia Region projects

However, the range 22-25m is today's *mean* value and would include vessels both longer and shorter than this. Expectations are also that this mean value will increase for future projects, as the length of newer vessels increases (Figure 5). Furthermore, there is evidence of a potential step-change in future vessel sizes. 1.2GW Hornsea Project One at 120km from shore is deploying 39m CTVs *MHO Gurli* and *MHO Esberg* with a 13.8m air draught. These vessels have the benefit of performing transfers in unfavourable conditions, widening the available weather window. It is unlikely such long vessels will become the norm given the level of investment recently in the existing fleet, but such 30m+ CTVs can reasonably be expected to form part of the developer's evaluation set when contracting for the logistics mix at far-shore, 1 GW+ scale projects such as Norfolk Vanguard, Norfolk Boreas and East Anglia THREE.

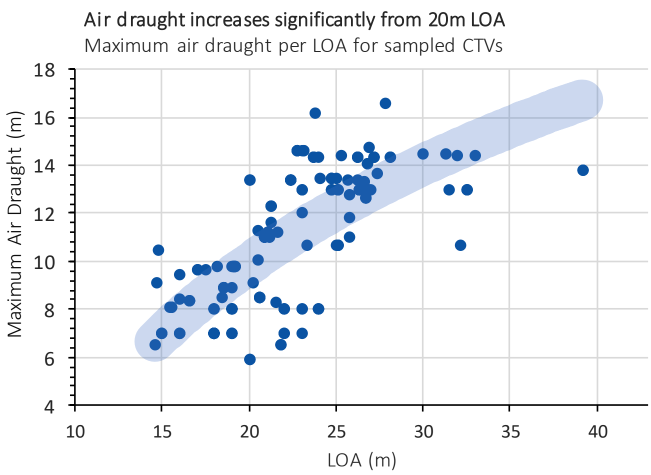
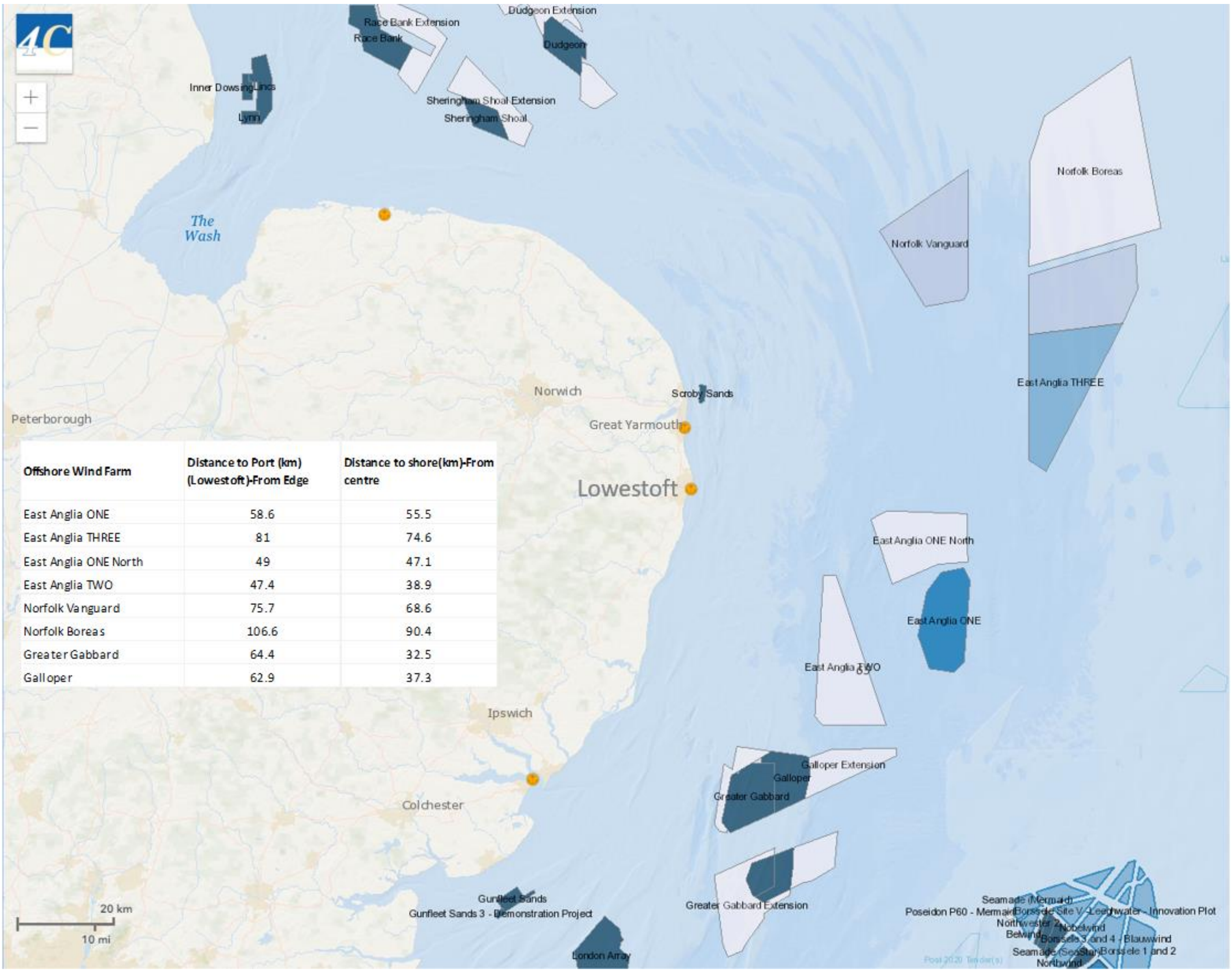



Figure 16. Maximum air draught versus LOA

Given the trend for increasingly longer vessels (Figure 5) and the nature of the East Anglian sites(Figure 17), potential LOA for CTVs contracted to far-shore East Anglia projects are likely increase beyond 25m and up to 40m LOA. The analysis has identified that the mean air draught for 25m LOA is 12m with an 8 to 16m range (Figure 16). The anticipated values for LOA and air draught are summarised below:

| | Under current CTV contracting norms | Under future contracting given the emerging trends |
|---|---|---|
| Mean LOA (m) | 22-25 | 25+ |
| LOA Range (m) | 16-28 | 24-40 |
| Mean Air Draught (m) | 10-12 | 12+ |
| Air Draught Range (m) | 6-16 | 8-16 |

Figure 17. Current and potential future CTV contracting trends at far-shore East Anglian projects




| Offshore Wind Farm | Distance to Port (km) (Lowestoft)-From Edge | Distance to shore(km)-From centre |
|---|---|---|
| East Anglia ONE | 58.6 | 55.5 |
| East Anglia THREE | 81 | 74.6 |
| East Anglia ONE North | 49 | 47.1 |
| East Anglia TWO | 47.4 | 38.9 |
| Norfolk Vanguard | 75.7 | 68.6 |
| Norfolk Boreas | 106.6 | 90.4 |
| Greater Gabbard | 64.4 | 32.5 |
| Galloper | 62.9 | 37.3 |

Figure 18. Map of East Anglian projects showing distance to port from nearest edge of project (km) and distance to shore from centre of the park (km)

# 6 Offshore Wind Growth to 2030 and beyond

Currently 22.9GW of offshore wind capacity is operational or under construction across Europe. This is expected to grow more than three-fold to reach a cumulative total of 86.4 GW, or over 10,000 turbines operational or in construction by 2030. The table below summarises the sources of expected growth for the period to 2030.

The certainty associated with forecasts of offshore wind build-out has increased significantly in recent years due to dramatically falling costs. This has created a very positive political climate for offshore wind, which is now considered the cheapest and most scalable renewable energy source for many coastal European countries. For example, the UK government recently committed to a long-term objective of 30GW by 2030; this 10 year visibility is unprecedented in the UK sector's history.

| Country | Expected Growth | Comments |
|---|---|---|
| UK | **30 GW by end-2030 installed**<br>As of January 2019 the UK had 10.5 GW installed or underway. An additional 20 GW is scheduled to be installed or underway by end-2030 at a rate of ~1.9 GW/year. | In March 2019 the UK government published the long awaited Offshore Wind Sector Deal with goals for 30 GW of capacity installed by 2030.<br>£557m has been made available for allocation via Contract for Difference auctions, the next auction will be held in late May 2019, with future auctions every 2 years. Future budgets will allow at least 1-2GW added annually throughout the 2020s, the upper end reflecting the 30 GW target.<br>There is the potential for further upward revision of this goal in light of potential recommendations from the Committee on Climate Change. |
| GERMANY | **17.2 GW by 2030 installed or underway**<br>As of January 2019 Germany had 7.6 GW installed or underway. According to the 2019 Draft of the Network Development Plan 2030 (NEP) an additional 10 GW is scheduled to be installed or underway by end-2030, to achieve a target of 17GW by 2030, at an average rate of ~1.7 GW/year. 3.1GW has been awarded in the first and second WindSeeG tenders and further tenders are scheduled to be held from 2021. | The government is investigating increasing offshore wind targets from 15 GW by 2030 to up to 20 GW (the "Cuxhaven Appeal 2.0"); the major argument against being onshore grid bottlenecks. In Spring 2019 the federal government is set to pass legislation raising renewable goals to 65% by 2030, and it is hoped an increase in the offshore wind target will be incorporated into law on the back of this.<br>On 30th November 2018, as part of the Energy Saving Act, the Maritime and Hydrographic Agency (BSH) was commissioned to investigate and prepare a framework for the potential expansion of current offshore wind targets beyond 15 GW by 2030.<br>The German offshore wind industry is also lobbying for an additional offshore wind tender to be held in 2019-2020. In early October 2018, the German Coalition Government announced plans for the implementation of an as yet unspecified amount of offshore wind to be tendered in 2019-2020 however, no concrete plans have been announced.<br>Published in January, the Draft Network Development Plan outlined a baseline target of 17 GW by 2030, with more ambitious scenarios of 23.2 GW and 30 GW by 2030. 4C Offshore considers 17 GW to be the most likely target under current legislation. |
| NETHERLANDS | **12.2GW by end-2030 installed or underway**<br>As of January 2019 the Netherlands had 1.1 GW installed. As part of the 2013 Energy Agreement and 2018 Energy Agenda, ~1 GW will be tendered and commissioned per year over the next decade. It is anticipated that 12.2 GW will be operational in 2030. | Early Round 1 (228MW) and 2 (729MW) projects have been fully commissioned. Two projects totalling 527MW are also being developed as part of the SDE+ Wind in Lake tender. In 2013, the Dutch government signed an Energy Agreement for an additional for five offshore wind farms to be commissioned by 2023 totalling 3.66 MW. Tenders for three of the five Energy Agreement sites have been awarded, with tendering for Hollandse Kust Zuid (III&IV) and Hollandse Kust Noord expected in 2019. Under the 2018 Energy Agenda an additional 7 GW of offshore wind will delivered across three zones at a rate of 1 GW per year from 2024-230. |
| FRANCE | **7.5GW by end-2030 installed or underway**<br>France currently only has one 2MW demonstrator turbine in operation. The government is targeting 2.4 GW of installed offshore wind capacity by the end of 2023, 5.2 GW by 2028 with potential for up to 7.5GW by 2030 at a rate of ~0.68 GW/year. | The six wind farms tendered in Round 1 and 2 in 2011-2014 are due to be operational by 2023 with a combined capacity of 2.9GW. Development of these projects has previously been hindered by complex administration hurdles and lengthy appeals processes.<br>Four 24MW floating projects are scheduled to be commissioned by 2021.<br>The latest draft of the governments Multiannual Energy Program (PPE) for the period 2019-2023 and 2024-2028 was published in January 2019. The PPE aims to double the installed renewable energy capacity (102-113GW) by 2028. The PPE has set a tender timeline for future offshore wind tenders totalling 6GW between now and 2028 of which at least 1GW will be floating. The results of the first 500MW fixed tender for the Dunkirk wind farm will be announced later this year.<br>The French Wind Power Federation has since suggested annual expansion of 2.1-2.9 GW could be applied (10 GW by 2028), however due to repeated delays associated with current projects this target is considered unlikely. |
| BELGIUM | **4GW by end-2030 installed or underway**<br>Belgium has an installed capacity of 877MW, with a further 679MW in construction and 706MW pre-construction. 1.75GW is included in post 2020 tenders for build out from 2024. | Belgium is on track to achieve 2.3GW installed capacity by 2020. Ministers have approved a memorandum for tenders for an additional 1.7+ GW post- 2020 within a 281$km^2$ area. This zone was confirmed in the 2020-2026 Marine Spatial Plan, with new wind farms built via a 'smart public tender', with the intention of subsidy free options. |

| | | |
|---|---|---|
| DENMARK  | **5.8 GW by end 2030 installed or underway**<br>Denmark has 1.3 GW of operational projects, the 406MW Horns Rev 3 project is under construction and 949MW of capacity is in pre-construction. A further 2.4GW of government tendered projects are scheduled to come online in 2027-2030. There are also numerous projects pursuing the Danish Open Door Scheme e.g. Omø Syd, Lillebaelt Syd, Fredrikshavn Demo and Jammerland Bugt. | The government has confirmed plans for 2.4 GW of offshore wind capacity across three projects to be tendered in 2019, 2021 and 2023 for commissioning 2027-2030, and has identified potential areas for development.<br>Uncertainty surrounds the open door projects and their competitiveness under the technology-neutral tenders or ability to progress subsidy-free. Developers are optimistic, but are dependent on the Danish Energy Agency processing their applications and some are facing local opposition; therefore only a few projects have been included in the forecast. |
| OTHERS | It is assumed four projects will proceed in Ireland totalling 1.82GW, 430MW in Norway (Havsul & Tampen), 350 MW of floating in the Spanish Canary Islands, 1.7 GW in Sweden, 30MW in Italy, around 4 GW in Poland and 25MW in Portugal. | |

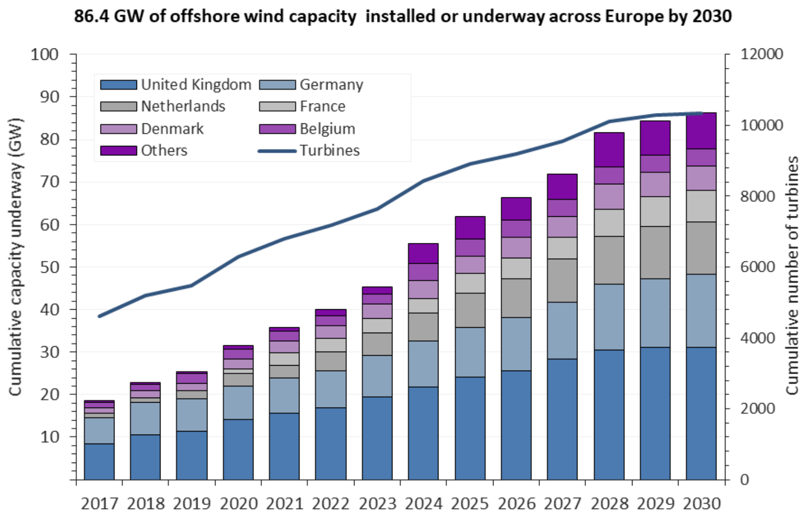



Figure 19 Cumulative capacity of projects and cumulative turbines operating or underway in Europe by country until 2030.

## 6.1 Offshore Wind Post 2030

European countries have set long term decarbonisation goals which include the diversification of the energy mix to incorporate renewable energy generation and a strong emphasis on reducing consumption and electrification. The European Commission recently proposed a comprehensive climate strategy targeting a carbon-neutral economy by 2050 and envisages that more than *80% of electricity will be coming from renewable energy sources by 2050 with generation increasingly located offshore*.

### UK

The National Grid Future Energy Scenarios (FES 2018) show UK electricity demand could grow from 60GW today to reach 85GW by 2050, in part driven by increasing electrification and decarbonisation. The Offshore Wind Industry Council (OWIC) in communications leading up to the sector deal, including the Supply Chain Review (January 2019) have reported that if offshore wind, currently the cheapest form of scalable renewable energy is to provide 50% of the UK's projected demand, then 50GW of installed capacity by 2050 will be needed. Given the finite lifetime of 25 years of offshore wind turbines, repowering of existing sites will be required, meaning the build-out rate of 2GW/year seen during the 2020s would be maintained.


Figure 20 Potential regions under consideration for future offshore wind leasing (The Crown Estate).

In order to prevent a shortage in project supply, The Crown Estate and Crown Estate Scotland will undertake new seabed leasing in 2019 ensuring a sustainable pipeline of new projects which can be built in the late 2020s and beyond. The Crown Estate is progressing with plans for Offshore Wind Leasing Round 4 which will allocate at least 7GW of new sites on a potentially repeatable basis, originally suggested as every four years. The tender round is due to be launched late spring 2019. The Crown Estate Scotland also intends to launch a new leasing round, dubbed ScotWind from July 2019.

## DENMARK

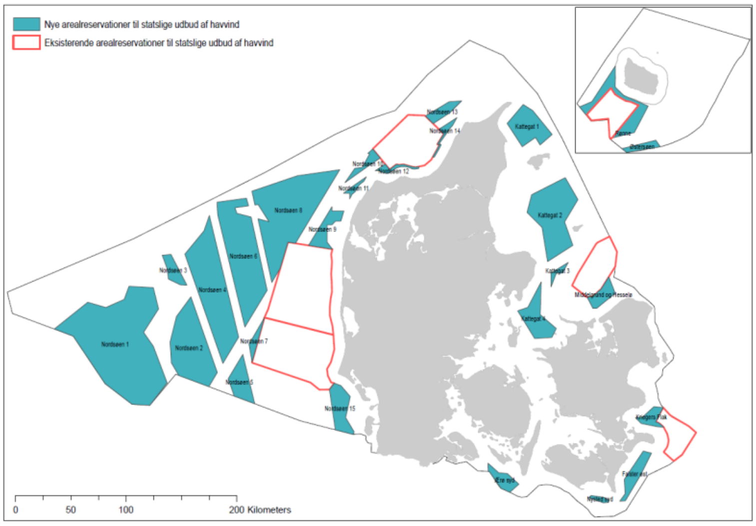



Figure 21 Screening Areas for 10GW offshore wind reservations (Danish Energy Agency)

Denmark is targeting an energy system independent from fossil fuels by 2050 with an intermediate goal of 100% renewables in the electricity and heat sectors by 2035. Under a wind driven scenario 14GW of offshore wind is possible by 2050. The Danish Government has commenced a large-scale screening of Danish waters to identify attractive sites for up to 10GW of offshore wind. Potential areas have been identified in the North Sea, Baltic Sea, Kattegat and internal Danish waters. The reservation was triggered in response to considerable interest from private companies looking to acquire sites for private development. The Government wishes to ensure enough area is reserved for state expansion.

## NETHERLANDS

By 2050, the Netherlands aim to reduce its greenhouse gas emissions by 95%, compared to 1990 levels, with an interim target of 49% reduction in greenhouse gas emissions by 2030. Energy production is also set to be carbon neutral by 2050. At present offshore wind allocations have only been assigned until 2030, the Dutch government aim to designate new zones for offshore wind development in the years to come.

## GERMANY

Germany aims to cut greenhouse gas emissions by up to 95% in 2050, compared to 1990 levels according to the anticipated Climate Action Law. The current drafts of the Network Development Plan (NEP) and Area Development Plan (FEP) include ambitious scenarios for 2035 which target a 70% reduction in $CO_2$ emissions and a goal of 74% of electricity generation from renewable sources of which offshore wind generation totals 23.2 GW in the North and Baltic Seas.

## BELGIUM

Belgium has an overall target of achieving 18.3% of generation from renewable sources by 2030 as well as regional goals to reduce greenhouse gas emissions by 95% in 2050. In the future the government foresees issues associated with the large-scale use of hydropower, onshore wind turbines and solar panels owing to the considerable challenges around land use and public support. Offshore wind has significant potential in the North Sea and Belgium is also working on developing an interconnection network with other countries in the North Sea e.g. ALEGrO and Nemo Link to allow the efficient transfer of offshore renewable energy generation.

## FRANCE

The French Climate Plan, adopted in July 2017, aims to achieve carbon neutrality by 2050. In order to achieve this France intends to improve energy efficiency, halve its energy consumption, and focus on electrification and diversification of the energy mix. France intends to close all coal-fired plants by 2022 and phase out nuclear power and replace with the most competitive renewable generation technology. According to the French Environment and Energy Management Agency (ADEME) the fixed offshore wind potential in France, taking into account limitations related to usage competition, is currently estimated at 16GW and 33GW for floating offshore wind. With the cost of offshore wind declining, France intends to invest in offshore wind particularly commercial floating projects over the next decade and beyond.

# 7 Appendix: Air Draught Specifications

| Vessel Name | Operator | Delivery Year | LOA(m) | Beam(m) | Pax | Maximum Air Draft (m) |
|---|---|---|---|---|---|---|
| CWind Alliance | CWind Limited | 2011 | 19 | 6.1 | 12 | 8.94 |
| CWind Athenia | CWind Limited | 2012 | 18.5 | 6.1 | 12 | 8.94 |
| CWind Buzzard | CWind Limited | 2012 | 18.5 | 6.1 | 12 | 8.94 |
| CWind Endurance | CWind Limited | 2014 | 20 | 7.8 | 12 | 5.90 |
| CWind Endeavour | CWind Limited | 2013 | 18.5 | 6.1 | 12 | 8.94 |
| CWind Adventure | CWind Limited | 2013 | 18.5 | 6.1 | 12 | 8.94 |
| CWind Challenger | CWind Limited | 2013 | 18.5 | 6.1 | 12 | 8.94 |
| CWind Resolution | CWind Limited | 2013 | 18.5 | 6.1 | 12 | 8.94 |
| CWind Fulmar | CWind Limited | 2014 | 20 | 7.8 | 12 | 5.90 |
| Windea One | EMS Maritime Offshore GmbH | 2013 | 25.68 | 10.23 | 12 | 13.38 |
| MO 3 | Mainprize Offshore Limited | 2017 | 23.8 | 11.2 | 12 | 16.15 |
| Marineco Dignity | Marineco UK Ltd | 2012 | 25.75 | 10.4 | 12 | 11.83 |
| MHO Gurli | MH-O&Co | 2019 | 39.2 | 10.3 | 24 | 13.80 |
| MHO Esbjerg | MH-O&Co | 2019 | 39.2 | 10.3 | 24 | 13.80 |
| Njord Avocet | Njord Offshore | 2013 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Kittiwake | Njord Offshore | 2013 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Curlew | Njord Offshore | 2013 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Lapwing | Njord Offshore | 2013 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Petrel | Njord Offshore | 2013 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Puffin | Njord Offshore | 2013 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Skua | Njord Offshore | 2014 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Snipe | Njord Offshore | 2014 | 20.6 | 7.4 | 12 | 8.50 |
| Njord Alpha | Njord Offshore | 2014 | 25.75 | 10.4 | 12 | 11.00 |
| Njord Odin | Njord Offshore | 2015 | 26.3 | 9.2 | 12 | 13.00 |
| Njord Freyr | Njord Offshore | 2015 | 26.3 | 9.2 | 12 | 13.00 |
| Njord Magni | Njord Offshore | 2015 | 26.3 | 9.2 | 12 | 13.00 |
| Njord Thor | Njord Offshore | 2015 | 26.3 | 9.2 | 12 | 13.00 |
| Njord Balder | Njord Offshore | 2016 | 26.3 | 9.2 | 24 | 13.00 |
| Njord Forseti | Njord Offshore | 2016 | 26.3 | 8.9 | 24 | 13.00 |
| Njord Zenith | Njord Offshore | 2018 | 27 | 9.2 | 24 | 13.00 |
| Njord Zephyr | Njord Offshore | 2018 | 26.9 | 9 | 24 | 13.00 |
| Njord NB1 | Njord Offshore | 2019 | 23 | 9.2 | 0 | 13.00 |
| Njord NB2 | Njord Offshore | 2019 | 23 | 9.2 | 0 | 13.00 |
| MV Accomplisher | Northern Offshore Services AB | 2012 | 22.4 | 7.6 | 12 | 13.40 |
| MV Achiever | Northern Offshore Services AB | 2011 | 19.99 | 7.6 | 12 | 13.40 |
| MV Advancer | Northern Offshore Services AB | 2013 | 22.4 | 7.6 | 12 | 13.40 |
| MV Anholt Wind | Northern Offshore Services AB | 2012 | 25 | 5.6 | 12 | 10.70 |
| MV Arriver | Northern Offshore Services AB | 2012 | 22.4 | 7.6 | 12 | 13.40 |
| MV Assister | Northern Offshore Services AB | 2012 | 19.99 | 7.6 | 12 | 13.40 |
| MV Attender | Northern Offshore Services AB | 2012 | 22.4 | 7.6 | 12 | 13.40 |
| MV Backer | Northern Offshore Services AB | 2012 | 20.9 | 7 | 12 | 11.00 |
| MV Boarder | Northern Offshore Services AB | 2012 | 20.9 | 7 | 12 | 11.00 |
| MV Bolder | Northern Offshore Services AB | 2013 | 20.9 | 7 | 12 | 11.00 |
| MV Booster | Northern Offshore Services AB | 2012 | 20.9 | 7 | 12 | 11.00 |
| MV Braver | Northern Offshore Services AB | 2013 | 20.9 | 7 | 12 | 11.00 |
| MV Bringer | Northern Offshore Services AB | 2011 | 20.9 | 7 | 12 | 11.00 |
| MV Builder | Northern Offshore Services AB | 2011 | 20.9 | 7 | 12 | 11.00 |
| MV Carrier | Northern Offshore Services AB | 2013 | 25.75 | 10.4 | 12 | 12.80 |
| MV Defender | Northern Offshore Services AB | 2016 | 26.2 | 9.2 | 24 | 14.35 |
| MV Deliverer | Northern Offshore Services AB | 2005 | 14.8 | 6.3 | 12 | 10.50 |

| Vessel Name | Operator | Delivery Year | LOA(m) | Beam(m) | Pax | Maximum Air Draft (m) |
|---|---|---|---|---|---|---|
| MV Detecter | Northern Offshore Services AB | 2016 | 26.2 | 9.2 | 24 | 14.35 |
| MV Developer | Northern Offshore Services AB | 2014 | 27.2 | 9.2 | 12 | 14.35 |
| MV Discoverer | Northern Offshore Services AB | 2014 | 27.2 | 9.2 | 12 | 14.35 |
| MV Dispatcher | Northern Offshore Services AB | 2015 | 27.2 | 9.2 | 12 | 14.35 |
| MV Djurs Wind | Northern Offshore Services AB | 2012 | 25.1 | 5.9 | 12 | 10.70 |
| MV Doer | Northern Offshore Services AB | 2017 | 26.2 | 9.2 | 24 | 14.35 |
| MV Kattegat Wind | Northern Offshore Services AB | 2013 | 25.1 | 5.9 | 12 | 10.70 |
| MV Performer | Northern Offshore Services AB | 2010 | 16 | 6.4 | 12 | 9.44 |
| MV Preceder | Northern Offshore Services AB | 1975 | 14.59 | 4.75 | 12 | 7.71 |
| MV Provider | Northern Offshore Services AB | 2007 | 14.7 | 6.3 | 12 | 9.12 |
| MV Supplier | Northern Offshore Services AB | 2005 | 20.5 | 8 | 12 | 10.03 |
| MV Supporter | Northern Offshore Services AB | 2009 | 18.2 | 7.25 | 12 | 9.77 |
| MV Transporter | Northern Offshore Services AB | 2009 | 15.5 | 6.3 | 12 | 8.12 |
| MV Voyager | Northern Offshore Services AB | 2008 | 15.5 | 6.3 | 12 | 8.12 |
| MV Wind Supplier | Northern Offshore Services AB | 2010 | 32.2 | 6.5 | 24 | 10.70 |
| MV Wind Supporter | Northern Offshore Services AB | 2007 | 23.3 | 5.4 | 24 | 10.70 |
| MV Wind Transport | Northern Offshore Services AB | 2011 | 25.1 | 5.9 | 12 | 10.70 |
| FOB SWATH 7 | Offshore Windservice A/S | 2016 | 31.5 | 11 | 24 | 13.00 |
| FOB SWATH 8 | Offshore Windservice A/S | 2018 | 32.5 | 11.5 | 40 | 13.00 |
| FOB SWATH 9 | Offshore Windservice A/S | 2020 | 32.5 | 11.5 | 56 | 13.00 |
| FOB SWATH 10 | Offshore Windservice A/S | 2020 | 32.5 | 11.5 | 44 | 13.00 |
| Largo | OPUS Marine GmbH | 2015 | 27.4 | 8 | 12 | 13.65 |
| Seacat Endeavour | Seacat Services Ltd | 2012 | 21.1 | 7.4 | 12 | 11.24 |
| Seacat Reliance | Seacat Services Ltd | 2012 | 21.1 | 7.4 | 12 | 11.24 |
| Seacat Vigilant | Seacat Services Ltd | 2012 | 25.1 | 8 | 12 | 12.96 |
| Seacat Defender | Seacat Services Ltd | 2013 | 25.1 | 8 | 12 | 12.96 |
| Seacat Resolute | Seacat Services Ltd | 2012 | 24.7 | 8 | 12 | 12.96 |
| Seacat Volunteer | Seacat Services Ltd | 2014 | 25.1 | 8 | 12 | 12.96 |
| Seacat Ranger | Seacat Services Ltd | 2014 | 24.7 | 8 | 12 | 12.96 |
| Seacat Intrepid | Seacat Services Ltd | 2014 | 26.77 | 9.12 | 12 | 14.09 |
| Seacat Courageous | Seacat Services Ltd | 2015 | 26.77 | 9.12 | 24 | 14.09 |
| Seacat Mischief | Seacat Services Ltd | 2015 | 23.1 | 7.7 | 12 | 14.60 |
| Seacat Magic | Seacat Services Ltd | 2016 | 23.1 | 7.7 | 12 | 14.60 |
| Seacat Enterprise | Seacat Services Ltd | 2017 | 26.93 | 9.4 | 24 | 14.76 |
| Seacat Freedom | Seacat Services Ltd | 2016 | 22.8 | 7.7 | 12 | 14.60 |
| Seacat Liberty | Seacat Services Ltd | 2017 | 22.8 | 7.7 | 12 | 14.60 |
| Sure Dynamic | Sure Wind Marine | 2016 | 26.2 | 8.9 | 24 | 13.38 |
| Aberdaron Bay | Turbine Transfers Limited | 2010 | 19.1 | 7.25 | 12 | 9.77 |
| Abersoch Bay | Turbine Transfers Limited | 2012 | 19.1 | 7.25 | 12 | 9.77 |
| Beaumaris Bay | Turbine Transfers Limited | 2014 | 21.3 | 7.3 | 12 | 12.30 |
| Bull Bay | Turbine Transfers Limited | 2014 | 26.7 | 7.85 | 12 | 12.65 |
| Caernarfon Bay | Turbine Transfers Limited | 2012 | 21.14 | 7.25 | 12 | 11.01 |
| Cemlyn Bay | Turbine Transfers Limited | 2012 | 24.7 | 8 | 12 | 12.96 |
| Church Bay | Turbine Transfers Limited | 2014 | 26.7 | 7.85 | 12 | 12.65 |
| Cymyran Bay | Turbine Transfers Limited | 2013 | 28.1 | 8.5 | 12 | 14.34 |
| Foryd Bay | Turbine Transfers Limited | 2012 | 21.3 | 7.3 | 12 | 12.30 |
| Holyhead Bay | Turbine Transfers Limited | 2014 | 21.5 | 7 | 12 | 8.32 |
| Kinmel Bay | Turbine Transfers Limited | 2011 | 19.1 | 7.25 | 12 | 9.77 |
| Llandudno Bay | Turbine Transfers Limited | 2011 | 19.1 | 7.25 | 12 | 9.77 |
| Malltraeth Bay | Turbine Transfers Limited | 2012 | 21.3 | 7.3 | 12 | 12.30 |
| Mill Bay | Turbine Transfers Limited | 2014 | 26.7 | 7.85 | 12 | 12.65 |
| Penrhos Bay | Turbine Transfers Limited | 2010 | 20.47 | 8 | 12 | 11.31 |

| Vessel Name | Operator | Delivery Year | LOA(m) | Beam(m) | Pax | Maximum Air Draft (m) |
|---|---|---|---|---|---|---|
| Porth Cadlan | Turbine Transfers Limited | 2011 | 16.52 | 6.35 | 12 | 8.39 |
| Porth Dafarch | Turbine Transfers Limited | 2011 | 16.52 | 6.35 | 12 | 8.39 |
| Porth Diana | Turbine Transfers Limited | 2011 | 16.52 | 6.35 | 12 | 8.39 |
| Porth Dinllaen | Turbine Transfers Limited | 2011 | 16.52 | 6.35 | 12 | 8.39 |
| Porth Eilian | Turbine Transfers Limited | 2014 | 18.4 | 7.3 | 12 | 8.47 |
| Porth Nefyn | Turbine Transfers Limited | 2015 | 20.2 | 7.8 | 12 | 9.14 |
| Porth Wen | Turbine Transfers Limited | 2011 | 16.52 | 6.35 | 12 | 8.39 |
| Rhosneigr Bay | Turbine Transfers Limited | 2015 | 28.1 | 8.5 | 12 | 14.34 |
| Trearddur Bay | Turbine Transfers Limited | 2014 | 21.6 | 7 | 12 | 11.18 |
| Tremadoc Bay | Turbine Transfers Limited | 2012 | 21.14 | 7.25 | 12 | 11.01 |
| Wylfa Head | - | 2009 | 15.43 | 6.3 | 12 | 8.12 |
| Iceni Spirit | Turner Iceni | 2009 | 15.5 | 6.3 | 12 | 8.12 |
| Iceni Defiant | Turner Iceni | 2012 | 17.5 | 6.4 | 12 | 9.63 |
| Iceni Victory | Turner Iceni | 2013 | 24.7 | 8 | 12 | 12.96 |
| Iceni Legend | Turner Iceni | 2017 | 23 | 7.7 | 12 | 14.60 |
| Iceni Vengeance | Turner Iceni | 2015 | 22.8 | 7.7 | 12 | 14.60 |
| Iceni Venture | Turner Iceni | 2015 | 22.8 | 7.7 | 12 | 14.60 |
| Iceni Conquest | Turner Iceni | 2015 | 21.3 | 7.66 | 12 | 11.64 |
| Iceni Courage | Turner Iceni | 2011 | 15.5 | 6.3 | 12 | 8.12 |
| Iceni Defender | Turner Iceni | 2016 | 22.8 | 7.7 | 12 | 14.60 |
| VOS Rosinante | Vroon Group BV | 2009 | 16 | 6.4 | 12 | 8.44 |
| VOS Cardenio | Vroon Group BV | 2012 | 17.5 | 6.4 | 12 | 9.63 |
| VOS Dorothea | Vroon Group BV | 2011 | 17 | 6.4 | 12 | 9.63 |
| VOS Dulcinea | Vroon Group BV | 2011 | 17 | 6.4 | 12 | 9.63 |
| VOS Cervantes | Vroon Group BV | 2012 | 17 | 6.4 | 12 | 9.63 |
| VOS Rucio | Vroon Group BV | 2009 | 16 | 6.4 | 12 | 8.44 |
| VOS Altisidora | Vroon Group BV | 2013 | 19.15 | 7.25 | 12 | 9.77 |
| VOS Lucinda | Vroon Group BV | 2013 | 19 | 7.25 | 12 | 9.77 |
| VOS Sampson | Vroon Group BV | 2014 | 19.15 | 7.25 | 12 | 9.77 |
| VOS Trifaldi | Vroon Group BV | 2014 | 19.15 | 7.25 | 12 | 9.77 |
| VOS Napoleon | Vroon Group BV | 2014 | 21.85 | 7 | 12 | 6.50 |
| VOS Snowball | Vroon Group BV | 2014 | 21.85 | 7 | 12 | 6.50 |
| Windcat 20 | Windcat Workboats Ltd | 2009 | 18 | 6.5 | 12 | 7.00 |
| Windcat 6 | Windcat Workboats Ltd | 2007 | 16 | 6.5 | 12 | 7.00 |
| Windcat 7 | Windcat Workboats Ltd | 2007 | 16 | 6.5 | 12 | 7.00 |
| Windcat 17 | Windcat Workboats Ltd | 2009 | 22 | 6.5 | 12 | 8.00 |
| Windcat 4 | Windcat Workboats Ltd | 2006 | 15 | 6.5 | 12 | 7.00 |
| Windcat 1 | Windcat Workboats Ltd | 2004 | 18 | 6.5 | 12 | 7.00 |
| Windcat 2 | Windcat Workboats Ltd | 2005 | 15 | 6.5 | 12 | 7.00 |
| Windcat 16 | Windcat Workboats Ltd | 2009 | 18 | 6.5 | 12 | 7.00 |
| Windcat 23 | Windcat Workboats Ltd | 2010 | 19 | 6.5 | 12 | 7.00 |
| Windcat 25 | Windcat Workboats Ltd | 2011 | 18 | 6.5 | 12 | 7.00 |
| Windcat 27 | Windcat Workboats Ltd | 2011 | 19 | 6.5 | 12 | 7.00 |
| Windcat 18 | Windcat Workboats Ltd | 2009 | 18 | 6.5 | 12 | 7.00 |
| Windcat 21 | Windcat Workboats Ltd | 2010 | 19 | 6.5 | 12 | 7.00 |
| Windcat 22 | Windcat Workboats Ltd | 2010 | 22 | 6.5 | 12 | 7.00 |
| Windcat 24 | Windcat Workboats Ltd | 2010 | 18 | 6.5 | 12 | 7.00 |
| Windcat 26 | Windcat Workboats Ltd | 2011 | 18 | 6.5 | 12 | 7.00 |
| Windcat 29 | Windcat Workboats Ltd | 2011 | 23 | 6.5 | 12 | 7.00 |
| Windcat 19 | Windcat Workboats Ltd | 2008 | 22 | 6.5 | 12 | 8.00 |
| Windcat 10 | Windcat Workboats Ltd | 2008 | 22 | 6.5 | 12 | 8.00 |
| Windcat 5 | Windcat Workboats Ltd | 2007 | 16 | 6.5 | 12 | 7.00 |

| Vessel Name | Operator | Delivery Year | LOA(m) | Beam(m) | Pax | Maximum Air Draft (m) |
|---|---|---|---|---|---|---|
| Windcat 14 | Windcat Workboats Ltd | 2009 | 18 | 6.5 | 12 | 7.00 |
| Windcat 28 | Windcat Workboats Ltd | 2012 | 18 | 6.5 | 12 | 7.00 |
| Windcat 3 | Windcat Workboats Ltd | 2005 | 15 | 6.5 | 12 | 7.00 |
| Windcat 11 | Windcat Workboats Ltd | 2008 | 22 | 6.5 | 12 | 7.00 |
| Windcat 15 | Windcat Workboats Ltd | 2009 | 18 | 6.5 | 12 | 7.00 |
| Windcat 101 | Windcat Workboats Ltd | 2011 | 27.8 | 9 | 45 | 16.6 |
| Windcat 30 | Windcat Workboats Ltd | 2012 | 18 | 6.5 | 12 | 7.00 |
| Windcat 31 | Windcat Workboats Ltd | 2013 | 18 | 6.5 | 12 | 8.00 |
| Windcat 32 | Windcat Workboats Ltd | 2013 | 18 | 6.5 | 12 | 8.00 |
| Windcat 33 | Windcat Workboats Ltd | 2014 | 18 | 6.5 | 12 | 8.00 |
| Windcat 34 | Windcat Workboats Ltd | 2013 | 19 | 6.5 | 12 | 8.00 |
| Windcat 35 | Windcat Workboats Ltd | 2014 | 19 | 6.5 | 12 | 8.00 |
| Windcat 36 | Windcat Workboats Ltd | 2014 | 19 | 6.5 | 12 | 8.00 |
| Windcat 37 | Windcat Workboats Ltd | 2015 | 23 | 6.5 | 12 | 8.00 |
| Windcat 38 | Windcat Workboats Ltd | 2015 | 19 | 6.5 | 12 | 8.00 |
| Windcat 39 | Windcat Workboats Ltd | 2016 | 19 | 6.5 | 12 | 8.00 |
| Windcat 40 | Windcat Workboats Ltd | 2017 | 23 | 7.3 | 12 | 8.00 |
| Windcat 41 | Windcat Workboats Ltd | 2018 | 23 | 7.3 | 26 | 12.00 |
| Windcat 42 | Windcat Workboats Ltd | 2018 | 24 | 7.3 | 26 | 8.00 |
| Windcat 43 | Windcat Workboats Ltd | 2019 | 24 | 7.3 | 26 | 8.00 |
| Windcat 44 | Windcat Workboats Ltd | 2019 | 24 | 7.3 | 26 | 8.00 |
| MV Sea Comfort | World Marine Offshore | 2014 | 25.3 | 11.3 | 12 | 14.44 |
| World Golf | World Marine Offshore | 2013 | 23.7 | 9.5 | 24 | 14.34 |
| World Passat | World Marine Offshore | 2013 | 23.7 | 9.5 | 12 | 14.34 |
| World Mistral | World Marine Offshore | 2013 | 23.7 | 9.5 | 24 | 14.34 |
| World Scirocco | World Marine Offshore | 2013 | 23.7 | 9.5 | 24 | 14.34 |
| World Bora | World Marine Offshore | 2014 | 30 | 13 | 24 | 14.48 |
| World Calima | World Marine Offshore | 2014 | 30 | 13 | 24 | 14.48 |
| Umoe Firmus | World Marine Offshore | 2016 | 26.6 | 10.4 | 12 | 13.31 |
| Umoe Rapid | World Marine Offshore | 2017 | 26.6 | 10.4 | 24 | 13.31 |
| WMO 1 (Wikinger) | World Marine Offshore | 2019 | 32 | 12.2 | 24 | 15.62 |
| WMO 2 (Wikinger) | World Marine Offshore | 2019 | 33 | 12.2 | 24 | 15.62 |