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NOVEMBER/DECEMBER 2023 | OEDIGITAL.COM | VOL. 48, NO. 6

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In the Machinery Space

What to Watch in '24
Rigs • OSVs • Offshore Wind

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VOL. 48 / NO. 6

FEATURES

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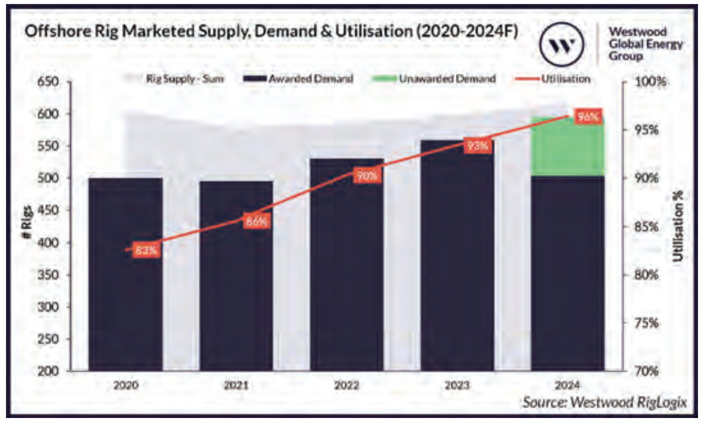
DEPARTMENTS



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WHAT'S IN STORE IN '24?

I've been in b2b publishing across maritime, offshore energy and subsea for more than three decades, and the job never gets old because two days are never the same. Yes, there is the daily/weekly/monthly slog of deadlines + meeting and beating sales targets, but the offshore energy business is ever fluid and changing, seemingly at a much brisker pace than ever before. There are multiple technologies that promise to positively disrupt this business in the coming years and decades, led by digitalization tech that offer operators both efficiency gains and carbon cuts. That's just the tip of the iceberg, and trust that the OE team will help to keep you abreast of evolving technology trends as they emerge.

As tradition holds, this final edition of the year is dedicated mostly to looking ahead, and up for the task are a full crew of industry insiders with exclusive insights on what to watch in the coming years. **Teresa Wilkie**, Director, RigLogix @ Westwood Global Energy Group takes a deep dive into the rig market; **Jesper Skjong**, Market Analyst, Fearnley Offshore Supply AS provides depth and breadth to the trends shaping the OSV market; **Philip Lewis** and **Tomasz Laskowicz** of Intelatus Global Partner offer the "Top 10" things to watch in offshore wind; and **David Moseley**, VP Operations for Europe for Welligence Energy Analytics gives the global exploration outlook.

Looking at the technologies that will impact the sector in 2024 and far beyond is **Wendy Laursen** with her dissection of the emerging carbon capture and storage sector, while **Bartolomej Tomic** examines in detail the emergence of green rig technologies.

On the latter, it is with regret that I share this is the last edition with Bartolomej (Bato) as managing editor of *Offshore Engineer*. Bato and I connected just before the world went into the Covid-induced shutdown in 2020, and what I found was one of the most knowledgeable, hard-working and genuine people that you could ever hope to cross paths with, personally or professionally. While his daily presence on OEDigital.com and in our pages will be sorely missed, personally I'm thrilled for the opportunity he has earned, and I'm sure you'll be seeing his name and work again very soon.

As we close the book on '23 and look ahead to '24, a sincere bit of thanks to you, our readers and our advertisers for your continued interest and support.

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OFFSHORE ENGINEER (ISSN 0305-876X) is published bi-monthly (6 times per year) by AtComedia, Inc. 118 East 25th St., 2nd Floor, New York, NY 10010-1062. Periodicals postage paid at New York, NY and additional mailing offices.
POSTMASTER: Send All UAA to CFS. NON-POSTAL AND MILITARY FACILITIES send address corrections to Offshore Engineer 850 Montauk Hwy, #867 Bayport, NY 11705

OE OFFSHORE ENGINEER
THE FUTURE OF OFFSHORE ENERGY & TECHNOLOGY.

Vol. 48 *No. 6*
ISSN 0305-876x USPS# 017-058

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NOVEMBER/DECEMBER 2023
WWW.OEDIGITAL.COM
VOL. 48 / NO. 6

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Wendy Laursen has 20 years of experience as a journalist. In that time, she has written news and features for a range of maritime, engineering and science publications. She has completed a Master of Science research degree in marine ecology as well as diplomas in journalism, communication and subediting.

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David Moseley joined Welligence in 2021 to lead North Sea Research and is currently Vice President Operations for Europe. Prior to Welligence, David spent 11 years at energy research firms Hannon Westwood and Westwood Global Energy. He has delivered a wide range of North Sea focused E&P analysis to upstream, midstream and investment companies. He has worked extensively with government and regulatory bodies, delivering insights through both subscription products and bespoke consulting mandates. David was also Communications Director for the Petroleum Exploration Society of Great Britain (PESGB) for two years.

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Teresa Wilkie is the Director of RigLogix within Westwood Global Energy Group, leading a team of experienced offshore rig market analysts. She has over a decade of knowledge as an analyst in the oil and gas industry bringing expertise from her time at IHS-Markit (formerly ODS-Petrodata) and Esgian (formerly Bassoe Offshore).


Moseley


Paradise


Skjong


Skučas


Tomić

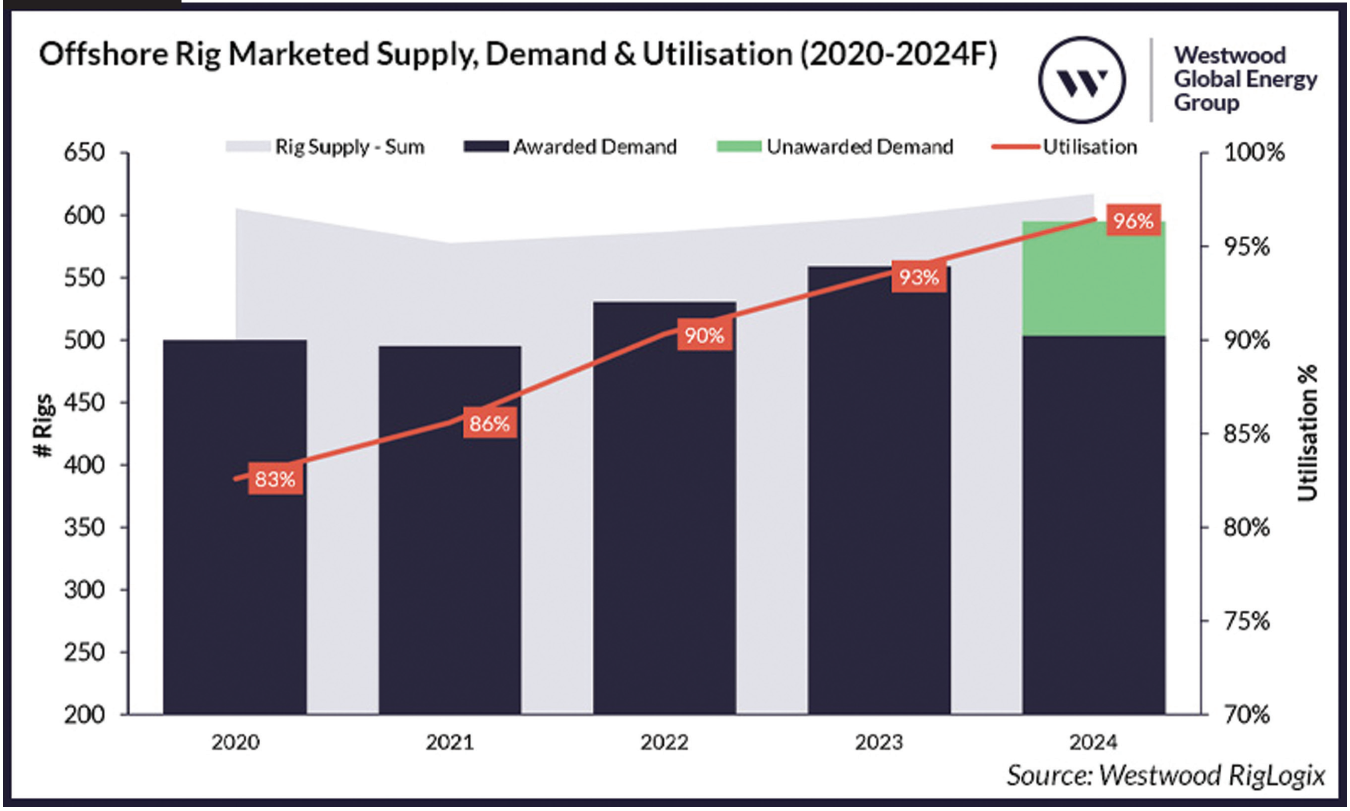

Wilkie

The Offshore Rig Market Recovery Continues, but What's in Store for 2024?

2023 has been another noteworthy year for the rig market's ongoing recovery, with a 3% increase in global marketed utilization versus 2022, a demand increase of 29 rigs, a 7% uptick in average contract duration, 16 further reactivations and newbuild deliveries, and not to mention floating rig dayrates exceeding the 'magical' $500,000 mark. So, what can we expect in 2024? Westwood has set out its top three predictions for the year ahead.

By Teresa Wilkie, Director, RigLogix – Westwood Global Energy Group

Figure 1



1. Some white space in 1H but further overall utilization growth

Westwood's overall outlook for the offshore rig market remains highly optimistic, albeit with the potential for more availability during the first half of 2024.

In addition to current warm-stacked supply with no future work in place, including 27 jackups, three drillships and eight semisubmersibles (semisubs), there are another 18 jackups, four drillships and five semisubs that are currently working and set to roll off hire in the first quarter of next year alone (these figures do not include rigs that have contract options available).

Of course, for semisubs in the UK and Norway, the most active region for this rig type, the winter period generally slows down as operators try avoiding weather related downtime, but drillships are also showing more potential availability than has been recorded since September 2021. It is likely that most, if not all, of these ships with upcoming availability are being bid on new opportunities and some are likely close to securing new deals.

In the jackup segment, the majority of rigs showing upcoming availability are located in Mexico, the Middle East or Southeast Asia and several are likely to be awarded extensions with incumbent operators come the new year.

Short-term Fluctuation

Overall this is expected to be a short-term fluctuation until operators firm up their 2024 budgets and drilling plans. Since many are now making bigger commitments for longer duration contracts, as indicated in our last Offshore Engineer article *'Operators Offering 15-year Rig Deals as Availability Dries Up'*, this can take more time to choose the most suitable rig and execute a deal.

RigLogix currently records a total of 22 tenders, pre-tenders or direct negotiations out in the market with a start date in 2024 that have a firm duration of two to five years, and many of these come with several more years of options attached to them. If also including those with start dates in 2025 and 2026, this figure increases to 46 pieces of work with some that could last as long as 10 years.

Subsequently, Westwood predicts further growth in demand and utilisation next year with India, Southeast Asia, South America and West Africa all expected to be important drivers behind further expansion. This is forecast to result in demand growth of up to 36 rigs year-on-year and a 3% increase in global marketed utilisation.

2. Little Attrition and Further Supply Growth

As stated in our earlier Offshore Engineer article *'Rig Dayrates Have Risen, So Where Are All The New Rig Orders?'*, Westwood does not expect a wave of new construction orders in the new year, as drillers continue to focus on financial prudence. However, it is likely that further supply will be added through reactivations and newbuild rig deliveries, which offers a more economically practical option in the short term.

With the anticipated increase in demand next year, and even with some expected higher availability in the first half of the year, marketed utilisation is forecast to reach as high as 96%. This will result in a limited choice of rigs for new deals, which could lead to more sublet activity and/or potential delays to planned campaigns if additional units are not added to active supply.

The number of reactivations and newbuild deliveries decreased by 64% this year in comparison to 2022, which is majorly attributed to national oil companies (NOCs) in the Middle East having sated their near-term jackup appetites after a contracting feast as part of a bid to ramp up domestic supply and production. Though floating rig reactivations and deliveries also decreased year-on-year, again this was mostly attributed to Brazilian NOC Petrobras cutting its award activity by 50% after a slew of long-term deals made in 2022.

However, this is expected to be short lived with Petrobras in the market with several long-term floater tenders that should result in three to four further rigs on their books, meanwhile ONGC many need as many as six more jackups next year, not to mention anticipated increased jackup activity in Southeast Asia and floating rig demand in West Africa.

Newbuilds to Remain Highly Sought After

Companies such as Valaris and Borr Drilling have already announced plans to take delivery of newbuild rigs, some of which have been delayed in yards for as long as a decade. It is probable that newbuilds and stranded assets will continue to be highly sought after in the new year, due to their modern and high-tech caliber. There are still 16 jackups, five semis and 11 drillships in shipyards with no contracts yet in place.

There are 86 cold stacked rigs in total, of which 39 have been idle for over five years, only eight have a five-year Special Periodic Survey (SPS) in place and 40 are already over 40 years old. Despite this, according to Westwood analysis, approximately 14 jackups, 12 drillships and 12 semis could be reactivation candidates. However, inflation and supply chain constraints have brought longer shipyard times and higher costs associated with restarting a rig, therefore this is not an easy or quick fix for supply concerns.

The lower attrition that has been recorded in 2023 (just two rigs removed from the market) will likely continue into next year too, as rig owners hold onto older units in hopes they may eventually be put back to work, especially since little to no new rigs are being built.

3. Dayrates to Continue North – but don't expect to see all Floater Fixtures at $500,000

This year has brought with it continued increases in dayrates for jackups, semisubs and drillships – with the latter two floating rig types now both having witnessed clean dayrates (excluding additional services such as MPD or mobilisation) at or above $500,000 per day.

These market leading rates are a positive sign, especially for rig owners and managers that have grappled with low dayrates since 2014. However, this is unlikely to be the norm for long-term contracts starting in 2024. The majority of fixtures in 2023 with dayrates that fell between $480,000 to $500,000 per day were for relatively short-term deals (i.e. 1-2 wells, 30 -200 days) or do not begin until 2025 onwards.

Next year Westwood expects a continued variance in floater dayrates with some long-term deals that could still be fixed in at the mid-to-high $300,000s as well as short-term deals that we expect will further exceed those leading rates already witnessed this year.

Meanwhile, the jackup segment has now seen a contract fixed with a dayrate of $180,000 for work off Australia, while two contracts have been fixed at over $165,000 per day for work in Southeast Asia. As is the case with the floating rig segment, Westwood forecasts to see more upward movement next year in line with the forecast tight market, but a likely continued range of rates based on term, location and technical specifications.

Ultimately, with the ever-tightening supply/demand balance, costly reactivation and new construction economics as well as inflationary pressures, Westwood expects dayrates to continue their northward trajectory in 2024 across the board. With that in mind, we predict that operators will continue locking in rigs earlier for their contracts in a bid to secure the right assets at as low a price as possible.

Figure 2

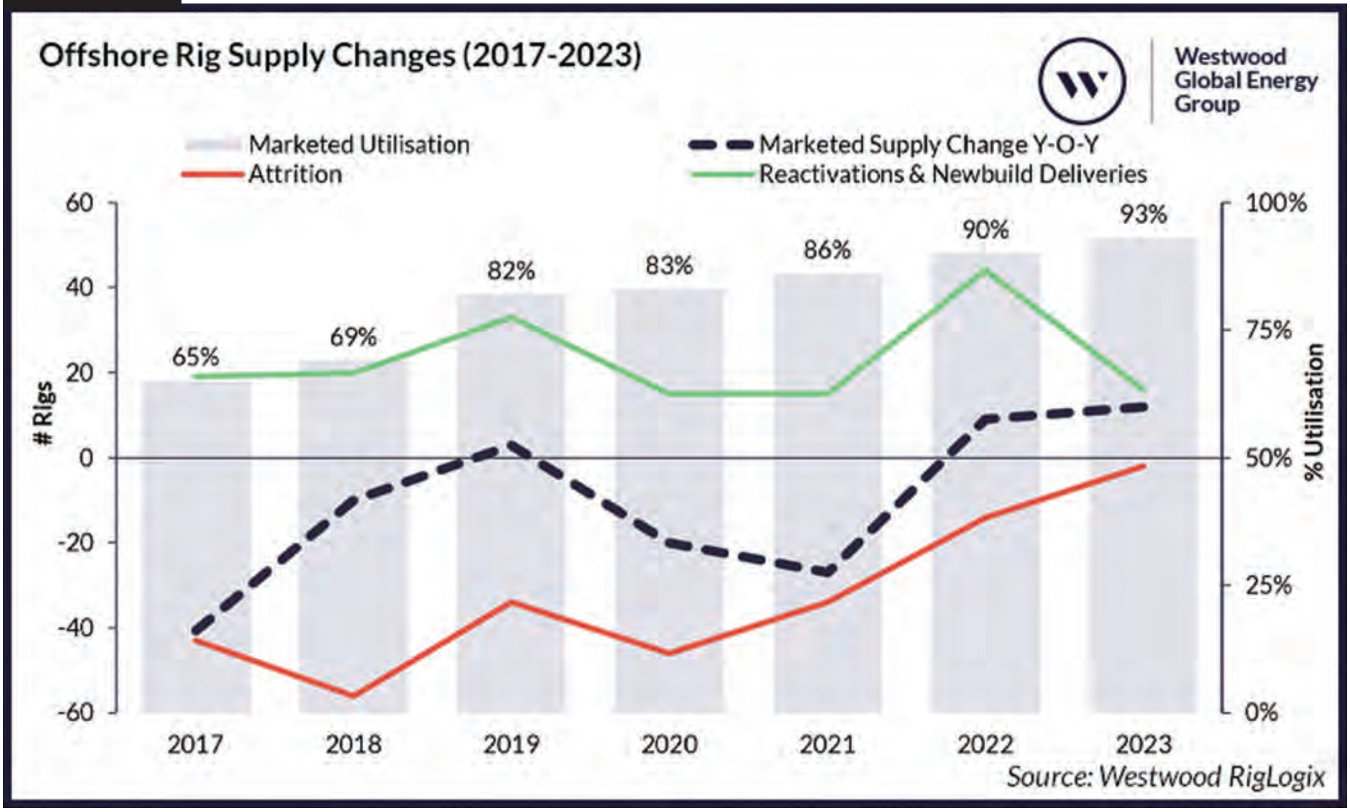
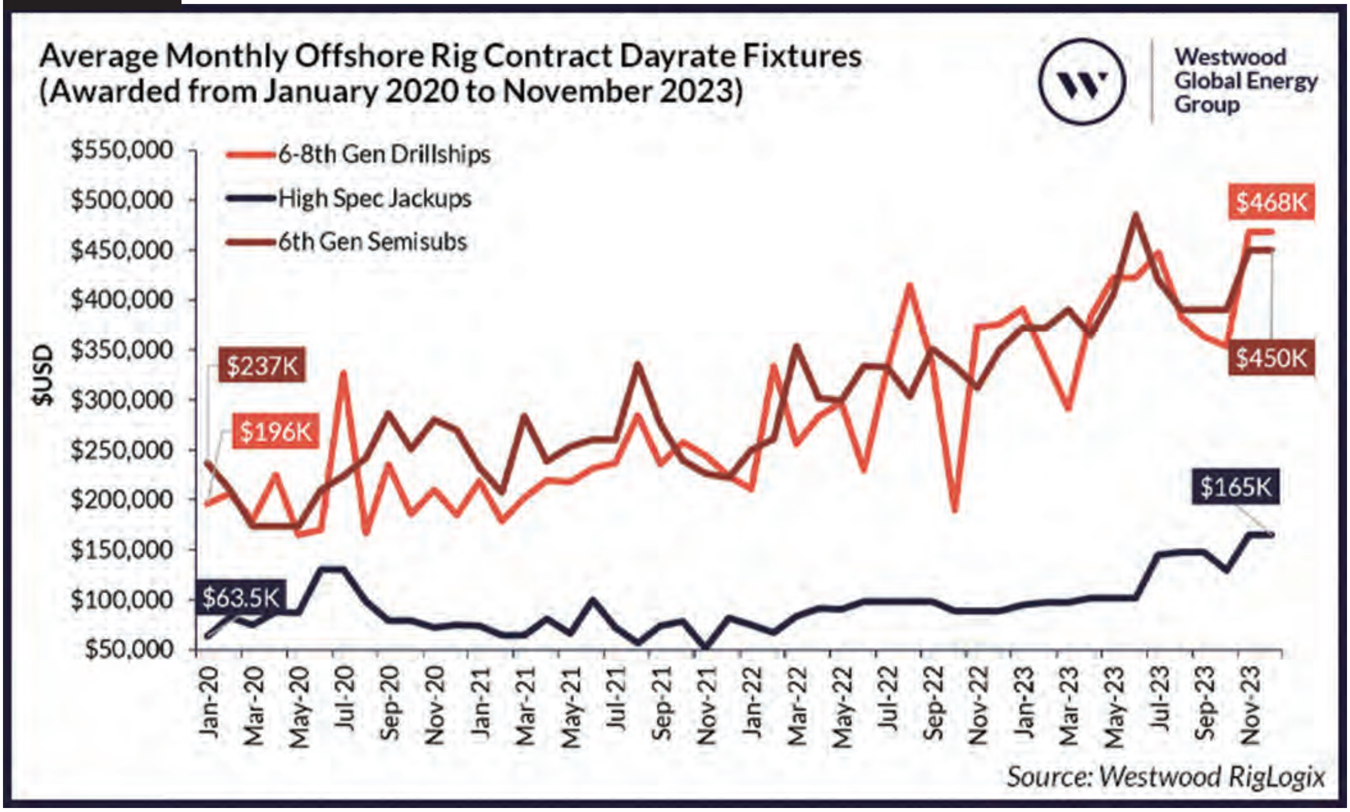


Figure 3



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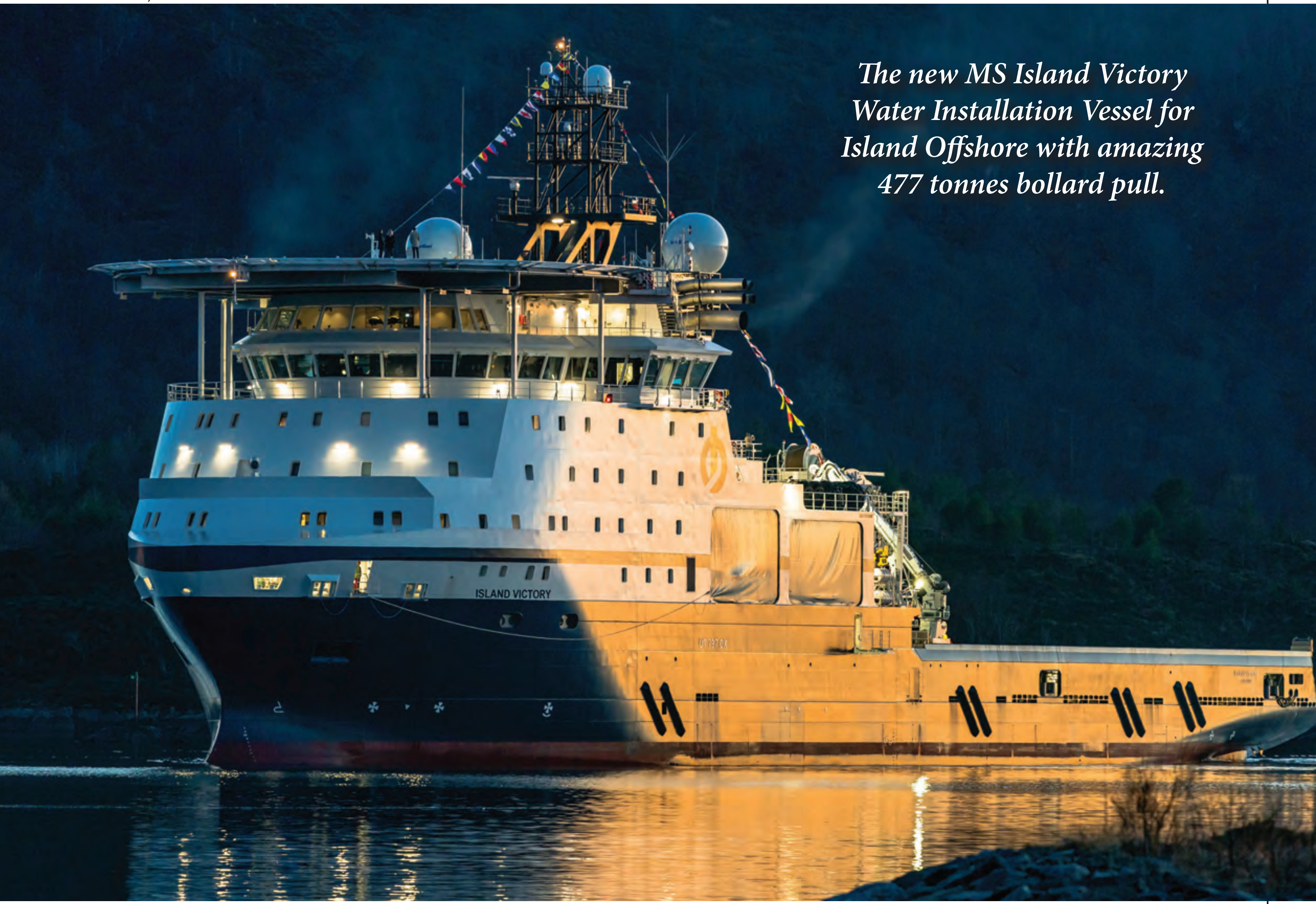

The new MS Island Victory Water Installation Vessel for Island Offshore with amazing 477 tonnes bollard pull.

2024 –

The Year of the AHTS recovery?

By Jesper Skjong, Market Analyst, Fearnley Offshore Supply AS

As 2023 is drawing to a close we would once again invite the readers of ***Offshore Engineer*** Magazine to gaze into our crystal ball to see what 2024 might have in store for the offshore support vessel industry. Before diving straight into our forward-looking sentiments however, it is important to address some of the main trends in the year that past as these lay the foundation for the year to come.

Continuing the market development from the year before, 2023 very much advanced the ongoing recovery for offshore support vessels further. When analyzing key metrics in our industry such as reported dayrates, average vessel utilization, and vessel valuations, this becomes abundantly clear as we find significant improvement in close to all regions and vessel segments.

That having been said however, the market has not recovered to the same degree everywhere, and different vessel segments have certainly seen their respective parameters develop in different strokes. Prime examples of this are the platform supply- and subsea construction markets, which saw tremendous improvements throughout the year. The developments seen in the anchor handling- and tug supply vessel market, however, were far more muted, especially when compared to the two former.

For PSVs specifically, we have recorded an almost 30% increase in dayrates so far this year, which comes on top of the 55% increase throughout 2022. Furthermore, 2023 has also seen the total number of large units on contract reach new all-time highs, so it is difficult to understate the market recovery herein.

In the subsea construction segments, we have seen both dayrates and contract durations increase. Not only are dayrates for several asset classes back to 2014-levels, 2023 have also brough back multi-year firm contracts for the first time in many years.

As mentioned, while improved, the AHTS segment did not muster the same kind of positive development seen elsewhere. In comparison to the above mentioned dayrate developments, average dayrates for AHTS have only seen around a 10% increase so far this year.

However, and especially in light of historical references, we see relatively weak market development as a potential identifier for opportunities rather than dismay. The AHTS vessel segment, which has lagged the above-mentioned two asset classes considerably, could, perhaps just as easily, be said to have the largest outstanding potential in its yet to be realized market recovery.

Furthermore, the foundation for a stronger market, a significant improvement to the "floor" for these assets, can certainly be said to have materialized. In the North Sea spot market for example, we note some very interesting statistics to this effect.

On the Norwegian Continental Shelf, 2023 year-to-date we have recorded just shy of 200 fixtures with the lowest level fixed at NOK 175,000 per day, whereas 2022 running to 26th November had 209 fixtures reported – but around 50 of these were fixed at lower than NOK 175,000 per day, with the lowest recorded fixture at just NOK 75,000 per day!

The spot market for AHTS working out of the UK saw an even sounder development with 285 reported fixtures so far this year which compares to around 230 at the same time last year. The lowest recorded dayrates in this time period went from just GBP 8,000 last year to GBP 14,500 per day so far this year. Moreover, 2023 thus far has seen the number of fixtures concluded at less than GBP 20,000 almost cut in half compared to 2022 at the same time.

So, while the North Sea spot market this year did not reach 2022's peak dayrate levels echoing past glories for AHTS, it has, by a large margin, raised the bottom levels for these vessels.

Nonetheless there is still something borderline confusing to note - some of the latest term fixtures fetched dayrates around USD 40,000 per day for both supply segments. Especially so when we know how much higher the dayrates for AHTS' were last time the market activity picked up as we have seen since the trough. And that allows us to pivot to next year – where the anchor handlers might very well catch up to other segments.

First off, the present state of the AHTS fleet is in the best position we have recorded since the start of the downturn. Not only is the number of working units globally back to 2016-levels but more importantly we now have a total fleet count last seen in 2012. Thus, as the demand for these units continues to improve the market balance will only tighten even further.

But those are overall figures, and the picture becomes even more interesting when we factor in the age and condition of the fleet in order to determine a more practical, or rather more commercial, fleet count. In fact, more than 15% of the total fleet is still laid up despite the market improvement. And while some of these assets will undoubtedly return to the market, around half of them are at least 25 years old, and around 70% have been cold stacked for at least five years.

Taking into account that more than half of the still cold-

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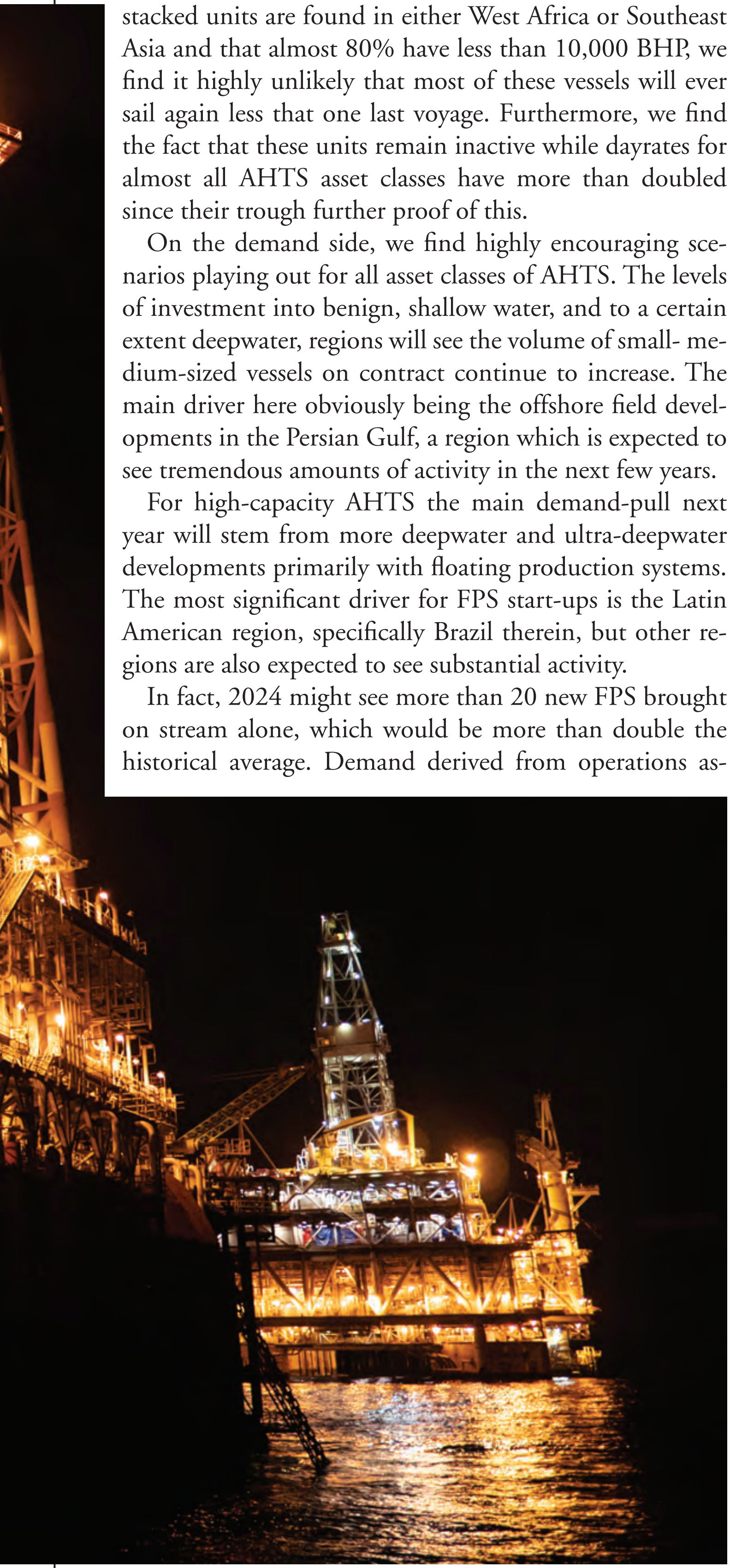
stacked units are found in either West Africa or Southeast Asia and that almost 80% have less than 10,000 BHP, we find it highly unlikely that most of these vessels will ever sail again less that one last voyage. Furthermore, we find the fact that these units remain inactive while dayrates for almost all AHTS asset classes have more than doubled since their trough further proof of this.

On the demand side, we find highly encouraging scenarios playing out for all asset classes of AHTS. The levels of investment into benign, shallow water, and to a certain extent deepwater, regions will see the volume of small- medium-sized vessels on contract continue to increase. The main driver here obviously being the offshore field developments in the Persian Gulf, a region which is expected to see tremendous amounts of activity in the next few years.

For high-capacity AHTS the main demand-pull next year will stem from more deepwater and ultra-deepwater developments primarily with floating production systems. The most significant driver for FPS start-ups is the Latin American region, specifically Brazil therein, but other regions are also expected to see substantial activity.

In fact, 2024 might see more than 20 new FPS brought on stream alone, which would be more than double the historical average. Demand derived from operations associated with floating structures, such as towage, anchor operations, mooring, and hook-up are thus expected to further increase next year.



Another important development to note is the offshore wind sector's burgeoning demand, particularly the floating offshore wind segment. While still in its infancy as an industry, project developments in this market space are expected to generate demand pull for primarily large AHTS and thereby contribute to a further tightening of the supply side.

In 2024 we count as many as 17 floating offshore wind projects scheduled to commence construction globally, adding 34 turbines and a combined capacity of 262 MW to the market. Just like other floating structures, these projects will require significant amounts of offshore support. Moreover, while these projects are quite marginal in size compared to the bottom fixed projects under development, due to the operational requirements, the high-end anchor handlers will be essential for large parts of the installation scope including towing, pre-lay, and hook-up activities.

Currently, the most relevant AHTS fleet for floating offshore wind, specifically vessels with more than 250t bollard pull, only count approximately 60 units out of a global fleet of around 1,600 units – or less than 4% of the total fleet. Furthermore, when accounting for other limiting factors such as vessels operating in China, Brazilian flagged or Jones Act units and exclude these from the competitive fleet – as they are unlikely to relocate from their existing markets – the pool shrinks to around 40 units.

Given the stagnant vessel supply due to the almost complete absence of newbuilds, coupled with the escalating demand from the Oil & Gas sector, a tight market supply for high-end AHTS is anticipated as a result. In this regard, it is also worth mentioning that the largest asset class is also the asset class that has seen the least movement dayrate-wise when compared to previous highs, arguing for an especially favorable upside for these units specifically.

Finally, we find it intriguing that while we have seen accelerating prices and strong volume in the secondhand sales market for PSVs, the AHTS market has been lagging here as well. Secondhand prices, and with it, asset valuations, for the former has seen a terrific boost during 2023, whereas the same trendlines for anchor handlers could again be described as less aggressive in comparison. As such, should our above listed market forecasts come to fruition, we find it more than likely that the S&P market for AHTS will greatly improve during next year – of which we are firm believers that it will!

OFFSHORE WIND: Things to Watch in 2024

Despite short-term obstacles driven by high inflation and interest rates coupled with supply chain issues, we maintain that the foundations supporting long-term offshore wind activity remain solid. As we prepare for the new year, let us look at 10 factors that will shape the offshore wind sector in 2024.

By Philip Lewis and Tomasz Laskowicz, Intelatus Global Partners

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1. A Continuously Dynamic Energy Trilemma

The dynamic relationship of the three key drivers of affordable energy, energy security and energy transition was clearly evident in 2023 as energy affordability and security were generally more prominent themes than the transition. 2024 will see a raft of elections within the European Union, and in the UK, the USA and Taiwan, all countries with large offshore wind programs. The speed of the energy transition and by extension offshore wind development depends, to some extent, on the outcome of these elections.

2. Solid Foundations

Despite the questions surrounding the speed of offshore wind development, the longer-term optimism for the supply chain is founded on declared offshore wind deployment targets by a growing number of countries amounting to more than 950 GW by 2050 (excluding China), driven by energy transition and energy security policies. From close to 75 GW installed at the end of 2023 to 220 GW commissioned by the end of 2030, we forecast global offshore wind capacity to rise to over 440 GW by 2035. Excluding the unique Chinese market, 2023 installed capacity is forecast to reach around 38 GW, rising to over 150 GW by 2030 and close to 350 GW by 2035. In all, outside of China, we anticipate that more than 21,000 offshore wind turbines will be installed globally between 2024 and 2035.

3. Core Markets = Good Opportunity

There remains abundant contracted and planned project capacity to develop in the core UK, Europe (Germany, the Netherlands, France, Denmark, Poland, etc.), U.S., and Asian (Taiwan, South Korea and Japan) offshore wind markets.

4. Potential in Australia and South America

Australia is seeking to identify developers for a number of multi-gigawatt sites, both bottom-fixed and floating, off Vicotria, New South Wales and Western Australia for commissioning in the next decade. In South America, Brazil and Columbia are the emerging markets, developing permitting frameworks and offshore wind opportunities.

In addition to Australia and South America, we anticipate that new commercial-scale markets will emerge in the waters of Europe's North Sea, Baltic, Mediterranean, and Atlantic.

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5. Inflation and High Interest Rates

In our 2023 preview prepared at the same time last year, we commented that, "Inflation and supply chain disruptions will result in delays and possibly cancellations." 2023 has indeed seen the cancellation and delay of several large projects in key markets like the USA and the UK. However, we note the pragmatic actions taken by the various agencies involved in the procurement of offshore wind. Actions include increasing CfD pricing in the UK and allowing projects to rebid in offshore wind procurements at higher rates and/or inflation indexed pricing in the USA. These delays have been necessary to address some of the fundamental challenges in the offshore business model, notably that a race to the bottom in pricing terms is not sustainable for developers and the supply chain. The indications are that 2024 will see a stabilizing offshore wind market.

6. Chinese Supply Chain Expands Outside of China

Despite some high-profile resistance, Chinese foundation, electrical cable and wind turbine OEMs are increasing their presence in the Asian and European markets. As European and US offshore wind turbine OEMs weather some strong financial headwinds and concentrate on generating value from their existing turbine platforms, Chinese OEMs continue to develop ever larger wind turbines that meet the 20 MW and above planning aspirations of many European and US project developers. The Chinese OEMs present a new client opportunity for companies in the international supply chain.

7. Uncertainty over Bottom-Fixed Construction Vessel FIDs

As the requirement to install bottom-fixed turbines and foundations grows, we see a tightening on the supply of vessels capable of installing the largest monopiles and turbines. New vessels are under construction for delivery in the 2023-2026 window and several vessels have been upgraded. But will owners take vessel FIDs? We see relatively limited new building activity being agreed in the short-term until demand, day rates and contract terms give owners the confidence that a vessel investment will make the required return. The cable laying segments has seen some interesting ordering activity in 2023, with a handful vessels committed on the back of substantial contracts. Larger turbines, bigger substations and increasing transmission distances have changed the technical drivers for cable layers but we see similar challenges for cable layer owners as for foundation and turbine installers – demand, day rate stability and contract terms all need to align to a vessel owner's expectations before FID.

8. Commercial Floating Wind

Floating wind will account for slightly more that 0.5% of the global installed offshore wind capacity (excluding China) at the end of 2023. By 2030, floating wind share is forecast to rise to over 4% (around 6.5 GW) and over 18% by 2035. Activity is expected to be concentrated in South Korea, the UK, Norway and the USA, with a number of secondary markets in Europe and Asia. To reach these forecast numbers, much work is still required to develop the supply chain. Key areas of development and investment include rationalization of the number of substructure concepts, the industrialization of substructure production, assembly, marshalling and wet storage ports, mooring system component manufacture, installation vessel supply, dynamic subsea cable manufacture and major component repair and maintenance solutions.

9. The Availability of Finance

We have mentioned high interest rates, a factor in developers and companies in the supply chain reporting mixed financial results. One cannot ignore the high-profile headlines of investor and financial institution reactions to project cancellations, deferments and impairments by companies including Ørsted, Iberdrola and Vattenfall as well as losses at large turbine OEMs, including but not limited to, Siemens. As a result, we continue to monitor not only the cost of debt but the availability of finance to the offshore wind space. This point links to our earlier comment about government agencies accepting the necessary price and support increases as well as inflation indexation of rates to make projects bankable. 2024 is certainly an important year for project financing.

10. The year of Hydrogen?

Hydrogen is a key enabler for the energy transition. Offshore wind projects are ideally suited to powering electrolyzers that produce hydrogen. We anticipate that more wind farms will be developed to only power electrolyzers and will not be connected to utility power transmission grids. We see the potential not only in the European market, which is already developing such projects, but also within the USA, where the Gulf of Mexico leases lend themselves to supporting hydrogen production.

Despite some significant ongoing challenges within the industry, we maintain our position that offshore wind will be a growing element within the energy supply chain, complementing natural gas, nuclear and other renewable technologies. The world will continue to demand more energy, and this will come increasingly in the form of electrons … a trend that offshore wind will continue to support.

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THE $1 BILLION OFFSHORE WIND PRIZE FOR U.S. SHIPYARDS

The growing CTV and SOV market represents a long-term demand for at least 60 to more than 130 vessels

By Philip Lewis, Research Director of Intelatus Global Partners

The U.S. offshore wind market presents a $1 billion long-term opportunity to builders of crew transfer vessels (CTV) and service operation vessels (SOV) that will support both wind farm construction and long-term operations and maintenance. Unlike many of the construction vessels to be deployed on U.S. wind projects, CTVs and SOVs must be Jones Act compliant, meaning they will be built, owned and operated by U.S. companies and personnel.

However, although seen as somewhat commoditized vessels, a clear understanding of the commercial technical drivers in each of the segments is required.

These are the findings of a new analysis of the global CTV market produced by Intelatus Global Partners.

The CTV and SOV opportunity

By the end of 2024, the U.S. Tier 1 (purpose built) and Tier 2 CTV (conversions) fleet will have grown to 23 vessels, with owners holding options to build at least a further 12 vessels.

Long-term, the market has a potential O&M related demand for 60-130 CTVs with additional CTVs required for logistics during the offshore construction of wind farms. MARAD Title XI loan guarantee documentation indicates U.S. CTV pricing of around $12 million per vessel. As a result, the net long-term capital requirement for new CTV construction is $440-1,140 million. Construction cycle time is at least 12 months per vessel (and as much as 15-20 months) excluding design and approvals. Most yards involved in the building of CTVs for the U.S. market appear to be able to produce between one and four CTVs annually.

By comparison, leading Southeast Asian yards will sell European specification CTVs for around $5.5-6 million per vessel, with build cycles of 8-10 months and capacity to produce 10 vessels a year.

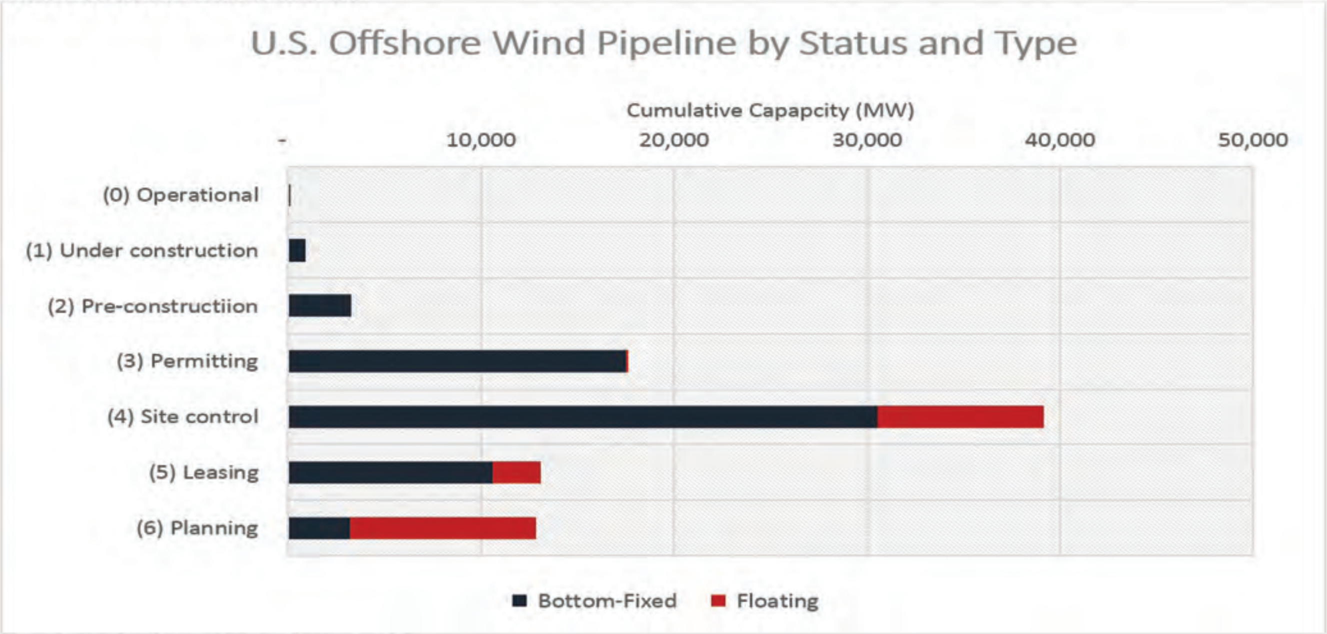
We note similar pricing trends in the SOV segment as seen in the CTV segment. We have reported previously the price difference in U.S. built SOVs compared to those deployed in Europe and the three Tier 1 vessels currently being built in the U.S. are reported to cost between $97 and 162 million each. SOVs contracted for the European market at a similar time to the three Jones Act vessels cost between $67-75 million.

Where the right conditions exist, such as a developer or turbine OEM operating a large number of turbines in a relatively close geographic proximity, Tier 1 SOVs will be used for turbine commissioning and O&M support. Tier 2 walk-to-walk vessels, mainly redeployed from the Gulf of Mexico's oil & gas sector, will also be used for turbine commissioning and some maintenance work from time to time. Vessels falling into this category include the Paul Candies and one of the Hornbeck HOSSOV 300E MPSVs.

There remains potential for additional Tier 1 vessels, with at least three vessels currently identified by developers, for an estimated CAPEX of $450-500 million.

To confirm the theme of comparatively high costs for locally built vessels, in its Q2-23 financial reporting, Dominion Energy has reported that the construction of the U.S.-built wind turbine installation vessel (WTIV) Charybdis had cost $367 million as of June 30, 2023, and is forecast to rise to around $625 million by time of delivery at the end of 2024 or early 2025. To put this in context, WTIVs contracted in Asian yards with similar specifications in the same time period as Charybdis, cost around $325 million. The delayed de-

U.S. OFFSHORE WIND PIPELINE



Source: Intelatus Global Partners

livery means that the vessel will (most likely) not be deployed on Ørsted's Revolution Wind and Sunrise Wind projects.

Drivers for CTV and SOV demand

Those reading about U.S. offshore wind over the last few months will have experienced roller coaster emotions, lurching between optimism and pessimism.

Developers have reported projects have become unfinanceable due to a combination of inflationary factors, U.S. specific tax credits and supply chain challenges. Several of these developers have sought to renegotiate or cancel contracts to sell electricity to states for agreed rates by agreed dates. As a result, some projects will see completion dates shift back for several months to even years.

However, the fundamental drivers for offshore wind remain sound. At the federal level, the current administration is focusing resource on the leasing and permitting of offshore wind and plans to approve over 13 GW of project capacity before the end of 2024 and provide financing support through the Inflation Reduction Act related tax credits.

At the state level, especially for the Northeast and Mid-Atlantic segment, we see states with clear ambitions to increase the use of renewable energy, reduce the amount of imported hydrocarbons, setting offshore wind procurement targets and creating a clear route to market for developers.

Our 87 GW project pipeline, shown in the chart, covers 73 wind farms located in federal and state waters off the Atlantic. Pacific and Gulf of Mexico Coasts as well as in the Great Lakes. 42 MW of capacity is operational, 938 MW currently in offshore construction and a further 3.3 GW of capacity has passed the final investment decision hurdle.

A good barometer for long-term CTV activity is to look at the number of turbines that will be installed as during their long lifetime, they will require constant routine inspection, repair and maintenance, the technicians for which are transported and/or housed on CTVs and SOVs.

Based on current developer plans, the pipeline translates to close to 4,500 turbines being installed in U.S. waters by 2035, which are expected to be supplied by the three dominant western OEMS: Siemens, GE and Vestas.

Looking to other markets for guidance

The mature and large European offshore wind market can be used as a guideline to developments in the CTV and SOV market space.

Europe is expected to have installed close to 7,000 turbines in total by the end of 2024. By the end of 2024, slightly more than 400 Tier 1 CTVs will be operational in Europe, supporting both long-term operations and maintenance support for existing wind farms as well as construction and commissioning of new wind farms. At the same time, 43 Tier 1 SOVs are expected to be working for developers and OEMs, a number which will jump to 64 by 2026 (although not all of these are contracted).

What about Tier 1 technical trends?

On average, CTVs have become longer, wider and feature increased passenger capacity.

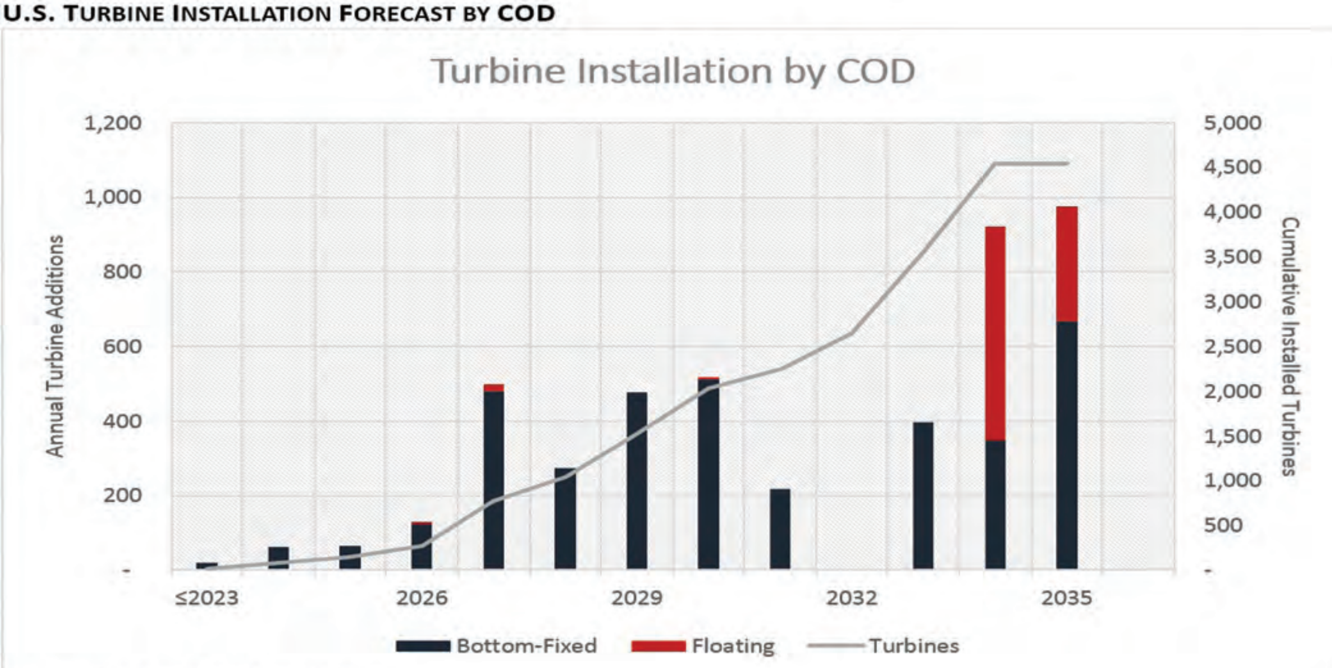
Catamarans remain the dominant hull type, but there are also an interesting number of surface effect vessels, SWATH (small waterplane area twin hull), trimarans, CTVs featuring outriggers and a CTV featuring a hydrofoil.

Waterjets and twin fixed pitch propellors are the leading solutions for active vessels, but the Volvo Penta quad IPS system has gained much favor, featuring in over 50% of new builds.

The SOV segment is defined by those vessels more focused towards longer term O&M work and those vessels suited to turbine commissioning projects, the latter which generally requires more technicians to be housed. As the charts show, the long-term contracted SOV supply has grown at a fairly steady rate, whereas the SOV segment is currently going through a significant growth spurt. The one concern for this segment remains that SOVs are a comparatively commoditized item, which is relatively easy to package and explain to investors, fueling the risk for speculative and over-building.

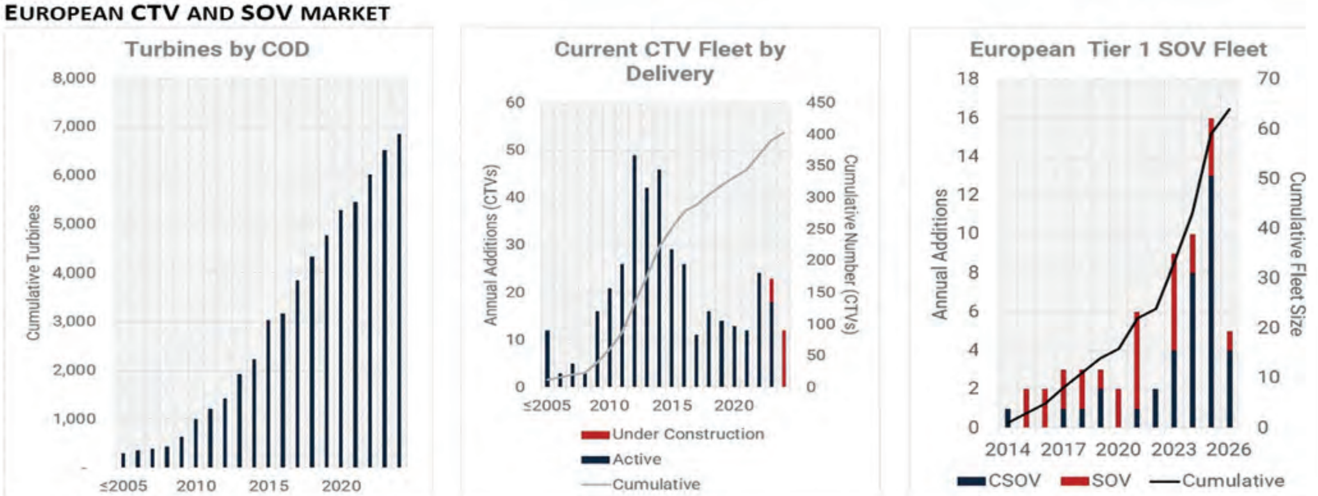
The trend for the SOV segment is for battery-based diesel electric propulsion systems, where the engines feature some form of fuel flexibility to accommodate hydrogen energy carriers, such as methanol and liquid organic hydrogen carriers (LOHC).

U.S. TURBINE INSTALLATION FORECAST BY COD



Source: Intelatus Global Partners

EUROPEAN CTV AND SOV MARKET



Source: Intelatus Global Partners

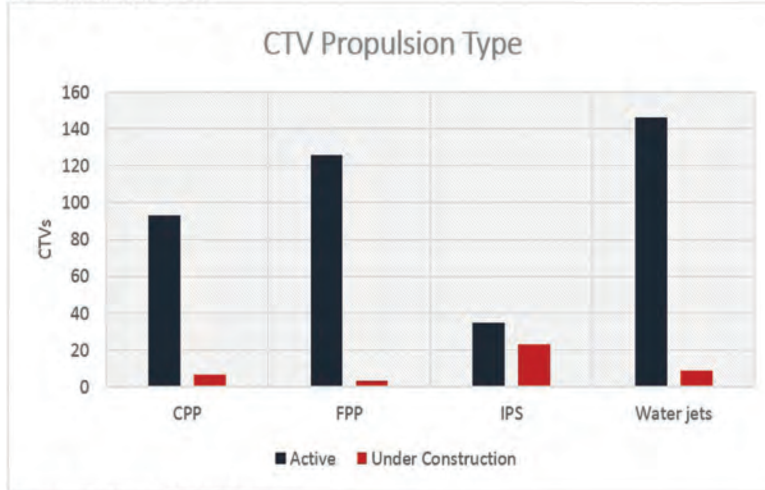
Still a bright future

Offshore wind projects, whether in the U.S. or globally, are navigating some significant obstacles, whether supply chain bottlenecks, financial support or inflationary pressures. However, the fundamentals remain strong for growth of offshore wind projects in Europe, East Asia and the U.S. Further, we anticipate new market entrants, including South America and Australia.

A common theme of all of these projects is that they will require logistical support during construction and operations. CTVs and SOVs remain key assets for these activities, and more will be required.

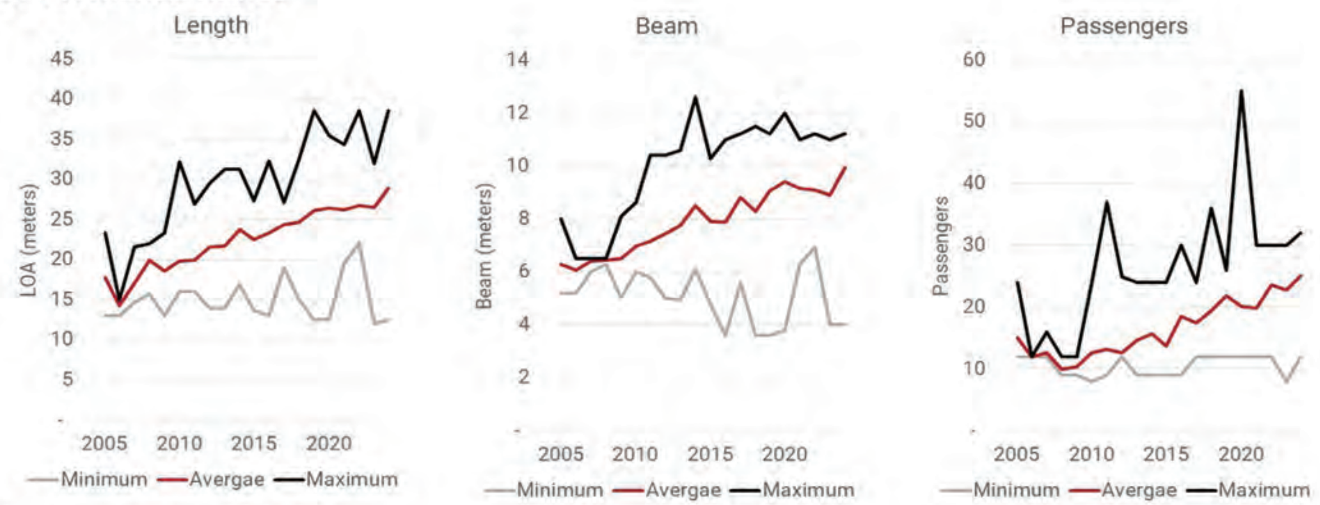
But to avoid the challenges that have been faced by many early movers, lower risk long-term charter contracts with no early termination provisions should always be considered as a potential option.

CTV Propulsion Types



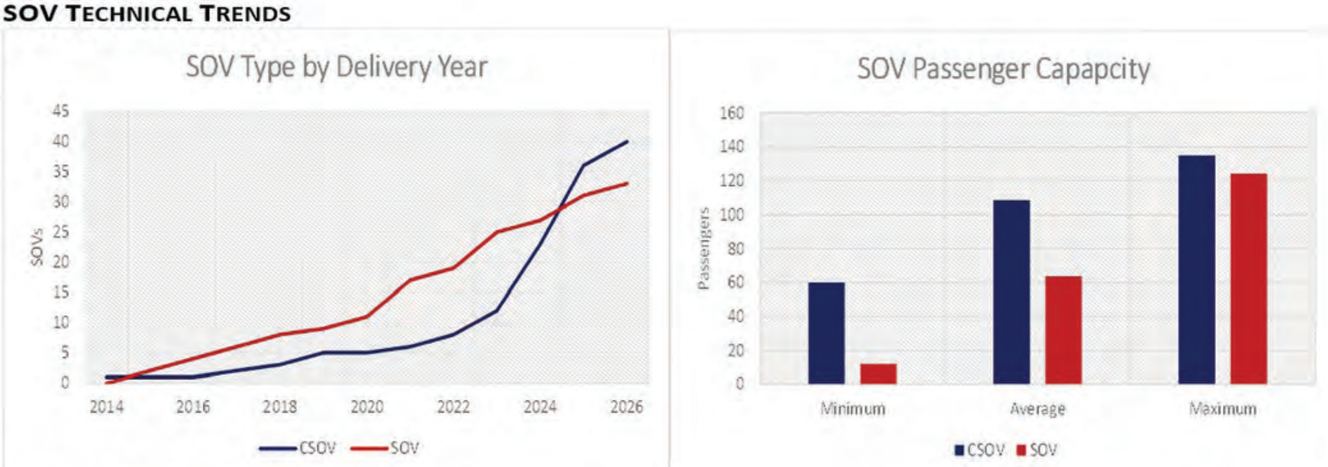
Source: Intelatus Global Partners

CTV Technical Trends



Source: Intelatus Global Partners

SOV Technical Trends



Source: Intelatus Global Partners

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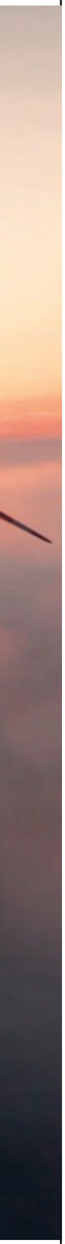
The Curious Case of the 1,200 MW Transmission Size "Limit" in New England

How the Maximum Contingency of 2,200 MW Was Recast to a 1,200 MW Ceiling

By K&L Gates partners **Theodore Paradise**, **Kimberly Frank**, and **Ruta Skučas**



As policy makers and energy developers look to develop and interconnect large offshore wind projects in the most economically efficient and least environmentally impactful way, an issue has developed. A relatively recent limit, set in place by the grid operator in New England in a planning process document, states that no single system loss of energy, or "contingency", can be larger than 1,200 megawatts (MW). This 2016 addition to ISO New England's (ISO-NE) Planning Procedure No. 5-6 is increasingly creating consternation among both policy makers and developers and threatening to raise the cost and impacts of offshore wind. Part of the reason is that a de facto standard has developed in Europe that utilizes 2,000 MW 525 kilovolt (kV) high voltage direct current (HVDC) cable systems to interconnect offshore wind, with tens of billions of dollars of these systems already ordered and scheduled to be in service by the end of this decade. The 2,000 MW size allows for single wind projects to be larger and benefit from economies of scale spread over more power production per project and significant reductions in the number of HVDC transmission systems needed to connect these projects to the grid. To meet New England's projected need of 30,000 MW of offshore wind power, 10 more HVDC cables and associated converters at several hundreds of millions of US dollars each would be required if the 1,200 MW single source limit continues to apply.

At the same time, the complex and opaque history of the 1,200 MW limit has led to the impression that this has been a long-standing ceiling in the region and a sense that it would be a significant effort to lift the limit. If the 1,200 MW ceiling is relatively recent, what is the long-standing single source New England loss limit agreed to by the predecessors of the New York Independent System Operator (NYISO), ISO-NE, and PJM Interconnection (PJM) in 1991? 2,200 MW. Instead of a ceiling, the 1,200 MW is a floor that the three systems will redispatch power flows on their system to maintain.

The 1991 agreement, the "Procedure to Protect for the Loss of Phase II Imports," set 2,200 MW as the single source loss ceiling and established a process for assessing conditions in the NYISO and PJM systems through an examination of seven reactive conditions. In PJM, this consists of power flows across three specified lines, and in NYISO, there are four monitoring points consisting of voltages at three substations and power flows on the Central East Interface. Any restriction below the 2,200 MW level down to 1,200 MW, and any point in between, is an at least hourly calculation involving a control-to-control room check. The 1,200 MW value does not appear in the 1991 agreement, but is observed by the three grid operators as the lower limit under which system operators will redispatch generation to maintain. The 1991 agreement was filed with the Federal Energy Regulatory Commission (FERC) in Docket No. ER07-231-000 on an "informational" basis in November of 2006 because it did not contain "rates, terms, or conditions" under the Federal Power Act (FPA). FERC rejected that informational characterization in its January 12, 2007 order, and accepted the filing under Section 205 of the FPA. The 1991 agreement can be found on the FERC website using the citation 111 FERC ¶ 61,017.

In practical terms, this means that, since 1991 until the present day, resources like the Phase II HVDC line from Canada to the United States that can operate at up to 2,000 MW, the Boston-based Mystic Generating Station units 8 and 9, which collectively are a 1,600 MW single source loss due to a common natural gas fuel source issue from an adjacent liquefied natural gas gasification facility, and the region's two remaining nuclear plants, Seabrook in New Hampshire and Millstone in Connecticut, can all operate above 1,200 MW and up to their limits as long as system generation dispatch and resulting power flows on the New York and PJM systems allow. The 2016 planning process limit only applies prospectively to new resources – HVDC lines interconnecting offshore wind included.

As more focus was placed on the 1,200 MW limit by policy makers and developers, in March of 2023, ISO-NE sent a letter to the Joint ISO/RTO Planning Committee requesting a coordinated study among ISO-NE, NYISO, and PJM to determine if the 1,200 MW limit could be raised. ISO-NE described the 1,200 MW design limit as a means to address the issue as one of "daily unpredictability" regarding the size of the single contingency limit under the 1991 agreement. In its letter, ISO-NE notes the size of larger resources could be "constrained by an otherwise optimal interconnection design," and asks the Joint ISO/RTO Planning Committee to assess the source limit to see if it can be increased. ISO-NE noted the upper limit for a single system contingency to be 2,000 MW -- instead of the stated 2,200 MW -- and sought study up to that lower 2,000 MW limit. While a 2,000

MW operating ceiling would accommodate the emerging offshore wind transmission standard set in Europe, it is worth noting that this is still 200 MW below the maximum level grid operators identified in 1991 and is contained in the ISO-NE tariff, the only upper limit in a document that has been reviewed and accepted by ISO-NE's regulator, FERC.

One interesting element of the ISO-NE request is that ISO-NE itself that has set the 1,200 MW ceiling as a design limit, not PJM or NYISO. The ISO-NE could similarly remove its self-imposed limit and instead abide by the hourly check-in set out in the 1991 agreement for new resources up to the 2,200 MW ceiling.

Regardless of the outcome of the exercise that ISO-NE has undertaken, policy makers and developers may also try and work around ISO-NE's 1,200 MW ceiling by ensuring that the loss of larger cables does not result in a simultaneous loss of more than 1,200 MW across the ISO-NE footprint. Suggestions from industry have included networking facilities from inception so that there are multiple paths for power to flow. The advent of HVDC breakers and commercial deployment of that technology in western European over the next five years may make the networked solution feasible, but the New England states will have to specify or agree upfront to networking in transmission requests for proposals and ISO-NE will need to confirm that additional transmission paths would address the single source loss issue.

Until one of these or another solution to address the lowered single contingency limit is adopted, offshore wind projects and transmission circuits in New England will likely continue to see limits of 1,200 MW.

January 1, 1991
Review Date: 10/1/2006

PROCEDURE TO PROTECT FOR THE LOSS OF

PHASE II IMPORTS

Reference: Procedure to Protect for the Loss of Hydro-Quebec Exports

INTRODUCTION

The Hydro-Quebec/NEPOOL Phase II tie has maximum transfer capability of 2,000 MW. Joint PJM/NYPP/NEPEX studies have concluded that the loss of the Phase II facilities at high levels of imports could have a worse effect on NYPP and PJM than the worst internal contingency that these individual systems normally protect against. Accordingly, it has been agreed that Phase II imports will be limited to the extent necessary to insure that NYPP and PJM operation reliability criteria are not violated by the loss of Phase II contingency. This procedure is designed to prevent the occurrence of a loss of Phase II contingency applicable when Phase II is operated in the isolated or synchronous mode. The absolute maximum loss of Phase II contingency allowable under this procedure will be 2,200 MW.

The introduction of the 1991 Procedure to Protect for the Loss of Phase II Imports

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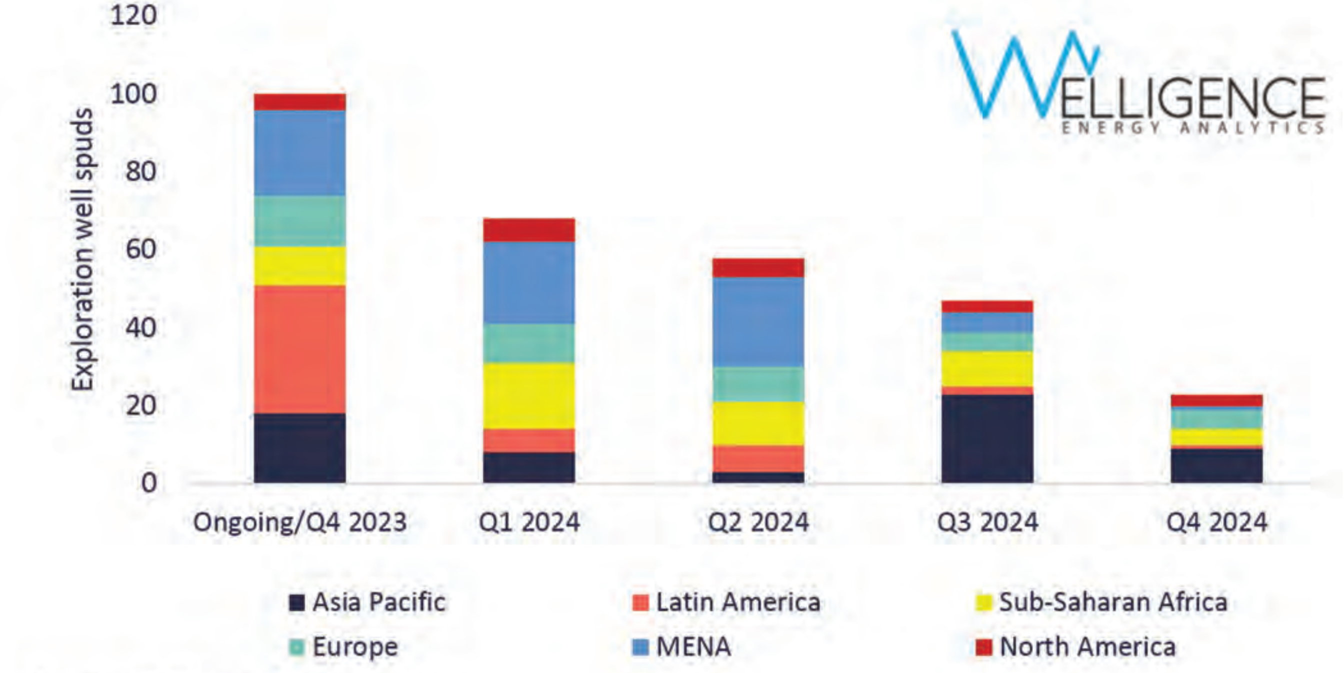
GLOBAL EXPLORATION OUTLOOK

Industry continues chasing big oil, key gas targets also on the radar

By David Moseley, Vice President Operations for Europe, Welligence Energy Analytics

The well count through 2024 will grow as companies finalise budgets and solidify exploration plans



Source: Welligence Energy Analytics

Global exploration drilling is set for a boost in 2024 – we have line of sight on over 200 wells targeting over 30 bnboe of resource (unrisked). Several gas hotspots are on the industry agenda, whilst the strong appetite for oil exploration in new and proven plays will continue on both sides of the Atlantic. Much of the activity is underpinned by increased drilling in MENA, Sub-Saharan Africa and Asia Pacific. Drilling in North America, South America and Europe looks set to remain stable.

Exploration Drilling Forecast by Region

Despite some cost pressures, and a growing energy transition agenda which is seeing some companies shift focus away from hydrocarbons, the appetite for both oil and gas exploration persists.

Hunting for Oil across the Atlantic Basin

In Brazil, we're closely watching Petrobras' Morpho-1 (Foz de Amazonas), a potential play opener in the country's Equatorial Margin. And it's not all about the Brazilian NOC, other operators are preparing to drill – PETRONAS and bp will be drilling the Mola-1 and Pau Brasil-1X wells respectively, both located in the pre-salt. While the days of multi-billion finds in the pre-salt are almost certainly over, the play still has material running room.

On the other side of the Atlantic, the world-class status of the Orange Basin in Namibia will be better defined in 2024 as other companies get involved following the success achieved by TotalEnergies and Shell – wells are planned by Galp (PEL 83-2X), Chevron (PEL 90-1X) and Woodside (PEL 87-1X). The recent hiatus in ultra deep-water exploration in Congo-Brazzaville and Senegal/Guinea Bissau is set to be broken, with wells planned by TotalEnergies (Niamou) and CNOOC (Pangolin).

Near field, infrastructure-led exploration (ILX) drilling is the focus in Europe and the US Gulf of Mexico. However, some wells such as Equinor's Rondeslottet and Aker

Selected exploration wells to watch - 2024

BP's Arkenstone in Norway show there remains material potential outside mature plays, with combined pre-drill volumes in these prospects totalling >1 bnboe. It's a similar story in the US Gulf of Mexico, where planned wells such as Hess' Corvus-1 and Chevron's Vancouver-1 are both targeting >100 MMboe.

Gas is the Target in Select Regions

The world wants gas, and the deep waters of the Eastern Mediterranean will see continued exploration. One well to watch is Eni's 7 Tcf Orion well in Egypt currently drilling ahead with results expected in Q1. The demand for gas that can be delivered into domestic and regional markets (in this case Europe) is a big driver of activity. Similarly, growing gas demand in Indonesia, both locally and to meet export needs, combined with material undeveloped reserves, means this is a key exploration focus, particularly offshore in the North Sumatra Basin. Harbour Energy's Halwa and Gayo wells are two such examples. And over in South America, Ecopetrol is also seeking to satisfy Colombia's hungry domestic market with its deepwater Orca Norte well in the Caribbean Sea.

It's not just the Majors chasing big targets

The Majors will continue to account for a significant share of global exploration investment, operating around 30% of wells. The peer group will drill the majority of high-impact wells, but with a strong regional focus. All but one (Argentina) of Equinor's wells are in Norway. ExxonMobil and TotalEnergies are focussed on the exploration hotspots of Guyana and Sub-Saharan Africa, respectively. Shell will be the most active in 2024, chasing targets in Malaysia and Oman. Eni and bp, the latter with minimal operated drilling planned in 2024, are largely concentrating efforts in the Eastern Mediterranean.

However, the independents are also set to drill important and potentially needle moving (in the success case) wells. Galp and Woodside (Orange Basin, Namibia), Harbour Energy (North Sumatra, Indonesia) and Aker BP (Norway) are three such examples.

2024 Offshore Engineer Editorial Calendar

January/February 2024

- Floating Production Systems
- Drilling & Completion: Downhole Data
- Offshore Wind Report
- Going Green: Carbon Capture & Storage
- Abandonment & Decommissioning
- Subsea: Workclass ROVs

Exhibitions

Floating Wind Solutions, Houston
Subsea Expo, Aberdeen
Oceanology International, London

March/April 2024

- Deepwater
- Production: Topsides, Platforms, Hulls
- Installation Vessels
- Offshore Wind Report
- Going Green: Electrification
- Subsea: Inspection, Repair & Maintenance

Exhibitions

Offshore Technology Conference (OTC), Houston
Europe Offshore Wind, Bilbao, Spain
IPF Wind Conference, New Orleans

May/June 2024

- Offshore Wind
- Going Green: Fuels & Lubes
- Brownfield: Projects & Life Extension
- Subsea: Subsea Tieback Projects
- Seismic & Geotechnical Surveys
- Safety Systems

July/August 2024

- Subsea: Robotics [UUVs, AUVs, ROVs]
- Offshore Wind Report
- Going Green: Green Hydrogen
- Transport & Installation
- Heavy Lifters: Deck Machinery & Cranes
- Drilling Rig & Equipment Innovation

Exhibitions

Offshore Europe
Gastech
OSW Port & Vessel

September/October 2024

- Digital Transformation
- Offshore Wind Report
- Going Green: Water Systems
- Subsea Processing
- Production Optimization, Projects and Technologies
- Power Generation

Exhibitions

ADIPEC

November/December 2024

- Decarbonization
- Offshore Wind Report
- Going Green: Outfitting the Green Rig
- Subsea: Electrification
- Marginal Fields: Projects and Technologies
- Production Automation & Autonomy

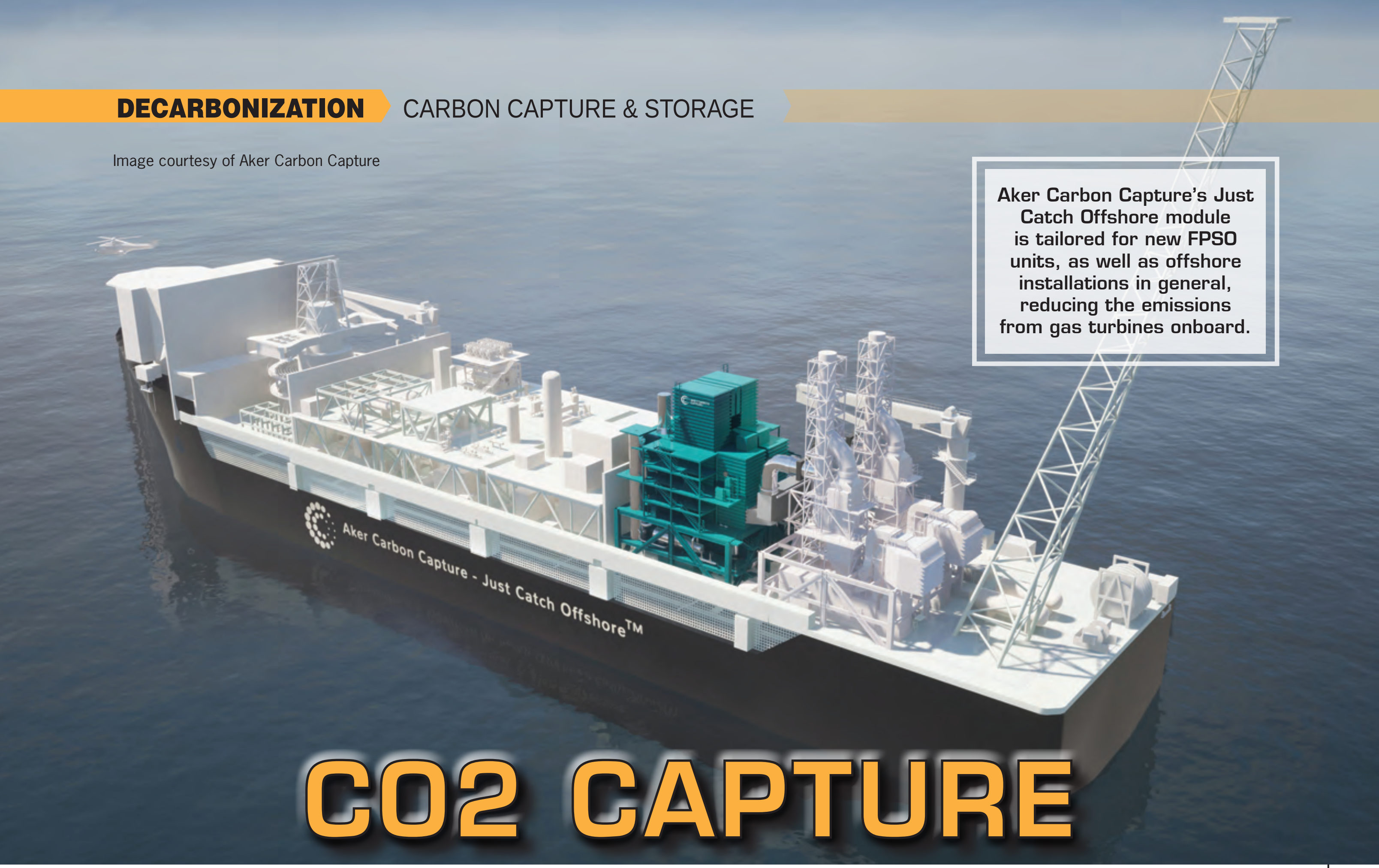


Image courtesy of Aker Carbon Capture

Aker Carbon Capture's Just Catch Offshore module is tailored for new FPSO units, as well as offshore installations in general, reducing the emissions from gas turbines onboard.

CO2 CAPTURE TECHNOLOGY READY FOR NEW OFFSHORE FRONTIERS

If the industry has been capturing CO2 for decades, why all the innovation now?

By Wendy Laursen

Larger scale adoption feels a way off – but economics could stack up favorably in some settings compared to options such as electrification and using e-fuels.

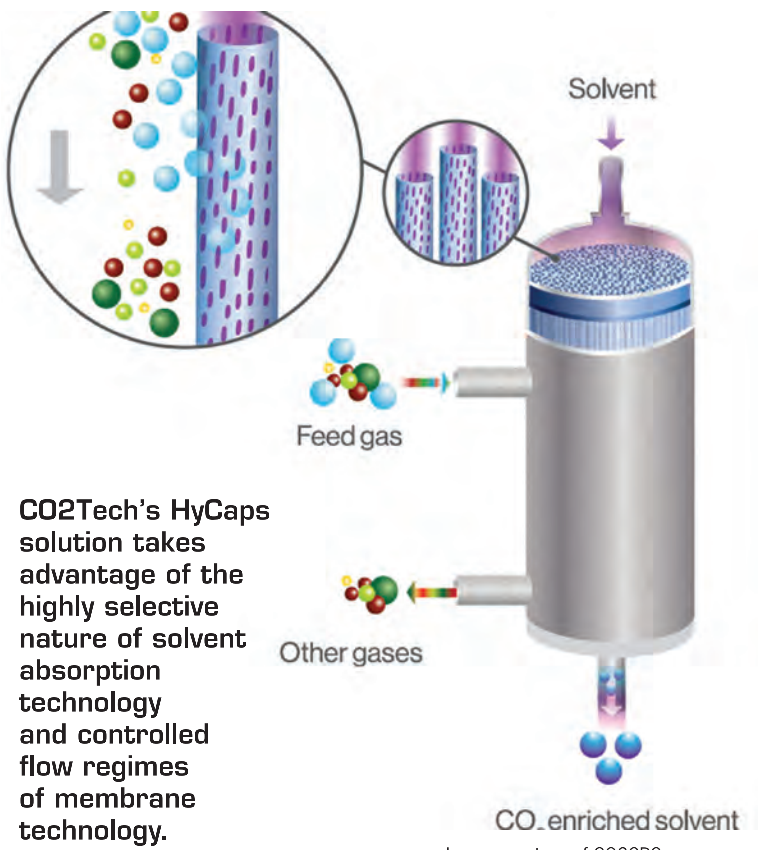
– Mhairidh Evans,
Head of CCUS Research at Wood Mackenzie

Image courtesy of Wood Mackenzie

CO2 capture technology has been used for around a century in natural gas processing plants to separate out the commercially valuable methane. In the 1970s, that CO2 found purpose in advanced oil recovery. Now, carbon capture and storage (CCS) is reducing upstream CO2 emissions, with more applications to come.

The processing technology is being adapted from onshore, but no one solution is likely to fit all given the wide range of locations, facility sizes, and infrastructure support. There have been encouraging results in post-combustion CO2 capture concepts, such as CO2Tech's HyCaps system, and chemical processes for its subsequent mineralization, such as that developed by Carbfix. Pre-combustion reactors are also under development.

Mhairidh Evans, Head of CCUS Research at Wood Mackenzie, says that oil and gas production will be one of the early adopters of CCS, with around 15% of operating and announced carbon capture projects. "However, these projects aim to strip the CO2 out of the produced gas, rather than addressing the CO2 from the operations of the production platform itself. For those emissions, we expect operators to prioritize other methods such as operational efficiency measures or alternative fuel sources before considering CCS."



CO2Tech's HyCaps solution takes advantage of the highly selective nature of solvent absorption technology and controlled flow regimes of membrane technology.

Image courtesy of CO2CRC

Image courtesy of Shell

The use of a limited number of gas turbine models on these vessels makes the projects very similar and opens the door for efficient standardization.

– Laurent Thomas,
Licensing Technology Manager Gas Process at Shell Catalysts & Technologies

Image courtesy of ABS

Using captured CO2 to synthesize methanol has been a topic of discussion.

– Joseph Rousseau,
ABS Director – Offshore Technology

While some carbon capture technologies are mature and well-understood, the application onboard platforms or vessels is relatively immature. Hurdles to overcome include deck space, a high energy requirement and relatively low volumes of CO2 from disparate sources, meaning economies of scale are hard to reach, says Evans. "Technology providers are ramping up R&D efforts to modularize carbon capture in smaller, mobile units. Larger scale adoption feels a way off – but economics could stack up favorably in some settings compared to options such as electrification and using e-fuels."

Aker Carbon Capture gained DNV qualification for its Just Catch Offshore™ system in October 2022 and has project studies underway. The company sees CCS as an important tool to help decarbonize the oil and gas industry, reducing emissions from gas turbines. The gas turbines used for power generation offshore can be an efficient local source of energy, covering the electrical and heat demand for both the host facility and the carbon capture process, says Aker. The energy efficiency can exceed 80% when utilizing all waste heat from the turbine exhaust. By implementing CCS instead of power from shore, there is no large electrical transmission loss across the onshore grid, and onshore power can be utilized elsewhere.

Laurent Thomas, Licensing Technology Manager Gas Process at Shell Catalysts & Technologies is optimistic about the potential for CCS as a solution for the decarbonization of offshore platforms. "We are indeed seeing an interest in platforms and FPSOs, although at this point it is mostly at the stage of feasibility studies looking at the specific challenges of these applications, such as plot space and heights limitations, vessel movements, management of chemicals and waste products, etc."

Modularity and standardization will be key, he says. "The use of a limited number of gas turbine models on these vessels makes the projects very similar and opens the door for efficient standardization."

The company's CANSOLV system is being offered in partnership with Technip Energies, and the joint solutions are adapted to emitters of all sizes. CANSOLV has a very low regeneration heat demand due to its advanced solvent and internal energy integration. Further development of optimized solvent formulations is underway. "We are also looking at expanding the design and operating window of our system to reduce the overall energy intensity of CO2 capture – an example is pushing up our regenerator pressure to deliver the CO2 at higher pressure for compression and transport and thus reduce compression energy."

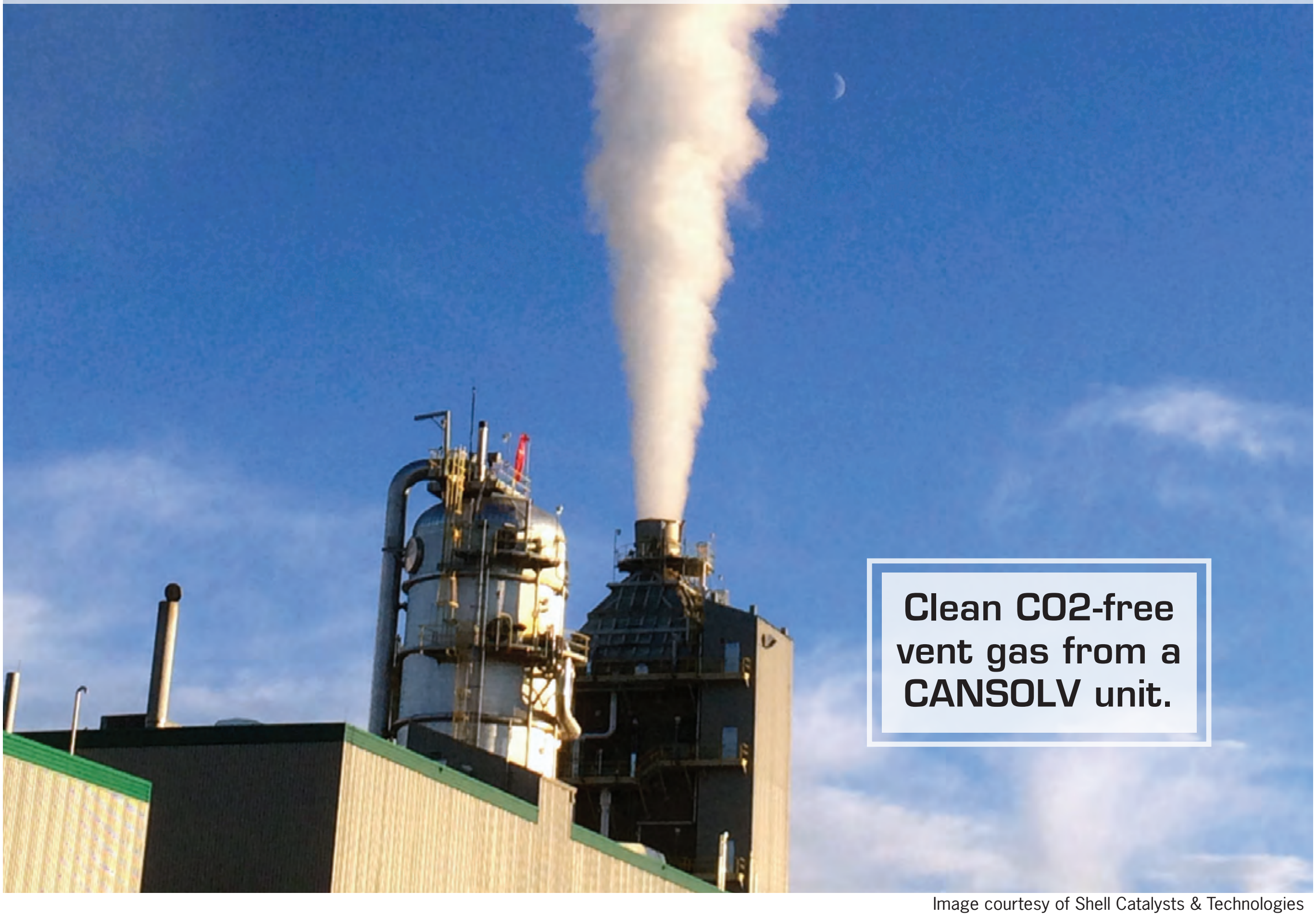
Downstream logistics are a focus of innovation both offshore and onshore. Landside CCS projects are scaling up to sequestration hub solutions, where a CO_2 transport system brings captured CO_2 from a range of industries to one or more locations, often offshore. The hub concept is also being considered for adjacent offshore platforms.

CO_2 from various sources contains different levels and types of impurities depending on the original source, capture technology applied and transport mode, with potential interactions. For example, impurities from pre-combustion sources and post-combustion sources can react and create undesired reactants, says Thomas. A key example is the oxidation of H_2S by NO_2 in dense phase CO_2 and the formation of strong acids. "From this point of view, we feel amine-based technologies, and in particular the Shell CANSOLV system, are well positioned as they deliver a very pure CO_2."

ABS sees the handling and storage of the captured CO_2 as a significant challenge for offshore producers. Joseph Rousseau, ABS Director – Offshore Technology, says: "There is a challenge on what to do with the captured CO_2 since there are no port visits to offload, but some may be injectable into producing or additional wells. Otherwise there needs to be an infrastructure for offloading via pipeline, if possible, or to offshore support vessels or liquefied CO_2 tankers, for transportation to appropriate reception facilities at a port or other offshore hub."

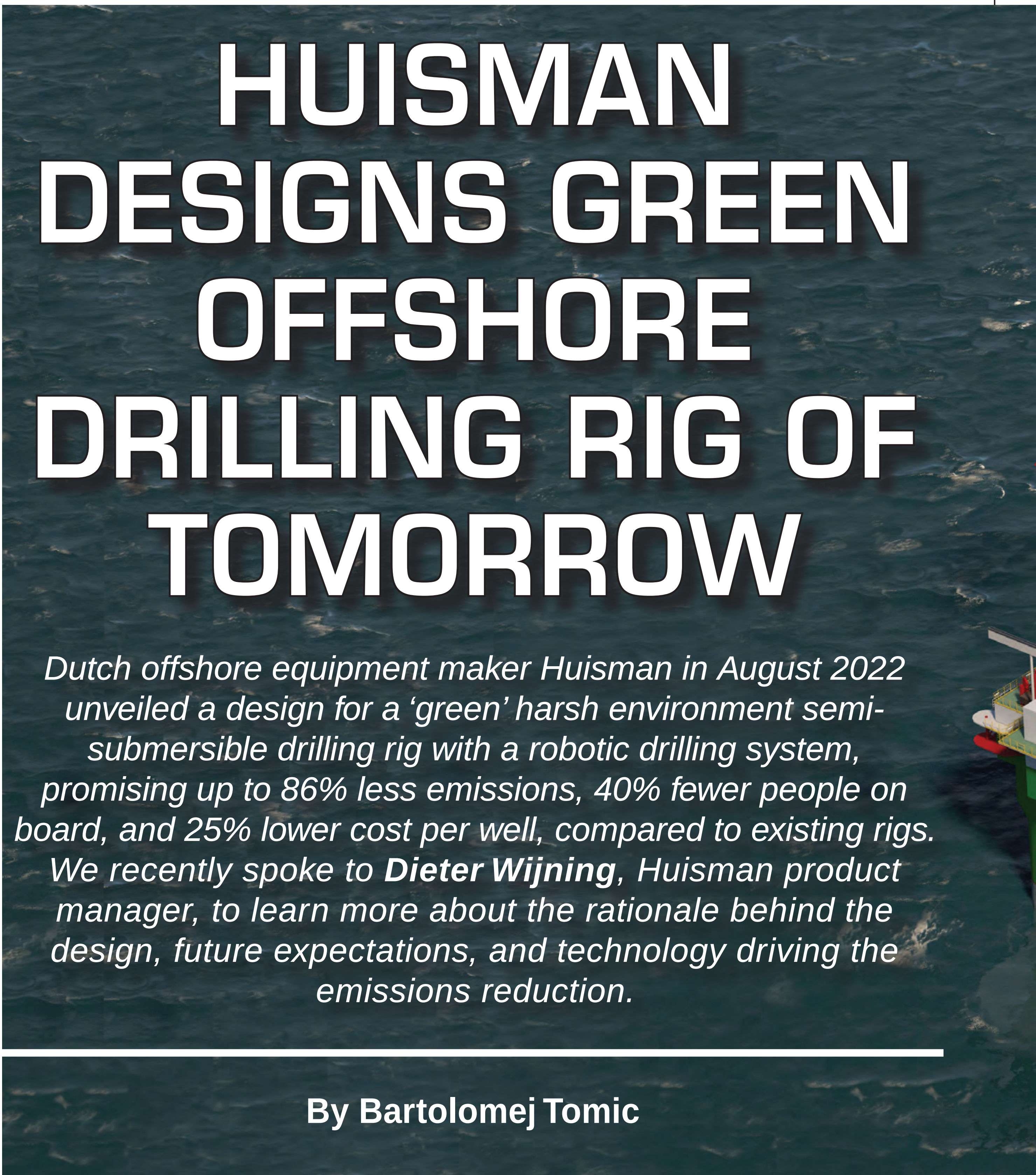
Another possibility is to use it for e-fuel production. "Using captured CO_2 to synthesize methanol has been a topic of discussion," says Rousseau. "Offshore platforms already deal with chemical processes and storage of various substances, so it is not a huge leap to make this part of a process facility, subject to the same constraints as usual on space, weight, power and so on. It would be a combined plant with processing of water for generating hydrogen, which would also be used for other e-fuels like ammonia."

As pointed out by the Global CCS Institute in its 2023 report The Investment Case for CCS: Policy Drive and Case Studies: "The growing global demand for low carbon energy carriers like hydrogen, ammonia and methanol as alternatives to LNG and coal for power plants and for bunkering fuel in maritime shipping has the potential to create a substantial market for these products."



Clean CO_2-free vent gas from a CANSOLV unit.

Image courtesy of Shell Catalysts & Technologies



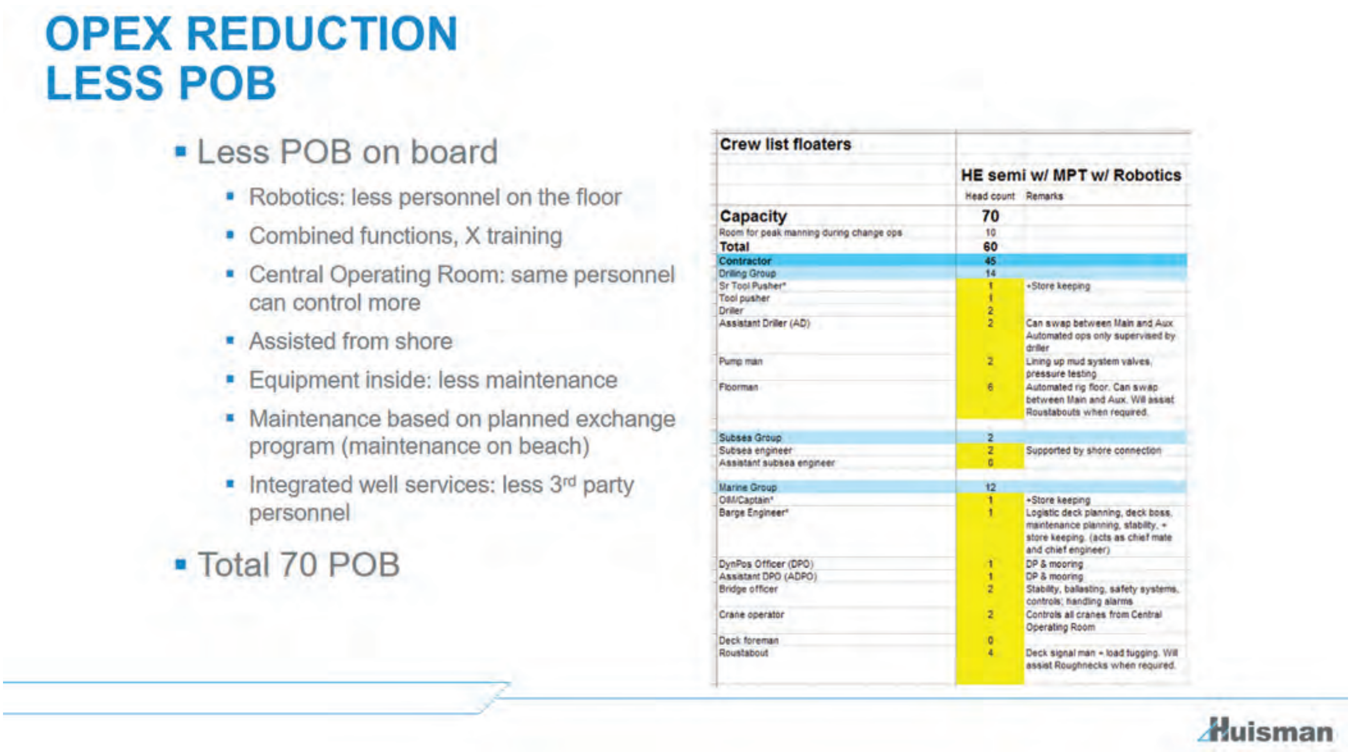
HUISMAN DESIGNS GREEN OFFSHORE DRILLING RIG OF TOMORROW

Dutch offshore equipment maker Huisman in August 2022 unveiled a design for a 'green' harsh environment semi-submersible drilling rig with a robotic drilling system, promising up to 86% less emissions, 40% fewer people on board, and 25% lower cost per well, compared to existing rigs. We recently spoke to ***Dieter Wijning****, Huisman product manager, to learn more about the rationale behind the design, future expectations, and technology driving the emissions reduction.*

By Bartolomej Tomic

All images courtesy Huisman


Huisman
Huisman
Huisman



Crew list floaters	HE semi w/ MPT w/ Robotics	
	Head count	Remarks
Capacity	**70**	
Room for peak manning during change ops	10	
Total	**60**	
Contractor	45	
Drilling Group	14	
Sr Tool Pusher*	1	+Store keeping
Tool pusher	1	
Driller	2	
Assistant Driller (AD)	2	Can swap between Main and Aux Automated ops only supervised by driller
Pump man	2	Lining up mud system valves, pressure testing
Floorman	6	Automated rig floor. Can swap between Main and Aux. Will assist Roustabouts when required.
Subsea Group	2	
Subsea engineer	2	Supported by shore connection
Assistant subsea engineer	0	
Marine Group	12	
OIM/Captain*	1	+Store keeping
Barge Engineer*	1	Logistic deck planning, deck boss, maintenance planning, stability, + store keeping. (acts as chief mate and chief engineer)
DynPos Officer (DPO)	1	DP & mooring
Assistant DPO (ADPO)	1	DP & mooring
Bridge officer	2	Stability, ballasting, safety systems, controls; handling alarms
Crane operator	2	Controls all cranes from Central Operating Room
Deck foreman	0	
Roustabout	4	Deck signal man + load tugging. Will assist Roughnecks when required.

When asked about what spurred Huisman to come up with the design, Dieter reminds that this is not the first time the company is designing an offshore rig that produces less emissions compared to conventional peers.

"In the past, we have built also what they call the greenest drillships in the world, the Noble Globetrotter I and II," which, he says, emit only 45% of the emissions of a typical drillship.

The two drillships, built in 2012 and 2013 respectively, and owned by Noble Corp., are still active. They are operating for Shell in the U.S. Gulf of Mexico, and have recently secured contract extensions with the oil major. Globetrotter I secured a dayrate of $390,000, with Globetrotter II securing $398,500 dayrate.

Back to Huisman's green semi-sub design, Wijning first explains where Huisman, which builds equipment for both oil and gas, and offshore wind, stands when it comes to the future energy mix.

"We actually fully acknowledge that we have to go to renewable energy, but we also know that this will take for a long, long time. So, we see that fossil fuels will be part of the energy mix for quite some time to go."

But he also says that Huisman has a 'rock solid belief' that "we have to produce and consume these fossil fuels in the greenest way possible, and this is why the company decided to design "the greenest rig possible." The rig design is currently targeted for eventual deployment in the wider North Sea region.

"Currently, we see that for Western Europe gas from the North Sea is the cleanest fossil fuel which is out there. And we also see that the current rigs o Tecgut there emit around 45,000 to 50,000 tons of CO_2 per year, and I think we can do something serious about that, that has to be lower. So that's why we started this whole path for the green Harsh Environment Rig."

40% FEWER PEOPLE ON BOARD

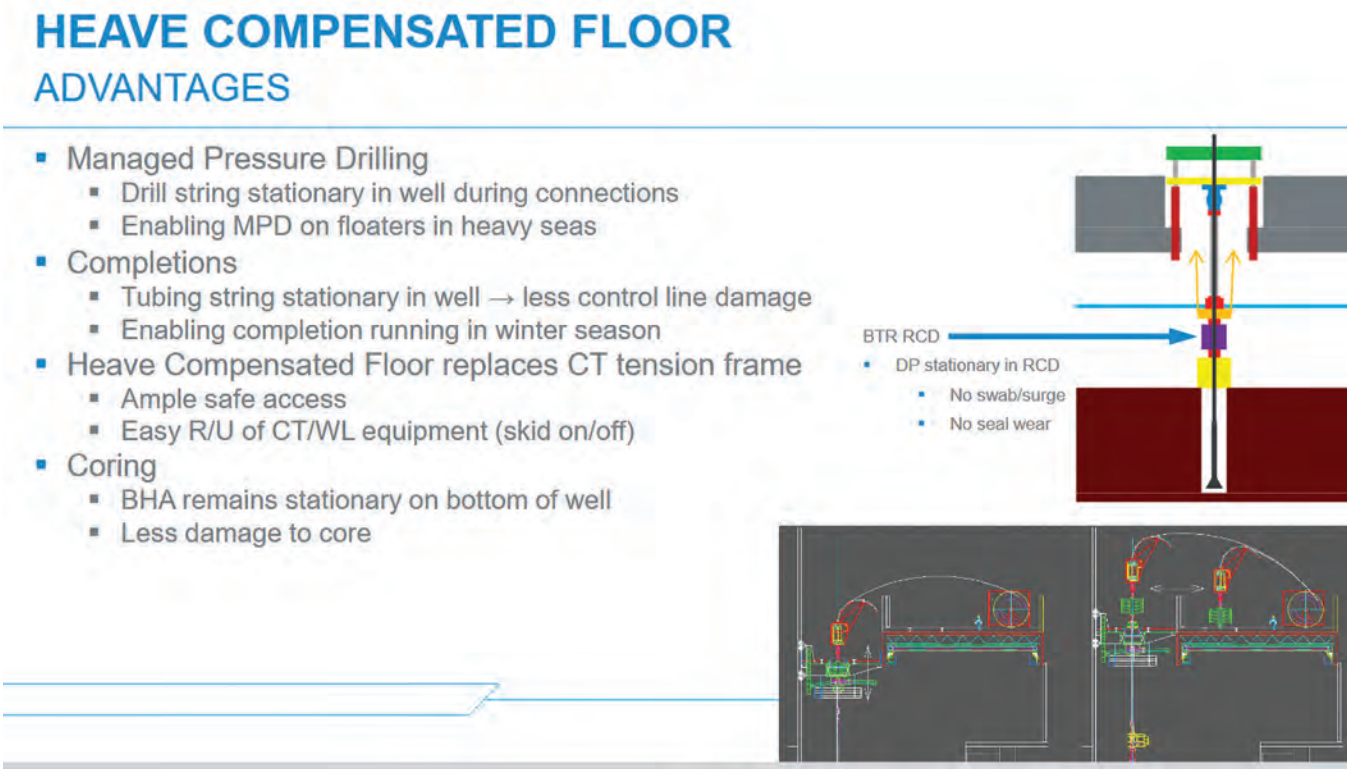
As mentioned before, Huisman promised a 40% reduction in onboard personnel with the new rig design.

How does one achieve this?

Wijning explains: "Well, first of all, the drill floor is completely unmanned. So, for example, stand building and pipe handling on the deck as well is done completely robotic and fully hands off.

"Tubulars will arrive on the rig in boxes and no personnel will touch these tubulars from arrival up to running into the hole itself. Therefore, you have much less people on the drill floor and on the pipe deck."

According to Wijning, the rig will have a central operating room where personnel can control the complete rig with fewer people.



Also, the maintenance and change out operations are planned to be completely done out of the critical path and in many cases even onshore.

"So, you ship pieces of equipment onshore, do the maintenance out there and then refit it on the rig," Wijning explains.

After thorough evaluation of POB requirements, Huisman found it could reduce the number of people on board by 40% to 50% compared to currently available rigs.

"Basically, we came to the conclusion that we can do with about 70 people on board instead of, say, 120 to 140," Wijning says.

FEWER DAYS PER WELL, LOWER COSTS PER PROJECT

Huisman also promised 25% lower cost per well compared to existing harsh environment semi-subs.

"Both lower costs and lower emissions start with less days per well. So, we designed the various pieces of equipment with reduced invisible lost time as a goal.

"We do not need to slip and cut the drill line, we do not need to exchange the inserts of the slips and of the elevators, and therefore you can run the complete drill string from top to bottom with bottom hole assemblies and everything without any exchange and any removal of the power slips."

"Further, we also have the drill floor completely flush with the main deck and therefore mobilizing of equipment is much, much easier, and therefore saving time, and therefore saving costs as well.

Wijning says that the design includes a heave compensated drill floor, which enables the drill string to be completely standing still relative to the seabed and to the hole.

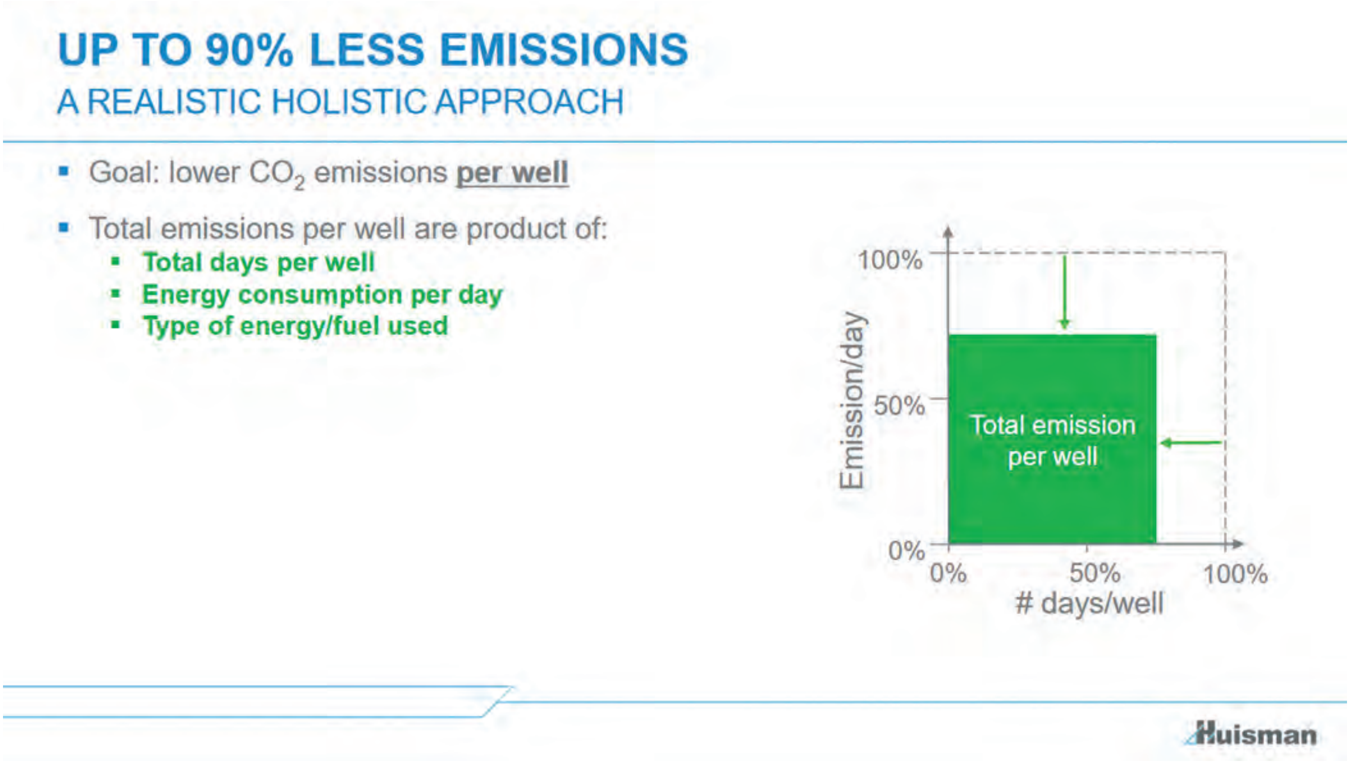
"This ensures that the drill string, the casing string, or also the completion string is stationary in the well, and therefore you can work with worse weather conditions and you have less waiting on weather days, all in all, saving days, and therefore also saving costs," Wijning explains.

HYDRO, WIND, AND… NUCLEAR?

While fewer days per well drive down emissions, this is not the main factor leading to the Huisman rig being green.

Namely, the plan is for the rig to be powered by onshore-produced hydroelectricity (available in Norway), via a power cable from a nearby platform. Alternatively, it can be powered by two floating wind turbines, moored next to the rig, which, the company says, could lead to up to 86% percent emission reduction in total.

This doesn't mean that the rig won't be able to operate without hydropower or floating wind, as diesel engines will still be there for these instances. as mentioned before, reducing emissions start with reducing the number of days



per well, and this is proven by comparing the green rig for the future with the current state-of-the-art rigs. So, we've done a complete drilling well on paper and we saw that we could reduce the time per well with about 18% to 20%. That's already part of that gain.

Wijning explains in more detail: "We have a zero energy active heave compensation system on it. We have a lower wind area, fewer people leadingto less hotel loads, and therefore, the energy consumption per day is less. So that combined with the less days when we are running on diesel, the rig emits around 40% to 45% less than its competition. But when running on external power (Hydro, Wind .OE) we can reduce the emissions up to 85% to 90%. So it depends on the case, when we can receive external power, then we can go up to the 86%.

What is more, Huisman has been thinking about nuclear powered rigs, but, Wijning says, we feel that's a little bit too early, so we haven't included that one yet.

Still, when asked when he could see nuclear powered rigs becoming feasible, he said 10 years from now could be possible.

"I know that here in the Netherlands we are investigating nuclear power for vessels and of course it's not new. I mean, the naval has done it for years and years, and in the past, also commercial vessels have been deploying nuclear power. So I think this will be coming back for sure," Wijning says.

CHICKEN & EGG

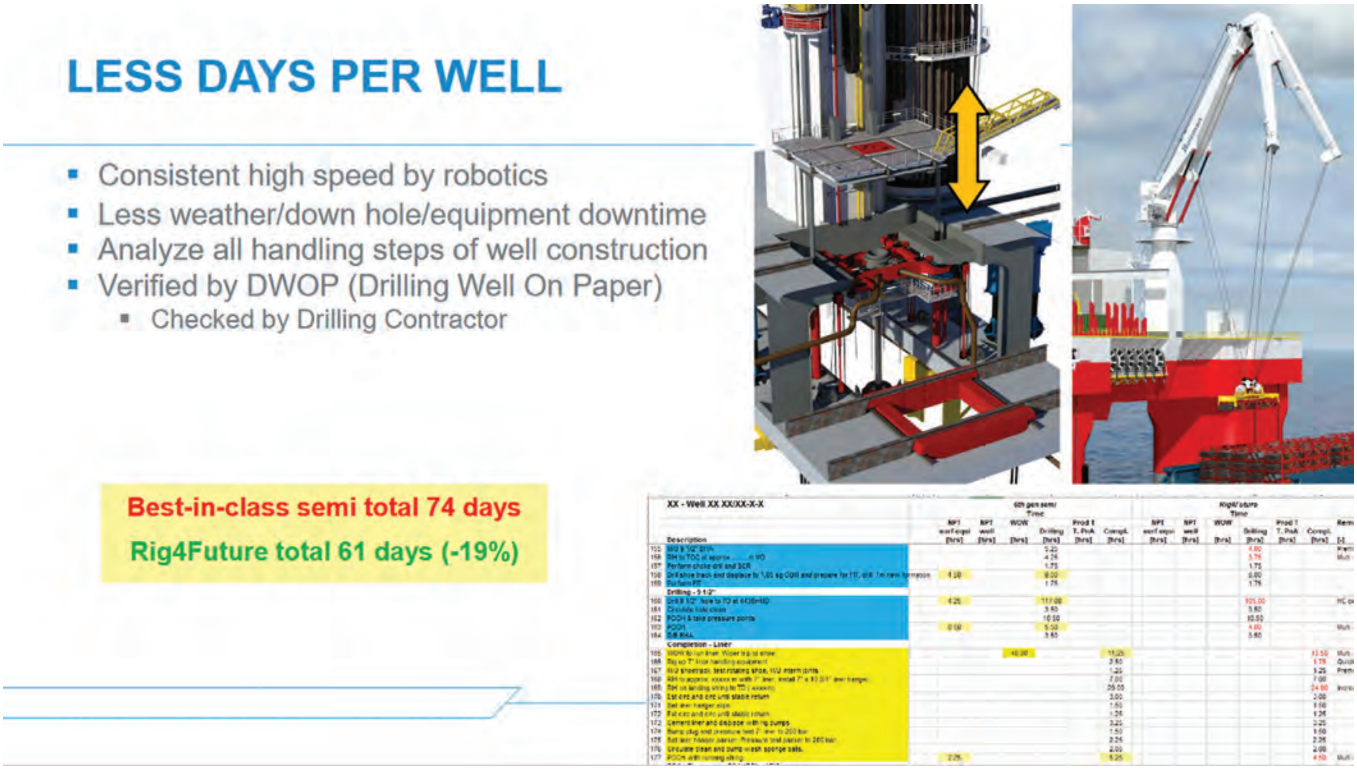
"When will the Huisman Green Rig design become an actual, tangible rig? What do the drillers say?," we asked Wijning.

He says: "Well, everybody is very enthusiastic about the design and its capabilities. However, we are dealing with the chicken and the egg situation here. Contractors focus on their own fleets and will only consider new builds when a sufficient long-term contract is basically handed out by an operator.

"Operators on the other hand, will be very happy to contract a rig when she's available. But yeah, she will only be available when a contractor will build it. So that's the chicken and the egg situation. But we do see definitely that in certain areas the drilling market is tightening, and we see some new build (orders) appearing on the horizon."

To back up this claim of newbuilds on the horizon Wijning says: "We see that the ambitions for emission reduction are rising significantly. For example, an operator wants to reduce the emissions of their contracted fleet by 50% by 2030, and 2030 is approaching very fast."

And, according to Wijning, without bold actions, it is



simply impossible to reach this emission reduction target by 2030.

HOW MUCH WILL IT COST TO BUILD?

It's been a while since anyone ordered a newbuild HE semi-submersible drilling rig. For reference, Awilco Drilling ordered two from Keppel in 2018 and 2019, respectively, for $425 million each. These have yet to be delivered as the contracts have since been cancelled leading to the two parties to seek dispute resolution through arbitration. More Here: **https://bit.ly/3GfqND5**

Back to the Huisman rig. Once that moment comes, and a drilling contractor orders a Huisman green harsh-environment semi-submersible drilling rig, what can they expect when it comes to the construction costs?

Wijning explains: "Well, I cannot mention numbers here, but I can say that we estimate the cost for the whole unit to be similar as to a new built traditional design."

He explains that while the technology on Huisman's rig might add up to the cost, overall, the rig is smaller, which is then reducing the costs.

"So basically, we think that in the end, CapEx will be more or less the same, but also said before, it's not only about the CapEx, of course, that's counting in day rate, but also the time per well is a significant amount in the overall savings."

He also says that, for example, fuel consumption, and also taxes on carbon emissions, are also taking part when it comes to lowering the operational costs.

ROBOTS TAKING OUR JOBS? NOT EXACTLY.

We reminded Wijning that OPEX will also be lowered by having to pay fewer salaries, as there will be fewer people onboard. Are robots coming for our jobs?

He replies: "Looking at personnel, you see on all sides the scarcity of personnel in the drilling industry. So needing less personnel, I think it's a big deal simply because the personnel is not there anymore.

Wijning points out a trend within the offshore drilling sector where many of the offshore drilling workers are retiring, or switching to the renewable energy sector, while at the same time one can say that the interest of the younger generation to join the drilling industry right now is not on high levels.

A 2017 survey by EY, found that 62% of Generation Z respondents considered a career in oil and gas "unappealing", and 39% ranked it as "very unappealing," compared with only 4% of young respondents who said it was "very appealing."

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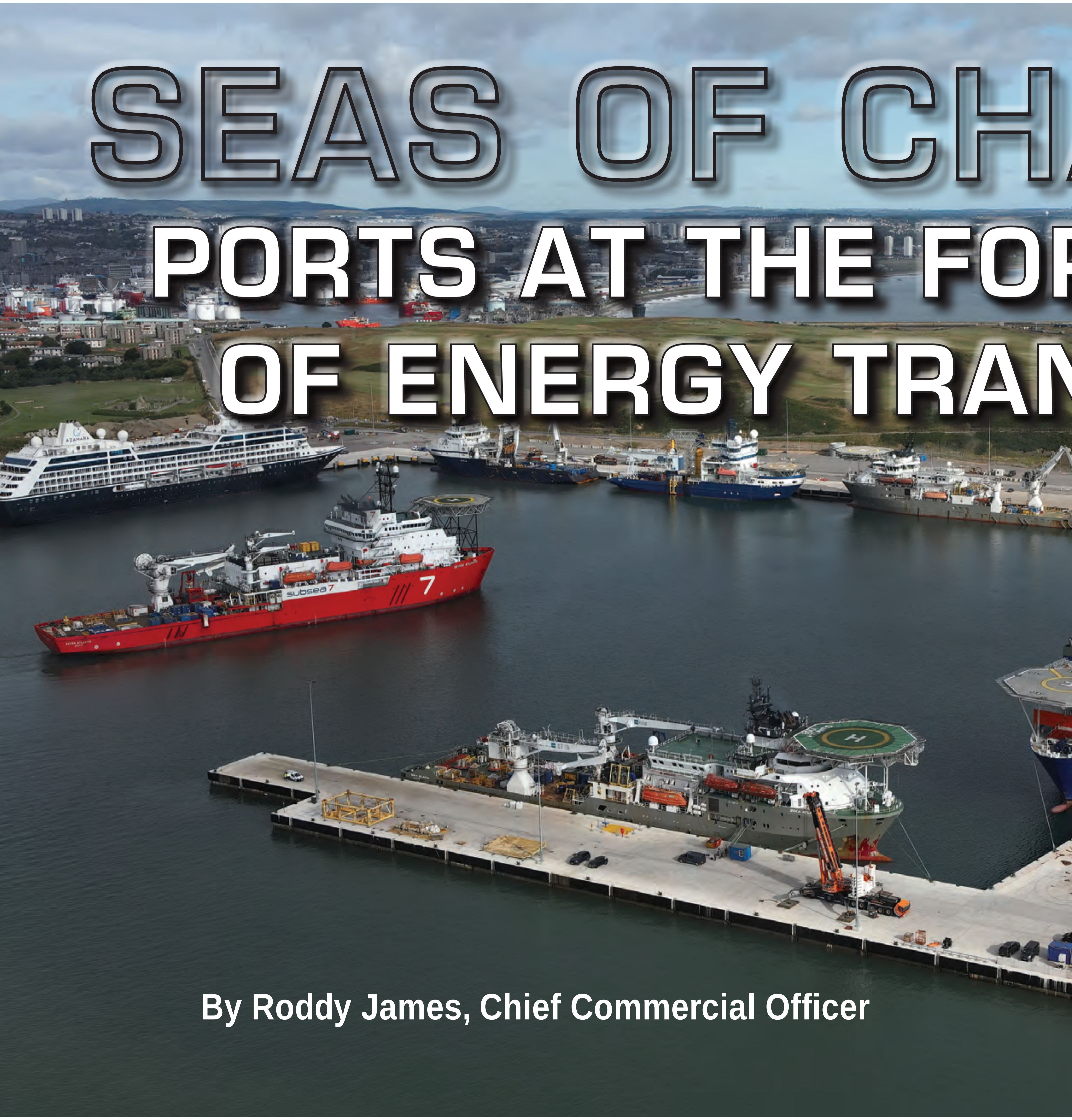


By Roddy James, Chief Commercial Officer

All images courtesy Port of Aberdeen

Ports in the UK such as Aberdeen serve as vital gateways to the offshore energy supply chain, providing services from surveying and construction to operational support, maintenance and decommissioning for oil and gas platforms and renewable energy installations all around the UK coastline.

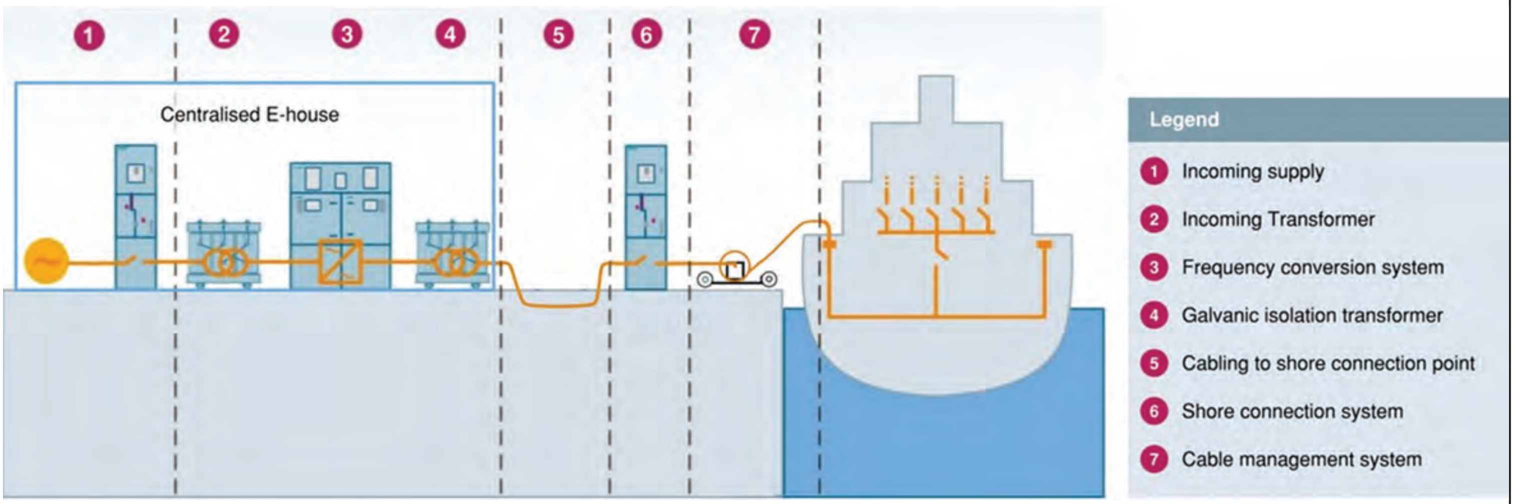
Vessels, moving 84.5 million tons of energy related cargo in 2022, are the lifeblood of the offshore energy industry, supporting tens of thousands of jobs. In the North East of Scotland, Europe's Energy Capital, more than 6,500 vessels (more than 580 unique vessels) call annually to Port of Aberdeen for offshore energy operations, with the port serving as a vital marine logistics hub throughout the energy project's lifecycle. Yet, as the drive to net zero gathers pace, curbing vessel emissions remains challenging. Developments like shore power and low or zero carbon fuels offer options for emission reduction, posing both challenges and opportunities from a port's perspective.

The Environmental Imperative

Since its inception in 1967, the UK offshore energy industry has produced approximately 45 billion barrels of oil equivalent (BBOe) from the UK Continental Shelf (UKCS). This has maintained the country's energy security, while keeping our homes warm, our country moving and creating hundreds of thousands of highly skilled jobs across the UK.

In the context of climate change, there's a pressing need for global transformation. In 2019, the UK took a pioneering step as the first major economy to commit to achieving net zero emissions by 2050, a legally binding and leading target. Acknowledging this urgency, the UK offshore energy industry swiftly supported the government's net zero objectives, establishing the North Sea Transition Deal (NSTD). This agreement is designed to change the nature of oil and gas production in the UK by halving greenhouse gas emissions from production activities by 2030, progressing towards net zero emissions by 2050.

Vessel emissions are accounted for as part of the supply decarbonization strand of the NSTD. The Deal focuses on immediate emissions reductions, and outlines measures such as operational process optimization, investments in innovative technologies, equipment upgrades, and the phasing out of high emission assets to comprehensively address vessel emissions.



Shore Power Advancements

Decarbonizing port infrastructure and vessels is integral to the UK's pursuit of net zero emissions. Shore power is considered the leading solution to reduce vessel emissions at berth, showcasing high technological readiness while ensuring adaptability for hybrid or fully electric vessels in the future. This approach promises reduced CO2 emissions and diminished noise pollution.

Shore power encompasses onshore electrical infrastructure, vessel electrical systems, and seamless connection mechanisms for safe and uninterrupted power transmission. This involves onboard systems for powering essential vessel equipment and automated processes for efficient power transfer between the vessel's power plant and the onshore source.

Vessel emissions have historically been hard to abate, however, Port of Aberdeen is taking significant and sustained action to make this a reality. The port's Clean Maritime Demonstration Competition Round One project revealed that 78% of CO2 emissions in the port stem from vessels at berth, prompting a significant focus on shore power implementation at seven berths. Projections suggest an annual mitigation of 3,100 tons of CO2 equivalent and substantial reductions in local noise and air pollution, and inhalable particulate matter (PM1, PM2.5 and PM10), following the full rollout of shore power and subsequent decarbonization of the UK grid.

Capital costs for shore power for ports are high and need to be recouped through electricity sales. However, this is challenging due to the current misalignment of economic incentives. Collaboration and funding from public and private sectors remain crucial to realizing this initiative and scaling up emissions reductions, aligning with Port of Aberdeen's Net Zero Strategy and supporting supply chain emissions reduction efforts.

Port of Aberdeen's multimillion pound 'Shore Power in Operation' initiative – a consortium between Port of Aberdeen and Connected Places Catapult, DOF Subsea, Tidewater Marine UK Ltd, OSM Thome, The University of Manchester's Tyndall Centre, and supported by major energy operators – represents Scotland's inaugural large scale landside and vessel side shore power system. Scheduled for completion by March 2025, the project will introduce shore power facilities at seven berths on Albert and Mearns Quays in the port's North Harbor, reducing emissions from vessels utilizing shore power provisions by over 80% at berth compared to traditional marine fuel, resulting in savings of 62,000 tons of CO2 equivalent over two decades.

This pioneering project serves as a catalyst for broader adoption of green shore power across the port's North and South Harbors, potentially cutting total emissions at berth by 78%, equivalent to an annual reduction of 34,000 tons of CO2 equivalent.

Low and Zero Carbon Fuels

Low and zero carbon fuels play a pivotal role in the decarbonization journey of the offshore energy industry. Diversifying the energy mix with renewable and sustainable fuels and transitioning to low or zero carbon fuels will be essential to mitigating the adverse effects of climate change.

Facilitation of future low or zero carbon fuels will re-

All images courtesy Port of Aberdeen

quire stringent regulatory compliance across the industry. Forecasting the demand of fuel types will help industry comply with evolving environmental standards and regulations. Similarly, investing in research and development of alternative fuels is required to drive forward technological innovation and advancements. These combined will lead to more efficient and cost effective low or zero carbon fuel solutions in the future.

The potential of alternative fuels in the decarbonization journey is significant. However, successful integration faces challenges such as scalability, infrastructure development, cost competitiveness and technology maturity and social acceptance. Nevertheless, with continued advancements, supportive policies and collaborative efforts among governments, industries and research institutions, alternative fuels have the potential to play a pivotal role in the decarbonization of the offshore energy industry, contributing to a more sustainable and environmentally friendly future.

Challenges and Opportunities

Decarbonizing vessel supply chains poses challenges across economic, technological, and logistical fronts. Transitioning to low or zero emission vessels demands advanced technologies like hydrogen fuel cells, batteries, or alternative fuels such as ammonia or methanol. However, developing these technologies to be both efficient and cost effective for the global fleet remains a substantial hurdle. Retrofitting current fleets or constructing ecofriendly vessels necessitates significant investments and time from operators. Similarly, energy density variations among alternative fuels can limit vessel range or payload capacity, demanding future solutions that don't compromise operational efficiency.

Technological advancements like autonomous vessels and leveraging data analytics, AI and machine learning can optimize vessel performance, reduce costs and improve safety. Electric or hybrid propulsion systems offer emission reductions and cost efficiencies, especially with advancements in battery technology. Innovations in design, such as Artemis Technologies' ground breaking 100% electric high speed Artemis EF-24 Crew Transfer Vessel (CTV), represents a significant leap forward and sets a new benchmark for performance, fuel efficiency and carbon emissions reductions.

Establishing infrastructure supporting sustainable vessel operations, including shore power facilities, renewable energy sources, alternative fuel stations and efficient cargo

All images courtesy Port of Aberdeen

handling, is crucial. However, addressing these challenges and seizing future opportunities for innovation demands a collaborative effort among offshore and maritime industries, policymakers, investors, and technology developers. Strong partnerships, substantial investments, and a steadfast commitment to sustainability will be pivotal in effectively decarbonizing vessel supply chains.

Offshore Energy Vessel Decarbonization Projects

Stillstrom and North Star have signed a Memorandum of Understanding (MoU) to accelerate offshore charging and vessel electrification for Service Operation Vessels (SOVs). Under the terms of the MoU, Stillstrom will leverage its extensive experience in offshore charging infrastructure to demonstrate how their charging solutions can benefit North Star's growing SOV fleet. This will enable vessels to recharge using wind energy while operational. North Star will provide valuable insights into vessel integration operations with Stillstrom's charging units. This project promotes the adoption of hybrid and fully electric vessels and charging solutions in the offshore wind sector, enabling cleaner offshore operations and improved vessel efficiencies.

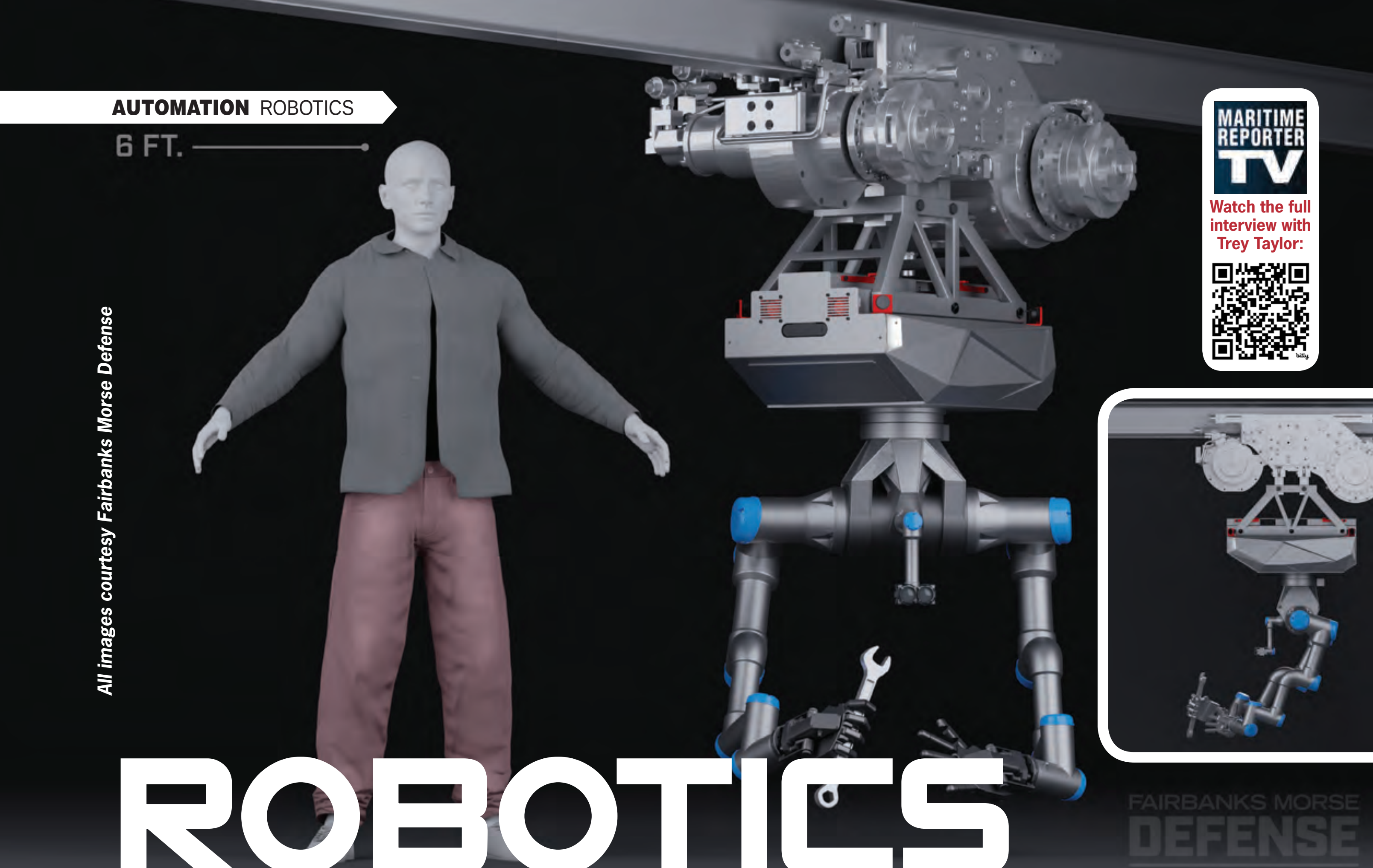
Additionally, as a consortium partner with Bibby Marine, Port of Aberdeen is collaborating on the construction of the world's first zero emission electric Service Operation Vessel (eSOV). This vessel, equipped with a robust battery system and dual fuel methanol engines, un-

derscores UK leadership in technology and design while significantly reducing emissions and costs. Nigel Quinn, CEO of Bibby Marine, highlighted the vessel's transformative potential for the industry and emphasised its pivotal role in positioning the UK as a premier hub for green technology, showcasing British innovations and enhancing local content.

Anchoring a Sustainable Future

The decarbonization of ports and vessels stands as the cornerstone to a sustainable future for the UK's offshore energy industry. The pivotal role of ports, serving as essential gateways for international trade and multimodal hubs in the energy supply chain, cannot be overstated. As the UK strides towards achieving net zero emissions by 2050, ports are at the forefront of this transformative journey, embodying the epicenter of the nation's energy transition and the broader ecosystem of the UK's energy landscape.

The commitment to decarbonize ports and vessels represents a fundamental shift, not only in reducing emissions but also in steering the course toward environmentally responsible practices within the offshore energy and maritime industries. As ports embrace this transition and spearhead initiatives to decarbonize vessels and operations, they set the stage for a significant leap towards a cleaner more sustainable future for the UK's offshore energy sector.



All images courtesy Fairbanks Morse Defense

ROBOTICS in the Engine Room

*When talk turns to autonomous ships, a first question usually centers on how routine and emergency repair and maintenance will be conducted with no crew. **Trey Taylor,** Director of Digital Innovation, Fairbanks Morse Defense, discusses FMD's research and development efforts on next-gen engine room robotics.*

By Greg Trauthwein

The FMD team that Trey Taylor leads is relatively new, kicking off in 2019 with a baseline product that was looking at monitoring equipment, "being able to provide that information back to our technical teams for diagnosis and also to give some data to the end customer for self-support." But that was just the start, and in 2020 Taylor's team pitched the executive team for more. The result was "a roadmap for five product verticals that we were interested in: AI, autonomy, robotics, mixed reality capability and secure communications."

In the development of robotic solutions for routine and emergency work and repair in the engine room, Taylor credits his boss, FMD CEO George Whittier, for instilling his principle: "Don't aim at the target, aim where the target's going to be."

So, Taylor and his team of 22 started looking more closely at one of its prime customers – the U.S. Navy. "We know that the Navy has a need, a desire to fill uncrewed assets sometime later this decade, and the timeframe that they want these assets to be on deployment without intervention is today only about 30 to 60 days," said Taylor. "But the long-term goal is 180 days, so our team started looking at systems for how to help the Navy achieve that goal. We quickly came to the conclusion that we're going to have to do maintenance, but how do we do maintenance when there's not a human on board?" Enter the robot.

Today, FMD's work centers not on a single solution, rather a number of different manifestations of how engine room robotics will look and work. "We decided a robot platform is probably going to be the right approach, but we

"You're going to need different capabilities at different times. For instance, if I'm doing something on an engine, I might need to be able to lift and support 150-200 pounds; but I may also need some very fine manipulation of small fittings to remove that part. So I probably won't have a bipedal two-armed robot. I will have a robot that can support itself either on a rail or a bulkhead for that heavy lift, and it may have four arms, two gross movement arms that can handle the heavy lift, and then two fine skilled arms that are doing the fine fixture movements."

– Trey Taylor, Director of Digital Innovation, Fairbanks Morse Defense

want to make sure that we understand the problems and we understand the actual product requirements that a robot would have to facilitate," said Taylor, a process which meant understanding the Navy's long-term roadmap.

Per usual in the maritime space, there is rarely if ever a 'one size fits all' technical solution premised on the broad variety of ship designs. "There's a lot of key challenges working in a marine environment," said Taylor. "I have bulkheads that I have to pass through; I have confined spaces and open spaces. In some cases, I might want to have a robotics platform that's mounted on a bulkhead; in some cases, I will transit on a rail; in some cases I'll be asked to move through the space with either tracked or walking design. So when we are looking at the robotics platform, we're really focused today on the modularity and those sub components."

Apart from the mechanical, the operational environment is a consideration. "How do I do service when I'm in a six foot trough on a vessel that's moving at 20 knots through it?," asks Taylor. "A human's very good at figuring out their own stabilization, three points of contact, one hand holding a tool. A robot's got to be able to do the same thing." In bringing it down to its core essence, Taylor said to envision it as Legos.

"There are core components that every robot's going to need: some basic autonomy, some basic AI, the way that you train it to move, the way you control it remotely, vision systems, et cetera, that are common platform items. But then when I think about all the pieces of equipment I'm going to change or interact with, I might need 15, 20 different tools of different sizes. I'm going to need different lifting capacities; and all of that requires the ability for our platform to be able to adapt to it; self-change parts to go to a specific work location or different configurations on that robot. But I want a common control methodology; I want a common charging methodology; I want a common autonomy methodology."

Ultimately, it boils down to the guiding principle surrounding any complex technology: keep it simple, which is far easier said than done.

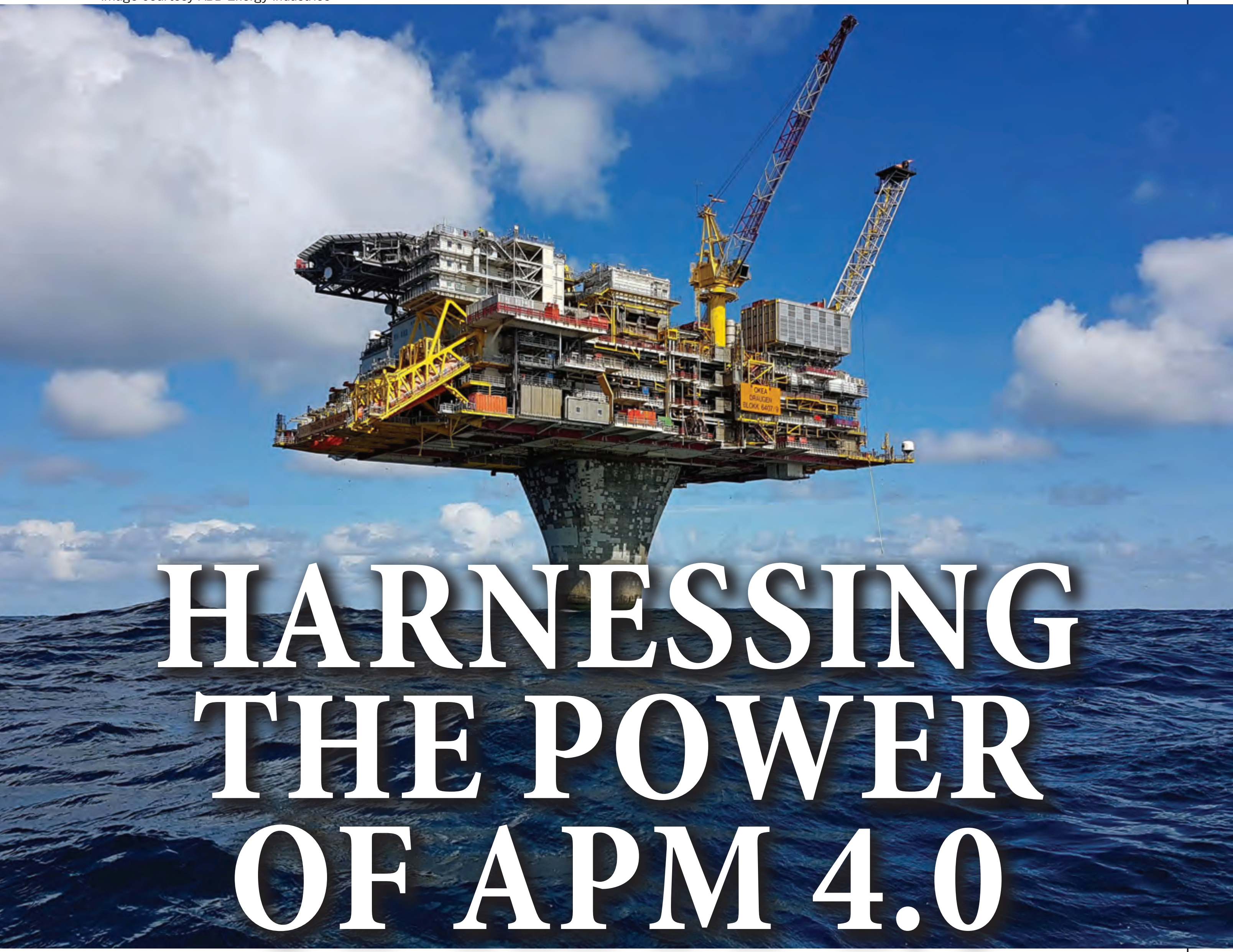
"You're going to need different capabilities at different times," said Taylor. "For instance, if I'm doing something on an engine, I might need to be able to lift and support 150-200 pounds; but I may also need some very fine manipulation of small fittings to remove that part. So I probably won't have a bipedal two-armed robot. I will have a robot that can support itself either on a rail or a bulkhead for that heavy lift, and it may have four arms, two gross movement arms that can handle the heavy lift, and then two fine skilled arms that are doing the fine fixture movements."

Ultimately, if successful with broad adoption, the use of robotics in the engine room could change the actual design of the engine itself. At the outset, the robotics must be designed to conduct its business as if it were a human, so at a minimum FMD is designing [robotics] to be human equivalent in strength and range in motion.

But as autonomy gains steam, there will be a gap. "It'll be a bit of a gap between when these uncrewed vessels start to be launched before there's enough of them in the fleet that the capital equipment suppliers will redesign their systems for robotic support," said Taylor. "So we have to bind a gap where we have human equivalent performance in a lot of cases, for tool manipulation, for reach, for degrees of freedom of movement, the kinematics of actually moving parts on and off a piece of equipment, for example: we're taking that into account in our designs today."

"Today, we're at what we call generation 0.2, where we have a prototype that moves. We have control features with limited sensing on board, but there's a lot of data-driven research that we need to do to influence the next generation. Right now we're going through a scientific evaluation of the basic and major maintenance procedures on an engine, where we're doing mapping: What are the number of fittings? What are the sizes? What's the volume that I have to perform the services as a human? How much torque do I need on any individual fitting in these maintenance procedures? We're doing that documentation right now, as we speak, on our engines, which will probably take us through this entire year [2023]," with the plan to have a basic platform by 2025.

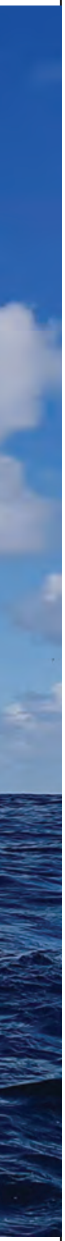
Image courtesy ABB Energy Industries



HARNESSING THE POWER OF APM 4.0

Ryan Conger, Technical Sales Manager for APM at ABB Energy Industries, explains how reactive asset performance management (APM) has evolved into APM 4.0, and why partnering with a trusted technology provider can help oil and gas operators avoid costly downtime and maximize profitability.

By Ryan Conger, Technical Sales Manager for APM at ABB Energy Industries



Over the past two decades, asset performance management (APM) has been transformed from a routine concern to front and centre in the process industries, turbocharged by digital innovations such as artificial intelligence (AI), the industrial internet of things and predictive data analytics.

Digitalization and automation solutions that extract and analyze OT, IT and ET data are empowering sectors such as oil and gas to get ahead of and own conditioning monitoring of their critical assets, rather than reacting when machinery or equipment fails, resulting in costly production downtime.

This remarkable evolution from 'run-to-failure' or reactive APM to today's high-end quantitative risk analysis and current state of machine health solutions – often referred to as 'APM 4.0' – is a boon for resource-heavy extractive industries like oil and gas, which now, more than ever, need to ensure they leverage the vast amounts of data available to them to maximize production and profitability, reduce downtime, energy consumption and carbon emissions, and maintain competitive advantage.

APM, when deployed cost-effectively in partnership with a trusted technology vendor like ABB, can help offshore operators establish a solid reliability culture by providing insights into asset health, and recommending proactive measures that predict and avert failures1, driving genuine business value.

In this article, we will focus on key trends in APM 4.0 and explain how a layered approach to can help demystify technology and help customers identify the correct solution based on their operational and risk profile, as well as take a look at ABB's ground-breaking project with Norwegian oil and gas operator OKEA to live-stream process data from their offshore platform to the cloud enabling remote monitoring of asset health.

A layered approach to APM

There are many buzzwords in the APM ecosystem, yet the ultimate goal is simple: to predict process upsets in real time, fix small problems before they become large, and avoid unplanned breakdowns, ensuring that industrial assets operate at their optimum performance and productivity levels, while at the same time minimizing operational risks and maintenance costs2.

When we talk about APM 4.0, it all starts with an initiating event – the process upset, the degradation of the asset, the failure of upstream or supporting equipment – which allows us to create layers of protection around that asset to avoid further failure. This first layer of protection is what we call rules-based monitoring: this may be a single sensor that sends an alert if the temperature or pressure exceeds a pre-defined threshold, or a more complicated if-then statement using multiple sensors.

An example of a derived or calculated monitor is taking raw vibration data and evaluating the spectral signature of that vibration. We know that if vibration is increasing, it's worth investigating the cause. Based on the signature in the frequency domain, we can infer the likely cause. Other than interference or rub, vibration issues don't fix themselves. So that's one layer of protection, let's call it the baseline layer, and customers can get significant value out of that form of APM.

However, there are additional layers that ABB can deploy to maximise protection around the asset, and, typically, the more advanced the layer is, the more lead time the customer will get in terms of predicting when something is going poorly. Using a medical analogy, the APM solution is alerting the operator to the fact that the calcification of their arteries exists three years ahead of the heart attack. Better yet, a layered approach can identify elevated cholesterol decades in advance so the risk can be mitigated before significant damage occurs.

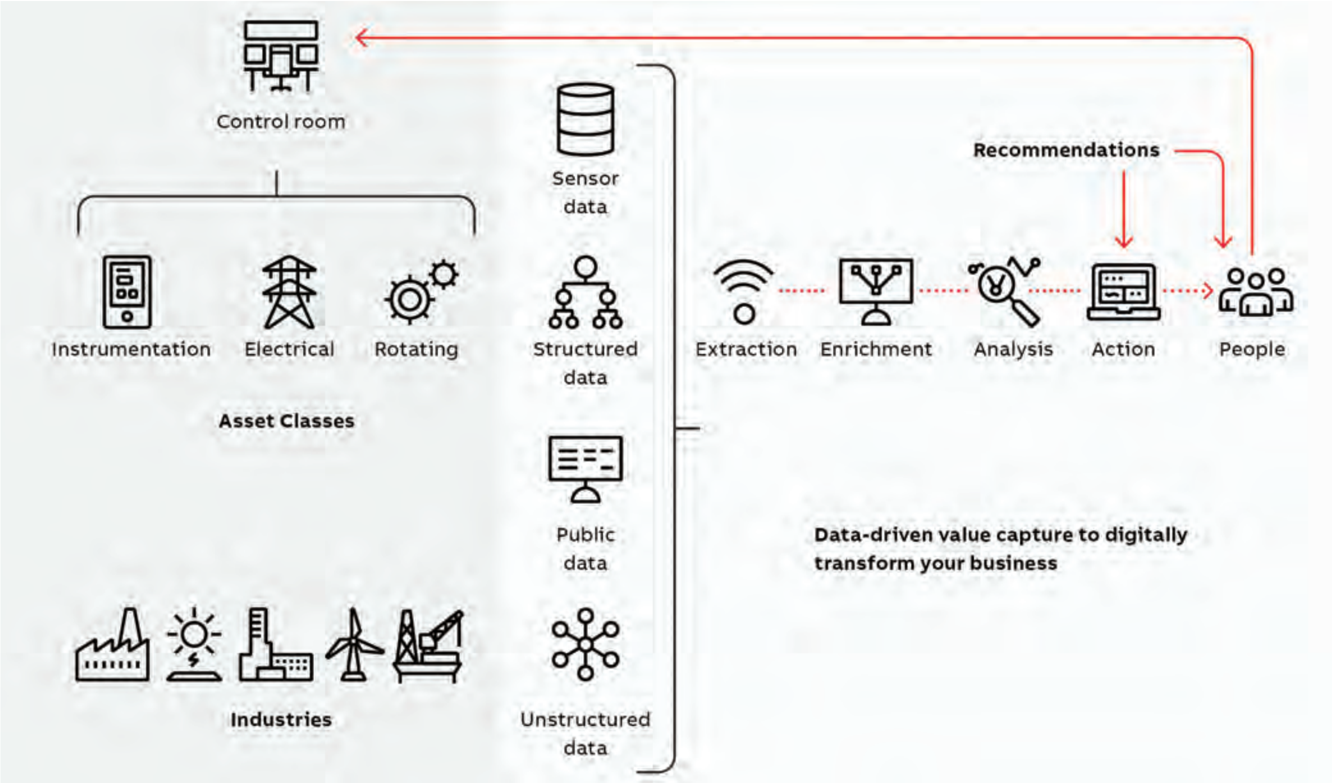
This more sophisticated layer works around 'first principles' models. 'First principles' models are based on the engineering design and physics behind the way a piece of equipment operates. We create physics-based models that tell us from a performance perspective how something should operate, which can be rolled out quickly across similar asset types. By comparing actual performance versus theoretical, degradation or sub-optimal operation can be quickly spotted.

Hybrid versus time-based models

The final layer utilizes data-driven and statistical models, also referred to as AI and machine-learning (ML) models. We teach algorithms what good asset performance looks like across the different variables. It then alerts the operator if and when the asset deviates from these conditions. Based on the variables that have deviated from past good behaviour, we propose the failure mode that is most likely to occur.

A key differentiator of this type of model is that it can be deployed on any asset type or system (rotating, electrical and fixed equipment) that can provide adequate levels of sensor data. When we combine both 'first principles' and data-driven model, we create a hybrid modelling approach to provide maximum protection for the most critical assets. Depending on the criticality of the asset and their specific risk profile, the customer can decide how many layers they want to put in place. Low-cost assets that are easy to

Image courtesy ABB Energy Industries



replace may be run to failure (reactive), whereas it makes sound business sense to secure more critical assets – where downtime and maintenance costs may run to millions of dollars – with data-driven APM.

Maintaining assets only when needed has been shown to decrease maintenance costs by 20–30% and doing so efficiently reduces downtime by 20–50%. Unplanned maintenance is 4–10 times more expensive.

It is also important to note that only 18% of asset failures happen due to wear and tear3, meaning that time or usage-based maintenance is the wrong strategy to use at least 80% of the time.

Pushing the boundaries: ABB and OKEA

Earlier, I mentioned that partnering with a technology provider with deep domain knowledge of APM and its role in the process industries is a prerequisite for success. This is vividly illustrated by

ABB's digital partnership with Norwegian operator OKEA, which resulted in the Norwegian operator becoming the first oil and gas company to successfully live-stream contextualized process data to the cloud.

Located 130km from shore, Draugen is one of Norway's largest oil fields. Streaming real-time data directly from the control system to the cloud was a major achievement. The time it takes for the high-resolution data including structure, objects, and alarms and events to be generated to being available in the cloud is just 0.8 seconds. Using ABB's portfolio of digital solutions including Asset Performance Management applications and services, OKEA is able remotely monitor asset health in near real-time. This project achieved distributed asset data updates securely, enabling personnel to visualize, analyze, and predict operations more efficiently for more informed, data-driven decision-making, and cost savings of as much as 30%5. In addition, less personnel were required on the platform to monitor equipment. This enabled safer operations without increased risk.

Projects such as this demonstrate the power of streaming solutions such as 'Software-as-a-service' (SAAS), and how APM 4.0 – incorporating innovations such as AI and ML, combined with creative problem-solving, expertise and collaboration6 – can help unlock the disruptive power of APM 4.0.

Sources:
- **1,2** https://new.abb.com/process-automation/genix/genix-apm
- **3** What is Asset Performance Management (APM)? | ARC Advisory Group (arcweb.com)
- **5,6** https://new.abb.com/oil-and-gas/digital/okea-digital-partnership (video and text)

MAXIMIZE YOUR POTENTIAL.

Image courtesy MacGregor

HORIZON GANGWAY FOR OFFSHORE WIND

By optimizing the transfer of supplies and technicians from ship to turbine platform, MacGregor's Horizon gangway is enlarging the operational time available to the vessels supporting the offshore wind energy market.

The 2023 Global Offshore Wind Report, published by the Global Wind Energy Council, predicts the addition of more than 380 GW of offshore wind capacity, across 32 markets in the next 10 years. More than 3,000 turbines are expected to be installed in Europe alone by the end of 2027.

In the immediate term, vessel day rates have also been growing fast, at 35% above their level 12 months earlier at the end of June 2023. Wind turbine installation vessel orders also reflect a sector looking forward with confidence: Clarksons reported 66 commissioning service operation vessels (CSOVs) and crew transfer vessels on order at the end of first half of the year - annualized as 20% ahead of the 110 counted for the whole of 2022.

But market predictability does not extend to weather, and a personnel and cargo transfer solution from MacGregor is gaining attention.

Selecting the right solutions to transfer supplies and personnel safely and efficiently between a CSOV and a turbine platform will be one of the key decisions an owner takes, the supplier advises, given that this activity will often define a vessel's maximum uptime hours: simply put, its ability to earn money for its owner.

"The ability for walk-to-work gangways and cranes to compensate for sea conditions for a safe transfer of personnel and equipment to the turbine platform will be weighed up in the voyage plan," says Sindre Halvorsen, Specialist Engineer, Product Owner Gangways. "Accuracy and reliability in this operation are critical for planning within the safety limits imposed by weather. Effectively, the ability to work alongside determines a vessel's operational window."

Developing solutions for the demanding wind energy market has involved collaboration with clients, says Halvorsen, with MacGregor contributing at an early stage of vessel design to ensure that the position and performance of its equipment are optimized

All-Electric Horizon Active Motion Compensated Gangways

The result has been MacGregor's all-electric 'Horizon' walk-to-work gangway, the first examples of which are now in full operation, with deliveries ongoing across a number of CSOVs through 2023.

Providing active motion compensation to land and work safely in significant wave heights of up to 4.2m, the Horizon gangway maximizes the available time for crew and supplies to be transferred between the ship and the platform. Platform capacity is given as 2000kg and up to 10 persons.

Available for newbuild ships and for retrofits, the Horizon's customizable foundations can be integrated with the vessel design and adapted to serve different landing heights and turbine clearance requirements. The solution is also delivered with an extra-wide transfer bridge (1.5m, against a class requirement of 1.2m) for optimized safety, logistics flow, and/or an integrated tower and 26-person elevator to connect goods and technicians between deck and gangway levels.

Based on its design philosophy, but also on feedback from first movers, Halvorsen says the all-electric option is proving increasingly persuasive for gangway specifiers.

"Comparative studies tell us that energy efficiency can be as low as 25% for hydraulic load handling equipment, while electric solutions achieve above 75%," he says. "Where the Horizon walkway is concerned, the amount of energy needed for operations is very low - amounting to less than 200 kWh per day.

"Based on efficiency, but also on the increasing focus energy suppliers place on sustainability - and especially on CO_2 emissions - our expectation is that all-electric transfer solutions may soon come under consideration for inclusion in charter party agreements."

The Horizon gangway features redundancy that goes beyond class requirements, with an entire electrical system maintaining control and safety levels to handle any single failure.

Automatic Choice

The Horizon's efficiency is enhanced by its ability to interface with other shipboard systems. MacGregor's Colibri 3D motion compensated crane is designed to provide flexibility and agility under load, and for its greater precision while less mass is in motion. Service vessels have now been ordered which feature the Horizon gangway system, the Colibri 3D motion compensated crane and the 'AROS' remote-control station.

Developed in close cooperation with customers, AROS is an augmented reality operator station positioned on the bridge, from where a single operator can switch seamlessly between crane and gangway operations. In addition to the overall efficiency and safety gains during a critical part of alongside operations, the combination provides another means of minimizing unplanned downtime and thereby maximizing a vessel's operational window.

Image courtesy MacGregor

Digitalization is also central to the supplier's strategy for lifecycle services and support for its offshore wind industry clients, according to Halvorsen.

"Because these vessels only earn when they work, their load and personnel handling equipment must be continuously available. Predictive maintenance is a key tool which can enable remote support and enhance planning for scheduled inspections and maintenance."

Several recent specifications for COSVs have included OnWatch Scout (OWS) - MacGregor's condition monitoring and predictive maintenance application. The predictive software analyses operational data streamed directly from the vessel in order to detect patterns which might indicate risk of failure, optimise planned maintenance and minimise unplanned downtime.

Growing turbine sizes, fixed platforms further out at sea and the emergence of floating wind energy solutions are just some of the factors that will demand further technical innovation in a fast-expanding industry. Whatever the challenges ahead, solutions which can be considered at the earliest stages of vessel design, have capacity for integration and are equipped for predictive maintenance will offer the most effective answers, according to Kalle Tuomaala, Vice President, Sales and Marketing, Offshore Solutions Division.

"The ability to offload and recover technicians at the turbine is one of the defining features of offshore wind support vessel utility. Understandably, owners are going to opt for the gangway that allows planned voyages to go ahead, while less well-equipped vessels may have to stay at home."

BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	7	73	80	91%
Jackup	174	297	471	63%
Semisub	26	47	73	64%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	14	15	93%
Jackup	13	16	29	55%
Semisub		6	6	100%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	6	10	60%
Jackup	80	76	156	49%
Semisub	17	6	23	26%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship		5	5	100%
Jackup	16	28	44	64%
Semisub	4	20	24	83%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	26	27	96%
Jackup	3	4	7	57%
Semisub	2	8	10	80%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	33	135	168	80%
Drillship				

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	22	23	96%
Jackup	20	32	52	62%
Semisub	2	2	4	50%

Oceania

Rig Type	Available	Contracted	Total	Utilization
Drillship				
Jackup		1	1	100%
Semisub		3	3	100%

Russia & Caspian

Rig Type	Available	Contracted	Total	Utilization
Jackup	8	2	10	20%
Semisub	1	2	3	67%

Global Average Dayrates

Floaters		Jackups	
Ultradeep water	410.9	High-spec	141.7
Deepwater	325.0	Premium	140.5
Midwater	421.4	Standard	98.1

This data focuses on the marketed rig fleet and excludes assets that are under construction, retired, destroyed, deemed noncompetitive or cold stacked.

Data as of December 2023
Source: Wood Mackenzie Offshore Rig Tracker

DISCOVERIES & RESERVES

Offshore New Discoveries

Water Depth	2018	2019	2020	2021	2022	2023
Deepwater	16	20	14	13	22	7
Shallow water	58	86	45	58	36	41
Ultra-deepwater	18	18	12	7	18	9
Grand Total	**92**	**124**	**71**	**78**	**76**	**57**

Shallow water (1-399m) Deepwater (400-1,499m) Ultra-deepwater (1,500m+)

Offshore Undeveloped Recoverable Reserves

Water Depth	Number of fields	Recoverable reserves gas mboe	Recoverable reserves liquids mbl
Deepwater	581	49,102	22,724
Shallow water	3,246	412,975	142,726
Ultra-deepwater	344	43,765	27,567
Grand Total	**4,171**	**505,842**	**193,017**

Contingent, good technical, probable development.

The total proven and probably (2P) reserves which are deemed recoverable from the reservoir.

Offshore Onstream & Under Development Remaining Reserves

Region	Number of fields	Remaining reserves gas mboe	Remaining reserves liquids mbl
Africa	584	18,054	11,271
Asia	843	14,784	7,411
Europe	752	12,510	11,423
Latin America and the Caribbean	193	6,628	39,954
Middle East	137	78,682	149,515
North America	471	2,691	12,559
Oceania	89	10,984	1,074
Russia and the Caspian	60	17,077	12,728
Grand Total	**3,129**	**161,410**	**245,935**

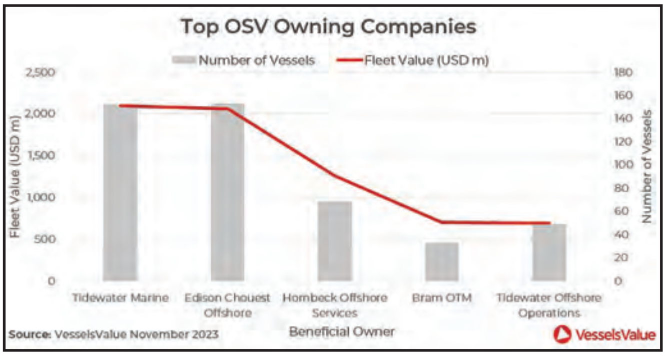
Onstream and under development.

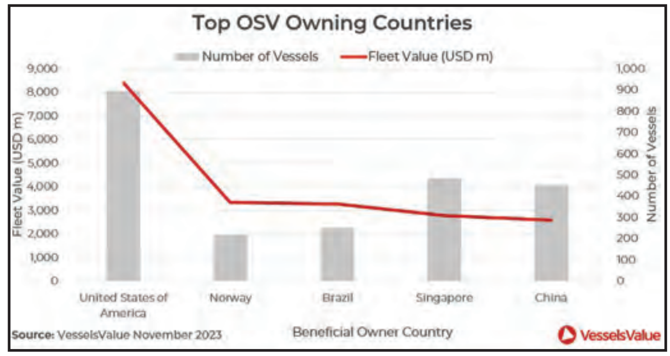
The portion of commercially recoverable 2P reserves yet to be recovered from the reservoir.

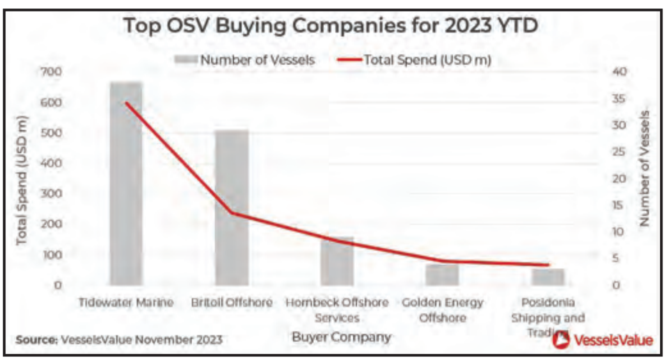
Source: Wood Mackenzie Lens Direct

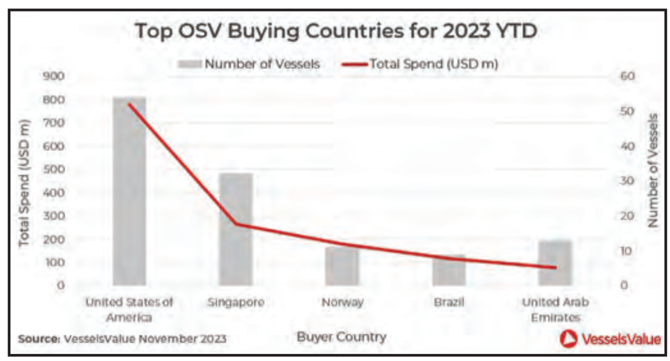
SECTOR IN FOCUS

OFFSHORE SERVICE VESSELS









Highest Value OSV

Name	Stepan Makarov
IMO	9753727
Beneficial Owner	Sovcomflot
Type	STANDBY / ERRV
Build Date	Jun 2017
Age	6.38 years
Builder	Helsinki Shipyard
BHP	24,138
Length Overall	104.4m
Ice Class	ARC6
Market Value (USD m)	102.84

Data & Statistics powered by
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