OE OFFSHORE ENGINEER

THE FUTURE OF OFFSHORE ENERGY & TECHNOLOGY

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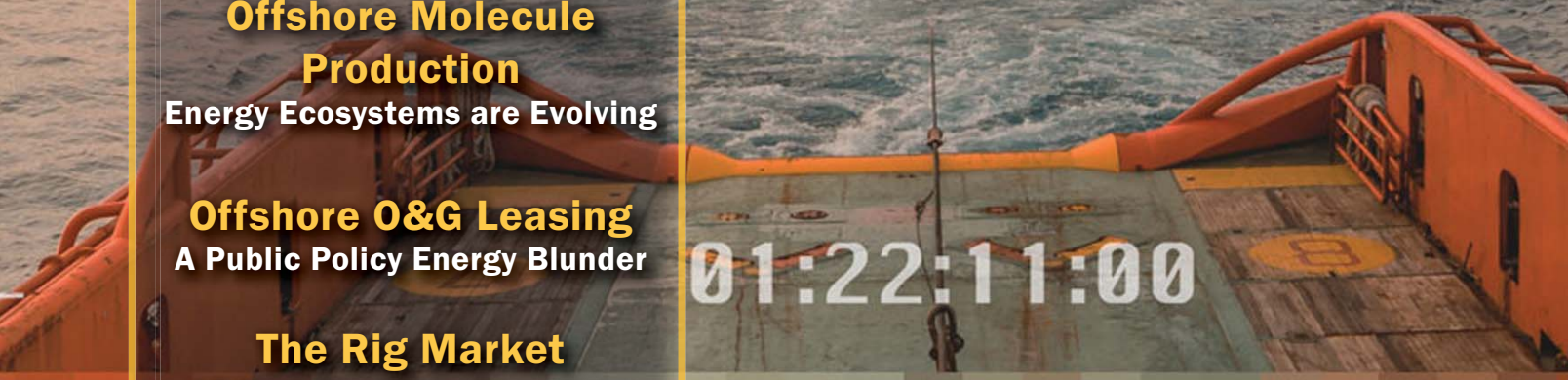
Digital Transformation

From Remote Ops To Full Autonomy



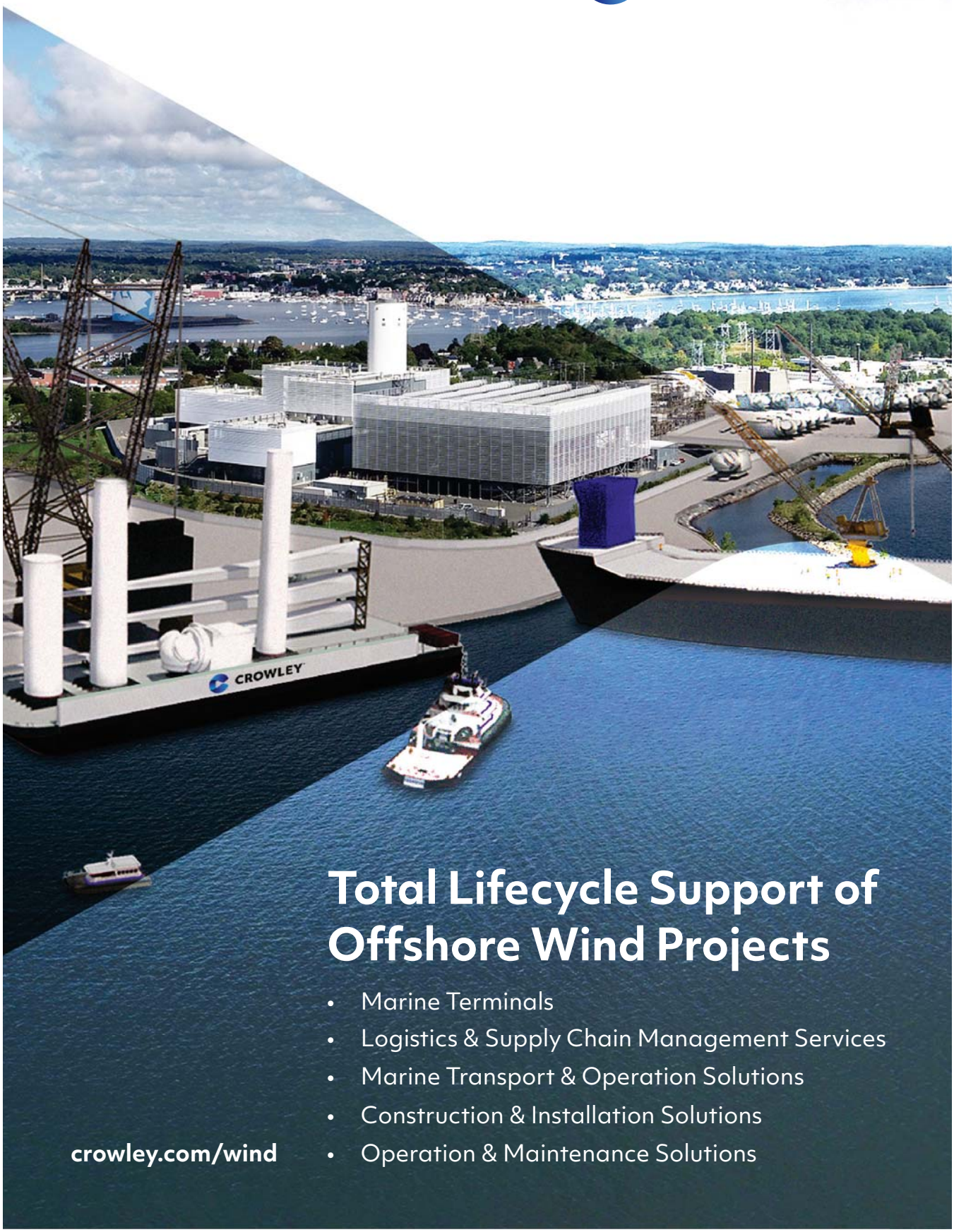
Tyra's Resurgence
Breathing New Life Into Denmark's Gas Giant

Offshore Molecule Production
Energy Ecosystems are Evolving

Offshore O&G Leasing
A Public Policy Energy Blunder

The Rig Market
15-Year Rig Deals Emerge as Availability Dries Up

CROWLEY



Total Lifecycle Support of Offshore Wind Projects

- Marine Terminals
- Logistics & Supply Chain Management Services
- Marine Transport & Operation Solutions
- Construction & Installation Solutions
- Operation & Maintenance Solutions

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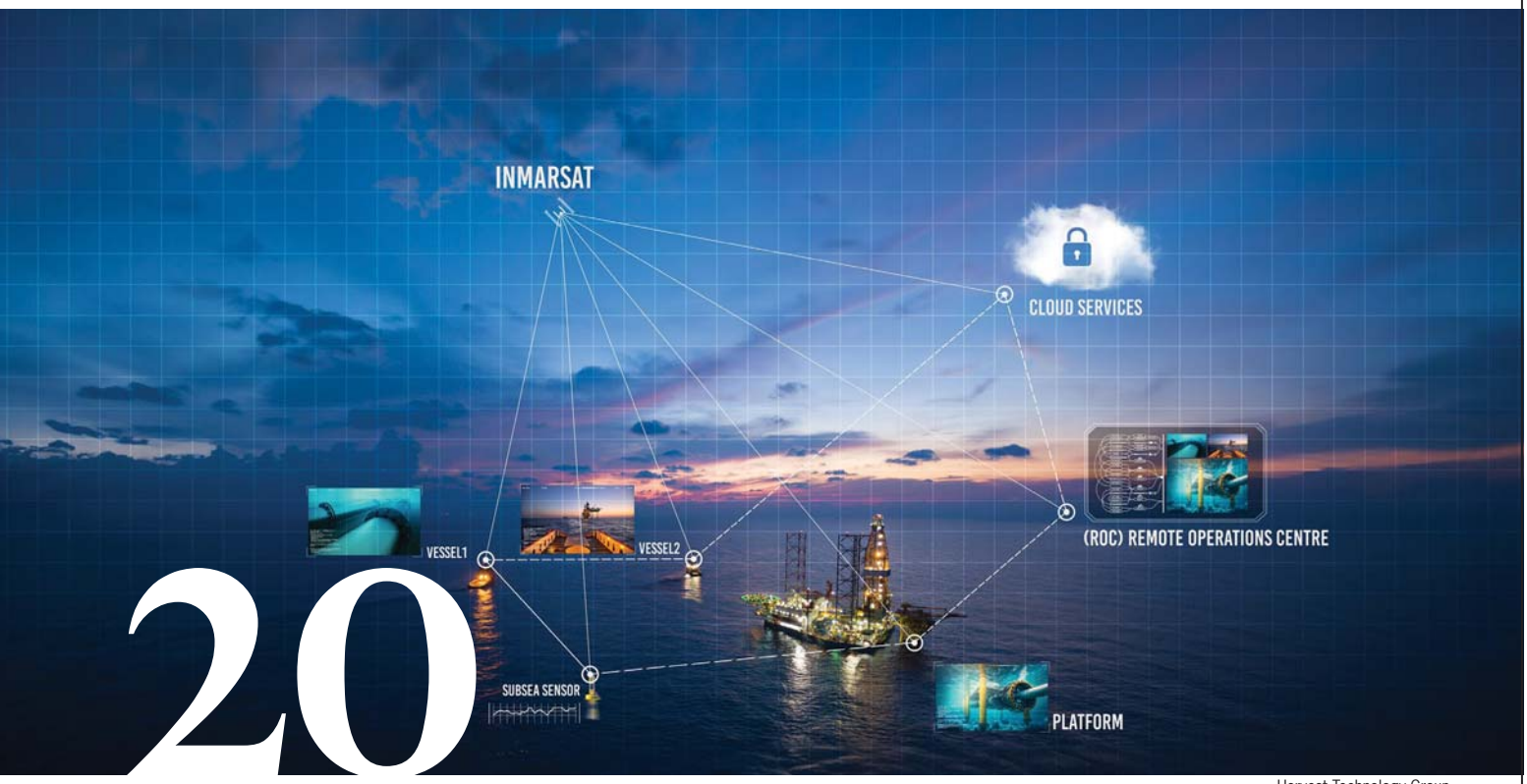
FEATURES



Harvest Technology Group

Cover photo: Harvest Technology Group

DEPARTMENTS

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Whether your business offshore is in the traditional oil and gas sector or the emerging offshore wind [or both], the ability to tap remote operation tools and techniques with an eye toward full autonomy is driving plans like never before. While there remain plentiful challenges to minimizing or removing humans from the physical assets offshore completely, there are equal if not more opportunities to significantly enhance safety and efficiency while slashing carbon footprint, with a potential personnel recruitment bump too as eliminating long travel to remote assets plays well into the work/life balance discussion.

Last month we had the opportunity to visit with **Damiain Brown**, Chief Product Officer, and **Adam Ford**, Special Projects Lead, from Harvest Technology Group, a young and fast-growing company that has a simple yet complex premise: improving connectivity in remote environments while removing people from work in hazardous and remote locations, all the while deploying its unique solution to utilize a fraction of the satcom bandwidth.

While new digital tech continues to transform the way we work offshore tomorrow, reinvigorating old offshore oil and gas fields remains a hot area of operation, particularly as increasing geopolitical conflicts make energy security and a steady flow of oil and gas a top priority today. This month **Bartolomej Tomic** takes a deep dive into the resurgence of Tyra, which has been the cornerstone of Denmark's offshore gas production since the mid-1980s but was facing an uncertain future as infrastructure aged and starting sinking ever closer to the sea's surface. The result was a multi-year project that has become Denmark's largest infrastructure project, as well as Denmark's largest recycling project.

Finally, **NOIA president Erik Milito** takes a double barrel blast to the recent release of the U.S. Department of the Interior's new federal offshore oil and gas leasing program, a program which slashes the number of oil and gas lease sales in the Gulf of Mexico to three in the coming six years, the fewest in history and far below the typical 11-20 range of lease sales in prior programs. The political winds regarding energy transition are certainly not new, they're not limited to the U.S. and they're not likely to change. However, oil and gas will underpin global energy for the coming two to three decades or longer; and the efficient search for new resources to keep the fuel flowing is vital to help keep energy prices in check and as a matter of national security.

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OE WRITERS


Laursen

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.


Lewis

Philip Lewis is Director Research at Intelatus Global Partners. He has extensive market analysis and strategic planning experience in the global energy, maritime and offshore oil and gas sectors. Intelatus Global Partners has been formed from the merger of International Maritime Associates and World Energy Reports.

Erik Milito is president of the National Ocean Industries Association (NOIA), a national trade association representing the full spectrum of offshore energy companies.


Milito

Barry Parker, bdp1 Consulting Ltd provides strategic and tactical support, including analytics and communications, to businesses across the maritime spectrum. The company can be found online at www.conconnect.com

Theodor Sørlie is a Market Analyst covering O&G and renewables, at Fearnley Offshore Supply AS since 2022. He has four years of experience within corporate advisory and technology consulting, supporting European Expansion across Amazon UK and Amazon Luxembourg. He graduated from University College London with a M.Sc. Management Finance (Distinction).


Parker

Bartolomej Tomic is managing editor of Offshore Engineer. He has, since 2010, written hundreds of articles covering the international offshore industry. The coverage includes E&P, Drilling, Seismic, interviews with oil and gas professionals, and reporting from industry events.

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).


Sørlie


Tomić


Wilkie

Extending Human Reach in the Oceans:

The Greensea IQ Approach

Greensea IQ's Vision

Greensea IQ champions the goal of extending human reach into the ocean through the application of intelligent robotics. The company's commitment to leveraging technology to overcome the challenges of underwater activities underscores this dedication to revolutionizing the possibilities of underwater work. Greensea IQ's endeavors are all founded upon its mission to improve the relationship operators have with robotics by making the work they do together more productive and more satisfying.

Greensea IQ has transitioned from custom development to the strategic utilization of data and autonomous marine robotics products to facilitate impactful, safe, and productive underwater operations across diverse sectors.

The Greensea IQ Approach and Intelligent Robotics

Greensea IQ stands at the forefront of innovation, delivering intelligent software, integrated systems, and services through data-driven autonomous marine robotics. The company's visionary approach is guided by its mission to extend human reach into the oceans and to harness its cutting-edge technology to make a positive impact on the planet.

Greensea IQ has developed a comprehensive software framework tailored for marine applications that addresses the limitations of conventional practices involving crew-manned ships and manual ROV operations. These established methods have not only proved to be economically impractical but also lack scalability to service growing demands.

With software development history dating back to 2006, the company set its sights on reshaping the path of ocean robotics around five years ago. This strategic direction led its team to develop capabilities of cutting-edge autonomy and over-the-horizon command and control operations, which were achieved through dedicated development, prototyping, and comprehensive testing in collaboration with early adopters. These groundbreaking innovations are quickly becoming established applications in numerous market segments.

Greensea IQ's approach of collaboration and delivery of intelligent robotics presents an innovative solution that not only overcomes the challenges posed by traditional approaches but also paves the way for an efficient and economically viable future in ocean operations.

The company's mantra, "Intelligence driving work in the ocean," underscores an unwavering commitment from

Bayonet 250 equipped with White River Technology sensor system initiating a UXO search

John Dunn, VP Operations at Greensea IQ, using Safe C2 technology to control an ROV located 1,500 miles away

its leadership and team to leverage intelligent solutions for marine environments so that they may tackle critical challenges safely and effectively.

Cutting-Edge Technologies

At the core of Greensea IQ's approach lies its open architecture software, OPENSEA™. The platform provides a modular framework enabling seamless integration of equipment and sensors, which creates advanced capabilities for ROVs, AUVs, and marine robotic vehicles; they become operator friendly and easy to maintain and update, yet still reliable and robust. The success of the OPENSEA platform is evident through its integration into more than 3,000 marine robotic systems worldwide.

OPENSEA Edge is the next evolution in vehicle intelligence from Greensea IQ. OPENSEA Edge is a hardware and software technology framework that places the computing resources needed to power perception systems and manipulators directly on the vehicle. It enables advanced autonomous behaviors, allowing for trusted human-on-the-loop autonomy and tetherless command and control over any subsea marine robotic platform.

OPENSEA Edge combines the power of OPENSEA with an edge computing package to provide an easy solution for system integrators or vehicle developers moving towards full subsea and untethered autonomy. OPENSEA Edge presents the tried-and-true navigation, vehicle control, and autonomy solutions of OPENSEA with new OPENSEA technologies—objective-based autonomy, perception system integration, and low-bandwidth communications-as-a-platform solutions—that can port to any vehicle system and support a wide range of applications.

In addition to providing the operating systems for OEMs, Greensea IQ has its own integrated systems and services that utilize OPENSEA/OPENSEA Edge. The Bayonet range of vehicles, comprising three sizes of autonomous underwater ground vehicles (AUGVs) for varying sensor loads, offers robust vehicles for bridging the gap between open water and the beach. Deployable from land or water in any weather or sea condition, these vehicles are engineered for movement on land, in the surf zone, and on the ocean floor. They effectively navigate unstable terrain, perform tasks, and run missions, all while carrying a wide range of sensor payloads, to accomplish a variety of environmental, oceanographic, hydrographic, and military applications.

Another integrated system benefiting from the power of OPENSEA's advanced capabilities and precision navigation is the EverClean robot, developed by Greensea IQ to

EverClean Robot

perform the EverClean service currently being offered to shipping vessel owners.

EverClean robots carry out cleaning operations with unmatched precision, resulting in minimal repetition and accurate data collection to deliver a hull condition report after each service; they offer a distinct "always clean hull" maintenance solution. Their compact size allows them to be resident onboard or at a harbor, providing a scalable and more cost-effective solution to maintain optimum efficiency, reduce carbon emissions, and lower fuel costs. EverClean, and the concept of an "always clean hull" offered by Greensea IQ, is the first service offering of its kind; it stands in stark contrast to the inherently harsher and larger manually operated or diver-assisted reactive systems currently being used.

Applications Across Sectors

Greensea IQ's dedication to intelligent robotics is evident across various sectors, including defense, renewables, unexploded ordnance, science, and maritime transportation.

Greensea IQ delivers solutions to reduce the need, and risk, for personnel to perform dangerous and costly tasks in defense, including EOD, and UXO clearance; it utilizes robotic technology to increasingly remove humans from harm's way, including through safe identification and removal of hazardous materials from ocean and land.

Given the growing emphasis on harnessing the ocean's potential for sustainable energy generation, the utilization of autonomous robots presents a viable strategy for aiding in the management of offshore infrastructure. This solution reduces reliance on human intervention, as autonomous offshore vehicles are proficient in conducting tasks on the seafloor and in the vicinity of installations.

Greensea IQ has been supporting scientific research since 2006, providing an open architecture platform to facilitate collaboration and the application of military-developed technologies for the benefit of research. Their expertise in applying military-developed technologies to support scientific research extends to addressing biofouling management: they have successfully minimized fuel consumption and toxic antifouling materials, thus contributing to emission reduction.

Tetherless ROV with OPENSEA Edge for autonomous EOD and MCM

Bayonet 250 Autonomous Underwater Ground Vehicle (AUGV)

The Greensea IQ Ecosystem

Greensea IQ is synonymous with intelligent solutions for working in the ocean and is primed as a force for impactful change. Whether through collaborating with robotic hardware manufacturers or the direct provision of integrated marine robotic systems and services, the company aims high.

Greensea IQ's ecosystem will help deliver a wide range of solutions for complex, difficult, and often dangerous tasks of working in the ocean.

OPENSEA's advanced software capabilities empower rapid field deployment of equipment to address emerging market needs. This allows Greensea IQ to seize opportunities to support these markets and deliver intelligent, integrated systems like the Bayonet AUGVs. Additionally, through RaaS engagements such as the EverClean service, maritime customers gain operational efficiency, performance, and environmental benefits via intelligent robotics, all without the high ownership and maintenance costs of the platform.

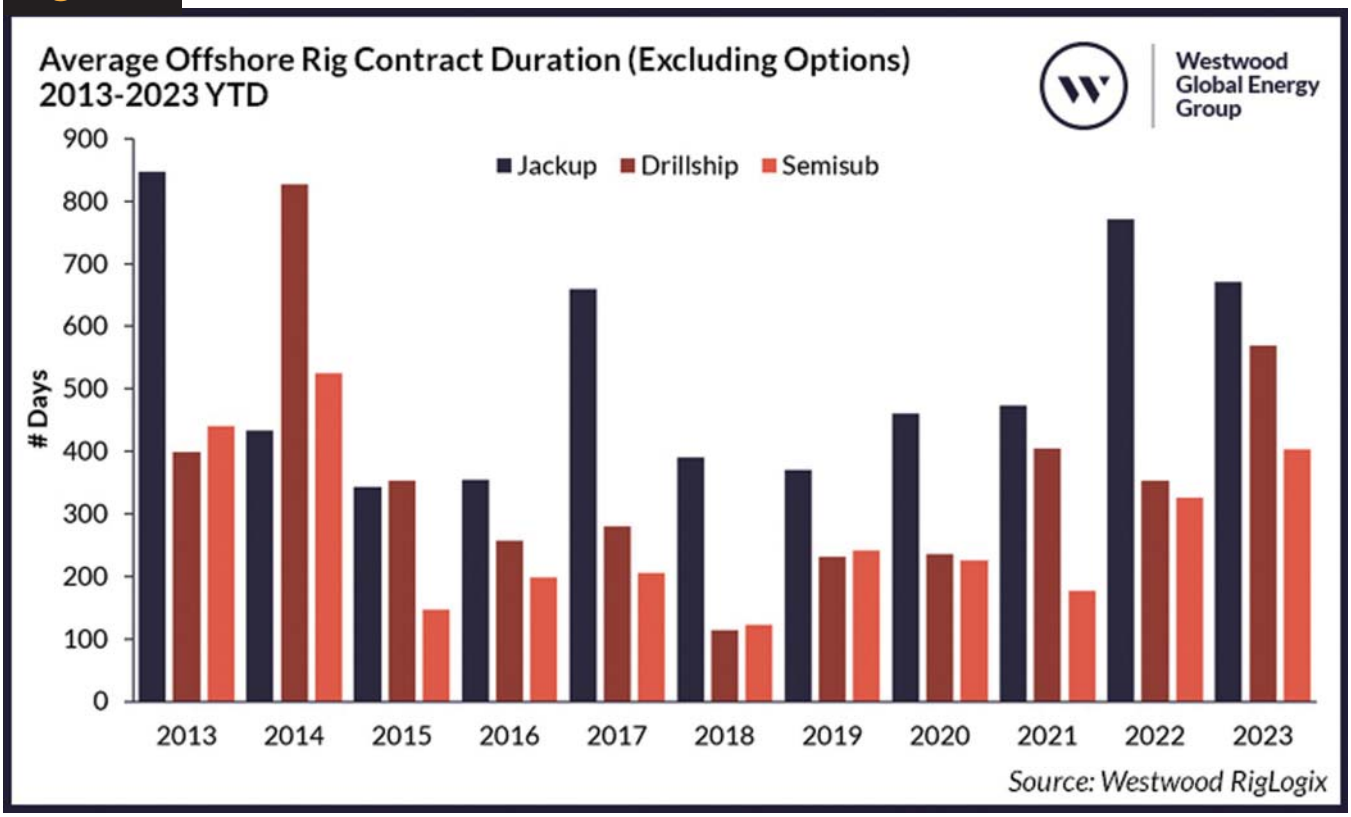
These are just two examples of how Greensea IQ's ecosystem adeptly harnesses advancements in marine technology solutions, which have been successfully developed on OPENSEA, seamlessly transitioning them for commercial application and widespread benefit.

Operators Offering 15-Year Rig Deals as Availability Dries Up

As offshore drilling rig utilization increases and availability continues to tighten, Westwood has recorded a marked lengthening of new contract award durations as well as for new tender opportunities. On average, awarded jack-up contract durations have increased 36% compared with 2021, while drillships have increased 41% and semi-subs a whopping 117%.

By Teresa Wilkie, Director, RigLogix – Westwood

Figure 1



As offshore drilling rig utilization increases and availability continues to tighten, Westwood has recorded a marked lengthening of new contract award durations as well as for new tender opportunities.

Over the last decade, new rig deal durations peaked in 2013 for jack-ups and in 2014 for floating rigs (semi-submersibles and drillships). Analysis shows that the length of such deals dwindled during the prolonged downturn and eventually reached the trough in 2018 for floaters and 2019 for jack-ups but has picked up steam again since the global rig market recovery got underway in 2021.

On average, awarded jack-up contract durations have increased 36% compared with 2021, while drillships have increased 41% and semi-subs a whopping 117%.

The areas driving these increases over the past year are quite varied according to rig type. Drillships have an average global duration of 569 days in 2023 year-to-date, driven by South America (698 days), Mexico (1,080 days), the Mediterranean (500 days), India (451 days) and West Africa (517 days).

Meanwhile, semi-subs are currently sitting at a global average contract duration of 384 days, and those areas driving demand are South America (414 days), Mexico (953 days), the North Sea (369 days), the Far East (627 days) and Australia (309 days).

Jack-up rig demand is coming from quite different areas to that of deepwater rigs, and mostly where there is a strong national oil company (NOC) presence. The average global contract duration so far this year is 661 days, and the biggest areas of demand come from the Persian Gulf (1,165 days), followed by India (840 days), the Far East (528 days), and Mexico (457 days).

Since 2022, awards with the longest contract duration have been for jack-ups in the Middle East.

Notably ADNOC Offshore awarded six deals last year, all for 15 years apiece. The same operator has since awarded a plethora of further long-term jack-up deals, five of which were fixed in June this year for 10 years apiece.

Floating rig (semi-sub and drillship) deals have so far been fixed at up to five years in duration, seen in recent fixtures for harsh environment semi-sub Deepsea Stavanger

and newbuild ultra-deepwater seventh generation drillship Stena Evolution.

10-year drillship deals outstanding

Westwood believes that further lengthening in average rig deals will be seen over the coming year. Interestingly, there are already 10-year tenders out in the market for a pair of drillships required for campaigns beginning in early 2025, which is unsurprising considering marketed utilization of sixth to eighth-generation assets is already at 97%.

We also expect to see further long-term deals secured for semi-subs, especially within the sixth-generation harsh environment segment, where marketed utilization is now at 100% and there is very limited availability – free of options – until the second half of 2024.

In terms of jack-ups, where global utilization is now sitting at 92% and around 95% for premium, high-specification assets, Westwood anticipates further long-term contracting activity to continue. Currently, RigLogix shows outstanding requirements with durations of up to five years, but it is likely there will be more direct negotiations or new requirements to come that will outstrip this.

Longest lead times since 2014

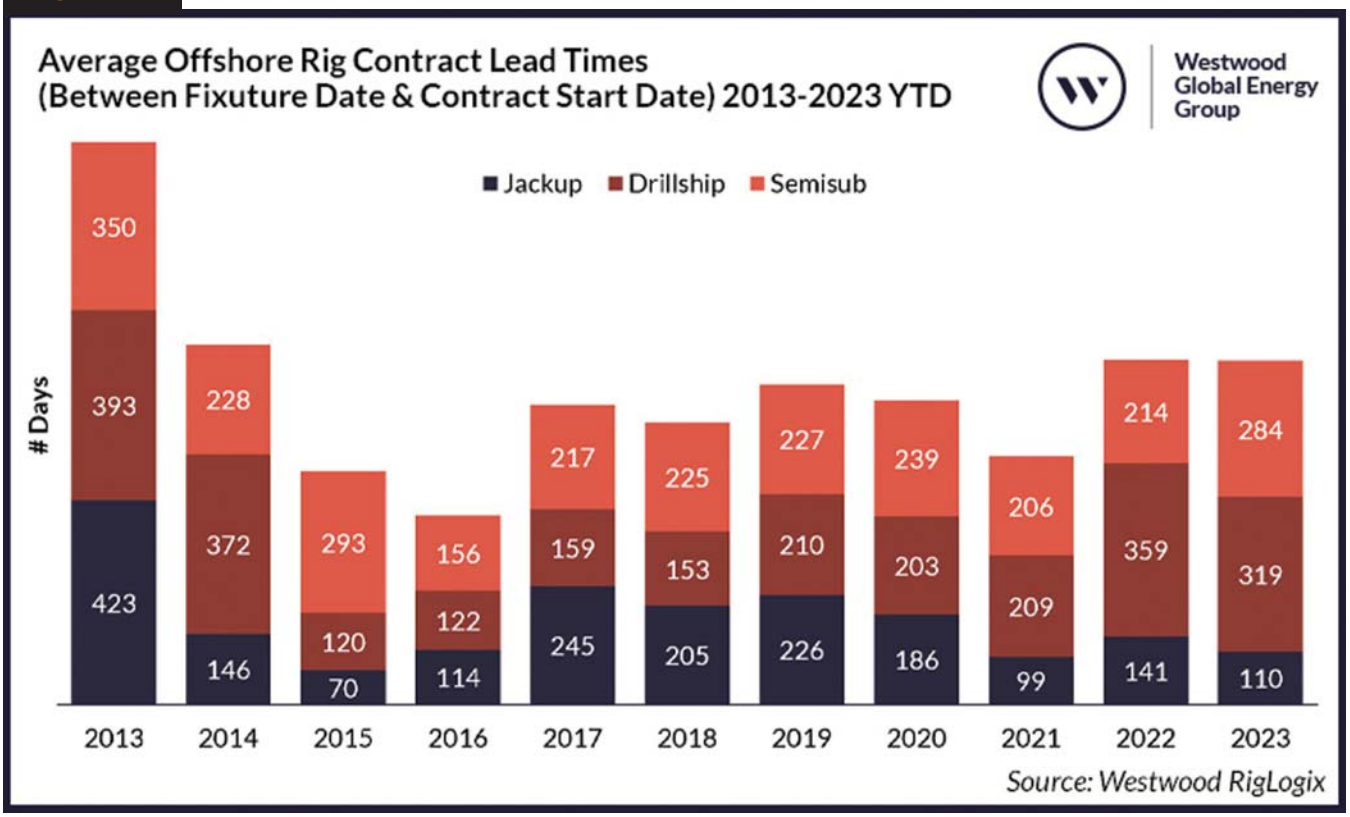
Historically, contract lead times (the duration between a rig contract being awarded and the deal beginning) also begin to stretch when rig availability becomes sparse. These reached their highest in 2013, when it was common for jack-up, semi-sub, and drillship deals to be fixed at least a year in advance of a campaign beginning.

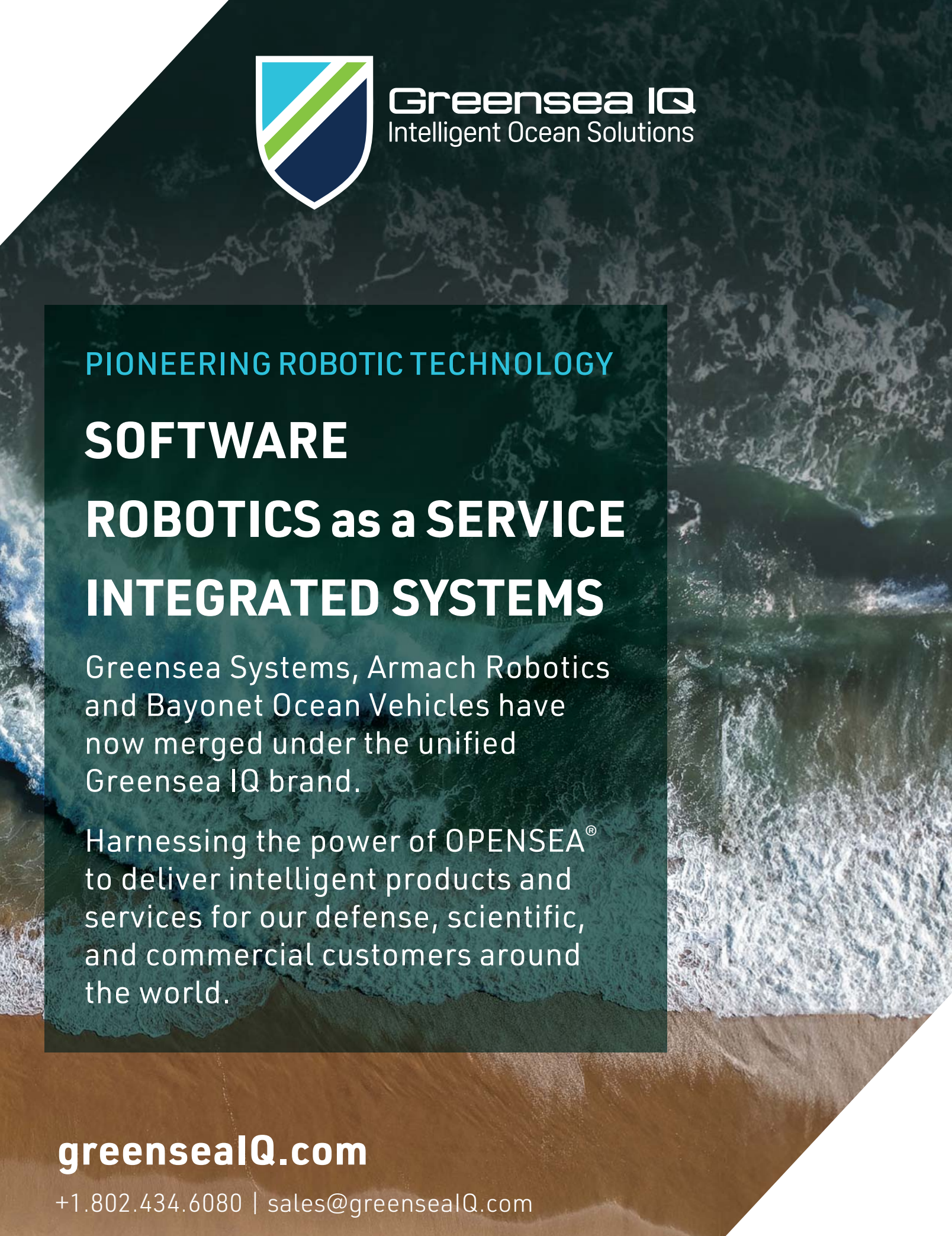
But by 2016, the average lead time dwindled to just 129 days, due to low utilization and a larger pool of readily available units to choose from – hence a lack of urgency from operators.

Compared with the 10-year average lead time, 2023 is performing almost 9% higher, but has year-to-date made no improvement on 2022's figure, with both recording an average lead time of 237 days. However, this number is still the longest recorded since the downturn hit in 2014 (248-day lead time average).

Westwood predicts that as contract duration and utilization continue to increase, coupled with decreasing availability and dayrates heading further north, lead times will lengthen as operators become more concerned with securing the right assets for their upcoming campaigns.

Figure 2




Greensea IQ
Intelligent Ocean Solutions
PIONEERING ROBOTIC TECHNOLOGY
SOFTWARE
ROBOTICS as a SERVICE
INTEGRATED SYSTEMS
Greensea Systems, Armach Robotics and Bayonet Ocean Vehicles have now merged under the unified Greensea IQ brand.
Harnessing the power of OPENSEA® to deliver intelligent products and services for our defense, scientific, and commercial customers around the world.
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The North Sea PSV Karket – Booming Worldwide, yet Underdelivering Locally

The Platform Supply Vessel market is heading towards full utilization for high-specification units, driving dayrates to levels not seen in a decade. However, it is interesting to note that when it comes to the North Sea fleet, all comparable regions are now accelerating at rates far higher than the North Sea.

By Theodor Sørlie, Market Analyst at Fearnley Offshore Supply

The North Sea fleet has experienced a steady decline in the number of vessels in recent years, primarily driven by scrapping of old tonnage, conversions towards renewables or aquaculture, and vessels sold to - or migration to other regions.

The world of offshore supply changed dramatically in the spring of last year due to the apparent sudden realization that OSV tonnage is required to keep offshore oil and gas production running.

The offshore supply market can be complex for outsiders and often entails quite technically complex vessels with high working capabilities, combined with advanced contract structures.

Yet the PSV segment might be the most "vanilla" offshore segment due to their similar capabilities, work scopes, and contracts globally.

The global PSV market experienced a similar story as most other OSV segments with low utilization and rates from the market deterioration starting in 2015 towards 2017, then a minor improvement in 2018 and 2019, followed by a complete crash in 2020. This changed rapidly in early 2022 and the global market is now heading towards full utilization for high-specification units, driving dayrates to levels not seen in a decade.

The North Sea fleet is arguably home to the most advanced tonnage, given the innovative drive from designers, equipment manufacturers, shipyards, vessel owners, and most notably, the strict requirements from Tier 1 charterers. Increased deck space, underdeck capacities, and power were key developments from the 1980s to the early 2010s, which were replaced by environmental efficiency and the ability to service more complex projects. Being home to the only efficient spot market globally is also contributing to its unique nature.

The North Sea fleet has experienced a steady decline in the number of vessels in recent years, primarily driven by scrapping of old tonnage, conversions towards renewables or aquaculture, and vessels sold to - or migration to other regions. The average fleet age is now just shy of 13 years and there are currently no vessels under construction targeting the high requirements of the North Sea operators.

The peak of the market deterioration in 2017 saw more than 120 PSVs laid up in cold stack, a number which has since gradually declined, and presently we do not count any units left in layup. Combining this with the lack of North Sea-compliant newbuilds, the entire excess capacity is gone. The total fleet is now under 180 units, compared to more than 250 units between 2016 and 2018, equaling a dramatic decrease in available vessels.

After a strong PSV summer in the North Sea last year,

there was unison optimism towards a fantastic PSV market this year. The consensus among owners and industry players was grounded in the declining fleet and increasing activity levels, combined with the lack of potential fleet growth.

Last year, the UK side of the North Sea achieved average spot rates exceeding GBP 20,000, and the Norwegian side saw roughly NOK 213,000 during the high-activity summer months of May, June, and August. Keep in mind that these rates are not adjusted for utilization, and the daily OPEX in Norway is currently just shy of NOK 100,000, compared to roughly GBP 6,000 in the UK, depending on operation mode.

This year saw the Norwegian market sold out from late April to late September, leading to achieved spot rates averaging more than NOK 315,000 during the summer months. The UK market, on the other hand, saw average dayrates decline to just below GBP 17,000 per day in the same period, which was a big and rather unfortunate surprise to most owners. The UK market was hit hard by a special windfall tax driving the total tax liability for major oil and gas producers to 75%, likely offsetting some investments this year, leading to less offshore activity.

In light of the promising market forecasts for this region before the start of the year, owners in the UK market reactivated the remainder of the then-laid-up fleet to meet expected demand. This led to a rather minor, albeit significant enough, increase in vessel availability in the spot market compared to last summer, which, in light of the above, was sufficient to soften rates, illustrating the market sensitivity.

When analyzing the dramatic improvement in the North Sea market balance in the last 18 months, it becomes clear that it is, in fact, not the number of working units that is driving the strong utilization development. The summer months of 2023, perhaps surprisingly, saw fever units working spot and term combined than 2018. Rather, we observe that the number of vessels in the fleet is at a decade-low.

Given the high technical state of the North Sea fleet, it might be a paradox that all comparable regions are now accelerating at rates far higher than the North Sea. Large PSV tonnage is now fixed for term contracts at close to USD 40,000 in South America, more than USD 30,000 in West Africa, more than USD 35,000 in the Mediterranean, and the Southeast Asian market has seen dayrates surpass USD 30,000 recently. All the while, the North Sea term market is averaging below USD 25,000.

Granted, the North Sea owners have also seen the benefits of these developments by being able to both sell tonnage at decent prices, as well as fix their ships outside of their local market this year. Yet it illustrates how far behind the region lags comparable regions. As a result, we have seen roughly 15 units leaving the North Sea region for long- or short-term work this year, primarily driven by higher dayrates achieved abroad.

Given recent market predictions suggesting that the number of contracted rigs in the North Sea will remain fairly stable next year, we find it likely that the vessel migration patterns will continue at the current pace. Short-term, we see no immediate nor compelling reasons for vessel owners to return to the North Sea given the higher earnings potential elsewhere.

The big question will then be what we can expect when all sanctioned offshore investments from majors such as Aker BP and Equinor are transformed into offshore activity from 2025 onwards. More than NOK 200 billion in offshore oil and gas development plans were submitted last year for Norwegian projects. Meanwhile, the UK saw Equinor reach the final investment decision on its major Rosebank development recently, illustrating the company's belief in the UK sector. Similarly, in late July, the UK government announced that hundreds of new oil and gas licenses will be granted, with the first to be awarded this autumn.

Energy security has moved towards the top of Europe's priority list and both the UK and Norway will play an important role in reducing dependence on unstable energy producers. To achieve this, both nations have accepted that significant greenfield investments will be required in the coming years, which in turn is likely to increase PSV demand substantially.

At the same time, the PSV fleet is aging without any potential renewal until 2026. We believe this will lead to a rush to source high-quality tonnage in the coming years, as the writing on the wall is suggesting that rates will have to increase to compete with comparable regions.

It might not happen this year, as the North Sea spot market normally softens sustainably towards the low activity winter months and owners accept lower term rates, yet the current trajectory can lead to a squeeze for charterers and a perfect storm for vessel owners in the medium term.

Floating Wind: $250B Global CapEx Through 2035

Floating offshore wind is an emerging technology with strong potential to become a major energy source. A fleet of specialized vessels will be required to help grow grid-connected floating wind capacity from 200 megawatts at the end of 2022 to a projected 61 gigawatts by 2035. The available market for vessel owners, ranging from pure T&I to full floater EPCI scopes of work, amounts to $28-145 billion in the period, according to a new report from ***Intelatus Global Partners****. The firm's research director,* ***Philip Lewis****, joins Offshore Engineer TV to discuss opportunities and challenges on the road ahead.*

A Public Policy Energy Blunder

How the New Federal Offshore Oil and Gas Leasing Imperils U.S. Economic, Energy and National Security

By Erik Milito, President, National Ocean Industries Association (NOIA)

The recent release of the U.S. Department of the Interior's new federal offshore oil and gas leasing program should be a moment of opportunity and progress for our nation. Mandated by law and long overdue, it was a chance to bolster our energy security, create jobs, and support economic growth. Instead, it's shaping up to be a failure for the country.

Energy inflation is rampant and the possibility of a national recession looms. The decision to severely limit leasing opportunities in our offshore areas could not have come at a worse time. The constraints imposed on this critical strategic energy asset ignore our energy realities, hindering American energy production when the world's demand for energy continues to reach record highs.

The Gulf of Mexico is a region known for its prolific oil reserves, highly skilled workforce, and world-class infrastructure. However, this new leasing program slashes the number of oil and gas lease sales in the Gulf, offering the fewest in history, a mere three, scheduled in 2025, 2027, and 2029. This is well below the typical 11-20 range of lease sales in prior programs.

Just as concerning is the decision to postpone environmental analyses for individual lease sales. Traditionally, these analyses are conducted concurrently with the development of the broader leasing program, ensuring uninterrupted lease sales. This fundamental approach was consistently followed, regardless of the party in power, as it supported uninterrupted leasing activities.

However, the Biden Administration has decided to deviate from this well-established norm. By delaying the lease sale-specific environmental analyses until after the leasing schedule is finalized, the Administration sets the stage for even further delays, exacerbating the drastic impacts from the regressive leasing program and potentially driving investment and energy production away from U.S. waters to despotic and autocratic regimes around the world.

While the Department of the Interior argues that this program aligns with the Inflation Reduction Act (IRA) and supports offshore wind leasing, the two-year gap between lease sales not only disrupts domestic oil and gas development, it also jeopardizes timely and predictable offshore wind leasing.

The repercussions of this failed leasing program are extensive. Discouraging investment in U.S. offshore energy production will burden families with escalating fuel costs, erase good-paying jobs vital to Gulf Coast communities, and diminish our geopolitical advantage in energy production – which is crucial at a time of historic geopolitical turmoil around the world

In these times of rising inflation and global instability, we should be leveraging our strategic advantage in the U.S. Gulf of Mexico. However, this leasing program does the opposite — it threatens the region's growth, along with hundreds of thousands of jobs, billions of dollars in investments, and substantial government revenue.

A growing body of research is calling for more oil and gas exploration and development to keep up with growing demand. Currently, global oil consumption is approximately 100 million barrels per day. Various scenarios forecast global oil demand through 2050 and beyond, and nearly all of them predict substantial oil production will be necessary through at least 2050. Research from energy analysts continue to predict massive investments in oil producing projects are needed to keep pace with growing demand. Some suggest that capital expenditures of at least $3 trillion will be required to replenish declining production from currently producing assets around the world to meet expected global demand in 2050.

To address these issues and harness the potential of our energy resources, we should companies to invest here by allowing opportunities for leasing through a plentiful and predictable schedule of lease sales. This approach not only supports our energy security but also strengthens our economic prospects and will actually serve to reduce emissions more effectively – the research continues to validate the Gulf of Mexico's status as an oil producing region with among the lowest carbon intensity emissions in the world.

It is also essential to consider the swiftly emerging offshore energy sectors, such as offshore wind and carbon sequestration. Many of the companies integral to the offshore oil and gas industry will play a crucial role in these emerging U.S. sectors. These areas all involve marine construction, and the engineering and construction capacity of businesses in the Gulf of Mexico's oil and gas sector will be instrumental for the build-out of these projects. The continued success of the companies in the offshore oil and gas supply chain will be pivotal to the future prospects for new American offshore wind farms and Gulf of Mexico carbon sequestration projects.

This new offshore oil and gas leasing program, as it stands, is not just a missed opportunity – it's a step backward. It is a regressive policy that threatens our energy future and weakens our position on the global stage. We must work together on a course correction to ensure that our offshore energy resources continue to be a source of strength for our nation.

CONNECTIN

FROM REMOTE TO FULL A

All images courtesy Harvest Technology Group Limited

G THE DOTS:

E OPERATIONS

UTONOMY

Realizing the full value of digital solutions far exceeds the capability of technology. The technology exists today to help offshore energy and maritime operators radically improve efficiency and cut costs in equal measure. The real trick to driving efficiencies is to take advantage of the latest technologies while at the same time negotiating the necessary culture change within individual organizations, to really reap the benefits.

***Harvest Technology Group** is a relatively young and small Australian company that has caught the attention of a number of offshore and subsea industry heavyweights, from Fugro to Ocean Infinity, Technip FMC, and DOF Subsea. **Damiain Brown**, Chief Product Officer, and **Adam Ford**, Special Projects Lead, from Harvest discuss the potential of technology to make a real difference in the maritime industry with **Offshore Engineer**.*

By Greg Trauthwein

Working in the offshore environment is difficult enough, however poor connectivity can increase the difficulty exponentially. Getting access to increased bandwidth, if possible, comes with increased costs, but what about reliability? How do you make sure your system is dependable enough to allow the transfer of massive data packets or live stream video to solve a technical problem? Harvest says it has the answer, or at least part of the answer, to achieving the true efficiencies and cost savings that come with seamless, fast, and reliable connections from shore to ship or offshore.

Founded just before the onset of the Covid-19 pandemic, Harvest has quickly grown its profile as a partner to help enable remote operations.

"Many of the Harvest team began their careers in the offshore and maritime sectors, and Harvest's core technology was born from solving a specific set of problems to enable operational transformation within these sectors," said Damiain Brown, Chief Product Officer. "In 2018, we set out with a mission to make remote operations possible, with a longer-term view of enabling the path towards robotics and autonomy."

Today, by Brown's estimation, Harvest supports the majority of tier-one service providers within the IMR space.

"We've recently joined Inmarsat Maritime's initiative as a certified application provider, so that's giving us access to a significant part of the global maritime and shipping sector," he said.

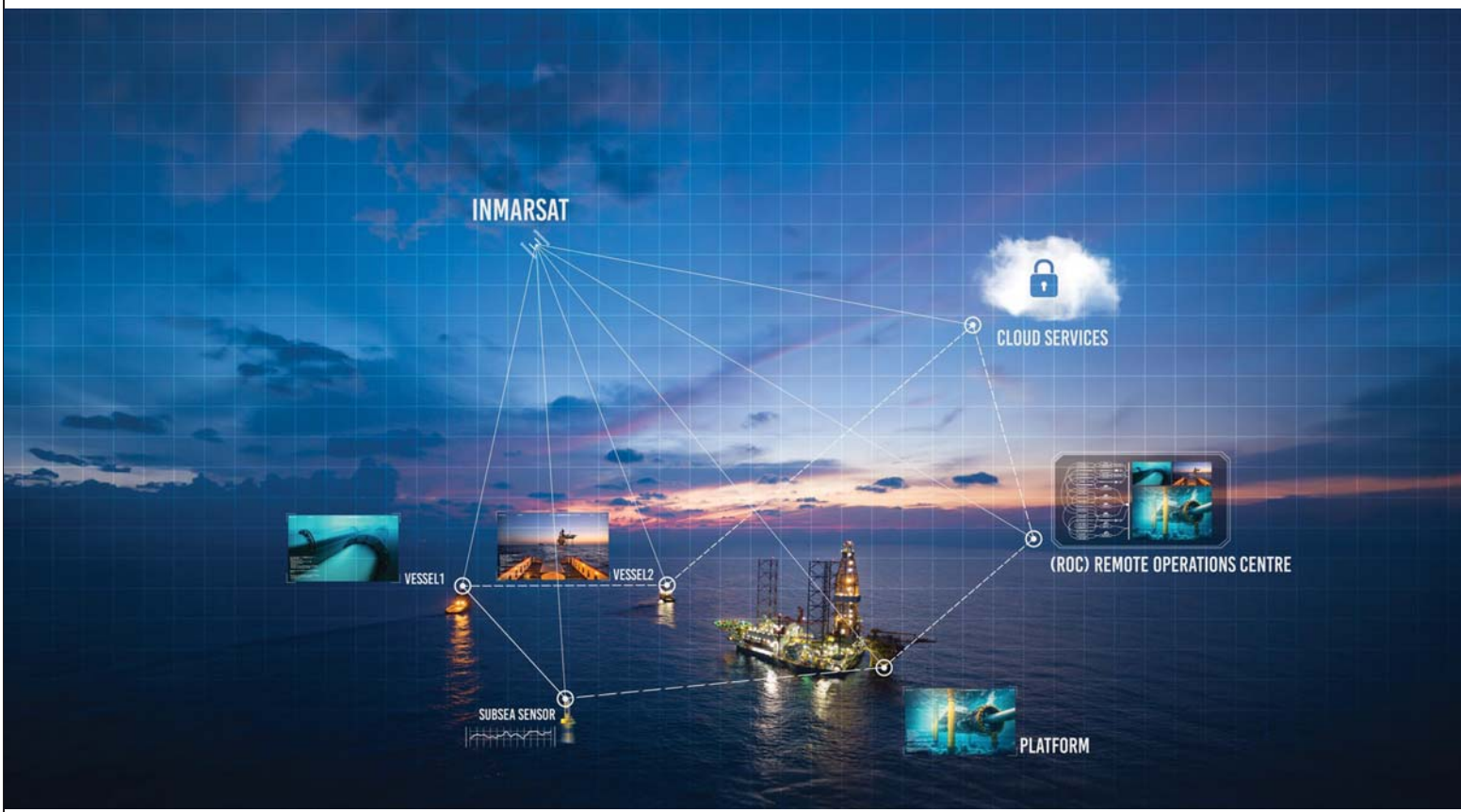
Harvest has also expanded its partner network which now includes AST Group and Shamal Technologies in Saudi Arabia.

The company's investment of about $5 million in R&D alone over the past 12 months is paying off with revenues up 42% year on year in 2023. Driving that growth are multiple markets, as maritime makes up 10% of its business (versus only 1% a year ago), with offshore services (36%) and energy (35%) delivering the bulk of its business today.

"Our focus on growing our business in the maritime sector is a key part of our strategic plan, which we're about halfway through implementing. The next phase will see us further diversify our target markets including defense and uncrewed assets across marine, land, and air," said Brown.

"In 2018, we set out with a mission to make remote operations possible, with a longer term view of enabling the path towards robotics and autonomy.

Damiain Brown, Chief Product Officer, Harvest Technology Group



> *The first part of any remote operations journey is assessing the feasibility, from the client's perspective, of which roles could be relocated from the remote site, followed by defining what the objectives for the remote operations journey.*

Adam Ford, Special Projects Lead, Harvest Technology Group Limited

Harvest's key focus, regardless of the market, is on improving connectivity in remote environments; while also removing people from work in hazardous and remote locations, which of course includes inspections on offshore facilities.

"Conventionally offshore inspection has been carried out locally on-site," said Brown. "It's usually a lengthy process which includes travel to and from offshore facilities, as well as a more laborious practice to acquire and transmit information.

"Harvest's Nodestream technology allows more direct acquisition and recording of asset integrity-related data that can be delivered directly into a customer's database," said Brown. "It's a big shift in what's possible, and you get a lot of efficiency gains, you're able to work in a proactive manner."

WHAT IS NODESTREAM?

Harvest's proprietary Nodestream technology is a remote operations system for organizations, a fully secure integrated communications platform for real-time collaboration, communication and data sharing, accessible to everyone, anytime, anywhere. It is a proprietary transfer protocol tech that enables live streaming of video, audio, and data, using ultra-low latency and ultra-low bandwidth,

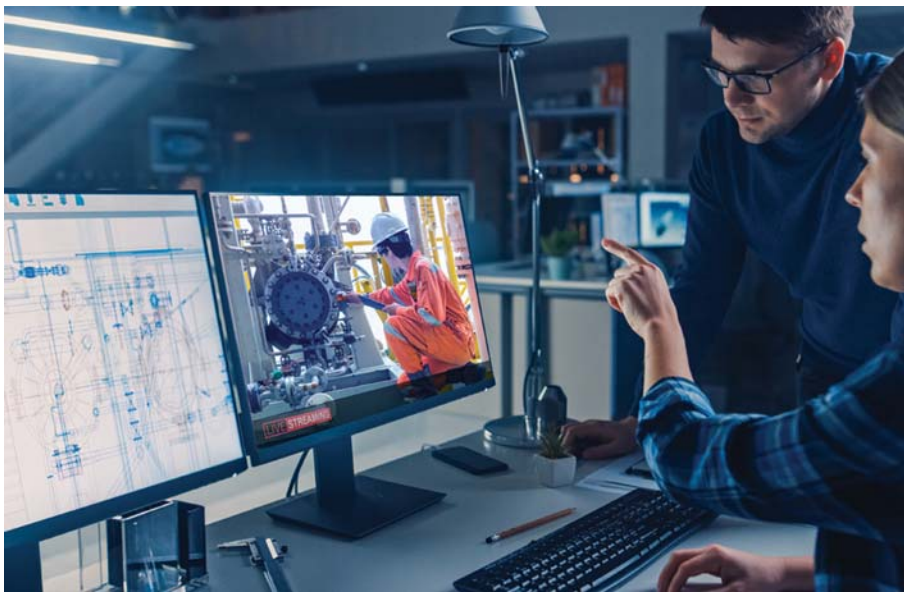
SERVICING CUSTOMER NEEDS

Harvest has a long list of customers in the offshore and subsea spaces including Ocean Infinity, TechnipFMC, and DOF Subsea. One of their major customers is Dutch offshore survey firm Fugro which recently selected the hybrid Nodestream/RiS™ Solution after an operational trial on a USV project for Woodside.

"We had two different technology offerings: a remote monitoring and remote situational awareness, a cost-effective solution, and our premium offering called RiS – or the Remote Inspection System – that allows users the ability to furnish their client deliverables," Brown explained.

"RIS is at a slightly different cost point. As a user, you might not need all the bells and whistles when you are transiting from location A to location B, but then once you get there you want to start a different mode of operation.

"In the last year Harvest has seen a growing customer desire for greater flexibility; to be able to utilize both technologies to support different operational modes, and so the team at Harvest hybridized the two technologies into one offering, enabling users to switch between modes as operations dictate.



and is capable of being integrated with a customer's existing systems and network infrastructure.

"Ultimately, it's Harvest's proprietary protocol which differentiates us from others operating in this market," said Adam Ford, Special Projects Lead. "Our typical offshore customer's networks are dependent on satellite connections in remote locations where communications are rightly considered critical. However, due to physical, technical, and operational constraints, these networks are often plagued with errors such as high latency, jitter, packet loss, and often limited in bandwidth from the beginning."

Harvest's technology is designed to be industry and network-agnostic, giving users the ability to tune settings and attributes on the fly to account for changing network conditions and, operational requirements such as prioritizing resolution and frame rate over latency.

Both Brown and Ford could not discuss Harvest's 'secret sauce' –the proprietary transmission protocol that drives Nodestream and the reported efficiency gains – but Brown said the 'recipe' was completely homegrown.

"We've developed our technology solution 100% in-house to solve a very specific set of problems and basically enable transaction of video, audio, and data over networks where previously it would've been impossible."

THE REMOTE INSPECTION SYSTEM (RIS)

While it's difficult to quantify the pace of the transition to remote inspection technologies due to the reluctance of operators to discuss the topic in much detail, the direction is clear: operators are taking people off of rigs and offshore infrastructure and moving to remote options to reduce costs, save time, and minimize safety concerns.

To enable this transition Harvest has developed the Remote Inspection System (RiS™), a system designed to optimize existing networks to reduce bandwidth utilization by up to 80%, enabling crew members to transmit 60fps HD video, hi-res images, and data in real-time from remote operations anywhere in the world on any connection.

Ford puts into perspective the service and its application in the offshore environment.

"The first part of any customer's remote operations journey is defining the strategic and operational objectives for the journey then determining which roles can be relocated from the remote site," Ford said.

"Our experience tells us that generally it's inspection personnel that get selected as their role mostly requires them to look at a monitor onboard a vessel using their skills to

identify and report on the assets," Ford said. "So, we asked ourselves the question, 'If we could reliably stream the content that inspection personnel look at offshore, could we enable them to complete the same task onshore?'" Ford explained. "This exposed a number of extremely complex problems given that satellite connections can be intermittent and unreliable with limited bandwidth capacity.

Ford explained that Harvest's RiS™ was developed to enable the transmission of quality video and the associated metadata along with clear and reliable audio system over these satellite links or networks, meaning operators could transform how they worked without needing to change the infrastructure they worked with.

"The solution itself is unique; it's intuitive, it's functional, but most of all, it's reliable and the only system we know of specifically designed to solve the technical problems of remote inspection. Plus, it's optimized to run on the most limited networks in any remote location on the planet," Ford said.

"Another key element is, without question, security," Ford added. "We have to be able to do it securely; we know with certainty that our data paths cannot be intercepted or interfered with; so someone can't take control or give wrong information. Security is paramount."

TECH VS. CULTURE

As technology advances at speed across industries in relation to digitalization, data, autonomy, and energy transition, it's clear that it's not just technology maturity that impacts the ability of organizations to truly transform their operations, to make them more efficient, safe, and cost-effective. There remain various hurdles, perhaps none higher than company habit and culture.

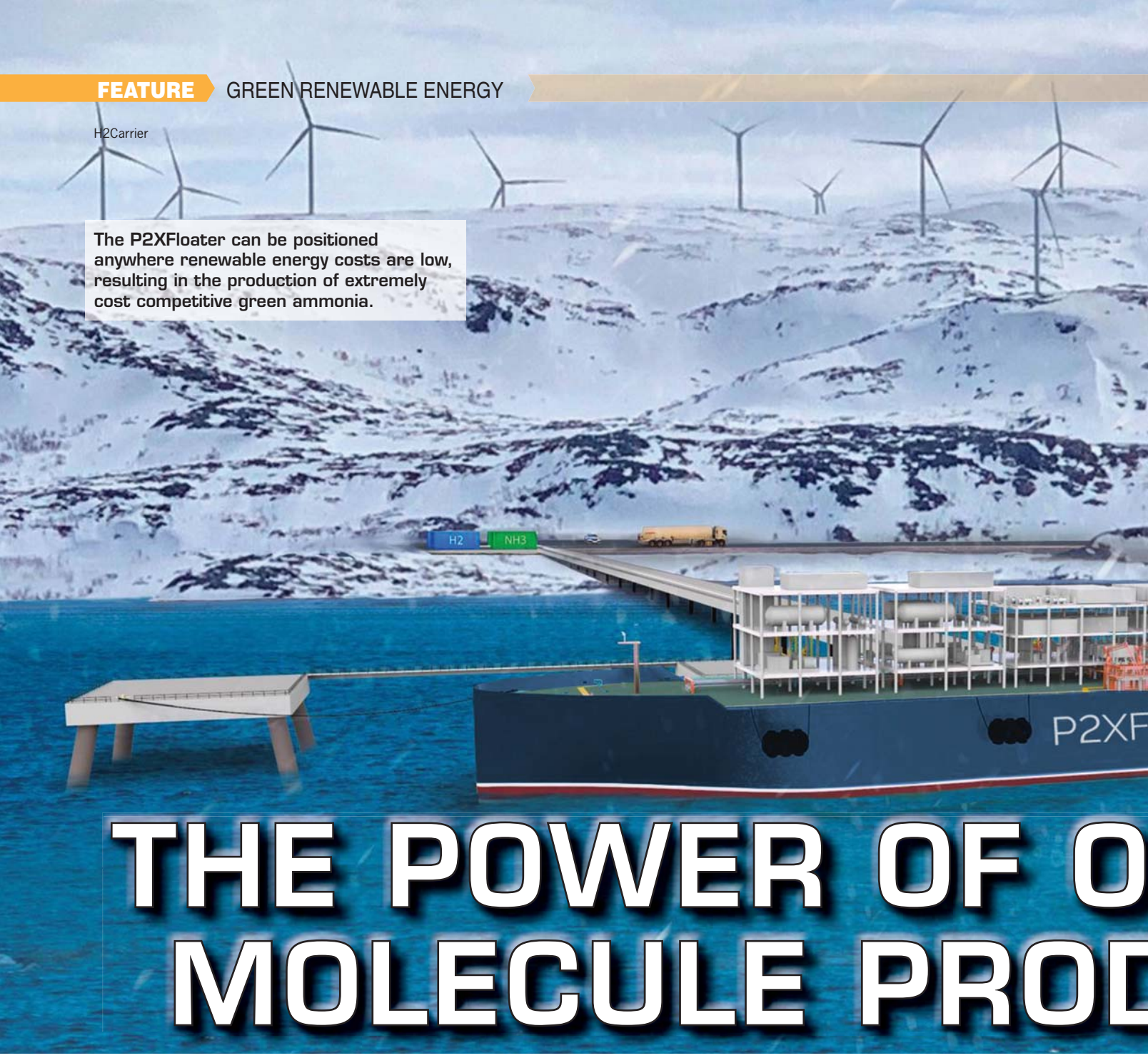
"This is a really important question and I think by far the biggest hurdle for companies transitioning to remote operations or implementing this type of technology is change management," said Brown. "It is really a different way of doing things and bringing your staff and your team along for the journey, communicating why it's being done and what the benefits are is essential. So, by far and above, the biggest one is change management," Brown noted.

Change management aside, Brown and Ford see boundless opportunity for all in this space. "The whole industry, in one form or another, is transitioning towards remote, robotics and autonomy. If there's a means to do something in a more environmentally efficient manner, a more cost-effective manner, and a safer manner, why would we not adopt it?", Brown said.

HARVEST TECHNOLOGY GROUP @ A GLANCE

Location: Perth, Australia
President/CEO: Paul Guilfoyle
# of employees: 43
Website: https://harvest.technology/
Key Technology: Harvest's proprietary Nodestream technology is pivotal to businesses looking to digitalization as a way to increase productivity and decrease costs. Nodestream is a proprietary transfer protocol technology that enables live streaming of video, audio and data, using ultra-low latency and ultra-low bandwidth, and capable of being integrated with a customer's existing systems and network infrastructure, enabling fully secure integrated communications for real-time collaboration, communication and data sharing - all in one place, accessible to everyone: anytime, anywhere.

H2Carrier



The P2XFloater can be positioned anywhere renewable energy costs are low, resulting in the production of extremely cost competitive green ammonia.

THE POWER OF O MOLECULE PROD

Energy ecosystems are evolving as the value of offshore power-to-X production is being realized.

By Wendy Laursen

FFSHORE DUCTION

Flexible and delivered in long lengths on reels in a fast-track operation, thermoplastic composite pipeline can transfer up to nine times the amount of energy as a cable and can be used to store hydrogen, increasing the uptime of offshore wind farm generated power.

That's according to Netherlands based supplier Strohm, member of the Hydrogen Offshore Production for Europe (HOPE) project and the Dutch floating green hydrogen and ammonia OFFSET project. It's one of the reasons why an increasing number of European clean energy projects are looking at the production of green hydrogen and power-to-X fuels such as ammonia on floating platforms.

In a study of the North and Baltic Seas, DNV concluded that the lower costs of hydrogen transmission compared to electricity and the possibility for large pipelines to aggregate offshore hydrogen production from several windfarms, makes offshore hydrogen production an attractive option for offshore wind farms, certainly at distances of more than 100 kilometers from shore.

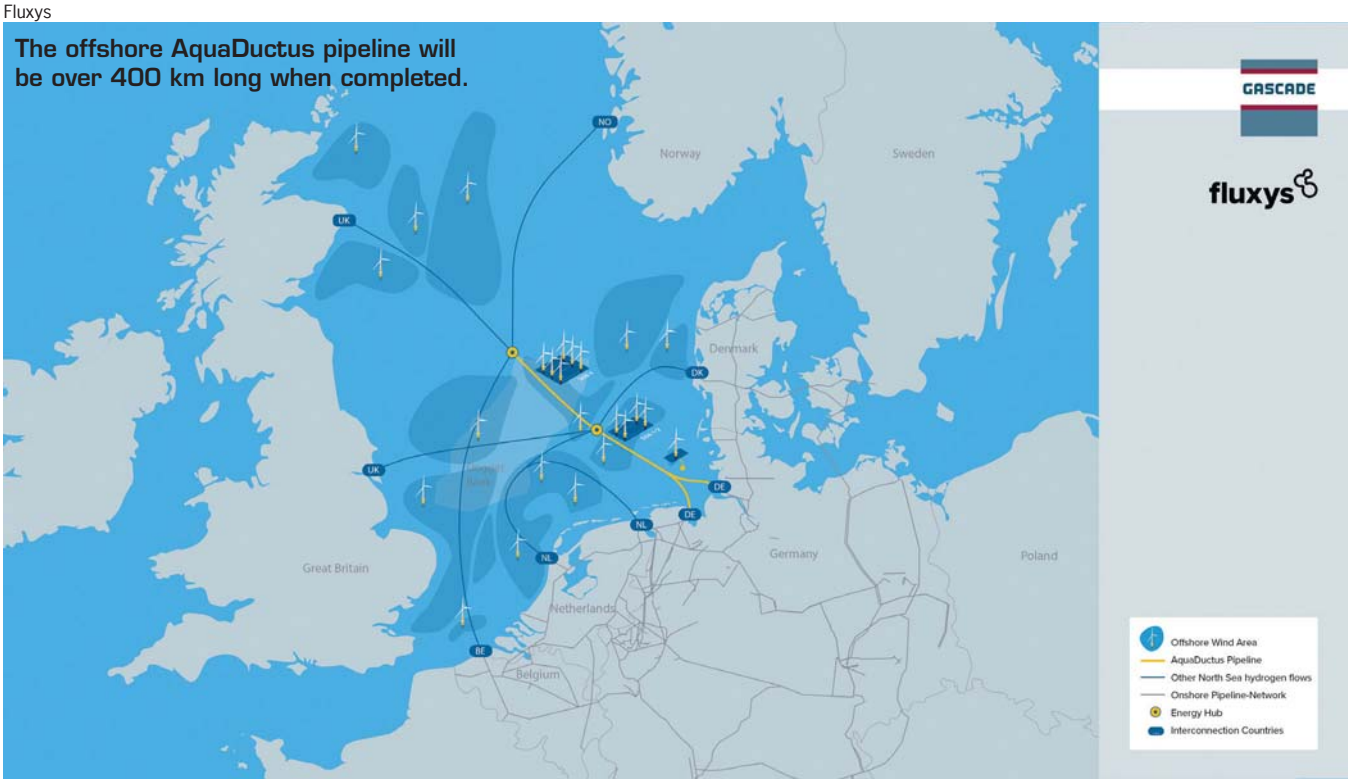
The alternative is shipping molecules to shore, and Maciek Lukawski, VP of Strategy & Business Development for ammonia power solutions company Amogy, points out that, for locations like Japan, Europe and the US with limited shallow waters and strong interest in ammonia, floating production platforms will enable strategic access to clean ammonia. "Transportation of green ammonia through shipping can provide widespread access in the near future rather than the development of offshore pipelines." Amogy has signed MoUs with Southwind to promote offshore wind development and Marco Polo Marine to develop its ammonia-to-power solution for deployment on OSVs.

Shipping will still involve new piping solutions. Earlier this year, H2Carrier and Trelleborg Gas Transfer signed an MoU on ship-to-ship ammonia transfer systems that will be based on Trelleborg's KLAW LNG technology and upgraded to operate with liquid ammonia.

H2Carrier has developed the P2XFloater for floating production of green hydrogen and ammonia. The concept is based on oil and gas technology combined with an e-control system capable of balancing renewable electricity feedstock through a fully integrated electrolyzer and Haber-Bosch synthesis system. The hull could be a newbuilding or a retrofitted very large gas carrier.

Mårten Lunde, CEO of H2Carrier, says the design solves a number of concerns for renewable energy projects: cost, time, use of land and environmental footprint, and lengthy planning and regulation processes. The P2XFloater can be positioned anywhere renewable energy costs are low, resulting in the production of extremely cost competitive green ammonia. "We plan for a near shore operation in the beginning, simply because we are targeting the lowest cost electricity." Offshore wind is technically feasible, but currently too expensive, he says. H2Carrier has signed a Letter of Intent with Anori for the development of Greenland's first commercial wind farm and ammonia production and export facility.

Fluxys



SwitcH2

3D graphic of the hydrogen guidance project H2Mare.

Lhyfe is coordinating a 10MW project in the North Sea off the port of Ostend, Belgium, as part of the HOPE project, which will pipe up to four tons of green hydrogen to shore a day. HOPE is the first offshore project of this size in the world to begin actual implementation, with the production unit and export and distribution infrastructure due to come on stream in mid-2026.

In another project, SwitcH2 and BW Offshore, along with partners Strohm, MARIN and TU Delft, are developing an offshore green ammonia FPSO that is both modular and scalable. The initial 300-meter FPSO will be able to produce 790 tons of green ammonia per day at its peak using a 300MW electrolyzer plant.

The FPSO can be moored in shallow waters with a submerged yoke or spread mooring system or in deeper waters a turret system. In areas where there is no or limited offshore pipeline infrastructure, the offloading features of an FPSO makes it suitable for storage and subsequent ship-to-ship transfer.

The electricity powering the FPSO will be imported onboard from an offshore wind farm via high-voltage electrical swivels allowing the unit to naturally weathervane when turret-moored. The FPSO will also use waste heat recovery and harness wave energy.

As part of the OffsH2ore project, researchers at the Fraunhofer Institute for Solar Energy Systems ISE, are also aiming for high production. Together with project partners PNE, Silica Verfahrenstechnik, Wystrach, Kongstein, they have developed a design for an 500MW offshore hydrogen production facility powered by offshore wind. "With the concept presented by the consortium, rapid and large-scale implementation has become realistic," says the Institute.

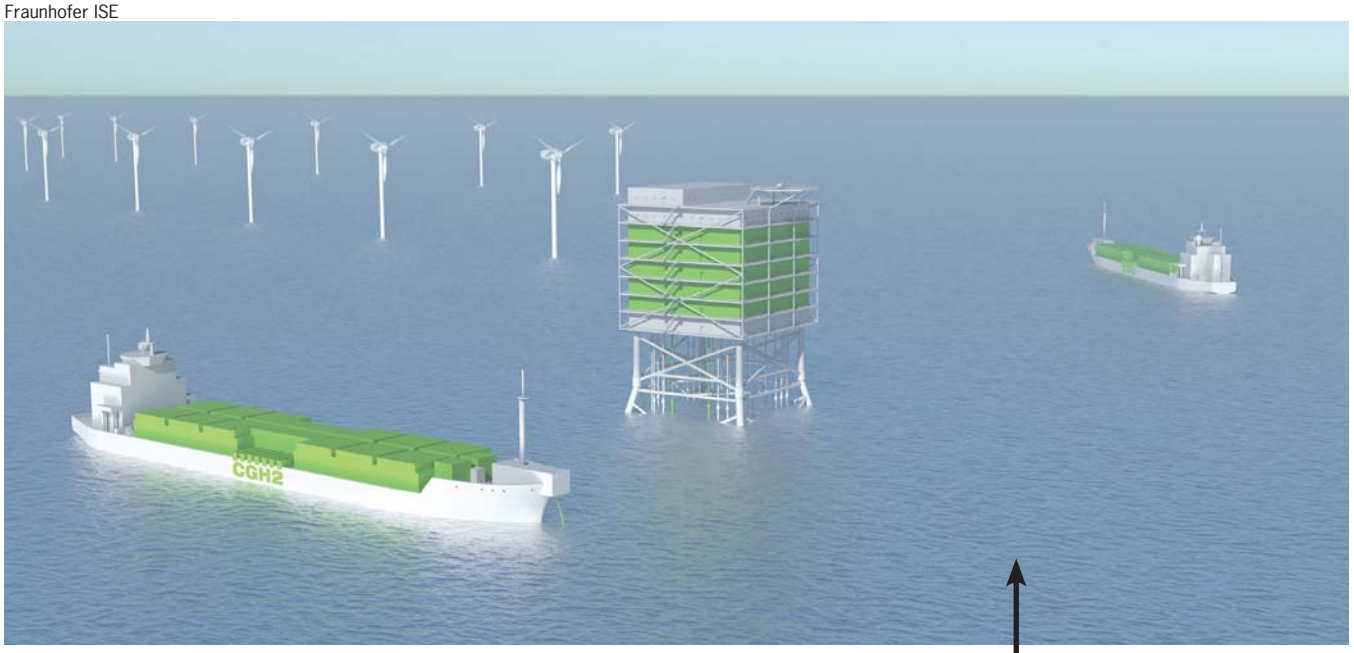
Others in Europe are working towards a "backbone" of energy islands and pipeline infrastructure. A study prepared by DNV for GASCADE and Fluxys highlights the advantages of an offshore hydrogen backbone, AquaDuctus, in the North and Baltic Seas. The study concludes that offshore hydrogen production connected by pipeline is cheaper than onshore hydrogen production.

By 2030, the 1GW SEN-1 offshore hydrogen wind farm will be connected to a 200-kilometer pipeline bringing green hydrogen to Germany. From there, it will be piped to European consumers. Pascal De Buck, CEO of Fluxys, says: "The AquaDuctus offshore pipeline, thought of as a regulated open access infrastructure available to all future operators of hydrogen wind farms, will make a substantial contribution to security of supply by diversifying Europe's hydrogen supply sources."

Siemens Energy is working with 32 partners on the H2Mare project to address, amongst other issues, whether it is better to supply power to offshore power-to-X production facilities as electricity or hydrogen. "You could produce hydrogen at each wind turbine and then combine it at the power-to-X facility, or you could combine the electricity from multiple wind turbines to produce hydrogen on a separate platform and then supply it to the power-to-X platform. It turns out that the former option is better," said Matthias Mueller, coordinator of the H2Mare project, and Professor Roland Dittmeyer of Karlsruhe Institute of Technology, in a recent IEEE Spectrum article.

They envisage a future where ships regularly dock at offshore platforms. All the processes would be fully automated and largely self-sufficient. Someday, even the ships themselves might be autonomous. "It seems like science fiction now, but major efforts are already underway to demonstrate the technologies needed to realize this vision."

Fraunhofer ISE



The OffsH2ore project has developed a design for an 500MW offshore hydrogen production facility powered by offshore wind.

Thermoplastic composite pipeline can transfer up to nine times the amount of energy as a cable.

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TYRA'S RESUR
BREATHING NEW
DENMARK'S GAS

All images courtesy Total Energies

GENCE: LIFE INTO S GIANT

Just a few years ago, Tyra, the cornerstone of Denmark's offshore gas production, faced an uncertain future. However, a bold decision to redevelop the field was made, making it one of Denmark's most ambitious infrastructure projects ever.

By Bartolomej Tomic

Tyra is Denmark's largest gas field, with its infrastructure also serving as a processing hub for other nearby gas fields, processing and exporting more than 90% of the natural gas produced in the Danish North Sea.

A couple of years ago, the field, which had been in production since 1984 was on the verge of being decommissioned as its facilities had been nearing the end of life, and its jacket-supported platforms were slowly sinking ever closer to the sea surface.

In 2017, then-operator Maersk Oil said the facilities were no longer safe for work, having sunk five meters deep over the years, and warned it would shut down the field for good on October 1, 2018, should no viable economic solution for the development of the field be found, putting in jeopardy hundreds of jobs, as well as other nearby fields.

A couple of months later, a decision was reached to redevelop the field, by removing old infrastructure and installing new jackets and platforms, not a simple undertaking, in what would become Denmark's largest infrastructure project, as well as Denmark's largest recycling project.

Namely, the redevelopment called for the field shutdown in 2019, removal and decommissioning of the prior Tyra platforms, some reuse, recycling, and 10-13 meters extension of the current jackets at six platforms that would have new topsides a totally new process platform, and a new accommodation platform.

According to the main decommissioning and removal contractors for the project, Allseas and Heerema Marine Contractors, the equivalent of multiple Eiffel towers in weight of Tyra infrastructure had to be removed and taken to shore for recycling, to make way for new infrastructure, also weighing tens of thousands of tons.

A lot has happened since the decision to proceed with the redevelopment of the Tyra field, located, in Blocks 5504/11 and 12, 225km west of Esbjerg, was made. Some companies no longer exist today, some have sold their interests in the project, and some have been renamed, and the production start-up deadline had to be postponed due to the COVID-19 outbreak.

Maersk Oil was bought from Maersk by France's Total in a deal estimated at $7.45 billion, struck in 2017 and completed in March 2018.

In September of the same year, the French oil major bought out Chevron's Danish business, increasing its operatorship in the DUC from 31.2% to 43.2%. In October 2018, Shell agreed to sell its Danish upstream business to Norwegian Energy Company (Noreco) in a deal valuing Shell's assets at around $1.9 billion. In May 2021, Total changed its name to TotalEnergies to mark „strategic transformation into a broad energy company," and in March 2023, Noreco announced its name change and is now known as BlueNord.

Sembcorp Marine which in December 2019 secured the subcontract to construct six topside modules and four bridges for the Tyra Redevelopment, is now called Seatrium, after completing its $3.4 acquisition of Keppel's off-

shore & marine unit.

Today, TotalEnergies is the operator of the Tyra field on behalf of Danish Underground Consortium (DUC) – a partnership between TotalEnergies (43.2%), BluNord (36.8%) and Nordsøfonden (20%).

REMOVALS

In July 2020, Heerema's giant LNG-powered semi-submersible crane Sleopnir vessel, equipped with a pair of revolving cranes that can lift 20,000 tonnes in tandem wrapped up the first phase of the Tyra decommissioning when the topsides, including wellhead and riser platforms, were removed.

The second phase of the decommissioning campaign consisted of two main lifts of the two integrated accommodation and processing platforms at Tyra East and Tyra West.

Allseas' giant catamaran Pioneering Spirit was employed for this part of the campaign, removing both topsides in single lifts.

The 14,000-tonne TEA topsides and 7,800-tonne TWA topsides were removed with the vessel's motion-compensated topsides lift system. For the smaller, lighter structures, the vessel's then newly aft-mounted 5000 t.

In September 2022, Allseas' Pioneering Spirit removed two more offshore jackets from the field and sent them for recycling. The removal of the two jackets concluded Allseas involvement in the Tyra Redevelopment Project.

Allseas' role in the redevelopment project covered engineering, preparation, removal, transportation, load-in to shore, and recycling of the Tyra East Alpha (TEA) and Tyra West Alpha (TWA) topsides and jackets, integrated production facilities (IPF) module, two flare jackets, and monopile.

In total, Pioneering Spirit removed more than 35,000 tonnes of offshore facilities from the field.

All in all, 50,000 metric tons of material were removed, which according to TotalEnergies, is the equivalent of seven Eiffel Towers.

INSTALLATION

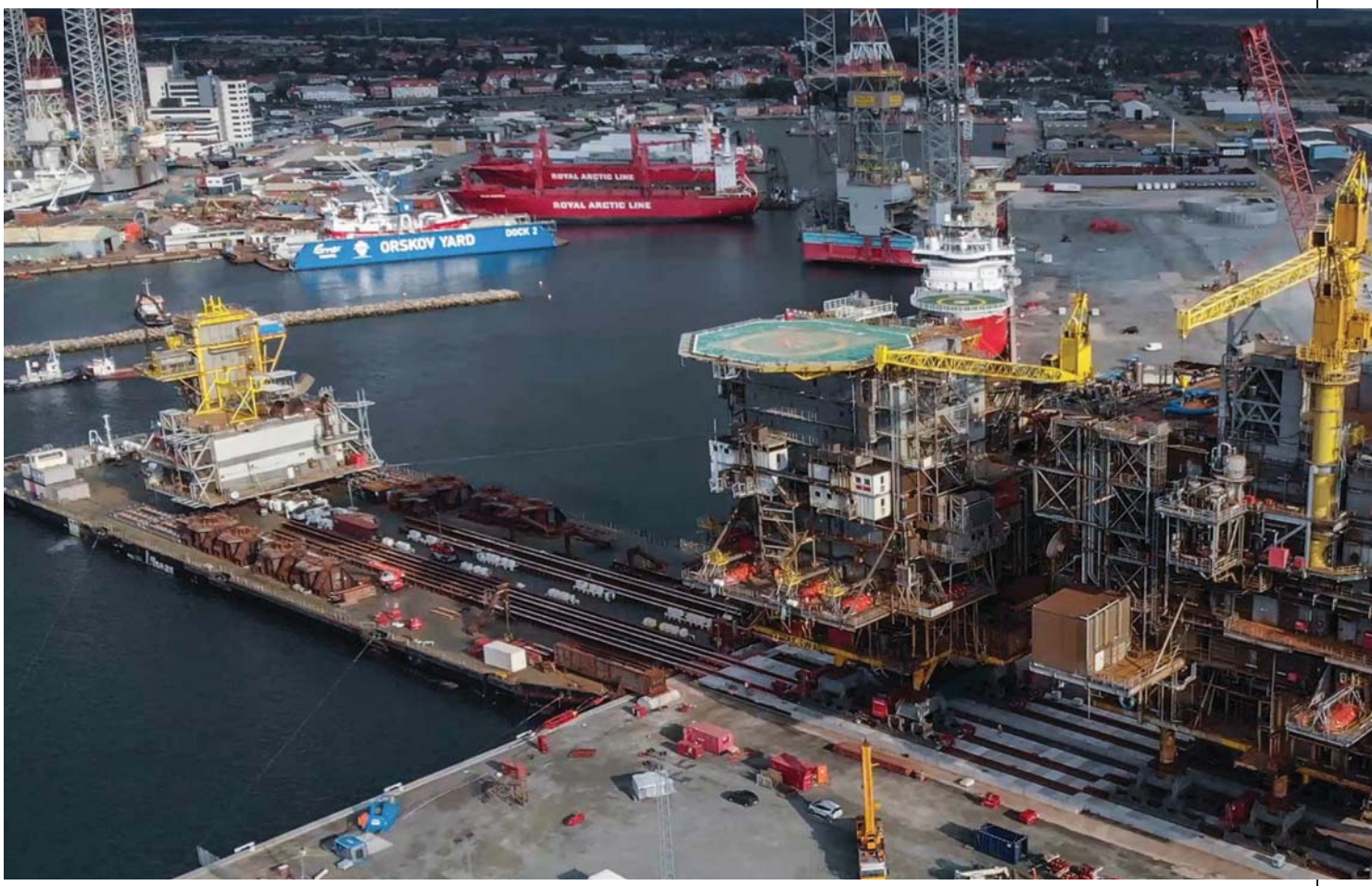
Heerema Marine Contractors' Sleipnir semi-submersible crane vessel in September 2020 installed two new Dragados Offshore-built jackets, which formed the foundation for the new Tyra process and accommodation platforms.

The two jackets were the first new jacket structures delivered and installed for the Tyra redevelopment project.

The vessel then also installed the remaining new Tyra II modules including the Rosetti Marino-built accommodation module, six wellhead and riser modules, and four bridges in September 2021 and April 2022.

In early October 2022, Heerema Marine Contractors installed the TEG module, described as the biggest Tyra II project topside, on the last remaining bare jacket at the Tyra offshore field.

Heerema said that it had broken a world lifting record with the installation of a 17,000 metric ton, 47-meter-tall, Tyra TEG module. Heerema's Sleipnir lifted the giant module from the heavy transport vessel GPO Emerald,



sailed one nautical mile to the pre-installed jacket in the North Sea, raised the module by nine meters, and then lowered it onto the six legs.

The processing module will, at peak, be able to process 300 million standard cubic feet of gas per day, which comes from both Tyra and five unmanned satellite fields, namely Tyra Southeast, Harald, Valdemar, Svend, and Roar.

On October 10, 2022, TotalEnergies said it had completed the offshore installation works at the project, with Heerema's Sleipnir setting down an 85.4-meter-long bridge between the new Tyra II processing platform and the accommodation platform.

"Now all dots of Tyra II are connected and lifting the final four Tyra II pieces – the process module, two bridges, and a flare tower – comes to a successful end." TotalEnergies said at the time.

RECYCLING

As previously mentioned, Tyra has also become Denmark's largest recycling project for offshore installations.

In December 2022, Total said that all the old platforms and structures removed from the Tyra field had been 98.5% reused and recycled.

M.A.R.S. yard at the Port of Frederikshavn was responsible for the recycling at its 290,000 m2 recycling area, which has been described as the world's first recycling facility built to recycle jack-up rigs, ships, and offshore platforms.

PRODUCTION

Noreco, now known as BlueNord, TotalEnergies' partner in the project, said in November 2020, that the start-up of the Tyra Redevelopment was expected in the second quarter of 2023, and not in 2022 as previously planned, citing COVID-19 impact and restriction imposed at the fabrication yards.

Since then, this deadline has been pushed some more, with the first gas from Tyra II now expected in the winter season 2023/24.

"It's exciting to be able to see the complete shape of Tyra II as all eight platforms, six bridges, two jackets, and one flare are now in their final position. I'm very proud of our installation team and our skilled partner Heerema Marine

Contractors who once again executed textbook lifting operations. Nevertheless, there is still a lot of work offshore to complete in order to get Tyra II ready for first gas in the winter season 2023/24," said Lars Bo Christiansen, Deputy Project Director for TotalEnergies EP Denmark A/S, said after Heerema installed the final bridge in October 2022.

On the last day of June 2023, TotalEnergies said it had reconnected the 30-inch export pipeline between the Tyra field and Denmark, to enable the gas export once the field resumes its production.

In July 2023, TotalEnergies said its dedicated teams were working around the clock to ensure that the Tyra field would be back to production in the winter season of 2023/24.

During the Tyra redevelopment, Tyra and the surrounding fields were temporarily disconnected and the satellite platforms Svend, Roar, Harald, Valdemar, and Tyra South East were put into idle mode to enable the removal of the old Tyra and installation of the new Tyra.

In September 2023, the project reached another milestone with the final work on the subsea infrastructure, reconnecting Tyra with the surrounding fields.

ENERGY SECURITY

Following the necessary Tyra shutdown for redevelopment works, in 2020, the total production of gas in Denmark dropped to 1.4 billion cubic meters, a steep decline compared to the gas production in 2019, where the total production was 3 billion normal cubic meters.

According to TotalEnergies, once the modernized Tyra II is back on stream, it will be the most modern natural gas field in the world and is expected to deliver 2.8 billion cubic meters of gas per year to Denmark and Europe through the export pipelines to Nybro and Den Helder.

The operator has said that the redevelopment will reduce CO2 by 30% and flaring can be reduced by 90%.

TotalEnergies has said that Tyra will play "a key role in making Denmark self-sufficient and net

exporter of affordable and stable energy again – also to the benefit of our European neighbors."

This is especially important as Europe has been working to wean itself off the Russian gas, amid the conflict in Ukraine.

Denmark started extracting North Sea oil and gas in 1972 and is European Union's largest oil producer. In 2020 it set a final phase-out date of fossil extraction by 2050, including Tyra.

However, in April 2022, Reuters reported that the Danish government aimed „to significantly boost renewable energy supply and temporarily increase production of natural gas from its fields in the North Sea, in a move to rapidly become independent of Russian supplies.“

"We are convinced it's better to produce gas in the North Sea than buying it from Vladimir Putin," Reuters reported Prime Minister Mette Frederiksen as saying at the time.

New gas supplies will be appreciated even more as Rystad recently week said that global gas demand is projected to rise in the next decade, influencing a 12.5% surge in production between 2023 and 2030.

However, Rystad Energy forecasts that even in scenarios of 1.9 and 2.5 degrees Celsius warming, with rapid growth in renewable energy sources, the current set of existing gas fields will not meet global demand, and more new fields will be required.

As for Denmark, information on the Danish Energy Agency's website shows that after the reconstruction of the Tyra field, Denmark will remain a net exporter of natural gas until the mid-2030s while Denmark will remain a net importer of oil until the phase-out in 2050.

Seeing Wind's Problems with 'Digi-eyes'

How adopting digital technologies hold the key to enabling asset control

By Mirelle Ball, Content Marketing Manager, ONYX Insight

As the collective pursuit of net-zero accelerates, nations across the globe are facing increasing pressure to support the development of renewable energy infrastructure that can drive low-carbon economies. Wind continues to hold up in the energy mix but its challenges to fast scale-up are becoming more known, especially with regards to turbine reliability.

Transformative growth across the physical supply chain within the wind industry is already evident – installed wind capacity globally reached 906 GW in 2022, with forecasts indicating a further increase of 680 GW in the next five years, according to GWEC's Global Wind Report 2023.

However, the race for scale in the past decade is notably having knock-on effects on operations and maintenance (O&M) strategies as the supply chain races to keep pace. As windfarms increase in size and components increase in complexity, recent reports highlight a correlation between the deployment of larger, modern wind turbines and rising mechanical issues that lead to unplanned downtime. This can prove costly to operators, with decreased energy production and component replacements seeing some making early exits with reductions in profitability.

As such, the rapid development and adoption of the digital supply chain continues to be a lifeline in addressing these issues. To some extent, the acceleration of digitalization has been similar to that of physical supply chain developments; as the wind industry faced new challenges, digital innovators and suppliers evolved to solve them. Demands for in-

creased output as well as enormous scaling of the industry including new challenges in offshore and floating offshore wind has meant that pressures on the need for technological advancements in software has also increased, including the development and deployment of advanced data and analytics in predictive maintenance (PdM) solutions.

Data Driven O&M

Predictive maintenance technologies aim to prevent unplanned downtime and reactive unscheduled maintenance by providing accurate data on asset health for owner/operators to make the best decisions for their fleet. These solutions provide overviews of turbine performance across the breadth of a windfarm, providing early indications of component faults before these become critical and result in turbine failure. By fueling data-driven decision making, advanced data sensing can optimize fleets and support effective asset management, ensuring efficiency in performance and production to boost profitability.

ONYX Insight's own research has found on average, a 100 MW wind farm can produce 200 false alerts per year, resulting in approximately $200,000 in technician labor costs, transport to turbines and lost revenue during downtime. However high-quality predictive maintenance using advanced analytics can reduce those false alerts by 93 percent.

But aside from the clear benefits operationally, they also give investor confidence. Accurate data can provide a much-needed boost to the industry by providing data for better decision making and long term strategic planning.

The introduction of PdM as a key component of windfarm O&M strategy is also contributing to the profitable life extension of turbines. This is particularly relevant in more mature wind markets, such as those in Europe, where ageing turbines are beginning to meet the end of their design lifespan at 20 to 30 years and require continued maintenance and management during life extension.

By retrofitting condition monitoring systems on older turbines wind farm operators can modernize and extend lifespans through the adoption of detailed analysis and affordable monitoring. Replacing individual components when efficiency starts to deteriorate avoids catastrophic failures and unplanned downtime as far as possible, thus increasing the return on infrastructure investment.

Increasingly operators are encountering a struggle with too much data, which is unfiltered and difficult to interpret. Multiple data streams across turbines can be difficult to link together and turn into action plans for engineers, meaning the most effective maintenance is not always prioritized. At the same time, there are differences in the taxonomy and functionality of different CMS tools which can lead to data integration challenges.

More recently, there is growing adoption of more 'holistic' approaches to PdM which combines sensor technology with drone inspections and periodic internal inspections to encompass the whole turbine, and not just individual components. This is driving even greater efficiencies and cost savings for operators. As wind farms continue to increase in size and move farther from shore and into deeper waters, O&M is more challenging whole turbine PdM enables a safer, more reliable view of assets, allowing for early detection of potential faults before they become serious and maintenance to be scheduled.

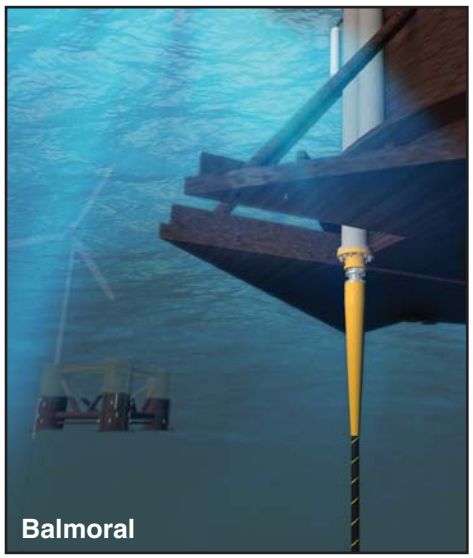
Supply Chain Collaboration

Moving forward, the need to obtain value from excessive data streams through integration, automation and simplification must be prioritized. Specialized solutions for individual components within wind turbines can provide a more complete health assessment overview though the focus must shift to packaging these solutions into coherent decision-making processes. As a result of aggressive project portfolio growth and increased turbine sizes the digital supply chain must streamline and standardize its outputs to allow operators to make data-driven decisions with ease.

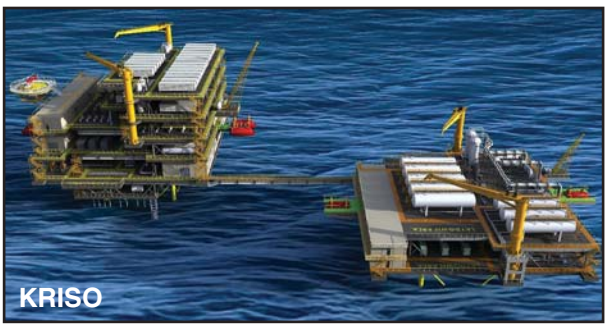
Collaboration is a key element to the continued development of predictive maintenance strategies which remain fit for purpose in the expanding wind industry. This has been observed already, with digital solution providers combining their technologies to be able to integrate that data and deliver value on a much larger scale to operators' efficiency. Increasingly, the future of windfarm operation and maintenance will be data-driven and crucially, encompass whole turbine fleets, monitoring all components with integrated systems from single providers.

The strengthening of the wind industry's digital supply chain will be of the utmost importance as looming global net-zero targets are approaching and owner/operators manage their reliability while keeping the cost of LCOE down. As operators seek to improve project efficiency while reducing cost and financial risk, the answer lies with the right predictive maintenance strategies.

For these technologies to be deployed effectively across the world's windfarms at pace, continued investment, data integration and system streamlining are essential to accelerate their effectiveness.



KENC



Balmoral Seamless Bend Stiffener Connector

Balmoral introduced a number of subsea solutions over the past few years, including Balmoral HexDefence and Balmoral FibreFlex, scour and cable protection systems respectively for the offshore wind sector. The latest product solution from Balmoral is a bend stiffener connector.

Bend restricting devices are usually attached at topside or seabed connection areas and are typically conically shaped polyurethane moldings with a cylindrical bore that fits over the asset.

In seamlessly integrating dynamic bend stiffeners with offshore structures, the Balmoral BSC features diverless installation and an elevated level of operational performance.

Diverless installation lies at the heart of this innovation while the design and manufacturing process adheres to API 17L standards. This commitment to operational efficiency is further highlighted by the incorporation of a reusable pull head which not only enhances installation timelines but also adds practicality to the overall process, the company claims.

The full system consists of a lead-in cone, BSC and dynamic bend stiffener. The BSC is drawn through a bellmouth located beneath a floating platform. As the BSC latching system engages with the bellmouth the anchoring mechanism comes into action. This latch secures the mechanism during descent and maintains system stability as the anchors find their place on the tapered neck of the bellmouth.

Methane Measurement Instrument

SLB's End-to-end Emissions Solutions (SEES) business debuted a new methane point instrument, a self-installed continuous methane monitoring system that uses IoT-enabled sensors to detect, locate and quantify emissions across oil and gas operations. It provides operators with leak detection sensitivity in a small, durable, 'plug-and-play' solution. The technology automates continuous methane monitoring; contains an integrated solar panel, wind measurement and methane sensor; is designed to be self-installed in minutes, mounted on existing infrastructure and deployed at virtually zero cost. The methane point instrument supports the reporting requirements of the Oil & Gas Methane Partnership 2.0, or OGMP, the flagship reporting and mitigation program of the United Nations Environment Program.

Flange Monopile Upending Tool

KENC announced the commencement of fabrication for build a flange monopile upending tool [FMUT] for Van Oord. Designed to face the challenges of varying sea conditions, the FMUT is designed to be versatile and its engineering enables efficient upending and lifting of monopiles - with a diameter between 7.5 – 8 meters - while effectively managing the challenging side leads. The FMUT's light yet strong design – with a weight of under 75 tons and the strength to lift an SWL of 1,600 tons - was achieved through a combination of various materials. The tool will be delivered in December.

Offshore Hydrogen/Ammonia Production Platform

An offshore hydrogen and ammonia production platform design from the Korea Research Institute of Ships & Ocean Engineering (KRISO) received approval in principle (AIP) from ABS. The design developed by KRISO produces green hydrogen using electricity generated by a wind


Forum Energy Technologies


Skansi Offshore


Roll Group & Hebetec Engineering AG

farm. Among the features, the design consists of a desalination system that desalinates seawater and turns it into clean water, an electrolysis system that produces hydrogen by electrolyzing water, a compression system that pressurizes the produced hydrogen, a nitrogen generation system that separates nitrogen from the air, and an ammonia synthesis system that produces ammonia by reaction of hydrogen.

New ROV Tooling Rental Offering

Forum Energy Technologies (FET) introduced a new tooling rental offering for remotely operated vehicles (ROVs) in response to the changing demands of the subsea sector. With increasing ROV asset investment across hydrocarbon and offshore renewable energy, as well as defense sectors, FET's new rental offering is designed to address the need for readily available tooling equipment in the development, operation, and maintenance of upcoming offshore projects.

Available immediately for rental are torque tools, linear actuator override tools (LAOTs), isolated hydraulic power units (IHPUs), and associated accessories.

The fleet of tooling will initially be manufactured and managed at FET's UK facility in Kirkbymoorside, North Yorkshire. FET, which already has an existing rental fleet in Brazil, will also expand the availability of equipment to Europe, Asia and elsewhere in the Americas.

FoWeLo: Offshore Wind Farm Load-out Solution

Roll Group & Hebetec Engineering AG announced a shared patented solution for offshore wind farm load-outs, developed to provide efficient and cost-effective solutions to logistical challenges of large and heavy offshore wind farm components.

The patented FoWeLo system was developed to solve two critical industry challenges: the high cost and port logistics constraints of launching floating offshore wind foundations. The system offers a robust design using existing hydraulic equipment and temporary steel structures. It is designed to be fully containerized, with no restrictions due to tidal effects, which simplifies mobilization and ensures low CO2 emissions by using seawater as a counterweight.

Battery & Hybrid Solution

Skansi Offshore, a Faroese shipping company, is increasing its commitment to sustainable marine operations. In relation to the 10-year classification of platform supply vessel Kongsborg, the shipping company has now installed a battery and hybrid solution on board, designed to reduce greenhouse gas emissions and fuel consumption. SEAM delivered, and was the system integrator of, its effective hybrid solution, the e-SEAMatic BLUE. The system, boasting 1800kVA/620kWh, was installed in a dedicated pre-built deckhouse, complete with necessary auxiliary systems – significantly reducing the installation time onboard the vessel. The objective of this integration was twofold: a significant reduction in fuel emissions, as well as minimizing maintenance costs by operating with fewer engines. Anticipated fuel and CO2 savings with their new hybrid solution.

- Anticipated savings during sailing are around 4-5%.
- For Dynamic Positioning (DP) operations, a reduction of 20-25% is expected.
- Moreover, the hybrid system will also support shore power, allowing the ship to perform energy-intensive operations without firing up the generator set.

BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	7	75	82	91%
Jackup	169	302	471	64%
Semisub	25	52	73	66%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	15	16	94%
Jackup	12	18	30	60%
Semisub		4	4	100%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	5	6	11	55%
Jackup	78	78	156	50%
Semisub	17	6	26	26%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship		7	7	100%
Jackup	14	30	44	68%
Semisub	3	20	23	87%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship		24	24	100%
Jackup	3	4	7	57%
Semisub	2	9	11	82%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	33	134	167	80%
Drillship		1	1	100%

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	23	24	96%
Jackup	20	32	52	62%
Semisub	2	2	4	50%

Oceania

Rig Type	Available	Contracted	Total	Utilization
Drillship				
Jackup		1	1	100%
Semisub		4	4	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	410.4	High-spec	143.8
Deepwater	325.0	Premium	140.1
Midwater	398.7	Standard	90.8

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 October 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	56	86	44	55	33	31
Ultra-deepwater	18	18	11	7	18	5
Grand Total	**90**	**124**	**69**	**75**	**73**	**43**

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	580	47,932	22,979
Shallow water	3,233	414,073	143,413
Ultra-deepwater	341	45,824	27,981
Grand Total	**4,154**	**507,830**	**194,378**

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	578	18,643	12,387
Asia	837	15,868	8,100
Europe	753	13,458	12,207
Latin America and the Caribbean	192	6,979	41,319
Middle East	135	80,521	150,874
North America	471	2,944	13,636
Oceania	89	11,753	1,176
Russia and the Caspian	60	17,509	13,330
Grand Total	**3,115**	**167,674**	**253,029**

Onstream and under development.

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

Source: Wood Mackenzie Lens Direct

IGP

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2022 U.S. Offshore Wind Outlook and Market Forecast

The monthly report and database contains all of the latest developments and information on the projects that will lead the U.S. to deploy 30 GW of offshore wind by 2030 and 110 GW by 2050. The report contains insights to support component manufacturers, shipyards, vessel owners and operators, service providers, ports and terminal operators, public agencies and financial institutions amongst others to better understand the opportunities and challenges presented by this growing segment.

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