OE OFFSHORE ENGINEER

THE FUTURE OF OFFSHORE ENERGY & TECHNOLOGY

MARCH/APRIL 2024 | OEDIGITAL.COM | VOL. 49, NO. 2

INTO THE DEEP

Oil & Gas in Deeper Waters

Subsea Mining
The Nodule Collectors are Lined Up & Ready to Go

SOV Market
Current & Future Demand Drivers

IMR Tech
Optimizing Cathodic Protection Survey Using Non-contact Sensors

ABS

THE LEADER IN **OFFSHORE WIND SUPPORT VESSELS**

Built on 160 years of maritime classification services and more than 75 years of offshore innovation, we are the proven partner for design review and advisory services for specialized wind vessels including WTIVs, SOVs, CTVs, HLVs, feeders, rock/scour, and cable laying vessels.

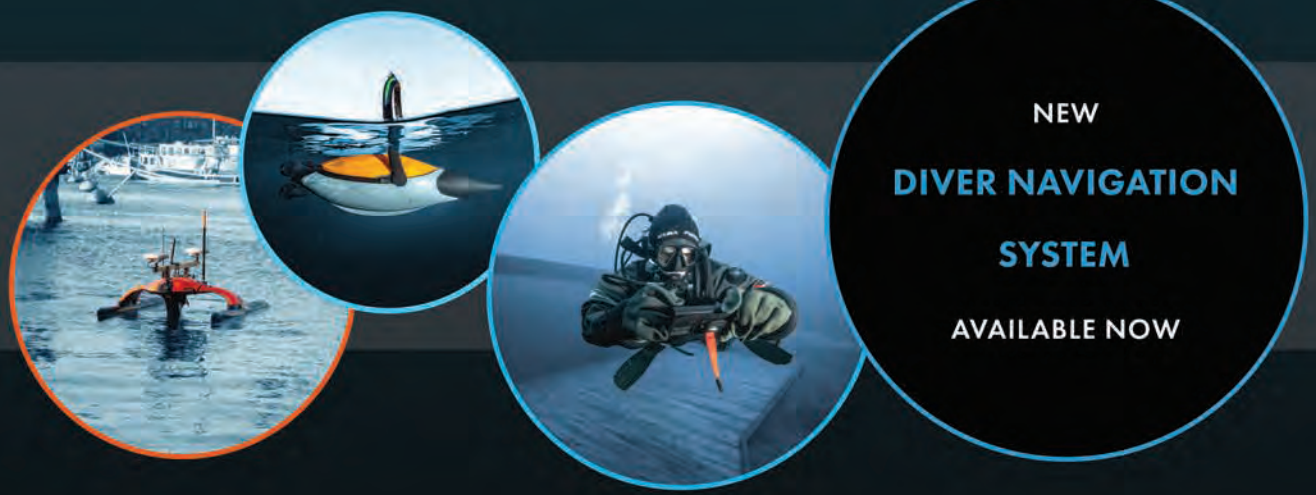
GOING TO IPF IN NEW ORLEANS?
VISIT THE **ABS BOOTH (1719)**

Explore more at
eagle.org/offshorewindvessels

Evo Logics

SMART SUBSEA SOLUTIONS

- Delivering data in most adverse conditions: underwater acoustic modems with advanced communication technology and networking
- Accurate USBL, LBL and hybrid positioning of underwater assets, navigation for divers
- Modem emulator and multiple cost-saving developer tools
- Sonobot 5 - the autonomous surface vehicle for bathymetry, monitoring, search & rescue, and AUV support
- Quadroin - the novel bionic AUV for surveys and monitoring



NEW

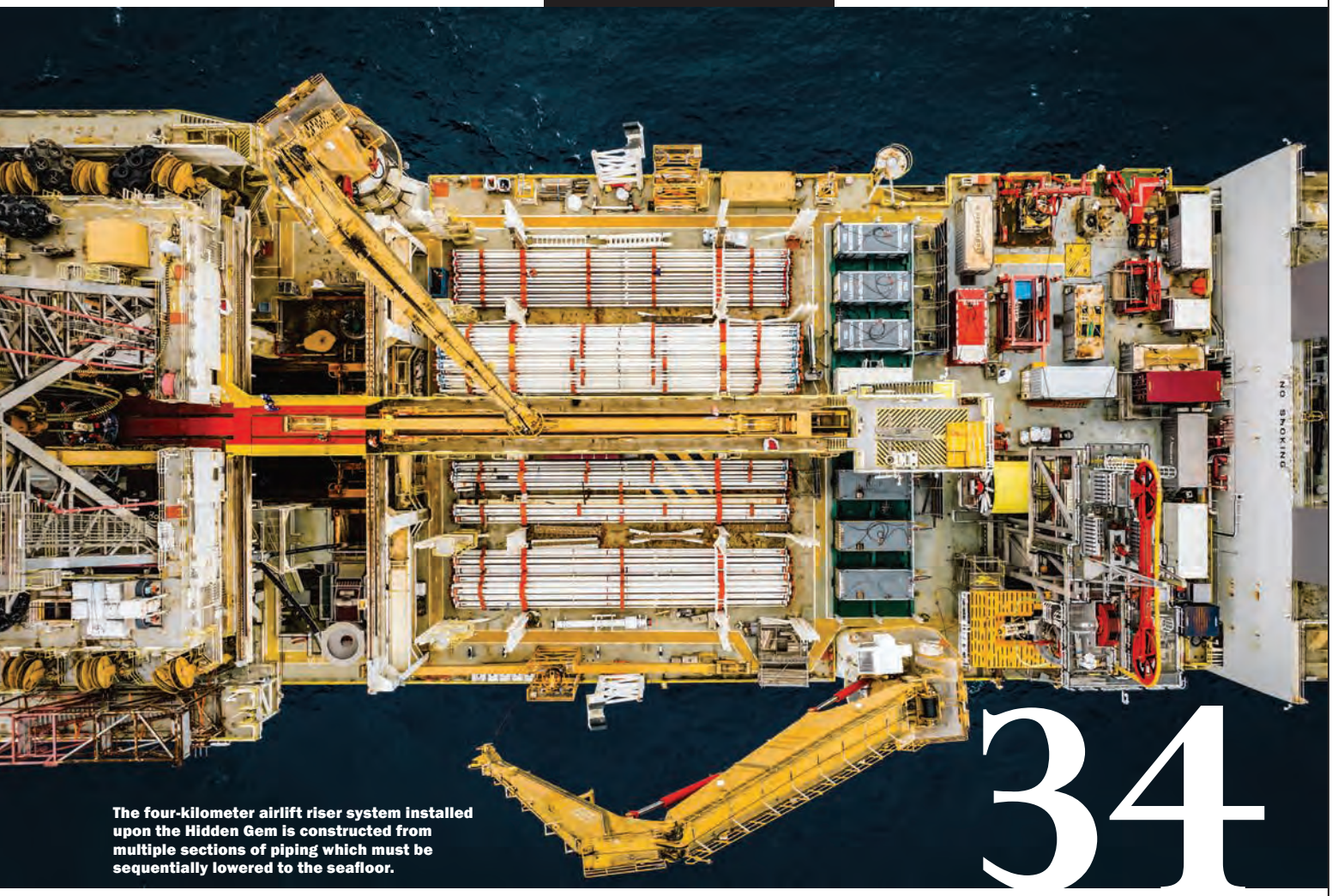
DIVER NAVIGATION SYSTEM

AVAILABLE NOW

sales@evologics.com
sales-us@evologics.com

EvoLogics.com

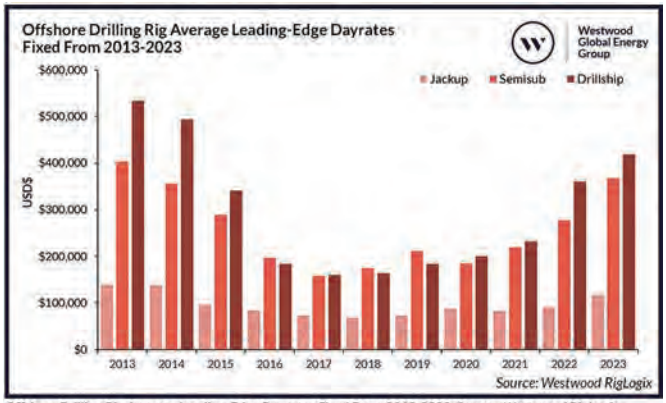
MARCH/APRIL 2024
WWW.OEDIGITAL.COM
VOL. 49 / NO. 2



The four-kilometer airlift riser system installed upon the Hidden Gem is constructed from multiple sections of piping which must be sequentially lowered to the seafloor.

34

Photo this page courtesy TMS; Cover photo courtesy ENI



Offshore Drilling Rig Average Leading-Edge Dayrates Fixed From 2013-2023. Source: Westwood RigLogix.

10

© Björn Wylezich/AdobeStock

© TechnipFMC

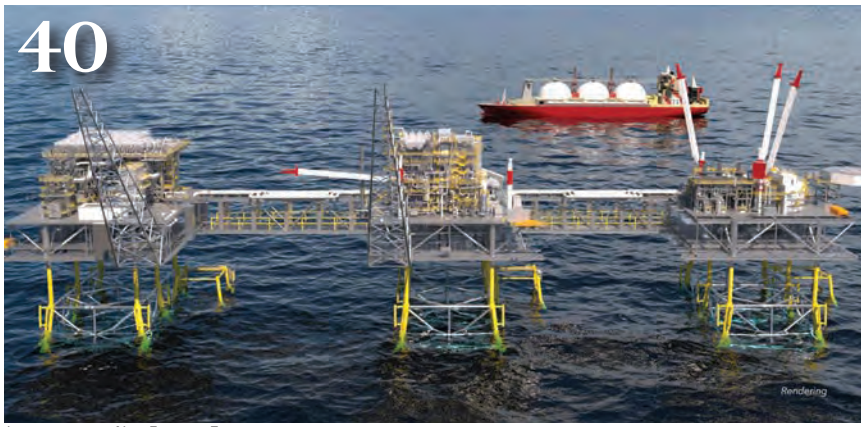


Image courtesy New Fortress Energy

Geopolitical tensions are at a fever pitch, with Russia's war in the Ukraine, fighting in the Middle East that seems primed to boil over across the region, and the deepening rift between the East and the West that is re-writing decades-long economic partnerships and trading routes. But in reality, it is business as usual, as a read on human history suggests global power struggles are the norm, not the exception. At the center of it all is energy: who produces, transports and consumes it – reliable, bountiful energy is the grease that keeps the global economy chugging along. Anyone with any tenure in the energy business is well-accustomed to the peaks and valleys that define it. Oil and gas today has risen again to the top, and despite the political push for 'clean and green', the fact remains that O&G is the reliable and bountiful energy source for decades to come, and in the offshore business that means a dive into deeper waters.

Barry Parker examines the trend, citing a recent Rystad Energy note that upstream oil majors are diving into deeper waters. "Despite tightened budgets, frontier drilling is fueling optimism for a productive year, particularly deepwater projects in the Atlantic Margin, Eastern Mediterranean and Asia." Rystad analysts predict approximately 50 more deepwater and ultra-deepwater exploratory wells this year compared to 2023, and in this edition Parker reports on the companies, the vessels and the technologies that are poised to get it done.

That said, the push to lower emissions is real, it's here and it's going to get ever more restrictive. We follow closely the early movers in the sector that are making strides toward emissions reduction and energy efficiency, and in this edition, Wendy Laursen takes a deep dive into energy storage on oil and gas platforms, technologies that not only help save fuel, but offer a wide palette of safety benefits to an industry obsessed with safety.

On the green side too is the offshore wind industry, a sector initially welcomed with disdain and distance by traditional O&G players, now gaining acceptance as the potential synergies and business opportunities present themselves. While offshore wind has boomed globally, most dramatically for a generation in Europe and more recently in China, it has stumbled in the U.S., encountering a number of starts and stops during its adolescence. Though down, it is far from out, and in fact during our recent meet with him in Houston, Robert Langford, ABS' VP of Global Offshore Wind, paints a bullish picture long term for offshore wind in the U.S., including the eventual advent of floating wind.

Check out the 2024 Media Kit via the QR Code Below

Gregory R. Trauthwein
Editor & Publisher
trauthwein@offshore-engineer.com
m: +1-516.810.7405

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. 49 *No. 2*
ISSN 0305-876x *USPS# 017-058*

118 East 25th Street,
New York, NY 10010
tel: (212) 477-6700; fax: (212) 254-6271
www.OEDigital.com

EDITORIAL
GREGORY R. TRAUTHWEIN
Editor & Publisher

AMIR GARANOVIC
Managing Editor
garanovic@offshore-engineer.com

BARRY PARKER, New York
WENDY LAURSEN, Australia

PRODUCTION / GRAPHIC DESIGN
NICOLE VENTIMIGLIA
nicole@marinelink.com

SALES
TERRY BREESE, VP Sales
+1 (561) 732-1185 | breese@marinelink.com

JOHN CAGNI
cagni@marinelink.com | +1 631-472-2715

FRANK COVELLA
covella@marinelink.com | +1 561-732-1659

TRICIA GARRETT
garrett@marinelink.com | Tel: +1 516-441-7254

MIKE KOZLOWSKI
kozlowski@marinelink.com | +1 561-733-2477

GARY LEWIS, Panama
(516) 441-7258 | lewis@offshore-engineer.com

CORPORATE STAFF
CEO
JOHN O'MALLEY
jomalley@marinelink.com

President & COO
GREGORY R. TRAUTHWEIN
trauthwein@offshore-engineer.com

IT Director
VLADIMIR BIBIK

Public Relations
MARK O'MALLEY
momalley@marinelink.com

Accounting
ESTHER ROTHENBERGER
rothenberger@marinelink.com

Circulation
KATHLEEN HICKEY
k.hickey@marinelink.com

SUBSCRIPTION
To subscribe please visit:
www.OEDigital.com

Email: oecirc@offshore-engineer.com
Web: www.OEDigital.com
t: (212) 477-6700

MARCH/APRIL 2024
WWW.OEDIGITAL.COM
VOL. 49 / NO. 2

OE WRITERS


Blaquiere


Grotsky


Laursen


Lewis


Parker

Andrew Blaquiere is a mechanical engineer by trade and brings extensive knowledge on risers, moorings and flex-lay operations from a detailed engineering and project management perspective. In 2020 he relocated from MDL US office in Houston, TX to Aberdeen, UK to take on the role of Managing Director.

Vice President of Engineering, **Steve Grotsky**, leads ABS Group's Global Engineering team across multiple sectors, including marine and offshore. The team specializes in complex CAPEX and OPEX engineering projects that support the risk management needs of its clients serving the global critical infrastructure.

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.

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.

Barry Parker of bdp1 Consulting Ltd provides strategic and tactical support, including analytics and communications, to businesses across the maritime spectrum. He is a freelance writer and regular contributor to this magazine.

With more than 15 years' experience in the energy industry, both on and offshore, **Carl Pilmer** is responsible for driving the development, sales and promotion of JDR's energy products and services.

Jesper Skjong is a market analyst at shipbrokerage Fearnley Offshore Supply covering the offshore support vessel market, including O&G and offshore renewables.

Fernando Tamayo currently leads the Emissions team at Welligence Energy Analytics, based in Houston. He has extensive knowledge in the upstream oil and gas sector, with a focus on emissions and decarbonization. He was responsible for the design and implementation of the Welligence Greenhouse Gas (GHG) offering.

Svenn Magen Wigen is a Cathodic Protection and corrosion control expert having worked across engineering, design, modelling, project management, inspection, sales, marketing and management in the sector since 2001.

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).


Pilmer


Skjong


Tamayo


Wigen


Wilkie

As Demand for Energy Goes Up, Regal Rexnord Marine Solutions Team Here To Help

© enanuchit/AdobeStock

Richard Mayberry started his career as an engineer for Wichita™ Clutch in Wichita Falls, Texas, creating custom heavy-duty brake solutions. Over the course of his career, he personally oversaw the creation of many new technologies and services, such as the air-cooled AquaMaKKs SSB brakes to robust in-house testing and field service programs.

Today, however, Mayberry thinks about a lot more than just brakes.

He is now a Senior Engineer for the Regal Rexnord® Marine Industrial Powertrain Solutions Team -- a group of industry leaders designing strategic systems to meet the toughest above- and below-deck marine challenges.

Every day, Mayberry is thinking about how to best blend together couplings, shafts, gearboxes, bearings, clutches, brakes, and IIoT from across Regal Rexnord's 60-plus brands.

"With the tremendous horizon of products we have, there's a lot of history and legacy here," Mayberry said. "From the Twiflex™ TLB [Turning, Locking, Braking System] to Svendborg Brakes™ ... Jaure™ and CENTA™ couplings ... We have so much to choose from. And now we can truly be a one-package solution for a marine customer."

Headquartered in Milwaukee, Wisc. with more than 36,000 associates worldwide, Regal Rexnord is a global leader in the design and engineering of custom Powertrain Solutions for mission-critical marine vessels that support pipelay and cables, construction and dive support, floating production, and more.

As global demand for oil increases, offshore OEMs working in renewable wind, oil, LNG, shale and other markets can harness the simplicity, reliability, and innovation of ONE Regal Rexnord.

Below deck challenge? Regal Rexnord takes 'full responsibility for the complete driveshaft'

Decades of engineering and innovation excellence enables Mayberry to partner with his colleagues across the globe to provide the most reliable and strategic solutions possible for customers.

For example, Falk is already incorporating Wichita

Clutch into its popular Marine Reduction Gear system.

"Falk MRH series Marine Reduction Gears have incorporated Wichita Clutch clutches and brakes and CENTA elastomeric couplings as default system components with exemplary performance," Falk's Don Willis said.

Regal Rexnord is a leading supplier of torsional stiff and flexible couplings, which are combined with steel or carbon fiber shafting to meet the specific needs of a vessel. When creating a total drive package for the user, Jaure and CENTA engineers work together with colleagues to integrate the most appropriate braking systems, bearings, and bulkhead seals into couplings packages.

"Our engineers design customized solutions to reduce complexity of intermediate shafting in between the main engine and gearbox," Jaure's Ana Arrizabalaga said. "As a company, we take full responsibility for the complete driveshaft."

Whether they are sold as single components or part of a larger drivetrain package, Regal Rexnord components are highly customizable. Heavy duty brakes used in draw works, for example, are custom designed down to the size, padding, materials, and more.

"We do the entire system," Svendborg Brakes applications engineer Tyler Calvert said. "We design the controls and the hydraulics in house. We do the design in-house. Most other brands will outsource that ... If you go to a hydraulic supplier down the road, they're going to make some design choices that don't make sense for a brake system."

Whether it's a high-torque propulsion drive or a low-speed propellor shaft, selecting the right coupling is paramount to a below-deck application's success. In an effort to protect the rest of the drivetrain, CENTA offers in-house Torsional Vibration Analysis (TVA) during the design process.

Through TVA, engineers can help choose the best solution for the end user, CENTA's Bob Lennon said.

"By specifying a Stromag™ 2-in-1 engine flywheel clutch/coupling, CENTA torsional couplings, or CENTA/Jaure intermediate drive shaft solutions, we can ensure marine drives are built to withstand torsional vibration," Lennon said. "Understanding the properties of each component, along with the operating conditions of the system, allows us to design a trouble-free operation ... be it a traditional, alternative fuel, or hybrid system."

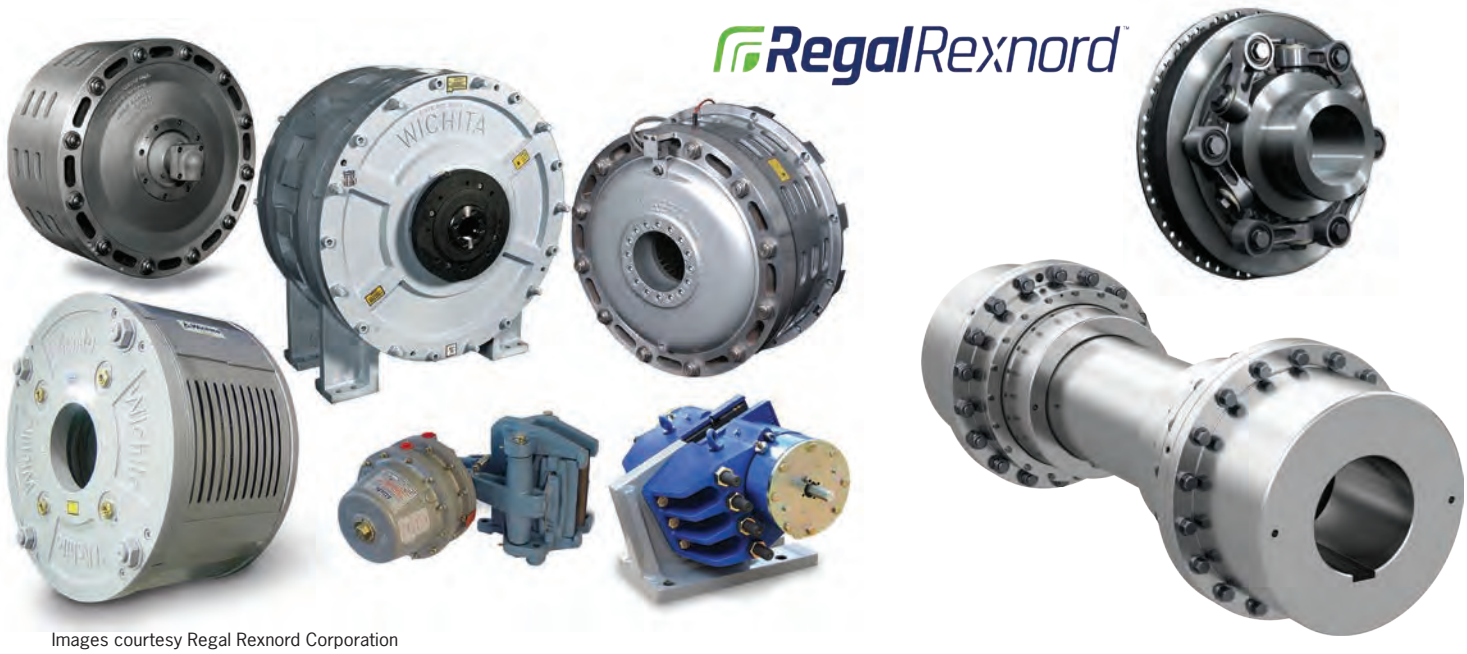
Dynamic braking for cranes? Winch challenges? We've got your above-deck needs covered

Regal Rexnord has a full program of both torsional stiff and flexible couplings that go inside the azimuth thrusters that support the dynamic positioning of crane vessels, which are used in offshore heavy lifting.

Sometimes, the best option is to think outside the box.

A worldwide offshore heavy lifting OEM recently worked with Regal Rexnord on an end-to-end shafting solution for a crane vessel. After learning more about the unique needs of the customer, engineers designed a 3-in-1 combination of a CENTAX torsional flexible coupling, a Jaure MT gear coupling, and a Jaure JCFS carbon fiber shaft.

This solution had dynamic positioning ensured by eight underwater mountable thrusters, four of which were retractable. The OEM connected the retractable shaft to an electric motor.

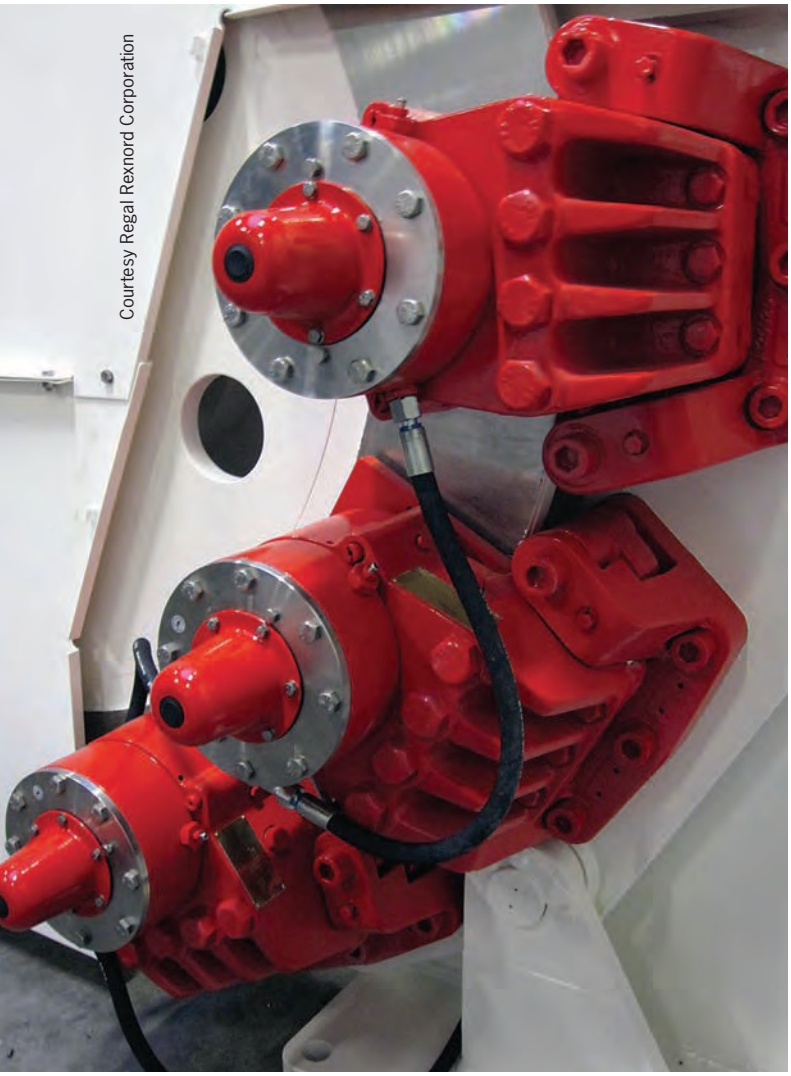


Images courtesy Regal Rexnord Corporation

At Regal Rexnord, "engineer-to-engineer collaboration" aren't just buzzwords.

Winching systems, which are designed to withstand high winds and water pressure in offshore conditions, are a frequent source of engineer collaboration. In 2018, a winch OEM in the Netherlands working on building ship-to-ship towing winches tapped Twiflex to design caliper brakes.

Twiflex engineers devised a unique "parked-off" system (a maintenance condition under which no hydraulic pressure is present in the brake, and the spring pack is fully relaxed; the unit may be set, adjusted and maintained with no stored energy present). The operation repeats itself (in bad weather) several times until the ship is alongside.



Courtesy Regal Rexnord Corporation

Twiflex Limited winches marine VKSD-FL spring applied brake vessel mooring winches.

Regal Rexnord creates solutions for various above-deck needs, including winches for anchors, davits, fishing, gangways, mooring, towing & positioning, abandonment, and recovery.

Designing the most strategic drivetrain is particularly important for winches, as vessels are often working to install offshore wind turbines – a growing source of renewable energy.

As the offshore skills gap grows, tap into Regal Rexnord engineering expertise

With a growing skills gap in the industry, leaning on a Regal Rexnord engineer to service components or even troubleshoot operational issues in the field is a huge advantage.

CENTA was an early leader of Torsional Vibration Analysis. When done properly, TVA will study the complete marine propulsion system, predicting stress levels and heat loads across all connected equipment – not just couplings. CENTA offers TVA on new designs using Regal Rexnord products and existing systems in the field.

Those investing in heavy-duty brakes may take interest in Regal Rexnord's growing portfolio of IIoT/predictive maintenance capabilities from Perceptiv™. These investments can give vessel architects and shipyard owners alike peace of mind that components and drive systems are fully operational in the field.

Data collected from Svendborg Brakes' Soft Braking System (SOBO), for example, recently predicted the necessary replacement of fading brake valves in a draw works on an Italian drill ship. Utilizing an in-house Universal Control Case (UCCase), Svendborg engineers were able to remotely monitor braking torque and pressure curves without having to be on site for service.

"Engineers are always just a phone call away," Mayberry said. "We know and understand these applications. We've been in this business for a while."

The benefit of working with a strategic partner like Regal Rexnord doesn't stop at point of sale. From self-serve tools and condition monitoring upgrades to on-site testing and repair and rebuild programs, Regal Rexnord goes the extra mile – knot – for your offshore vessel.

Jump start your next marine project today by connecting with a Regal Rexnord engineering expert.

As Dayrates Continue to Rise, Could We See More Energy Companies Buying Offshore Rigs?

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

The price to rent an offshore rig hit a nine-year high last year with jackups, semisubmersibles and drillships costing on average $118,000, $368,000 and $419,000, respectively (as of 31 December 2023). These figures represent an overall 54% increase in dayrates when compared with 2021. This swift rate of cost inflation – sparked by higher global rig demand, rising utilisation and tightening availability – has more recently become a factor in the slowdown in contracting activity as operators take stock of their current rig provisions and look at ways to keep future projects economical, as well as being extra careful to make the right rig selection, especially for long-term campaigns.

One potential solution, as demonstrated by a recently struck deal between TotalEnergies and Vantage Drilling, is to acquire a majority stake in a rig. Specifically, ultra-deepwater 7th generation drillship Tungsten Explorer, for which the operator is to purchase a 75% stake through creation of a new joint venture (JV) with the drilling contractor that will retain the remaining 25% interest in the 2013-built rig. As part of the deal, TotalEnergies will pay $199 million and Vantage will continue to manage the rig for 10 years.

TotalEnergies Chairman and CEO, Patrick Pouyanne, stated that the deal was done to help control costs as rig dayrates continue upwards. The operator also commented that the effective dayrate for the rig will be "much lower than $400,000", which is around the current average price per day for a rig of this calibre. Pouyanne also stated that the JV will provide "value and flexibility" and hinted that more such deals are to be expected from the company in the future.

Back in June last year, the operator issued a tender in search of two ultra-deepwater drillships for up to 10 years apiece, with one rig to be solely placed offshore Angola while the other unit would move between various countries including Angola, Mozambique, Namibia and Suriname covering exploration and development activities. In late 2023, the same operator tendered again for up to three more rigs (two floaters and one jackup) to work under long-term deals offshore Suriname.

With the first deal awarded, rumors are rife that a similar ownership agreement could be struck for another of the company's long-term requirements.

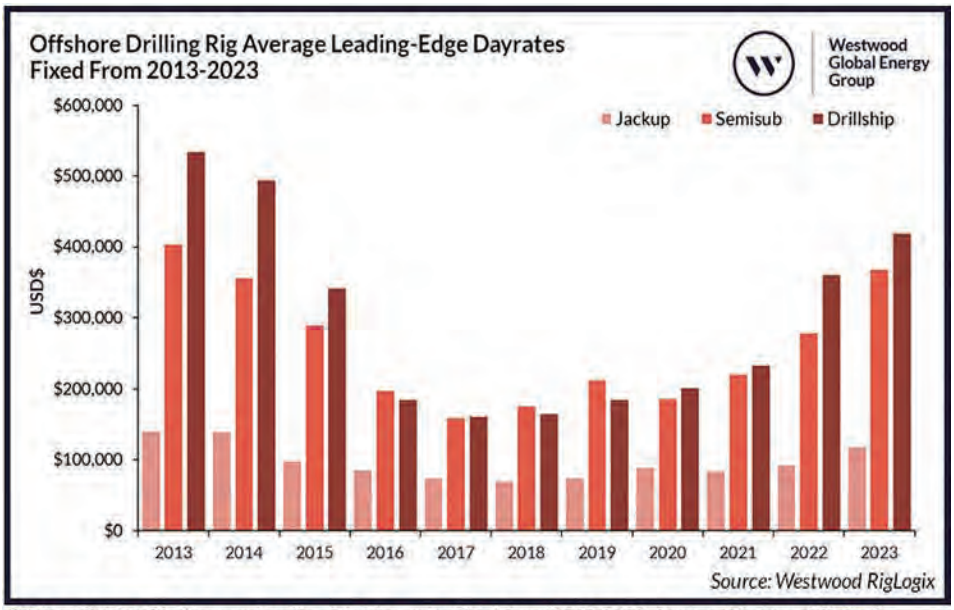
Previous Agreements with Mixed Success

While the deal is certainly one of a kind, this is not the first time an operator has opted to buy or at least acquire a partial stake in an offshore rig in a bid to control costs and availability. In fact, joint drilling contractor and oil company rig ownership dates back to the 1970s, but oil companies eventually decided they did not want to be in the rig owning business and most partnerships were dissolved.

Some of the more recent examples include Brazilian National Oil Company (NOC) Petrobras and Mitsui JV – P&M Drilling International, which owns the ultra-deepwater drillship Petrobras 10000. Transocean manages the rig, which has been working for Petrobras since its delivery in 2009, and it has an agreement in place with P&M to acquire the rig under a 20-year capital lease contract.

In addition to Petrobras, there are other NOCs that have owned fleets at their disposal. ONGC is a good example, as it currently owns and operates six jackups and two drillships in addition to the 34 rigs it rents from other rig owners.

Meanwhile, Shell and Noble jointly designed ultra-deepwater drillships Noble Bully 1 and 2, which were both delivered in 2011 at a cost of $600 million apiece but only worked for the operator for five and seven years respectively, before the pair were retired in 2020 and 2021 due to limited success with the ship's design. The Bully rig de-



Offshore Drilling Rig Average Leading-Edge Dayrates Fixed From 2013-2023. Source: Westwood RigLogix.

sign featured a compact box-type drilling tower, known as a multi-purpose tower, instead of a conventional derrick.

In addition, two Cat-J jackups Askepott and Askeladden are owned by the Norwegian Oseberg and Gullfaks licence holders (both licences are operated by Equinor). The two rigs, managed by KCA Deutag, are being used for exploration and development drilling within the offshore licences and were specifically designed to suit Equinor's requirements at the fields. The pair were delivered in 2017 and 2018, respectively.

Another E&P company that bent on ensuring its rig supply is U.S.-based Arena Energy. Arena has set up multiple affiliates to manage various activities, including a group of companies that operate under the White Fleet umbrella, one of which is White Fleet Drilling (WFD). WFD was created in 2017 and was established to secure jackup services in the wake of the shrinking local rig supply, as well as fewer contractors. The company currently owns three jackups – WFD 250, WFD 350, and WFD 400. When operating, the rigs are managed by Enterprise Offshore Drilling. A fourth unit, WFD 300, was retired upon purchase of WFD 400 in 2022. All of these jackups were previously owned by other rig contractors. While these units are primarily for use by Arena Offshore, they have, from time to time, been leased to other U.S.-Gulf operators. As of March 2024, two of the five jackups working in the U.S. Gulf are WFD rigs working for Arena Energy affiliate Arena Offshore.

Who Else Could Look to Buy?

It may not be the first time we have witnessed an operator buying a stake in a rig, but it certainly is the first time in almost a decade, which is a sign of the times in the ongoing rig market recovery. But will we see more operators jump on the bandwagon?

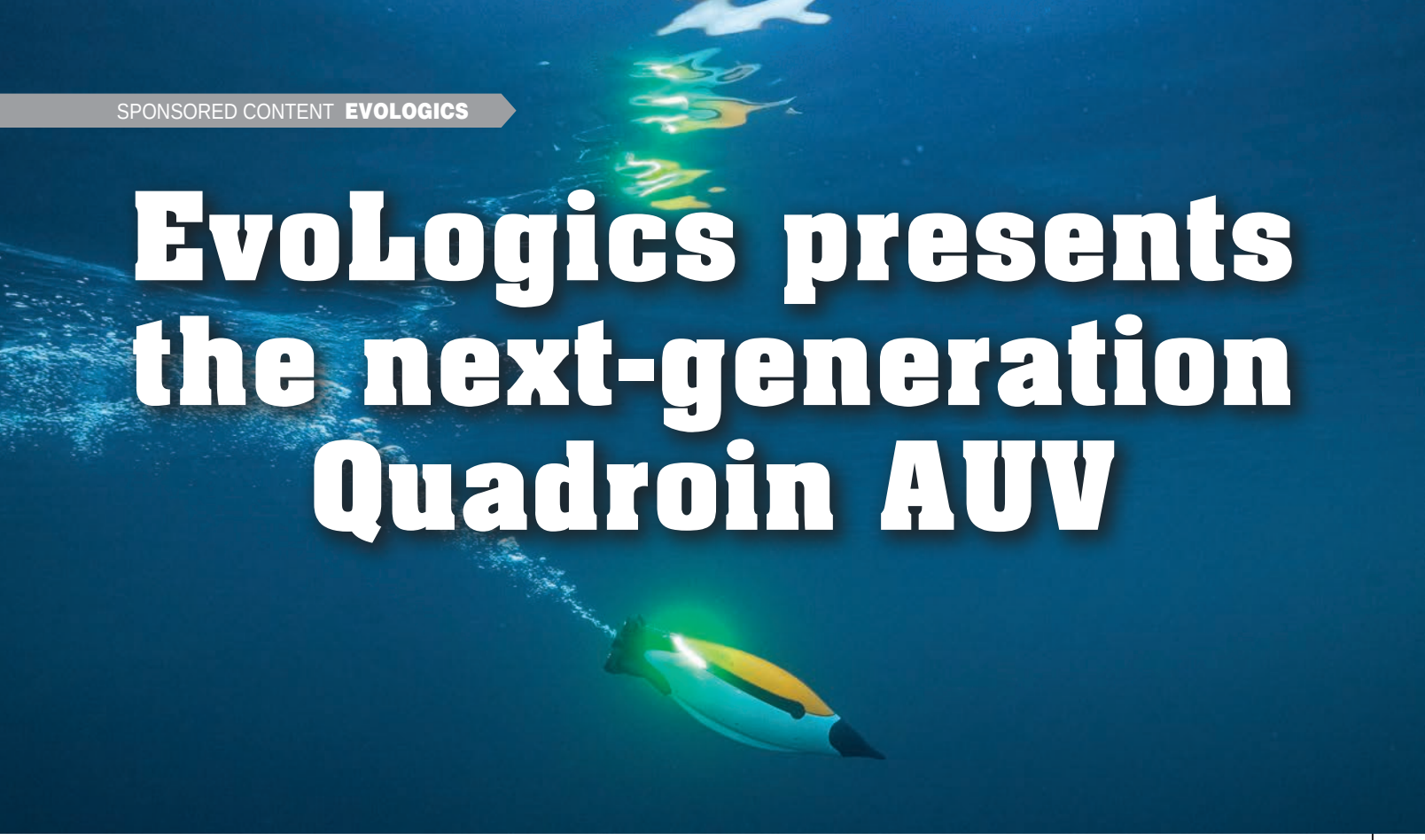
It is unlikely, as was the case in the previous market upcycle, that this will become a common trend. However, for those operators with the need to secure long-term capacity of over 10 years it could be a solution to help control project economics.

As it currently stands, outside of TotalEnergies' second drillship requirement, there are no other known outstanding 10-year (or longer) duration tenders in the market. However, a few supermajors as well as NOCs have several three-to-five-year requirements for jackups and floating rigs currently at a pre-tender, tender or direct negotiation stage, though this is likely not long enough to warrant taking a stake in a rig.

In addition, a drilling contractor must be interested in taking part in such a deal, so what is in it for them? Vantage Drilling CEO Ihab Toma commented that "the proceeds from the sale of the Tungsten Explorer will completely deleverage our balance sheet while putting in place a meaningful, long-term revenue stream leveraging our strong management expertise."

Not only did Vantage secure almost $200 million in cash, it also locked in a substantial flow of long-term revenue for the company, which is also rumoured to be gearing up for a potential sale. Meanwhile, TotalEnergies will benefit from the drilling contractor's ongoing management expertise.

To conclude, it is unsurprising in this current market upcycle that some operators are considering 'out-of-the-box' ways to keep rig costs down and secure the right assets for future projects. While unlikely to become a common trend, and depending on how the market performs over the next few years, we may see a few others follow in TotalEnergies' footsteps.



EvoLogics presents the next-generation Quadroin AUV

EvoLogics, a Berlin-based provider of high-tech underwater robotics, data networks, positioning, and sensor technologies, proudly announces the launch of the next iteration of the **Quadroin AUV**.

Originally introduced in May 2021, the Quadroin vehicle garnered attention for its distinctive, penguin-like design. Engineered for monitoring and surveying, the fast and maneuverable Quadroin leverages EvoLogics' expertise in low-drag bionic design. Dr. Rudolf Bannasch, EvoLogics founder, delved into years of research on penguin locomotion, resulting in the AUV's remarkable hydrodynamic properties. With its low-drag shape, the Quadroin achieves speeds of up to 10 knots, minimizing energy consumption and enabling versatile deployments.

The initial series of Quadroin prototypes, developed in collaboration with Hereon for the Helmholtz Association's MOSES initiative, focuses on monitoring ocean eddies. These vehicles are equipped with sensors for collecting geo-referenced data on various physical water parameters, including temperature, pressure, oxygen, conductivity, and fluorescence, at different depth levels.

Building upon this foundation, EvoLogics has undertaken significant enhancements to the Quadroin platform, with a primary focus on expanding its instrument payload capacity and underwater A.I. computations. This evolution led to a comprehensive redesign of the vehicle's internal layout, integration of updated components, and optimization of sensor systems to accommodate a broader range of instruments while maintaining operational efficiency.

The new generation Quadroin now carries an expanded instrument payload. The side-scan sonar enables acoustic seafloor imaging. Additionally, two full-HD underwater cameras—one forward-facing at a 45-degree angle and one downward-facing—equipped with dimmable LED lights, provide a visual identification of the vehicle's surroundings.

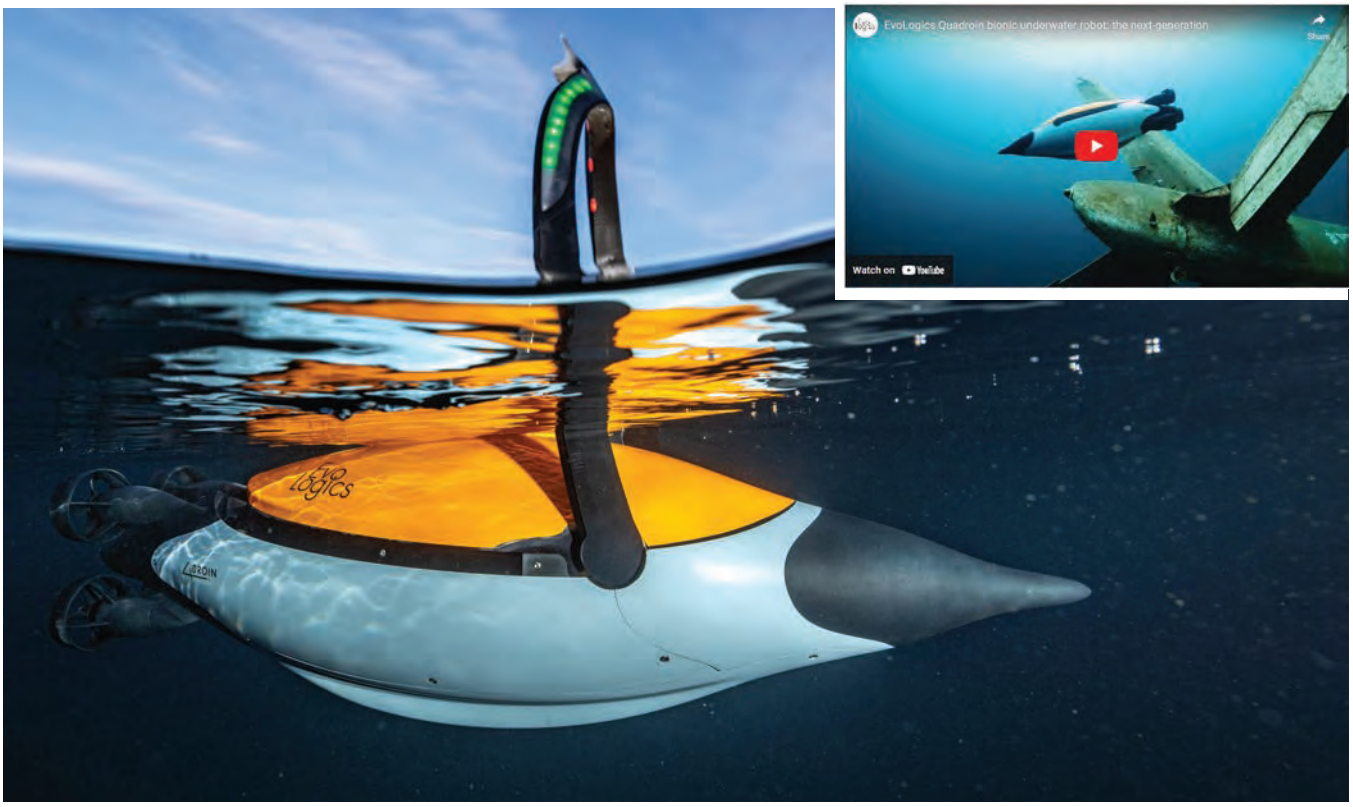
The newly integrated EvoLogics AI-powered object recognition module allows detecting objects in the side-scan sonar and video feeds live during the mission with processing carried out onboard the vehicle. It is also to enable automatic collision avoidance through a front-looking sonar system.

The hardware and propulsion systems were redesigned with next-generation components for optimal performance. The Quadroin now features a Nortek Nucleus1000 integrated subsea navigation package that couples Nortek's DVL technology with additional position-aiding sensors for reliable vehicle control.

Today, team EvoLogics is happy to reveal a new video of the Quadroin vehicles in action, shot in late 2023 at the Kreidesee Lake in Hemmoor, DE.

EvoLogics will be presenting the upgraded Quadroin at Oceanology International 2024 through live on-site demonstrations.

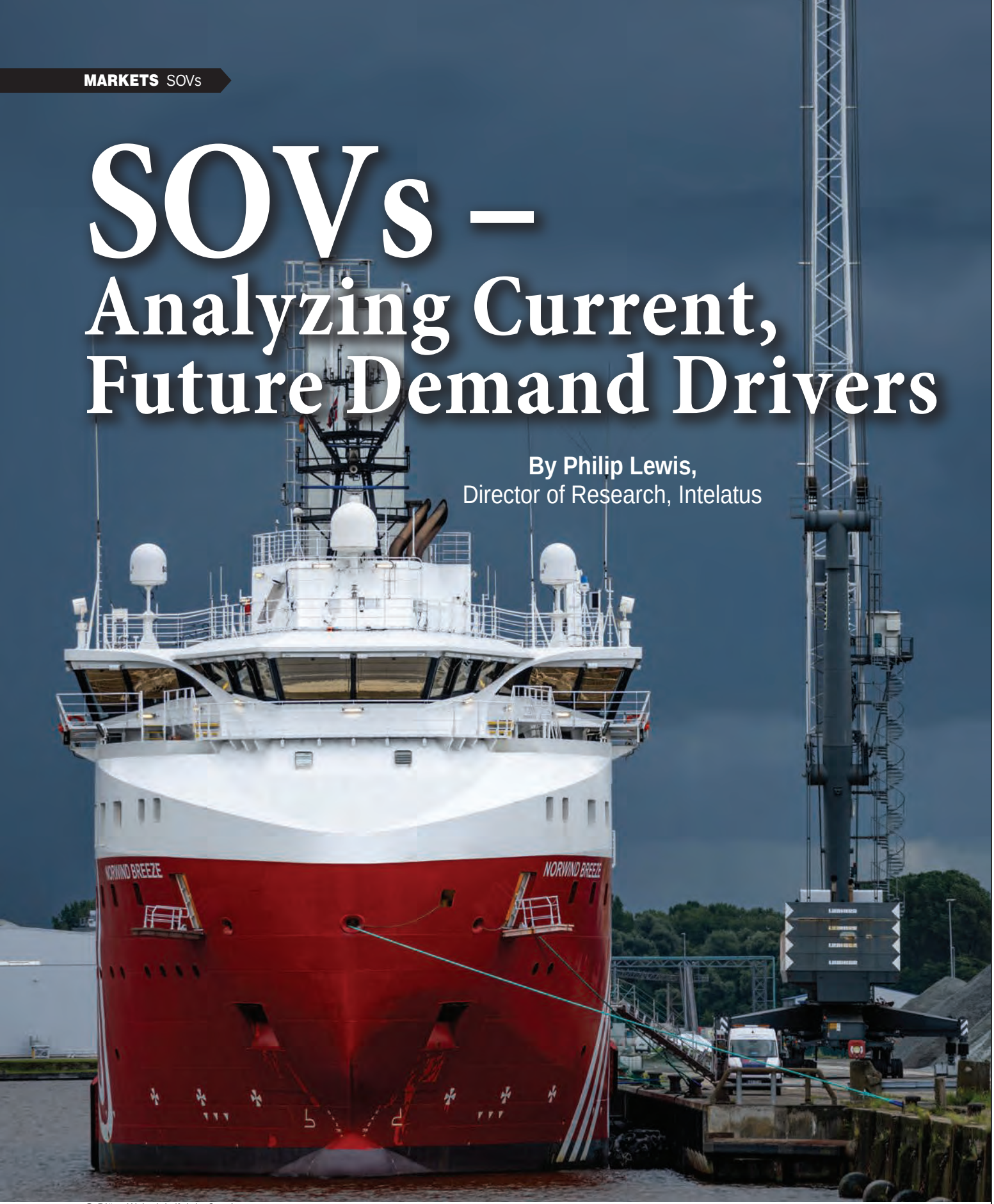
Watch the EvoLogics Quadroin AUV video on YouTube:
https://www.youtube.com/watch?v=nbwXrKI1X7k



All images by Submaris and EvoLogics

SOVs – Analyzing Current, Future Demand Drivers

By Philip Lewis,
Director of Research, Intelatus



At a high-level, there are three solutions to transferring technicians from shore bases to offshore wind farms for construction and O&M activities: crew transfer vessel (CTV), helicopter, and SOVs/CSOVs.

SOVs and CSOVs generally house 60-120 technicians offshore for a few weeks at a time, allowing them to transfer to structures on integrated heave compensated gangways, by daughter craft or on CTVs. The vessels are also equipped with cranes, storage, and small workshop areas.

SOV: Service operations vessels, generally on long-term charter to a wind turbine OEM or offshore wind farm operator to service and maintain equipment during the operations period of the wind farm. A typical SOV will accommodate ~60 technicians. A typical SOV is diesel electric and increasingly includes dual fuel flexibility and battery energy storage systems.

CSOV: Commissioning service operations vessel, generally on short-to-mid-term charters for project construction, turbine installation and commissioning, and initial service warranty periods. A typical CSOV will accommodate ~120 technicians. A typical CSOV is a battery hybrid diesel electric, ready for dual fuel operations.

Lower day rate CTVs are often used for daily transfer of 12-24 and increasingly 30+ technicians on a daily basis and have an advantage when windfarms are close to shore. There is a trend for CTVs to be built with crew accommodation, allowing the vessels to stay offshore overnight, and to serve accommodation and construction vessels (including CSOVs) for extended periods.

In some applications, helicopters are cost competitive, although their use is relatively limited.

- **Tier 1:** purpose-built vessels for offshore wind with in-built crane and gangway.
- **Tier 2:** Generally, oil & gas tonnage (MPSVs, PSVs, etc.) with fixed gangway, serving oil & gas and offshore wind markets.
- **Tier 3:** Generally, oil & gas tonnage (MPSVs, PSVs, etc.) with temporary gangway, serving oil & gas and offshore wind markets.

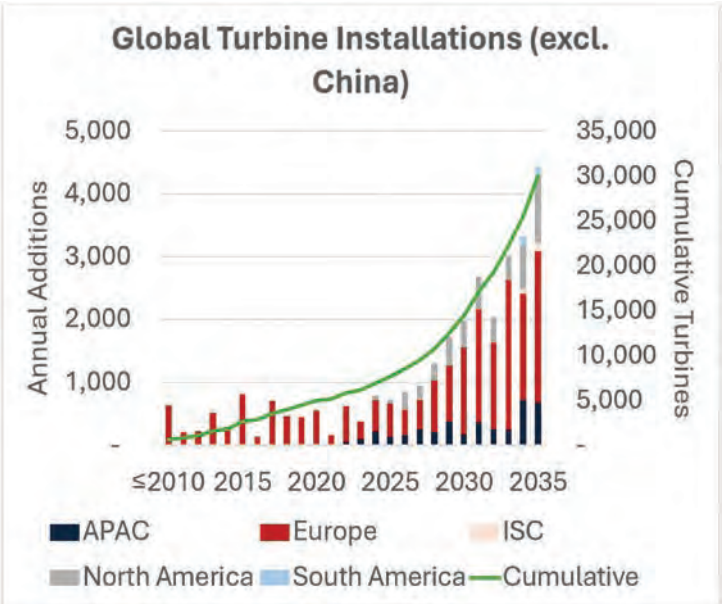
Market Drivers

When we look to understanding SOV/CSOV demand, we look at the number of turbines installed and planned. Given that three international OEMs (Siemens, Vestas and GE) currently dominate the global offshore wind space outside of China, we do not look at demand for SOVs/CSOVs as having a linear relationship to the number of wind farms or turbines installed. We look to see where a large number of wind turbines are concentrated in relatively close proximity, generally in a very large wind farm or in a project cluster featuring two or more wind farms, which will give the economies of scale required to justify a SOV/CSOV. We should note that some Chinese OEMs are targeting international market expansion, which may result in the demand base becoming more fragmented.

As the developer space already is more fragmented, we look to the developers of large wind farms and/or developers of geographically close project clusters. Developers in this space include Ørsted, RWE, Equinor, SSE, and others.

Outside of China, the global installed and operational turbine base amounted to approximately 6,200 turbines at the end of 2023. The Tier 1 SOV/CSOV fleet stood at 32 vessels, 31 one of which being active in Europe. ~530 active CTVs served operating and under construction wind farms in Europe, APAC, and the USA.

Approximately 8,300 turbines are forecast to be installed globally (excluding China) between 2024 and 2030 and close to 15,500 in 2031-2035, as global offshore wind capacity (excluding China) grows to around 380 GW of capacity at the end of the forecast period. The high-level conclusion that one can make is that more turbines will drive the demand for more Tier 1 SOVs and CSOVs.



Source: Intelatus Global Partners

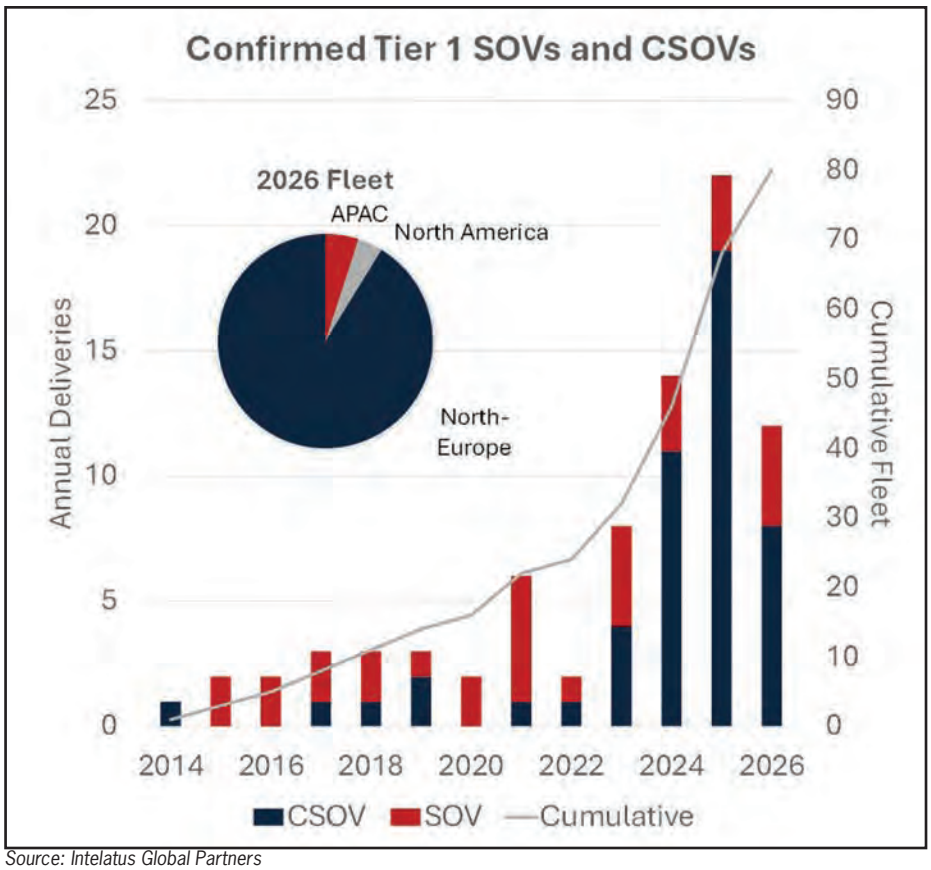
Till now demand for Tier 1 vessels in the maturing European offshore wind segment has been driven by scale, more wind turbines, wind farms being built further offshore, clustering of developer projects (i.e., many multiple projects in close geographic proximity), and consolidation of wind turbine OEMs. 73 Tier 1 SOVs and CSOVs are active or under construction in the North European wind segment. Tier 2 and Tier 3 walk-to-work (W2W) vessels are currently active in the segment, but as oil & gas activity returns, we anticipate that supply of the vessels to offshore wind projects will reduce, driving demand for additional CSOVs.

Outside of China, the Asia Pacific region is in the early stages of wind farm development, with one active Tier 1 SOV and three Tier 1 CSOVs in construction for the comparatively near shore Taiwanese market, which is also actively served by CTVs. Oil and gas offshore support vessels have been widely deployed to support construction logistics. South Korea, Japan and, in the longer-term, Vietnam and Australia, are forecast to be the largest APAC offshore wind markets and therefore sources for vessel demand.

The U.S market is preparing for a period of large wind farm construction and operations, with three Tier 1 SOVs, two of which are on long-term charter for operators and one for an OEM. Construction and commissioning have been supported by several Gulf of Mexico Tier 2 and 3 vessels, the supply of which is expected to find core deployment in an increasingly active Gulf of Mexico oil and gas segment in the short-to-midterm. The 2024-2035 period is expected to witness strong growth in the U.S., as offshore wind spreads from the North and Mid-Atlantic, to the Pacific Coast and the Gulf of Mexico, effectively creating three or four sub segments for SOV/CSOV demand.

The Question of Emissions

Given that SOVs and CSOVs operate in a segment targeting reduced emissions, and many operate in the North European segment, characterized by a general strengthening of emissions reduction measures, more than 20 active or under construction vessels feature fuel flexibility through dual fuel engines and (space for) a bunkering system. Currently, methanol is a preferred energy carrier although hydrogen and liquid organic hydrogen carriers also feature.



Source: Intelatus Global Partners

Battery energy storage systems feature extensively as do electric drives.

Designers and Builders

SOV and CSOV owners have generally sought pricing from Norwegian yards (which generally build the hulls in countries including Vietnam, Turkey, Romania, and Spain) and China.

According to CSOV owner Integrated Wind Solutions, the contracting price of a Norwegian newbuilding has risen from €60 million to €68 million between Q1-2021 and Q1-2024. With a hull built in Spain or Romania, the cost rose from €52 million (2021) to €66 million (2024). In the same period, a Chinese built CSOV for the European market would attract a yard price of €44 million (2021) and €61 million (2024). Based on this data, we note that the premium for a Norwegian built vessel fell from around 25% in early 2021 to approximately 12% today.

The biggest new building premium is found in the USA, for a variety of reasons, where the three tier one SOVs are being built for €87-168 million.

VARD is a leader in the design and construction of SOVs and CSOVs, building hulls in Romania, Spain and Vietnam that are completed and commissioned in Norway. The company is also building a vessel through its Fincantieri Bay Shipbuilding subsidiary in the USA. The most popular design in the VARD 4 19 platform.

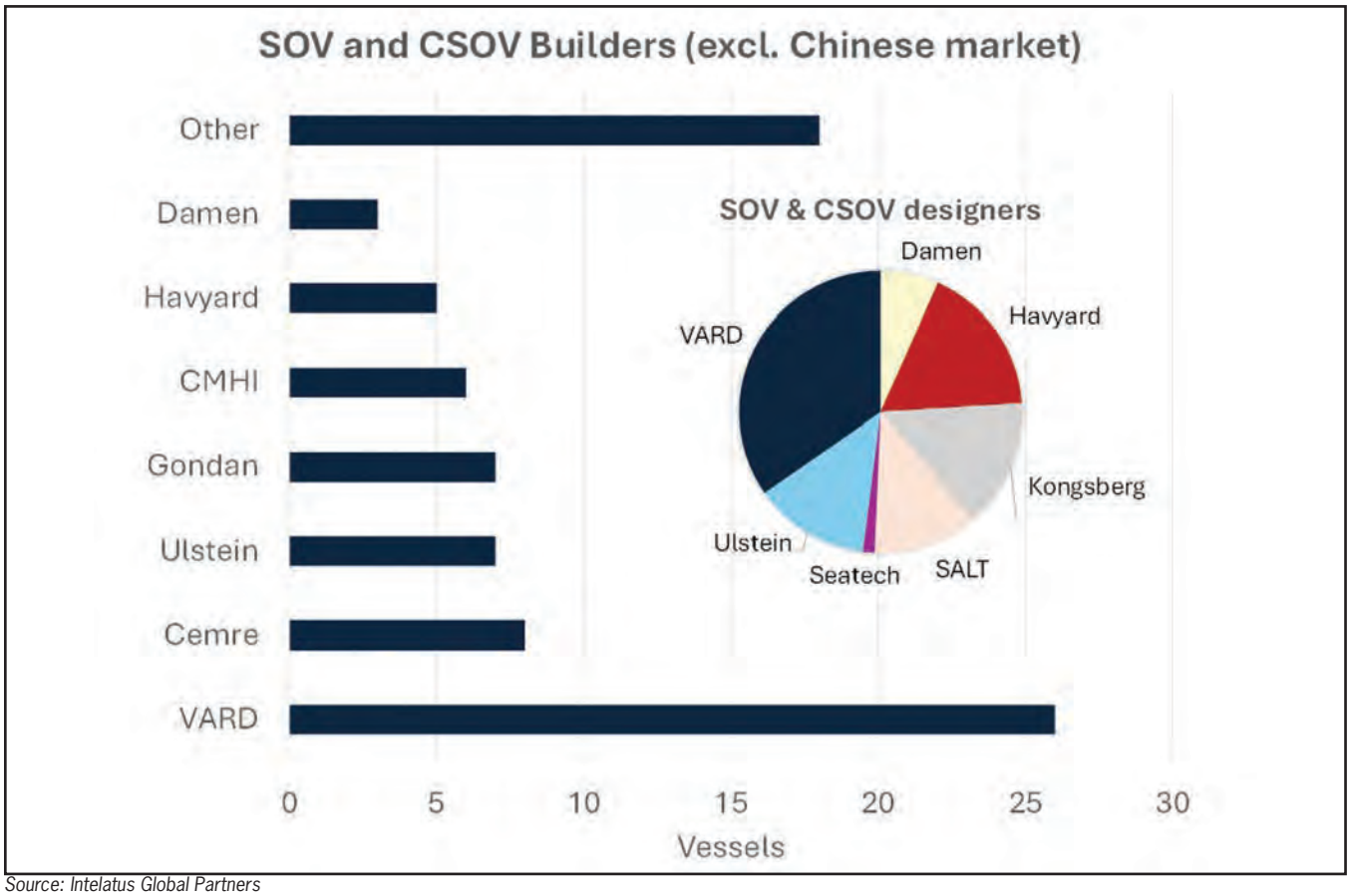
Far behind VARD is the Turkish yard Cemre, building Havyard and SALT Ship designs, Norway's Ulstein, Spain's Gondan (SALT Ship Design and Kongsberg designs), and China's CMHI building Kongsberg designs.

Ten yards account for the remaining vessels.

The Future Looks (Generally) Bright

The market fundamentals, reflected by an increasing number of turbines being installed and operational coupled with a likely reduction of Tier 2/3 vessels, support a growth in the vessel supply-side.

Whereas, SOVs are generally built against long-term charter and therefore have a certain amount of financial security, CSOVs are more exposed to redeployment risk and there remains a concern that overbuilding of a commoditized vessel may result in future oversupply as seen in the oil and gas OSV space in the 2008-2014 period.



Source: Intelatus Global Partners

© TechnipFMC

SUBSEA VESSEL MARKET IS FULL STEAM AHEAD

Since our last market update in the subsea space about a year ago both our current market view and forecasts have strengthened significantly.

By Jesper Skjong, Market Analyst, Fearnley Offshore Supply AS

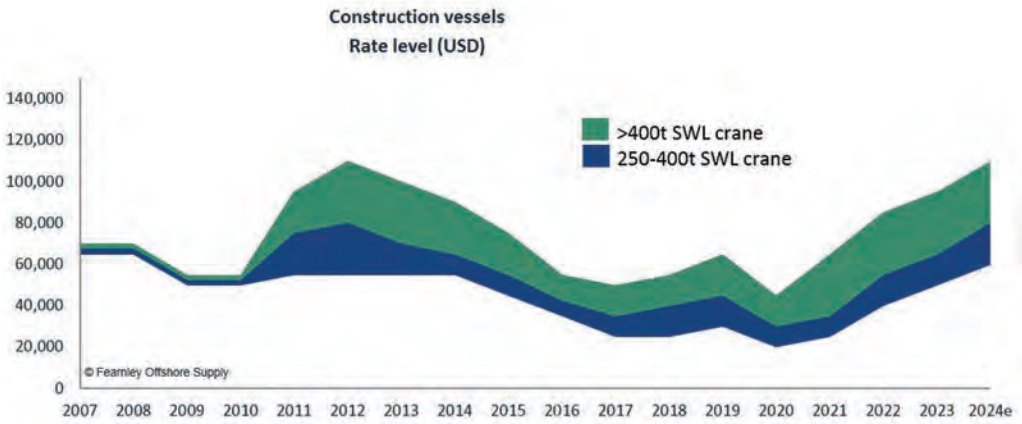
While the demand picture is looking solid and arguing for a strong multi-year upcycle, the supply side has also started to wake from its slumber albeit ever so slightly at the time of writing. Moreover, we register an interesting dynamic on the shipowner side, where everyone is trying to position themselves for the impeding market boom.

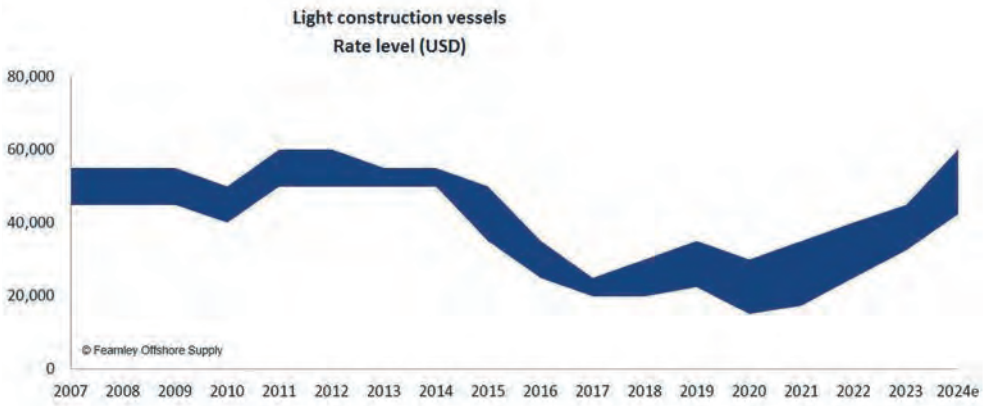
Please note that vessel definitions and abbreviations in this part of our industry can vary, but for the purposes of this article, we will focus on what we at Fearnley Offshore Supply define as subsea construction vessels (CON), anchor handling construction vessels (AHCON), light construction vessels (LCV), and multi-purpose supply vessels (MPSV) above 68m length overall.

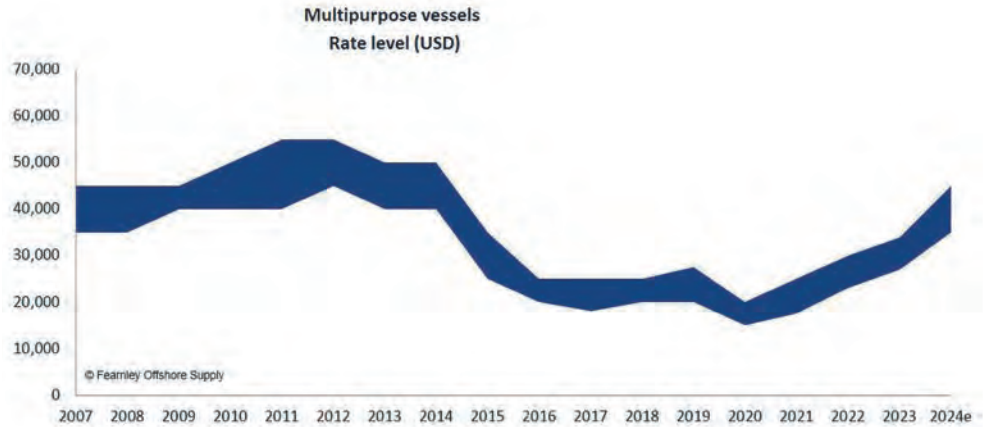
We have previously highlighted the severe tightness of vessel supply in the offshore construction space as project development in both oil and gas as well as offshore renewables are pulling on the same asset pool for a large range of work scopes. With that same combined demand firmly on a rising trajectory with forecasts pointing to a multi-year plateau of high vessel activity the market, we argue, will soon find itself in dire need for more tonnage.

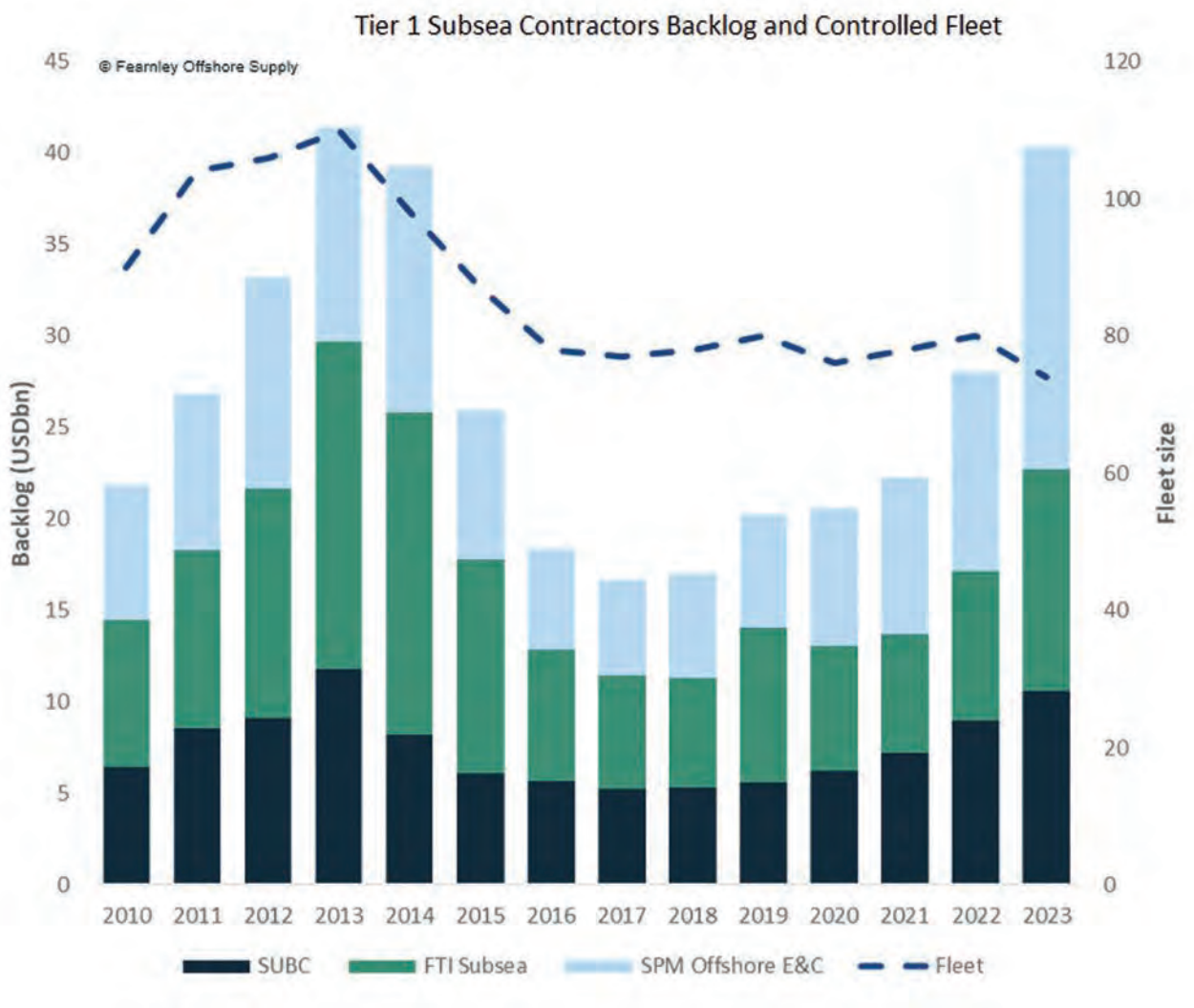
Combine that with the fact of very limited fleet growth, and even a larger number of units exiting the industry in recent years, it is almost ironic that the largest number of construction support vessels is not the present fleet, but was recorded back in 2021.

Coincidently, the market has vastly improved since 2021, especially from the shipowners' perspective. Dayrates for construction support









assets, as displayed on the graphs below, have improved by more than 100, 95, and almost 90 % for construction vessels, light construction vessels, and multi-purpose units respectively. Other metrics as well, such as utilization for example, has also improved significantly in that same span of time, and while the aforementioned vessel exits has had some degree of positive impact herein, the most significant driver has undoubtedly been the demand development.

Another insightful method to measure the health of the subsea market is to analyze the order backlog of the Tier 1 offshore construction contractors: Subsea 7, TechnipFMC, and Saipem. When doing so, we find that as per the end of 2023, these companies' combined backlog stood at almost the same value as the previous peak 10 years prior. With more than $40 billion of work in their books, the Tier 1 players have just around 2% less orderbook value than in 2013. As such we argue quite firmly that the market, in a lot of respects, have fully recovered.

Furthermore, back in the previous market upcycle the major subsea contractors significantly increased their controlled fleet, that is the owned and long-term chartered construction support vessels, through large newbuild programs, acquisitions, and long-term chartering. This made a lot of sense given the amount of work they were lining up and threading new water in terms of project complex-

ity at the time.

As the market crashed in the following years, investments in offshore developments all but dried up and the Tier 1's orderbooks were brought down with it. Unsurprisingly, these companies reduced their controlled fleet significantly by shedding older and non-core tonnage as well as letting charters roll off their engagement without replacements or renewal.

What is rather surprising, however, is that the controlled fleet of these same companies at the time of writing, when their orderbook stands almost at its previous record, is at its lowest in well over a decade. In fact, what we had previously assumed would be the through fleet figure for the Tier 1's, at 78 controlled vessels during 2020, reached a new low at 74 units during as of the end of last year.

Therefore, we see no other alternative than that something has got to give, and in light of the vessel demand forecast for these assets, we are of the firm belief that the major subsea contractors sooner rather than later will make some strategic and significant investments. We are not alone in that belief by any means, and as a matter of fact we have seen several positioning moves on the supply side of the market.

Firstly, on an otherwise rather ordinary Thursday in March, not one, nor two, but three subsea construction newbuilds were announced all on the same day!

Rem Offshore confirmed the placement of a construction vessel at Myklebust Verft in Norway. The vessel will have a 250-ton crane and methanol power, enabling their first net zero emissions vessel of this type.

With an expected delivery in 2026, we see the announcement as the first major construction vessel newbuild in the current cycle. Furthermore, two SALT-designed light construction vessels were placed by an undisclosed owner the same day, which will be built at Wuchang Shipbuilding in China. The vessels will be prepared for alternative fuels, including a large battery package with expected delivery in 2026. The vessels are a further development of the successful SALT 305 design, which will be suitable towards both traditional oil and gas clients and core offshore wind scopes.

As we head into a stage of the cycle where vessel shortages could very well soon be reality, we see these newbuilds as a natural development. Other traditional owners have opted for the rearrangement of existing assets, with high corporate activity in recent weeks. Following the battle for Solstad Offshore between Aker and Kistefos, Siem Offshore announced the split of assets between the company founder and remaining shareholders.

Kristian Siem will exit the company he founded with nine vessels in exchange for 35% of the outstanding shares, which include three AHTS, four PSVs, and two subsea construction vessels. Kristian Siem's Siem Sustainable Energy will become the new owner of the vessels, leaving Siem Offshore a fleet of 17 vessels. Following completion of the transaction, Siem Offshore will continue to manage the vessels on behalf of Kristian Siem for a minimum of one year.

Kistefos, owned by Christen Sveaas, will now be the largest owner of Siem Offshore, combined with being the major owner of Stockholm-listed Viking Supply Ships, which controls a fleet of six AHTS. The rationale for owning two OSV operators with separate organizations, in the same city now less, might be challenged in the near term, yet we have noted that there are no plans for consolidation as of now.

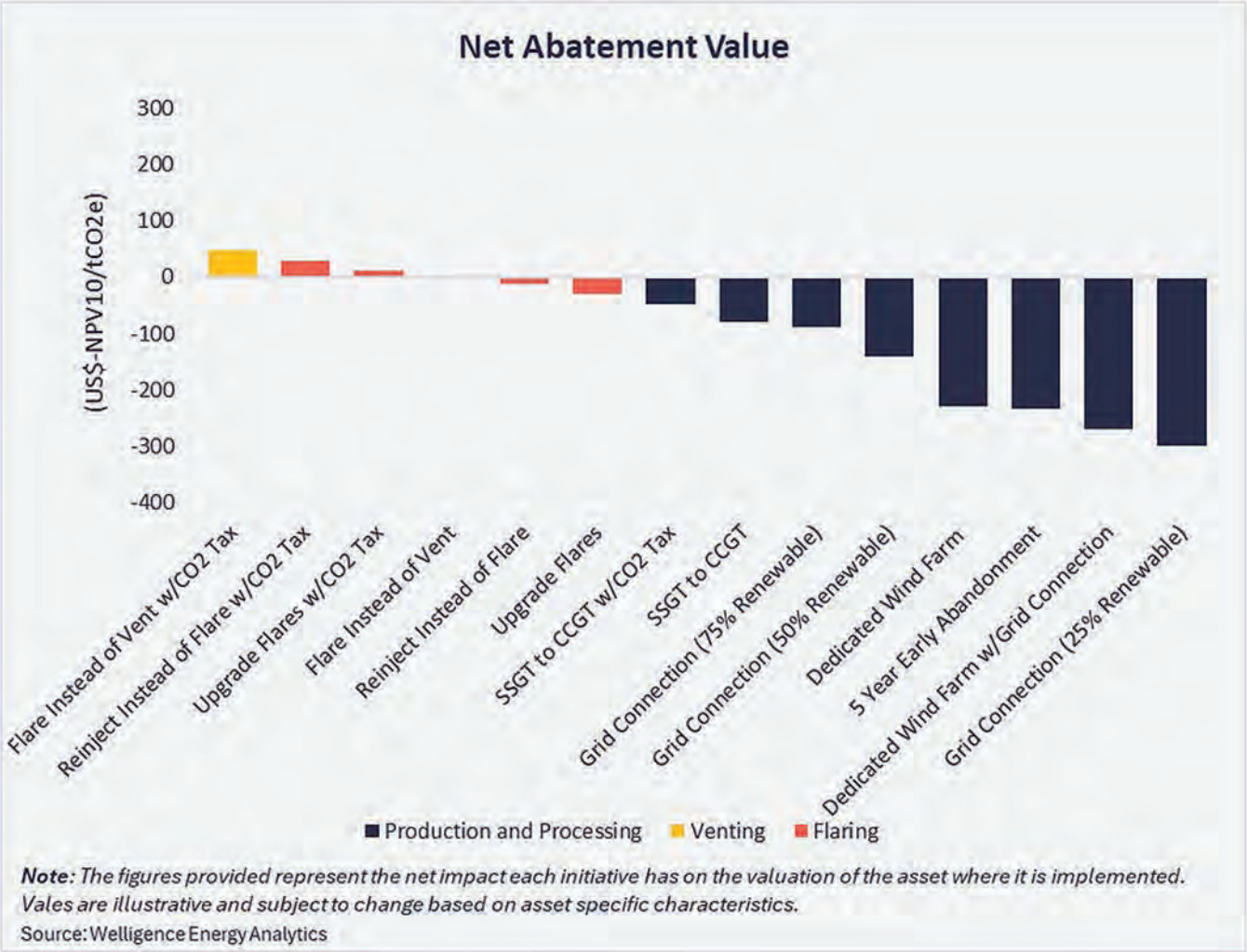
Havila Holding also made moves with the full acquisition of Volstad Maritime, where they have held 52.5% of the shares since 2017. The fleet consists of five subsea construction vessels and one diving support vessel, which is considered high specification and include three 250-tone crane DP-3 units. Havila Holding is now the controlling shareholder in Havila Shipping with a fleet of 14 vessels, joint owner of Skansi Offshore with five vessels and full owner of Volstad Maritime with five vessels.

Subsequently, we can say that the puzzle for securing high quality steel has started and multiple interesting developments have occurred on the corporate side in recent weeks. Investors with strong competence in the space are positioning themselves for a prolonged period of strong earnings, and we can expect further M&A activity going forwards as newbuilding is still limited owning cash generating steel is a top priority. Nonetheless it still bodes well for the future prospects of the subsea construction segment as these market movements all point to even brighter days ahead.

Decarbonization Strategies in the Offshore Oil and Gas Industry: Navigating the Path Forward

In recent years, the oil and gas industry has faced mounting pressure to address its environmental impact. This has led many companies to set decarbonization targets – we are tracking more than 460 targets set by independents, majors, and NOCs across the sector. However, achieving these goals is a complex challenge and uncertainties persist about the most effective strategies to reach said targets.

By Fernando Tamayo, Senior Rig Market Analyst, Westwood Global Energy



***Note:** The figures provided represent the net impact each initiative has on the valuation of the asset where it is implemented. Vales are illustrative and subject to change based on asset specific characteristics.*

Source: Welligence Energy Analytics

Upstream Commitments Towards a Net Zero Future

Over 83% of companies we are tracking across the upstream sector have established greenhouse gas (GHG) emissions reduction targets. The number will rise as NOCs, which have historically lagged behind the rest of the industry in target-setting, finalize their decarbonization strategies. Moreover, as financiers come under increasing pressure to assess emissions linked to any project they fund, upstream companies lacking existing targets will be compelled to establish and publicly disclose their decarbonization strategy to secure financing.

Arguably, one of the most important sub-sets of the decarbonization targets being set are net-zero commitments. As of today, 70% of independents, 100% of majors, and 64% of NOCs have set net-zero targets. While most majors aim to reach Scope 3 carbon neutrality, in general, the industry will mainly target Scope 1 and Scope 2 emissions – only 14% of companies with net-zero commitments are targeting Scope 3 emissions.

Available Decarbonization Options

Nonetheless, the path toward net-zero is an uncertain one. This is primarily due to the cost associated with many of the decarbonization options available.

Initiatives targeting gas management, such as replacing venting with flaring, upgrading flares to reduce the amount of uncombusted methane that is released, or even drilling injector wells to limit the amount of gas that is flared or vented are relatively cheap. In some cases, these initiatives can even generate value for the asset in which they are implemented.

However, these initiatives will only take operators so far

as around 60% of upstream emissions come from fuel consumption at production and processing facilities. These emissions are harder to abate and significantly more expensive, as fundamental changes to an asset's infrastructure are required. Options include connections to the grid, building dedicated wind farms, or upgrading existing simple cycle gas turbines (SSGT) with more efficient, but costly, combined cycle turbines (CCGT).

Unfortunately, in many cases, such initiatives necessitate that the assets be taken offline for months, or even longer, as the production facilities undergo modifications. In other cases, such initiatives will force operators to incur heavy costs associated with new machinery, additional permitting, and environmental assessments. All to say that many of the initiatives being pitched will not be feasible for most offshore assets due to capital or time constraints – especially in assets that have already plateaued and have entered terminal decline.

The Economic and Environmental Case for ILX

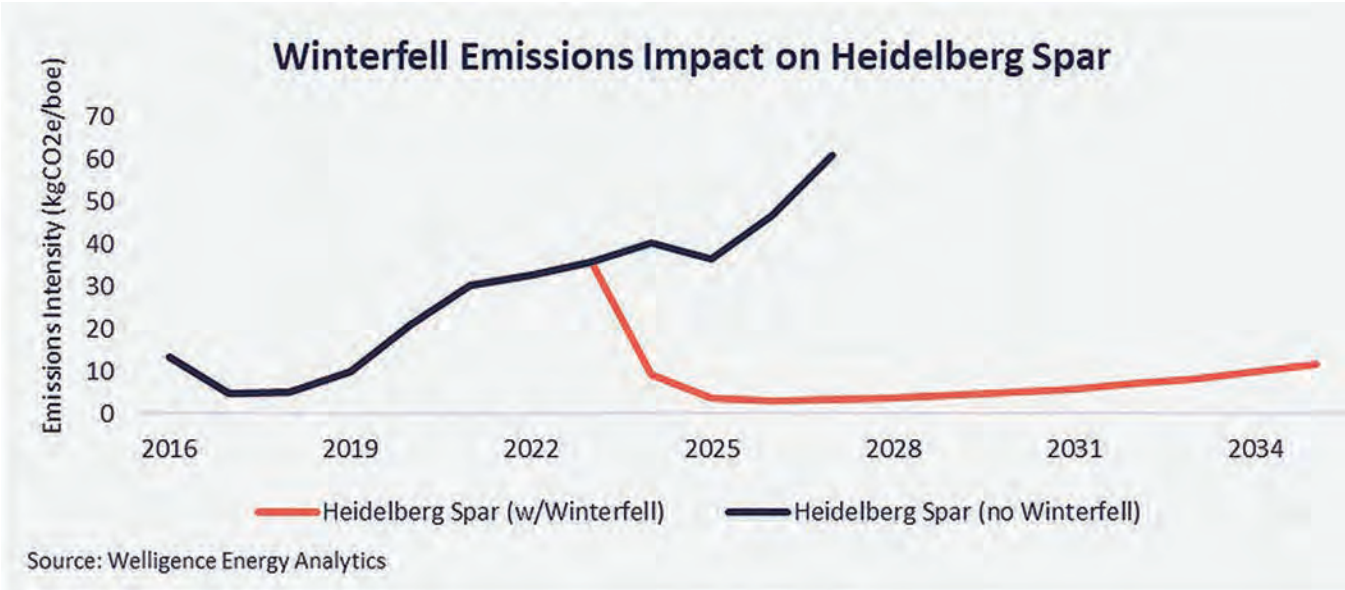
Infrastructure-led exploration offers a viable solution as it offers a rare case where all parties involved can point to financial and environmental benefits. Furthermore, it's a suitable strategy for mature offshore assets where facilities are underutilized.

Explorers can utilize existing infrastructure limiting the capital expenditure and time required to bring a project online, while at the same time avoiding the incremental emissions associated with new dedicated facilities.

Operators of the host infrastructure can share the cost and emissions linked to their production platform, extending the life of their asset while also decreasing the associated emissions of all tiebacks. This provides the market with incremental, low-emission barrels.

No better example of this exists than the Winterfell tieback to the third-party-operated Heidelberg Spar in the US Gulf of Mexico. By 2023, the Heidelberg Spar had become one of the highest emitting fields/facilities (on a per barrel basis) in the US Gulf of Mexico. However, after Beacon Offshore Energy made the Winterfell discovery, Occidental, the operator of the Heidelberg Spar, decided to open up its facility to host production.

For the Heidelberg field/spar, the tieback meant that a significant share of the operating costs was passed onto the Winterfell consortium in the form of processing and handling (P&H) fees. This eased the OPEX burden on the Heidelberg field, leading to an extended economic limit, and ultimately an increase in valuation of nearly $400 million. Furthermore, the tieback also transformed the facility from one of the highest-emitting (on a per barrel basis), with an intensity of 35 kgCO2e/boe before Winterfell came online, to one of the lowest emitting facilities in the world with an intensity of <4kgCO2e/boe once Winterfell is fully online.



One-on-One with ROBERT LANGFORD,

VP, Global Offshore Wind

As the U.S. offshore wind industry endures a predictable number of stops and starts during its adolescence, common mantras are 'learn from the established European model' and 'embrace technology transfer from the offshore oil and gas sector.' In **Robert Langford**, *the American Bureau of Shipping has all of that and more bundled in one neat package. Langford recently visited with* ***Offshore Engineer*** *on the sidelines of a floating wind conference in Houston to offer insights on the pace, direction and hurdles to overcome in U.S. offshore wind.*

By Greg Trauthwein

Rob Langford has worked in the offshore industry for more than three decades, 'cutting his teeth' in a UK design firm working in the North Sea oil and gas platforms, the holy grail of rigorous conditions in offshore energy production. From that start he – like most other burgeoning leaders in the sector – became 'mobile and global', working with SBM in the floating offshore world with FPSOs and the turret business, then moving to New Orleans to work on Gulf of Mexico deepwater projects with Shell. Eventually he settled in Houston, working with engineering and advisory/EPC companies for offshore developments and another stint at SBM, which entailed project work globally.

About five years ago he made the switch over to offshore wind, working for Worley as senior director of offshore wind, and today he finds himself at ABS as the VP of Global Offshore Wind, a pivotal cog in helping to facilitate this emerging market globally.

Roadblocks on the Wind Path

Like most organizations in the maritime and offshore sectors, renewable energy and sustainability are a focus aread for ABS. "We are growing and evolving our services across all offshore infrastructure along with our continued support to the marine industry," said Langford. "We continue to hire key individuals and partner to provide best-in-class solutions."

Also – like most companies in the maritime and offshore sectors – today it is not possible for ABS to put a definitive number on 'how fast, how far' this business will grow. "It is difficult to provide quantitative figures as this is driven by the developers and approval regime," said Langford. "However, we are gung ho about making this happen, and we are confident that the offshore wind business will grow year-on-year."

While there are plentiful regulatory and environmental hurdles, they are not alone.

"One of the main risks I see is the onshore infrastructure to support fabrication, staging, O&M along with grid connectivity and PPA's," said Langford, noting that vessels to support installations are proving problematic, too.

From the government side, he sees a need for further support – incentives and subsidies – to develop ports and projects. "We need to help educate the local communities, helping them [especially government representatives] to better understand what we're trying to achieve," said Langford. "Some of them do understand, but I think there's more work to do in that regard to meet the renewable energy goals."

Is There Good News?

By its very nature, bad news sells, and there is no exception when it comes to offshore wind. At the end of '23 rolling into 2024, the industry hit significant regulatory roadblocks – driven by environmental concerns, both real and manufactured – coupled with a rapidly changing economic situation [ie. runaway inflation] that caused several key stakeholders, early movers, to head for the exit. While the cost of project delays and cancellations have a real impact on the players that remain, Langford maintains an optimistic outlook long term.

"We are engaged with multiple US OSW wind developments and seeing an up-tick for CVA, technology review and risk reduction services in early development phases," said Langford. "With new lease rounds coming and new opportunities, we do not see a big slowdown for OSW developments apart from the obvious project delays and re-bids."

To date the U.S. has more than 30+ commercial scale projects underway and more to come, as BOEM approves more projects and lease areas. Virginia Offshore Wind and Revolution is in construction; Southfork is into installation, "so Orsted remains a key player in the U.S."

"Equinor and BP obviously split the JV where Equinor takes the Empire Wind development and BP continues Beacon Wind," said Langford. "New Jersey awarded a combined 3.7MW of offshore wind capacity to Invenergy, energyRE's Leading Light Wind Project and Attentive Energy LLC's Attentive Energy Projects in January 2024; all good signs for the industry. RWE and OceanWinds are also eager to push forward with their developments."

Another good news story that could and should emerge is an energized U.S. shipbuilding and repair base, an orderbook packed with new ships and boats to feed this emerging market. While that has yet to transpire, Lanford assesses the potential.

"To meet the US offshore wind goal of 30GW by 2030, we see the demand of 5 to 7 installation vessels, 12 to 15 service operation vessels and 50 to 60 crew transfer vessels by 2030. Adding dredges, rock installation vessels, cable layers and feeder vessels, the U.S. Department of Energy

"We are engaged with multiple US OSW wind developments and seeing an up-tick for CVA, technology review and risk reduction services in early development phases. With new lease rounds coming and new opportunities, we do not see a big slowdown for OSW developments apart from the obvious project delays and re-bids."

– Rob Langford,
VP, Global Offshore Wind, ABS

estimates a total of 110 vessels."

Currently two purpose-built Wind Turbine Installations are under construction, one the U.S.-flag WTIV Charybdis being built at Seatrium Amfels for Dominion Energy Coast Virginia offshore wind; and the foreign flag Maersk supply WTIV at Seatrium Singapore, together with U.S. flag feeder ATBs for transportation and installation of the Empire Wind. Three newbuild SOVs and three conversions/retrofits were awarded, too, and 22 CTVs were also announced. The first US rock installation vessel was ordered by Great Lakes Dredge & Dock Company, LLC.

Floating Future?

While the reality of widespread utility level floating offshore wind is still years away, it is generally acknowledged that floating wind is the future premised on its ability to operate further from shore to catch the stronger, more favorable winds. While the speed of technological development continues to pick up pace, Langford proposes that in the U.S. market, a correctly paced approach to suit supporting supply chain might be best in the long term. "It really boils down to further demonstrations … let's build it. But let's not try and do everything at once. The European model was more of a staged process in making things happen, and I think the U.S. can learn a fair bit from the European model. We're trying to do a lot all at the same time, and I think that's potentially problematic. Starting more demonstration projects would be a good path to success."

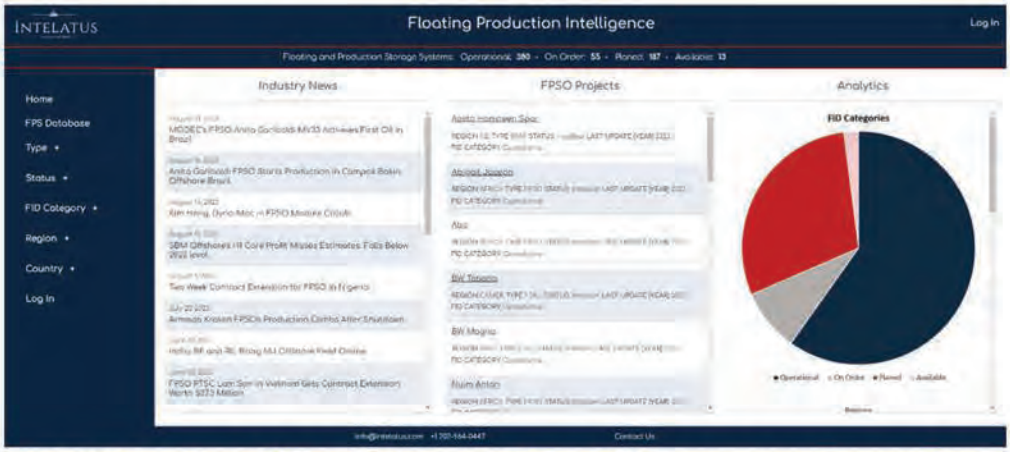
IGP

INTELATUS

GLOBAL PARTNERS

The all-new way to track FPS production in real time

Floating Production Systems Intelligence



Introducing the **ultimate online resources for offshore energy professionals** - the Floating Production Systems Intelligence and the Floating Wind . This comprehensive database provides key technical and commercial details on all floating production systems worldwide.

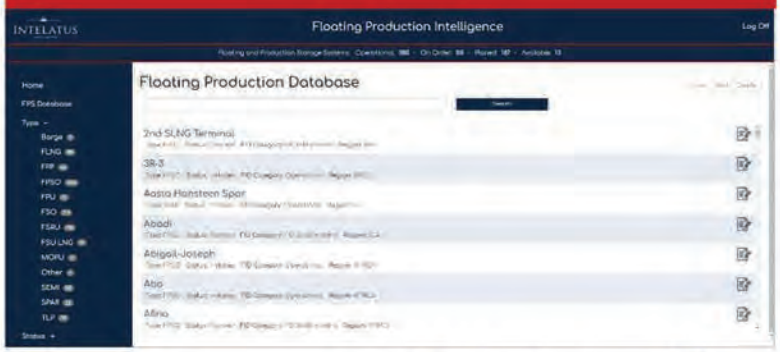
Track Progress and Production on:

Operational: 380

On Order: 55

Planed: 187

Available: 13



With over 700 floating production unit listings, the database is the most extensive compilation of FPSO, FPU, FPS and other floating production system information available.

The user-friendly interface allows for easy browsing and searching of the database by easy to filter parameters. Each system profile includes all key facts and capabilities, storage capacity, mooring type and more.

Visit https://fpso.intelatus.com for pricing and more information.

FORCE Technology

Optimizing Cathodic Protection Survey Using Non-contact Sensors

By Svenn Magen Wigen, Sales Manager (Integrity Management), FORCE Technology

The principle behind sacrificial anodes, which are used to safeguard underwater pipelines and structures from corrosion, is relatively straightforward. Made of alloys like aluminum, Zinc and is some cases Magnesium, the anodes are more reactive in the electrochemical process than the steel used in pipelines and other subsea structures. When connected to a structure, the anodes willingly 'sacrifice' themselves by corroding first, effectively redirecting the corrosion away from the vital structures.

The methodology, known as Cathodic Protection (CP), is used on all underwater structures that consist of two or more touching metals, and therefore act like a battery in seawater, creating a current that causes consumption of the anode material. The practice significantly extends the lifespan of underwater structures, reducing the need for frequent repairs and replacements, which also aligns well with sustainable operational practices in the offshore industry. However, in order to protect underwater assets effectively, the condition of CP anodes must be regularly surveyed to determine when replacements are required.

Survey Methods

CP survey is part of a larger underwater integrity management strategy, normally consisting;

- Identification of threats,
- Assessment of risk associated with the identified threats,
- Inspection, testing and maintenance planning,
- Inspection, monitoring and testing activities,
- Integrity assessment, and
- Mitigation, intervention and repair.

Selecting the best method for collecting the data these workstreams demand can have implications across the board, from reducing the risk of spill events on pipelines

to saving time and money across decades long maintenance regimes.

There are several methods available for measuring CP condition, and a combination of these methods may also be used to obtain a comprehensive understanding of the anodes' condition. The choice of method depends on factors like the structure's location, depth, environmental conditions, and the specific requirements of the maintenance plan.

The most common form of measuring CP systems is known simply as 'stabbing'. It involves the use of a contact probe (a.k.a., 'CP stabber') making direct contact measurement to the steel structure and the anodes, either by divers or ROVs. The probe typically consists of one or two silver/silver chloride (Ag/AgCL) reference electrodes. A voltmeter measures the potential difference between the structure and the reference electrode.

The CP level of structures can be measured with conventional CP probes, provided that the structure is not buried or otherwise covered, e.g., by rock dump. As for depletion of sacrificial anodes, this can be difficult or even impossible to estimate due to poor visibility, the presence of marine growth and/or corrosion products, or due to the anode being buried in seabed sediments or under rock dump (pipelines).

Proximity or cell to cell technologies which also required frequent calibration stabs are limited to just providing a potential profile on the structure/pipeline based on known formulas. Such technologies will not be accurate enough to provide accurate calculations of anode currents to assess remaining life, nor determine issues with current drain to or from adjacent structures.

Field Gradient Technology

Data quality and value improves through the use of non-contact surveys using field gradient sensor technology. Standard sensors in this field work by detecting potential differences between the Ag/AgCl cells, placed approximately half a meter apart, to gauge anodic and cathodic activities. However, these cells are prone to drifting and necessitate regular recalibrations — typically after every kilometer of pipeline surveyed, or every hour.

There are also weaknesses in terms of accuracy because of signal noise and the ability to detect small field gradients. In this process there is a risk that possible issues like coating damages are not discovered. This can happen because some of the signal peaks are interpreted as noise instead of being picked up as coating damage.

In contrast, a new generation high sensitivity field gradient sensor for use on ROVs and AUVs developed by FORCE Technology employs a novel approach with its electrodes mounted on a rotating head. Called FiGS, the design effectively counters the issue of cell drift and the need for calibration. Moreover, the rotating mechanism enables the sensor to determine the direction of the electric field. This directional insight not only provides a relative positioning for the findings but also ensures that the sensor's readings are consistent, irrespective of the varying positions of the ROV during the survey.

FiGS technology integrates field gradient detection with the measurement of protection levels (potential) using non-contact sensors. The collected data is then merged with CP modeling to provide a comprehensive analysis. This analysis includes accurate predictions of the asset's lifespan, anode current output, and a potential profile, offering a more efficient and thorough assessment of maritime structures' protection against corrosion than possible with stab surveys or dual cell field gradient surveys.

FiGS Operations and Benefits

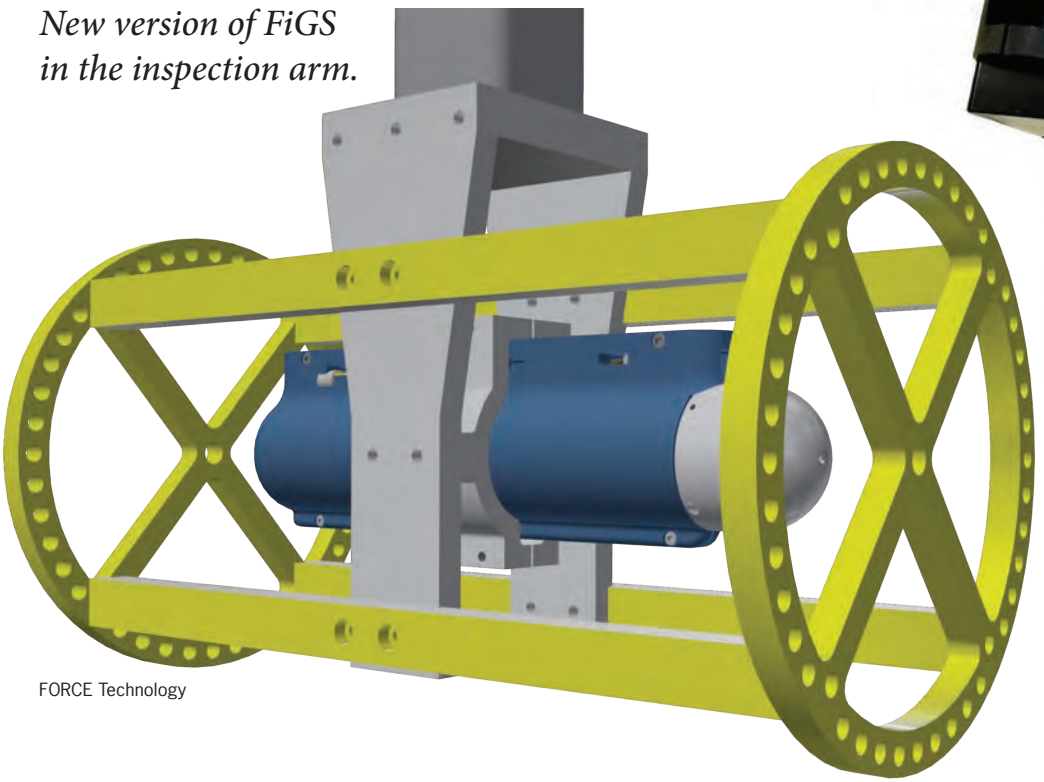
Conventional approaches to evaluating cathodic protection (CP) systems offer only a momentary glimpse into their status. This limitation compels operators to schedule CP inspections at predetermined intervals, typically every three to five years, or to conduct CP assessments opportunistically when in the vicinity. FiGS, however, revolutionizes this process by providing detailed insights into the lifespan of the CP system. This capability enables operators to tailor survey schedules more effectively, basing them on the residual life of the anodes, thereby optimizing the frequency of inspections and reducing maintenance costs.

The system can also collect data faster than other measurement methods. A FiGS pipeline survey can be conducted with an ROV flying at a speed up to 6-8 km/h without losing valuable information. This is faster than any other advanced CP inspection tool on the market. FiGS can also be positioned higher above the pipeline and still obtain valuable data. The increased speed saves costly vessel time, while the larger measurement distance lowers the risks associated with the flight of the ROV.

Crucially, the system can be used on buried, trenched or rock dumped pipelines, obtaining the same information as for an exposed pipeline. It integrates with active pipe trackers (e.g., TSS440) as the signals from the track-

FORCE Technology

New version of FiGS in the inspection arm.



FORCE Technology

er do not affect the sensor readings. This feature reduces offshore time as a pre-survey with the pipe tracker is not required, resulting in significant cost savings, mainly related to vessel charter.

The major advantage of using FiGS on any type of subsea structure is the large amount of accurate information obtained over a relatively limited extent of time. Also, because FiGS data is combined with detailed CP models developed using FORCE Technology's SeaCorrTM software, it's possible to easily identify issues such as hotspots including areas of under-protection as well as the impact of CP current drain e.g., to wells, using simple visualizations such as heatmaps. The larger scope, e.g., combining pipelines and structures within a subsea field on one survey mobilization increases the advantages of using FiGS, as all connected assets will affect performance of a CP system.

A complete FiGS report includes; Potential profile plot for pipelines/Potential distribution plot for 3D structures to identify hotspots/areas of under-protection, Anode current output (pipeline and structure anodes), Effective steel current density (including coating breakdown for coated pipelines/structures), Life time expectancy of the CP system in years (i.e. remaining life of sacrificial anodes), Recommended time to next inspection based on condition of CP system, Current drain (from anodes on pipeline/structures to adjacent structures, e.g., drain to well from anodes on X-mas trees), and Coating damages, with position and current supplied.

Another unique aspect is that FiGS data can be used as part of a much wider system that incorporates all pipelines and subsea structures across an entire field. Combined with new cloud-based online reporting and visualization, FORCE Technology can provide a central portal for information on all CP at an entire development or even multiple developments. This can unlock new savings across assets and locations by informing a decades long data-driven maintenance program based on highly accurate lifespan prediction for every CP anode protecting the entire subsea infrastructure.

THE NODULE COLLECTORS ARE LINING UP, READY TO GO

Engineers prepare to launch the pilot collector vehicle to the seafloor.

Courtesy of TMC

The battle lines have been drawn, and those on the ***"yes to seabed mining"*** *side are getting ready to go.*

By Wendy Laursen

In January, Norway said "yes" to seabed mining, adding its weight to the momentum that is likely to override the calls for a moratorium by over 20 countries and companies such as Google, BMW, Volvo and Samsung.

Those against mining aim to protect the unique and largely unknown ecology of the seafloor from physical destruction, sediment smothering and noise pollution.

However, the International Seabed Authority (ISA) has granted 31 exploration contracts in international waters and is expected to confirm mining guidelines this July, or perhaps next. Nearly two thirds of the licenses are for nodule mining, the most advanced sector.

Belgium-based GSR, part of the DEME Group, has Transocean as a cornerstone investor, and it conducted trials of a patented nodule collector, Patania II, at 4,500 meters in the Clarion Clipperton Zone in 2021. Full-scale trials will be conducted in 2027.

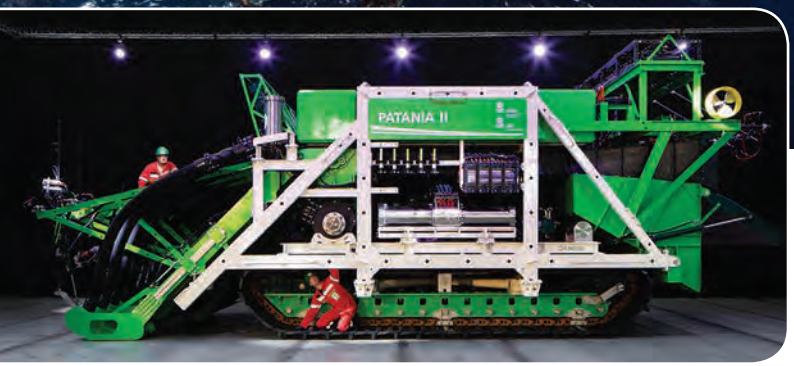
Patania II uses jet water pumps to lift nodules into a collection drum. Peer-reviewed research has indicated that released sediment-laden water led to a low-lying, laterally spreading turbidity current. Only 2-8% of the sediment mass was detected 2m or higher above the seabed and hadn't settled after several hours.

"All indications to date point to polymetallic nodules having the potential to become one of the most responsible ways to help meet the world's spiraling demand for metals," says GSR managing director Kris Van Nijen. "Our focus is on developing a source of high grade, low carbon minerals which can work alongside other strategies to reach the eventual goal of a circular economy and a stable planet."

Canada-based The Metals Company has partnered with Allseas which has a converted drillship, Hidden Gem, set up for nodule collection.

Patania II uses jet water pumps to lift nodules into a collection drum.

Images courtesy of GSR

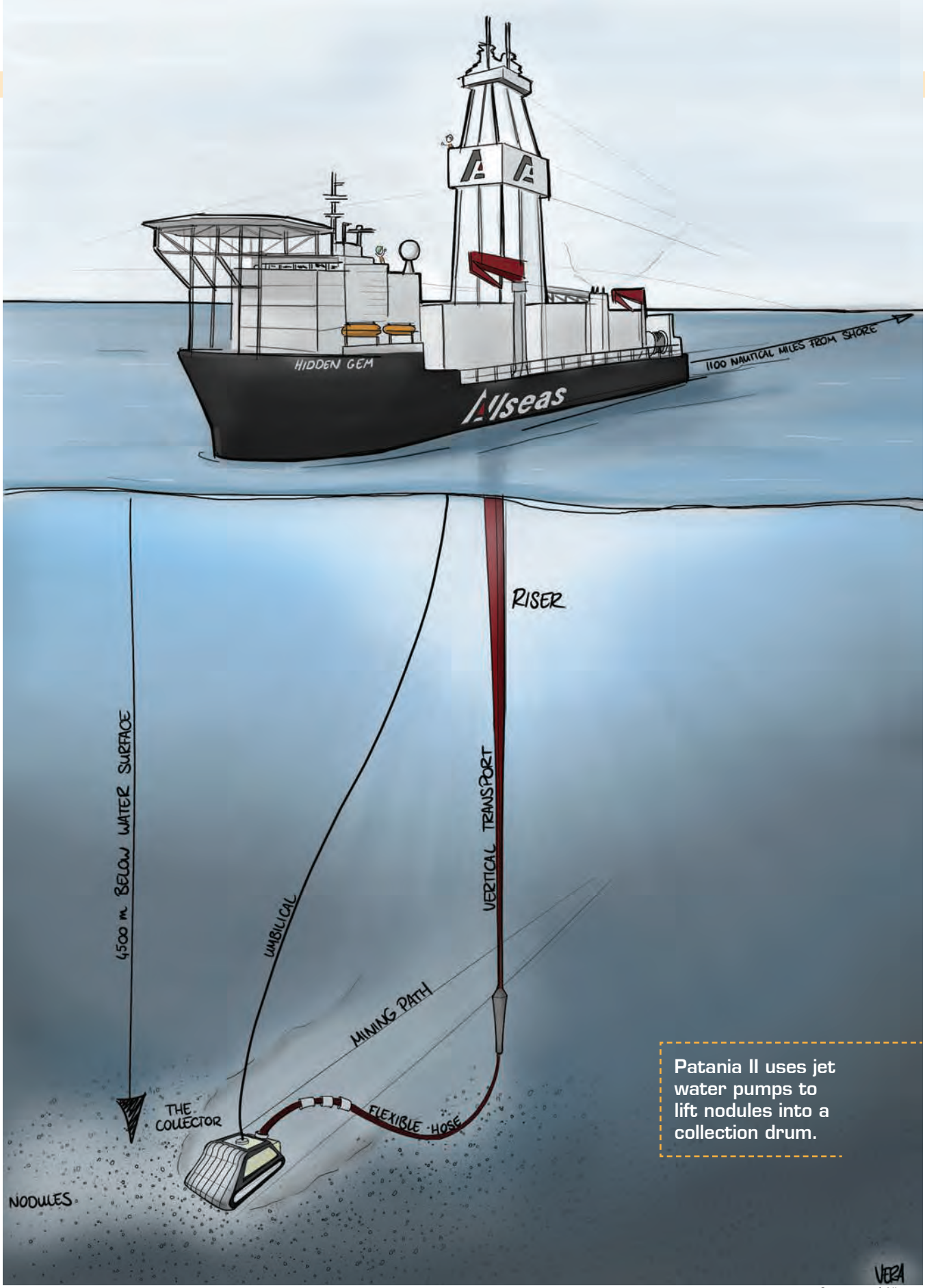


Onboard technology developments include the vessel's launch and recovery system (LARS) which deploys and recovers the collector and feeds its power and control umbilical. It has passive heave compensation which nullifies the wave, current and vessel motions that influence loads in the power umbilical. The LARS can operate in up to 3.5m wave height significant. The physical connection and disconnection between collector and power umbilical is performed subsea, and the LARS is fitted with a routing system that keeps the umbilical in a single plane during collector operations.

The collector's front-mounted Coandă-effect nozzles guide water over the seabed, creating negative pressure and a suction effect that picks up nodules. A diffuser at the rear creates an exit from where the sediment flows out, over 90% of which stays close to the seabed. The collector is fitted with low-impact tracks, and to further limit sediment disturbance, it has a fines rejection system.

This type of technology was first tested successfully in the 1970s by major Western corporations like Shell, BP and Kennecott. "The focus since then has been on scaling while ensuring the lightest environmental impact," says The Metals Company CEO Gerard Barron. In-field collection system trials conducted in 2022, where TMC collected 3,000 tonnes of nodules, have helped further advance the design.

Digital twin technology analyzes data gathered from multiple sensors and assets to enable 3D visualization of operations in real time. AI modelling can then determine the environmental impacts of the operation and test how, for example, how increasing production rate or collector speed would affect sediment mobilization and enable TMC to model different scenarios to reduce this impact,



Patania II uses jet water pumps to lift nodules into a collection drum.

Courtesy of Allseas

During its 2022 pilot collection system trials, TMC subsidiary NORI uplifted 3,000 tonnes of nodules from depths of four kilometers and transferred them to the hold of the Hidden Gem.

Images courtesy of TMC

says Dr Greg Stone, Chief Ocean Scientist.

Research conducted by Nauru Ocean Resources, a subsidiary of The Metals Company, found that organisms continue to be present and alive 12 months after having been influenced by a seafloor plume from its pilot collection system test.

The Metals Company recently signed a binding MoU with Pacific Metals Corporation of Japan for a feasibility study on processing 1.3 million tonnes of wet nodules per year, and the company is also exploring opportunities for the construction of a U.S. refinery - the Pentagon is expected to deliver an action plan on nodules by March 2024.

UK-based Soil Machine Dynamics (SMD) designed, developed and delivered the mining machinery planned for the Solwara 1 Seafloor Massive Sulphides project some 15 years ago, and it is now developing a patent pending, least impact, nodule collection system that utilizes mechanical and hydraulic technology.

The company's SMD Q-Collector range is available in a variety of sizes to suit vessel and client requirements. Engineered to have a low submerged weight, these vehicles are made with light plastic tracks and buoyant syntactic foam. The collection vehicle uses sonar to identify the position of the nodules and has attained collection efficiency rates of at least 97% in recent university trials.

Ian Maskell, principal engineer, says: "The eyes of the world will be on these projects, and this will be the most regulated industry in the world." However, commercial success depends on many factors, not least a predictable OPEX. Over the past four years, SMD has worked with Oil States Industries to calculate cost per tonne figures for prospective customers.

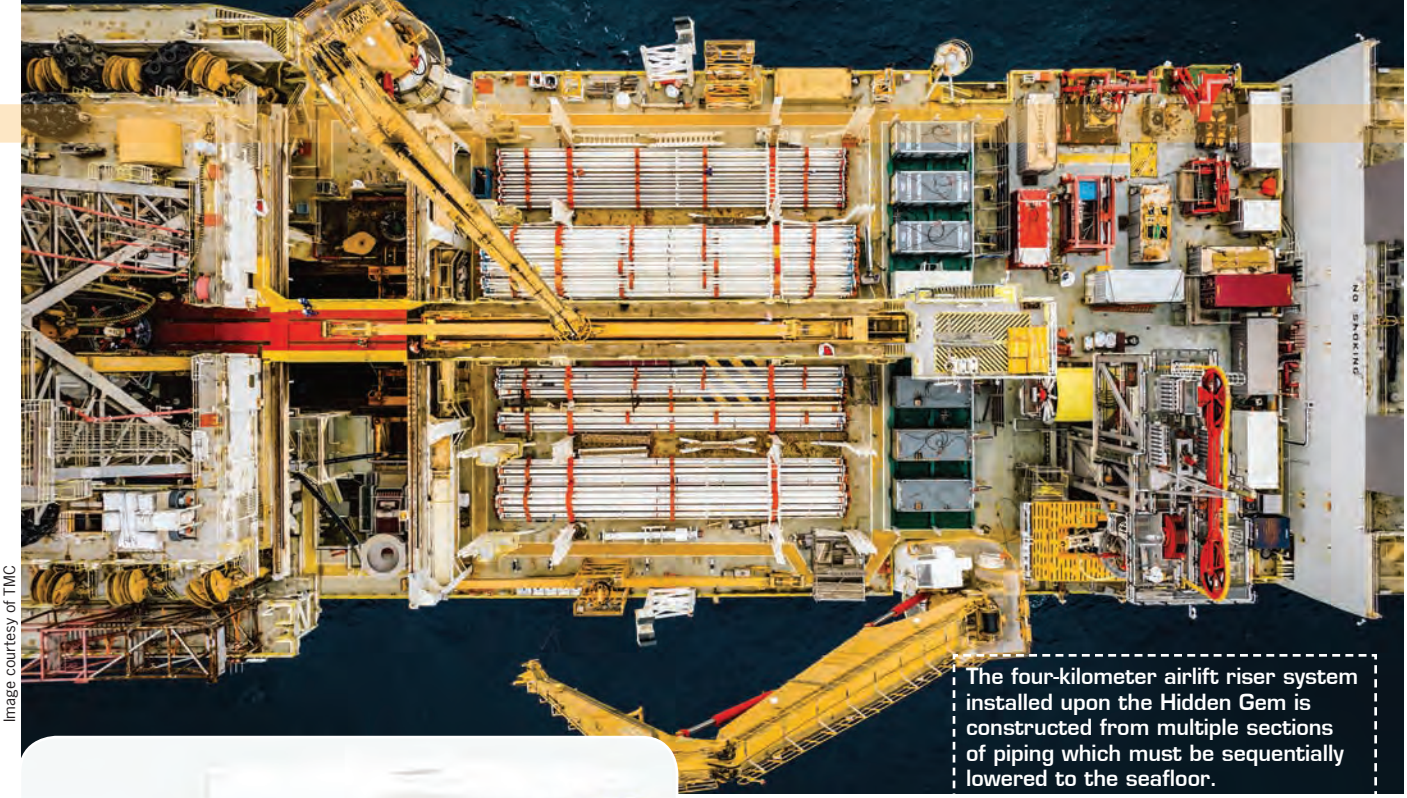


Image courtesy of TMC

The four-kilometer airlift riser system installed upon the Hidden Gem is constructed from multiple sections of piping which must be sequentially lowered to the seafloor.

Image courtesy of SMD

SMD's QCollector has been engineered to have a low submerged weight with the use of light plastic tracks and buoyant syntactic foam.

Image courtesy of Impossible Metals

Hundreds of Impossible Metals' Eureka III collectors could be deployed concurrently.

Oil States' Merlin™ riser systems were successfully deployed on both the TMC / Allseas and JAMSTEC 2022 pilot projects. They also hold a world record water depth for a producing riser system of 14,764 feet.

Impossible Metals is developing a nodule collector which, unlike other technologies, is untethered and hovers above the seabed, picking nodules with robotic arms. CEO Oliver Gunasekara cites three unique developments: the battery-operated buoyancy engine, fast-acting robotic arms and the AI algorithms that guide them, identifying and avoiding nodules with visible life present.

A second-generation collector, Eureka II, is currently being tested off the US east coast. It has three arms, but the much larger Eureka III will have 16 arms. Gunasekara estimates that a fleet of around 16 of these autonomous collectors would be a break-even point for commercial operations, with scale up from there possible gradually.

Hundreds of collectors can be deployed concurrently. Once a collector has achieved its 6,000kg payload, it can return to the surface, and as the surface vessel reaches capacity, it can return to shore while the collectors continue to load on a second vessel.

There is no sediment release mid-water like the other technologies and no noise from pumps or the DP system of vessels. "We have really gone out of our way to mitigate all of the negative feedback that the industry has received."

Still, the pushback continues. A 2023 Planet Tracker report highlighted that, like crude oil, nodules take millions of years to form, so biodiversity loss would essentially be permanent. And in February 2024, the European Parliament passed a resolution raising concerns about Norway's mining intentions.

Image courtesy ENI

Coral Sul FLNG -
Coral South field, offshore Mozambique.

INTO THE

As oil and gas continues to power forward, production increasingly finds deeper waters.

By Barry Parker

DEEP

Offshore energy is on a growth trajectory.

Rystad Energy wrote in February 2024 that upstream oil majors were diving in to deeper waters. "Despite tightened budgets, frontier drilling is fueling optimism for a productive year, particularly deepwater projects in the Atlantic Margin, Eastern Mediterranean and Asia," Rystad wrote, noting that "the trend suggests a significant push toward deeper waters, with more than half of the awarded blocks targeting deepwater or ultra-deepwater reserves."

This focus is reflected in global exploration activity, with Rystad analysts predicting approximately 50 more deepwater and ultra-deepwater exploratory wells this year compared to 2023. "Frontier and underexplored basins, teeming with hidden potential, offer the promise of substantial untapped resources," Rystad wrote. "Unlike mature basins where exploration yields smaller, scattered finds, these new areas hold the allure of large, geographically concentrated prospects."

The "Golden Triangle" (bounded by the U.S. Gulf, Brazil and Nigeria) continues to dominate the offshore side of oil and gas exploration and production, but diversification of geographies, into the new areas looms large on planners' charts. In Africa, hydrocarbon production generally, and offshore oil and gas in particular, play key roles in countries' development plans. As previously unexploited oil and gas plays are developed, fine tuning of business models is complementing the march into the new geographies.

New Projects, New Promise

One cooperative effort hopes to produce first gas during 2024. BP and Kosmos Oil, working in conjunction with the national oil companies of Senegal, and their counterparts in neighboring Mauritania, have been developing the Greater Tortue Ahmeyim project. The project is all about innovative production and transportation. The gas, from subsea production wells roughly 120 km offshore at a depth of 2,850 meters, will be processed aboard the FPSO N999 Tortue (completed in early 2023 at COSCO's yard in Qidong, China) then piped to the Golar LNG owned Gimi, an FLNG (converted from a 1976 built LNG tanker at Seatrium in Singapore) moored 10 km offshore.

In a crude oil production project set come online in 2024, the Australian gas developer Woodside Energy will deploy the FPSO Léopold Sédar Senghor at the Sangomar field, approximately 100 km offshore Senegal. The FPSO will be fed by two dozen subsea wells, in waters depths of around 1,000 meters. The vessel (with conversion from a VLCC completed in China at a COSCO yard, followed by pre-commissioning work in Singapore by Seatrium, with MODEC handling topside integration), will be capable of processing 100,000 bbl day of crude – anticipating European refineries being the likely buyers – with a storage capacity of 1.3 million bbl.

Woodside, with a $60 billion balance sheet at end 2022, post the BHP transaction, has placed the overall cost of the project's Phase 1 to around $5.2 billion (versus the $4.1 billion originally budgeted circa 2020), with Woodside noting that COVID-related construction deficiencies on the FPSO had brought about a need for "remedial work" that was undertaken in Singapore.

FLNG Gimi
outbound from Singapore.

Image courtesy Golar LNG

Images courtesy Vantage Drilling

Tungsten Explorer,
6th Generation Ultradeepwater drillship.

Annual reports from Woodside peg its capital expenditures on Sangomar at $1 billion in 2021 and $1.034 billion in 2022 – significantly more than half of the company's CapEx spend during that year. The capital stack buttressing Sangomar (with Woodside holding an 82% stake) has benefitted from a loan of $54 million from the multinational infrastructure capital provider Africa Development Bank.

Italian energy behemoth ENI has been active in offshore Africa.

In late Summer, 2023, ENI began crude production at its Baleine field, offshore Ivory Coast (southeast of Abidjan, using FPSO Baleine , previously named Firenze, originally an Aframax tanker Betatank II, built in 1989, converted at Dubai Drydocks World for Saipem and acquired by ENI in 2013).

Initially handling up to 15,000 bbl/day of oil and around 25 Mscf/day of gas – to be delivered onshore by a newly constructed pipeline – its capacity will be ramped up to up to 150,000 bbl/day of oil and 200 Mscf/day of gas in mid-decade. Work is beginning on a second FPSO/FSO combination at Baleine, with Norwegian subsea specialist DOF awarded a contract for installation of seabed mooring systems and other tasks, including a flowline that will link the FPSO, with the storage tanker.

In Congolese waters, ENI is set to begin production, pegged at 3 million tons/year (tpy) from its Tango FLNG, with storage aboard the FSU Excalibur The FLNG, previously owned by Exmar before its sale to ENI, had previously been on charter to YPF in Argentina before a 2023 upgrade in Dubai at Drydocks World. Exmar, the Saverys-family controlled owner based in Antwerp, is putting the FSU (built in 2002) on 10 year charter to ENI- which says that a second FLNG is under construction and expected to commence production in 2025.

A Shifting Triangle

As the Triangle changes its shape, Namibia, further south, is set to come on the scene as an offshore oil producer in the late 2020s; Shell and Total are currently involved in exploration efforts in the Venus Basin, with Chevron expected to enter the fray. As appraisal drilling progresses, a Total subsidiary exercised an option to extend its charter of the 6th generation DP3 semisubmersible Deepsea Mira (owned by John Fredriksen-linked Northern Ocean). Shell has a sister rig Deepsea Bollsta drilling in the nearby Orange Basin, expected to come off charter in mid-2024. Previously, the 7th generation drillship Maersk Voyager had been on to Total, with Vantage Drilling's Tungsten Explorer presently on charter until mid-2025, with further options.

In adjacent waters farther east, Total is leading a group of partners including Qatar Energy, and Africa Energy, seeking to develop gas fields discovered in Brulpadda and Luiperd blocks within the Outeniqua Basin, with plans to process the gas (transmitted using existing infrastructure serving existing fields closer to shore) at a gas-to-liquids facility at Mossel Bay. Rystad, in its commentary, had opined that: "…discoveries such as Brulpadda and Luiperd in South Africa in 2019 and 2020 and Venus and Graff in Namibia, both in 2022, have led to the opening of new hydrocarbon plays."

Elsewhere, a U.S. Department of Energy's Energy Information Administration (EIA) December 2023 report explained that: "Mozambique has in recent years dealt with a sudden influx of militant attacks on areas close to export infrastructure. These security issues have resulted in the declaration of force majeure on the Mozambique LNG project, delaying the facility's start date and the development of other LNG infrastructure projects."

But there has been progress. In late 2022, ENI began exporting LNG of the Coral South floating liquefied natural gas project, where it is the operator and majority partner. The FLNG Coral Sul, drawing gas from six undersea wells, has the capacity to produce 3.4 million tpy. A second FLNG project, also in Mozambique's Rovuma Basin, is reportedly in works, though no FID has been announced.

Moving Energy

For the transport side, the new equipment and infrastructure configurations are complemented by financial structures that are variations of more conventional balance sheet funding. They keep the longer-term flavor and project-specific flavors that have characterized offshore investing, but move ownership to the Private Equity (PE) sphere, albeit with a different focus than previous on shipping investments. At the February, 2024 annual "HACC NACC" event in New York, Art Regan, CEO, Energos Infrastructure, an owner of LNG carriers, storage vessels, and importantly, floating storage and regasification(FSRU) capabilities, delved into backers' financial rationale of its backers: the $14B Infrastructure division of PE-giant Apollo Global.

"I would say it's predictable income. Using Apollo as a reference, the mandate has moved away from risk; they are more of a pension fund manager than a PE shop as we know them from 20 years ago." Earlier rounds of PE investment in shipping companies – by Apollo and others – had looked to asset appreciation, with mixed outcomes. Regan, continuing, explained that suitable structures are "long-term income based" adding that "what we do is more terminal management than pure play shipping."

Apollo now owns 100% of Energos Infrastructure, following a deal cemented in February, 2024 when New Fortress Energy (NYSE: NFE, an offshoot of the PE behemoth Fortress Investment) with Assets Under Management (AUM) of $46 billion in late 2023, sold a 20% stake that it held.

Energos represents a new breed of infrastructure provider, motivated by energy security concerns as well as the ongoing transition to fuels with lower carbon footprints. Energos Infrastructure actually came on the scene in the months after the 2022 disruptions in the movement of Russian gas into Europe, bringing in a fleet previously owned by Golar LNG Partners LP, and then transitioned into NFE before moving into the hands of Apollo.

In the wake of reduced gas availability from Russia, Energos (which has chartering arrangements with NFE around six of its 13 vessels, with NFE dealing with the gas importers and exporters) was quick to deploy its FSRU Energos Igloo at Rotterdam to feed the Dutch power grid. Another FSRU, Energos Celsius, is being deployed at Barcarena in northern Brazil (after conversion at Seatrium in Singapore from a conventional LNG carrier) and will be fueling alumina production in addition to serving a power plant under construction. Nine of Regan's company's 13 vessels are described as FSRUs. In early 2024, two additional vessels, 174,000 cbm capacity acquired from Greek owner Dynagas (Procopiou), handling gas imports into Germany, were slated to join the fleet.

Talking about customers' motivations for floating regasification using FSRU's (which Art Regan described as "plug and play" in his HACC NACC remarks) rather than build-

Deepsea Mira,
6th Generation DP3 Semisubmersible - working offshore Namibia.

mage courtesy Northern Ocean

FPSO Firenze - at ENI's Baleine project, offshore Ivory Coast.

mage courtesy ENI

Woodside FPSO

Image courtesy Woodside

FSRU Alexandroupolis,
providing gas to Eastern Europe.

mage courtesy Gastrade

Image courtesy New Fortress Energy

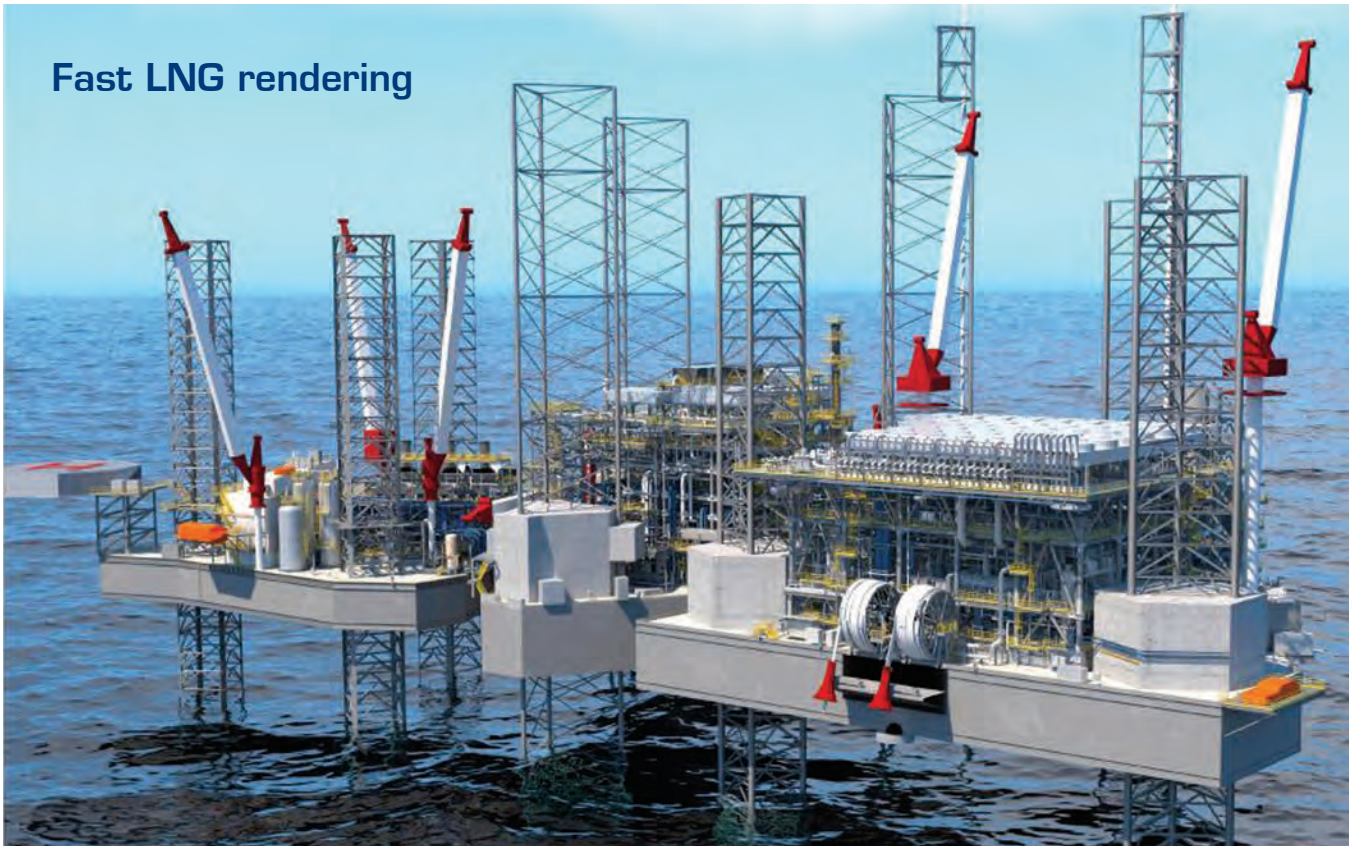


Image courtesy New Fortress Energy

ing land-side import terminals, he said, "They don't have to go through the exercises of approval, permitting, etc. They can hire us for one, five, 10, hopefully 25 years, and always have the option to change that if it doesn't work for their power grid." Other owners participate in FSRU's; another LNG carrier refitted for "regas" duty, Alexandroupolis, owned by Gastrade, with links to the Livanos controlled owner GasLog, has moved to a site offshore northern Greece after a 10 month conversion project, also at Seatrium.

The innovations in moving LNG are not all on the imports side, where FSRUs are becoming increasingly prevalent. In a recent LNG export deal, Energos Penguin, a vessel storing LNG for export after processing, is integral to the configuration at NFE's Altamira, Mexico floating liquefaction facility, which has been built in the "FAST LNG" mold, on three platforms configured on jack-ups stationed in 10 miles offshore in the Gulf of Mexico, near Tampico.

The facility, dubbed FastLNG 1 – with modules for treatment, liquefaction and utilities – promises quicker deployment than extensive construction of an FLNG vessel. The Altamira installation will be treating gas originating in Texas, and then piped down to Mexico. After liquefaction, the LNG will be stored on the Energos vessel prior to shipment aboard internationally flagged LNG tankers to destinations expected to include Puerto Rico, where NFE has invested in a terminal for distributing gas on the island.

Siemens Energy has installed its BlueVault ESS on the West Mira semi-sub drilling rig.

ENERGY STORAGE CAN BRING A SAFETY BOOST TO O&G PLATFORMS

Image courtesy DNV

The fuel savings gained by installing energy storage systems on oil and gas platforms are significant, but it's the safety benefits that might overcome what has been a relatively slow uptake of late.

By Wendy Laursen

Industry lore has it that drilling rigs say hello to each other using the gensets onboard to make smoke signals. The reality is that the engineers are often just running the generators at low load to ensure they have spinning reserve. The soot released is a byproduct of that sub-optimal load and the need to maximize energy security.

Energy security is paramount offshore, so sub-optimal energy production can be maintained for days or weeks, for example in adverse weather conditions, due to the long time needed to stop and restart generators.

In 2019, Woodside claimed a first when it installed a 1MW battery ESS on the Goodwyn A production platform to provide spinning reserve so that three gas turbine generators can run optimally rather than four sub-optimally.

The same year, Siemens Energy claimed a first for the installation of its BlueVault ESS on the West Mira semi-sub drilling rig. Here it is used for peak shaving during topside operations as well as spinning reserve in DP operations, nearly halving the run time of the platform's diesel engines. Siemens Energy's subsequent installations include the jack-ups Maersk Intrepid and Maersk Integrator.

Between 2019 and 2022, Corvus Energy delivered energy storage for NOV PowerBlade installations on four Odfjell Drilling semi-subs: Deepsea Aberdeen, Deepsea Atlantic, Deepsea Stavanger and Deepsea Nordkapp. The system captures electrical braking energy from drilling or hoisting systems and provides it to the power grid to enable peak shaving.

One of the world's most advanced offshore construction vessels, the North Sea Giant, was the first vessel where batteries (from Corvus Energy) were part of a DP3 power management system.

Corvus Energy SVP sales, Efraim Kanestrom, notes some cooling off on retrofit projects over the last couple of years due to rising oil prices and the greater geopolitical need for energy security. It's a temporary lull that he believes could be overcome soon even if the focus on emission reduction and energy efficiency is temporarily reduced in the industry. The operators still need to focus on the safety of crew and assets.

NOV powerblade Corvus dolphin lightweight ESS scaled.

Image courtesy Corvus

Corvus Energy has delivered energy storage for NOV PowerBlade installations on four Odfjell Drilling semi-subs.

Image courtesy Corvus

Images courtesy Siemens Energy

Siemens Energy's installations include the jack-up Maersk Intrepid.

The safety features of the Siemens Energy BlueVault system include using liquid cooled modules built into a standard Siemens Energy switchboard system.

In addition to the environmental and financial benefits, hybridization reduces soot and NOx emissions, a health benefit for offshore crews. Blackout prevention and better station-keeping are also beneficial to operational safety, reducing downtime and improving crew well-being.

Still, the industry has been reticent over concerns that the ESS itself could be a hazard by acting as an ignition source in an already high-risk environment. Kanestrom notes that the company's Orca system was the first ESS to be approved for use on offshore oil and gas platforms and that its in-built safety systems include the possibility to shut down the system completely (with no risk for sparks) in case of an emergency situation with hydrocarbons on deck.

The safety features of the Siemens Energy BlueVault system include using liquid cooled modules built into a standard Siemens Energy switchboard system. Each module is connected touch-free at the rear of the system to the battery interface module through short-circuit-proof rails. For additional protection of the crew and the establishment of robustness against internal faults, the plant is enclosed and equipped with doors, so the design is like a distribution switchboard where several racks are connected through the same internal busbar. Arcing cannot occur on either the battery or the busbar side of the battery interface module, so the design will prevent an internal electrical failure from igniting the battery modules, regardless of the cause of the failure.

Siemens Energy business development manager for offshore solutions, George Bitar, says demand is growing

Image courtesy Siemens Energy

"Demand is growing significantly.
– George Bitar,
Siemens Energy Business Development Manager for Offshore Solutions

Image courtesy NTNU

"Offshore oil and gas platforms may represent the next frontier.
– Professor Elisabetta Tedeschi
Norwegian University of Science and Technology (NTNU) and University of Trento

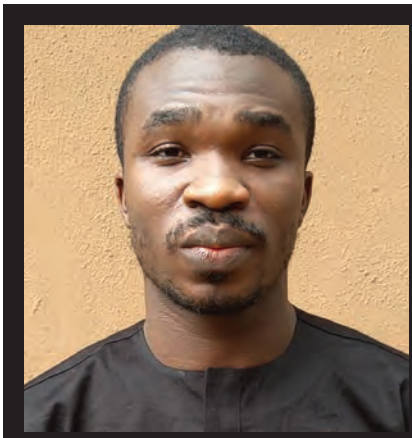


Image courtesy NTNU

"ESS can play a major role in upstream decarbonization and increase the penetration of renewable energy.
– Ayotunde A. Adeyemo

significantly for the system offshore for both newbuildings and retrofit, partly as a result of the reduction in opex that BlueVault offers through its advanced digital battery monitoring system.

Battery manufacturer Echandia has entered the market too, with a 2023 order for an ESS for a jack-up drilling rig in the Middle East.

Professor Elisabetta Tedeschi of the Norwegian University of Science and Technology (NTNU) and University of Trento says that while uptake has been limited to date, lithium ion batteries have only recently experienced wide adoption in several other sectors due to a relatively steep cost decrease. As an example, according to the International Energy Agency, the global installed capacity of grid-scale battery ESS was 28GW as of 2022, of which 11GW was added in 2022 alone. Offshore oil and gas platforms may represent the next frontier.

Tedeschi and her team have developed a versatile seven-step technology suitability assessment for the installation of ESS on offshore platforms. Testing the assessment methodology on the operating profile of one North Sea platform, the required ESS capabilities were calculated based on the need to provide maximum power for six hours to reduce the 77MW load peak by 5%. The results indicated that lithium iron phosphate (LFP) was the most suitable battery chemistry for peak shaving. LFP has the safety advantage that it is thermally stable, so there is no risk of thermal runaway.

A second case study indicated LFP and lithium nickel manganese cobalt (NMC) were jointly most suited for providing spinning reserve on another platform.

In both cases, safety was an important consideration, along with factors such as high volumetric density, low maintenance and solid operating experience.

Using offshore renewable power offers an alternative way of reducing emissions on production platforms, but this is unlikely to eliminate the need for ESS. Tedeschi's team have evaluated the lifecycle costs of using ESS for primary frequency control to ensure the intermittency of wind power generation does not result in sudden critical frequency fluctuations.

Lithium-ion capacitor technology from Beyonder in Norway was regarded as a promising technology. This combination of battery cell and supercapacitor is very safe, with reduced risk of thermal runaway when compared to lithium ion battery chemistries. However, the technology is not yet mature, so it is yet to see large-scale adoption.

That is expected to change in the future, and Tedeschi co-researcher Ayotunde A. Adeyemo says ESS can play a major role in upstream decarbonization and increase the penetration of renewable energy.

"Smoke signaling" could soon be a thing of the past.

All images courtesy MDL

PORTABLE IS KEY TO ENABLE EFFICIENT SURF LAY AND DECOMMISSIONING

By Andrew Blaquiere, MDL Managing Director

As the demand for energy continues to rise, fueled by global population growth and fight against energy poverty in developing economies, competition for access to enabling assets is intensifying. This is particularly true for the offshore industry, where specialist vessels play a crucial role in exploration, development and production.

In this competitive landscape, where new energy developers share the same pool of resources with established oil and gas players, cable layers, anchor handlers and other construction vessels are rapidly becoming in very short supply.

At the same time, operators and EPIC companies are increasingly looking for technologies and solutions to decarbonize their operations and make them safer, faster and more automated.

Something's gotta give… It's time to apply alternative thinking to flex lay projects.

Let's Start with a Clean Back Deck

MDL has a track record in supporting EPICs and independent operators with packages of portable equipment enabling efficient lay or retrieval of flexibles from "vessels of opportunity" – ships within the client's fleet or locally available in the region.

Adopting a modular spread approach allows several back-deck layout configurations to be considered depending on the final specification of vessel selected i.e. moonpool deployment, over-side deployment or deployment over stern.

A flexible back-deck solution allows smaller, more cost-effective vessels to be considered which may not have been deemed feasible previously. This may also include a vessel with other equipment on board that could perform other tasks whilst in-field, not just the installation – which carries a whole new host of time and cost benefits on a project.

The MDL differentiator in the portable equipment market is the versatility and capability of its technology.

An example is the MDL Horizontal Lay System (HLS) - an industry-proven alternative that can replicate the functionality of a Vertical Lay System (VLS). The MDL HLS integrates a pipelay tensioner and an overboarding chute, together with other project-specific equipment, into a single modular frame. This integrated system allows the product to be transferred from the horizontal to vertical orientation, facilitating the installation and recovery of risers, with the capability to install or remove the product jewelry

such as buoyancy modules, tether clamps, bend stiffeners or restrictors, thanks to the retractable work platform.

The work platform - offering up to 4.5m height clearance - provides a safe working environment for

personnel utilizing the systems integrated within the HLS, such as davit arms and runway beams, to install or remove jewelry which, without the right tools, can be a highly manual and time-consuming process considering the volumes of modules to be installed on long lengths of dynamic products.

DNV-verification guarantees that this portable package is purpose-built and can therefore be confidently deployed on any vessel of opportunity - ensuring that mission safety is prioritized in both design and operation.

What is also particularly attractive is the compact and integrated nature of the system, which allows it to be transported by road to the port of choice - eliminating dependency on marine transits.

The Decommissioning Balance Challenge

Efficiently increasing production or power supply is not the only challenge that the global energy players are currently facing as the need for reinstatement of the seabed to its natural state is increasingly becoming a requirement dictated by state laws.

With that, the decommissioning sector is growing in busy markets such as Brazil, Gulf of Mexico, North Sea or Australia, owing to the maturity of their oil and gas infrastructure. As more offshore assets reach the end of their productive lives, there is an increasing demand for recovery services. This can be costly in deep waters, which in their prime required specialist construction vessels to bring

the fields to life.

In 2022, MDL was approached by a Brazilian contractor looking for a cost-efficient way to recover SURF from the deep-water Santos basin: using a modular spread on an Offshore Support Vessel (OSV).

We had used our HLS as the base case; however, engineering studies with the product specifications, combined with the environment in which the system would operate, highlighted limitations on handling the recovered pipes over a chute.

Due to the friction between the flexible and the chute, the system's recovery capacity was dramatically reduced, even when using a high line pull-capacity tensioner. The solution to reduce friction was to replace the chute with a wheel - giving birth to MDL's Wheeled Horizontal Lay System (WHLS).

The system maintains all the HLS features facilitating recovery of various lengths and diameters of products, including: an integrated hang-off for handling end fittings, davits for overhead handling of products, integrated work platform for over the side or moonpool scopes and an adjustable wheel position to accommodate various product diameters.

Incorporating a wheel into the HLS design boost recovery capacity to match the tensioner's capability without extra space or weight from additional steel structures. The 2-point contact from the wheel profile on the product results in reduced MBR (Minimum Bend Radius) requirements, opening up the OD (outer diameter) window for wider application.

The best part? The compact system can easily move between vessels and can be deployed for both flexible recovery and installation scopes - making it a highly capable enabler for busy markets, addressing those construction vessel shortages.

Pulling It All Together

Besides designing and manufacturing a brand new technology, MDL assisted the Brazilian contractor with Project Management and Engineering services during the mobilization of the OSV in port, benefitting from MDL's skilled design team for deck layouts, lift planning and sea fastening, and the company's experience of managing quayside operations.

This expert support is on hand to ensure the most optimal equipment specification, deck arrangements and even execution methodology when working with spot-market

All images courtesy MDL

or bare-back tonnage. Storyboards and visualizations bring the whole package to life long before the construction phase to get all stakeholders' buy-in – which may be the biggest challenge for forward-thinking leaders looking to progress their campaigns in an alternative way.

Honing a track record in problem solving and innovation in the harsh North Sea since 1999, MDL has been enabling constrained projects around the world through a combination of out-of-the-box thinking and highly-capable portable technology deployed on locally available bare-back vessels.

Whether it is a new offshore field or one in advanced phase, MDL is here to support - from feasibility studies and front-end project engineering, to design, equipment supply and operation execution.

Steering a Resilient Subsea Supply Chain Through Foggy Weather

A perfect storm is brewing in the subsea supply chain, early engagement is needed to bring fairer weather writes ***Carl Pilmer****, Energy Sales Director at JDR Cables.*

To date, the manufacture of UK-made subsea cables and umbilicals has been a runaway success story, backed by rapid development in dynamic cable technologies and underpinned by enthusiasm for the energy transition. The importance of a strong offshore supply chain is undeniable, ensuring new projects achieve fruition in a safe and efficient way, whilst also protecting and evolving current offshore infrastructure.

However, concerns over the outcome of the government's latest Contracts for Difference round, long lead times to turn new North Sea oil and gas licenses into production, and the far-reaching impacts of the Russian invasion of Ukraine are beginning to see the future look decidedly overcast.

The forecast? Possible storms ahead.

We know that many of these factors are outside of the offshore industry's control. Increasing project costs, heightened East-to-West competition, and M&A deals that have put new energy infrastructure project plans on the backburner, are all percolating together to create a foggy outlook. However, the subsea supply chain is used to turbulence and its resilience has weathered many energy industry storms over the decades.

Early Engagement to Navigate Stormy Seas

One thing that has the potential to bring much fairer weather to the industry is early project engagement. The impact of early engagement is two-fold. First, it brightens the future for those operating within the subsea supply chain and allows it to remain responsive to the needs of developers and confidence in the industry's direction of travel.

But secondly, and perhaps more importantly, we can maximize efficiencies to give those projects – be it oil and gas, offshore wind, hydrogen or carbon capture, utilization and storage (CCUS) – the best possible chance of going ahead. It is always a bitter pill to swallow when we hear that a final investment decision has been knocked back because a project's CapEx or OpEx requirements are too high, knowing if we had been brought in earlier, we could have proposed more cost-efficient design and engineering options.

When we know project details early and gain timely access to final investment decision information, solutions can be efficiently designed and resources planned, helping to maximise investment, as well as accelerating and streamlining project delivery. For example, we have innovated new cable designs to mitigate fluctuating steel and copper costs and supply constraints. As a business, we have also invested in 132kV cable technologies and manufacturing facilities to meet the future demands of higher-powered energy assets.

Making the Most of Subsea Innovation

In fact, most subsea supply chain companies welcome the opportunity to provide design and engineering works so that the details for a proposed project can be as accurate and innovative as possible. With new technologies and incremental improvements being developed in the subsea space all the time, developers can benefit from working collaboratively with the supply chain on their plans.

As an example, at JDR Cables, we have developed a thermoplastic hose solution that is suitable for the longest subsea tiebacks when used with industry standard multiplexed control systems with 25-year design lives. The umbilical

armour provides and major advantage for shallow water seabed stability and has been tested and qualified at depths of up to 2,000 metres, making them ideal for use in places like the North Sea and the Middle East. The solution is also lighter, more flexible and more durable, making it easier to install. As manufacturers of both steel tube and thermoplastic hose umbilicals, when a tender comes in and a thermoplastic hose solution is feasible, it is always our first choice.

Similarly, if we can understand the need for the replacement, there may be more cost-effective solutions to solve the problem. As an example, we are seeing requirements from operators managing ageing infrastructure where low voltage subsea circuits are experiencing insulation resistance problems in terminations of very old umbilical systems. Usually, the thermoplastic hoses are still performing and so a new electrical umbilical with advanced terminations can be installed alongside the old umbilical thus extending the life of the system at a much lower cost.

Supporting the Local Supply Chain

The last few years have seen significant investment in the UK's subsea supply chain and positive intent on local content. We could not be where we are today without it. Yet foreign governments such as China are deeply interested in following this success story and are heavily subsidising Chinese businesses to gain market share. As much as the industry wants to stand on its own two feet, at some point this will become unsuitable, and more proactive involvement from government will be welcomed to ensure new UK energy infrastructure is built making the most of the local supply chain.

It is therefore essential for manufacturers to coach and develop stronger, more resilient and sustainable local supply chains. There is a growing appreciation of this need within the sector. The JDR team and I saw this first hand at a recent event we hosted in partnership with NOF and Energi Coast where the future of supply chains was a key discussion point.

We are committed to doing our part and demonstrating to the developers and operators of offshore energy infrastructure that shoring-up local supply chains, ahead of the anticipated growth in offshore energy, is not only good business sense but also the responsible way to source the critical expertise and technology we can see ahead of us on our low-carbon energy horizon.

The weather for the UK subsea supply chain has been unsettled of late, and ultimately a lot of these pressures are outside of the control of any company. However, small but impactful changes in terms of early project engagement and a continued focus on leveraging the best in innovation stand to help steer the industry to better weather.

The Power of Due Diligence:

Adopting a Holistic 3-Step Approach Can Mitigate CapEx Risk

By Steve Grotsky, Vice President of Engineering, ABS

The Journey to Operational Success

When it comes to any asset capital expenditure (CapEx), investors, owners and operators are actively focused on the question of investment risk vs. investment reward. And while CapEx may present well on paper, the journey to operational success can be full of pitfalls, risks and dangers – both seen and unforeseen.

Although Due Diligence plays a vital role in the risk mitigation process, it is all too often isolated and does not integrate across the plan, design, build and operational lifecycle of the asset. In this article, I will explore the benefits of taking a holistic 3-step strategy that can help stakeholders mitigate CapEx risk in a more effective way. Risk mitigation and global regulatory compliance connects both the Western and Eastern owners, operators, and builders' investments through demystifying the procurement, supply chain, build and operations cycle.

Addressing EPC's in 2023 and beyond means one major issue, and that is making sure the asset and, in this case, an FPSO is operationally and regulatorily ready to operate off the coastal waters of any new oil rich nation. The ultimate risk mitigation of fines, shutdowns and overall non-compliance is centered around Global Regulatory consultancy and regionally based guidance for procurement, onsite engineering and representation of regulatory compliance.

Due diligence means understanding your CapEx costs upfront of local content, regulatory based asset requirements, people requirements and operational drilling and production issues. Adopting a due diligence approach plays a vital role in the project lifecycle that aligns with investment and operational expenditures. The goal is simple, maximize uptime and minimize cost by combining due diligence and regulatory compliance.

A Multi-Layered Approach

I often see clients strive to answer two fundamental questions: 1) How do I substantiate that an idea is viable, and 2) How do I make sure that ROI will hit the target?

These are questions of Risk vs. Reward, and they are not easy to answer - especially when the approval of shareholders and board members hangs in the balance. There are risks at every stage of the plan, design, build, operate and decommission lifecycle, including design risk, regulator risk, manufacturing risk, operational risk and cost risk.

It is a hugely complex maze to attempt to navigate, and it is one that ultimately takes a multi-layered approach to solve. There are pressing questions for investors, owners and operators:

- How can we minimize exposure while maximizing profitability?
- How can we chart as smooth a journey as possible to get the desired outcome?
- Will we get the return needed from the current market we operate in?

However, the overarching question is how do all three (investors, owners and operators) integrate to achieve the outcomes they ultimately seek?

-

Addressing the Value Chain and Stakeholder Needs

Given the sheer scale of an investment of this type, it is crucial to connect all phases of the value chain and understand the needs of all stakeholders by de-risking the planning, design, build, operational and decommissioning stages holistically. The solution lies in developing connected teams across all phases that provide a seamless journey from one stage to the next.

By adopting a 3-step model we can address these challenges. One of key success factors to this is to take a synergized approach to de-risking the asset investment at every stage of the process, enabling the specific project needs to be met while providing clarity and consistency throughout the entirety of the project.

In short, synergy provides a foundation that seamlessly connects money to the asset, and asset to its operational parameters. We also combine this with external expertise in finance, investment, appraisals and specialist advisors, each bringing a unique benefit to the client and in wider cases, the client's client. It's an approach that adds value, mitigating risk and creating efficiencies across the asset lifecycle.

What Does Adopting a Holistic 3-Step Approach to Due Diligence Look Like in Practice?

Let's say, for example, a client wants to invest in a new asset.

Step 1 – Planning and Feasibility

In this beginning step, clients share their ideas and discuss the market opportunity they are looking to leverage. Based on these preliminary discussions, correlating market intelligence and client status, this conversation can include:

- Feasibility studies
- Market Analysis
- Shipyard review
- Owner/operator capability review
- Design Review and Verification

Financing is also critical at this stage. Considerations and research should include:

- Non-Recourse
- Long Term
- Annuity Based
- Cash Flow Generated from revenue.
- Asset Market Demand

At this intelligence gathering stage, consultation will determine viability and feasibility. A positive outcome will often lead to the next step - design.

Step 2 – Designing

Just because it looks like a good idea on paper does not mean it is. Therefore, Step 2 concentrates on any issues and investment challenges a client may face in the design phase. The goal is to identify the main risks at different decision gates by reviewing the commercial, technical and project documentation to ensure that a profitable approach has been taken regarding planned project implementation.

This process covers six major components:

1. Asset (specification and technical review)
2. Manufacturer (shipyard)
3. Charterer (potential user or market; charter requirement review)
4. Operator (track record)
5. Project/project team (experience, past project history)
6. Financier (financial records)

All these major components need to be connected and each party involved. In my experience, an independent specialist with objective third-party advice is vital to ensuring that the investment is sound. This involves workshops, engineering assessments, analysis reviews, and reports – all developed with supporting evidence that can be fed back to investors, boards and financers to support the decision-making process.

It is important to verify the actual goals before moving to the asset and configuration of the service. Oftentimes, the end goal will change throughout this process as we gain information connected to each major component. In short, we take everything we have learned in Step 2 and put it into the asset managing and mitigating risk.

Effectively, we build the asset twice – the first time envisioning the desired result and then testing it. Next, we take that knowledge and build it into the physical asset itself utilizing multi-stakeholder input. Once sanctioned, we will look at the third step in the process.

Step 3 - Construction

The planning and physical build should be undertaken through a Construction Monitoring Program – again designed to manage and mitigate risk by planning, reviewing and monitoring throughout the asset construction period. This should include verifying compliance with the applicable state/local technical specifications, standards, procedures, governmental regulations and Classification Society rules.

The intensity as well as frequency of the Construction Monitoring Program is dependent on the Project Life Stage as well as the Project Risk Profile – leading to detailed monitoring and frequent visits during critical stages of the project and can cover areas including:

- Completion Risks
- Resource Risks
- Operating Risks
- Currency Risk
- Supply Chain Risk

Throughout this step, our team physically visits the chosen shipyard to act on behalf of the client and their investment, helping to ensure that it is technically sound and that the build is progressing as planned.

At Step 3, having specialist expertise is vital to ensure a clear understanding of where the project is and where it needs to be, as well as identifying any potential issues or risks. Utilization of a team of shipping and offshore professionals, former captains, chief engineers, drillers and shipyard professionals who understand the end-to-end process from the first piece of steel cut to commissioning and yard departure is vital to success.

Investment Risk vs. Investment Reward – A Non-linear Journey

Engineering, Procurement and Construction (EPC) projects are large, complex and capital-intensive, which bring with them a unique set of risks at every stage. Answering the question of investment risk vs. investment reward is a non-linear journey that needs to be navigated cohesively from start to finish through the core project phases.

Through this holistic 3-step approach, stakeholders can gain a much greater understanding of the potential risk profiles inherent across each phase, enabling them to make better decisions and ultimately providing a highly effective way to reduce and mitigate risk, enabling a project to achieve its contractual, regulatory and operational milestones better and more efficiently.

BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	7	77	84	92%
Jackup	175	297	472	63%
Semisub	30	45	75	60%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship		15	15	100%
Jackup	14	15	29	52%
Semisub		5	5	100%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	5	9	56%
Jackup	78	78	156	50%
Semisub	17	5	22	23%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship	2	6	8	75%
Jackup	13	29	42	69%
Semisub	7	18	25	72%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship		29	29	100%
Jackup	3	4	7	57%
Semisub	3	7	10	70%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	34	138	172	80%
Drillship				

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	22	23	96%
Jackup	24	27	51	53%
Semisub	2	2	4	50%

Oceania

Rig Type	Available	Contracted	Total	Utilization
Drillship				
Jackup		1	1	100%
Semisub		6	6	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	469.8	High-spec	170.4
Deepwater	361.5	Premium	120.5
Midwater	166.7	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 April 2024
Source: Wood Mackenzie Offshore Rig Tracker

DISCOVERIES & RESERVES

Offshore New Discoveries

Water Depth	2019	2020	2021	2022	2023	2024
Deepwater	20	13	14	22	13	2
Shallow water	86	47	59	35	56	2
Ultra-deepwater	18	12	7	22	12	2
Grand Total	**124**	**72**	**80**	**81**	**81**	**6**

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	588	50,151	22,501
Shallow water	3,252	461,223	154,057
Ultra-deepwater	351	43,969	26,812
Grand Total	**4,191**	**555,343**	**203,370**

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

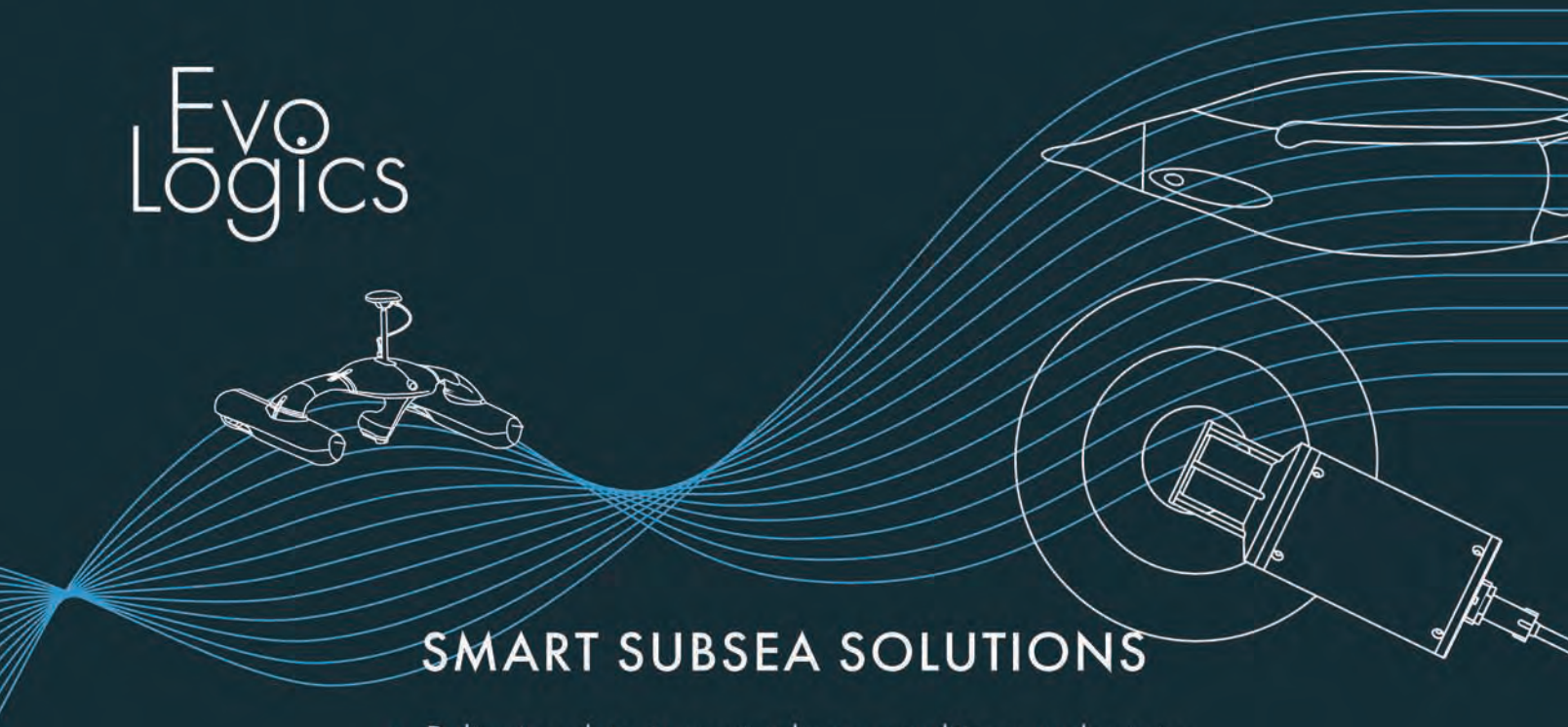
Region	Number of fields	Remaining reserves gas mboe	Remaining reserves liquids mbl
Africa	574	18,959	11,390
Asia	832	14,948	7,521
Europe	761	12,345	11,583
Latin America and the Caribbean	193	6,643	39,937
Middle East	138	87,766	152,459
North America	471	2,555	12,756
Oceania	85	10,823	1,090
Russia and the Caspian	60	17,013	12,716
Grand Total	**3,114**	**171,053**	**249,451**

Onstream and under development.

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

Source: Wood Mackenzie Lens Direct

Evo Logics



SMART SUBSEA SOLUTIONS

- Delivering data in most adverse conditions: underwater acoustic modems with advanced communication technology and networking
- Accurate USBL, LBL and hybrid positioning of underwater assets, navigation for divers
- Modem emulator and multiple cost-saving developer tools
- Sonobot 5 - the autonomous surface vehicle for bathymetry, monitoring, search & rescue, and AUV support
- Quadroin - the novel bionic AUV for surveys and monitoring

UPGRADEDD

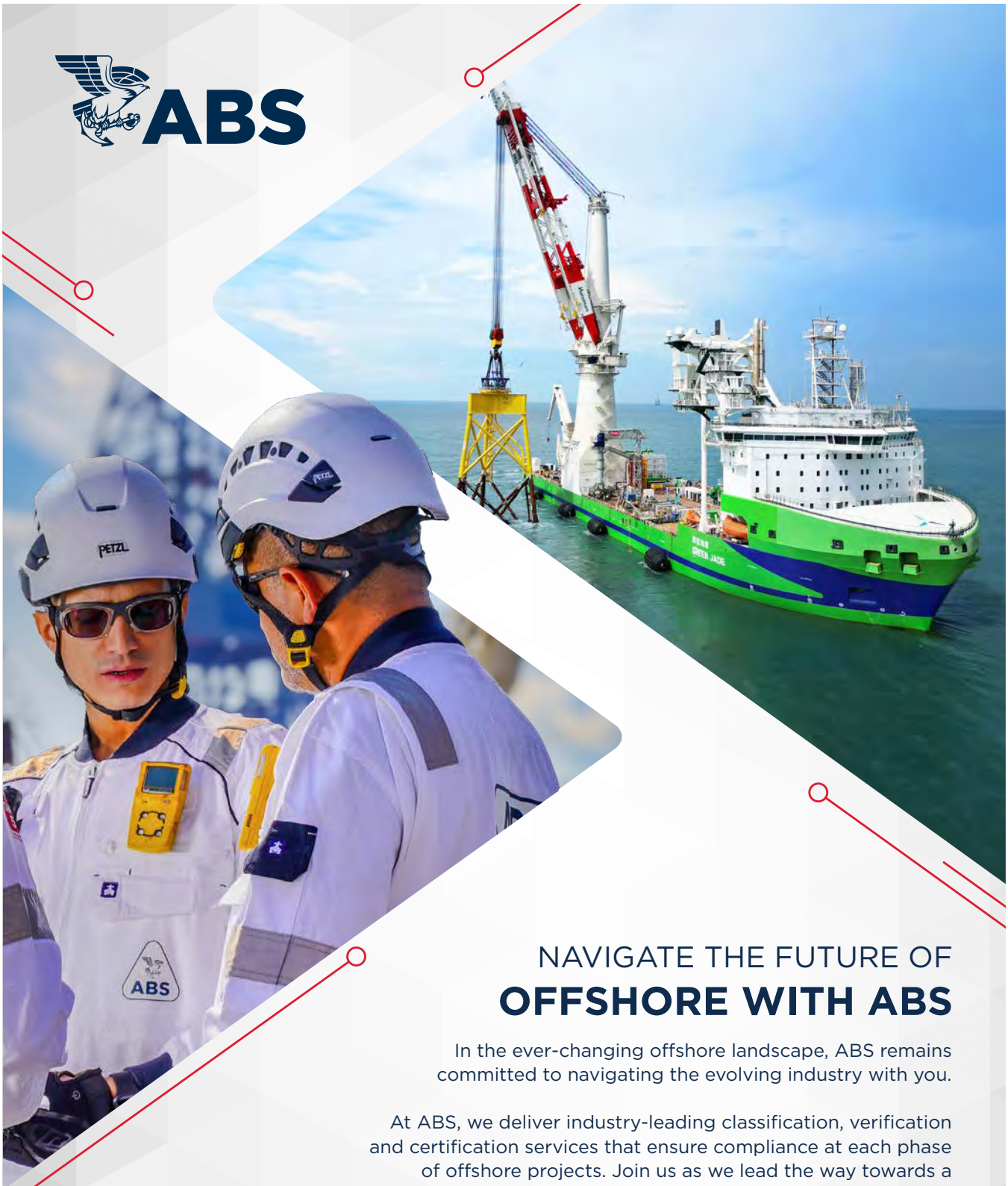
QUADROIN AUV

AVAILABLE NOW

sales@evologics.com
sales-us@evologics.com

EvoLogics.com

ABS



NAVIGATE THE FUTURE OF

OFFSHORE WITH ABS

In the ever-changing offshore landscape, ABS remains committed to navigating the evolving industry with you.

At ABS, we deliver industry-leading classification, verification and certification services that ensure compliance at each phase of offshore projects. Join us as we lead the way towards a **safer, efficient and more sustainable future offshore.**

GOING TO OTC IN HOUSTON?
VISIT THE **ABS BOOTH (3239)**

Explore more at
eagle.org/offshore