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GO FOR THE "GREEN"

Talk of energy transition surrounds us, but driven by geopolitical conflict, talk of energy security sustains us. In doing a final read of this edition, I think London-based ***OE*** correspondent Paul Bartlett's article introduction summarizes the issue succinctly:

"Scientists warn that climate change is the greatest peril that humankind has ever faced. Yet oil and gas exploration is set to clock the highest growth for more than a decade this year and next. Protesters cause disruption but, for the moment, hydrocarbon energy underpins life as we know it."

Well said and executed throughout this edition, as we balance the business of producing oil and gas with the integration of new and emerging renewable technologies. That was a central theme in my interview this month with **Kevin Sligh Sr., Director, Bureau of Safety and Environmental Enforcement (BSEE),** who reflects on progress made and the path ahead one year into his post.

Sligh discussed the myriad challenges and opportunities ahead for offshore energy development in the U.S. With a sharp focus on safety, enforcement and compliance on the Outer Continental Shelf (OCS), Sligh and his team eye the challenges and opportunities in building out offshore wind to the targeted 30GW of offshore wind power by 2030 and another 15GW from floating wind by 2035

Another nascent industry to monitor closely for monetization is the creation of "**Hydrogen Hubs**" as Barry Parker reports in this edition. This was funded in the wake of the massive $1.2T Infrastructure Investment and Jobs Act which authorized spending of $7B on the establishment of regional clean hydrogen hubs. Predictably, the line for this entre is already long, as 79 proposals were received to DOE's initial request for concept papers, with DOE expecting to fund up to 10 such hubs through its H2Hubs program. The green corridors and hydrogen hubs fit nicely together in the U.S. Gulf, and in New Orleans, the H2theFuture consortium is seeking to "…establish a world-leading clean hydrogen cluster in South Louisiana."

Whether it's established energy like oil and gas, or emerging renewables, hydrogen hubs or carbon capture and storage – there's plentiful amounts of "green" flowing to power offshore energy companies through another boom cycle.

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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.

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


Maas


Parker


Sørlie


Tomić


Wilkie

FLOATING OFFSHORE WIND AND THE NEED FOR HIGH-END AHTS

By Theodor Sørlie, Market Analyst, Fearnley Offshore Supply AS

As the world continues to scramble for renewable energy, floating offshore wind has emerged as a key capacity enabler in the coming decades. With no major commercial scale projects currently in operations, the segment is largely based on governments and developers ambitious project plans for the future. Nonetheless, this market segment can offer vast opportunities to the world of offshore support vessels in both near- and long-term prospects.

In this piece, we will discuss the key opportunities and challenges related to offshore floating wind, in addition to the potential implications for offshore vessel owners. Rystad Energy expects a global installed base of 13 GW in 2030, growing to 70 GW in 2035, and both governments and developers seem to agree on the fact that floating wind can deliver green energy at scale in the future.

This translates to developer commitments of roughly 4,000 turbines installed by 2035 in Europe, while Asia will contribute with 850 turbines. An interesting theme is multiple countries leap-frogging straight to the floating space, as opposed to developing an installed base of bottom-fixed capacity initially. Examples of such countries include South Korea, Portugal, Italy, and Spain, which have all announced major projects to be commissioned towards the end of the decade, with no current fixed capacity operational.

The leading developers within the space include oil and gas majors such as Shell and Equinor, pure-play floating developers such as Simply Blue Group, renewable energy majors such as Iberdrola and renewable investment firms such as Copenhagen Infrastructure Partners. We believe developers with existing maritime industry experience will have an advantage in commissioning projects according to

announced timelines, while oil majors current excessive cash flows also contribute positively towards their ability to finance major floating projects.

There are currently hundreds of designs available in the market, where the concepts can be divided into main categories of SPAR, tension-leg platforms, and semi-sub solutions. Looking at the capacity towards 2030, the majority is still un-decided, and we observe a degree of technological risk as a result. SPAR solutions require deepwater port infrastructure and are therefore unlikely to be applied outside of Norway in the near future, while semi-subs are leading in terms of awarded concepts despite being the most material-intensive.

There are still risks of project delays, as developers are prone to input cost increases and higher cost of capital in today's market, risking squeezed margins. Additionally, with the lack of consensus on the concept designs, there is still uncertainty when it comes to fabrication of the substructures, as these are expected to require immense production capacity from yards that are already seeing strong orderbooks from traditional shipping and offshore wind.

Today, we can only count a handful of operational projects globally, which have served as critical case studies to understand the potential OSV demand for the planned capacity additions going forward. Hywind Scotland was commissioned in 2017 with five turbines, followed by Kincardine Scotland at five turbines in 2021, and lastly Hywind Tampen offshore Norway at eleven turbines.

The former Scottish projects are fully operational, while the latter still has four turbines scheduled to be commissioned in the current summer season. Looking at the AHTS requirements from these projects, we can quite confidently conclude that floating offshore wind is more than likely to become the savior for the high-end AHTS fleet after eight years of challenging market conditions.

As floating turbines utilize mooring lines and large anchors to secure the turbine substructure to the seabed in order to create stability, AHTS are utilized for large parts of the installation scope including towing, pre-laying of anchors, tensioning and hook-up. The current method of installation requires substantial tensioning power, while the towing can be performed with less advanced tonnage. When studying the aforementioned floating windparks we found that the vessel days per turbine installed ranged from 25 to 35. This not only serves as a good indicator for what vessel demand to expect in the near future, but also illustrates the need for finding increasingly efficient methods of installation.

However, far from all AHTS are set to benefit from this market development. Based on current and future workscopes, we believe the relevant AHTS fleet towards the floating space will need to have capacity exceeding 220t bollard pull. This part of the AHTS fleet consists of roughly 110 units today compared to the total fleet of more than 1,700 units globally. Segmenting further by reducing the vessels operating in closed markets such as China, Brazil and the US Gulf of Mexico, we count a fleet of around 90 vessels fitting the bill.

The vessel spread involved in the mentioned projects have all been advanced, with the hook-up and anchor installation utilizing especially high-end vessels such as Olympic Zeus, Havila Venus, Skandi Iceman, and Skandi Hera, all with bollard pull exceeding 285t. With the ever-increasing turbine sizes and location of floating projects trending towards deeper waters, it's likely that similar vessels will be relevant for the installation going forward unless we see major technological advances in the immediate future.

When setting a threshold at 300 bollard pull and excluding Chinese and US assets, we count less than 25 vessels today. Newbuilding activity is non-existent due to vessel owners' excessive debt, high newbuilding costs, and lack of available financing, leading to a somewhat fixed supply at least towards 2026. With an expected 350 turbines entering the construction phase in the coming three years and 800 from 2027 to 2029, we find it more than likely that the coming years may very well see sold out AHTS market for the high-end units.

In addition to the installation phase, the operations and maintenance phase is also expected to drive AHTS demand. Some industry averages suggest that one in every hundred mooring lines will need replacement annually, which will add up to considerable vessel needs when the installed base reaches commercial scale.

Finally, it is pertinent to note that the capacity coming from 2025 onwards is likely to be built in a market where oil and gas enter a new super-cycle, leading to fierce competition for the same tonnage. In conclusion we find both floating offshore wind and especially the high-end AHTS vessel segments to be key growth markets with very exciting prospects going forward.

Moreover, as most of the world's technical offshore wind capacity is found in water depths exceeding 50 meters, it is only a matter of time before the market transitions towards floating offshore wind as the main market. According to IEA for example, around 80% of the global offshore wind capacity potential comes from floating wind parks, which was confirmed by the latest ScotWind auctioning round last year where more than half of the total 27.6 GW awarded was won by floating projects.

SOMEWHERE, OVER THE HORIZON. ROBOTS FLY.

Greensea Systems' OPENSEA Edge™ and Safe C2™ can keep ROV pilots onshore – reducing risk and costs

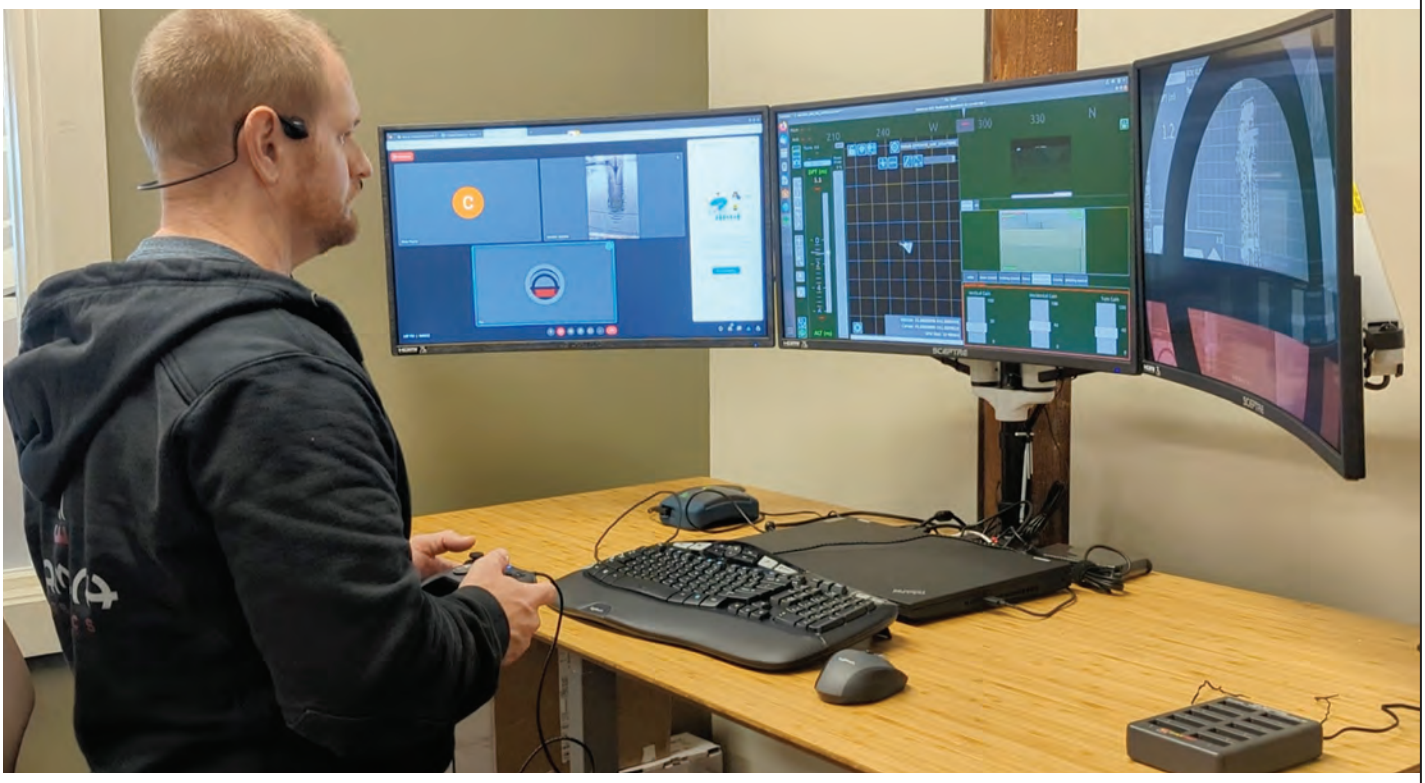
With thousands of miles of pipeline and infrastructure to inspect, the use of ROVs for inspection and intervention tasks are normal operating procedures for offshore energy. The ROV team often consists of multiple pilots or subject matter experts along with launch crews and maintenance personnel. This adds up to a lot of crew members needed just to operate the ROV from a floating vessel.

What if the ROV could be controlled from an entirely different location? This is where Safe C2 comes in. The idea behind the Safe C2 technology originated from use in the military for explosive ordnance disposal. This is a very clear case for getting the ROV crew as far away from the vehicle as possible in case of accidental explosion. For offshore energy, the motivating factors behind moving crew off the offshore vessels aren't quite as clear cut as being blown up, but there is a reduction to employee risk if crews stay onshore. It also frees up more ship space while providing an alternative to crews going to sea.

The technology hurdles

Moving the crew further away poses several technology hurdles. The first is data management. ROVs transmit a large amount of data along the tether to the crew on the surface. High definition video and sonar data are really big chunks of data that are happy to run along the high bandwidth of fiber optic or ethernet cables in the tether. Once that data needs to be transmitted over the lower bandwidth connections of radio, cellular, or satellite, problems appear. Safe C2 addresses the data management challenge by reducing and managing the amount of transmitted data to optimize whichever communications link is available while dynamically allocating bandwidth based on tasks.

The next technology hurdle to overcome is the operator situational awareness. When the crew is onboard the vessel there are several physical and visual clues that the ROV operator is processing while flying the ROV. When these clues are removed, the technology has to compensate for this loss of situational awareness. In addition, Safe C2 also addresses the length of time and further distance that the data needs to travel. It does this by managing the latency and synchronization of the data stream. It also provides user interface elements that are optimal for situational awareness.



One of the remaining challenges to overcome if the crew is no longer on the vessel is tether management. Safe C2 provides active and autonomous tether management which includes tether modeling in the water column that predicts the optimal length required.

Remove the tether

With Safe C2, the crew is removed from the surface vessel but there is still a physical tethered connection between the subsea ROV and the surface vessel. But what if you could remove the tether completely? This is where OPENSEA Edge comes into play (along with acoustic modems and batteries). Acoustic modems are, for the most part, a low bandwidth and high latency means of communication. Small pieces of data take a long time to travel. One way to avoid the small/slow data lane is to not send any data at all and let the ROV do the processing. OPENSEA Edge does exactly that – putting the processing power on the ROV so less data is sent by the acoustic modem.

OPENSEA Edge is a hardware and software stack residing on any ROV. OPENSEA Edge includes the OPENSEA robotics platform providing data processing, navigation, autonomy and vehicle control; Safe C2 communications package and additional space for any third party artificial intelligence and machine learning libraries. Armed with AI software such as automatic target recognition, the ROV processes its own data, sending alerts when it recognizes objects of interest and sending data only when needed to an operator on-the-loop, who can intervene or instruct only when needed.

Once the ROV can pick up some of the processing power, operators change from pilots commanding every move, to supervisors observing, ready to pass on instructions as needed. Armed with batteries and the ability to recharge subsea, the ROV can now become a resident ROV and the ROV supervisor can manage not just one ROV but entire fleets of ROVs.

Safe C2 and OPENSEA Edge have been successfully demonstrated at sea using both tethered and untethered ROVs. During Offshore Technology Conference, Houston, TX in May, Greensea will be demonstrating the Safe C2 technology.

AFRICAN FLOATING RIG MARKET CLOSE TO SOLD OUT

A noticeable recovery in the West African offshore floating rig market (semisubmersibles and drillships) has been slower to arrive than the other two points of the Golden Triangle – Brazil and the US Gulf of Mexico – but now appears to be well underway.

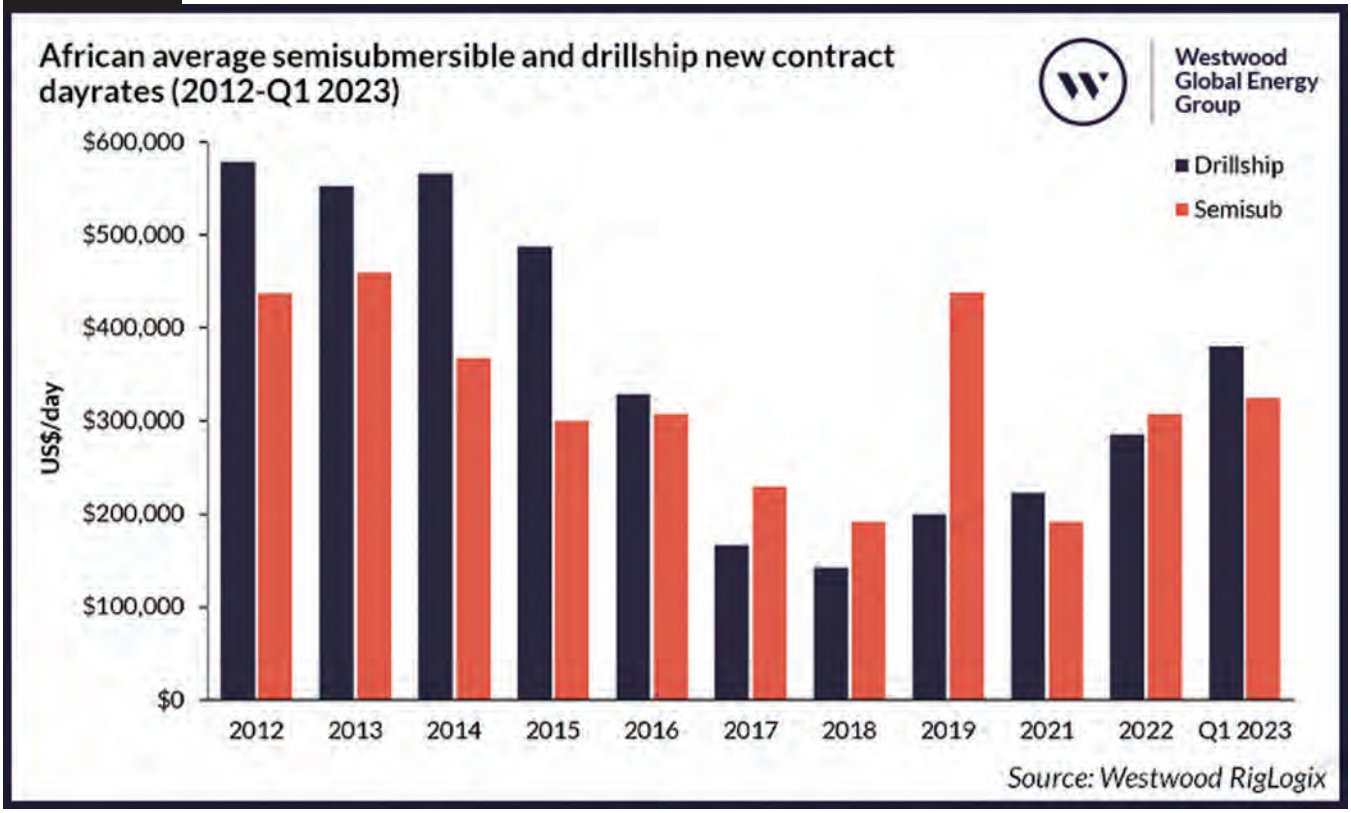
By Teresa Wilkie, Research Director, RigLogix

As of March 2023, marketed committed utilisation within the combined East and West African floater market had increased to 92%; its highest level since 93% in July 2013. Over the past year alone utilisation has risen over 10 percentage points and since March 2021 it has rocketed up by almost 30 percentage points.

This recovery has been majorly aided by a sizable decline in marketed supply. Between the height of supply in July 2014 to the trough in June 2020, the fleet shrunk by 20 semis and 19 drillships as units were cold stacked, retired or moved out of the region due to paltry demand.

Although there are still five cold stacked floaters in region, there are just two marketed units that are not currently on hire or have future work lined up, namely semis Scarabeo 5 and Aquarius. Meanwhile, the drillship segment is now fully utilised with no availability until 3Q 2023, when Diamond Offshore's Ocean BlackHawk finishes its current campaign with Woodside Energy offshore Senegal. There are five further drillships that could become available in 4Q 2023, but all have options that could extend them into 2024 or further if exercised.

Figure 1



Marketed supply in the region has been inching higher since the low of 2020. Currently sitting at 23 units, this is five rigs higher than it was in March 2022 and seven rigs higher than March 2021. This is the result of the likes of Blackford Dolphin, West Bollsta and Island Innovator, moving in from other regions such as Mexico and the North Sea for lucrative new jobs, or due to idle units in Las Palmas having been reactivated.

Higher demand is also behind the tightening market and as can be seen in Figure 1, floater demand is 47% higher than one year ago and 114% higher than the same period in 2021.

Recent Giant Discoveries Buoying Demand

Outside of the two traditionally popular areas of demand of Angola and Nigeria, new exploration and discoveries have been significant contributing factors to rig demand shown in Figure 2. Namibia, a country which until a year or two ago had limited drilling activity, will by the middle of this year have three rigs operating in parallel following large discoveries from TotalEnergies and Shell. There are also additional requirements in the market from operators to bring further rigs into the country for more wildcatting activity this year and the next. Meanwhile, Cote d'Ivoire has also seen an increase in floating rig contracting activity following Eni's large Baleine discovery, which it plans to put into production just 18 months after the initial discovery was made.

Of the backlog secured for work in African waters from January 2022 to March 2023, 25% was for exploration and appraisal purposes and the remaining 75% for development work.

Supermajors continue to dominate in the region, with the top three largest users of deepwater rigs: TotalEnergies, Eni and Shell accounting for 74% of the secured backlog days since the beginning of 2022. These three operators are especially prevalent in Angola, along with BP/Eni joint venture Azule Energy, while they are also the main companies behind the recent Namibia and Ivory Coast discoveries. In Nigeria, contracting during the period saw 38% of contracting activity coming from smaller homegrown companies, while the remaining 62% was secured by supermajors.

Figure 2

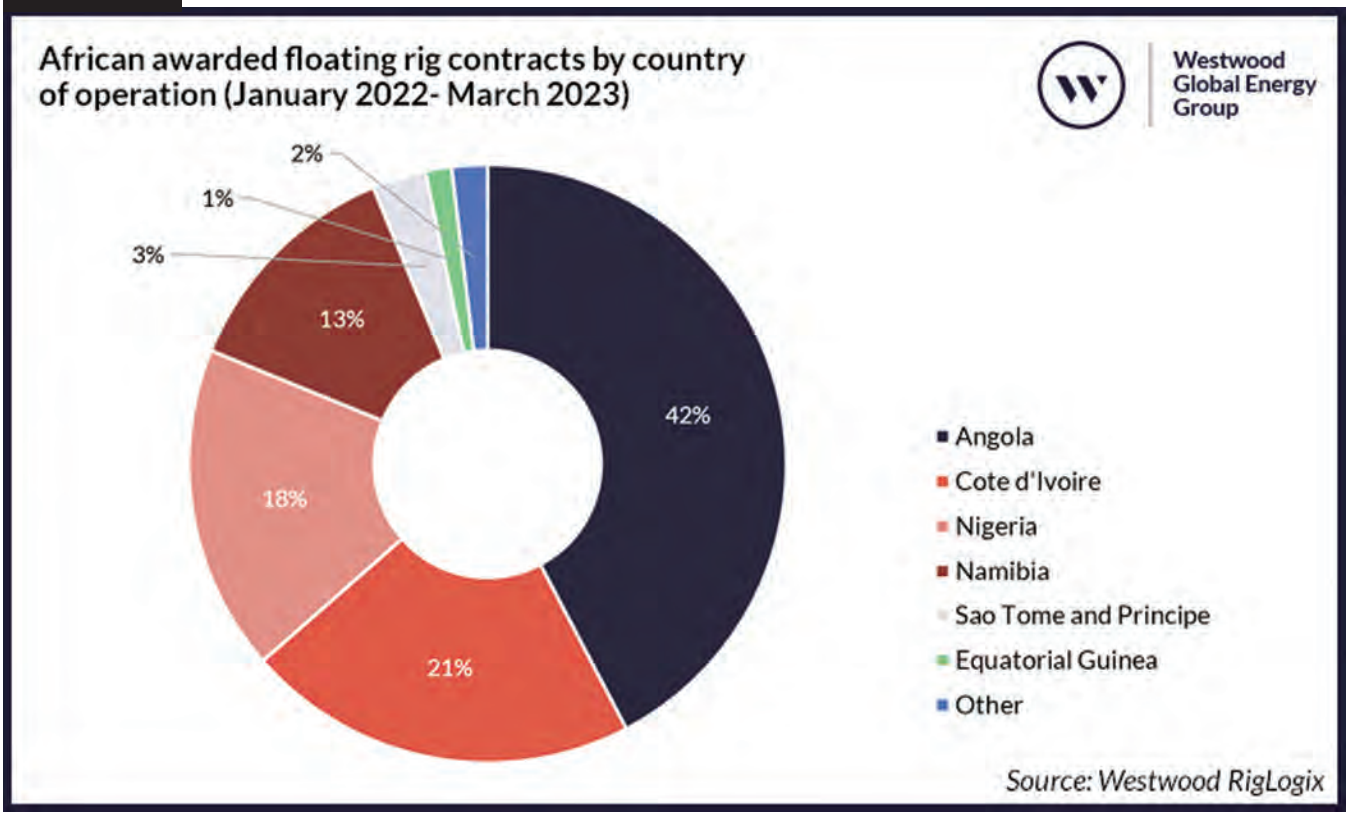
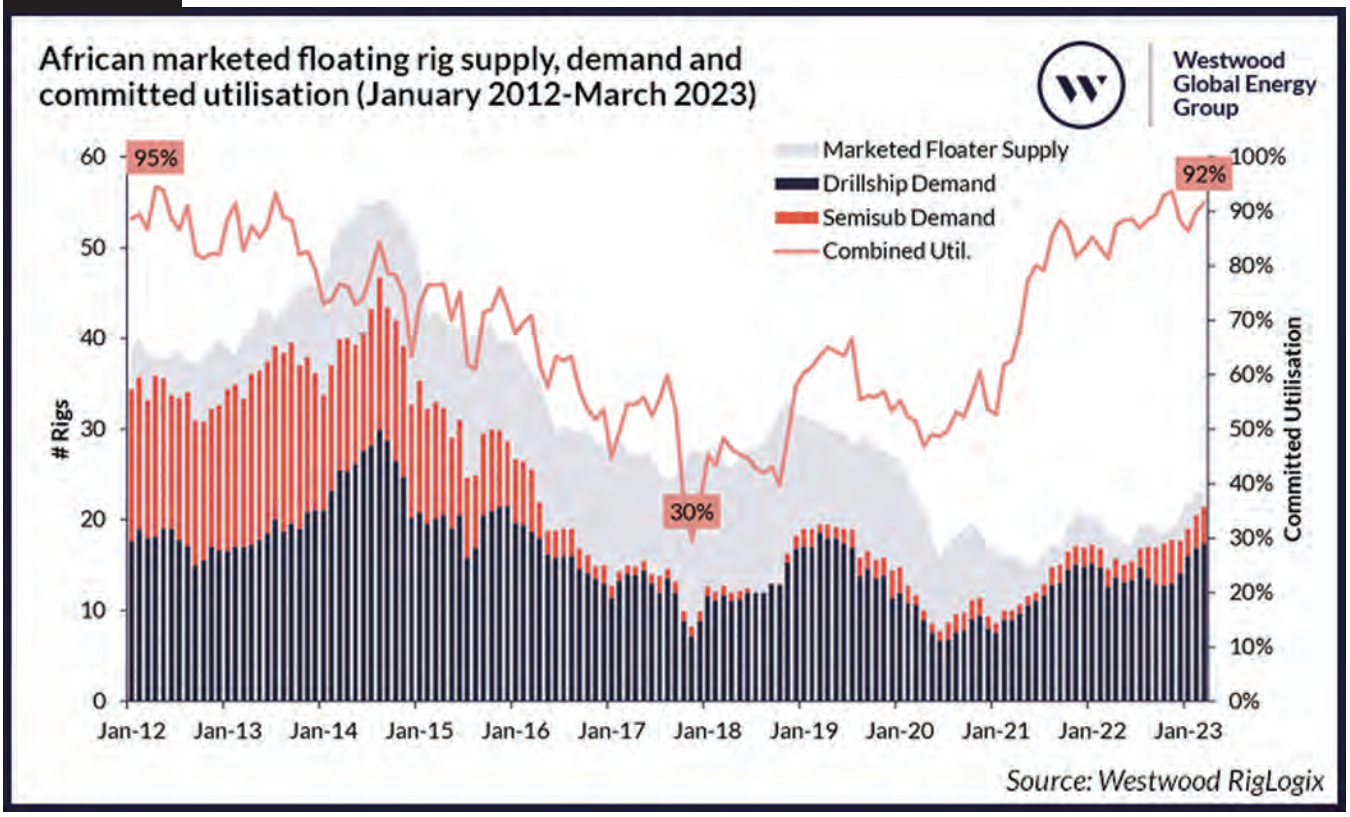


Figure 3



Dayrates moving higher

As has been previously reported by RigLogix, dayrates across most rig types and regions have been rising rapidly with global floater dayrates on average 9% higher than this time last year and 49% higher than the same period in 2021, and the African floater market is no exception.

Although dayrates in the region have not recovered to the same sort of levels (circa $400,00-$550,000 per day) recorded pre-oil price crash in 2014, there has been a noticeable upward movement. Since the lowest year of demand in the region in 2018 until the first quarter of 2023, dayrates for semis have increased on average 69% ($133,000), while drillship dayrates have increased by 168% ($238,000). In the past year alone, floater dayrates overall have increased on average 24% ($69,000).

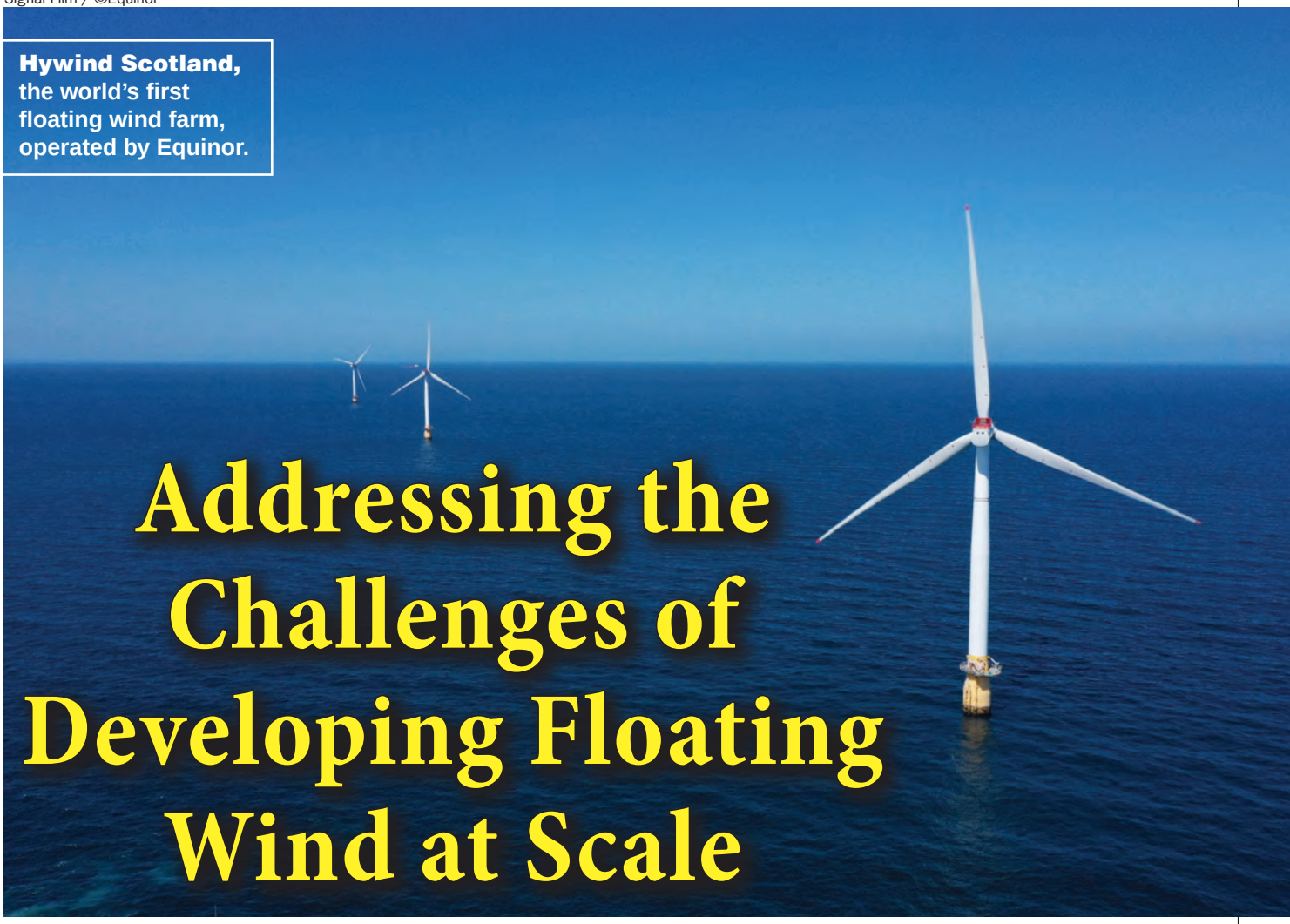
During the first quarter of 2023, African drillship dayrates have been fixed at a high of $380,000, while a semi was secured at a dayrate of $325,000. However, it should be noted that some of these contract values and dayrates include a mobilisation and/or demobilisation fee which can significantly amplify the "clean" dayrate.

What's next for the region?

In addition to rising supply, demand, utilisation and dayrates in this region, other indications of a market recovery include increasing contract duration and options being exercised on a more regular basis. Also, further tonnage is set to enter the region this year with newbuild drillship Deep Value Driller already confirmed for Eni's long-term campaign off Cote d'Ivoire, while another rig from the North Sea, Deepsea Mira, will be mobilised in to work off Namibia.

There are a few multi-year requirements remaining in the market from the likes of Angola's Azule Energy, as well as several shorter-term exploration campaigns for work starting in 2023 and 2024. With the market close to sold out it is likely that more rigs will be brought in to cover this additional demand. We expect to see further newbuilds being bid into the region as well as units from areas with weaker demand, such as the North Sea. Additionally, with the improvement in dayrates, it is also likely that some drilling contractors will evaluate the possibility of reactivating cold stacked units, if the right terms can be agreed.

Signal Film / ©Equinor



Hywind Scotland, the world's first floating wind farm, operated by Equinor.

Addressing the Challenges of Developing Floating Wind at Scale

Tens of gigawatts of floating wind projects are slated for development in this and the next decade, but many obstacles remain.

By Philip Lewis, Research Director of Intelatus Global Partners

There has been much focus on the emerging floating wind market of late.

The U.K. is forging ahead with commercial scale floating wind developments through the Scotwind and INTOG awards of at least 24 gigawatts (GW) of floating wind capacity representing close to 1,500 floating turbines that will come on stream through 2030. And this will be soon followed by the award of at least 4 GW of capacity through the Celtic Sea floating wind auctions. The U.S. has awarded floating wind leases with a potential of over 8 GW of capacity in the Pacific and will move ahead with large floating wind leases in the Atlantic this

year. Norway is planning to award 1.5 GW of floating wind capacity at Utsira Nord this year and France is targeting bring 750 megawatts (MW) of floating turbines on stream at the end of the decade in the Atlantic and Mediterranean. Spain and Portugal are entering the fray with announcement of multi-gigawatt floating wind aspirations. In Asia Pacific, developers are navigating their path through a complicated permitting framework, where the prize is over 8 GW of floating project potential, mostly off the east coast Usan region. Australia and Japan are also the subject of much interest. This is not an exhaustive list of countries with floating wind aspirations, but a selection of the most discussed.

This all sounds very positive – tens of gigawatts of floating wind projects driving demand for suppliers and contractors in this and the next decade. However, many obstacles remain to delivering on these aspirations. This article goes on to discuss some of these challenges that must be addressed:

• ***Permitting:*** A feature of offshore wind is the disconnect between aspirational targets and what is realistically achievable in terms of leasing and permitting. An example is Portugal, which has till now permitted less than 100 MW of offshore wind capacity, yet plans to auction, permit and deploy 10 GW of mostly floating wind by 2030. While it is realistic to expect Portugal to award leases for 10 GW by 2030, it is an optimistic timeline to permit, build and deploy the capacity within the time frame.

• ***No one standard technical approach:*** Although most projects will deploy one of three broad concepts to support the turbine, a semis-submersible (V-column or barge), spar (buoy or hanging counterweight) or tension-leg platform (TLP), there is an ever-growing number of technical solutions being offered. This drives the need for flexibility in the supply chain.

• ***Industrialized substructure manufacture:*** Using the example of permitting applications for U.K. floating wind projects, developers are seeking design envelope approval for structures with footprints of up to 15,000 square meters. We expect to see substructures in the 5,000-10,000 square meter range. The substructures will weigh each weigh a minimum 3-5,000 tonnes if made from steel and up to 20,000 tonnes if made from concrete. On a 1 GW wind farm, over 60 of these will be required in, most likely a two-year delivery window.

• ***Ports:*** Deep draft ports will be required to assemble, launch, support turbine integration, store and maintain structures that will feature turbines with rotor diameters over 220 meters. Floating wind ports will likely host large submersible barges, to transfer and launch substructures, as well as some extremely large quayside cranes, of which there is currently insufficient supply.

• ***Turbine supply:*** Three western OEMs currently dominate the market outside of China: GE, Siemens Gamesa and Vestas. We anticipate the rise of Asin OEMs, and particularly the Chinese OEMs who are developing 16-18 MM turbines, which only push the potential size of structures even bigger.

• ***Dynamic cables:*** Floating wind projects will feature subsea cables, and particularly the inter-array cables that connect the turbines, that are different in nature to bottom-fixed wind. New manufacturing capacity is required. Installation of these cables will also call on the subsea fleet, which is increasingly occupied in the oil and gas segment.

• ***Floating substations:*** Till now only one floating substation has been demonstrated. Although the concept should be familiar to developers of deepwater oil and gas projects, new concepts are required.

• ***Installation vessels:*** It is often said that floating wind projects require "small" and readily available tugs to support installation. This is not the case. The highest bollard pull anchor handlers featuring the largest clear back decks and biggest chain lockers will be a minimum requirement for many floating wind projects and may even be considered technically inefficient. A new asset class concept suitable for floating wind projects is emerging. These feature bollard pulls in well in excess of 300 tonnes, back decks over 1,200 square meters, AHC cranes with a minimum 250 tonnes capacity and chain clockers to accommodate multiple mooring spreads. It is hard to see these vessels being financed and built in numbers without firm commitments to long-term deployment. To date, we have not seen such commitments.

• ***Major component repair and exchange:*** Do you tow the structure to port for maintenance as has already been done with one pilot array? Do you maintain in-situ with either floating cranes or turbine mounted cranes, for which there are currently limited technical options? This is a question that the industry is working on but still needs further development.

The floating wind segment presents a great opportunity to advance renewable energy supply and support the offshore and marine industry. But many challenges still need to be addressed to make projects and new supply chain investments financeable and realizable.

DNV

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And as the maritime industry changes, becoming more competitive and complex, we look forward to continuing to cooperate. Using our expertise and deep technical experience to set industry standards, advance safety, enable sustainable performance, and build trust.

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All images: DNV

DNV CELEBRATES 125th ANNIVERSARY OF OPERATIONS IN THE U.S.

Offshore Engineer recently interviewed Antony DSouza, Executive Vice President and Regional Manager, Americas DNV, to mark DNV's significant milestone of 125 years of operation in the United States, and to learn more about the company's path from having a single surveyor in the U.S. in 1898 to currently having nearly 1,200 experts in the country.

By Bartolomej Tomić

OE: The world has seen a lot of challenges during the last two years. What do you see as the key challenges and opportunities for the offshore energy industry, specifically?

If you look at the oil and gas industry before the pandemic, it was already going through a downturn that was then aggravated by the pandemic crisis. It put the industry on hold, especially when it comes to investing in future projects. The companies were not fully ready to just go back at full speed for capital projects.

In the past, the oil and gas industry spent about $500 billion a year on capital projects. That has gone significantly down. But then, in the last two years, things have started returning to normal, businesses started opening, and consumers are spending money, needing goods and services to be delivered. That brought up the need for energy, and of course, the Ukraine War put more demand for energy security and supply.

So, now the industry is back to a normal level, but we are still worried about how sustainable this demand is going to be. The companies are going to be more careful in committing capital to future projects, and I think they will be very selective in picking their projects.

Also, the supply chain complications that we see because of the pandemic put a strain on their plans for future projects. In fact, some companies put their project on hold and deferred those projects for a couple of years until the supply chain becomes normal.

So, I think you will see the demand is coming back, and the companies are getting more comfortable, but with the worry about how sustainable this demand will be.

Also, the offshore wind industry is very buoyant because of the policies around the world. Even the Ukraine war actually gives some incentive for companies to fast-forward some of the commitment to cleaner energy.

In the U.S.A., you see the Inflation Reduction Act that commits policy on government funding that will motivate people to look at offshore wind more positively.

There are some challenges with grid integration, and [it remains uncertain] whether the grid is ready to take on all this [offshore] wind energy planned by 2030. [Ed. Note – The United States has set a goal of installing 30 GW of offshore wind by 2030]. The grid needs to be upgraded. Also, there are issues with the supply chain and the infrastructure limitations that we see from the pandemic. Still, by the time these projects mature, I think the industry will be ready to commit to the offshore wind industry.

OE: The topic of collaboration is a vital part of driving transformation, particularly as the offshore energy industry faces myriad emissions reduction and energy transition challenges. Do you feel the industry as a whole is moving in the right direction here? What more can be done, and how is DNV driving collaboration in the offshore energy sector?

We see companies are pivoting from being oil and gas companies into becoming energy companies. Because of the policies around the world, energy security, and new energy needs, everybody agrees that we really need to collaborate. It will not come from one company or one particular fuel. So, DNV has been very vocal in all the public forums, saying that the future fuel is collaboration; the more companies come together, collaborate and understand their own position in the whole energy mix, and their contributions, the better.

Stakeholders of all kinds—supply chain, policymakers, the big energy industry, and manufacturers—need to come together and make this work. I can see in almost every conference I attend these days, people talk about collaboration more than ever, and are willing to share what they are doing with others, hoping that others will engage with them so that we don't have to duplicate efforts, and go forward.

OE: DNV is celebrating 125 years in the U.S., an impressive milestone. Can you give a brief background on why this then-young Norwegian classification society back in 1898 decided to cross the ocean to establish itself in the United States, and also, what are some of the highlights of DNV's long history in the country?

First of all, I just want to emphasize how proud we are of our long history in the United States, with the market

expertise we have built up, our highly capable resources within U.S., and importantly of the fruitful and lasting customer relationship that we've established over 125 years. DNV actually grew from one surveyor to close to 2,000 employees in the U.S. alone in this period.

The short answer to your first question is we followed the customer. That's how we ended up in the United States. By the end of the 1800s, there was a big transformation from wooden ships to iron steamships, quite a contrast to current developments in areas such as digitalization and decarbonization. We just followed those iron steamships, and there was a need for us to go to places like U.S. and China and other places, to establish a presence there so that our clients could be serviced locally.

Our first surveyor's name was Hans Johansen. A very experienced surveyor, Johansen arrived in New York City in 1898 and established the first DNV office; and now we are celebrating our 125th year in the U.S.

I'm actually getting some congratulations letters from government officials, and our clients. So it's very good to see that people acknowledge what we've contributed to the United States.

OE: On that note, what are some of the highlights of the DNV's long history in the country? So what are the contributions?

We initially established our office to serve the maritime industry, but in the 1980s, DNV recognized the growing importance of the petrochemical industry and expanded its focus. As a result, Houston became a crucial base for DNV, and today, our Americas headquarters is located in Houston, Texas. This office has become a center of excellence for the offshore drilling and production industries and a hub for equipment manufacturers.

In addition to serving the maritime industry, we also became a major player in the offshore market from the 1980s onwards. We have led or participated in many record-breaking efforts in the deepwater market and are proud to remain an active player in that market today. Looking ahead, with the energy transition aiming to shift from fossil fuels to cleaner sources by 2050, we still believe that oil and gas will continue to play a significant role for a foreseeable time.

We expect oil to remain an active part until 2035, with gas playing a very important role even beyond that point.

Today, we have about 39 offices in the United States, and are very well represented in almost all parts of the U.S., including Hawaii and other places.

OE: So, what are the key themes DNV's discussing with its client base in the U.S. in 2023? What DNV services and innovations are you delivering this year to customers and stakeholders in the region?

We allocate 5% of our revenue towards research and innovation, which provides X.Y. with significant foresight for our stakeholders. Our publications, such as the Energy Transition Outlook and the Path to Zero Carbon, are highly sought after by both our clients and the general public. Many companies even utilize our reports in their board meetings to help develop their own strategies.

Lately, in the past five years, we know that we are going to achieve more efficiency through digitalization. So, as part of our research and innovation, we invested heavily in digitalizing our services and also to help our clients digitalize. That was between 2016 and 2020, and because of that, when the pandemic hit, we were fully ready to do things very remotely or work from home, and our services were delivered seamlessly during that time.

But in the new strategic period, from 2021 to 2025, our focus has been mostly on decarbonization. We are exploring various options and technologies available, not only in the maritime and oil and gas industry but also in other industries where we operate. Our goal is to leverage these technologies and bring them to the industries we work in, to assist our clients in their decarbonization efforts.

Decarbonization is going to be on everyone's agenda, especially with some of the policies that are coming out of Europe, the emission trading systems that really require companies to pivot and do their part and make sure that they don't get penalized so that they can trade with the European

countries without penalties. So, we are helping our clients to measure their emissions, document them, and verify them in a way that their stakeholders can trust those reports.

In the race towards decarbonization, there is a pressing need to discover the fuel of the future. According to DNV, this won't be just one single fuel; it's going to be many. However, the challenge is determining these fuels' suitability in the short and long term. So we are helping our clients navigate that complex landscape with confidence.

OE: Obviously, the offshore oil and gas business in the U.S. is well established, but the offshore wind business is in its infancy in the U.S. With DNV's long history in Europe and Scandinavia, which have a generations lead on U.S. offshore wind, what lessons learned or a device can you offer to the industry as whole as these established markets and emerging markets mature together?

DNV is a leading classification society and risk management service provider when it comes to the energy industry, particularly in the offshore sector.

The offshore wind industry requires significant funding, and committing capital can be relatively risky, but the industry needs the size and scale, along with policy support. DNV has gained considerable experience from our work in Europe, which we are now applying to new locations like U.S. and Korea.

The regulatory framework [in the U.S.] is not ready yet. For instance, it took around 20-30 years for the first FPSO in the U.S. Gulf of Mexico to gain acceptance. The U.S. Coast Guard collaborated with DNV, and that collaboration served as a basis for the U.S. Coast Guard to come up with a policy letter for FPSOs. DNV is now replicating this effort for the offshore wind industry.

Bottom-fixed offshore wind technology is proven and relatively easy to implement, which is why its development on the East Coast of the United States is progressing more rapidly. However, offshore wind development on the West Coast is expected to take more time due to California's strict environmental policies. DNV will work closely with its clients, policymakers, and regulators to navigate the regulatory policies in a way that is both environmentally friendly and sustainable.

There is also the importance of collaboration. We think that many competencies needed for the offshore wind industry can be found in the offshore oil and gas industry, where the U.S. has a solid base. In the south, they have a lot of experience working offshore, and those skills are readily transferrable to the offshore wind industry. We already see that many oil and gas experts are moving into the offshore wind industry. And if you look at the supply chain, turbine manufacturers, cable manufacturers, they're all used to supplying similar equipment to the offshore oil and gas industry. So the supply chain is relatively ready as well.

From the DNV side, we have built strong expertise within renewables in U.S., where we now have about 1,200 experts to support this industry.

When it comes to the local content, that may be a little bit challenging, especially on the west coast. Still, it is natural that all these [offshore wind] companies will eventually set up shops to support the offshore wind industry closer to where the action is.

Editor's Note: The interview has been edited for brevity and clarity.

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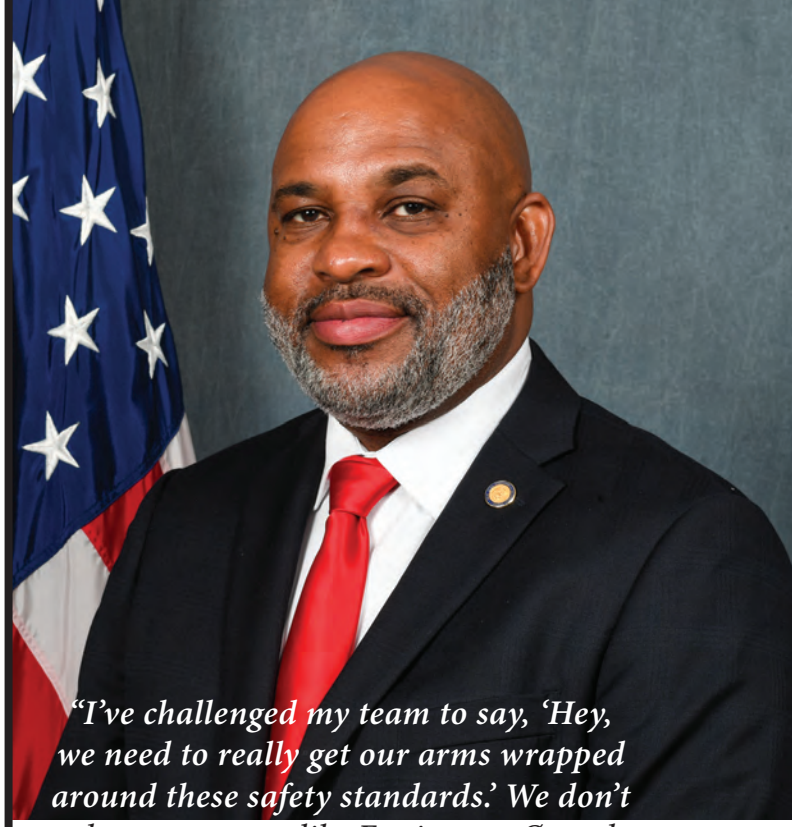
BSEE GEARS U OFFSHORE WIND O

*After his first year on the job, Bureau of Safety and Environmental Enforcement (BSEE) Director **Kevin Sligh Sr.** discusses with **Offshore Engineer** the myriad challenges and opportunities ahead for offshore energy development in the U.S. While the Bureau of Ocean and Energy Management (BOEM) handles the leasing side and permitting side, BSEE now owns the engineering reviews. With a sharp focus on safety, enforcement and compliance on the Outer Continental Shelf (OCS), Sligh and his team eye the challenges and opportunities in building out offshore wind to the targeted 30GW of offshore wind power by 2030 and another 15GW from floating wind by 2035.*

By Greg Trauthwein

UP FOR VERSIGHT



"I've challenged my team to say, 'Hey, we need to really get our arms wrapped around these safety standards.' We don't need one company like Equinor or Ørsted or Dominion working on their own. We need to have consensus-based safety standards that will then be incorporated by reference back into our new 285 Reg that we anticipate we'll be putting out a notice of proposed rulemaking by the end of the year."

Kevin Sligh Sr., *Director, Bureau of Safety and Environmental Enforcement (BSEE)*

How do you see the U.S. offshore energy production changing today, and what are some of the key safety and environmental concerns from the BSEE'S perspective?

The first few [Offshore Wind] projects' Construction Operation Plan (COP) were approved by BOEM years ago, and we're starting to look at those engineering reports. The COP is the envelope of what could be built from a turbine and electrical substation facility off the coast. And now we're getting into what they really want to put on the OCS, as in a few years technology changes, from the monopiles to the supporting beam to the blade sizes. Now we're taking a harder look to make sure that the plans are sound and structurally safe before we give a no objection.

We are committed to this administration's 30 by '30, which is 30GW (of offshore wind power) by 2030, and then 15GW by 2035 for floating offshore wind. We are learning as fast, and while I don't want to say we're building an airplane while we're flying, we're close to it, and we are exceeding our expectations on these first few projects.

What challenge does BSEE's responsibilities on offshore wind bring to the organization, and how is regulating offshore wind energy different compared to your usual work in the offshore oil and gas sector?

While we are the lead for safety and environmental enforcement and compliance, BOEM is responsible for the leasing and the NEPA [National Environmental Policy Act] work that goes on.

So in conjunction, we are both leads; we just have our respective lanes. Now that the split has occurred, we are coordinating reviews. Those FDR [Facility Design Report] and FIR [Fabrication and Installation Report] reviews are being coordinated between BSEE and BOEM. We've brought on the Army Corps of Engineers and their

engineering expertise to help us do the facility design and facility installation reviews moving forward. As offshore wind ramps up and Congress has provided us personnel to do the work, we're in the process of a huge hiring phase, hiring new engineers to be able to do the work and also building out and creating standard operating procedures and notice the lessees to make sure that we're as transparent as possible in communicating with industry.

[Looking at how oil and gas differs from offshore wind], I think they are different risk profiles, and in the future, I will flag carbon sequestration, as we're currently working on a rule with BOEM to figure that piece from a regulatory standpoint. [While offshore oil and gas and offshore wind] are different risk profiles, ultimately, it's all about trying to deliver energy for our country.

How does BSEE see offshore wind energy developing in the coming five years?

Great question, Greg. Within the next five years, we're expecting approximately 24-25 offshore wind projects on 19 leases to be in commercial operations or the late construction phase.

By 2028, we'll be up to almost 2,000 turbines on the OCS on those 19 leases, along with 44 electrical substations offshore.

Think of the floating production facilities in the Gulf of Mexico and off the coast of California, 44 of those alone off the east coast [with more to come on the west coast and Gulf of Mexico]. With that, this administration is focusing on high-paying union jobs and skilled positions to be able to build out all of the different needs that are going to occur on the OCS. We're going to stimulate local economies.

What do you see as the primary challenges to having offshore wind energy develop as you envision?

This industry's been around for a long time; onshore here domestically, offshore internationally. There's a lot of regulatory insights that the international community can bring to bear and help us out with. But I go back to my Coast Guard and FEMA emergency management roots; it's coming up with consensus-based safety standards. That's going to be the challenge.

You have different entities … American Clean Power … American Petroleum Institute … the Offshore Operators Committee here in the U.S., and other organizations that are all working on their own standards. I've challenged my team to say, 'Hey, we need to really get our arms wrapped around these safety standards.' We don't need one company like Equinor or Ørsted or Dominion working on their own. We need to have consensus-based safety standards that will then be incorporated by reference back into our new 285 Reg that we anticipate we'll be putting out a notice of proposed rulemaking by the end of the year.

Staying on that safety note, can you describe BSEE's process for conducting inspections of offshore energy production activities and specifically how it ensures adherence to those safety regulations?

In the case of [offshore] oil and gas, we have about 120 BSEE inspectors that go out on the road to the Gulf of Mexico, to the west coast, and to Alaska to conduct risk-based inspections.

We're in the nascent stages of building out what that's going to look like for offshore wind. Do we need that many inspectors to fly out to these turbines? I don't think so. Do we need inspectors to be able to go onto these electrical substations? Of course.

So right now, we're working on an inspections program for offshore wind … an inspections program to make sure that the OCS as it relates to offshore wind, oil and gas, and in the future, carbon sequestration, stays as safe as possible.

What do you see as some of the technological advancements that BSEE is currently looking at to improve the safety and environmental protection in offshore energy production?

Technological advancements can stem from various operations engaged by a production facility. Initiatives can span from routine activities, such as accessing a vessel/tank for cleaning and inspection through cameras/devices to serve as visual aids and to eliminate confined space hazards for personnel, or non-routine activities, such as enhancements for monitoring subsea wells to clearly and definitively observe pressure fluctuations that indicate potential leaks to highly specialized project requiring specialized technical abilities, such as High Pressure – High Temperature projects to new technologies available to address oil spills, such as the Low-Emission Spray Crude Oil Combustor technology [also known as the BSEE Burner].

BSEE's Environmental Compliance Program (ECP) works with BOEM OCS resource leads to assess improved methodologies/new technologies intended to decrease/negate environmental impacts during offshore operations. Examples include the bureaus' coordination with NOAA and NASA on the use of satellites for OCS emis-

sions and discharge detection to help identify chronic violators and assist in inspections, and work with the National Marine Fisheries Service (NMFS) on equipment/methodologies that could be employed during construction/decommissioning operations to reduce noise (pressure-waves/acoustic energy) and potential impacts on Marine Protected Species.

BSEE ECP also proposes, helps fund, and participates in research led by BOEM's Environmental Studies Program (ESP) that focuses on detection, monitoring, and control devices that could be used to improve environmental protections during OCS energy operations.

What do you see as some of the challenges that the offshore energy industry as a whole will face in the coming years, and how is BSEE preparing to meet those challenges?

The offshore environment is dynamic with certain inherent risks. The offshore energy industry, whether conventional oil and gas or offshore wind, has been at the forefront of advancing technologies, and our continued ability to keep pace with those advances is critical. To do this, we must continue to attract a diverse, talented workforce with skills and expertise in both conventional and renewable energy operations. At the same time, our sister agency, BOEM, has provided incentives, through recent offshore wind lease sales, to the offshore wind industry to provide for workforce training and supply chain development as they work to develop their leases.

What are some of the cybersecurity challenges that the offshore energy industry faces, and specifically, what is BSEE doing to address these challenges?

Last summer when I came on board, GAO [U.S. Government Accountability Office] sent out a report with some recommendations for BSEE to take a look at offshore oil and gas from a cybersecurity perspective.

We're at the point now where we're actively building out a cyber strategy here in BSEE as it pertains to being a regulator.

The industry players maintain their own systems, and we're starting to make visits to some of the industry players down in Houston to take a look at their Emergency Operations Centers (EOC) to understand what they're using and ensuring that they have adequate resources to handle cyber.

I think industry knows it and gets it. There may be a few players out there, a few of the [mid- and small-sized] entities which I'm more concerned about. But from what I'm seeing, oil and gas companies understand the threat and the risk.

Looking at offshore wind, these electrical substations are going to be connected to the grid. So we're also talking to offshore wind developers about their connections to the grid; their infrastructure concerns.

Can you discuss BSEE's efforts to train and equip its workforce? I know you talked about staffing up, but do you have enough people to manage the workload?

We're growing, Greg. Our most valuable asset is our workforce, our team players, and everything that we can do to get everything that they need is critical. We also have something called the National Offshore Technical Center (NOTC) which produces about 23,000 contact hours per year on training, and it's everything from oil and gas to offshore wind, and now, too, even carbon sequestration.

Watch the full interview with Kevin Sligh Sr., Director, Bureau of Safety and Environmental Enforcement (BSEE), on Offshore Engineer TV.

Editor's Note: *The proceeded is a compilation of both Offshore Engineer's video interview with BSEE Director Kevin Sligh Sr. and written responses to questions via email. It has been edited for brevity and clarity.*

A NEW GENERATION OF WTIVs

Photo by Ulrich Wirrwa; Image Source Cadeler

WTIVs have always been fuel-hungry. Now they are being tasked with installations that are further, deeper, and heavier.

By Wendy Laursen

Cadeler has two X-class and two F-class WTIVs currently under construction.

Cadeler A/S

Offshore wind farms continue their march into deeper water, further from shore, with turbines that can now reach more than 270 meters high with blades 120 meters long. Designers and OEMs are pushing efficiency to new levels to contain OPEX on the new-generation jack-up WTIVs taking them up there.

Danish ship design firm Knud E. Hansen has chosen specialization for its Atlas A-class WTIV, a smaller derivation of its massive C-class design. This smaller vessel will assemble turbines on pre-installed foundations. The expectation is that the expanding industry footprint can support this more specialized vessel.

Texas-based Bleutec Industries has taken the idea further by delegating tasks to both a piling installation vessel and service operation vessels – which will provide accommodation that would otherwise have added to the WTIV's payload. The company's WTIV-Light is focused solely on installing turbines of up to 22MW.

In contrast, Danish installation firm Cadeler is creating economies of scale with larger vessels that will make fewer transits out to installation sites. Its two X-class and two F-class WTIVs, currently under construction, will be able to transport and install seven complete 15MW turbine sets or five sets of 20+MW turbines.

To reduce weight, and, therefore the power required for propulsion and jacking, the Cadeler vessels will feature a mixed medium and high-speed engine concept from MAN Energy Solutions that optimizes the power/weight ratio, minimizes engine room and funnel footprint, and achieves a total weight of around 200 tons, a significant reduction. The mix includes a frameless version of its medium-speed 32/44CR engine.

WTIVs have distinctly different operating modes (loading, sailing, DP, jacking, and installation), and Halvor Økland, Offshore Sales, Global Sales & Marketing, at Kongsberg Maritime, says integrated systems, including winches, electrical systems, and control systems on the bridge, save space and reduce weight.

He says: "WTIVs need to lift the complete weight of the vessel for every installation sequence, so it's crucial to optimize the weight and balance it forward and aft while at the same time ensuring DP, sailing, and maneuvering capability is kept to the highest standard."

Kongsberg Maritime is delivering electrical packages to the four Cadeler vessels, Dominion Energy's Charybdis, and Maersk Supply Service's Maersk Sturgeon.

Kongsberg Maritime's integrated control and electrical system delivers synthesized data from both consumers and power producers, including feed forward signals from DP

Dominion Energy

ABB

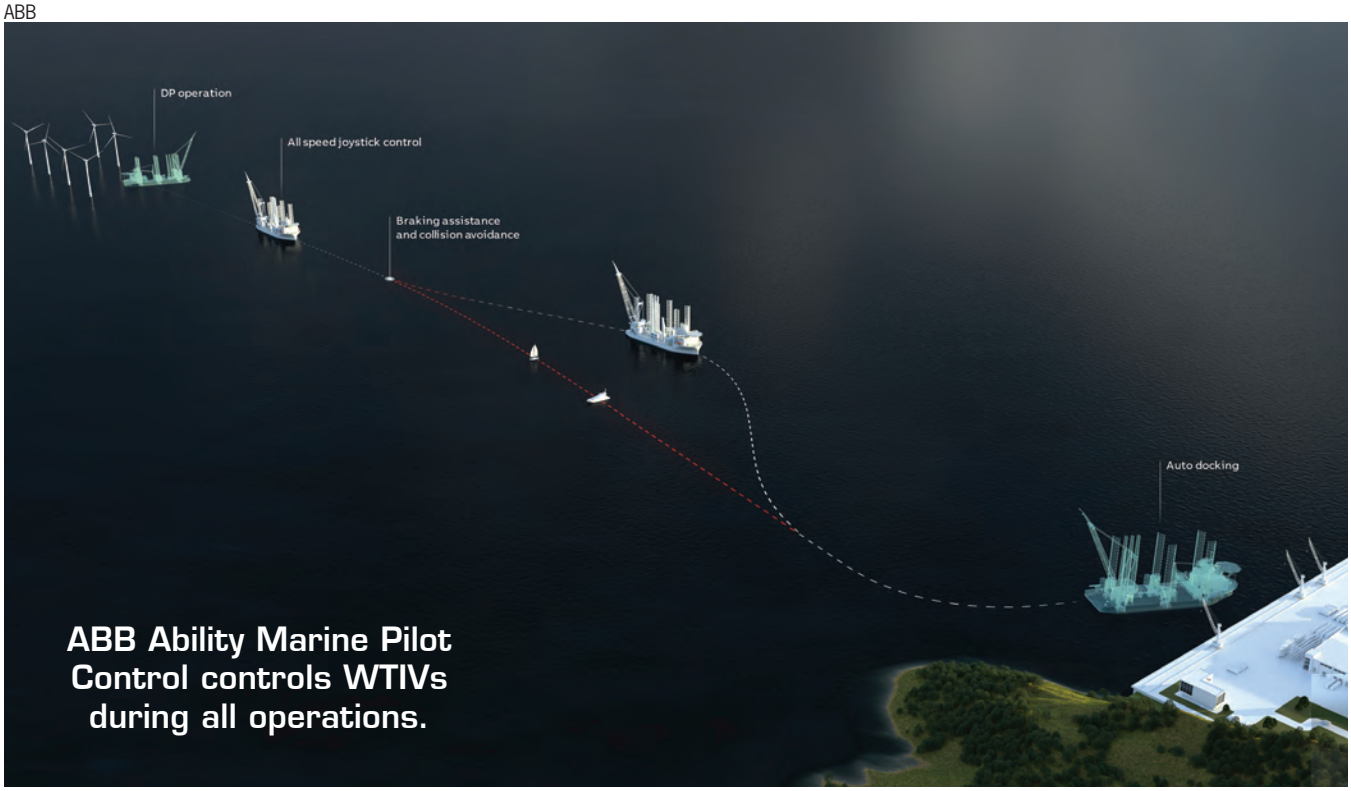


ABB Ability Marine Pilot Control controls WTIVs during all operations.

Kongsberg Maritime is delivering electrical packages to the Maersk Sturgeon.

Maersk Supply Service

control, to reduce fuel consumption. For Maersk Sturgeon, Kongsberg Maritime is also delivering its EcoAdvisor system that uses that data and machine learning to advise the operational crew on optimization in real-time.

The Cadeler and Bleutec vessels will feature energy storage systems, and designer Knud E. Hansen has added hybridization to the industry's traditional diesel-electric power system design for Van Oord's Boreas, currently under construction.

Four 126-meter legs will allow this 175-meter vessel to work at depths of up to 70 meters, and Knud E. Hansen designed the vessel to include energy recovery from the jacking systems and a 5,000kWh battery pack.

Mechanical engineer Frederik Jonassen says it is possible to recover more than 50% of the energy used when the jacking units are reversed. The batteries provide instant power, avoiding the use of gensets to provide spinning reserve. "It's possible now to get an equivalent amount of energy in the battery package as you can from a generator, so we can remove one or more gensets from the equation."

Subsea 7 claims a 20% reduction in emissions compared to similar vessels with its newbuilding Seaway Ventus. The hybrid GustoMSC NG-14000XL-G design includes energy recovery, waste heat recovery, and shore power capability.

With transits to deeper water comes the potential for more adverse conditions, and ABB's Ability Marine Pilot Control system optimizes all operational modes, including maneuvering, transit and position-keeping using models of the vessel, the thrusters and the environmental forces to estimate and anticipate the vessel's state and the required thrust. Combining it with ABB Ability Marine Advisory System OCTOPUS allows vessel safety and availability to be optimized while providing for broader analysis by shoreside specialists.

These two systems can deliver a significant increase in operational efficiency and reduction in fuel consumption, says Jostein Thue, Vessel Type Responsible, Offshore Wind

Vessels at ABB Marine & Ports.

"For WTIVs, this means everything from exact position keeping, to normal voyage maneuvering that would be previously handled by the auto-pilot is done in the same system, using the same controls," Thue says. "ABB Ability Marine Pilot Control supports consistency in operations, reducing the impact of varying operator skill levels on complex maneuvers. This will be measured in greater time efficiency in operations and in improved energy efficiency."

A key part of operational efficiency is finding a combination of thrusters that achieve high performance in transit and for dynamic positioning, combined with light weight. Wärtsilä is supplying such a package to Eneti's Nessie and Siren WTIVs, seven units each.

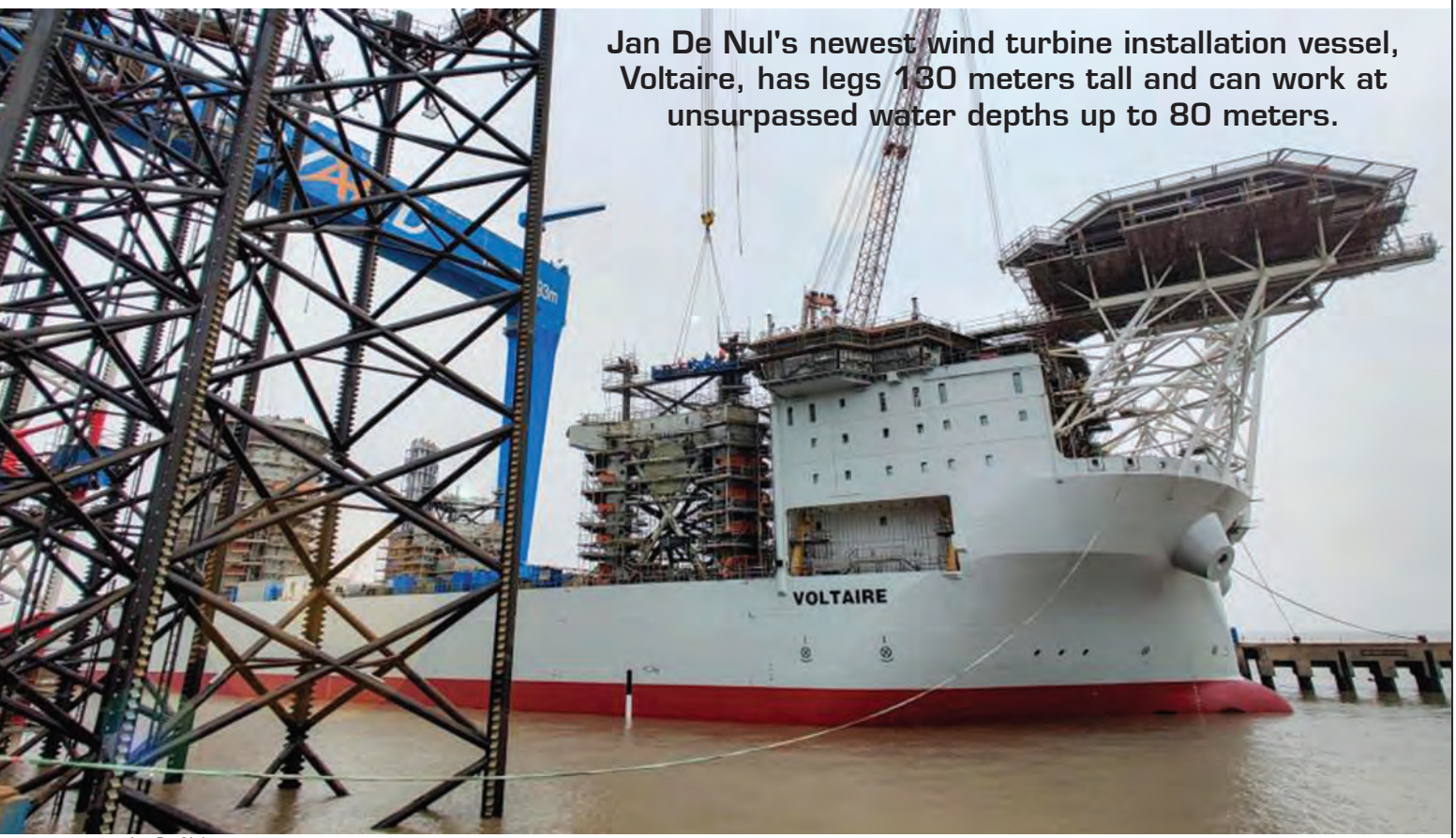
The thruster solution includes 8° tilted retractable thrusters to achieve high thrust with limited power. The propeller shaft tilt reduces the interference between the thruster wake and the flat-bottomed hull, increasing the bollard pull by up to 20% and reducing fuel consumption. Wärtsilä can further minimize the vessel's environmental impact with retractable thrusters that have full electrical retraction and steering systems. Wärtsilä's references also include supplying thrusters for two WTIVs being built for the China Three Gorges Corporation.

There are currently 11 WTIV active or under construction able to work in 70m water, plus Jan De Nul's newest wind turbine installation vessel, Voltaire, which has legs 130 meters tall and can work at unsurpassed water depths up to 80 meters.

However, Philip Lewis, Director Research at Intelatus Global Partners, says: "There are a multitude of factors other than water depth to consider, including the appetite of vessel owners to invest in new vessels, given the speed of technical change in turbine sizes and foundations and their ability to pay-back the investments before having to upgrade."

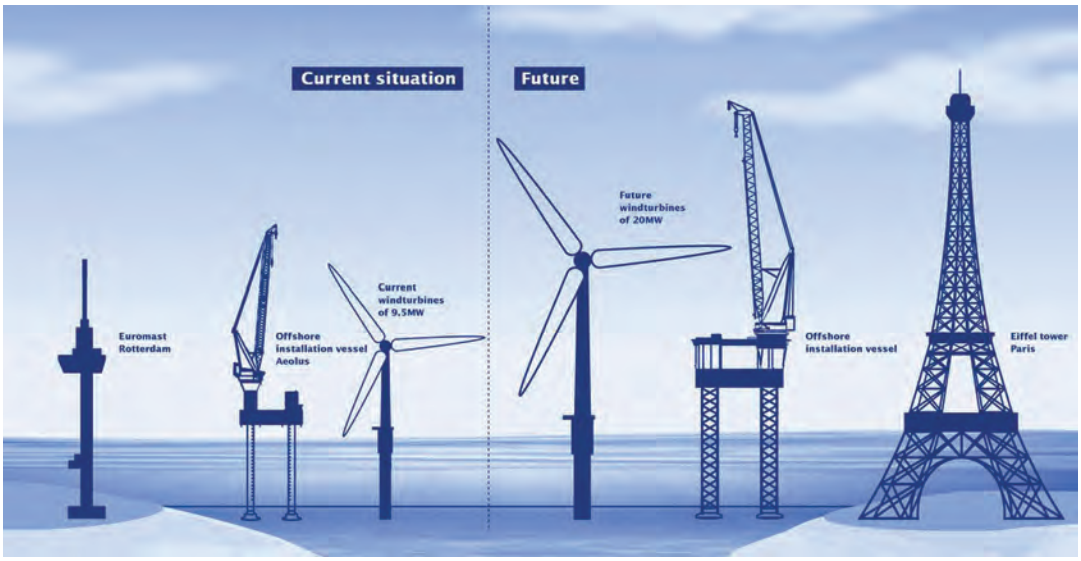
New-generation WTIVs will help meet growing demand in core European/Taiwan markets, new European markets (Mediterranean and Baltics), South Korea, Japan, US, and Australia, says Lewis. Demand in these markets is set to grow strongly after the middle of the decade.

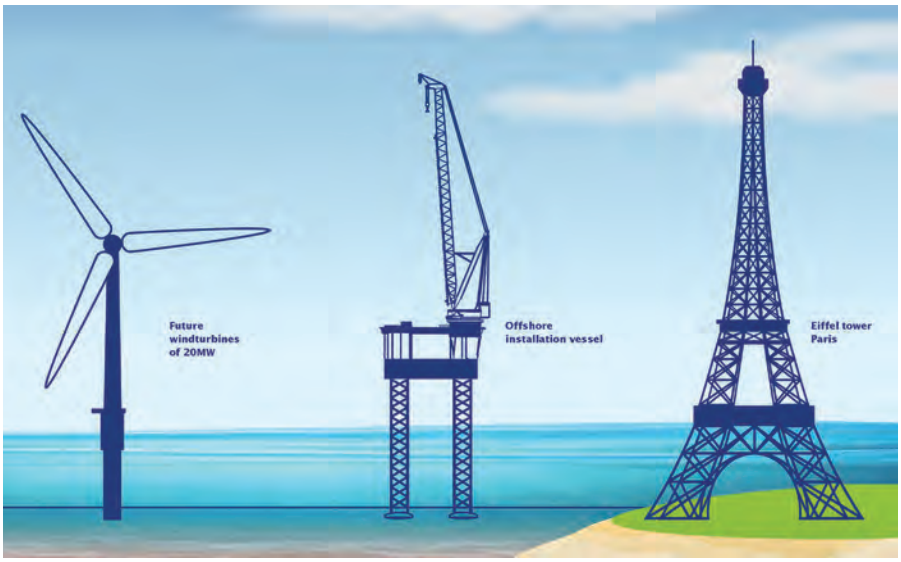
Even so, water depth will ultimately limit the outward march of fixed turbines and, with them, jack-up WTIVs.

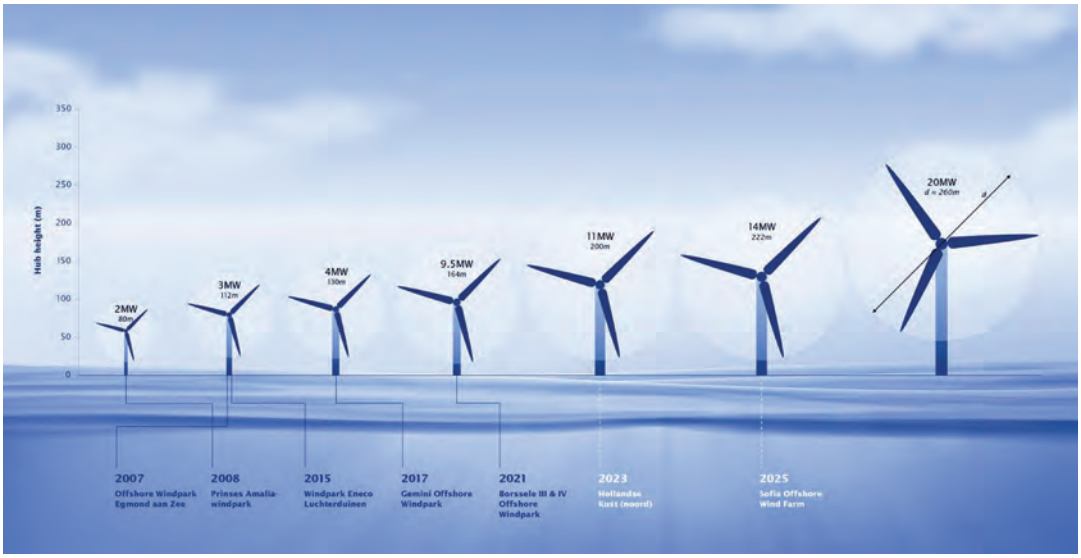


Jan De Nul's newest wind turbine installation vessel, Voltaire, has legs 130 meters tall and can work at unsurpassed water depths up to 80 meters.

Jan De Nul







All images on this page courtesy Van Oord

Van Oord's Boreas, currently under construction, will have four 126-meter legs that will allow this 175-meter vessel to work at depths of up to 70 meters.

"Hydrogen Hubs" to the Fore

The path to decarbonization is defined by partnership and fueled by government funding. This month we examine the players, partnerships, and evolution of Hydrogen Hubs in the Gulf of Mexico.

By Barry Parker

The Green Shipping Challenge, organized by the United States and Norway at COP 27 held in late 2022, brought about dozens of announcements on maritime decarbonization. Among these was a joint statement from the Blue Sky Maritime Coalition (BSMC) – a consortium of North American shipowners and ancillary service providers – and the American Bureau of Shipping (ABS) announcing an effort to create a corridor for the Gulf of Mexico and Lower Mississippi River region, joined by port authorities and stakeholder organizations from Houston and New Orleans in this initiative.

There are multiple definitions of what, exactly, constitutes a 'Green Shipping Corridor,' as dozens of initiatives have been announced since the introduction of the concept at COP 26 in October 2021.

They can be thought of as a port-to-port trade route (with actual port operations having a reduced or zero carbon emission profile), hauling non-fossil fuel commodities produced with a reduced carbon footprint onboard vessels powered by alternative fuels.

The Green Shipping Corridor concept links together with a newly emerging concept – "Hydrogen Hubs" – which will be funded in the wake of the massive $1.2 Trillion Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Bill) signed in 2021, which authorized spending of $7B on the establishment of regional clean hydrogen hubs.

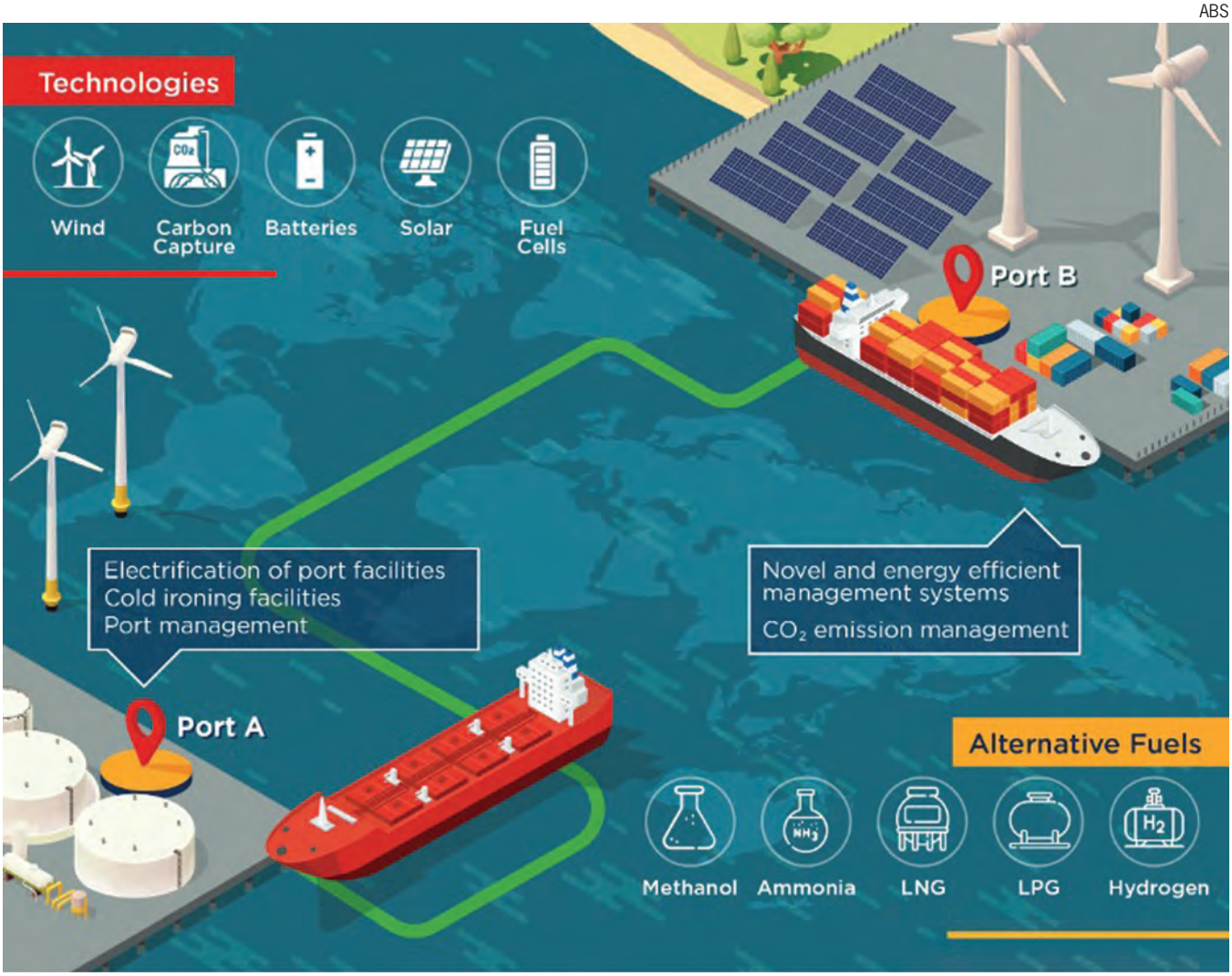
While the U.S. Department of Energy (DOE) expects to fund up to 10 such hubs through its H2Hubs program, 79 proposals were received to DOE's initial request for concept papers. Of these, 33 received a "thumbs up," encouraging them to submit more extensive proposals (due in April, 2023) for funding.

The corridors and hubs fit nicely together in the U.S. Gulf, which is known in the crude oil and refined products trades as PADD 3 (Petroleum Administration for Defense District).

Natural Resources Defense Council, the influential advocacy group, in publications examining and promoting the hub concept reminded policy-makers (and infrastructure architects) "…that when targeted at the hard-to-electrify end-uses like steelmaking, marine shipping and aviation, green hydrogen has the strongest potential to support America's transition to a clean economy."

In Green Corridors, a key element is the availability of alternative fuels on a particular trade route; with the U.S. Gulf's key role in hydrogen production, well-known ports

ABS



in the region were seeking to play a role.

In New Orleans, the H2theFuture consortium (led by the Greater New Orleans Development Foundation, or GNODF) is seeking to "…establish a world-leading clean hydrogen cluster in South Louisiana."

The hub received a $50 million Federal grant in September 2022 from the Build Back Better program. Like the other hubs, the infrastructure includes a wide variety of components. The group envisions the use of offshore wind to power electrolyzers that produce "green" hydrogen, which might be used in the further production of green fuels.

Among the industrial sectors that GNODF expects to see benefits are "coastal and river vessels" as well as "long haul transportation."

If H2theFuture moves ahead, it will be tied to efforts at the Port of South Louisiana, a network of ports on the Lower Mississippi, to provide a fueling station, with a hydrogen fueling barge (dubbed H2P3) for an emergent fleet of hydrogen-powered river vessels, which could be built at yards in region.

According to H2theFuture: "The investment leverages the private-sector investment of the Marine Vessel (M/V) Hydrogen One, currently in development by international private partners led by locally-based firm Maritime Partners."

The GNODF adds that: "By providing this new fueling asset for e-methanol-fueled vessels, this component project contributes to the overarching cluster strategy by enabling the maritime sector to initiate a transition towards green hydrogen fuels. The H2P3 project demonstrates the comprehensive, end-to-end value chain of the South Louisiana green hydrogen cluster."

The HyVelocity Hydrogen Hub (HV), a consortium of energy majors and important organizations seeking to "… accelerate the development of clean hydrogen projects

in Texas, Southwest Louisiana, and the U.S. Gulf Coast," were among the submitters that received encouragement from the DOE.

The objective is to "…leverage the world's largest concentration of existing hydrogen production assets, infrastructure, and customers in the Gulf Coast region to produce clean hydrogen…"

In an FAQ document on HV's website, they say: "The hub encompasses a variety of projects, including end-use applications, connective infrastructure, pipelines, shipping, and trucked hydrogen delivery."

The view from high up shows this hub to part of clean hydrogen network that will help decarbonize many sectors of the economy, on a national scale.

Corpus Christi, a leading participant in exports of U.S. crude and distillate products, has also set its sights on the hydrogen future. Like the H2theFuture and the HV, it also received of vote of confidence from the US DOE.

The port says: "The HCH2 Concept Paper, submitted to the DOE on November 7, names around 30 private sector team members as owners, developers and/or operators, off-takers, and end users of various hydrogen value chain projects and supporting infrastructure…"

The list of potential collaborators on the infrastructure side includes Buckeye Partners (operators of a large tanker terminal in the port, and numerous other facilities, fed by a pipeline network), Magellan Midstream and Epic Midstream – both major pipeline operators.

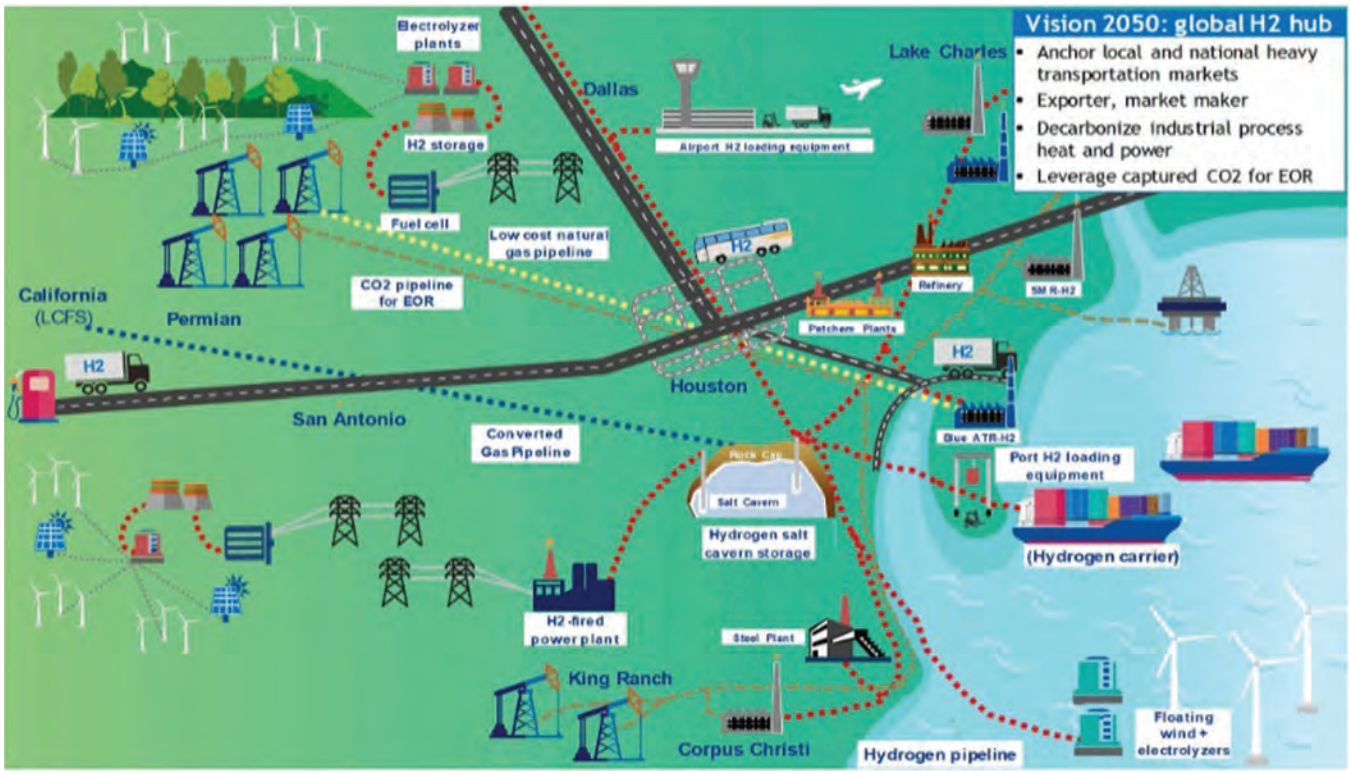
Commodity participants, if the port's efforts move ahead, include well-known traders Trafigura and Sempra.

They suggest that: "When it is to be exported from the hub by rail or ship, hydrogen likely will be reacted into ammonia, which is a larger, more stable molecule that can either be used directly as an energy source or processed to yield free hydrogen."

In conversations with ***Maritime Reporter & Engineering News***, Sean Strawbridge, Port of Corpus Christi's CEO, suggested that methanol (which can also be produced from hydrogen) would also be a potential fuel to be moved from the Hub at Corpus Christi (the leading port for U.S. crude exports).

Strawbridge, who is the current Chair of American Association of Port Authorities (AAPA), provided a broader perspective on decarbonization, and the U.S. abundance of potential hydrogen production available, in the future, for export.

"Texas is the largest producer of wind energy, and the second largest producer of solar power in the nation," he said, adding that "many foreign nations are looking to the United States for the production of green fuels."



Center for Houston's Future

The role for Corpus Christi is clear: "Crude oil has made us so prolific as a traditional energy export gateway, we think that leadership will also hold true as we transition to the export of hydrogen and its derivatives."

The maritime sectors will see a push by technology providers as hydrogen is seen as a viable fuel source for vessels (whether tied to methanol fuel production, or through use in fuel cells).

Maritime Partners, the vessel owner involved with New Orleans' potential hydrogen hub, is behind Element 1, an Oregon-based small-scale manufacturer of advanced hydrogen generation systems.

Its e-1 Marine division has been actively marketing a technology where hydrogen fuel cells, which generate electricity similar to batteries, are fed hydrogen produced onboard in a process where water is added to methanol stored in tanks.

Maritime Partners has also invested in ownership of Hydrogen One, a tugboat which will deploy the technology. The boat will be placed on a long-term charter to a leading inland provider of barge transportation. Other efforts, not tied to specific hubs, are now gaining traction.

Ammonia power specialists Amogy, a 2020 startup based at the Brooklyn Navy Yard with a presence in Norway, announced a demonstration project where an existing diesel-powered tugboat will be fitted with a mechanism feeding liquid ammonia (stored in fuel tanks) through "cracking modules" which supply hydrogen into a hybrid fuel cell system.

The 1MW-rated powerpack will then provide electricity to motors driving the vessel's propellers. Current plans have the vessel being deployed along the Hudson River. The vessel is being converted at the Feeney Shipyard in Kingston, NY, and will be classed by DNV.

ABS announced its role in the classification of a Glosten-designed research vessel (to be based in San Diego) that would "feature a new hydrogen-hybrid propulsion system that integrates hydrogen fuel cells alongside a conventional diesel-electric power plant, enabling zero-emission operations."

Christopher J. Wiernicki, ABS Chairman, President and CEO, said, "This project will be closely watched by the industry as it breaks new ground and demonstrates the capabilities of this promising alternative fuel at sea."

Alex Parker, Managing Partner of Rose Cay, which actively invests in real assets for the energy transition, is both an owner and an operator of a fleet of 18 coastwise Jones Act vessels.

The Rose Cay fleet was purchased in 2021, underwent material, technical enhancement, and now transports energy products for Fortune 100 companies, along what could be future Green Shipping Corridors of America.

Port of Corpus Christi

1. Rose Cay Maritime tugboat Susan Rose.

2. Amogy's ammonia fueled tug.

3. The Hydrogen One vessel.

During a Capital Link conference regarding Jones Act M&A opportunities Parker said, "There is going to be a material Energy Transition, and it is underway. The Inflation Reduction Act together with legislation funding hydrogen hubs, solidified Washington, D.C.'s commitment. The impacts will touch both the commodities being transported and the marine fuels being used."

As an industry, the U.S. Jones Act community is actively preparing for the future of energy transportation, and it is clear Rose Cay intends to be a leader.

Rose Cay Maritime is included in a list of partner entities, in a recent announcement from another group, the Northeast Hydrogen Hub (with 100 partners from seven states in PADD 1A- New England and PADD 1B- mid-Atlantic states).

Parker told ***Offshore Engineer:*** "At Rose Cay Maritime, we are committed to serving our customers and American communities with safe, reliable, and environmentally responsible Jones Act transportation today and tomorrow, as the U.S. energy complex evolves. The hard-working men and women in the Jones Act trade stand at the ready to ensure our country's energy security throughout the Energy Transition."

The entire maritime supply chain will undoubtedly be monitoring the developments as the Green Corridors and Hydrogen Hubs move forward.

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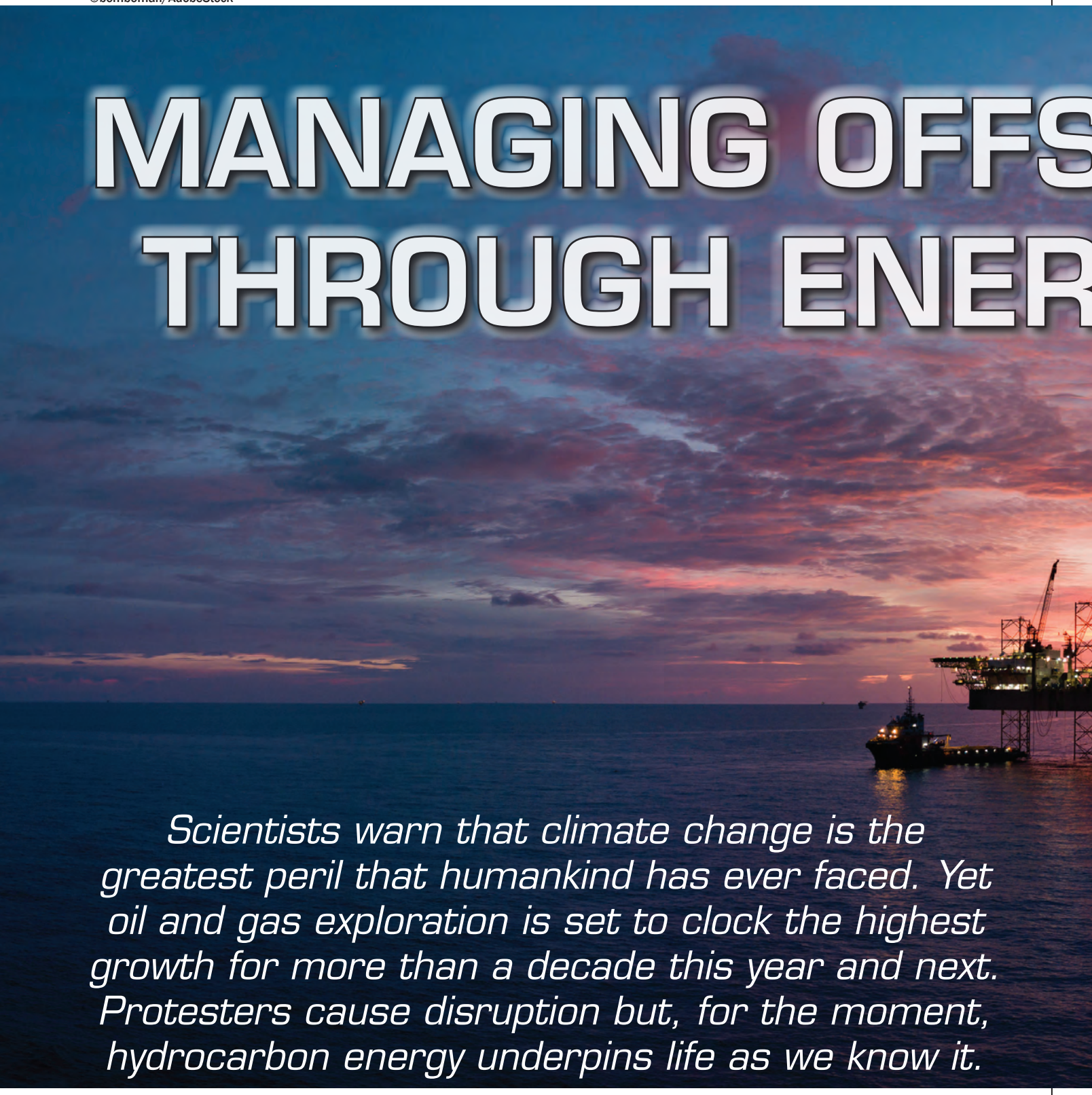
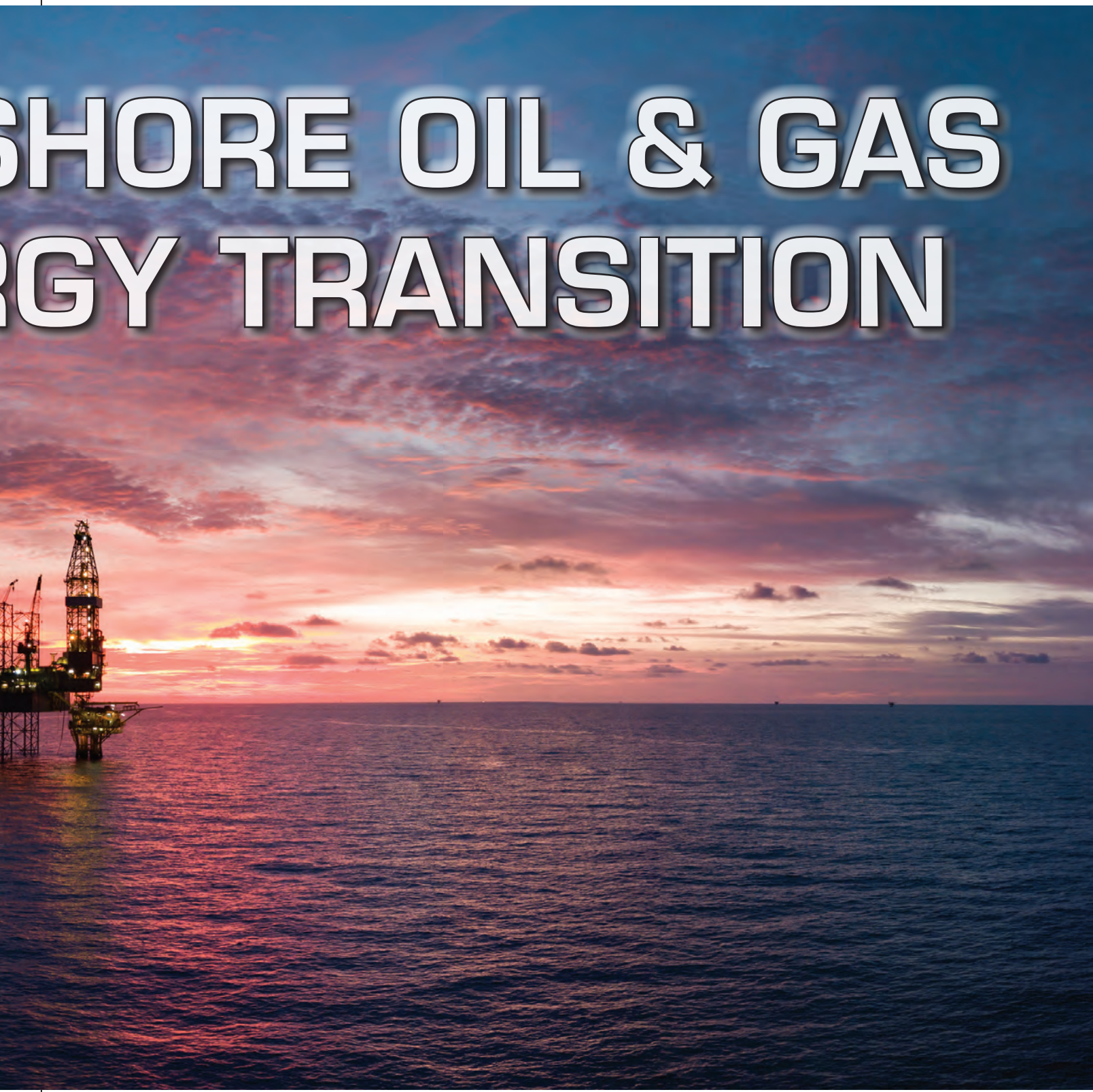


MANAGING OFFS
THROUGH ENER

Scientists warn that climate change is the greatest peril that humankind has ever faced. Yet oil and gas exploration is set to clock the highest growth for more than a decade this year and next. Protesters cause disruption but, for the moment, hydrocarbon energy underpins life as we know it.

By Paul Bartlett


SHORE OIL & GAS
RGY TRANSITION

"Offshore oil and gas production probably matters now more than ever," declared Audun Martinsen. The Rystad Energy Partner and Head of Energy Research told *Maritime Reporter & Engineering News.*

"It is one of the lower carbon-intensive methods of extracting hydrocarbons and there is significant scope to decarbonize the production process further. Offshore operators should expect a windfall in the coming years as global superpowers try to reduce their carbon footprint while advancing the energy transition."

Martinsen was commenting after the Oslo-based firm revealed that offshore oil and gas investment is lined up to hit $214 billion in the two years ending December 2023, the first time it has reached this 24-month level since 2012-13. And offshore activity is expected to account for 68% of all sanctioned conventional hydrocarbons this year and next, up from a pre-pandemic average of around 40%.

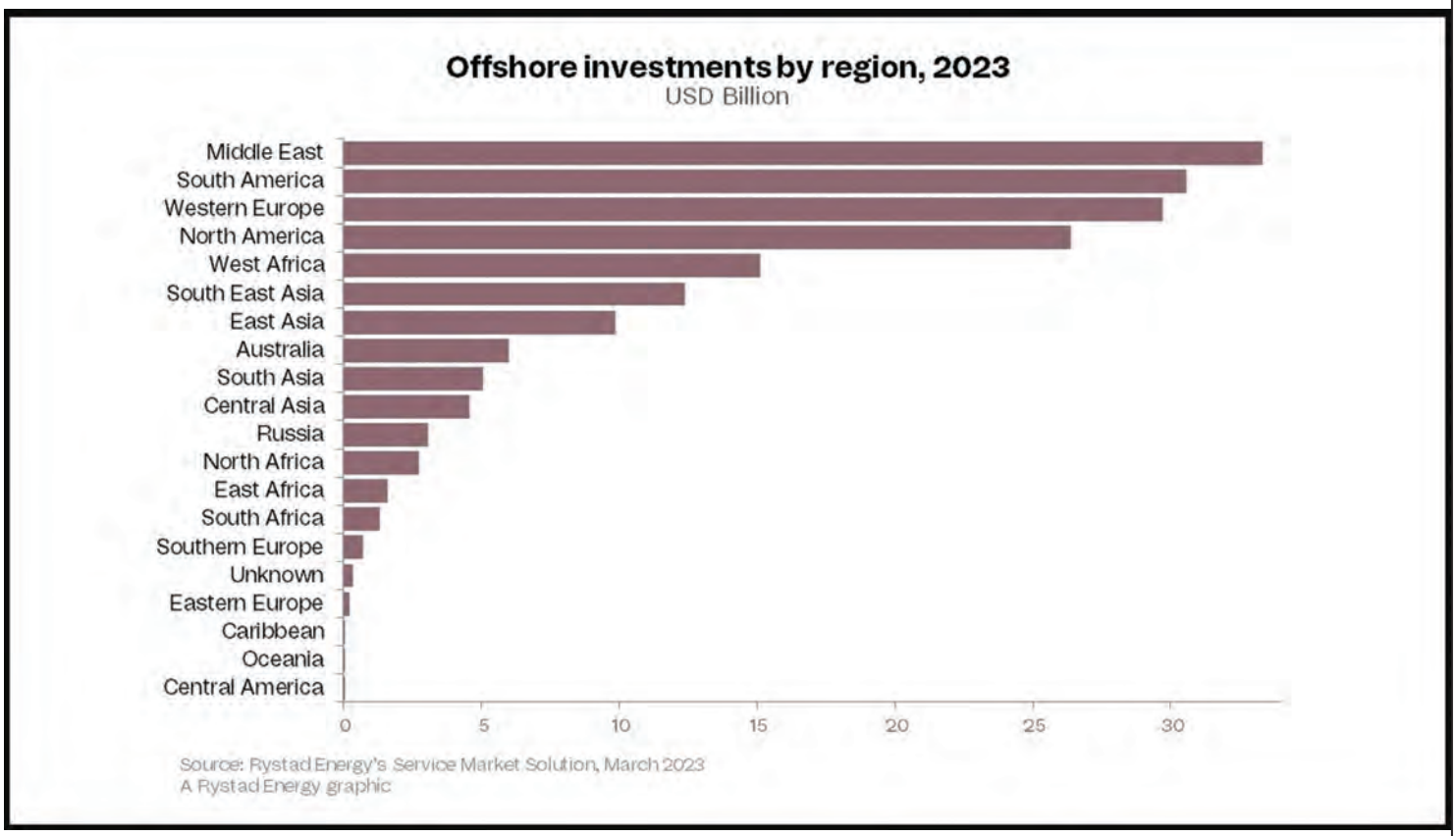
There are many factors at work, but post-Covid recovery, China's re-opening, and Russia's invasion of Ukraine have driven energy security to the very top of the agenda in many countries. The war in Europe is causing a cost of living crisis in many countries, and widespread food shortages in others.

Rystad's analysis reveals that the Middle East is a hotspot for spending (see chart). Offshore capex across the region will exceed all others, driven by huge projects in Saudi Arabia, Qatar, and the United Arab Emirates, according to Rystad analysis. But strong growth is evident elsewhere , too.

South America, notably Brazil, is second, followed closely by Western Europe, specifically the North Sea. North America comes next, with more than $17 billion of capital investment expected this year.

What's the problem?

There is clearly a public perception problem, not helped by the super-profits clawed in by the world's largest energy majors over the last two years. Electric cars may help by replacing gas guzzlers to some extent, but global lithium supplies could not sustain a long-term switch without new technologies.



Bluntly, there is no short-term option to hydrocarbons as a means of fueling the planet. So the challenge becomes hastening the transition; imposing as little further damage as possible in the process; and mastering a collaborative response, experts say.

Unfortunately, as they point out, many of today's demonstrators and protestors do not realize that hydrocarbons are fundamental to most aspects of everyday life – not just fuel for making steel, running most cars and buses, and heating or cooling homes. The petrochemicals sector provides key components for many everyday products – including plastics, fertilizers, rubbers, clothes, medical equipment, detergents, adhesives, pesticides, and paints and coatings.

Asked recently what she would say to a 'Just Stop Oil' protester stuck to a gantry, Lloyd's Register's Claudine Sharp-Patel thought about this long and hard. "I think I'd like to ask them where they got the glue," she said.

So, on the basis that we have no scalable options to hydrocarbons in the short run, what can we do?

New Strategies

Wood Mackenzie has developed a new analytical tool, Lens, to help exploration personnel identify the most attractive opportunities in oil and gas that are likely to generate the best returns. The firm's Vice President of Exploration, Andrew Latham, described how access to data has facilitated for more effective decision-making.

The tool is designed to demonstrate how different exploration opportunities compare, Latham said, and how their economics stack up. The quest now, he says, is to identify 'advantaged' oil and gas. This means lower cost, lower carbon, better access to markets, better fiscal terms, and lower risks. Also, how much of this resource might be available given a certain price point, a given set of circumstances, and/or a specific timeframe?

Norway, with the largest sovereign wealth fund in the world, huge hydrocarbon reserves, and an abundant supply of renewable hydroelectricity, stands in pole position to spearhead the drive for clean energy. State energy company, Equinor, aims to reduce net group-wide operated emissions by 50% by 2030 "and is focused on medium-term actions consistent with the goals of the Paris Agreement and a 1.5 degrees pathway", according to a statement.

However, commenting recently on the future, Equinor said: "Even in the most optimistic forecast scenarios for the green shift, the world will still be dependent on oil and gas for a long time to come. It is therefore essential that oil and gas that the world needs is produced with as low a carbon footprint as possible."

The company has adopted three 'pillars': carbon-efficient oil and gas production; expansion in renewables; and the development of new low-carbon technologies and value chains. As a leading developer of offshore wind, it is a pioneer in the rapidly developing floating wind sector, which offers scope to harness renewable energy in waters where the winds blow stronger and longer.

The company is nearing completion of the world's largest floating wind farm, Hywind Tampen, almost 90 miles off the coast in the Norwegian Sea. The 11-turbine facility, with a capacity of 94.6 MW, will provide renewable electricity for the Snorre and Gullfaks oil and gas fields nearby. Its first electricity was generated late last year and when the wind farm is fully commissioned in a few months' time, it will mean Equinor produces almost half of the world's floating wind energy.

The N-word

Against this daunting backdrop, however, some experts claim that there are chinks of light. One of these is tried and tested technology which has received barely a mention until recently. Even in Norway where renewables are a top priority, nuclear power based on molten salt reactor (MSR) technology is now the subject of detailed research.

Concepts are being developed to provide carbon-free energy for hard-to-abate industrial applications. And, in a project developed by family-owned shipbuilding group, Ulstein, experts are working on generating power for a small fleet of expedition cruise ships. They could be deployed in high-north waters where conventional refueling would be impossible.

Meanwhile, in the UK, Core Power is pioneering the development of MSR technology for heavy industrial applications as well as the maritime sector. With offices in London and Washington DC, the company is working with international power, engineering and nuclear technology firms to generate zero-emission energy for floating industrial facilities, such as semi-mobile desalination plants, and power for deep-sea shipping.

Many advocates of nuclear power cannot understand the reticence to look at options. MSR technology is widely seen as safer than other forms of nuclear technology, they point out, because pressures are low and fuel is already in a molten state. In an emergency, it can be drained into a

The belief that nuclear power is somehow unsafe and dangerous is a myth not born out by facts of science,"

► Dr Rory Megginson,
Head of Analytics, Core Power

containment vessel before solidifying.

No surprise that Core Power's Head of Analytics, Dr Rory Megginson, is a staunch advocate of the carbon-free energy source and a proven technology, he stresses, that is available today. "The belief that nuclear power is somehow unsafe and dangerous is a myth not born out by facts of science," he said.

Megginson explained that green ammonia is likely to offer hard-to-abate industries, including shipping, an effective zero-carbon fuel at some time in the future. But as things stand, its production relies on the nascent science of carbon capture or the limited scalability of production from intermittent renewable sources.

On the other hand, MSR technology offers a large-scale source of clean energy suitable both for heavy industry and transport and, with one major advantage. Once installed, MSR technology would enable ships, steel mills, petrochemical plants and other heavy industries to use a constant source of energy supplied over a long period, perhaps 10-20 years.

And in shipping, the eye-watering cost of a global network of new bunkering facilities might not be necessary.

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THE WAIT IS O
Deep Value Driller
Unleash Its Pot

A lesser known offshore rig owning firm recently secured a long-term deal for a drillship that has been stacked since 2017, in yet another proof that the offshore drilling industry is back.

By Bartolomej Tomić

OVER: Ready to tential

The offshore drilling industry is back.

After several years of downturn and uncertainty, offshore drilling analysts and rig owners alike are now painting an optimistic picture for the future, with rig demand, utilization, and dayrates growing across the board.

"As an industry, it is clear that we have finally emerged from eight exceptionally challenging years and are now in the early stages of what we believe will be a multi-year upcycle," said Transocean CEO Jeremy Thigpen in the company's recent quarterly presentation.

Rystad Energy recently said that the offshore oil and gas sector was set for the highest growth in a decade in the next two years, with $214 billion of new project investments lined up, and annual greenfield capital expenditure (capex) set to break the $100 billion threshold in 2023 and 2024 – the first breach for two straight years since 2012 and 2013!

While the words of Transocean and Rystad resonate through the industry, this article is about a recent drillship contract secured by a little-known company: Oslo-listed Deep Value Driller AS and its 7th-generation drillship.

THE DRILLSHIP

The ultra-deepwater drillship, bearing its current name, might be known to few in the oil industry; however, the rig's previous name – the Bolette Dolphin – could be more familiar. The rig, which has a maximum operating depth of 3,048 meters, and a maximum drilling depth of 12,192 meters was initially owned by then Fred. Olsen Energy's subsidiary Dolphin Drilling.

Delivered in February 2014 by Hyundai Heavy Industries, it had spent years working for (also then) Anadarko Petroleum before the contract was terminated in July 2017, and it hasn't worked since.

Come 2019, Dolphin Drilling lenders decided to sell the Bolette Dolphin to refocus Dolphin Drilling's business on the mid-water fleet.

However, the sale only occurred two years later, when in the early 2021, Deep Value Driller said it had scooped the rig for only $65 million. The price represented ~9% of the rig construction cost of around $750 million.

Deep Value Driller's strategy is written on its website's homepage:

"Invest in high quality drilling vessels and bareboat to reputable drilling contractors, with the ambition to create value to our shareholders and customers."

BAREBOAT CHARTER

On February 23, 2022, Deep Value Driller said it had secured a bareboat charter for the drillship with the Italian offshore services firm Saipem. The contract, for approximately three years, is worth around $160 million.

While Deep Value Driller AS did not say how many days exactly the rig would be on a contract with Saipem (ie. "approximately three years"), if we assume that the contract is for three years exactly, this means that the dayrate for this 7th generation rig would be around $145,985.

This comes at a time when global drillship utilization is reaching record highs and dayrates, with analysts and drilling companies alike forecasting a multi-year growth cycle in the industry.

Westwood's offshore rig analyst Terry Childs recently said that drillship utilization had averaged 93% for 2022, with several contracts awarded at over $400,000 dayrates, "with the highest reaching $462,000 for a contract offshore Brazil."

During the 2014–2017 period, when it was still called Bolette Dolphin, the drillship worked for three years for Anadarko at a reported $488.000 dayrate.

It is worth noting that the deal between Deep Value Driller and Saipem is for a bareboat charter, meaning it was on Saipem to find work for the rig, provide crew, bear operational expenses, and secure a big enough contract to both pay for the bareboat charter to Deep Value Driller and make profit for itself.

According to a November 2021 article by offshore drilling rig market analysts, Esgian, the daily operational expense for a modern drillship could reach around $150,000.

According to information on the rig owner's website, between 2017 and 2020, the rig was warm-stacked at the cost of $70,000 per day, and it was then relocated to Norway for more efficient stacking in 2020.

Upon buying the rig, Deep Value Driller AS said in an April 19, 2021 presentation that its goal was to reduce the stacking cost to $20,000 a day, and that it was fully funded for 18 months of stacking.

A little over 22 months passed between that presentation and the Saipem contract.

REACTIVATION

In conjunction with the bareboat charter news, Deep Value Driller AS also said it had entered into a $75 million senior secured term loan facility agreement "with a reputable private lender."

The company said it would use the proceeds to fund the reactivation activities for the drillship, the refinancing of the company's existing credit facility, and general corporate purposes.

The reactivation of the drilling rig is expected to cost around $40 million, with about $10 million to be used to refinance the existing credit facility. The remaining proceeds will be used for general corporate purposes.

In a presentation back in April 2021, Deep Value Driller AS said that it would reactivate the rig only with a firm contract secured.

The planned reactivation scope shared at the time included an NOV package, ABB package, well control equipment (with full recertification required), and hull and structure class renewal.

According to the company's 3Q presentation 2022, the vessel was warm-stacked with a crew of 15 people at Westcon Yard in Ølensvåg in November 2022, at an average cost of $21,270 a day during the quarter. The company also said at the time that the activation of the rig would take place at Westcon Yard.

After the bareboat charter announcement, Deep Value Driller awarded Scana's PSW Technology a contract for deepwater BOP stack services.

PSW Technology will provide services for the classification and testing of two deepwater BOP stacks.

Scana said the contract was a sizeable one, meaning it is worth between $966,370 and $4.8 million (at the time of the award).

HMH, a drilling equipment and services firm, subsequently said it would be supporting Deep Value Driller (DVD) in reactivating its ultra-deepwater drillship.

HMH said that the full project would contain recertification of the complete portfolio of subsea pressure control products, including the riser system, diverter System and Dual Stack Blow-out Prevention System.

"Soon the BOP frame […] will be furnished with newly refurbished HMH BOP equipment and be deployed back to the rig after [five years] in preservation," HMH said in a social media post. HMH itself is a relatively new firm, at least under the current name.

The company was established after oilfield services firm Baker Hughes and Norway's Akastor in late 2021 merged Baker Hughes' Subsea Drilling Systems business with Akastor's subsidiary, MHWirth. The company did not share details on the contract value.

WHERE NEXT FOR THE DRILLSHIP?

Just days after Deep Value Driller announced the bareboat charter deal with Saipem, the Italian contractor revealed that it had secured a $400 million contract for the Deep Value Driller drillship in the Ivory Coast with the joint venture between Eni and Petroci.

The contract length was not disclosed, and Saipem did not reply to ***Offshore Engineer's*** request for more information.

Announcing the $400 million deal with the Eni-led consortium, Saipem said the value "is to be considered

gross of the leasing costs of the Deep Value Driller vessel that will be used for the operations."

"The contract includes the use of the seventh-generation drillship named Deep Value Driller, one of the most modern in the world, for which Saipem has entered into a charter agreement with the company Deep Value Driller. Saipem is thus strengthening the competitiveness of its fleet by leveraging its consolidated expertise in the selection and management of technologically advanced vessels," Saipem said.

The Italian offshore services firm also said the contract award represented an important consolidation of Saipem's presence in the Ivory Coast "a strategic area where the company is currently executing the project for the development of the oil and gas field Baleine."

Eni discovered the Baleine, Ivory Coast's largest ever offshore discovery, in August/September 2021 using the Saipem 10000 drillship at Baleine-1x, its first ever well drilled in the country.

"The potential of the discovery can be preliminarily estimated at between 1.5 and 2.0 billion barrels of oil in place and between 1.8 and 2.4 trillion cubic feet (TCF) of associated gas," Eni said at the time.

Come July 2022, the size estimate was boosted with the help of Saipem 12000 drillship which Eni used to drill the Baleine East 1X well, results of which led Eni to boost the hydrocarbons in place estimate at the Baleine field to 2.5 billion barrels of oil and 3.3 trillion cubic feet (TCF) of associated gas.

Now, the Italian energy company will be hoping that the third Saipem-managed rig, Deep Value Driller, will bring it more joy and value, pun intended, in the West African country.

Deep Value Driller drillship specs (as found on the rig owner's website)	
Design	GustoMSC P10,000
Rig water depth	10,000 ft - 3048 m
Drilling depth	40,000 ft - 12192 m
Dual activity	Yes
Rig status	Warm stacked
Build cost (USD)	750,000,000
Build yard	Hyundai Heavy Industries
Delivery date	February 2014
Number of BOP stacks	Dual 7 RAM BOP Stack Equipped
Max hook load (lbs)	2,500,000
Quarters capacity	210

THE 'GREEN

IS COMING CL
TO REALIT

All images courtesy DNV

N RIG'

LOSER
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As the world continues its journey toward attaining net zero goals by 2050 there is an increasing pressure on the oil and gas industry to reduce its greenhouse gases (GHG) while maintaining global energy demands. Decarbonization has remained at the top of the news agenda in the last few years, with operators eager to create more 'green' rigs which operate with a reduced carbon footprint. But are more environmentally friendly oil rigs really on the horizon? We explored some of the key developments which show this vision is becoming a reality.

By Alex Imperial,
VP and Area Manager, South America, Energy Systems at DNV

One of the most important elements of reducing CO2 emissions is having a clear understanding of the way forward. While new technology is essential to driving greater energy efficiencies, this can often be expensive and time intensive to implement. DNV's Decarbonization – Act Now paper was introduced to highlight an accessible and credible pathway for all upstream operators to reduce direct emissions by incorporating cost-effective means of carbon savings.

Along the same lines, specifically for mobile offshore units, DNV has also put in place the ABATE (Ready) Class notation, which provides a structured approach to identify and assess the implementation of abatement measures, based on the design and operation of individual installations, to enable measurable reductions in an installation's GHG emissions. Primarily developed to cover offshore oil and gas installations, the general principles can be also applied to other floating offshore installations.

The decarbonization paper proposed a three-tier method:

1. **Reduce overall energy usage**
2. **Seek to remove environmental losses**
3. **Replace energy supply with low carbon alternatives**

The intention is that this approach provides simple, and actionable, steps to allow operators to explore CO2 savings, within time and budget constraints, without the need to focus specifically on novel and expensive technology. Simple actions such as flare management, power management, and venting reduction can be adopted almost immediately to deliver carbon reductions.

Verifying hybrid power application

The use of hybrid power is an increasingly popular solution to support the decarbonization of traditional drilling rigs; with DNV having classed eight such units that have

been converted. In late 2022, Dutch-based Huisman announced the development of a harsh environment semi-submersible drilling rig design, which can be powered with onshore-produced hydroelectricity but also with floating wind turbines. The rig includes a low drag electrified robotic drilling system that offers consistent speed of operation, as well as a heave compensated drilling floor. The hybrid power system and energy storage systems could ensure that emissions are reduced by 30-40% per well1.

DNV also completed the concept verification review of Odfjell Oceanwind's WindGrid (WindGrid) system, a solution for providing an uninterrupted power supply from Mobile Offshore Wind Units (MOWUs) to micro-grids. It combines energy storage, grid converters and floating wind turbines in order to enable gas turbine generators to be shut down during peak wind power production.

DNV's review confirmed the technical feasibility of the WindGrid system, and that expected reductions in CO2-emissions for North Sea applications are in the range of 60-70%, compared to generation of electricity from conventional gas turbines.

Elsewhere, there is advancement in the utilization of hydrogen for powering oil rigs. DNV was recently engaged by Ocyan as independent third party in the qualification process of a system injecting hydrogen as an additive in the internal combustion engines of drilling rigs, in order to reduce diesel consumption and GHG emissions from drilling. DNV's technology qualification process will ensure that the technology achieves the expected degree of maturity, following provisions in DNV-RP-A203 – which provides the industry with a systematic approach to technology qualification, ensuring that new technologies function reliably within specified limits.

Digitalization driving efficiencies

With a focus on decarbonizing offshore oil & gas platforms, Technip FMC's Deep Purple project aims to creates a complete, sustainable subsea energy solution. The pilot includes an electrolyser, hydrogen storage, fuel cells, and energy control system as well as the development and testing of an advanced control and advisory system and a dynamic process simulator. The pilot will allow the consortium partners to ensure energy efficiency and autonomous operation offshore, as well as prepare the system for large-scale offshore commercial use. DNV helped TechnipFMC and the consortia develop the specification for the associated suite of digital twins according to their Recommended Practice DNV-RP-A204 ("Qualification and Assurance of a Digital Twin"). DNV collaborated to define the digital modules needed to be able to enable safe, unmanned, energy efficient and cost-effective remote operation of the system.

Carbon capture and storage

Carbon capture and storage (CCS) is playing an increasingly important role in decarbonizing assets. DNV recently qualified a modularized carbon capture facility for offshore installations, developed by Aker Carbon Capture. The Just Catch Offshore technology is proven to capture CO2 from flue gas stemming from turbines on floating offshore installations, even in harsh weather conditions. The modularized solution can fit into any type of application where gas turbines are present, bottom fixed as well as floating production facilities, such as floating production, storage, and offloading (FPSO) and floating liquefied natural gas (FLNG) vessels, power hubs, and offshore power gas plants.

The system is based on a modularized design with two standard units of 120 and 180 kTPA as building blocks. The units are typically configured and installed into one module. However, by combining modules, the capacity can be increased and adjusted in accordance with the specific requirements, providing significant flexibility towards capture capacity and power demand. The qualification follows concept studies with exploration, development and production, and FPSO operators in the oil and gas industry globally and the system will now support emission reductions across the sector.

Effective well management

While many decarbonization efforts focus on the rig itself, there are substantial energy efficiency benefits to be garnered within well operations. Oilfield services business Expro launched its iTONG™ System last year to address

Hydrogen renewable offshore energy production - hydrogen gas for clean electricity solar and wind turbine facility.

Oil and gas drilling rig work over remote wellhead platform to completion oil and gas produce well by using drilling bit which made from carbide or diamond at head bit and drive by mud pressure.

emission reductions in tubing operations. The technology allows operators a 'single push button' solution to ensure joints of casing and tubing can be made to a specific torque, or broken out in an automated sequence. It is estimated the system can reduce annual emissions by 146 tons per year through reduced personnel and energy requirements.

Fuel efficiency gains

Engine management is one of the key drivers in reducing Scope 1 emissions on a rig with many drilling contractors adopting systems which improve fuel efficiency. There has been significant progress in developing management solutions which reduce fuel usage and lower emissions. Oil and gas drilling contractor, Nabors Industries, developed a system which sends automated alerts to the driller through dashboards to advise the optimal number of engines to run. The technology is fully automatable and connects to a rig's generator control system with engines automatically turned on or off based on the advisories. During field testing, the system indicated a reduction in diesel consumption in line with internal models of up to 20% in certain applications, with an equivalent reduction in CO_2 emissions.

Supporting net zero goals

As energy transition efforts continue to ramp up, identifying and verifying new concepts for more carbon neutral rigs is essential to the future of the oil and gas industry. While energy security concerns remain high, new technologies which drive recovery with a reduced carbon footprint will support net zero goals while delivering essential fossil fuels to the global energy market.

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A Developer's View: Floating Foundation Choices

By Johan Daelman,
Floating Foundation Lead Engineer,
Thistle Wind Partners

Challenges and opportunities in choosing the right material and design for floating wind foundations, drawing on the author's experience from the Eolmed project and exploring the innovation gaps in the floating wind sector. Thistle Wind Partners (TWP) is developing two projects after securing rights to almost 400k m2 of seabed under the ScotWind leasing round in 2022. Currently in development is the Ayre Offshore Wind Farm, a 1GW floating-foundation project located 33km to the east of Orkney, and the Bowdun Offshore Wind Farm, a 1GW fixed-foundation project lying 44km off the coast of Aberdeenshire.

Thistle Wind Partners (TWP) was founded in 2020 by DEME Concessions, Qair, and Aspiravi as a wind development business with a focus on Scotland. While our founders have a combined 60 years of experience in renewables with projects across the world, TWP is the new kid on the block in Scotland.

We attract a lot of curiosity at industry events, especially when it comes to our plans for floating offshore wind development – one of our project sites, which lies 33km to the east of Orkney, will be a 1GW floating wind farm (estimated start of construction – 2029).

How are we approaching design selection? What are our requirements for suppliers and fabricators? As a ScotWind developer, we have also set ambitious targets for the use of the local supply chain in line with the expectations set by the Scottish Government and Crown Estate Scotland. We need and want to develop a robust local supply chain, and this is a major factor in how we will procure our turbines and components.

Eolmed: Learnings from France

I came to the TWP project fresh from working on the design team for the Eolmed Floating Wind Farm, a Qair project in the South of France that is now entering its construction phase.

My role was to conduct the combined elasto-aero-hydrodynamic analysis of floating foundation designs using numerical modeling.

We took a technology agnostic approach, initially considering concrete as an alternative to steel. The local market conditions meant that on this occasion, the choice landed on steel, and we are now in the construction stage.

At TWP, we are starting the process of choosing floating foundation materials and designs once again. Concrete and steel floaters are on the table for us, and we will be pursuing conversations with foundation designers, fabricators, and supply chain in the coming year.

We expect that this is an area of development that will move on fast as we consider the options, but there are a

few known pros and contras for using concrete versus steel.

Being agnostic, with the stretching targets we have for local content, we are exploring various solutions such as steel or concrete.

While concrete (although containing a lot of steel) is a solution that seems intuitively easier to implement, steel is a material that allows us to design complex, modular and adaptable shapes. We are exploring the possibilities in the local Scottish supply chain.

You do need to factor in the cost of having to use steel for the reinforcement, and a solution that can provide concrete steel-reinforced foundations at a cheaper cost than steel alone would be of interest to us.

We also need to consider the carbon recycling footprints of both solutions as well. When we considered this during the Eolmed planning, and when all considerations were weighed, the difference between steel and concrete was found to be negligible. Again, we are ready to have this perception overturned.

Looking at the durability of using each material, we are aware that steel has a drawback already well known (in marine activities): any steel structure immersed in seawater corrodes and requires an anti-corrosion system.

The most common method is galvanic cathodic protection, using a sacrificial anode (zinc or aluminium) that corrodes before the material being protected (essentially 'taking the hit'). However, as a promising technology – Impressed Current Cathodic Protection – uses an external power source and reduces the risk of any leakage into the environment.

That still leaves a supply issue for steel: but during our EolMed project, we found that early and supportive engagement with local suppliers resolved any doubts that we could source steel locally at a viable price. We worked with a joint venture between a local producer of steel sheets and a foundation fabrication company, keeping us to our 100% local ambition.

The legacy we are leaving in the South of France goes beyond supporting local steel production and fabrication, we are also working with another TWP founder company DEME under the SEMOP public-private partnership to lead operational development of the local port (Port-La Nouvelle) as a hub for heavyweight operations in the offshore renewables sector.

Innovation gaps in floating wind

This brings me to the question of innovation in floating wind and the burning issues that still need resolution from a developer's point of view.

1. Lack of standardization

Floating wind is an area of active R&D, which is what makes it exciting from an engineer's and a technology developer's perspective. It also means that we have a great number of options on the table – few of them tried and tested. If the industry can come together to agree some standardized models, we will start to see costs reduce, which would greatly accelerate floating wind.

2. Structural compliance between turbines and floaters

The turbines on the market are primarily designed to be installed on fixed-foundations and are not structurally compatible with floating foundations (in terms of natural frequency couplings). Much like when you flick a plastic ruler and it reverberates, wind turbine towers reverberate in tune with their powerful rotors. When you place them upon a floating foundation, you create a higher frequency that is much more difficult to tackle than for a turbine fixed to the seabed. Solutions that can meet that challenge will be preferred.

3. Ever-growing turbines

The major achievement of offshore wind – the constant increase in the size of turbines – is also a spanner in the works when trying to plan. Where will we be in terms of size in 2029? Foundation developers and fabricators need to understand this as early as possible.

4. Dynamic cable resistance

The industry has not yet achieved a satisfactory way of predicting the behavior of dynamic cables out at sea. There is an intricate web of measurements we need to know – how will the cable move in a certain type of current? How will it withstand different types of forces? This is an area of active R&D that we will be watching closely.

What next?

For TWP's Orkney wind farm, we are back to the beginning of the process once again. While we have taken learnings from Eolmed, we are determined to leverage upcoming technology developments for the Orkney site. Our team is currently assessing the entire spectrum of floating foundations that are out there – from next year, we will start whittling them down to a few favored options (that meet a satisfactory level of maturity and meet the conditions of our site).

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The Role of Technology in Making Renewable Energy a Reality

Fugro's Wouter Maas highlights the potential for technology to extend the lifespan and optimize the performance of offshore wind turbines, leading to increased renewable energy production and a faster transition away from fossil fuels.

By Wouter Maas, Strategy Director Offshore Wind O&M, Fugro

The offshore wind industry is now well established and widely relied upon to meet our energy needs.

In January 2023 the UK saw the record for the highest-ever level of wind generation, providing over half of its daily electricity, according to the National Grid. And in November 2022, there was a day when wind contributed its highest-ever share to the electricity mix (70 %).

Clearly, good progress has been made in the shift to renewables, but there's a long way to go for society to make the full shift away from fossil fuels.

Building new offshore structures is a big part of the solution and, encouragingly, the UK government has pledged to deploy 40 GW of offshore wind by 2030.

This is four times more than the 10 GW it currently has in production and enough to power every home at current electricity usage levels.

There may, however, be a missed opportunity to use technology to further increase the production of renewable energy.

Scaling Up Energy Production

Electrification, rising living standards, and a growing population means energy demand is increasing around the globe. In fact, power consumption is projected to triple by 2050, according to McKinsey.

Most of this energy will be supplied by renewable sources, with the IEA claiming that renewables will be the world's top electricity source within three years.

This rapid shift towards renewables is driven by both wants and needs; individuals, countries and organizations want to reduce their impact on the planet, and many are also being held to account by global climate goals.

The advantage of renewable energy is that it is scalable. Arguably, with the right infrastructure in place, it is almost infinite. Technology can play an important role here in making sure that production is fully optimized and the transition to renewable energy can finally become a reality.

Improving Asset Longevity

New offshore wind projects are critical for countries to meet growing energy demands and reach Net Zero targets. However, we must not forget the contribution of existing sites and structures. To scale up production, we need to look after the old, as well as the new.

There are already over 2,000 wind turbines off the coast of England, Scotland, and Wales – and we cannot afford for any of them to fall into a state of disrepair.

The goal should be for wind turbines to stay operational

beyond 25 years – with each additional year in operation generating ~20 GWh in renewable energy (the equivalent to powering 14 million homes). This will help to significantly increase the production of renewable energy.

By monitoring offshore wind turbines remotely with a set of specific sensors, operators can identify and correct issues such as fatigue, corrosion, and scour before they impact the asset's integrity or performance. This can reduce the frequency of subsea inspections (which is critical to bring down costs) and help to make sure turbines function efficiently to the end of their life cycle and beyond.

Technology Takes Industry to New Levels

Technology is rapidly advancing to optimize offshore wind projects. For example, automated data delivery can now provide real-time access to data and support continuous remote monitoring of assets.

This is helping to provide early indications of fatigue and failure – reducing costs, enhancing asset performance, minimizing downtime, and improving safety for wind farms. All these things are helping to increase production of renewable energy and reduce our reliance on fossil fuels.

Overall, better access to real-time data will help operators and asset owners to make more informed decisions and implement strategies based on the reality of the situation.

This enables condition-based and preventative maintenance to be decided and implemented on a per-turbine basis – maximizing the total value of their asset, speeding decision-making, and extending its lifetime and value.

It is important to also remember that, as energy production is scaled up, wind projects may be located anywhere in the world. Conditions can be extremely different, so enhanced visibility is critical to prevent asset owners from making assumptions and misguided decisions.

Clearly, there is a huge opportunity to use automated data delivery to extend the life cycle of wind turbines and increase production – but this does also mean that wind farm operators are now grappling with huge datasets.

To make sure the right data is available at the right moment in time, they should use a data delivery and engagement platform. After all, every decision based on this information could contribute to achieving the bigger goal of supporting the transition to renewables.

Technology can play a huge role in optimizing renewable energy production. Ultimately, the asset owners that continually push the boundaries will not only be more profitable but will make the biggest difference towards a more sustainable future.

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ACTIVATED DRILLING SCRAPER OPTIMIZES DEBRIS RECOVERY WHILE REDUCING RIG TIME

During a recent drilling campaign Coretrax's Activated Drilling Scraper (ADS) was deployed in the Middle East for efficient debris recovery and reduced rig time.

By David Cook, US Country Manager, Coretrax

The ADS eliminates the requirement for a dedicated scraper trip.

Technology development is playing a crucial role in reducing emissions while driving efficient hydrocarbon recovery as the oil and gas industry increases its efforts to support international environmental targets. With global drilling activity set to increase by 19% this year compared to 2020 levels1, operators are increasingly looking to adopt new solutions which deliver more efficient and economical operations.

Debris recovery is an essential step of any drilling campaign to ensure that the well cleanliness is optimized before moving to the next stage of operations, creating clean setting areas for packers and reducing the risk of damage to subsequent tools being run.

Well integrity and production optimization company Coretrax developed its Activated Drilling Scraper (ADS) to lie dormant in the drilling bottom-hole assembly (BHA) until drilling has been completed to deliver a more efficient and effective debris removal and casing cleaning method.

When activated, a ball is dropped to activate the scraper and allow the scraper blades to engage with the casing ID. The casing can then be cleaned and prepared for the installation of packers, including liner hangers while pulling out of hole with the drilling BHA.

Coretrax recently deployed its ADS technology for a client in the Middle East, which successfully eliminated the requirement for a dedicated scraper trip once drilling was complete, resulting in reduced rig time and effective debris removal.

Driving Efficient Debris Recovery

During a recent drilling campaign in the United Arab Emirates, the operator required a more efficient solution for debris recovery which would reduce rig time without compromising the effectiveness of residue removal or personnel safety.

Coretrax's ADS was selected as the most appropriate tool as it remains dormant in the string until activated, allowing the operations and liner hanger preparation to be completed in a single trip.

The design features high torque premium connections making it suitable to be in heavy-duty drilling BHAs even when drilling horizontal sections with significant torques and drags.

Once hydraulically activated, by dropping a ball from surface, the ADS's blades provide 360° coverage for effective removal of debris. Multiple activated drilling scrapers can be run in tandem to scrape multiple casing strings in a single trip, further optimizing drilling operations and wiper trips.

While drilling, the ADS system was run in hole with a 6" drilling assembly with two drilling scrapers positioned in the 9-5/8" and 7" casing sections. The tagging depth of 15,378ft [~4687m] was reached, and the hole was circulated clean. The 7" scraper was then hydraulically activated, by dropping a 1.69" ball from surface, followed by a 2.75" ball to activate the 9-5/8" system.

The 7" and 9-5/8" inner diameter (ID) casing sections were then effectively scraped clean simultaneously across the required intervals

Debris recovery is an essential step of any drilling campaign.

The ADS lies dormant in the BHA to deliver efficient debris removal.

of 14,070ft [4288.5m] - 13,890ft [4233.6m] and 7,874ft [~2400m] - 7,694ft [~2345m], respectively.

The tools were then pulled out of hole and liner hanger operations were able to continue immediately. Following retrieval, the tools were found to be in good condition, with all stages efficiently activated.

The application of the ADS eliminated the requirement for a dedicated scraper trip to prepare the ID casings prior to setting the liner hanger, effectively saving the operator 30 hours in valuable rig time and delivering a more efficient, sustainable solution.

As operators are increasingly more closely scrutinized on ESG commitments, technology which effectively decarbonizes operations while delivering efficient oil recovery is crucial. With the world moving closers towards global net zero goals, bringing together technical advancements and multi-functional products combined in one package to deliver highly efficient products will be essential to the future of the oil and gas industry.

BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	6	74	80	93%
Jackup	223	263	486	54%
Semisub	25	52	77	68%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	14	15	94%
Jackup	17	12	29	41%
Semisub	1	4	5	80%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	5	9	56%
Jackup	93	67	160	42%
Semisub	17	5	22	23%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship		6	6	100%
Jackup	14	30	44	68%
Semisub	6	17	27	78%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	24	25	96%
Jackup	4	3	7	43%
Semisub		12	12	100%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	59	119	178	67%
Drillship		1	1	100%

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship		24	24	100%
Jackup	26	24	50	48%
Semisub	1	3	4	75%

Oceania

Rig Type	Available	Contracted	Total	Utilization
Drillship				
Jackup	1	2	3	67%
Semisub		4	4	100%

Russia & Caspian

Rig Type	Available	Contracted	Total	Utilization
Jackup	8	2	10	20%
Semisub		3	3	100%

Global Average Dayrates

Floaters		*Jackups*	
Ultradeep water	421.9	High-spec	130.2
Deepwater	325.0	Premium	174.2
Midwater	378.8	Standard	73.0

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 2023
Source: Wood Mackenzie Offshore Rig Tracker

DISCOVERIES & RESERVES

Offshore New Discoveries

Water Depth	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*
Deepwater	16	20	14	13	22	
Shallow water	56	86	42	57	26	6
Ultra-deepwater	18	18	9	7	16	3
Grand Total	**90**	**124**	**65**	**77**	**64**	**9**

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	576	48,279	22,827
Shallow water	3,239	424,081	143,189
Ultra-deepwater	335	47,419	28,513
Grand Total	**4,150**	**519,779**	**194,529**

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	586	19,157	11,985
Asia	804	15,198	6,929
Europe	774	12,386	12,323
Latin America and the Caribbean	195	6,839	40,527
Middle East	133	73,935	145,770
North America	466	2,824	12,821
Oceania	89	11,679	1,173
Russia and the Caspian	61	17,282	13,828
Grand Total	**3,108**	**159,302**	**244,354**

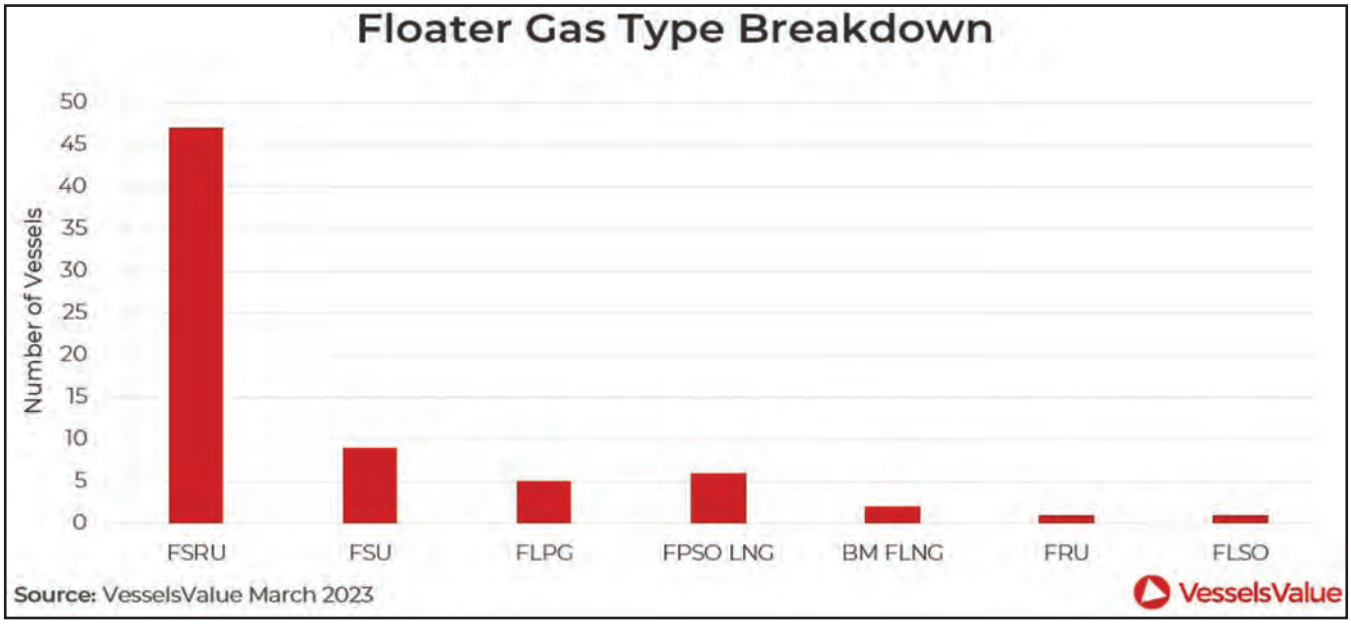
Onstream and under development.

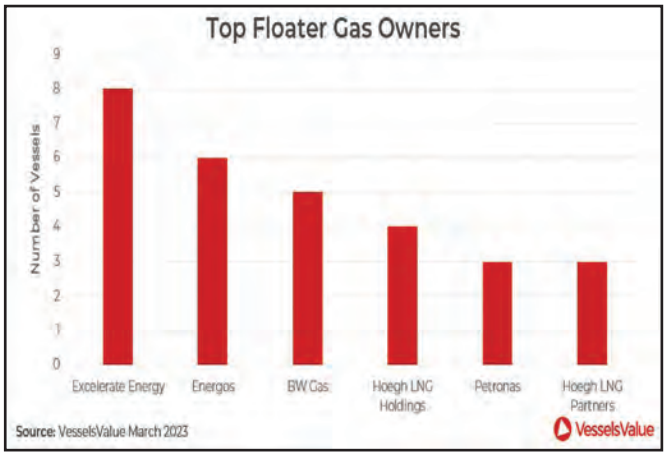
The portion of commercially recoverable 2P reserves yet to be recovered from the reservoir.

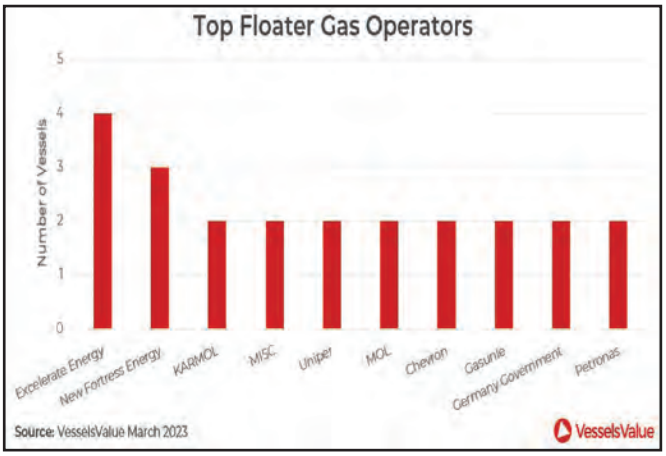
Source: Wood Mackenzie Lens Direct

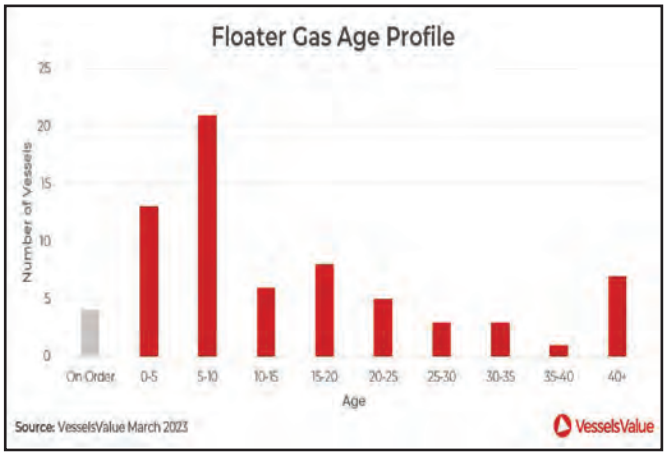
SECTOR IN FOCUS

THE FLOATER GAS MARKET









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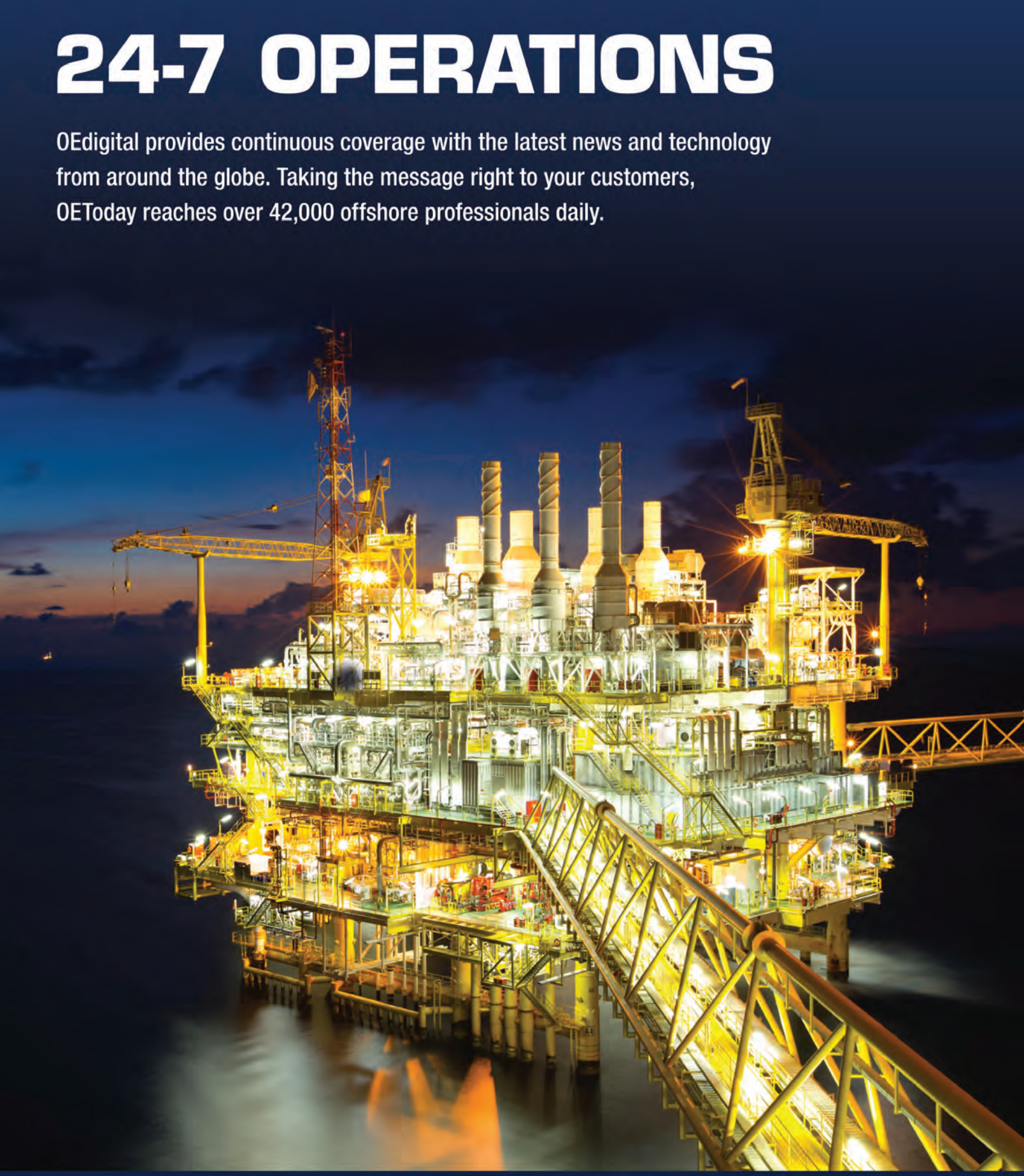

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