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All-electric Subsea Production System Remains A Work In Progress

OSLO, Norway—Work on the next generation of all-electric subsea production systems is being advanced, albeit not swiftly, as there is a three-way competition amongst big hardware companies.

Aker Solutions and TechnipFMC are working on developments, following in the footsteps of work done more than a decade ago by OneSubsea-cum-Cameron.

The subsea technology arena is well familiar with the false dawn of technology take-up. One can go back to the beginning of the 21st century and the development of the Troll Pilot subsea separation system by Norsk Hydro with the support of ABB. It took more than another half decade before Statoil released its Tordis seabed separation system in Norway and another similar period for Total to put down another such system at Pazflor in Angola.

So it has been with all-electric subsea production systems.

Originally developed with support from BP, Cameron—now OneSubsea, a Schlumberger company—delivered the first two all-electric christmas trees to Total for installation on the Dutch K5F Field in 2008. Technically they were not all electric, as the development of an electric downhole safety valve (e-dhsv) was slow to follow. It was not until the third tree for K5F was

installed last year—which included Halliburton's Depth-Star e-dhsv—that it could be described as truly all-electric.

Progress has been made.

FMC, prior to the takeover merger with Technip earlier this year, had delivered more than 200 electrically actuated valves and 38 electric subsea control modules, according to TechnipFMC's Olav Monsson, who spoke during the Subsea Valley Conference in Oslo, Norway. The first group—16 in all—of e-actuators were supplied to Statoil for choke valves. However, either the hydraulics were problematic or the retrofit valves could not be accommodated within the existing subsea control system. The big breakthrough, though, was the delivery of nearly 80 subsea valves with electric actuators for the Åsgard subsea compression station, Monsson said.

The early electric actuators were installed with batteries, originally NiCad (nickel cadmium) and later Li-Ion (lithium ion). By the time the Åsgard project came along with a big electric power supply for all the turning machinery, batteries were not required.

Monsson said TechnipFMC continues to work on new variations of actuators for what it has done before, such as for choke valves, and possibly for high-integrity pipeline protection system applications, but taking the step up into

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Cameron, now part of Schlumberger, delivered the first two all-electric Christmas trees to Total for installation on the Dutch K5F Field in 2008. (Source: Cameron)

an all-electric tree with higher safety requirements will take some time. Monsson said he expected such Christmas trees to become available in 2020 or 2021.

umbilical was “half the cost of the entire subsea production system.”

—Steve Sasanow

DEVELOPMENT

Columbus, Cheviot Projects Push Forward In North Sea

Two field development projects in the U.K. North Sea are moving forward at a promising rate—both featuring subsea elements—as activity in the mature region shows signs of increasing after a couple of very quiet years due to the low oil price environment that sparked the severe industry downturn.

Serica Energy is making strong progress with development work on the Columbus gas field in the U.K. North Sea and is planning to choose a development solution this year. First gas is scheduled a further two years down the line.

Two potential development options are being mulled in collaboration with operators that have facilities nearby. The two choices are:

- A subsea well completion tied into a proposed third-party pipeline to the Shearwater platform; and
- An extended-reach development well drilled from the Lomond platform delivering “capital cost efficiencies and easier maintenance access.”

“Serica is working toward selection of the best alternative and a full field development plan by the end of 2017 with a view to commencing development work in 2018. First gas is targeted for late 2019,” the company said.

Contingent resources at Columbus are estimated at 12.4 MMboe. Serica has a 50% stake in the project.

“Serica has continued to strengthen its financial position after a particularly strong fourth quarter. Following an especially good performance in terms of production rates and efficiencies, lower opex and improved sales prices since the restart of Erskine Field production in late August, we enter 2017 with a strong balance sheet, no borrowings, growing cash resources and increasing opportunities to add value from our existing oil and gas resources,” said Tony Craven Walker, Serica’s chairman.

“We are looking to build on this strong financial base. Our immediate focus is to broaden and expand our producing asset base through progressing the Columbus Field to development and by acquiring additional production where we believe Serica can add value,” Walker added. “The U.K. North Sea, where there are strategic benefits, tax efficiencies and opportunities on offer and where we feel we have an edge, remains a prime area of focus.”

Speaking on exploration activity, Walker said the company has begun preparations to drill a well on the U.K. Rowallan prospect. Serica has a 15% carried interest. “A

successful outcome of this well would have a material impact on Serica," he said.

Well planning for the Rowallan prospect is advanced. Partners will approve site survey and long-lead items during 2017, with drilling planned for 2018. Serica is fully carried on costs through to completion of the first well on Rowallan. Serica estimates potential net 20 MMboe.

"In Ireland and Namibia we have received license extensions from the authorities and continue to progress our holdings where we see real future potential," he added.

Alpha Eyes Varg For Cheviot Field

Alpha Petroleum Resources has sealed a FEED study agreement with Teekay Offshore for its *Varg* FPSO vessel.

Alpha is looking to deploy the *Varg* FPSO on its 100% owned Cheviot oil field, which "is one of the largest undeveloped oil fields in the U.K. sector of the North Sea," Alpha said.

In addition, Petroleum Equity-backed Alpha said it has entered an exclusivity agreement with Teekay Offshore and will negotiate a lease and operate contract during FEED for the life of the Cheviot oil field.

The development is expected to be sanctioned during third-quarter 2017 with first oil production planned for 2019 at an anticipated rate of at least 30,000 bbl/d. The development will consist of at least 18 wells, including

13 production wells, two water injection wells, two gas injection wells and one production well established in the satellite Peel oil reservoir, the company said.

There is also an option to use additional processing capacity on the *Varg* FPSO unit. Such options will be considered during the FEED process. "This would allow for infill wells to increase ultimate recovery. Development of the Cheviot Field is predicated upon rigorous evaluation of historical production data and new 3-D seismic surveys," Alpha said.

Alpha has decided that maximum recovery will be best achieved via reinjection of produced gas and water and use of horizontal wells to minimize drawdown.

"This is a key milestone in the development of the Cheviot Field and follows innovative thinking and continued investment during a downturn in the market. Teekay Offshore has a strong track record in the North Sea," said Andy Crouch, Alpha's executive chairman. "Alpha's collaborative approach with contractors has resulted in a project that is economically robust in a low oil price environment, minimizes our delivery risk and time to first oil and meets the U.K. government's MER [Maximum Economic Recovery] requirements."

The company is committed to bringing Cheviot to production and building a hub in the area to further upside, Crouch added.

—Steve Hamlen

US Grants BP License To Operate North Sea Field With Iran

BP and Iran's state-run oil company received a license from the U.S. Treasury last year to operate their joint gas field in the North Sea following the lifting of Western sanctions on Tehran, BP said April 6.

Production at the Rhum Field was suspended in 2010 when Europe imposed sanctions on Iran over its nuclear program and only resumed four years later after Britain agreed to set up a temporary management scheme whereby all revenue due to Tehran would be held until sanctions were lifted.

Following the removal of EU and U.N. sanctions on Iran in January 2016, the temporary management scheme ceased.

Iran regained control of its stake and on Sept. 29, 2016, BP obtained a license from the U.S. Treasury, through its sanctions enforcement arm—the Office of Foreign Asset Control (OFAC), to continue operations at the field, BP said in its 2016 annual report.

BP, which was founded more than a century ago as the Anglo-Persian oil company, has multiple business operations in the U.S. and therefore needs an OFAC license to avoid potential breaches of existing U.S. sanctions.

Last year BP created an executive committee to explore business in Iran, which would exclude its American CEO Bob Dudley in a bid to avoid potential sanctions violations.

London-based BP recorded a net profit of \$31.6 million in 2016 from its 50% stake in the field, which supplies about 4% of Britain's gas demand.

"BP currently intends to continue to hold its ownership stake in the Rhum joint arrangement and act as operator," it said in the annual report.

While international sanctions on Iran were removed more than a year ago, the U.S. has held separate measures in place and President Donald Trump's administration has promised a tough line.

BP did not specify for how long the Rhum Field license was valid.

Previous U.S. President Barack Obama tried to encourage non-U.S. companies and non-U.S. banks to increase trade with Iran, although Tehran said Washington did not do enough to ease its access to international financial markets and banks for vital capital after years of isolation.

—Reuters

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DEVELOPMENT BRIEFS

Wintershall Kicks Off Oil Production In Danish North Sea

Wintershall Noordzee B.V. has begun production from the Ravn Field, its first owned and operated Danish oil field, the company said in a news release.



Ravn produces oil from a newly constructed production platform in the North Sea. (Source: Wintershall Noordzee)

The field, located in Block 5/06, produces oil from a depth of about 4,000 m (13,123 ft) via a new production platform in the Danish North Sea. The oil is transported via a subsea pipeline about 18 km (11 miles) away to Wintershall Noordzee's A6-A processing platform, where it is fed into the existing export network to the Netherlands, Wintershall said.

Wintershall Noordzee is taking a phased approach for Ravn. Called "appraisal through development," the concept will enable the company to continuously gather performance data on well productivity and the lateral extent of the reservoir, the company said. Data analysis will provide the basis for and contribute to further field development options.

"Ravn paves the way for potential further oil and gas developments in this region," Robert Frimpong, managing director of Wintershall Noordzee, said in the release.

Wintershall Noordzee owns a 63.64% share in the Ravn Field. The Danish state-owned oil and gas company Nordsøfonden holds the remaining 36.36%.

Tenaris Provides Offshore Line Pipes For Total's Moho Nord

Tenaris provided TechnipFMC with a package of offshore line pipe solutions for Total's deepwater Moho Nord project offshore the Republic of the Congo.

The package included rigid flowlines, jumpers and spools, bending solutions, taper joints and buckle arrestors, and coating systems with the support of a coating sub-supplier, Tenaris said in a news release.

"This project is among the most complex SURF [subsea, umbilicals, risers and flowlines] projects Tenaris has ever executed and a landmark in many aspects," said Mariano Armengol, pipeline services business unit director for Tenaris.

The Moho Nord Field, which started production in March, consists of 34 wells tied back to a new tension-leg platform and an FPSO unit. The field, which is



The Moho Nord Field started production in March. (Source: TechnipFMC)

located in water depths up to 1,200 m (3,937 ft), has an expected production of 100,000 bbl/d.

Wood Group Wins Tolmount FEED

Premier Oil has awarded Wood Group a contract for FEED on the Tolmount Field development project in the U.K. Southern North Sea.

Wood Group will provide topsides, jacket, pipeline, flow assurance and subsea engineering expertise for Premier's Tolmount offshore assets and export pipeline, which ties into the Dimlington onshore terminal in Humberside, England.

"This award demonstrates the integrated solutions that we are uniquely positioned to provide: bringing facility engineering, specialist technical solutions and our operational reputation to FEED," said Robin Watson, Wood Group's CEO. "We are committed to delivering a full systems engineering approach from the subsea wellhead, through the offshore facilities, export pipeline and to the onshore terminal, complete with end-to-end flow assurance."

Sandvik Materials Technology Wins Order For Leviathan Gas Field

Sandvik Materials Technology, a developer and producer of advanced stainless steels and other materials, has secured the contract to be the sole provider of stainless steel umbilical tubes for the Leviathan gas field, the company said in a news release.

The Noble Energy-operated field is located in the Mediterranean Sea offshore Israel.

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The order, valued at about 400 million SEK (US\$44.2 million), was booked in the first quarter with deliveries scheduled for 2017.

Hansa Transports Equipment For Fields Offshore Indonesia



Subsea equipment is loaded and transported on HHL Richards Bay. (Source: Hansa Heavy Lift)

Hansa Heavy Lift has successfully transported two dozen reels and a range of subsea equipment for the Jangkrik Complex Project offshore Indonesia, the company said.

The reels and subsea equipment were discharged onto the offshore vessel *Viking Neptun* in five mobilizations. Two more offshore vessels, the *Seismic Supporter* and the *Deep Orient*, were used to load and offload some of the equipment from HHL Richards Bay, which picked up the cargo at three ports in Malaysia.

“This was a complex project, which required a very careful planning process as well as continuous communication with all parties involved from the start,” said Henry Woo, head of Asia-Pacific for Hansa Heavy Lift. “Our P2-1400 vessel type was the ideal ship for this project, as she provided enough space to stow and handle the cargo and enough crane capacity for discharging.”

Heerema, AF Gear Up To Remove Four Ekofisk Platforms

Heerema Marine Contractors (HMC) subcontractor AF Gruppen said it has received notice that ConocoPhillips

Skandinavia AS intends to enter a contract with HMC for the removal and disposal of platforms connected to the Ekofisk Field in the North Sea.

The contract includes engineering, preparation, removal and disposal of four platforms with a total tonnage of about 36,000 tonnes, AF Gruppen said in a news release.

The platforms are to be removed and disposed from 2017 to 2022.

Wood Group Lands Contract For Statoil’s Snorre Expansion Project

Statoil has awarded Wood Group a FEED contract for the Snorre Expansion Project’s subsea flowline system, Wood Group said in a news release.

The Snorre Field is located in Norwegian North Sea. The contract will be delivered by Wood Group’s Stavanger, Norway, office and follows the successful completion of a concept study for the project completed at year-end 2016.

BP Taps Amec Foster Wheeler For Engineering Services

Amec Foster Wheeler has been awarded a global framework contract by BP International to provide engineering, procurement support and project management services for pre-FEED and FEED work for a range of projects, a news release stated.

The contract covers onshore, offshore, subsea, drilling, greenfield and brownfield upstream engineering services in Alaska, Angola, Azerbaijan, Egypt, the Gulf of Mexico, Indonesia, Oman, Trinidad and the U.K.

The three-year contract has an option to extend for two additional years.

Aker BP Awards Aker Solutions Engineering, Procurement Contract

Aker Solutions has secured a framework agreement for up to 10 years from Aker BP to provide engineering and

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procurement services for new offshore field installations, according to a news release.

The scope is for fixed facilities ranging from small well-head platforms to complete oil and gas field centers. The contract covers work in all project phases and includes early-phase studies, FEED, detail engineering and follow-on engineering, the release said.

The contract, which starts in April, has a fixed term of six years with a four-year extension option. The value depends on how much work the operator calls for under the agreement, and Aker Solutions will book orders as they are received.

Oceaneering Reels In Umbilical Contract For Anadarko GoM Project

Oceaneering International Inc. has landed a contract from Anadarko Petroleum Corp. to supply the umbilical for the operator's Constellation subsea tieback in the U.S. Gulf of Mexico (GoM), according to a news release.

The contract is for a dynamic and static electro-hydraulic steel tube control umbilical, which is expected to be tied back to Anadarko's Constitution spar and associated hardware. Plans are to use the control umbilical to transmit hydraulic control fluid and chemicals as well as provide electrical power and fiber-optic requirements to operate and monitor the subsea wells, the release said.

Located in the GoM's Green Canyon Block 627, the wells are in about 1,370 m (4,500 ft) of water.

Oceaneering plans to design and manufacture the umbilical at its Panama City, Fla., facility.

Kvaerner Lands Work From AkerBP For Offshore Platform Projects

Kvaerner was among the companies that scooped up long-term framework contracts awarded by Aker BP. The six-year agreement, Kvaerner said, covers construction and hookup of fixed offshore platforms, including topsides and steel jacket substructures. It has an option for four more years.

The Valhall West Flank installation is expected to be Kvaerner's first project under the contract, the company said.

The agreements are intended to enable Aker BP to use a more integrated project delivery model: a "platform alliance" for each project. Under Aker BP's management, Kvaerner and the other alliance members will work with a "one for all-all for one" mindset, the release said.

Kvaerner said its role in the alliance will include fabrication of jackets and topsides for fixed platform installations. In the agreement, hookup and commissioning assistance is also part of Kvaerner's roles. The value of the agreement will depend on which future projects involve Kvaerner.

"For Kvaerner, to become a strategic alliance partner with Aker BP opens up significant business opportunities. Our role in the alliance means that we can leverage the expertise and capabilities from Kvaerner's entire organizations at Stord, in Verdal and at Fornebu," Kvaerner President and CEO Jan Arve Haugan. "The agreement is also an important driver for further development of new solutions, such as Kvaerner's Subsea on a Stick concept for small, cost-effective unmanned platforms."

First Oil Flows From Flyndre Field

Production has begun from the Maersk Oil-operated Flyndre Field in the U.K. and Norwegian North Sea, Maersk said.

First oil began to flow on March 26, traveling 25 km (15 miles) via pipeline to the Repsol Sinopec-operated Clyde Platform. Production from Flyndre Field is expected to peak at about 10,000 bbl/d of oil, with the field expected to produce until at least 2023.

The field is about 293 km (182 miles) southeast of Aberdeen in blocks 30/13 and 30/14 of the U.K. North Sea and is 325 km (202 miles) west-southwest of Stavanger in Block 1/5 (PL018C) of the Norwegian North Sea. It was discovered in 1974 and straddles the U.K./Norway median line.

Partners in the field's development are Maersk Oil UK Ltd. (65.941%), Repsol Sinopec Resources UK Ltd. (22.739%), Repsol Sinopec North Sea Ltd. (4.24%), Maersk Oil Norway AS (6.255%), Statoil Petroleum AS (0.471%) and Petoro AS (0.354%).

Maersk continues focusing on the North Sea region in new developments such as the Maersk Oil-operated Culzean Field on the U.K. Continental Shelf, its stake in Norway's Johan Sverdrup Field (operated by Statoil) and other projects.

Maersk Oil CEO Gretchen Watkins said first oil at Flyndre represents new production for both the U.K. and Norway.

—Staff Reports

TECHNOLOGY

Collaborative Platform Promises New Digital Reality

OSLO, Norway—The concept of the digital oil field has been on the technology radar in earnest since the turn of the century but it remains a tantalizing vision, seemingly always just out of reach. The ability it would deliver to maximize oil recovery and increase profitability has increased its importance in the new world of lower oil prices. The advances in software, IT and engineering

have placed this within reach but until now the implementations were very much in narrow applications.

In the buildup to the Subsea Valley Conference in Oslo, Norway, Kongsberg unveiled Kognifai, its open and collaborative digital platform that places a portfolio of applications into the cloud. Kognifai focuses on optimizing data access and analysis for customers across mar-

itime and energy industries, and it provides an integrated development and distribution platform for efficiency enhancing applications.

At first glance it is a message that has resonated around press conferences across the globe for many years, but this time there is a fundamental difference.

“We have a more holistic view on this; we have the entire value chain covered with this from the maritime operations side right through production on the platform,” said Andreas Jagtoyen, vice president of energy at Kongsberg Digital. “There are other companies that cover parts of the value chain, but we are covering it all.”

Working With Digital Twins

Kognifai is an open ecosystem for customers, partners and suppliers that allows them to harness the power of data on their own terms. According to Jagtoyen, this will allow them to reap the benefits of the digital transformation in an easier and more efficient way.

“We understand the entire value chain,” Jagtoyen added. “We have supplied automation equipment to the drilling rigs and production platforms. We have our dynamic simulators that simulate the process plant and the pipeline flow in the wells. By combining all these elements, we can produce a digital twin of the entire system.

“The digital twin is interesting because it can allow you to verify whether the real-time data is actually a sensor failure or a value that has never been seen before. You compare the digital twin to the real world to gain an understanding of whether it is the output error or something wrong in the process. With this you can also predict what will go wrong in the future when you see parameter changes.”

The Kognifai ecosystem is built on a core of cybersecurity, customers’ ownership of their information and data integrity, but the open standards make it easy to add and integrate both Kongsberg and third-party applications. “We are amazed to see the cross-industry innovation and sharing that is already ongoing in our open ecosystem, and we are actively working with selected customers and partners on core business transformation challenges



Kognifai is an open ecosystem for customers, partners and suppliers that allows them to harness the power of data on their own terms. (Source: Kongsberg)

where new solutions are appearing due to the platform,” Jagtoyen said.

Although the basic technological building blocks are in place to deploy a digital oil field strategy, pulling these together in a coherent platform has yet to be realized. The advent of cloud and edge computing, Big Data and improved connectivity have increased opportunities, but the big question remains—is the industry ready to implement it?

Jagtoyen feels that day is fast approaching, but he believes it is the business mentality and processes that will hold up its development rather than the technology itself.

“I don’t think this industry is totally ready for this approach yet, but they are moving toward it,” he said. “Unmanned platforms are still some way off. The oil companies have a lot of work to do internally to get their organization ready for it, then the governments and local authorities need to accept it.

“It is also putting the technology together in a new way; there are a lot of products available, but the solutions are not there today. To make the next step you need to put all this technology together and this needs to be supported by work processes and organization. That is still some way off.”

—Mark Venables

TECHNOLOGY BRIEFS

EC-OG Turns On Subsea Power Hub Unit

EC-OG has reached a milestone with its Super Power Hub (SPH) ocean current energy conversion system, which is now fully operational, according to a news release.

The power hub was designed to serve as a cost-effective and reliable subsea power source.

As explained by EC-OG, the subsea hybrid drive system uses a combination of a marine energy convertor coupled directly to a lithium-based energy storage system. The unit, which was installed April 13, is performing in line with expectations.

“Although the weather was not on our side, we were still able to successfully complete the installation and commence testing ahead of schedule,” Robert Cowman, engineering director at EC-OG, said in the release.

“Having a vertical axis turbine means that the SPH is operating effectively in these unpredictable, sporadic flow conditions.”

EC-OG said the next task is to leave the SPH running 100% autonomously with wireless data monitoring during the summer months.

New Streamer Opens Possibilities For HR3D Survey Configurations

Sercel has released Sentinel HR, a high-resolution solid streamer designed to meet the specific imaging needs of shallow-target applications, such as oceanology, civil engineering and reservoir characterization as well as high-resolution 3-D (HR3D) seismic surveys for detailed mapping of geological features, a press release stated.

The latest member of the Sentinel streamer family has been developed with a close channel separation of 3.125 m (10 ft) to achieve reliable and cost-effective high-resolution surveys. Recent enhancements available in Sercel's new-generation Seal 428 marine seismic recorder allow a higher channel count, enabling up to 6 km (3.7 miles) of Sentinel HR to be deployed with full data and power redundancy to ensure nonstop acquisition, opening up new possibilities for HR3D survey configurations.

The Sentinel HR also adapts to all types of survey spreads, from comb deployment to larger configurations integrating the Nautilus steering system. In addition, Sentinel HR can provide marine mammal monitoring when combined with QuietSea, Sercel's passive acoustic monitoring system, which is seamlessly integrated into the seismic streamers.

L&N Scotland Releases Synthesis System To Subsea Market

L&N Scotland has expanded its portfolio, releasing the Synthesis system in an effort to combat constraints faced during product integration stages, the company said.

The new system offers a fully commissioned package complete with a premanufactured and "ready-to-fit" kit of parts, through a single purchase order. Synthesis includes a full turnkey support package with all small-bored tubing lines staged in reverse fitment order along with all line and assembly sequence documentation for ease of installation, L&N said in the release.

"This bespoke solution not only provides the necessary project cost and timescale reductions requested by the industry, but also facilitates a more efficient and stream-

lined manufacturing process, whilst maintaining the quality and integrity of the client product," said Craig Finnie, L&N Scotland's managing director. "We are delighted to bring Synthesis to the global subsea market, in which we can deliver a substantial solution for operators in the form of a rationalized supply chain."

Acoustic Insulation Jackets Shorten Application Process

Advanced Insulation has released a new range of ContraFlex acoustic insulation jackets, an adaptable product protecting personnel from high-sound pressure levels that are designed to significantly shorten the application process using a combination of absorbent materials and a mass-loaded barrier inside a removable jacket solution, a press release stated.

Workers are exposed to a variety of different mechanical noises every day, including loud turbines, pumps, valves and pipes. There is a call for continued innovation of effective noise control measures to combat noise-induced hearing loss.

"In an industrial environment sound comes from a variety of sources, such as mechanical noise, fluid flow and gas release, which all have different acoustic characteristics. It is important to understand them to be able to target noise attenuation and effectively insulate specific problem areas," said Chris Read, sales support manager at Advanced Insulation. "The system provides high-performance acoustic insulation and combined thermal insulation for industrial applications such as onshore refineries, offshore environments and a wide range of bespoke solutions for pumps, compressors and engines."

—Staff Reports

FLOATERS

Floating LNG Is Riding The Tide

Petronas marked an important milestone in the LNG industry in late March by shipping the first cargo from a floating liquefaction unit. While relatively small with an annual capacity of 1.2 mtpa compared to its gargantuan neighbors in Australia, Indonesia, and onshore Malaysia, the project, known as *PFLNG Satu*, represents a small but growing piece of the future of liquefaction.

PFLNG Satu began construction in mid-2013, shortly after Shell began construction on the *Prelude* floating LNG (FLNG) unit in late 2012. In the ensuing two years, Petronas took a final investment decision on a second FLNG unit,



Petronas shipped its first cargo from a floating liquefaction unit, *PFLNG Satu*, in late March. (Source: Petronas)

and Exmar agreed to provide the Western hemisphere's first unit, which would be moored offshore Colombia. Since then, other projects have been explored on both the east and west coasts of Africa as well as in Asia and Australia.

Upon first look, FLNG technology offers producers the ability to monetize stranded offshore gas fields that were previously thought to be inaccessible. But another significant market dynamic of the time influenced their growth. When these projects were considered in the 2011-2014 time frame, Australia was in the midst of an enormous LNG investment phase, and the U.S. was poised to do the same. Construction costs had started to skyrocket and labor shortages were anticipated in the short- to mid-term.

FLNG offered a solution to these issues. Shell, recognizing the cost challenges in Australia, opted to contract South Korea's Samsung Heavy Industries for construction. Petronas followed suit, selecting Daewoo for *PFLNG Satu*. The modular nature of the technology allowed the two companies to keep costs relatively low

by outsourcing the construction to locations where there were no labor issues. Unlike other onshore projects of the time, FLNG did not experience cost blowouts nor did they see the delays that plagued Australian projects.

The technology has not been immune to the market downturn, however. Exmar's FLNG in Colombia was canceled by Pacific Exploration and Production due to changes in the country's natural gas market as well as the changes in the international LNG market. Browse was shelved due to its cost issues, while Abadi was dropped after the Indonesian government decided to pursue an onshore option instead.

As far as floating technology, floating storage regasification units have received the lion's share of interest and coverage in the LNG industry. Their relative low costs and short lead times have opened up dozens of new markets and will help to nurture the nascent gas-to-power markets in developing parts of the world such as Latin America, West Africa and South Asia.

—Stratas Advisors

FLOATER BRIEFS

Western Isles FPSO Unit Journeys From China

Dana Petroleum's *Western Isles* FPSO unit, with a storage capacity of 400,000 bbl of crude, arrived in Rotterdam on April 17 after a seven-month journey from the Cosco shipyard in China.



Dana Petroleum's *Western Isles* FPSO unit arrived in Rotterdam on April 17. (Source: Dana Petroleum)

Western Isles was loaded onto the semi-submersible heavy-lift ship *MV Xin Guang Hua* in February. It is the first FPSO unit built by China for a foreign customer.

The FPSO unit will operate in the Harris and Barra fields in the North Sea. First oil is expected sometime this year.

DSME Selects TMC For Compressors For Newbuild

TMC Compressors (TMC) has won a contract from Daewoo Shipbuilding & Marine Engineering (DSME) to supply a marine compressed air system to a newbuild floating storage and regasification unit (FRSU), according to a news release.

Engineering, manufacturing and supply of a complete compressed air system for the FRSU, which is being built by DSME for BW LNG, are among TMC's scope of work.

Under the contract, TMC will supply 3 by 40 kW frequency controlled control air compressors and 3 by 40 kW service air compressors, the release said. The contract value is undisclosed.

DSME is currently constructing the LNG FRSU at its Okpo shipyard in South Korea. Delivery is anticipated in November 2019.

EM&I Receives First ODIN Services Agreement from Seadrill

Seadrill has tapped EM&I to provide an ODIN UWILD package for the ABS-classed ultradeepwater drillship *West Jupiter* operating offshore Nigeria for Total, EM&I said in a news release



(Source: EM&I)

The order came after Seadrill awarded EM&I a master services agreement.

Seadrill and ABS allowed EM&I to try out equipment on the *West Tellus* drillship in Las Palmas. EM&I deployed its NoMan system, which is used to identify potential failures using cameras inserted into confined spaces, and other equipment. EM&I said the experience allowed the company to better familiarize itself with these types of drilling assets.

—Staff Reports

VESSELS

Wärtsilä Engines To Power Two LNG-fueled Vessels



Spartacus, under construction in The Netherlands, will be the world's most powerful cutter dredger and will rely on Wärtsilä propulsion solutions. (Source: Wärtsilä)

Wärtsilä will provide engines and propulsion machinery for two new vessels that are the first in their classes to be powered by LNG: *Spartacus*, the world's most powerful cutter suction dredger (CSD) vessel, and *Orion*, an off-shore construction vessel.

The €20 million (US\$21 million) contract for *Spartacus*, booked in fourth-quarter 2016 and announced in April, includes delivery of:

- Four 9-cylinder Wärtsilä 46DF dual-fuel engines;
- Two 8-cylinder Wärtsilä 20DF dual-fuel engines;
- Wärtsilä LNGPac fuel gas storage and supply system with a newly designed bilobe tank arrangement;
- Two fixed pitch propellers with shaft assemblies and high-pressure nozzles;
- Two tunnel thrusters; and
- Commissioning, site supervision and extended project management services.

The equipment is scheduled for delivery in fourth-quarter 2017.

The 164-m (538-ft) vessel will have total installed power of 44,180 kW. It is being built at the Royal IHC yard in The Netherlands for Belgium-based Dredging International (DEME).

"Wärtsilä has worked in close cooperation with the owners starting from the early stages of this large project,"

Arthur Boogaard, general manager, business development special vessels at Wärtsilä, said in a statement. "This has enabled a well-engineered and fully integrated propulsion arrangement, and an LNG fuel system that is optimized for the needs of the vessel."

"We are very aware of our environmental responsibilities, and for this reason we have opted for Wärtsilä dual-fuel engines running on clean burning LNG fuel," said Jan Gabriel, head of newbuilding and conversion department at DEME.

CSDs are able to dredge nearly all kinds of soils, including sand, clay and rock. They are used wherever the ground is too hard for conventional dredgers to operate.



The world's first LNG-fueled offshore construction vessel being built for DEME will be powered by Wärtsilä. (Source: Wärtsilä)

The 210-m (689-ft) *Orion* will be powered by four 9-cylinder Wärtsilä 46DF dual-fuel electric propulsion engines and two 6-cylinder Wärtsilä 20DF dual-fuel engines, which are expected to be delivered later this year. The company will also supply:

- Two custom-made retractable thrusters;
- Four underwater demountable thrusters;
- The Wärtsilä LNGPac storage and supply system; and
- Commissioning, site supervision and extended project management services.

—Joseph Markman

'Natural Gas Operating Fleet' Concept Moving Ahead

An agreement by Wärtsilä and COSCO shipping Heavy Industry Co. (CHI) to develop a natural gas operating fleet has received Lloyd's Register's (LR) Approval in Principle (AiP) certificate.

A memorandum of understanding among the three companies was signed in June 2016.

The fleet comprises:

- A pusher tug;
- LNG storage barge;
- LNG regasification barge; and

- A floating liquefaction natural gas barge.

The pusher tug can be used to transport the three barges.

The companies seek to offer global operators a more efficient and economical fleet design that meets current and anticipated environmental requirements.

The concept's main advantages are its operative flexibility, and the fleet's competitive capex and opex costs. The companies envision the fleet acting as an LNG carrier (using only the pusher tug and LNG storage barge),

or deployed in more complex projects involving liquefaction and regasification systems (using all units). The low draft design makes it a good fit for gas power plant projects in Southeast Asia.

“This is a new and innovative fleet concept that is designed to create better efficiencies for companies involved in any part of the natural gas supply chain,” said

Sanjay Verma, director, business development, Southeast Asia, Wärtsilä Marine Solutions. “By combining CHI’s know-how in this field with Wärtsilä’s vast technological competences, we have together taken yet another step forward in creating an optimal LNG supply chain.”

—Joseph Markman

VESSEL BRIEFS

TechnipFMC, DOF Subsea Deliver *Skandi Búzios*

The *Skandi Búzios* pipelay support vessel, owned by the 50:50 joint venture (JV) formed between TechnipFMC and DOF Subsea, has started its eight-year charter contract with Petrobras, as scheduled on April 13, according to a news release.

Under the JV agreement, TechnipFMC is responsible for the engineering and management of the flexible pipeline, while DOF subsidiary Norskan is responsible for the marine operations.

Skandi Búzios is the sistership of the *Skandi Açú*, which started its charter contract on Aug. 13.

Solstad Lines Up Work For Two Vessels

Solstad Offshore has signed a four-year frame agreement with Saipem (Portugal) Comercio Marítimo (Saipem) for use of construction support vessel (CSV) *Normand Cutter*, Solstad said in a news release.

Through this agreement, Saipem can use the vessel to support its subsea construction activities worldwide at pre-agreed commercial terms, the company said. As part of the agreement, Saipem said it has declared a utilization of about six months from June for the vessel on a project in West Africa.

In addition, Solstad said it has entered an agreement with Mexico’s Typhoon Offshore, an affiliate of Grupo Salinas. Typhoon will charter the CSV *Normand Oceanic* for three years starting in May for use in Mexican waters.

Solstad entered the agreement on behalf of Normand Oceanic, a joint venture company owned by Solstad Offshore and Subsea 7.

Wärtsilä Working With Shipyards On IMO Regulations

Wärtsilä is taking a proactive approach to compliance with the International Maritime Organization’s (IMO) Convention for Ballast Water Management by signing agreements with several major shipyards, including Kappel Shipyard Ltd. (KSL) of Singapore, to ensure cooperation and communication, the company said.

The limited time frame—the regulations take effect in September—means the retrofitting market will likely be extremely active this year. By conveying critical information to shipowners and operators, Wärtsilä is seeking to ensure that full engineering, procurement, construction capabilities are provided to all customers.



Wärtsilä’s Aquarius ballast water technology has been type-approved for the IMO regulations. (Source: Wärtsilä)

Wärtsilä owns ballast water management system production facilities in the U.K. and China as well as manufacturing agreements with the China-based companies COSCO Weihai and CSSC Jiujiang.

The IMO’s regulations address the issue of ships discharging ballast water carrying invasive aquatic species in the sea where they can harm local species. Wärtsilä’s Aquarius ballast water technology has been type-approved for the IMO regulations.

Edison Chouest, BP Form New Alliance For Services In GoM

Edison Chouest Offshore (Chouest) has formed a 30-month alliance with BP, extending a relationship that involves Chouest affiliates ECO, vessel services; C-Port, multi-service terminal facilities in Louisiana’s Port Fourchon; and C-Logistics, for logistics coordination, expediting and tracking cargo movement, a news release stated.

The agreement includes a three-year extension for utilization of BP’s Gulf of Mexico (GoM) Preservation and Maintenance facility, designed and built by Chouest, in Houma, La.

In addition, the vessel alliance includes a new 95-m (312-ft) new generation, purpose-built platform supply vessel designed for delivery of supplies to BP’s GoM production platforms, ECO said in the release. The vessel is currently under construction at Chouest’s Houma shipyard, LaShip, and scheduled for delivery within the next several months.

Chouest and BP have had a business alliance for more than eight years.

—Staff Reports

EXPLORATION

Black Sea Offers Untapped Potential

Turkey has estimated that the Black Sea holds recoverable reserves of 10 Bbbl of crude oil and 2 Tcm (70.6 Tcf) of natural gas and operators are making progress, slow some might say, toward exploiting this potential that a few years ago was touted by some analysts as the “new North Sea.”

Apart from Russia, all the other littoral countries of the Black Sea—Romania, Bulgaria, Turkey, Ukraine and Georgia—have traditionally been dependent on energy imports. Stepping up exploration and development activity in the region could go some way toward easing this burden.

Romanian Wells

One company looking to push ahead is Black Sea Oil & Gas (BSOG), which along with its partners, has just awarded GSP Offshore a contract to drill two exploration wells in the XV Midia Shallow Block in the Romanian sector of the Black Sea.

The cantilever-type jackup drilling rig, GSP Uranus, has been contracted by BSOG to drill the two wells in water depths up to 100 m (328 ft). Drilling is scheduled to start in fourth-quarter 2017. Auxiliary services such as aviation, logistics and offshore service vessels to support drilling operations have also been contracted with GSP, BSOG said.

“The Midia Block concession holders are targeting prospects that not only could add to the resource base of the concession holders but, more importantly, could feed the Midia gas development project currently consisting of the Ana and Doina discoveries that is currently heading toward development approval,” BSOG CEO Mark Beacom said.

BSOG is obtaining approvals required to develop the Midia project. The partners are hopeful of obtaining these approvals in 2017.

“Once this has been achieved then it will take a further two years to build the offshore platform, drill the development wells, lay the offshore and onshore pipelines and construct the gas treatment plant,” BSOG noted.

In November 2016, BSOG and its co-venturers handed Xodus Group a FEED contract for the offshore and onshore facilities of the Ana and Doina gas discoveries on the XV Midia Shallow Block.

At the time, Beacom said “with this award we take a major step forward in delivering this offshore gas development in Romania’s Black Sea with expectations that we will reach a final investment decision in 2017.”

The offshore FEED services include engineering and design for the Midia gas development, which consists of:

- A wellhead platform at Ana in a water depth of about 70 m (228 ft), receiving and supporting production from a subsea tieback from the Doina subsea well controlled through umbilicals; and

- Infield pipeline from the Doina subsea well to the Ana wellhead platform—about 18 km (11 miles) and offshore export pipeline from the Ana wellhead platform to shore at about 121 km (75 miles).

The group will also be responsible for the onshore pipeline to the gas treatment plant and the gas treatment plant itself.

Domino Success

In December 2012, ExxonMobil and OMV Petrom spudded the Domino-1 exploration well—the first in Romania’s deepwater sector of the Black Sea—with the well discovering significant gas reserves.

Domino-1 is located in the Neptune Block about 170 km (106 miles) offshore at a water depth of about 930 m (3,051 ft).

Both partners said preliminary estimates are between 1.48 Tcf and 2.96 Tcf (42 Bcm and 84 Bcm) of gas, which is up to six times more than the annual consumption of Romania.

In terms of development options, some analysts have suggested that a Domino project could be combined with the potential plays in the Polshkov Ridge offshore Bulgaria.

Other Plays

A report by ICM Petroleum Management in 2012 suggested that the Western/Mid Black Sea has significant deepwater exploration opportunities. These include the Polshkov Ridge offshore Bulgaria, the Tetyaev High off Ukraine and the Andrusov Ridge off Turkey.

Also off Ukraine, ICM said the Forosa area has recoverable resources of between 952.9 MMboe and 1.1 Bboe, while the New Skifska area has recoverable resources of between 586.4 MMboe and 733.0 MMboe.

The report noted that the offshore Russia/Caucasus area needs more exploration.

“The prospects of finding major untapped reserves of oil and gas deep under the Black Sea are driving exploration projects in the region. Developing these resources, however, will call for sophisticated designs and advanced tubular technologies,” Tenaris said, regarding the Black Sea’s deepwater plays back in 2011 before the recession hit exploration and development budgets.

“Should this and future exploration campaigns confirm the vast energy resources that are believed to exist beneath the Black Sea, this emerging oil and gas province might one day match the production rates currently seen in established major markets, such as Russia, the Caspian Sea or the North Sea,” Tenaris added. “The challenging conditions posed by ultradeepwater offshore rigs require the support of sophisticated tubular products and services, which in many cases make the difference between failure and success.”

Enough Potential?

The western part of the Black Sea, driven by Romania as well as Bulgaria, is considered one of the most promising hydrocarbon plays in Southeast Europe.

However, striking a few large discoveries is not enough to kick start a surge in activity in the region in the current low oil price environment. That said, oil prices are

slowly rising and the industry has gone through a serious cost-cutting campaign that has brought down margins for field development projects.

Lower rig rates could also encourage more drilling in the Black Sea or at least trigger a rethink on many of the wells that were delayed after the oil price crash.

—Steve Hamlen

Brazil Draws Auctions Calendar, Confirms Santos Basin Most Attractive Area

RIO DE JANEIRO—Brazil's government released on April 11 a calendar of licensing rounds through 2019, offering up interest in onshore, presalt and post-salt fields.

The presalt Santos Basin, off Brazil's southeast coast, is expected to attract great interest from the majors. According to Brazil's Energy Ministry, of the 14 presalt fields to be auctioned during the next two years, 10 are located in the 350-sq-km (135-sq-mile) Santos Basin. The figure adds to the basin's potential to surpass Campos Basin as Brazil's most productive offshore basin. Currently, Campos Basin accounts for 55% of Brazil's oil output, compared to the Santos Basin's 35%. However, this scenario is quickly changing.

"Campos Basin will continue to be an important area for offshore activities. Yet, due to high oil well productivity, Santos Basin will be Brazil's most productive basin very soon," said Glauco Nader, an oil and gas specialist at Dynamus, a Brazilian consultancy company. "The high oil production in the area is attracting oil companies. Even Petrobras is focusing its investments there."

Numbers prove this new trend. Of the 10 highest-producing wells in Brazil, nine are located in the Santos Basin, and the significant volume produced per well in the Santos Basin presalt far exceeds the industry's average. The most productive is in the Lula Field, with an average daily flow of 36,000 bbl/d of oil. The Lula presalt field, which was discovered in 2015, is estimated to have between 5 Bbbl and 8 Bbbl of recoverable oil.

In only six years, Petrobras started operating eight production systems in the Santos Basin. The systems included FPSO *Cidade Angra dos Reis* in the Lula Field, FPSO *Cidade de São Paulo* in the Sapinhoá Field, FPSO *Cidade Paraty* in the Lula Nordeste Field, FPSO *Cidade de Itaguaí* in the Lula Field and FPSO *Cidade de Maricá* in the Lula Alto Field.

That performance has drawn attention by other operators that want to increase their portfolio. They see Santos Basin's presalt fields as a good business opportunity. Companies such as Statoil, Galp and Total are already operating in the Santos Basin, and they have announced they might participate in future presalt licensing rounds.

ExxonMobil, one of the few oil majors without a presalt presence in Brazil, may enter the presalt club. Recently, the U.S. major announced great interest in becoming a partner of Petrobras in ultradeep waters.

"Considering movements toward a strategic partnership, we have nothing concrete with Exxon, but they



(Source: Shutterstock)

have certainly expressed strong interest in the Brazilian presalt exploration," Petrobras CEO Pedro Parente told reporters after a conference in Rio de Janeiro.

Auctions Calendar

Oil companies have been calling for additional licensing rounds in Brazil for years. According to the Brazilian Institute of Petroleum, a calendar helps the industry to organize its investments in the long term.

"With these new changes made by the government, we hope that oil companies have enough time to approve their budgets. The calendar will boost job creation, seismic and R&D activities," Brazil's Minister José Coelho Filho said. "Companies are going to study the areas to be offered between 2017 and 2019. I am sure that the calendar will give a new dynamism for the oil and gas industry."

The third presalt licensing round will auction four presalt fields—Pau Brasil, Peroba, Alto de Cabo Frio-Oeste and Alto de Cabo Frio-Central. The Pau Brasil Field, located in the Santos Basin, is seen as the most attractive. With a total area of 135 sq km (52 sq miles), the Pau Brasil oil field is estimated to have up to 2.5 Bbbl of recoverable oil.

As for the fourth presalt licensing round, scheduled for May 2018, Brazil's government is evaluating three Santos Basin fields and four Campos Basin fields. The Santos Basin fields are Saturno, Três Marias and Uiapuru, and the Campos Basin exploratory blocks are C-M-537, C-M-655, C-M-657 and C-M-709.

Brazil's government scheduled the fifth presalt licensing round for 2019. Five Santos Basin fields will be evaluated—Aram, Lula Southwest, Jupiter South, Jupiter Southwest and Bumerangue.

—Brunno Braga

EXPLORATION BRIEFS

Brazil Court Suspends Petrobras Oil Field Sale To Statoil

A Brazilian court has ordered Petrobras to suspend the sale of its stake in an exploratory block to Statoil after a union argued there should have been an open bidding process.

Petrobras, said in a securities filing on April 17 that the deal for its stake in the BM-S-8 region known as the Carcara Field was approved by regulators.

Half of the \$2.5 billion in proceeds were due when the deal closed in November, and the company said it had used those funds to repay debts. Petrobras said it would take legal measures to defend its interests.

The sale of the 66% stake in the offshore prospect was the first major presalt asset sold as part of a divestment plan that now aims to raise \$21 billion in two years for Petrobras to pay down its debts.

The National Federation of Oil Workers said it had filed the lawsuit because Petrobras, as a state-controlled enterprise, is required to hold an open bid for any asset sale.

Statoil is confident that its deal with Petrobras to acquire a stake in exploration Block BM-S-8 offshore Brazil will eventually go ahead despite a court suspension, a spokesman said on April 18.

"We are confident that the deal deal will go ahead. ... We are considering various legal options, but we are confident that we have a strong case," Statoil's spokesman Erik Haaland said.

Lundin Appraisal Well Hits Oil At North Sea's Edvard Grieg

A Lundin Petroleum subsidiary appraisal well, targeting additional resources on the southwestern flank of the Edvard Grieg Field in the central North Sea, has hit oil.

The find confirms the upside for the field "in the order of 10 to 30 MMboe," Lundin said in a news release. "The final implication for total reserves for the Edvard Grieg Field will be quantified in the 2017 year-end reserves update."

Drilled 3 km (1.9 miles) west of the Edvard Grieg platform by Lundin Norway, appraisal well 16/1-27 in PL338 encountered a 15-m (49-ft) gross oil column in a 94-m (308-ft) thick sandstone reservoir compared to the pre-drill estimate of 38 m (125 ft) thickness, Lundin Petroleum said in a news release.

The top reservoir was hit deeper than expected with excellent reservoir quality that was also better than anticipated, the company said. The oil water contact was encountered at 1,948 m (6,391 ft) below mean sea level, 9 m (30 ft) deeper than the established contact in this part of the Edvard Grieg Field.

Pressure data confirm communication with the Edvard Grieg Field, Lundin said. Conventional coring and fluid sampling were among the data acquired.

The well, drilled using the Island Innovator semisubmersible drilling rig, will be permanently plugged and abandoned.

Lundin Norway is the operator of PL338 with a 65% working interest. Partners are OMV Norge AS and Winterhall Norge AS, holding 20% and 15% interest, respectively.

—Staff & Reuters Reports

CONFERENCE REPORT

Plans For Development Forecast To Rise Offshore Norway

OSLO, Norway—Norway, like the rest of the offshore world, has spent the last two and a half years suffering through the worst downturn since it began producing oil more than 40 years ago. That appears to be over now.

Terje Søviknes, Norway's minister of petroleum and energy, told people gathered at this month's Subsea Valley Conference that he expected the number of plans for development and operations (PDOs) to be filed this year to be double that of the mere five put forward in 2016. While this is a modest increase, it indicates that either the worst of the recession is over, the industry has finally come to terms with the lower oil price in terms of development costs—what Søviknes called "efficiency gains"—or a bit of both.

The minister was upbeat about the upcoming licensing round with 93 blocks in the Barents Sea to be made available, making this northerly region the next big thing in the Norwegian offshore sector. And he pointed to new activity in two arenas where Norway has always punched above its weight—R&D and exports.

The Demo 2000 technology development program, created by the Research Council of Norway (RCN) at the turn of the century during an earlier new project drought, has had another cash injection of NOK100 million (just under US\$12 million). RCN has reported 44 applications for funding under the scheme.

In a move that acknowledges the growing importance of the offshore renewables sector, Norway has merged the international marketing and networking organizations for its oil and gas (INTSOK) and renewables (INTPOW) industries into a new organization—Norwegian Energy Partners.

Even with the reduced level of activity worldwide, new developments continue to be funded in Norway. Three projects—Johan Sverdrup, Trestakk and Alta Gohta—which are at different points in the development spectrum received special attention here in the form of what the Subsea Valley organization dubbed "master classes."

Sverdrup is one of the biggest—and maybe the biggest—current offshore developments in the world, but its significance may extend well beyond its 2 Bbbl to 3 Bbbl of oil in place. Operator Statoil, working closely with main partner Lundin Norway, has managed to shave significant costs off the overall price tag for this big four platform plus subsea development, making it a model for how others might be able to tackle such a large project.

According to technical director Trond Stokka Meling, the original NOK123 billion (US\$14 billion) figure for Phase One—based around three platforms with projected production of 440,000 bbl/d—has been cut to NOK97 billion (US\$11 billion) and Phase Two—which is due to add another 220,000 bbl/d—has seen its estimated project cost reduced from NOK80 billion (US\$9 billion) to just NOK40 to 55 billion (US\$4 billion to \$6 billion). This has sliced the overall per barrel development cost for an estimated \$25/bbl, making it profitable at any projected oil price.

Some of that cost cutting has been achieved by plans to use Allseas' new heavy-lift vessel *Pioneering Spirit* for single lift topside installation on three of the platforms, maximizing completion of the decks before offshore activities and reducing the number of offshore working days.

Phase 1 also includes a major subsea water injection system consisting of 10 wells, while later development of the Kvitos and Geitungen satellites are now expected to make use of the new low-cost CapX subsea concept. There will also now be a permanent seabed reservoir monitoring system covering 80% of the field area.

Statoil also showed off its newly developed cost-cutting skills by getting the Trestakk subsea tieback project on the development ladder with the PDO approved on the first day of this event. Project director Havard Stensrud said costs have been reduced by 50% from the original estimate—although at least one-third has been due to market forces since the oil price crash—and with additional reservoir work increasing reserves

by 30%, the net present value of the field has jumped by 60%.

The project is a classic North Sea small field, which has been long on the drawing board. Discovered more than 30 years and approved in 1987, it had to wait for the development of the Asgard Field to provide the infrastructure required to bring it onstream. It passed the first development hurdle in 2010 and by 2014 was seen as part of a joint development scheme with Wintershall's Maria subsea field, but the crash sent the cost up and the field back to the drawing board.

Then things changed. An improved business case included an extension to the operational life of the Asgard A semi to 2030 without drydocking plus reduced market rates for drilling and operations sent the breakeven price down to \$27/bbl and the project going ahead.

But there were other improvements. Umbilical costs were reduced by linking through an existing seabed facility, copying designs from Sverdrup for the template and christmas trees—the now standard vertical trees—saved on redesign and the use of inline tees with flexible tails knocked 40 days of offshore vessel operations. Many of these improvements were achieved through extended FEED work by Forsys, now re-absorbed into the bigger TechnipFMC organization.

Further into the future will come Lundin's Alta Gohta in the Barents Sea. This is a most unusual offshore reservoir made up of cave-like structures, known as karstified carbonates, more commonly found onshore. An improved understanding of the subsurface was achieved through the use of seismic contractor CGG's TopSeis technique, which separates acoustic sources and hydrophones onto different vessels.

This will be developed with some form of floater with subsea wells, likely at least five templates including one on the nearby Fellicudi Field, but any decision on the facility will likely await a decision by Statoil on its nearby Barents Sea prospect John Castberg. Both gas lift and gas injection are planned, and Lundin is interested in a possible all-electric production.

—Steve Sasanow

POLICY

Nigeria's Senate Receives Oil Industry Reform Bill

Nigeria's senate will debate a long-awaited oil industry reform bill after receiving the draft law on April 6, the latest step in efforts to overhaul the energy sector in Africa's largest economy.

The legislation is part of proposed reforms that make up the sprawling Petroleum Industry Bill, which has been in discussion for over a decade and redrafted many times but has yet to be passed into law.

President Muhammadu Buhari, who took office in May 2015, made passing the legislation a priority as part of an attempt to crackdown on the mismanagement and corruption that has held back the country's energy sector. Oil sales account for two-thirds of government revenue in the OPEC member state.

The bill's acceptance into the upper house marks the closest it has yet come to becoming law, said Senate President Bukola Saraki.

"I think we are all proud that we have gone this far and we have finally broken this jinx," he said.

Once the senate has approved the bill, it will be sent to the lower chamber of parliament. With the approval of both, the final version will be sent to the president to be signed into law.

Its backers said Nigeria's oil sector is in dire need of change, with power currently concentrated in the state oil company Nigerian National Petroleum Corp. and the petroleum ministry.

—Reuters

Iran Security Body Reviewing New Oil Contracts

Iran’s top security body is still reviewing the Iran Petroleum Contract (IPC) model, Oil Minister Bijan Zanganeh was quoted as saying on April 9, as the contracts aimed at attracting foreign investors appear to face fresh delays.

In January, Iran named 29 companies from more than a dozen countries as being allowed to bid for oil and gas projects under the IPC, which Tehran hopes will boost production after years of sanctions.

But the IPC model has been delayed several times due to opposition from hardline rivals of President Hassan Rouhani.

“The new oil contracts (IPCs) are currently being reviewed by the Supreme National Security Council,” Zanganeh told parliament, the students’ news agency ISNA reported.

Zanganeh did not elaborate or say how long the review might take, ISNA and other agencies reported.

The IPC model ends a buy-back system dating back more than 20 years under which Iran did not allow foreign firms to book reserves or take equity stakes in Iranian companies.

Oil majors have said they would only go back to Iran if it makes major changes to the buy-back contracts, which companies such as France’s Total or Italy’s Eni have said made them no money or even incurred losses.

The IPC has more flexible terms that take into account oil price fluctuations and investment risks, a senior Iranian oil official told Reuters in November.

—Reuters

BUSINESS

Global Subsea Market: Entering An Age Of Recovery

The global subsea market has undergone one of, if not the, most brutal downturn in recent history. The Upstream Supply Chain research group at Wood Mackenzie has observed that lengthy project delays caused by long-term concerns about subsea cost stemming back from the previous decade coupled with the oil price crash of 2014 have created a perfect storm of challenges for the overall offshore market.

Adapting To New Conditions

The oil and gas industry has always been one of innovations driven by the challenges of maximizing recovery safely and efficiently. This downturn required the industry to closely examine how it executes subsea projects and understand how it can further increase efficiency, return and recovery.

Industry collaboration has been an ongoing theme in the industry as the supply chain comes together with unique solutions to the high cost issues in deep water.

The operators are doing their part by reassessing their developments, prioritizing the highest potential and optimizing development concepts given an outlook of a lower-for-longer oil price. The operators and supply chain have come together to work on these projects earlier in the life cycle than had historically taken place in the hopes that the earlier the two parties work together on a project, the better the chances are at maximizing potential efficiencies and “red flagging” potential costly pitfalls.

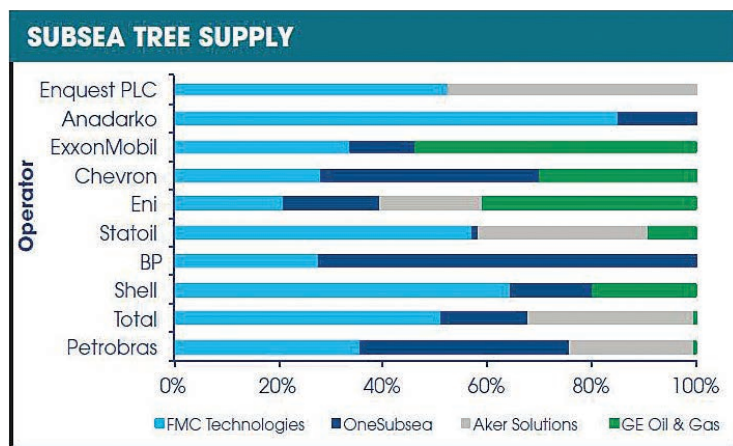
Near-term Demand Outlook

According to Wood Mackenzie, the near-term outlook for subsea demand is one of growth compared to 2016, which saw fewer than 100 subsea trees ordered for the year. In the base-case forecast for 2017 Wood Mackenzie is forecasting about 120 subsea tree orders. While this still pales in comparison to previous years’ activity, it remains an upward move from 2016.

Brazil will remain weak in 2017, with limited demand potential for 2018. There remains a large inventory of subsea trees for Petrobras that will likely satisfy project startups until 2020 (containing subsea tree startups for years in the future).

Africa’s outlook for the next 24 months is flat to slightly down compared to the previous two years. The natural gas projects of Northern Africa have helped buoy local subsea demand in the recent past. While Wood Mackenzie does not expect significant improvement in this market over the near term, it is important to remember the region will continue to play a critical part in overall global demand.

The North Sea actually stands to realize the highest recovery in the near term. Coming off a record year in 2013, the past three years have seen very muted subsea activity from the



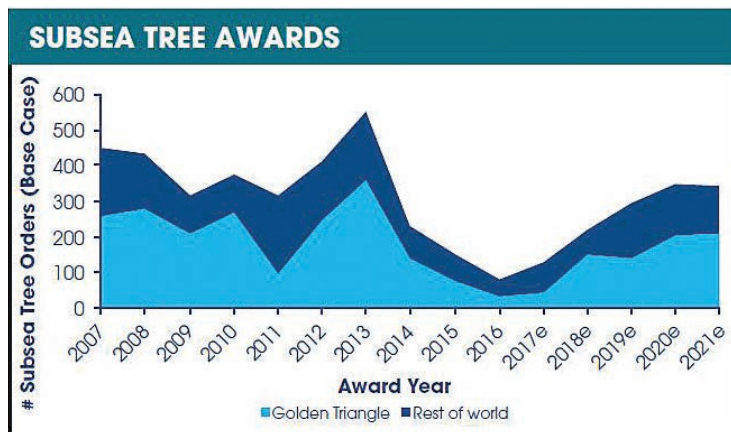
TechnipFMC and OneSubsea remain the long-term supply leaders for subsea tree manufacturing. (Source: Wood Mackenzie)

North Sea. Wood Mackenzie expects the region to outpace the past three years' worth of subsea demand within the next 24 months. Projects like Johan Castberg, Njord Future, Cheviot and Snorre Future projects underwrite the region's near-term potential.

Golden Triangle Will Remain Long-term Driver

With a slight adjustment to the definition, the Golden Triangle will remain dominant in future subsea demand. The Brazil portion of the region will need to be expanded to South America in general, and West Africa will need to be extended up to North Africa and around to East Africa. These areas are expected to represent about 60% of future subsea demand through the end of the decade.

Brazil can only grow from the current lack of subsea demand experienced since its record-setting year in 2013. Recent legislature working to enable international oil companies (IOCs) to come in and operate presalt fields will help accelerate this recovery. Adjustments to local content requirements also will open up opportunity for Brazil by enabling active operators to more widely use the global supply chain. That said, exploration success and subsequent project executions in frontier areas around the continent (Falkland Islands, Guyana, etc.) will help support the continent's anticipated growth.



Global subsea tree awards reached a record low in 2016.

(Source: Wood Mackenzie)

Due to the historical high cost of developments off Nigeria and Angola, the current downcycle has severely impacted their subsea demand. Instead of new megaproject executions, smaller scale subsea tiebacks and infill subsea orders are underlying award potential for the countries. African demand through the end of the decade will be underwritten by natural gas finds in North and East Africa. The Transform Margin also has an interesting backlog of smaller oil developments operated by a handful of different operators.

The U.S. Gulf of Mexico (GoM) will remain the main source of subsea demand in North America through the forecast period. The region has struggled considerably through this downcycle, seeing IOCs and independents

alike stalling, selling and reengineering projects. This activity is leading to an anticipated uptick in 2017-2018 subsea demand, when more efficient versions of these projects are executed.

A key driver to recovery and ongoing activity is diversity—in projects, in operators and regionally. While South America and Africa are growing their diversity, U.S. GoM operators have a long history of using this diversity to their benefit. Typically, the majors will push the frontier boundary of developments in terms of water depth, and a strong mix of independent operators will come in behind that wave and develop more marginal fields as subsea tiebacks.

Suppliers Competing For Less

Global equipment suppliers have been grappling with quickly diminishing backlogs during this downturn as recovery remained just out of reach. Members of the supply chain have collaborated and consolidated through this challenging period and have emerged a more efficient and stronger group of companies. They're focusing on various aspects of the subsea project—well efficiencies, subsea plumbing and installation, among others—to provide cost-effective avenues to project execution.

Through year-end 2016 it appears that relationships still weigh heavily on market share results. For major subsea production equipment TechnipFMC and OneSubsea remain the long-term supply leaders. They hold strategic frame agreements with some of the most active operators in deep water, and where they do not hold frame agreements, they have longstanding relationships with them.

That said, the next few years could see some interruption in typical market share trends. Operators are considering the cost-reducing strategy of opening up the bid process to non-frame-agreement holders. The highly competitive nature of the subsea market at the moment could prove this approach successful and provide an extra amount of cost savings for the operator. How permanent, if at all, those interruptions might be long-term are hard to understand since many deepwater operators are creatures of habit and tend to stay true to suppliers and contractors with whom they have a long track record.

Cautious Optimism Ahead

Subsea and the greater deepwater market have undergone a tremendously difficult period wherein operators have had to reevaluate how they do business. The industry will have to redefine what a "good" year means to their business since a return to historic norms is all but impossible before the turn of the decade. That said, the industry continues to adapt and incorporate lessons learned to evolve into a more compact and efficient market better poised to withstand the lower oil price outlook.

— Caitlin Shaw, Wood Mackenzie

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BUSINESS

Cobalt's Exploration, Appraisal President James Painter Resigns

Cobalt International Energy Inc.'s James H. Painter, president of exploration and appraisal, has resigned, the Houston-based company said in regulatory filings on April 11.

Effective April 13, Tim Nicholson was appointed senior vice president of exploration and appraisal of Cobalt, the company said. Nicholson joined Cobalt in 2005 and has previously served as its vice president of exploration.

"Nicholson has been a key leader within the exploration team for the past decade and has been instrumental in the company's exploration success in both West Africa and the Gulf of Mexico [GoM]," Cobalt said in filings with the Securities and Exchange Commission (SEC).

Painter, whose resignation is effective April 30, had held his current position since January. He previously served as Cobalt's executive vice president of the GoM from the company's inception in 2005.

"The company extends its gratitude to Mr. Painter for his vision, leadership and many contributions and wishes him the best in his future endeavors," Cobalt said in SEC filings.

Painter has more than 35 years of experience in the oil and gas industry, according to Cobalt's website.

Sembcorp Sheds Interest In Shanghai Guofeng Marine

Sembcorp Marine Ltd. has disposed of its 70% equity interest in Shanghai Guofeng Marine Engineering and Technology Co. Ltd. (SGMET) to the other existing shareholder for RMB 5.8 million (US\$1.3 million), according to an April 7 stock exchange announcement.

Following completion of the disposal, Sembcorp will no longer have any interest in SGMET, which will cease being a subsidiary of Sembcorp.

SGMET's principal activity is in R&D of technologies for civil ships and equipment for oceanics industries and the provision of related technical consultation services. Sembcorp said the sale is in line with its strategy to realize investment in non-core business and its commitment to optimize profitability and operations.

Sembcorp said it intends to apply the net proceeds toward its working capital.

Service Provides Global Coverage Of Offshore Projects, Discoveries

Stratas Advisors' new Global Upstream Project Analytics (GUPA) provides worldwide coverage of offshore projects with a focus on recent and future developments, the company said.

Coverage includes multiple measures of specific project economics throughout the project life cycle, analysis of publicly announced E&P projects and detailed fiscal models by country. The company's transparent modeling

lets operators see the calculations, adjust the assumptions as desired and analyze the results.

GUPA is designed to be a highly valuable resource that will help companies make informed business decisions in the industry's most challenging, complex and high-cost operating environment.

Dennis Proctor Retiring As CEO Of Hunting Oilfield Services In 2017

Oilfield services company Hunting Plc said its CEO Dennis Proctor will retire later this year after a successor has been appointed.

Hunting, which provides drilling tools to oil and gas producers, said it has begun the process to identify a successor and is considering both internal and external candidates.

Proctor will remain CEO until the appointment is made, Hunting said on April 7.

Aqualis Offshore Opens Office In Taiwan

Aqualis Offshore, a marine and offshore engineering consultancy, has opened an office in Taiwan to support local offshore wind and oil and gas developments, the company said.



Tim Ho, head of Taiwan office; Phil Lenox, director – Asia Pacific; and Peng Yongfei, country manager China, stand in front of Aqualis Offshore's new office in Taiwan. (Source: Aqualis Offshore)

"Taiwan has a rapidly growing offshore wind sector as well as certain requirements for offshore engineering and marine survey services," says Phil Lenox, director of the Asia-Pacific region for Aqualis Offshore. "Aqualis Offshore and Offshore Wind Consultants (OWC) provide senior competence for the offshore sectors, so we believe that our experience can be utilized well in Taiwan."

In December 2016, OWC was appointed by a Taiwanese renewables company to provide consultancy services related to wind turbine installation vessels and their suitability for different wind turbines and sites offshore Taiwan, Aqualis said.

UH Names Founding Director for Engineering Programs in Katy

Phaneendra Kondapi, the engineering educator who helped develop the first subsea engineering program in the U.S. at the University of Houston (UH), has been



(Source: University of Houston)

named founding director of engineering programs at UH in Katy, Texas, a news release said.

Kondapi is returning to UH after serving as director of subsea engineering at Texas A&M University for the past year. Formerly an adjunct professor of subsea engineering, Kondapi has more than 20 years of experience managing engineering projects at energy industry giants FMC

Technologies and KBR.

Kondapi, who taught the UH subsea engineering program's inaugural course on flow assurance in 2011, will teach a graduate-level subsea course on flow assurance.

Trelleborg Releases Cable, Flowline Protection System

Trelleborg's offshore operation has released Buoyant Uraduct, a protection system for subsea cables, umbilicals, flowlines and hoses, a press release stated.

Based on the original Uraduct design, Buoyant Uraduct protects cables from abrasion and impact. The protection system reduces the crush risk at crossing locations by reducing the overall weight of a subsea cable. Made from highly buoyant materials, the protection system also minimizes drag and lift, avoiding possible stability issues.

Buoyant Uraduct is a protection system for sub-

sea cables, which can be customized for customer specifications for buoyancy, pipeline diameter and multiple subsea configurations. It is also a suitable alternative to subsea crossing bridges and can be installed on the cable or pipeline before it is laid on the seabed.

Total Taps Aptomar For Environmental Monitoring

Total E&P Norge (Total) has selected Aptomar's tactical collaboration and management system (TCMS) to digitalize and manage environmental monitoring and oil spill detection at its Martin Linge Field, according to a news release.

The TCMS will combine subsea, topside and aerial oil spill detection sensors into one common operating picture (COP), providing an overview of all available sensor information.

As explained in the release, Total's main objectives for the system are to:

- Make all oil spill detection elements, remote sensors, cameras and process sensors accessible to its personnel onshore and offshore; and
- Give a quick overview of the current status of the oil spill detection sensors in one interface.

"The oil spill detection COP will enable Total to detect significant acute discharges within the required timeframe, and that satisfactory expertise and methods are available for determining the position, extent, quantity and combustibility of unintended discharges," the release said.

—Staff & Reuters Reports

UPCOMING

The next issue of *Subsea Engineering News* will be distributed May 11. Until then, visit epmag.com.

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