SEN
SUBSEA ENGINEERING NEWS

HARTENERGY vol. 35 - no. 24 December 13, 2018

Tullow Oil Eyes Next Hot Spot, Gears Up For Guyana Probe

Tullow positions itself offshore Comoros, a potential future hot spot, as it prepares to drill offshore Guyana next year. (Source: Sad Agus/Shutterstock.com)

When it comes to navigating the intricacies of the unknown, Tullow Oil is considered an expert, particularly in Africa where it has discovered over 4 Bbbl of oil during its 30-plus-year history on the continent.

The London-headquartered independent E&P company, which is behind the giant Jubilee and Tweneboa-Enyenra-Ntomme oilfield developments offshore Ghana, has reset its exploration portfolio and is ready to test its potential.

During the last few years, the company has exited noncore areas—like many of its peers—and focused on what it describes as high-value assets in Africa and South America. Since August 2013, Tullow's reshaped portfolio shrank to 10 countries, down from seven, while the number of licenses dropped by two-thirds to 29, company executives said. Acreage fell to about 206,000 sq km (79,537 sq miles) from more than 346,000 (133,591 sq miles).

Tullow's executives appear excited about the low-cost acreage it has loaded into its portfolio. These include assets offshore Guyana, Suriname, Comoros and Peru, among other areas.

"A little goes a long way if you're smart with where you're looking," Ian Cloke, executive vice president of new ventures for Tullow, said recently during the company's 2018 Capital Markets Day.

Tullow hopes its existing portfolio packs transformational potential. The company has a $150 million exploration budget—coupled with experience, discipline, technology and sound execution—to make that happen.

"Put simply we're trying to do a lot more with less," Cloke said.

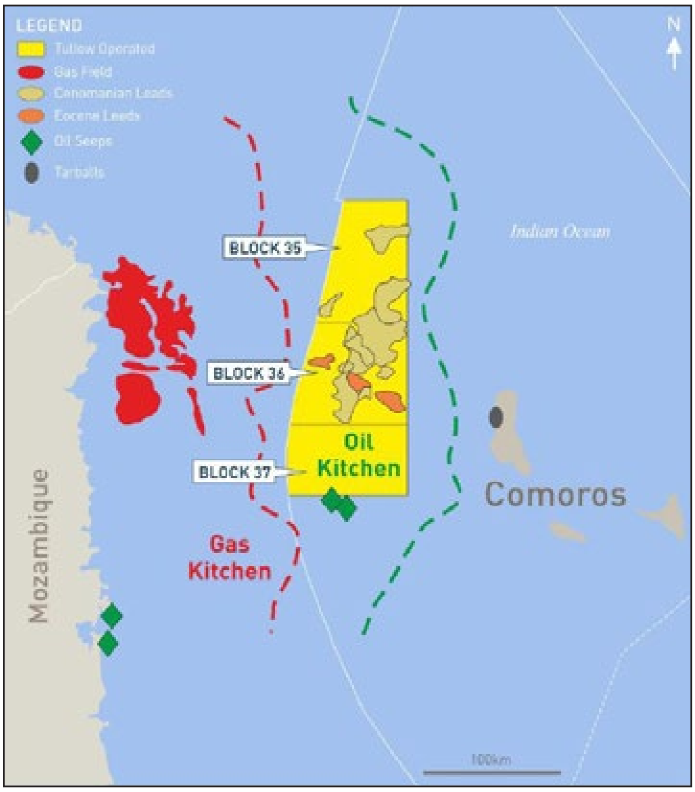
But if the company's planned three to five wildcat wells lead to discoveries, the prize could be big.

"These licenses have one thing in common: the follow-on potential," Cloke said. "The major prospects… could be transformational for both Tullow and the host countries. This is a huge prize that we are going after and it's going to be pretty busy."

Offshore Comoros

These opportunities include offshore Comoros, an independent state comprising of islands off the southeast coast of Africa. Tullow in late November announced it

WHAT'S INSIDE



(Source: Tullow Oil)

reached an agreement with Discover Exploration Ltd. to farm into blocks 35, 36 and 37 offshore Comoros in the Indian Ocean. If the deal receives governmental approval, Tullow will have a 35% operated position.

"This is a massive frontier opportunity at all scales—whether it's the Turbidite systems [or] whether it's leads that we've got mapped," Cloke said. "We've been evaluating many licenses up and down East Africa. This one passed our selection criteria."

Chasing giant Turbidite fans shut off the Rovuma Delta, the company is looking for oil in deep water offshore Comoros.

"We believe there's an oil kitchen out here, outboard of the gas," he said.

Two partly stacked prospects in Comoros blocks 35, 36 and 37 together contain gross mean unrisked prospective resources of about 7.1 Bbbl of oil, according to an August 2018 Competent Persons Report conducted by ERCE, a U.K.-based independent energy consulting group.

About 17 leads, spanning more than 16,000 sq km (6,178 sq miles), have already been identified.

Discover said in a news release that the Comoros production-sharing contract area is outboard of the about 5,663 Bcm (200 Tcf) of gas in place discovered in Rovuma areas 1 and 4 offshore Mozambique. That's the area where joint venture partners Anadarko Petroleum Corp., China National Offshore Oil Corp., Eni SpA, Exxon Mobil Corp., Mitsui & Co. and PTT Exploration and Production are developing a massive LNG complex.

Currently, Tullow said it has tenders out for seismic work. Plans are to acquire 3-D seismic over the Comoros acreage in 2019.

"We're positioning ourselves in a future hot spot before it becomes a hot spot just as we did a decade ago in Guyana," Cloke said.

Offshore Guyana

Offshore Guyana has already proven fruitful for Exxon Mobil, which has made 10 discoveries in the 26,800-sq-km (10,348-sq-mile) Stabroek Block offshore Guyana. The company and its partners—Hess Guyana Exploration Ltd. and CNOOC Nexen Petroleum Guyana Ltd.—put discovered recoverable resource estimates at more than 5 Bboe. Discoveries include Liza, Liza Deep, Payara, Snoek, Turbot, Ranger, Pacora, Longtail and Hammerhead.

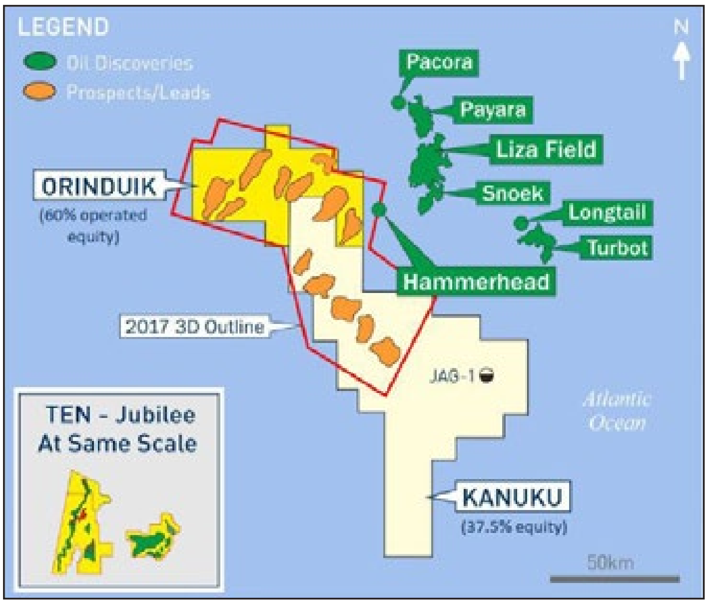
Tullow Oil, which has 60% operated equity in the Orinduik Block and 37.5% equity in the Kanuku Block, could be next in line to strike oil in waters offshore the small South American country.

"Put simply it has everything going for it. There is oil here," Cloke said. "It is highly likely that the Hammerhead discovery announced earlier in the year comes into our block."

Tullow plans to drill two to three wells offshore Guyana in 2019, putting the area at the top of its list of priorities. About 1 Bbbl gross unrisked resources will be tested by the wells. Drilling candidates for 2019 include Amaila, Jethro, Aurituk and Carapa, all Tertiary prospects, plus Kumaka and Carapa, which are Cretaceous prospects.

The company has acquired 3-D seismic across the Kanuku and Orinduik blocks, Cloke said, calling the quality excellent.

"We can use AVO [amplitude versus offset] to derisk the Tertiary and prospectivity at the Cretaceous has been seen from the Liza discoveries," Cloke said.



(Source: Tullow Oil)

The Orinduik prospects are in a string of Turbidite channels deposited across a series of terraces, he explained, noting they fill and spill through the Orinduik and Kanuku licenses and out into the Liza licenses.

"The wells will be simple. The water is shallow, and the commercial terms here are excellent. … We will be aiming to commence drilling here in the first half of next year."

If the company strikes oil, it plans to move from exploration and onto appraisal, development and production to mark first oil within three years.

"If we are successful, they [the prospects] offer exceptional economics," he added, later noting long lead items have been ordered and rigs identified. "The IRRs [internal rate of returns] here are in mid-$20s, breakeven oil price in the low $30s."

However, despite the major discoveries made offshore Guyana, Cloke cautioned that "this is still exploration. … Mother Nature can be cruel."

He recalled a few dry wells in the area. Exxon Mobil's Sorubim and Skipjack failed to encounter commercial quantities of hydrocarbons.

Still, hopes are high.

"When you look at the potential here, this could be a possible game changer for Tullow," Cloke said.

In all, Tullow believes the acreage holds about 4 Bbbl of gross mean unrisked resources.

—Velda Addison

DEVELOPMENT

Apache Achieves First Oil At Garten Development In North Sea

Apache Corp. has started production from its Garten development on Block 9/18a Area-W in the U.K. sector of the North Sea, the company said Dec. 4.

The discovery well, which is located 6 km (3.7 miles) south of the Beryl Alpha Platform, was placed on production in late November, less than eight months after being drilled in March 2018, the company said. Production was originally set to start in first-quarter 2019.

"Performance from the three zones we tested is very encouraging, and we expect this field will significantly increase Apache's reserves and production in the U.K.," Jon Graham, region vice president for Apache's North Sea operations, said in the release. "With exposure to strong Brent oil and U.K. natural gas prices, Garten will be a notable contributor to Apache's cash flow in 2019."

Apache said the discovery well at Garten encountered a downthrown structural closure with 237 m (778 ft) of net oil pay in stacked, high-quality, Jurassic-aged sandstone reservoirs. The well is currently producing from the Beryl sand at a rate of 13,700 bbl/d of oil and 445 Mcm/d (15.7 MMcf/d) of gas. Two lower zones were also successfully tested. Plans are for all three zones to be commingled to maximize recovery.

"Garten is a unique technical achievement and represents Apache's most complex smart well completion to date," added Mark Hobbs, director of operations and projects at Apache North Sea.

The recoverable resource from the field, which is tied back to the Beryl Alpha platform, is expected to exceed 10 MMbbl of light oil plus associated natural gas, Apache said in the release.

Apache has a 100% working interest in the Garten development.

"It is great to see the Garten Field come onstream less than a year from the original discovery and well ahead of the original plan. The Garten well was the 2,500th exploration well on the U.K. Continental Shelf," Andy Samuel, CEO of the Oil and Gas Authority, said in the release. "Apache's continued success reinforces the tremendous potential of the UKCS, which Apache is unlocking using advanced data gathering and analytics with excellent application of a number of technologies including 3-D seismic to uncover high value near-field prospectivity."

—Staff Reports

DEVELOPMENT BRIEFS

Eni Begins Production At Vandumbu Offshore Angola

Eni has started production from the Vandumbu Field in Block 15/06 through the West Hub *N'Goma* FPSO offshore Angola, the company said Dec. 10.

First oil was achieved in late November, three months ahead of schedule, followed in early December by the startup of a subsea multiphase boosting system. Eni said the ramp-up of Vandumbu will be completed in first-quarter 2019 to achieve a total production of about 170,000 bbl/d of oil, further extending the production plateau.

The two startups are part of Eni's phased and clustered development strategy for the block. The block is being developed by a joint venture that comprises operator Eni (36.84%), Sonangol P&P (36.84%) and SSI Fifteen Ltd. (26.32%).

Equinor Gets OK To Extend Lifetime Of Troll Gas Field

Equinor has received government approval for its plan to boost output and extend the lifetime of Troll, Norway's largest oil and gas field, the company said Dec. 7.

The field accounts for about 40% of the natural gas reserves on the Norwegian Continental Shelf (NCS) and meets about 7% to 8% of Europe's consumption. Norway is Europe's second largest gas supplier after Russia.

Contracts for subsea facilities and the construction of a new processing module on the Troll A platform have been awarded to Aker Solutions. (Source: Ole Jørgen Bratland/Equinor)

The approved $915 million Phase 3 development will help to produce an extra 2.2 Bboe and extend gas production beyond 2050, the company said.

In Phase 3, a gas cap located above the Troll West oil column will be produced at the same time as oil production continues.

"With a breakeven of less than $10 per barrel, Troll Phase 3 is one of the most profitable and resilient projects ever in our company," said Torger Roed, Equinors senior vice president for the project.

Equinor and its partners have awarded $111 million in contracts for marine installations and subsea facilities to Nexans, Deep Ocean, IKM, Allseas and Marubeni. In addition, the partnership has awarded contracts worth about $235 million for subsea facilities and the construction of a new processing module on the Troll A platform to Aker Solutions.

In October, Equinor said it had upgraded its oil-producing Troll B platform to process natural gas for export until the Phase 3 comes onstream in 2021.

"In a few years Troll will only produce from the large remaining gas reserves. The production horizon for gas from Troll lasts beyond 2050," the company said.

Equinor, the field's operator, has a 30.58% stake. Partners are state-owned Petoro (56%), Shell (8.1%), Total (3.69%) and ConocoPhillips (1.62%).

Neptune, Partners Present Development Plans For Cara

Neptune Energy and its partners in the North Sea Cara oil and gas discovery have presented preliminary development plans to Norway's energy ministry, the company said Dec. 6.

"The license partnership will now progress its technical and economic plan before making a final investment decision early in 2019," Neptune said.

The plan, if sanctioned, is to tie the discovery back to the nearby Gjoea field platform via a subsea production system.

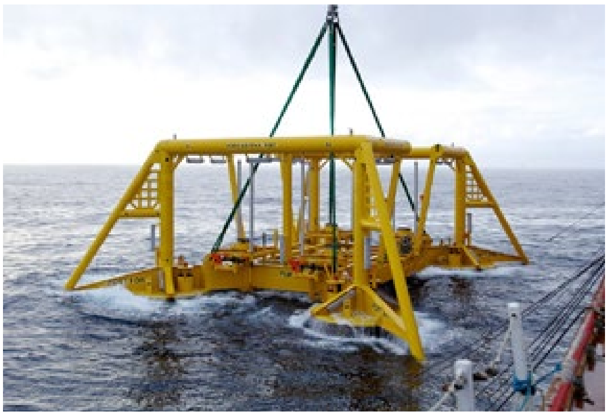
Cara is expected to yield between 56 MMboe and 94 MMboe.

Discovered in 2016, the Cara license is operated by Neptune, which holds a 30% stake, and is co-owned by Idemitsu Petroleum (30%), Pandion Energy (20%) and Wellesley Petroleum (20%).

Neptune, founded by Sam Laidlaw, is backed by CIC and funds advised by Carlyle Group and CVC Capital Partners, the company said.

Equinor, Partners Give Vigdis A Boost

Equinor and partners have agreed to invest about $165 million in the North Sea's Vigdis Field, which came onstream in 1997.



The Vigdis subsea installation is shown. (Source: André Osmundsen/Equinor)

The project is expected to increase field production to nearly 11 MMbbl with a multiphase boosting station slated to go online in first-quarter 2021, Equinor said Dec. 5.

"The boosting station will be connected to the pipeline to enhance the capacity between Vigdis and Snorre A, and will help bring the well stream from the subsea field up to the platform," Equinor said in the release. "Thanks to the boosting station wellhead pressure can also be reduced, which further increases production from the wells."

As part of the project, Snorre A and Snorre B will also receive some modifications. Snorre A receives oil from the Vigdis Field with Snorre B supplying the new boosting station with power from a new umbilical, Equinor said.

OneSubsea has already landed the contract, valued at an estimated $82 million, to deliver the boosting system, including subsea template and trawling protection.

Spirit Becomes Operator Of Babbage Field

Spirit Energy has confirmed that it has taken over operatorship of the Babbage Gas Field in the U.K. North Sea, where it holds a 13% interest, according to a Dec. 7 news release.

The company also said it has taken on operatorship of the nearby Cobra license, where it holds a 50% interest and plans to drill an additional well in the area to prove up reserves.

The transfer of operatorship comes after completion of the divestment of Premier Oil's 47% interest in Babbage and 50% interest in the Cobra license to Verus Petroleum SNS Ltd. (Verus) and securing relevant regulatory approvals, the release said. Premier Oil confirmed completion of its divestment on Dec. 6.

"As operator we will be able to leverage our experience with this asset and area that we know well," Rune Martinsen, Spirit Energy's North Sea asset director, said in the release. "We are looking forward to working with our new partner Verus and existing partner Dana to maximize the value of the field."

Dana Petroleum (Dana) has a 40% interest in the Babbage Field.

Babbage, which first came onstream in 2010, has a year-to-date 2018 average production of about 4,900 boe/d, the release said.

Eni's Indonesia Gas Project To Start Up In 2021 Under New Contract

Eni aims to start output of natural gas from its offshore Merakes project in Indonesia in 2021, the country's deputy energy minister said on Dec. 4.

IP at Merakes would be 155 MMcf/d of natural gas, rising to a forecast peak output of 391 MMcf/d, deputy minister Arcandra Tahar said.

A spokesman for Italy's Eni did not immediately respond to a request for comment on the matter.

The targets are part of an amended development plan for the East Sepinggan Block in the Makassar Strait under a new production-sharing contract that is expected to be completed before Dec. 12, he said.

As part of the revision, the contractors have agreed to adopt a gross split scheme, whereby Eni and its partner Pertamina would take 67% of crude oil and 72% of natural gas production from the project, and the Indonesian government would take the rest.

It was not immediately clear what split was set previously. Eni said in April it had obtained approval for plans to pipe natural gas from Merakes to the Bontang LNG processing facility in East Kalimantan.

The amendment would be first time a conventional cost-recovery production-sharing contract (PSC) in Indonesia is converted to use the gross split scheme, Tahar said.

"By using the gross split scheme, it will be simpler and they don't need a lengthy tender process, so they see it as an opportunity," Tahar said, referring to Eni's proposal to make the switch, which he said had been received two weeks ago.

Indonesia recently adjusted its gross split mechanism for new and expiring oil and gas PSC, whereby contractors shoulder the cost of E&P, rather than being reimbursed by the government. The changes were intended to attract investment amid tepid interest in Indonesia's energy tenders and after the industry pointed to more attractive opportunities in other countries.

Eni announced approval of the field's development plan in April. The plan is to drill and complete six subsea wells and construct and install subsea systems and pipelines, which will be connected to the Jangkrik FPU. The gas will then be shipped, Eni said, through the existing pipelines from the FPU to the Bontang LNG processing facility operated by PT Badak in the East Kalimantan.

James Fisher Ocean Team Finishes Work On South China Sea Project

The TwinR2000 is one of the two excavation spreads positioned permanently in China. (Source: James Fisher Ocean Team)

James Fisher Ocean Team (JFOT) in China has completed a project for COOEC Subsea that involved post-lay trenching of a 7-km (4-mile) subsea cable in the South China Sea.

The work was for development of a Zhujiangkou Basin oil field joint development, the company said in the news release. The work was finished on time and within budget.

In an effort to better support clients in the oil and gas along with offshore wind sectors, JFOT said it has two excavation spreads—the Twin R2000 and T8000—positioned permanently in China.

Santos Marks First Gas From Final Bayu Undan Infill Well Program

Australia-headquartered Santos Ltd. reported that partner ConocoPhillips has wrapped up the Bayu Undan infill program, having reached first gas from its third and final well of the program, the company said Dec. 3.

The drilling program for the gas and condensate field, located in the Timor Sea offshore the Northern Territory in Australia, consisted of two platform wells and one subsea well connecting into existing offshore infrastructure.

"This drilling campaign has been very successful, providing strong subsurface results, with the whole project having been executed approximately 40% below budget and the final well brought online over three months ahead of schedule," Santos Managing Director and CEO Kevin Gallagher said in the release.

Holding a 57.2% stake, ConocoPhillips is the operator for the Bayu Undan joint venture and Darwin LNG plant. Santos holds an 11.5% interest. Other partners include Inpex, Eni and Tokyo Timor Sea Resources.

Nigeria Oil Minister Expects Green Light For Bonga Oil Field By February

Nigeria's oil minister expects a final investment decision (FID) on its Bonga Southwest offshore oil field by February 2019, he said Dec. 7 on the sidelines of an OPEC meeting.

The project, one of the country's largest with an expected production of 180,000 bbl/d, will generate profit at below $50 per barrel, according to Royal Dutch Shell which operates the field.

"Negotiations [are] still going on. The contractual dynamics [are] still being perfected ...," Emmanuel Kachikwu told reporters. "Shell wants to do it by the end of the year. Probably it will slip into early next year for FID purposes ... Between now and February we should see a FID on Bonga."

Shell's partners in the project are Exxon Mobil, Total, Eni and the Nigerian National Petroleum Co.

Kachikwo said Nigeria aims to produce 2.2 MMbbl in 2019.

Nigeria currently produces about 1.8 MMbbl of crude oil, excluding extremely light oil known as condensates. The minister said that with production cuts agreed by OPEC that number would be about 1.74 million.

As for the planned 650,000-bbl/d Dangote refinery project, Kachikwo said he expected production to start in fourth-quarter 2020.

—Staff & Reuters Reports

EXPLORATION

Exxon Mobil Makes 10th Discovery Offshore Guyana

Exxon Mobil Corp. and partners have added a 10th discovery to its blossoming exploration success story offshore Guyana, where discovered recoverable resource estimates have now surpassed 5 Bboe.

The Irving, Texas-headquartered company said Dec. 3 the Pluma-1 well, which was drilled by the *Noble Tom Madden* drillship, hit about 37 m (121 ft) of high-quality hydrocarbon-bearing sandstone reservoir. The well is located about 27 km (17 miles) south of the Turbot-1 well and 67 km (42 miles) southeast of Liza.

"With 17 prospects still to drill, Stabroek is writing Guyana's future. It will easily become the fourth largest oil-producing nation in Latin America by the next decade, with chances to outperform the countries preceding it," Luiz Hayum, research analyst with Wood Mackenzie's Latin America upstream oil and gas team, said in a statement. "If

The Pluma-1 well, which was drilled by the *Noble Tom Madden* drillship, hit about 37 m (121 ft) of high-quality hydrocarbon-bearing sandstone reservoir offshore Guyana. (Source: Shutterstock.com)

Venezuela and Mexico fail to address production declines, Guyana could quickly surpass them to number two."

Drilled to a depth of 5,013 m (16,447 ft) in a 1,018 m (3,340 ft) of water, the Pluma-1 well targeted Upper Cretaceous reservoirs.

Wood Mackenzie estimated the discovery holds 300 MMboe of recoverable resources.

"The discovery of a resource base of more than 5 billion oil-equivalent barrels in less than four years is a testament of our technical expertise and rigorous evaluation and pursuit of high-potential, high-risk opportunities in this frontier area," Neil Chapman, Exxon Mobil senior vice president, said in the release. "We will continue to apply what we've learned to identify additional exploration prospects and potential future discoveries that will deliver significant value to Guyanese people, our partners and shareholders."

The drillship is set to drill the Tilapia-1 prospect next. Tilapia is located about 5.5 km (3.4 miles) west of the Longtail-1 well, Exxon Mobil said.

The Pluma-1 discovery followed news in August of the Hammerhead-1 discovery, which opened a new play concept for potential development.

So far, Exxon Mobil has announced five discoveries in the Stabroek Block this year with the latest bringing the total count to 10. Others include Liza, Liza Deep, Payara, Snoek, Turbot, Ranger, Pacora, Longtail and Hammerhead, proving the hydrocarbon-prolific nature of the 26,800-sq-km block.

"Our ongoing work will evaluate development options in the southeastern portion of the block, potentially combining Pluma with prior Turbot and Longtail discoveries into a major new development area," said Steve Greenlee, president of Exxon Mobil Exploration Co.

The Stabroek Block is operated by Exxon Mobil affiliate Esso Exploration and Production Guyana Ltd., which holds a 45% interest in the block. Partners are Hess Guyana Exploration Ltd. (30%) and CNOOC Nexen Petroleum Guyana Ltd. (25%).

"Guyana is a truly world class investment opportunity with multi billion barrels of additional exploration potential," John Hess, CEO of Hess Corp., said in a statement. "The growing resource base on the Stabroek Block further underpins the potential for at least five FPSOs producing more than 750,000 barrels of oil per day by 2025."

The latest find was made as work progresses on development of Liza Phase 1, the play-opening discovery. Sanctioned in June 2017, Liza Phase 1 is expected to mark first oil by early 2020, producing up to 120,000 bbl/d of oil from the Liza Destiny FPSO.

The larger Liza Phase 2 development will have a capacity of 220,000 bbl/d. "Pending government and regulatory approvals, Liza Phase 2 project sanction is expected in early 2019 and will use a second FPSO designed to produce up to 220,000 barrels of oil per day," the release said.

A third development, Payara, is also on the horizon. If sanctioned, a decision for which is expected next year, production could begin in 2023. The Payara Field is located about 12 miles northwest of Liza.

The total resource base on the block, which increased from the previous estimate of more than 4 Bboe, "reinforces potential for at least five floating storage, production and offloading vessels producing more than 750,000 barrels of oil per day by 2025," according to Hess.

—Velda Addison

EXPLORATION BRIEFS

Eni Strikes Oil Offshore Angola

Eni has found oil at the Afoxé exploration prospect located in Block 15/06 offshore Angola, the company said Dec. 10. The discovery is estimated to contain between 170 MMbbl and 200 MMbbl of light oil in place.

The Afoxé-1 NFW well is located in the southeast area of Block 15/06, about 50 km (31 miles) southwest of the *Olombendo* FPSO and 20 km (12 miles) west of the recent Kalimba-1 discovery. The well was drilled in a water depth of 780 m (2,559 ft) and reached a total depth of 1,723 m (5,652 ft).

Afoxé-1 NFW encountered 20 m (65 ft) of net oil pay in Upper Miocene sandstones with excellent petrophysical properties. The well has not been tested, but an intensive data collection has been carried out that indicates a production capacity in excess of 5,000 bbl/d of oil. The new nearby discoveries of Kalimba and Afoxé combined account for a potential 400 MMboe to 500 MMboe of high quality oil in place and represent a new cluster that can be exploited jointly in a new development concept.

The Afoxé discovery further confirms the oil exploration potential in the southern part of Block 15/06, previously considered mainly gas prone. Eni is planning to drill up to four new exploration wells in Block 15/06 during 2019.

Block 15/06 is developed by a joint venture formed by Eni (36.84%, operator), Sonangol P&P (36.84%) and SSI Fifteen Ltd. (26.32%).

Seapulse, Maersk Drilling Execute Global Exploration Drilling Program

Seapulse Ltd. is teaming up with Maersk Drilling A/S to drill 12 offshore oil and gas exploration wells over the next two years targeting over 4 Bboe, according to a Dec. 5 news release.

"This alliance is a key example of a fully integrated service delivery model aimed at eliminating inefficiencies by aligning incentives and removing complexity across the entire value chain," Maersk Drilling CEO Jørn Madsen said.

Seapulse is taking a low-cost, high-impact portfolio approach to exploration to maximize value creation and diversify risk, the release said. The exploration wells will be drilled in diverse play types and basins in frontier and established areas.

As part of the alliance, Maersk Drilling will deliver drilling services and act as integrated well services provider. "By focusing investment specifically on providing the necessary capital for drilling, Seapulse is addressing a significant gap in the market, addressing the inherent industry inefficiencies associated with the traditional farm-in/out processes," the release said.

The target portfolio was developed by several selected E&P companies using seismic data and interpretive technologies with their operators and license partners.

—Staff Reports

TECHNOLOGY BRIEFS

Seatools Introduces Precision Flow Excavation Spread 'Carrera E'

Following an extensive R&D trajectory, subsea technology company Seatools introduced the Carrera E 3-D motion-controlled, precision-flow excavation spread, the company said in a news release on Dec. 5.

The Carrera E's boosted production rates can be attributed to a highly powerful and efficient all-electric drive configuration. (Source: Seatools)

The 630+ KW, all-electric deepwater excavator features Seatools' ROV DP (dynamic positioning) technology and is designed for improved accuracy, production and workability in the mass flow excavation (MFE) market.

The patent-pending spread features 3-D motion control, which enables precision excavation operations at a minimum of seabed disturbance. With DP capabilities, the tool can follow a pre-programmed track with high precision and in a highly automated manner.

The Carrera E is launched by means of a dedicated, actively heave-compensated LARS. The LARS minimizes trench depth variation and, under all circumstances, prevents physical contact between the product and the excavator.

The motion control technologies—AHC and DP—maximize the spread's workability and extensively boosts both production rates and dredging tolerances, even under adverse environmental conditions such as strong currents and high-sea conditions.

The Carrera E's boosted production rates can be attributed to a highly powerful and efficient all-electric drive configuration. With over 500 KW of installed power dedicated to dredging, the spread takes on a wide range of soil conditions. Despite its hefty power rating, the MFE spread is compact in size.

The LARS, including tool, only requires a 20-ft container footprint and minimal vessel interfaces.

The Carrera E can be deployed from a wide range of vessels including smaller, low-day-rate vessels.

The spread can be operated by just four operators. Value creation also results from its integrated survey capabilities. The Carrera E enables pre-process, intermediate, and post-process surveys without requiring a separate WC-ROV spread.

OPT Inks Deal To Supply Subsea Batteries

OPT's subsea battery solutions will enable the powering of subsea equipment, sensors and communications, and the recharge of AUVs and eROV. (Source: Ocean Power Technologies Inc.)

Ocean Power Technologies Inc. has signed a letter of intent to enter into a long-term supply agreement with NEC Energy Solutions, the company said on Dec. 5. Under the terms of the supply agreement, NEC ES will supply lithium ion batteries for OPT's subsea battery solutions.

In November, OPT expanded its product line to include subsea battery solutions that will provide sea floor energy storage for offshore operations. NEC ES is engaged in the business of designing, manufacturing, and integrating smart energy storage solutions for the electric grid and for applications with critical power needs. Recently, NEC ES expressed an interest in providing its energy storage solutions for remote marine applications.

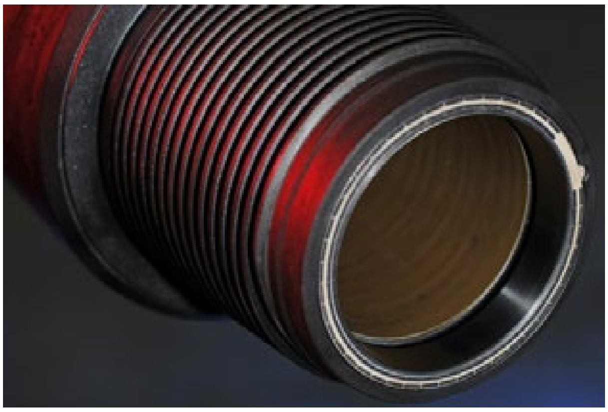
OPT's subsea battery solutions will enable the powering of subsea equipment, sensors and communications, and the recharge of AUV and electric ROV. They can power sensors, chemical injection systems and electric trees and control systems, which regulate the flow of oil, chemicals and water and gas injection and disposal.

According to data from Fior Research, the global subsea battery sales market is projected to grow to over $668 million over the next five years as industries such as offshore oil and gas begin to digitize operations and turn to electric powered equipment to replace aging and less efficient hydraulic powered equipment.

Equinor Awards Wired Drillpipe Contracts To NOV, Schlumberger

Equinor is stepping up its use of wired drill pipe to acquire subsurface real-time data during drilling operations, in line with the corporate digitalization strategy and to prepare for automated drilling.

National Oilwell Varco (NOV) and Schlumberger have been awarded corporate frame agreements for global deliveries of IntelliServ wired drillpipes to Equinor.



NOV and Schlumberger will deliver IntelliServ wired drillpipe for the project. (Source: NOV)

In addition to the corporate frame agreements with the two suppliers, commitments have been made on the use of wired drillpipe delivered by NOV for specific operations, such as Mariner in the U.K., the West Herkules exploration campaign on the Norwegian Continental Shelf and Transocean Enabler's drilling campaign on Trestakk.

The contracts allow the technology to be used on all Equinor installations globally. The total contract value may exceed NOK 1 billion during the first three years of the contract period.

—*Staff Reports*

VESSEL BRIEFS

MOL's FSRU Will Provide Fuel For West Java Power Plant

The floating storage regasification unit (FSRU) to be built for Mitsui O.S.K. Lines Ltd.'s (MOL), announced on Dec. 7, will supply fuel for a power plant in Indonesia's West Java province that will provide electricity for more than 25 years.

The agreements for the Jawa 1 Gas-Fired Project involve PT Jawa Satu Regas (JSR), a joint company of PT Pertamina, Marubeni Corp., and Sojitz Corp. MOL will build the FSRU.

PT Jawa Satu Power, a joint venture of Pertamina, Marubeni and Sojitz, will build and operate a gas-fired power plant with generating capacity of 1760 MW in West

Java. The plant and FSRU will be maintained and operated in tandem. The FSRU's tank and regasification capacity will be customized to the power plant's specifications.

Financing was secured with Japan Bank for International Cooperation, Asia Development Bank, Mizuho Bank Ltd., MUFG Bank Ltd., Oversea Chinese Banking Corp., Crédit Agricole Corporate and Investment Bank, and Societe Generale Bank & Trust. Nippon Export and Investment Insurance will insure the project.

Höegh LNG Receives World's Largest FSRU

The world's largest floating storage regasification unit (FSRU) has joined the Höegh LNG Holdings fleet, adding regasification capacity of 1 Bcf per day and storage capacity of 170 000 cbm of LNG to the company's portfolio.

Höegh LNG Holdings took delivery of *Höegh Gannet,* its ninth FSRU. (Source: Höegh LNG)

Delivery of *Höegh Gannet* to Bermuda-based FLNG operator Höegh was announced on Dec. 6. It is the FLNG company's ninth FSRU.

Hyundai Heavy Industries of South Korea built the massive vessel, equipping it with a reinforced GTT Mark III membrane containment system and dual-fuel, diesel-electric (DFDE) propulsion.

Höegh Gannet will play a role in the company's ongoing tender processes for projects, with scheduled startup from 2019 through 2021. Until then, the FSRU has been contracted for a 15-month charter with Naturgy.

India To Install Another FSRU By April

The Indian government plans to install a second floating storage regasification unit (FSRU) LNG terminal at Moheshkhali by April 2019, State Minister for Power, Energy and Mineral Resources Nasrul Hamid said on Dec. 5.

The second facility will have a capacity of 500 million cubic feet per day, Hamid said, and will join the first FSRU at Cox's Bazar.

"The government, under the leadership of Prime Minister Sheikh Hasina, is committed to ensure energy security in the country," Hamid said.

The Astra Oil and Excelerate Consortium installed the FSRU LNG terminal at Moheshkhali Island in the Bay of Bengal.

Nautilus Minerals Seeks JV To Acquire PSV

Nautilus Minerals Inc. is pursuing a JV to purchase a PSV. (Source: MAC Goliath Pte Ltd)

Toronto-based Nautilus Minerals Inc. is looking to create a joint venture (JV) to fund the purchase of a production support vessel (PSV) after the shipyard rescinded its contract with MAC Goliath Pte Ltd., the contractor engaged by Nautilus to procure the vessel.

The underwater mineral exploration company is negotiating with arm's length third parties to form the company, Vessel JV. The parties and a Nautilus subsidiary, Nautilus Minderals Niugini Ltd. would own the company. The deal would also cover the integration costs of installing mining equipment on the vessel.

Fujian Mawei Shipbuilding has continued to install components of the company's seafloor production equipment on the vessel, including the installation in mid-November of an operating console.

The JV would charter the PSV to the Solwara 1 JV between NMN and Papua New Guinea's nominee, Eda Kopa (Solwara) Ltd.

Nautilus is also negotiating with Deep Sea Mining Finance to extend the maturity date of the existing secured loan facility which is due on Jan. 8, 2019, to allow sufficient time for the company to move forward with the JV transaction.

First Steel Cut For FPSO That Will Operate Offshore Israel

First steel was cut on the Karish and Tanin FPSO, the first that will operate in the eastern Mediterranean, in late-November at the COSCO shipyard in Zhoushan, China.

Energean Oil and Gas's vessel is due to be delivered to the Karish field 90 km (56 miles) offshore Israel in late 2020, the company said, with first production expected in first-quarter 2021. The FPSO will have a gas treatment

First steel has been cut for the first FPSO in the eastern Mediterranean. (Source: Energean Oil and Gas)

capacity of 800 MMscf/d, or 8 Bcm, and liquids storage capacity of 800,000 bbl.

"The cutting of the first steel on the Karish-Tanin FPSO marks an important and symbolic moment for our flagship Karish-Tanin project and for Energean as a whole," said Mathios Rigas, CEO of Energean, in a statement. "We have gone from asset acquisition to FID in 15 months and to cutting first steel in under two years."

Energean plans to spud Karish North, the first of four wells scheduled for 2019, in March. The company anticipates 1.3 Tcf of prospective resources from Karish North with a high chance of success over and above the 2.4 Tcf of reserves in Karish-Tanin. The company has already signed firm contracts for 4.2 billion cubic meters per year of gas sales into the Israeli domestic market. Future agreements will focus on both the growing Israeli domestic market and key export markets in the region.

—Staff Reports

UPCOMING

The next issue of *Subsea Engineering News* will be distributed Jan. 17, 2019. Until then, visit *EPmag.com*.

JOBS

Looking for a new job in the industry? Find opportunities in the jobs section at *EPmag.com/jobs*.

CONTACT INFORMATION

LEN VERMILLION Group Managing Editor
Digital News Group
lvermillion@hartenergy.com

CONTRIBUTORS:

Velda Addison (Houston)
Mary Holcomb (Houston)
Ariana Hurtado (Houston)
Joseph Markman (Houston)
Emily Patsy (Houston)

Subsea Engineering News (ISSN 0266-2205) is published twice monthly by Hart Energy Publishing LLP, Houston TX, USA. Telephone: +1 713 260 6400; Email: sen@hartenergy.com or custserv@hartenergy.com; Website: www.epmag.com/subsea-engineering. Email for subscriptions: mpigozzi@hartenergy.com.

2018 ANNUAL SUBSCRIPTION: £425 + VAT (WHERE APPLICABLE), $675 USA. FOR MULTI-USER SUBSCRIPTIONS, CONTACT US OR CHECK THE WEBSITE. CREDIT CARDS ACCEPTED SUBJECT TO CHARGES.

HARTENERGY
1616 S. Voss, Suite 1000 • Houston TX 77057-2627 • USA
www.hartenergy.com | www.epmag.com

Follow us on Twitter @Hart_EPMag