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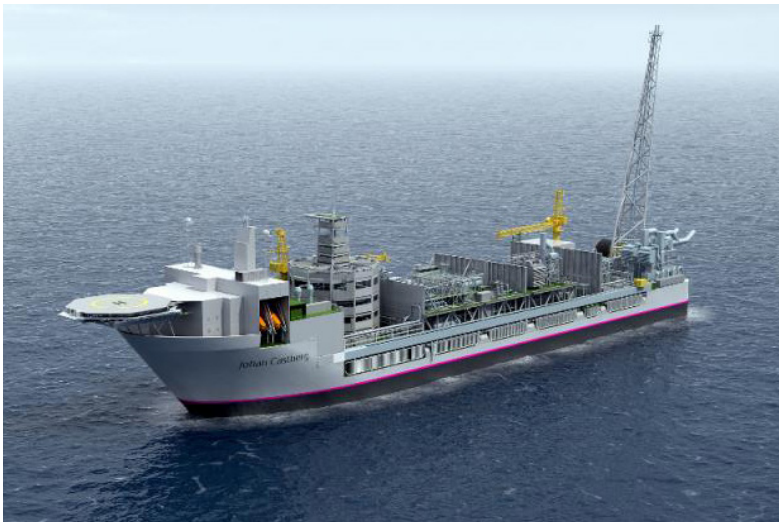
Equinor Preps For Icy Conditions At Johan Castberg

Equinor said conditions in the area of its northernmost-operated field under development in the Arctic are not considerably more severe than other regions where it operates, but the company is preparing for icy conditions that could come its way.

Morten Opsal, Equinor's drilling and well manager for the Johan Castberg development in the Arctic, shared insight on some of the steps being taken as the company and partners Eni and Petoro move toward first oil in 2022.

"The topside layout has been optimized to reduce the negative consequences of this risk, and we have done full-scale testing on the lifeboats for icing," Opsal said during the recently held Arctic Technology Conference in Houston.



The hull of the ship-shaped FPSO, illustrated above, for the Johan Castberg development is under construction in Singapore. (Source: Equinor)

He added that the risk for icebergs in the Johan Castberg area, which is about 100 km (62 miles) north of the Snøhvit Field in the Barents Sea, is low with the frequency being less than one per 10,000 years.

However, "there are uncertainties in these statistics; we need to take that into account. So we have done extensive studies of ice-hull interactions for the FPSO to see how we can optimize that, and some reinforcement has been done to the hull due to the local ice pressure,"Opsal said. "In general we see that the Johan Castberg FPSO is a robust design in moderate ice conditions. …In general, ice risks will be handled by use of operational measures," including production shutdown.

Floating structures are frequently impacted by winds, waves and currents, Opsal said. Johan Castberg will likely be no exception.

Companies like Equinor have been progressing exploration and development plans in the Arctic, which has returned to the spotlight—particularly in Norwegian waters—following the market downturn.

Besides Equinor, Lundin Petroleum is advancing appraisal drilling and testing at the Alta/Gohta discovery in the Southern Barents Sea. In September, the company said results from an appraisal well and an extended production test in the license were better than expected. Lundin expects to increase the gross resource range of between 115 MMboe and 390 MMboe for the discovery.

In addition, OMV has found more than an estimated 1 Bbbl of oil at the Wisting Field in the Barents Sea. Here, like its Arctic neighbors, OMV is also assessing ice risks.

WHAT'S INSIDE

Exploration and development in the area have benefited from the Gulf Stream, which brings warm waters and milder climates to the area. Norway's Barents Sea is ice-free during the summer. But companies must still assess risks associated with weather conditions like polar lows that can spark elevated wind speeds and change wind directions to safely produce hydrocarbons.

"We do have occurrences of polar lows," Opsal said, adding these are not always easy to capture on traditional weathercasts. So the operator is relying on low-pressure risk forecasts.

The plans are to develop Johan Castberg—comprised of the Skrugard, Havis and Drivis discoveries—with a winterized FPSO.

The hull of the ship-shaped FPSO for Johan Castberg is under construction by Sembcorp Marine in Singapore with the turret being built by SBM Offshore in Dubai. The vessel will measure 350 m (1,148 ft) in length and 55 m (180 ft) in width and will have a processing capacity of 190,000 bbl/d and storage capacity of 1.1 MMbbl. The turret system will be moored in a water depth of about 370 m (1,214 ft).

Developers have also had to design for an uneven seabed due to ice scoring for placement of the field's 10 subsea templates. The winterization strategy for the FPSO includes helideck heating, wind chill protection of the turret and ice protection for escape ways as well as wind chill protection of star towers and ice protection for lifeboats.

"We're also installing a permanent reservoir monitoring system on the seabed on all the three fields' structures," Opsal said. "That is seismic sensors with cables that permanently install on the seabed so we can do regular seismic updates to see the production development and injection development over time."

At a water depth of between 350 m and 400 m (1,312 ft), the shallow-water development will have 30 wells, 10 subsea templates and two satellites. Drilling operations will start in late summer or fall 2019, Opsal said, later pointing out that a minimum of 13 wells are needed to reach the startup production profile.

Recoverable reserves for the field are estimated at between 450 MMbbl and 650 MMbbl.

Equinor and partners cut the costs of Castberg from NOK 100 billion (US$ 11.7 billion) to between 45 and 50 billion by changing the design concept. Changes included switching from a semisubmersible platform with a pipeline to shore to an FPSO and reducing the number of wells from 40 to 30. The breakeven fell from about $80/bbl to less than $35/bbl.

Following Norway's approval of the field development plan in June, analyst firm Rystad Energy said the project was "poised to generate some NOK 264 billion (US$33 billion) in profits."

First oil is anticipated by fourth-quarter 2022.

—Velda Addison

DEVELOPMENT

OMV Assesses Ice Risk For Arctic's Wisting Development

Austria-based OMV has already discovered more than an estimated 1 Bbbl of oil in place with up to about 500 MMbbl of recoverable reserves at the Wisting Field, which lies far north in the Arctic's Barents Sea.

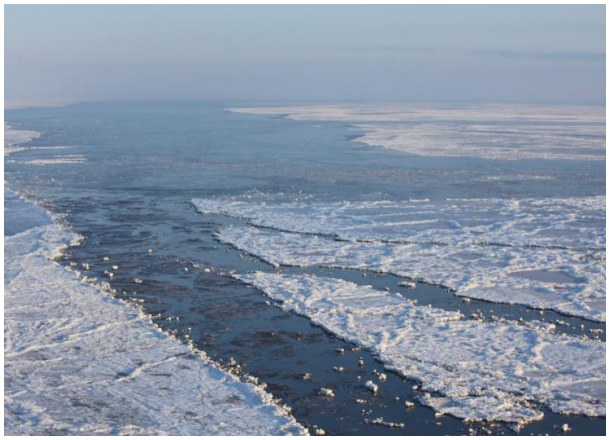
The operator, working with Schlumberger, has also proven that it can drill a shallow horizontal offshore well from a floating drilling facility, having landed out horizontally about 250 m (820 ft) beneath the seabed and extended about 1,400 m (4,593 ft).

But the biggest challenge for the development may still lie ahead for OMV and its partners: planning for and coping with sea ice and the unknown obstacles it could pose.

Speaking during the Arctic Technology Conference in Houston in November, Andrew Train, head of projects for OMV Norway, spoke about the project that is billed as the largest undeveloped discovery on the Norwegian Continental Shelf.

"This is significant for Norway and it's very significant for OMV," Train said of Wisting.

The Wisting discovery, located in the Hoop area of the Barents Sea, sits at a water depth of about 400 m (1,312 ft). Reservoir characteristics include low pressure and temperature of 70 bars and 17 C (63 F), respectively, along with good quality sands, OMV has said. So far, five fully-appraised wells have been drilled, including through several faults. The concept includes 19 producers and 15 water injectors.



Developing oil and gas resources in the Barents Sea requires ice management and equipment capable of withstanding harsh conditions. (Source: Vladimir Lugai/*Shutterstock.com*)

The plan is for oil to be offloaded via a shuttle tanker, given the lack of pipeline infrastructure, and produced gas will be reinjected or used as fuel gas.

However, developers haven't chosen which type of floating structure it will use, though Train said some options have been thrown out. The choices have come down to either a ship-shaped FPSO or a cylindrical FPSO.

A ship-shaped FPSO is more prevalent with disconnect capability, while a circular FPSO would lend itself to power from shore, Train said. Regardless, the ability to handle sea ice will be a factor in the decision. Developers aim to choose a concept in 2020.

Ice management and assessing ice risk at Wisting are what OMV is busy doing at the moment, Train said. He pointed out wide variations between 10-year, 100-year and 10,000-year returns on sea ice contour maps in the area of the development and the challenge of determining which conditions to design for.

"It is a wide range of uncertainty and has a huge impact on where you actually end up. It's a key element for the whole development of Wisting—whether we have to deal with sea ice and deal with icebergs and the potential to disconnect," Train said. "It's a big issue. …That's our key consideration. How do we deal with ice?"

Given the range of uncertainty, he said more detailed assessment on ice is needed. OMV and partners have started its technical qualification program working with DNV GL. This involves looking at ice conditions, return periods, ice thickness and design requirements needed, he said, adding modeling as well as ice risk management, surveillance and detection and physical ice management are also part of the program.

"It's the first [development] in the far, far north," Train said. There are no compatible fields offshore Norway, he added, but there are fields operating with FPSOs under similar conditions in other parts of the world. "We can learn and implement best practices from Canada."

Such developments include the Suncor Energy-operated Terra Nova Field, which uses the *Terra Nova* FPSO offshore Newfoundland, and the Husky Energy-operated White Rose oil field offshore St. John's, which utilizes the *SeaRose FPSO*. The two are among the first developments in North America to use FPSOs in harsh weather environments with sea ice and icebergs.

The *Terra Nova* was specially designed for Arctic conditions. The vessel is ice-strengthened to withstand a 100,000-ton iceberg impact, according to KBR, which carried out engineering, procurement, construction, operations and maintenance for project.

As explained by Suncor, the vessel is double-hulled with five thrusters and an automated global dynamic positioning system that allows it to maintain its headings.

"The same system reduces the impact of waves by allowing the FPSO to change to more favorable headings in high winds and storms," Suncor said on its website. "In addition to its design specifications, the Terra Nova field operation has measures and practices in place to keep its people, the environment and the facility safe. Its ice management program allows Terra Nova personnel to monitor and deflect icebergs when required."

Support vessels are also capable of encircling an iceberg with a cable or net to change is direction, while water cannons can be used to push the iceberg into a different direction, the company said.

OMV hopes to learn from the best practices of other Arctic players as the company develops the field.

"It's really about reaching out for us," and incorporating best practices from other areas, Train said.

—Velda Addison

DEVELOPMENT BRIEFS

Wood Lands Contract Extension For Upper Zakum Project

Abu Dhabi National Oil Co. subsidiary ADNOC Offshore has extended a multimillion-dollar contract with Wood for the Upper Zakum oil field project offshore Abu Dhabi, Wood said in a news release Nov. 13.

The work scope includes project management consultancy services for the development, which Wood said comprises four new artificial islands and the associated drilling, production, utilities and infield pipeline facilities.

The one-year extension becomes effective Jan. 1.

Point Resources: Balder X Project Progresses As Planned

Point Resources said the Balder X project, which aims to extend the field life of Balder and Ringhorne offshore Norway, is progressing according to plan.

A final investment decision for the estimated NOK 15 billion (US$1.8 billion) project is planned for 2019, with production startup in 2021.

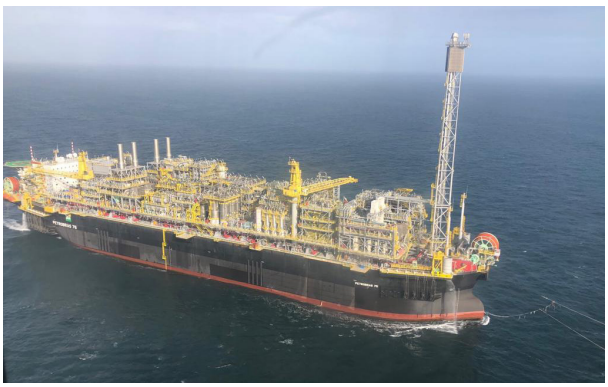
The project involves taking the *Jotun* FPSO to a yard in 2020 for modifications before relocating it to the Balder/Ringhorne area, Point said.

"Sixteen new subsea wells will then be tied into the relocated *Jotun* FPSO and five additional wells will be drilled at Ringhorne as a continuation of the already sanctioned Ringhorne Phase III drilling program," the company said. "The life of *Balder* FPU [floating production unit] will be extended to 2030."

So far, two exploration wells have been sanctioned for drilling in 2018 in the area. The outcome will be reflected in the overall Balder X area development plan, the company said.

Petrobras Starts Oil Production From *P-75* FPSO

Brazil's Petrobras has begun oil production at its *P-75* platform in the presalt area of the Santos Basin, the state-run oil company said Nov. 12.



The platform is Petrobras' fourth to start production in 2018. (Source: Petrobras)

The platform, located in the Búzios 2 oil field, will be able to produce up to 150,000 bbl/d of oil and 6 MMcm of natural gas, the company's statement said.

P-75 is the fourth platform to start production this year. It follows the FPSO *Cidade de Campos dos Goytacazes* in the Tartaruga Verde Field, the *P-69* in the Lula Field and the *P-74* in the Búzios Field.

Aquaterra Energy Scoops Another Contract For Johan Sverdrup Field

Equinor has selected Aquaterra Energy to deliver early well construction operations for the next 16 wells of the Johan Sverdrup field development in the North Sea, according to a news release.

Under the new contract, Aquaterra said it will supply its Well Start solution to engineer conductor guide, cellar deck and internal centralizers for the field to ensure conductor performance for the 50-year field life. The project will also include hang off tools for the conductor.

Work is scheduled to begin in fourth-quarter 2018 with delivery planned for first-quarter 2019.

Ghana Approves State Oil Company As Partner In Exxon Mobil Deepwater Field

Ghana has approved state-owned company Ghana Oil Co. (GOIL) as minority local partner for Exxon Mobil's deepwater offshore oil field, Ghana's Energy Minister John Peter Amewu said Nov. 7.

The West African nation is receiving "huge interest" from international and local oil companies after the government launched its first bidding rounds for offshore blocks last month, Amewu told reporters.

Exxon Mobil signed a deal with Ghana in January for exploration at the Deepwater Cape Three Point oil field after direct negotiations without an open tender because of the nature of the field, where the depth ranges from 2,000 m (6,562 ft) to 4,000 m (13,123 ft), the government said.

The U.S. oil major is lead operator with 80% interest in the field, while state-run Ghana National Petroleum Corp. holds 15%. The deal required a local partner to own the remaining 5%.

Exxon named GOIL as the partner about two weeks ago and the government has given the consent it needed at the ministerial level, Amewu said.

The deal still requires parliamentary approval.

Lundin Norway Awards EPCI Contract To WorleyParsons

Rosenberg WorleyParsons has secured an engineering, procurement, construction and installation (EPCI) contract by Lundin Norway ASO in the Norwegian Continental Shelf, a press release said.

The services include planning, engineering, prefabrication, offshore installation and commissioning support in preparation for Lundin's Edvard Grieg platform to receive and process oil and gas from nearby offshore fields.

The project, which started immediately, will last two and a half years.

Jumbo Lands Transportation, Installation Work For TechnipFMC

Jumbo has been tapped to transport and install a 410-ton subsea production manifold at a depth of 1,643 m (5,390 ft) offshore Israel for the Leviathan development in the Mediterranean Sea, the company said in a news release.

The contract was awarded as TechnipFMC prepares for a project that involves connecting high-rate subsea wells to a fixed platform.

Jumbo said it will lower the manifold onto the seabed and install various other subsea isolation valves and valve skids at a water depth of about 86 m (282 ft), transport equipment from the U.S. Gulf Coast to the Eastern Mediterranean and provide project management and engineering services for this scope of work.

"Jumbo will appoint one of her offshore HLCVs [heavy lift crane vessels] to complete this project in early 2019," Brian Boutkan, Jumbo's head of sales and business development, Americas, said in the release.

Total Inaugurates Kaombo, Continues Development Offshore Angola

Total CEO Patrick Pouyanné recently joined Angolan State Minister for Economic and Social Development Manuel Nunes Jr. and Sonangol's board chairman Carlos Saturnino to inaugurate the deepwater Kaombo project, which went online in July.

Located on Block 32, the project's aim is to tap into the oil deposits of six fields connected via subsea pipelines to two FPSO vessels: *Kaombo Norte* and *Kaombo Sul*, Total said.

The ultradeepwater Kaombo has estimated oil reserves of 658 MMbbl at water depths of up to 1,950 m (6,398 ft) across 800 sq km (309 sq miles). (Source: Total)

During the Nov. 10 event, Total also announced the company is continuing its development program in the country. Projects include the Zinia 2 project, which launched in May, and the CLOV Phase 2 and Dalia Phase 3 tiebacks on Block 17.

The CLOV project calls for seven additional wells, while Dalia calls for six additional wells. First oil is expected from the projects in 2020 and 2021, respectively, Total said.

"Zinia 2, CLOV 2 and Dalia [Phase] 3 will develop 150 million barrels of additional resources to maintain the Block 17 production plateau above 400,000 bbl/d until 2023, and further extend the profitability of this prolific block, with over 2.6 billion barrels already produced," Total said.

Kosmos Eyes 2020 For Subsea Tieback Startups In GoM

Kosmos Energy expects to bring the Nearly Headless Nick oil discovery in the U.S. Gulf of Mexico (GoM) online facility in 2020.

The oil discovery in the GoM's Mississippi Canyon area was made during third-quarter 2018, hitting 26 m (85 ft) of net pay in the Middle Miocene objective, the company said in the operational update of its latest earnings report.

The discovery is being developed as a subsea tieback. The plans are to bring it online through the Delta House floating production facility.

Kosmos also said a third Odd Job well is expected to start production through existing subsea infrastructure to Delta House by early 2020.

BP, Partners Target Year-end 2018 FID For Tortue

BP and partners are still targeting a final investment decision (FID) by year-end 2018 for the Tortue project offshore Senegal and Mauritania.

Partner Kosmos Energy said FEED work for Phase 1 of the cross-border project is substantially complete, the unit development plan has been submitted to the governments of Mauritania and Senegal, and the partnership has reached an agreement with the governments on the non-PSA [production sharing agreement] fiscal terms.

"With the non-PSA fiscal terms agreed, the partnership intends to submit the Declaration of Commerciality," Kosmos said. "The next key step is for the governments to grant the Exclusive Exploitation Authorization, which would enable [the] FID. In parallel, the partnership is progressing the LNG offtake agreement."

In late October, BP CFO Brian Gilvary said the FID is still expected this year. First gas for the project is scheduled for 2022. "We're targeting a first phase of about 2.5 million tonnes per annum and then, we've got a further second phase to test up to a further 10 million tonnes per annum. But we've got nothing left to update on that," Gilvary said on BP's latest earnings conference all.

More details could be shared during BP's Investor Day in December.

—Staff Reports

EXPLORATION BRIEFS

TGS, AGS Collaborate On Ocean-bottom Node Projects In North Sea

TGS revealed a strategic collaboration with Axxis Geo Solutions (AGS) for multiclient ocean-bottom node projects in the North Sea, the company said Nov. 12.

The area of mutual interest covers the core part of the central North Sea up to and including the Utsira area. Under this agreement, the parties will work together to develop opportunities to co-invest in multiclient ocean-bottom node projects. TGS will have a right to process all new node data acquired under this collaboration.

TGS will join the 1,560-sq-km (602-sq-mile) Utsira node multiclient project, which is currently being acquired by AGS in the Norwegian North Sea.

Hess Completes Drilling On Aspy Well Offshore Nova Scotia

Hess Corp. said Nov. 9 that drilling of the Aspy exploration well offshore Nova Scotia reached total depth of 7,400 m (24,278 ft).

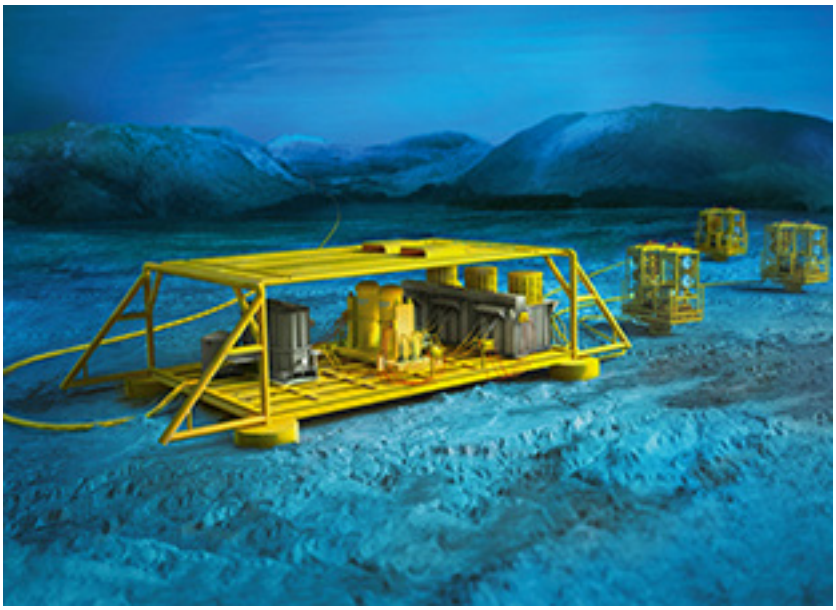
The prospect did not encounter commercial quantities of hydrocarbons and Hess' share of the well cost through Sept. 30, 2018 will be expensed in the third-quarter and reflected in the company's quarterly report on Form 10-Q.

BP Canada as operator and Hess each hold a 50% participating interest.

—Staff Reports

TECHNOLOGY

Siemens Completes First Phase Of Subsea Power Grid Shallow-water Test



Siemens and its partners are developing what would become the world's first subsea power grid for distribution of medium-voltage power using pressure-compensated technology. (Source: Siemens)

Siemens has successfully concluded the first phase of its Subsea Power Grid shallow-water test in Trondheim, Norway. Siemens, in collaboration with industry partners Chevron, Equinor, Exxon Mobil, and Eni Norge, is in the final stages of a program to develop a barrier-breaking system, which will become the world's first subsea power grid designed for distribution of medium-voltage power using pressure-compensated technology.

The subsea power grid system consists of a subsea transformer, subsea switchgear, subsea variable speed drive, subsea wet-mate connectors and a highly reliable remote control and monitoring system that includes cloud-based user dashboards and data analytics.

Subsea power distribution systems will play a major role in the future of subsea field development projects, according to a company press release. The subsea power grid is an enabling technology for subsea processing with multiple seabed power consumers. The system is designed to support enhanced recovery in subsea brownfield projects and tie-back fields, benefitting from single- or multiphase boosting to increase oil recovery.

During the initial test phase at Siemens' test site in Trondheim, the system operated in a ring loop topology at full load and a predetermined test and verification program was performed. The initial results from the shallow-water testing were positive and all units operated within their design parameters.

In agreement with its program partners, Siemens will now move into the next phase with an extended shallow-water test to build operational experience and verify long-term reliability. The goal is to accumulate 3,000 hours of runtime on the equipment while performing further system testing.

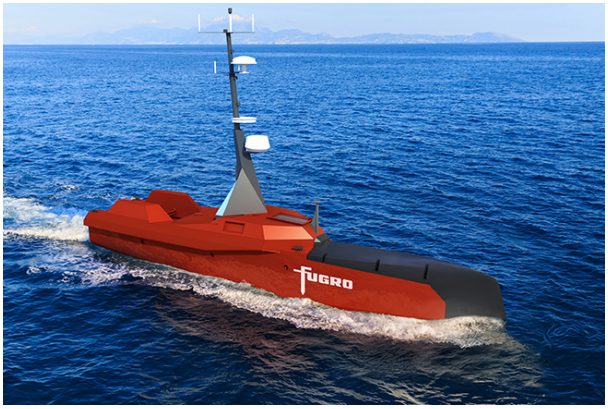
In parallel, preparations are ongoing for a deep-water pilot program where the equipment will be installed and used on a subsea field.

—Staff Reports

TECHNOLOGY BRIEFS

Fugro, L3 ASV To Develop Next-generation Autonomy

Fugro has signed a joint development agreement with L3 ASV to create what it calls the next generation of autonomous vessels for the commercial survey market.



Fugro is developing fit-for-purpose unmanned surface vessels. (Source: Fugro)

The partnership brings together the expertise of both companies for the joint development of a variety of fit-for-purpose unmanned surface vessels (USVs).

Delivery of the first USV, designed for medium- to large-scale hydrographic survey applications, is scheduled for second-quarter 2019.

Trelleborg, LB Bentley To Launch Pioneering Rotary Gate Valve

Trelleborg Sealing Solutions worked in partnership with LB Bentley, specialists in creating small bore subsea valves for subsea applications, to support the company in its development of its medium-duty rotary gate valve. The new gate valve incorporates a custom seal that demonstrates stem-sealing technology that reduces the "risk of contamination and failure." The seal was specifically engineered for a compact and robust subsea valve that has already achieved field-proven success.

As subsea oil and gas exploration becomes increasingly challenging, LB Bentley realized a highly specialized gate valve that met a wide range of extreme working pressures and operating temperatures was needed. To this end, it developed its product with minimal moving parts and a time-saving quarter-turn mechanism that can be operated manually or with hydraulics. Even in the event of over-torque, the internal parts of the valve cannot be damaged and will continue to rotate and function as normal.

Trelleborg developed a custom version of its Turcon Variseal MC with high-pressure extrusion resistance and back-pressure protection in NORSOK M-710-compliant PTFE and PEEK materials to provide the main stem-sealing function. In order to cater for subsea use, Trelleborg's Turcon Glyd Ring T was selected as a contaminant exclusion seal.

The simplicity and versatility of the rotary gate valve is immediately apparent when the orientations and variations are considered. Almost any style and combination of inlet/outlet connections can be provided, and there is also an extensive range of proven manual interfaces.

The design phase will continue into early 2019 followed by the build and factory testing. Sea trials and a capabilities demonstration in Indian Arm, British Columbia, will be concluded by April 2020.

—Staff Reports

VESSEL BRIEFS

Golar FSRU Wins LNG Croatia Project

Golar Power has landed the contract to deliver a floating storage regasification unit (FSRU) for Croatia's first LNG import facility.

The EUR 159.6 million (US$181 million) deal, announced Nov. 12, is a triumph for Golar Power, a joint venture between Golar LNG and Stonepeak Infrastructure Partners that beat out two other bidders, said state-owned LNG Croatia LLC. The LNG carrier *Golar Viking*, built in 2005, will be converted into an FSRU.

"After reviewing and evaluating the bids, the committee for opening, review, evaluation of the bids and the selection of the most advantageous bidder determined that the bid from Golar Power Ltd. was fully in line with the requirements of the tender documentation and according to the criterion of choosing the most economically advantageous bid, the bid was ranked with highest score," LNG Croatia LLC said in a statement.

Golar Viking will be converted into an FSRU for Croatia's first LNG terminal. (Source: Golar LNG)

Delivery of the vessel is expected between Sept. 30 and Oct. 30, 2020, depending on a final investment decision and the open season for capacity booking, which closes Dec. 20, 2018. The LNG terminal is scheduled to be fully operational by the start of 2021.

Golar Viking has an LNG storage capacity of 140,000 cm (4.9 MMcf), with regasification capacity of 2.6 Bcm (91.8Bcf).

FPSO Overhauls Cited As A Reason For Petrobras' Crude Output Decline

Overhauls of FPSOs were instrumental in the 9.3% year-over-year decline in domestic crude output reported by Brazil's state-controlled oil producer Petrobras in third-quarter 2018.

The company produced an average of 1.937 MMbbl/d in the quarter, down from 2.134 MMbbl/d in third-quarter 2017 and a 6.2% decline from the second quarter, the company said.

Petrobras shuttered FPSO *P-58* at the Jubarte Field and FPSO *P-52* at the Roncador Field in September. Prior to that, the company closed FPSOs *Cidade de Angra dos Reis* and *Cidade de Maricá* at the Lula Field in August.

The company might benefit from a production boost in the fourth quarter following installation of three FPSOs and plans to install three more before year-end 2018. Petrobras pumped first oil from the Lula Extremo Sul area of the Lula Field in late October, the Tartaruga Verde Field in June and the Búzios Field in April. The company expects to start up the FPSO *P-67* at the Lula Norte area of Lula and the FPSOs *P-75* and *P-76* at Búzios in the fourth quarter.

Golar FSRU Golar Freeze Lined Up For Jamaican Project

Golar Freeze, a floating storage and regasification unit (FSRU), is headed to the warm waters offshore Jamaica to begin operations in January 2019 for a charter of up to 15 years.

Golar Freeze will begin operations offshore Jamaica in January 2019. (Source: Emerson)

The contract with an energy and logistics company will begin in fourth-quarter 2018, when the vessel arrives, Norway-based Golar LNG Partners said. The hire is expected to provide about $18 million in annual adjusted EBITDA to the company.

Among the company's other contracts

- *Golar Maria* FSRU began its 10-month charter in early August and achieved an 89% utilization rate in the third quarter;
- *Golar Mazo* was reactivated and began its voyage charter in early October, one that has been extended at an attractive rate, the company said; and
- Kuwait National Petroleum Co. extended its 2018 regasification season through December for *Golar Igloo* and will decide by the end of November whether to extend the charter for another year.

—Staff Reports

UPCOMING

The next issue of *Subsea Engineering News* will be distributed Nov. 29. Until then, visit *EPmag.com*.

JOBS

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