ATLANTA

A Brazilian independent unlocks the world's heaviest deepwater crude.

Supplement to

OIL&GAS JOURNAL Offshore

BRAVA energy

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Unlocking BS-4 and Beyond

The development of deepwater, greenfield oil projects under extreme conditions is typically the realm of major oil companies. In Brazil, however, a remarkable success story is emerging. Brava Energia, one of Brazil's young, independent oil and gas companies, is showing that it too can meet the challenges of designing, developing, and operating the systems needed to produce heavy crude from a deepwater field.

In 1998, three of the world's largest oil companies, Petrobras, Shell and Chevron, took up the search for oil in the Brazilian offshore oil block known as BS-4. With Shell as the operator, a drilling program discovered the Atlanta field in 2003 and declared the field commercial in 2006.

But the challenges of tapping BS-4, home to some of the world's heaviest deepwater crude, proved to be unappealing for the majors.

It's here that Brava enters the story.

In 2012, Shell and Chevron gave up on the block and its hundreds of millions of barrels of estimated oil and gas reserves. They sold their stakes to two Brazilian companies. After the transactions, Brava, then known as Queiroz Galvão E&P (QGEP), and Barra Energia each owned 30% with Brava taking over as the operator.

In 2013, Brazil's state-led oil giant Petrobras gave up on BS-4 too, selling its 40% stake to OGX (later Dommo Energia).

After assuming the operation of BS-4, Brava charged ahead with the design and deployment of an Early Production System (EPS) in Atlanta. Overcoming the technical challenges of pumping deepwater heavy crude from a complex, unconsolidated post-salt reservoir, the independents succeeded in doing what the majors couldn't, producing the first oil from the Atlanta field EPS in 2Q 2018.

Over the next two years, Brava assumed a 100% interest in BS-4. Meanwhile, Brava (then known as Enauta) used the EPS to perfect operations, learning to safely and efficiently produce and market heavy 14°API crude from a reservoir that lies beneath 1,550 meters of water, 185 kilometers off Brazil's coast. With the experience from the EPS under its belt, Brava approved Atlanta's Full Field Development (FFD) plan in February 2022, expanding what was already the world's heaviest deepwater-crude development.

In Q3 2024, Enauta merged with 3R Petroleum and rebranded as Brava Energia. Brava produced its first oil from the FFD in 4Q 2024.

To get to this point, Rio de Janeiro-based Brava and its partners pushed the technological boundaries by testing and proving several unique systems for horizontal drilling, flow assurance, and the production of viscous-crude using high-pressure artificial lift. To operate the field, Brava procured, converted, and hired two floating, production, storage and offloading (FPSO) ships and coordinated service and equipment providers located on four continents.

Understanding the risks and responsibilities of operating offshore, Brava has made strenuous efforts to reduce Atlanta's carbon footprint, ensure the safety of its employees and contractors, and deliver a positive return to both investors and society at large.

Today, Brava has more than 9,000 employees working on its onshore and offshore operations in five Brazilian states: Rio de Janeiro; Espírito Santo; Bahia; Rio Grande do Norte and Ceará.

"Atlanta is the first deepwater greenfield project in Brazil to be developed by an independent company, requiring advanced technology and operational expertise."

Décio Oddone,
Brava CEO

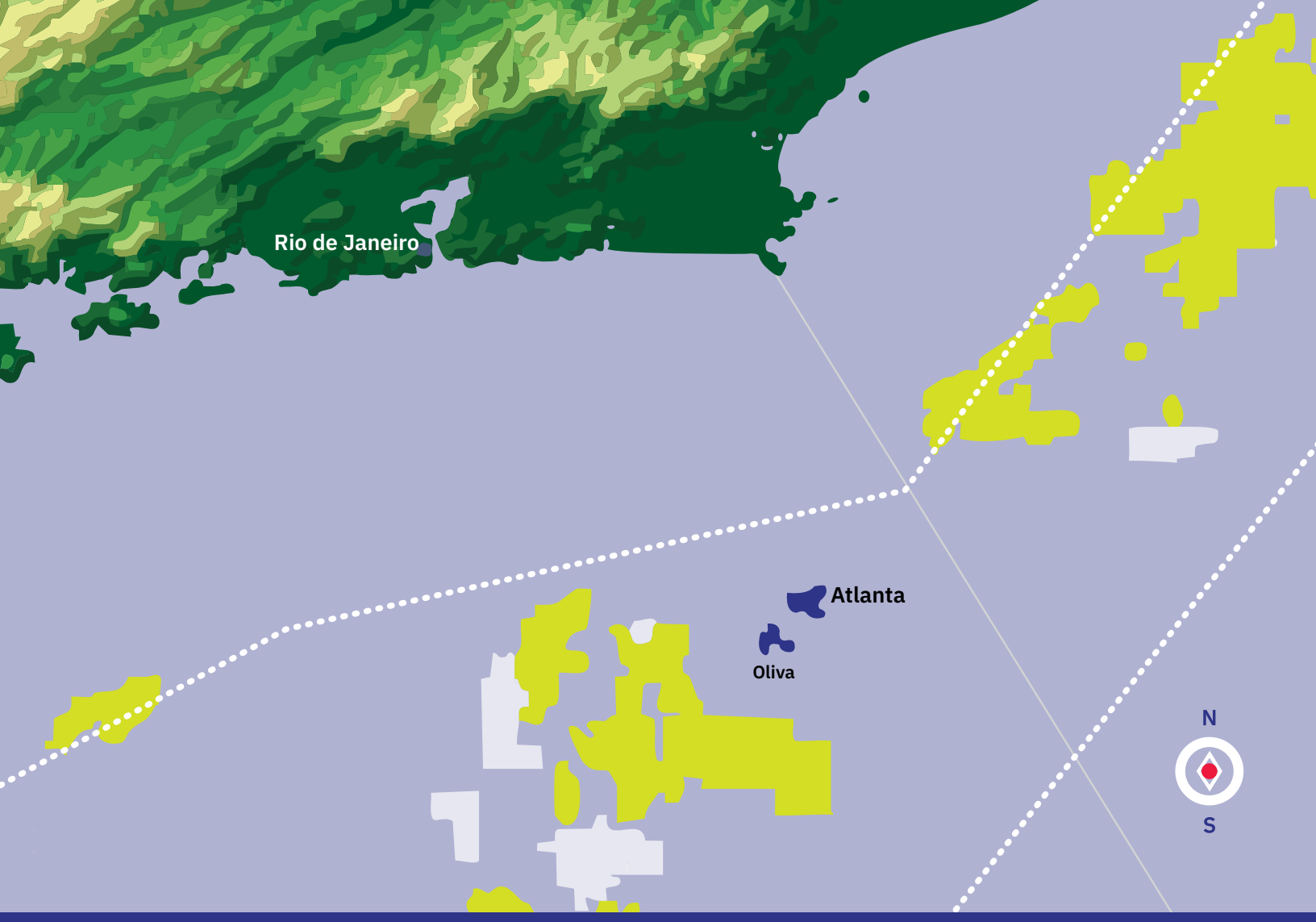
Setting the Scene

Anchored 185 km southeast of the city of Rio de Janeiro, the FPSO *Atlanta* is the center of a production system in Brazil's offshore Santos Basin. Connected to six wells, the 322-m-long floating, production, storage and offloading (FPSO) ship is the size of an aircraft carrier. At peak production, FPSO *Atlanta* will be able to hold more than 20-days' worth of Atlanta-field output before having to offload its cargo of low-sulfur, heavy oil to a shuttle tanker for transport to market.

To get the oil from the deepwater reservoir to the FPSO on the surface, Atlanta's crude moves through a complex, technologically advanced and carefully engineered system of wells, subsea flow-lines, high-powered ocean-floor pumps, and flexible risers.

The system is designed and engineered to resist cave-ins, prevent the intrusion of sand and water into the oil column, and withstand sharp changes in temperature and pressure that could restrict the flow of heavy crude through equipment exposed to the extremes of a deepwater offshore oilfield.

Brava's success in Atlanta comes after years of effort and the development, integration and deployment of sophisticated and breakthrough technologies. It also comes after other companies gave up or withdrew from the technically challenging project.



Location
Santos Basin, Block BS-4, 185 km southeast of Rio de Janeiro

Water Depth
1,550 m

Discovery
2003

Early Production System
- Three producing wells tied directly to FPSO *Petrojarl I*
- Production capacity of 30,000 barrels of oil per day (bopd)
- First oil: May 2018

Full Field Development (FFD)
- Production capacity up to 50,000 bopd via FPSO *Atlanta*
- Phase 1: six producing wells; first oil Q4 2024
- Phase 2: ten producing wells; est. completion 2027

Ownership
- Brava Energia SA (80% and operator)
- Westlawn Group LLC (20%)

Proven & Probable (2P) Reserves
174.3 million barrels of oil equivalent (boe)

Atlanta Reservoir Specifications	
Porosity Average	36%, 82%-94% net-to-gross
Permeability	4-6 darcys
Viscosity	14°API, 228 cP at reservoir conditions
Acidity	9.8 mg (KOH/g)

"Atlanta is a textbook case of a flat spot."

Felipe Barbuto, Brava Energia's New Ventures Executive Manager

Discovery and Field Assessment

The Atlanta field's road to success began in 1993 with the discovery of oil by Petrobras in Brazil's BS-4 offshore oil block. Because of technical challenges in developing the initial pre-salt discovery, the block remained inactive until 1998 when Shell bought 40% of the area and became the operator. With partners Petrobras (40%) and Chevron (20%), Shell conducted new seismic surveys of BS-4 and decided to focus its drilling plan on the block's more-conventional post-salt sweet spots.

Shell drilled four wells and made two discoveries in the offshore block. One of them was Atlanta, which was declared commercially viable with an estimated 1.6 billion barrels of oil (boe) in place.

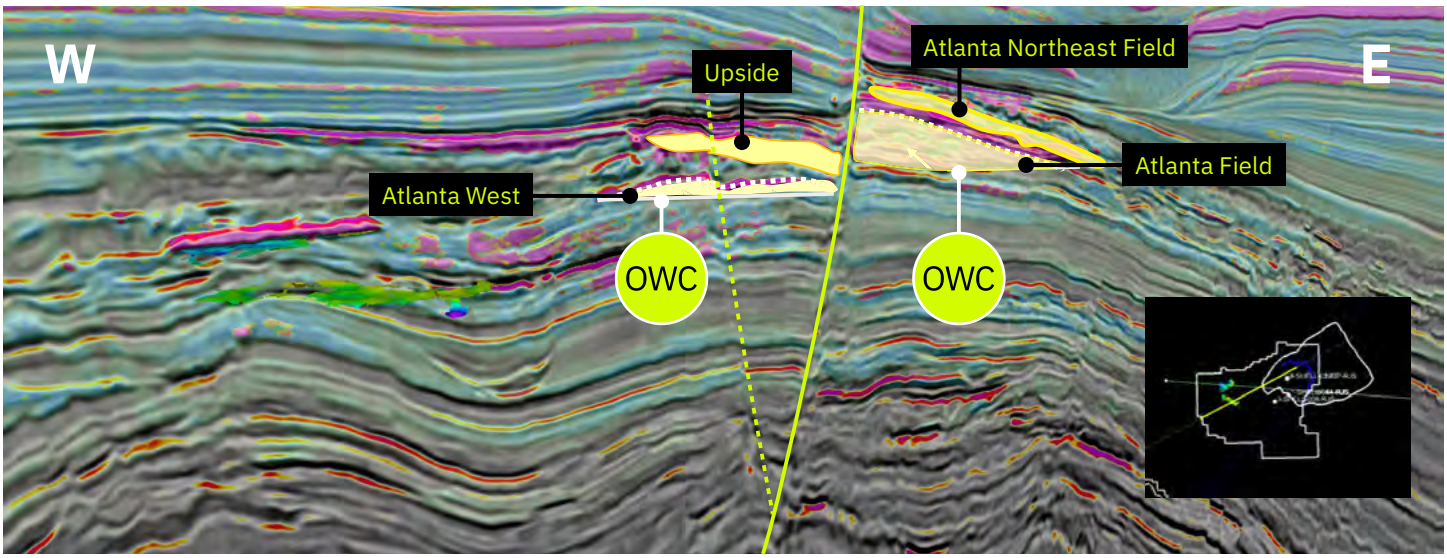
The post-salt Atlanta reservoir is located in highly porous and permeable geological formations (see above table). These desirable qualities, however, are offset by the high viscosity of the Atlanta crude. Thick and sludge-like, it requires the assistance of artificial lift to pump it to the surface.

The crude also contains acidic impurities, which must be removed by processing equipment aboard the FPSO that control Atlanta's operations. At the same time, the crude has a low-sulfur content, making it highly desirable for use as bunker fuel.

Geological Analysis

Reprocessing of the seismic data for Atlanta resulted in the discovery of a "flat-spot" anomaly. The flat spot suggested not only the presence of hydrocarbons but also the likely location of the reservoir's oil-water contact (OWC), making it easier to calculate the size of the reservoir. "Atlanta is a textbook case of a flat spot," said Felipe Barbuto, Brava Energia's New Ventures Executive Manager. "The clear imaging made our job of calculating the oil-in-place much easier."

Atlanta holds an estimated 174.3 million barrels of proven-and-probable oil equivalent, or "2P", reserves, according to a recent estimate by oil-reserve certification firm Gaffney, Cline & Associates.



Seismic data reveals that the Atlanta reservoir is partitioned by a fault into Atlanta and Atlanta West fields. The image also reveals the oil-water contact (OWC).

Drilling Challenges

The Atlanta reservoir consists of a relatively flat, horizontal stretch of sandstone with a total area of 10 km^2. The 100-m-thick deposit is located beneath 1,550 m of water and only 800 m of overburden, consisting of easily collapsible soft, unconsolidated geological formations. As a result, the development of the field required long, horizontal wells with high deliverability — a challenge that the previous operators could not overcome.

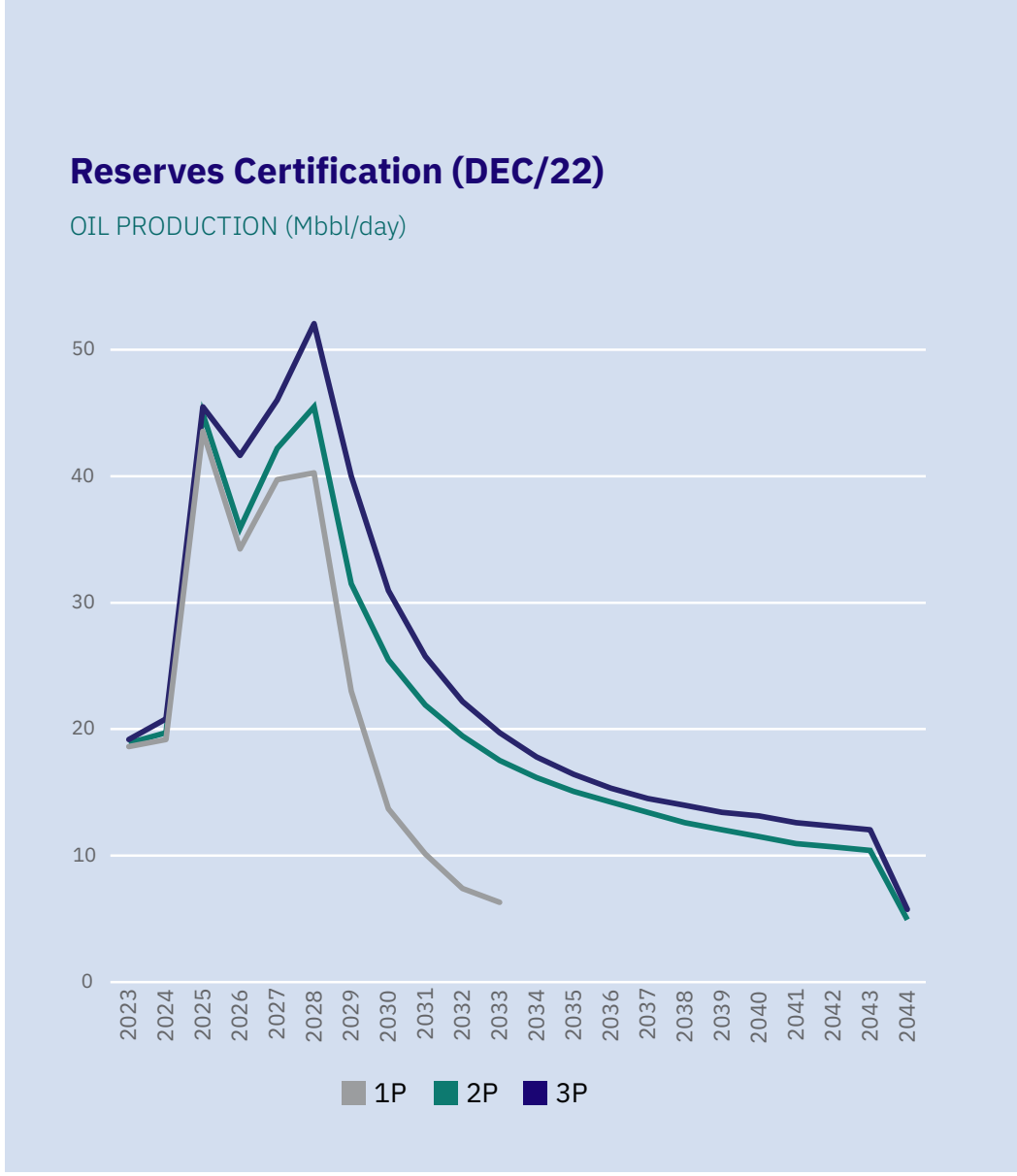
Brava was able to drill the production sections of the wells with a hole diameter of 9.5 in., maintaining an inclination of 88° through 800 m of the reservoir. Achieving this vertical-to-horizontal transition was a challenge for the former operators. Brava's team held extensive conversations with the previous owners and contractors which allowed it to make optimal decisions about well positioning and drilling methods, leading to successful drilling, gravel-packing and completion campaigns.

"Constructing these wells, I would say, was a work of art in terms of drilling techniques," said Brava Drilling Manager Jacques Salies.

Completion and Production Challenges

At the start, Brava faced a series of difficulties drilling and completing the wells. The narrow, 800 m overburden meant there was little room for a kickoff that could turn the well horizontally to access the flat, shallow reservoir. The unconsolidated reservoir geology also made completion and flow assurance for the wells a major challenge.

The reservoir engineering team was also concerned about the aquifer below the reservoir. Would it help maintain reservoir pressure, improving oil flow? How much of the water would mix with oil reducing output efficiency? Would water



Atlanta reserves certification with expected oil production through 2044: 1P represents proven reserves; 2P refers to the sum of proven and probable reserves; and 3P is the sum of proven, probable, and possible reserves.

"Constructing these wells, I would say, was a work of art in terms of drilling techniques."

Jacques Salies, Brava Drilling Manager

THE *ALPHA STAR* drilling rig helped turn Atlanta's challenging deepwater reservoir into a producing field, drilling complex horizontal wells that enabled Brava Energia to extract some of the world's heaviest offshore crude.

"Some of the challenges, however, turned out to be opportunities."

Carlos Mastrangelo,
Chief Operations Officer

need to be reinjected into the reservoir to maintain flow?

"Some of the challenges, however, turned out to be opportunities," said Chief Operations Officer Carlos Mastrangelo. "The crude, for instance, can flow without water injection. If water injection had been necessary, the cost of the project might have been prohibitive," he added.

Ultimately calculated to be 15 to 20 times the volume of the oil reservoir, the aquifer is now considered an important factor behind Atlanta's commercial potential, according to Brava Reservoir Engineer Igor Ferreira.

"A large aquifer below the reservoir was a major uncertainty for us," Ferreira said. "After producing more than 30 million barrels (MMbbl) during the Early Production System, we've confirmed that the aquifer is large enough to maintain pressure for crude recovery. As a result, we could forgo injector wells to maintain reservoir pressure."

Mastrangelo also highlighted the fact that the reservoir and wells have no issues with scale or wax deposits, reducing the need for expensive mitigation efforts. Perhaps best of all, the crude, while heavy and sludge-like, sells at a premium to oils of similar viscosity.

"Due to its low sulfur content, Atlanta crude is highly valued in oil markets as a feedstock for bunker fuel," he said.

The rig was selected to drill through unconsolidated formations and handle high-pressure conditions, enabling safe and efficient extraction of Atlanta's 14°API heavy crude.

"Ultimately calculated to be 15 to 20 times the volume of the oil reservoir, the aquifer is now considered an important factor behind Atlanta's commercial potential."

Igor Ferreira,
Brava Reservoir Engineer

Production Confirmation

After drilling two wells, Brava conducted formation tests to evaluate the production potential.

"We opened up the wells to see if the entire effective length was producing and to check if there was any damage," Ferreira said. "Through the well test, we confirmed that the entire well was contributing to the flow and that there was no damage."

Production Strategy

In the face of the challenging field characteristics, Brava made a strategic decision to develop the Atlanta field in two phases: an Early Production System (EPS) and a Full Field Development (FFD) stage. The reasoning behind the decision was to use the EPS to assess the reservoir, production, and operational data and to test technology solutions to fine-tune the design parameters for the FFD.

Not only did the EPS help Brava perfect directional drilling into narrow reservoirs, but it also helped in developing gravel-packing solutions to prevent sand and water infiltration into wells, optimal methods to produce oil with artificial lift, and ways to limit the formation of pipe-blocking hydrates.

Early Production System

Work on the first EPS horizontal well (7-ATL-2HP-RJS) began in the second half of 2013. Two drill-stem tests (DSTs) were completed in February 2014 showing flow rates of between 1,250 bopd and 5,000 bopd. A second well was then drilled and DSTs showed flow rates of between 6,000 bopd to 12,000 bopd.

Production via FPSO

Operated by Altera Infrastructure (formerly known as Teekay Offshore) the FPSO *Petrojarl I* has a production capacity of 30,000 bopd, a natural-gas compression capacity of 225,500 cubic feet per day (cfpd), and a crude-storage capacity of 180,000 bbl. Brava awarded Altera a five-year contract to charter FPSO *Petrojarl I* for the Atlanta field development in December 2014. The FPSO, however, arrived at the Atlanta field in January 2018. In January 2022, Brava extended the FPSO contract until May 2025.

The production system for the Atlanta-field EPS was designed for up to 30,000 bopd using three producing wells tied directly to the FPSO. Processing

FPSO Petrojarl I was used during the Early Production System (EPS).

Watch the Atlanta Project Come to Life

Now, you can witness it firsthand.

Explore a visual journey through the challenges, the breakthroughs, and the people who made it possible. See the technology in action, go behind the scenes, and experience how this project came to life.

SCAN TO WATCH

equipment aboard the FPSO allowed for oil separation, treatment, storage and offloading. The processing plant was designed and renovated to process oil with Atlanta's unique characteristics and to comply with Brazilian laws and regulations.

Brava experimented with two types of artificial lift during the EPS: in-well electric submersible pumps (IW-ESPs) placed in the reservoir and backup ESPs on the seabed. The IW-ESPs, however, were prone to failure, so the production team placed bypass valves in the wells and used the backup ESPs instead. For the Full Field Development (FFD), Brava decided to use highly reliable seabed, multiphase pumps (MPPs) to provide all the artificial lift.

Full Field Development (FFD)

Brava approved the FFD of the Atlanta field in February 2022. At a projected cost of $1.2 billion, the project has a planned maximum production capacity of 50,000 bopd. During this FFD Phase 1, there are six production wells — three newly drilled and three existing wells drilled during the EPS. In February 2022, Brava completed the purchase of the FPSO OSX-2. Originally built for a canceled project in Brazil's adjacent offshore Campos Basin, it was converted into the FPSO *Atlanta* by Dubai-based Drydocks World at its shipyard in the United Arab Emirates (UAE). The following month, Brazil's oil and gas regulatory agency, the ANP, approved Atlanta's field-development plan and extended Brava's concession to operate the field until 2044.

"Adapting an existing FPSO was a very practical and deliberate approach to utilize as much of the existing structure as possible, minimizing the capital expenditure (CAPEX) needed for modifications," said Brava's Executive Operations Manager, Ricardo Abi Ramia.

Following upgrading, refurbishing, and conversion, the FPSO *Atlanta* is capable of processing up to 50,000 bopd, treating up to 140,000 barrels of liquids per day (bwpd), producing 20 megawatts (MW) of power, and storing 1.25 million barrels (MMbbl) of oil.

With a production capacity of 50,000 bopd, the FPSO *Atlanta* requires a shuttle tanker to visit every 20 days to offload and export the oil.

"Adapting an existing FPSO was a very practical and deliberate approach to utilize as much of the existing structure as possible, minimizing the capital expenditure (CAPEX) needed for modifications."

Ricardo Abi Ramia,
Executive Operations Manager

Installation of critical production modules that will enable it to process up to 50,000 barrels per day in Brazil's deep waters.

FPSO *OSX-2* during conversion to FPSO *Atlanta* at the Drydocks World Dubai shipyard in UAE.

The FPSO *OSX-2* arrived in Dubai in March 2022, and its conversion at Drydocks World was a major challenge. It involved comprehensive refurbishment and life-extension services to ensure that the FPSO could meet Brazil's safety and environmental regulations and the demanding technical requirements of the Atlanta field.

Work on the ship, which began life as an oil tanker, included the replacement of steel plate on the hull, the addition of state-of-the-art, greenhouse-gas reduction systems, and the installation of new, crude-processing equipment. To minimize crude viscosity and ensure safe and efficient operations, the heavy-oil processing systems required the addition of heat tracing and insulation to pipes and the heating of production fluids. The crude-oil storage tanks have steam coils in order to maintain the oil at 65°C and facilitate offloading operations.

The successful conversion relied heavily on effective project management and collaboration between Brava and its subcontractors.

Greenhouse-Gas Mitigation

FPSO *Atlanta* uses an advanced carbon-management system to reduce greenhouse-gas emissions. In a conventional FPSO, carbon dioxide (CO_2) is used to fill up the empty space above the crude in the storage tanks to create an inert "blanket" to prevent explosion or fire. As the tank fills with crude, some of this CO_2 — a greenhouse gas — is vented into the atmosphere.

Aboard FPSO *Atlanta*, however, Brava's partner Yinson developed an inerting-blanket system using fuel gas produced from the reservoir. During the filling of the vessel's crude-storage tanks, the fuel gas is recycled back through a recovery gas compressor, ensuring the methane-rich fuel gas is not released into the atmosphere as the tanks fill.

"Instead, it is monitored, captured, compressed, and fully reused in the FPSO's energy generation system, thereby significantly reducing greenhouse gas emissions without sacrificing storage-tank safety," Mastrangelo said.

"We focused on using proven technologies and maintaining the systems that worked well. Our goal was to ensure reliability and efficiency by only making changes that were absolutely necessary," he added.

Key processing modules are installed during conversion, equipping FPSO *Atlanta* to handle the unique challenges of producing, treating, and storing Atlanta's ultra-heavy crude.

The FPSO Atlanta, stationed 185 km offshore in the Santos Basin, serves as the heart of Atlanta Field's production system, capable of processing up to 50,000 barrels per day of heavy crude.

Another interesting initiative is the use of oil produced from the Atlanta field to directly fuel the naval or deck boilers. By coupling a steam turbine to the deck boilers, the FPSO can generate up to 16 MW of electricity. The use of Atlanta oil as an alternative to diesel was attractive as a result of the low gas-to-oil ratio (GOR) of the Atlanta reservoir and the high-quality Atlanta crude with its low levels of sulfur and nitrogen.

Over the life of the field, the GOR has remained close to 45 Sm^3/Sm^3. So, as oil production falls with time, associated-gas production also falls, limiting the amount of gas that can be tapped from the output stream to power the FPSO and production systems. As a result, more liquid fuel is needed to replace the associated gas used in the boilers. At that point, one may use either diesel fuel shipped out from shore to the FPSO or Atlanta oil sourced directly from the reservoir.

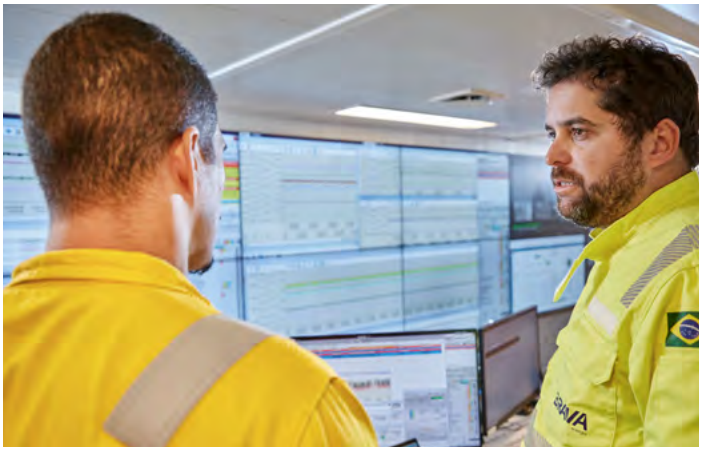
"The use of Atlanta oil instead of diesel is good for the environment," explained Henrique Cerqueira, Brava's Project Engineer. "Diesel needs to be produced somewhere else and requires dedicated shuttle trips to provide diesel to the FPSO during the life of the field, adding indirect CO_2 emissions due to refining and logistics."

A life-cycle analysis study concluded that using Atlanta crude instead of diesel reduces the CO_2 equivalent emissions by 13%.

"The use of Atlanta oil instead of diesel is good for the environment."

Henrique Cerqueira,
Brava Project Engineer


Safety and
Efficiency
3M
PELTOR



Several other environmental initiatives were also implemented on FPSO *Atlanta* that reduce CO_2 emissions indirectly.

The decision to refurbish and adapt an existing FPSO rather than build a new, purpose-built ship, reduced the amount of energy and raw materials needed to produce steel and other shipbuilding materials.

Aboard the refurbished FPSO, the installation of a waste-heat recovery unit (WHRU) on the gas turbines, the adoption of closed-flare systems, and the use of a subsea hydraulic power unit (HPU) with a closed hydraulic circuit all increase Atlanta's energy efficiency and reduce fuel-consumption needs. FPSO *Atlanta*'s systems have also reserved space for the installation of new carbon-capture technology in the future.

This approach not only ensured the operational success of the FPSO but helped Brava achieve its broader goals of cost efficiency, reliability and sustainability in its offshore projects.

A key achievement of the FPSO conversion project was its exemplary safety record. Despite the extensive and difficult work required over two years, there were no lost-time incidents. This achievement underscores the project's commitment to safety and operational excellence.

In July 2023, Malaysian FPSO operator Yinson acquired FPSO *Atlanta* from Brava for $465 million. Through this sale, Brava reduced its net investment in the FPSO to about $100 million, cutting its overall up-front investment in the field.

The divestiture to Yinson also came with a 15-year charter of the vessel under which Yinson will operate and maintain the ship for Brava. That term can be extended for an additional five years. The total contract value is estimated at about $2 billion.

Following conversion and sea trials, FPSO *Atlanta* left Dubai and set sail for Brazil in March 2024. It arrived off Brazil's coast in May 2024.

Brava achieved a seamless transition from the EPS to FFD by keeping FPSO *Petrojarl I* in operation while connecting FPSO *Atlanta* to the new wells. The flowlines from FPSO *Petrojarl I* were then transferred to FPSO *Atlanta*.

"Surpassing 10 million man-hours with no lost-time incidents reflects our strict safety protocols and the team's commitment to a safe work environment."

Maria Eduarda Pessoa,
Offshore Safety and Environmental General Manager

Building Trust in a Global Supply Chain

"We had to conduct negotiations over large sums of money and to manage the complexity of contracts associated with manufacturing and importation of equipment from locations throughout the world,"

Vinicius Passos,
Executive Delivery Manager

It took a global supply chain to make the Atlanta field's FFD successful. Building trust with those suppliers and making them feel like essential partners in the project was the key to bringing the FFD to fruition on time and within budget.

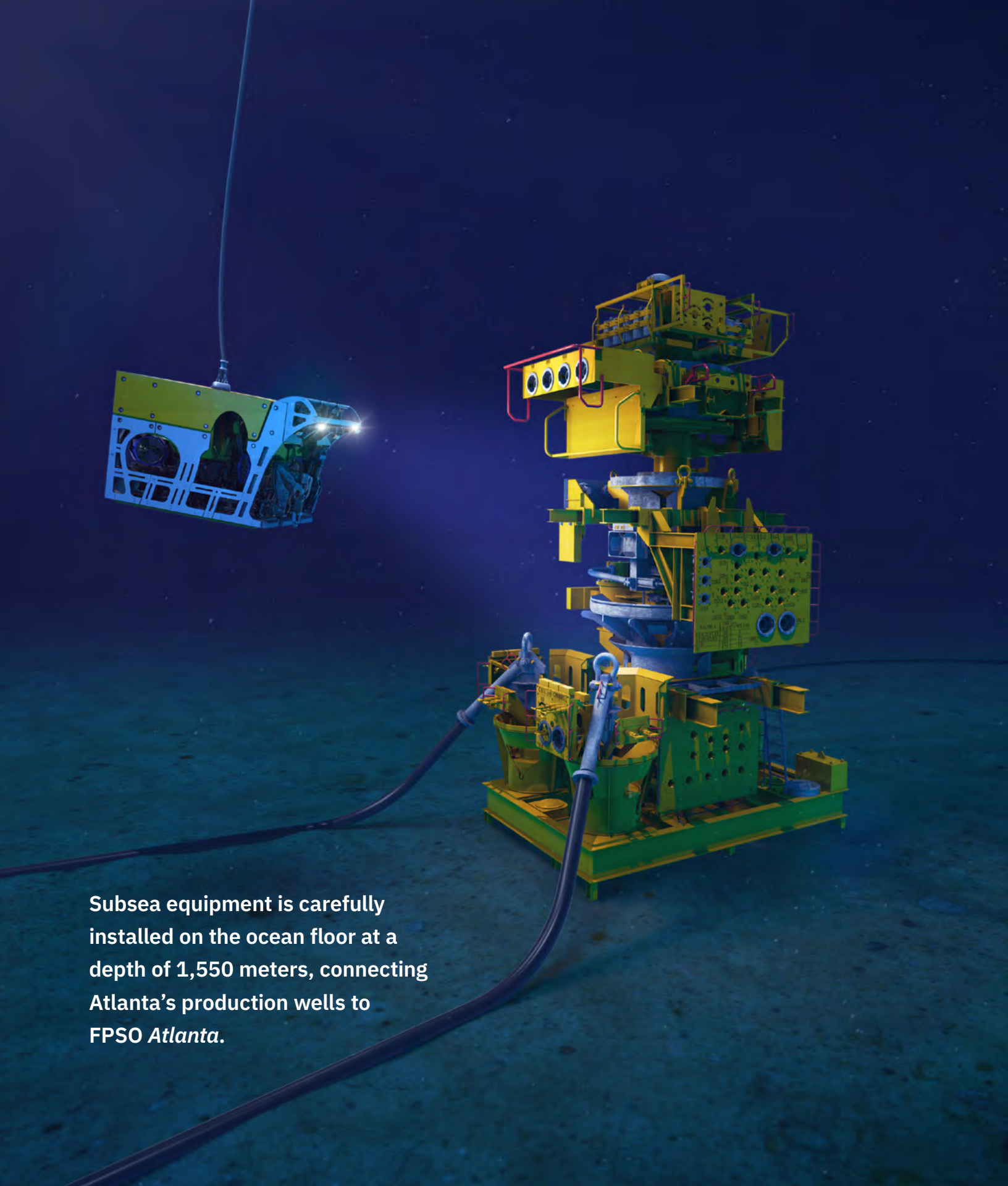
To align the goals of Brava and its suppliers and enhance the project's chances of success, Brava formed a steering committee. This committee helped partners understand the Atlanta project, improved the interfaces between suppliers and systems, and created a sense of ownership.

The steering committee brought together the top executives of Brava with their counterparts at Atlanta's major service contractors and suppliers' facilities, according to Brava's Executive Delivery Manager Vinicius Passos. The committee met every quarter to assess the project's progress and ascertain how it aligned with the overall goals to stay on schedule and within budget.

"We called in all the CEOs to present the project as a whole," explained COO Mastrangelo, "This was done to show how each company could see itself within the project and to stress that their equipment or services were critical to the success of the project."

In addition to meeting at Brava's headquarters in Rio de Janeiro, the committee also held meetings at contractor facilities around the world, gaining understanding of how the different pieces of the field's infrastructure needed to fit together.

Committee members witnessed flexible-flowline manufacture by Baker Hughes in Newcastle, UK, and the assembly of the MPPs at OneSubsea's



Subsea equipment is carefully installed on the ocean floor at a depth of 1,550 meters, connecting Atlanta's production wells to FPSO *Atlanta*.

Main Supply Partners	
Altera Infrastructure (formerly Teekay Offshore)	FPSO *Petrojarl I*
Baker Hughes	Drilling Services, Flexibles
Bunker One	Fuel
Edison Chouest Offshore	Anchor Handling Tug Supply (AHTS) vessels
Constellation	Drilling Rig
Delp	Torpedo Anchors
Drydocks World Dubai Shipyard	FPSO *Atlanta* conversion
Halliburton	Autonomous Inflow Control Devices (AICDs) and screens
Oceaneering	Umbilicals and ROVs
OneSubsea	Subsea Equipment
Prysmian	Umbilicals
Sapura Energy/Seagems	Engineering, Procurement, Construction and Installation (EPCI)
Solstad Offshore	AHTS vessels
Wilson, Sons/Brasco	Support-base services
Yinson	FPSO *Atlanta*

facility in Bergen, Norway. The committee also met at the Drydocks World shipyard in Dubai where FPSO *Atlanta* was converted.

In Brazil, the committee held meetings at the Prysmian umbilical plant in Vitória, Espirito Santo state, at Delp's facility in Belo Horizonte, Minas Gerais state where the torpedo anchors were fabricated, and at OneSubsea's Taubaté plant in São Paulo state where the wet Christmas trees (WCTs) and pipeline-end manifolds (PLEMs) were built.

Such engagement helped control risks, anticipate problems and meet deadlines.

"We had to conduct negotiations over large sums of money and to manage the complexity of contracts associated with manufacturing and importation of equipment from locations throughout the world," Passos said. "We had to ensure that all the equipment and supplies were delivered at the right time."

The close collaboration also increased economies of scale and efficiency.

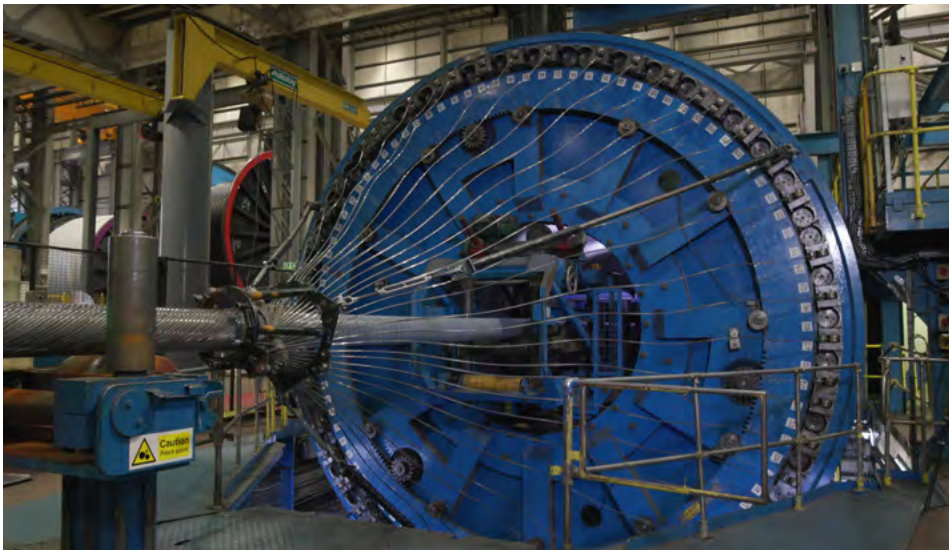
"For instance, we had ordered six Christmas trees from the same supplier, either identical or with only minimal changes," Brava's Subsea Production System Manager Monteiro Neto said. "As a result, we carried out each of the installations for the last two trees in less than 20 hours."

"Suppliers are fundamental to the process," Passos concluded. "Without them, there is no project."

"Three state-of-the-art subsea Multiphase Pumps (MPPs), delivered from Norway, have been installed to lift Atlanta's heavy crude to the surface, ensuring efficient production flow from the reservoir."

Monteiro Neto,
Subsea Production
System Manager

Local Manufacturing Resources



While there is no local-content mandate applicable to Brava, the company is well aware of the need for local content to promote the growth of Brazil's own domestic network of suppliers and service contractors. Brazil has the manufacturing capacity to produce a wide array of subsea equipment.

"Among the products manufactured locally that met our technical specs included the innovative torpedo anchors, Christmas trees, and subsea equipment such as PLEMs (pipeline-end manifold), PLETs (pipeline-end terminations) and umbilicals," Passos explained.

Well Drilling Solutions

Horizontal wells were required to maximize pay-zone drainage from the full reservoir. The plan for the third well (7-ATL-4HB-RJS) in the EPS was based on lessons learned from the first two wells and became a template for the three wells drilled during the FFD Phase 1.

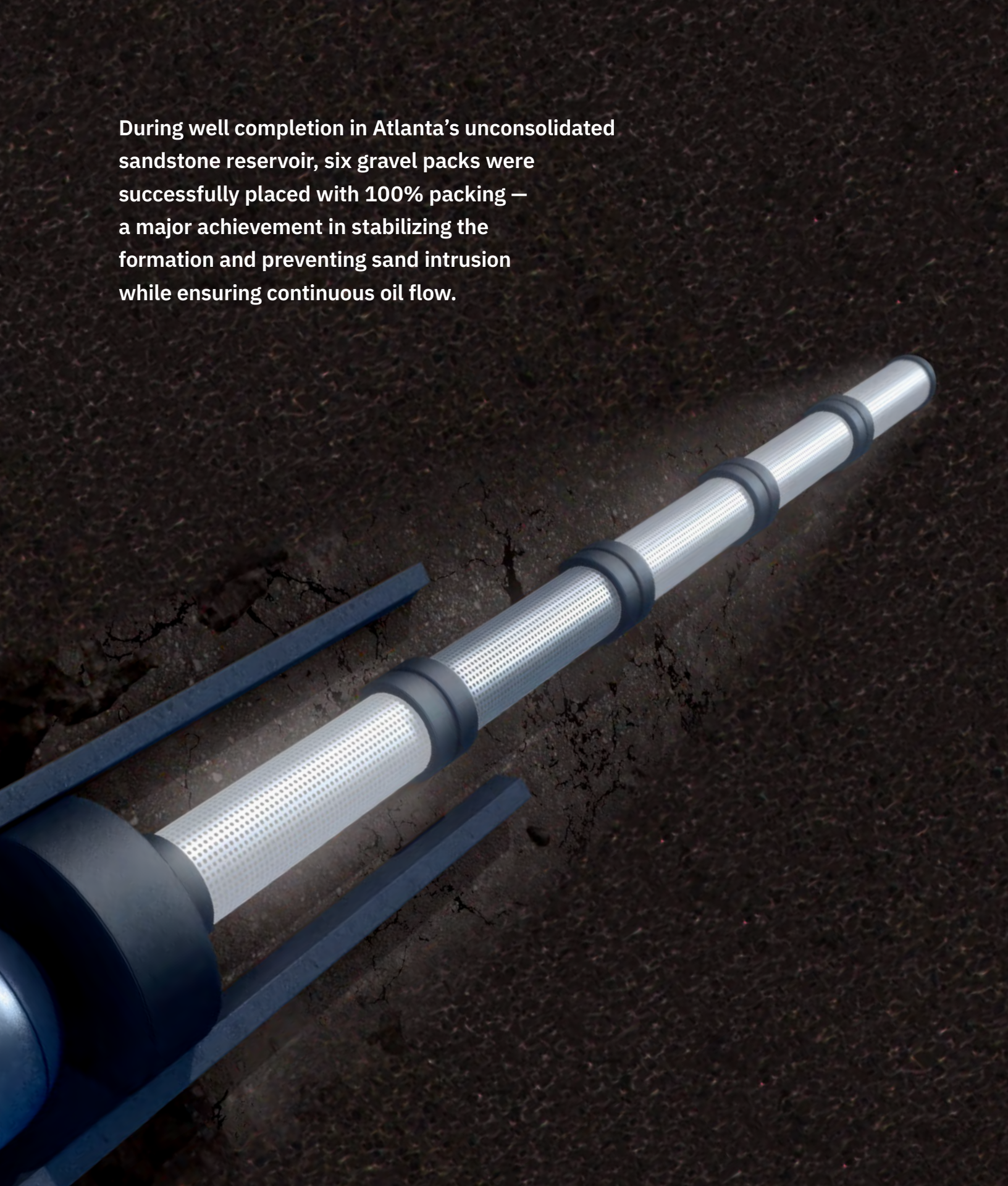
The well plan required kicking off from the vertical just 3 m below the 36-in. conductor casing shoe. From the seabed at 1,550 m below the ocean surface, the conductor casing is 47 m long. The dogleg severity (DLS) was increased in steps of 0.5°/30 m, starting at 1°/30 m to a maximum of 3°/30 m due to expected low buildup rates in the shallow, unconsolidated overburden formations. A 100-m slant section was planned before the top of the reservoir where the in-well electric submersible pump (IW-ESP) would be installed during the completion phase.

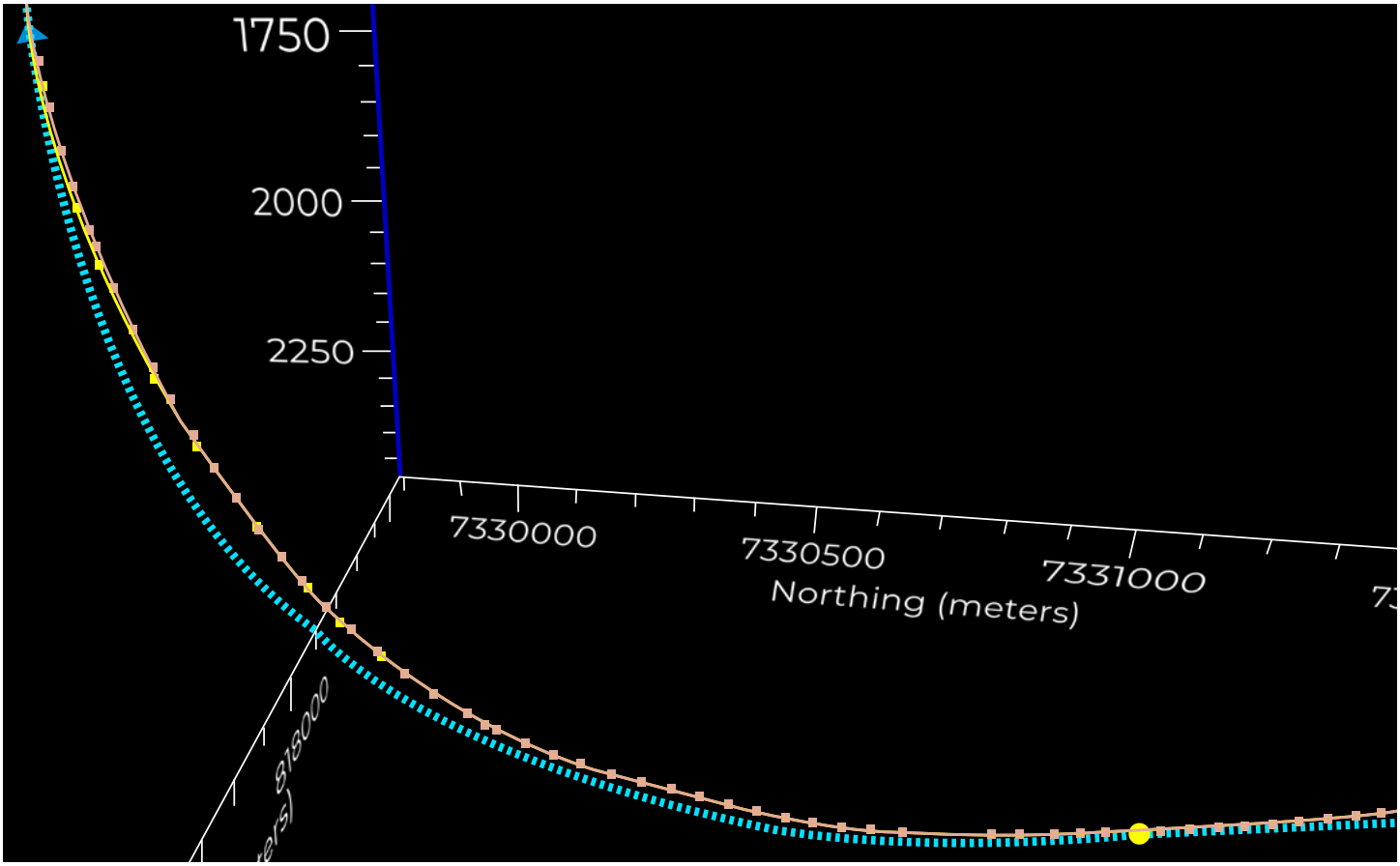
The drilling operation was carried out in several stages: jetting, kick-off, hole opening, well landing, and reservoir navigation. To support flawless execution, a 24/7 service team was deployed to assist offshore drilling operations with guidance regarding real-time optimization, such as vibration control, performance drilling, and key performance indicators (KPIs) to measure operational effectiveness. A drilling automation service monitored torque and drag to automatically identify any unexpected change in trend patterns. Next, the 36-in. conductor casing was jetted to support the loads for the next phases of the well.

The kick-off operation required a carefully planned approach. A 12¼-in. bottomhole assembly (BHA) was used to achieve the desired dogleg severity (DLS). The motor utilized sliding mode for 55.24% of the hole section and 44.76% in rotating mode. However, due to the unconsolidated formation in the top section above 1,797 m, 73% of sliding was required. The drilling operation took 28.2 hours to complete 963 m, yielding an effective ROP of 19.96 m/hr. A hole opening operation was conducted in two stages — first at 16-in. outer diameter (OD) and then 20-in. OD for smooth deployment of the 16-in. casing. This was the first application of the two-stage, hole-opener design in Brazil. Upon pulling out of the BHA, a visual inspection revealed minimal damage to the hole-opener's cutting structure, with only five instances of chipped teeth.

The 14¼-in. section was designed to reach the top of the reservoir with a slant section of 175 m. Hole cleaning was identified as a critical issue in the cased hole between inclinations of 30° to 45°. Back-reaming was performed to address this issue. The drilling automation software was programmed to run in

During well completion in Atlanta’s unconsolidated sandstone reservoir, six gravel packs were successfully placed with 100% packing — a major achievement in stabilizing the formation and preventing sand intrusion while ensuring continuous oil flow.





A 3D view of planned (dotted line) and actual (solid) well paths.

advisor mode to monitor hole cleaning. This application allowed for equivalent circulating density (ECD) monitoring by the directional driller (DD) and the drilling automation system for the detection of potential cutting beds or hole-cleaning deficiencies.

The drilling-automation system identified the slant section with a cuttings height of over 21%. The final build section, with an inclination of greater than 80°, also had a cuttings height of 10%. By raising the flow rate to 800 gallons per minute (GPM) and starting rotation at the surface at 140 RPM, the system detected a reduction in the cuttings bed height in both intervals. During the drilling process, the hole-cleaning view was continuously monitored by the 24/7 support team to ensure proper cuttings bed removal.

The long-term partnership between Brava and Baker Hughes, the drilling-service provider, facilitated the introduction of the latest drilling-automation service, which allowed multiple features to improve real-time, data-driven decision making. These features yielded successful torque-and-drag simulations, efficient hole cleaning, and avoided unnecessary back-reaming operations.

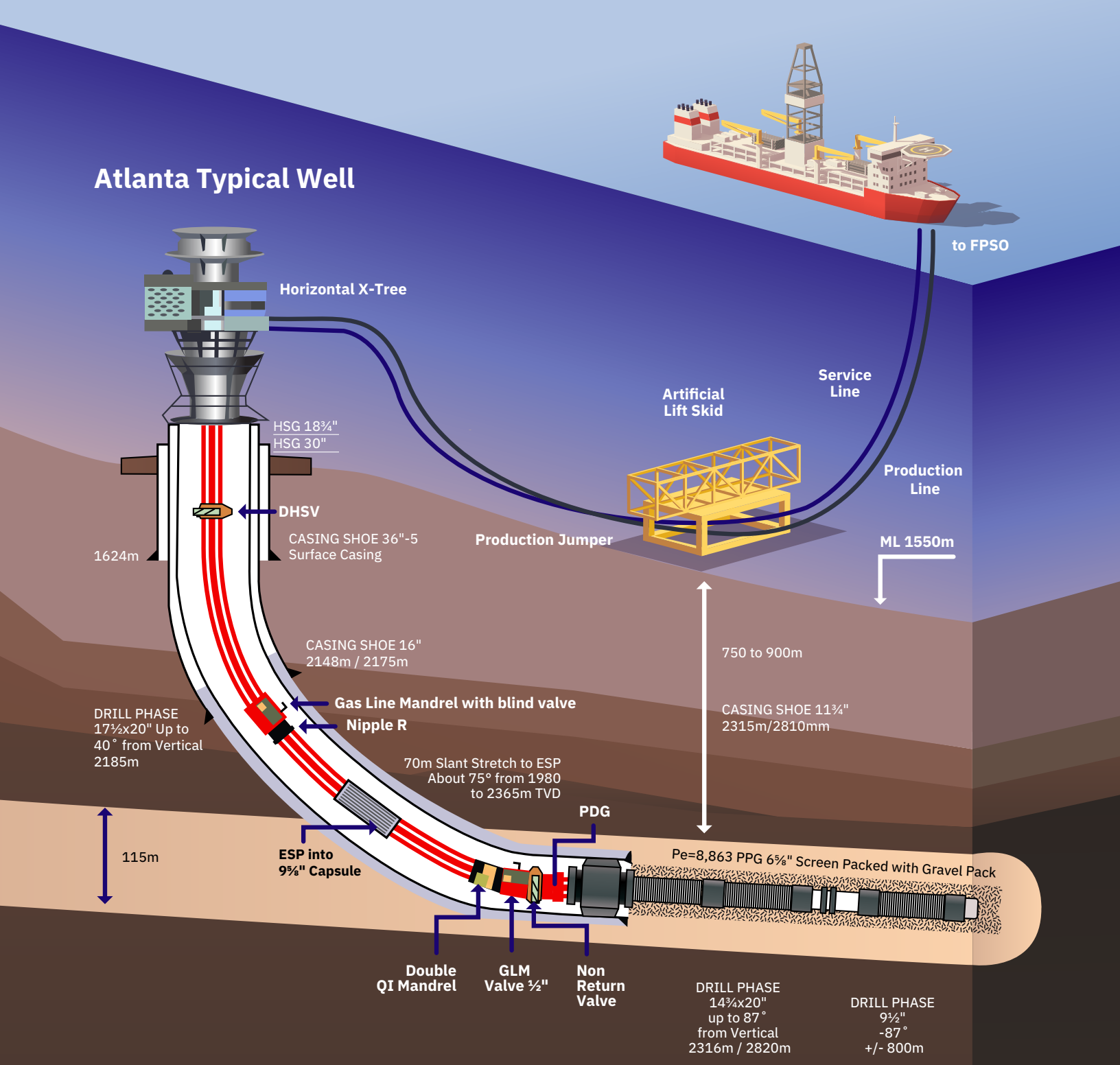
Well-Construction Solutions

Commercial production of the Atlanta field requires extended horizontal sections in the reservoir, large-diameter production strings, and robust sand control using horizontal open-hole gravel packs (HZ-OHGP).

The first reservoir appraisal well, drilled by a previous operator, had a vertical, cased-hole gravel pack completion with 91 m of perforations. The well exhibited poor productivity and high skin, suggesting that a HZ-OHGP would be required for field development.

The first attempt to complete a well for testing the horizontal concept was made by the previous operator and was not successful. A well test showed poor productivity, clogged sand production, and ended up burning out the electric submersible pump (ESP).

At the beginning of the EPS, two long (800-m) horizontal wells were completed with HZ-OHGP. These wells had large (6⅝-in.) screens to minimize the open-hole annulus and accommodate a larger

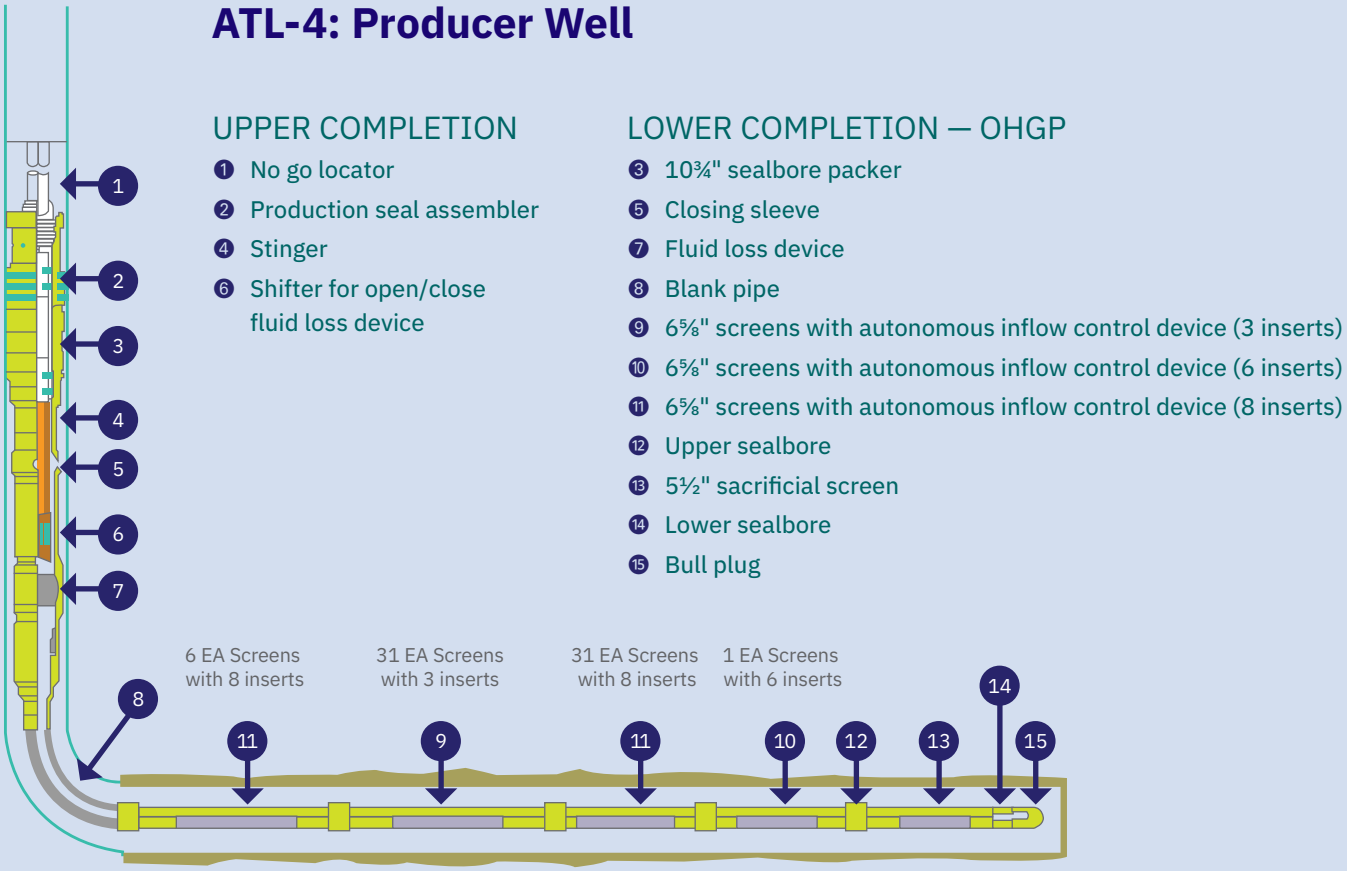


Typical Atlanta well during the three-well EPS. During the FFD, the in-well ESPs were bypassed for each of the first three wells. Subsequently, the flow from all six wells will be assisted by multiphase pumps (MPP) on the seabed.

5-in. wash pipe to increase the flow area and reduce friction in the return flow path. The risk of gravel-pack failure was further minimized by using lightweight gravel, reducing carrier-brine weight, and adding a friction reducer in the carrier fluid.

A better understanding of the minimum horizontal stress (from a microfrac/extended leak-off test) and improved modeling of HZ-OHGP in low-pressure environments (using data from the first two wells) provided an opportunity to apply autonomous inflow-control devices (AICDs) in the third well.

AICDs restrict the water influx into the gravel pack and, thereby, delay water breakthrough. The selected AICD was tested in a third-party laboratory (SWRI — Southwest Research Institute) to confirm the efficiency and pressure drop added during gravel-pack pumping.



Gravel pack assembly and AICD screen distribution.

Biphasic and triphasic loops were used to stimulate the flow of water, oil and gas in different proportions.

This was the first well worldwide to be completed with AICDs and 6⅝-in. premium screens.

The Atlanta reservoir consists of six different facies which have permeability and porosity heterogeneities resulting in uneven production from each layer. Based on extensive reservoir simulations to equalize flux and maximize production, the best configuration for the well consisted of eight inserts followed by 31 screens with three inserts, 31 screens with eight inserts, and one screen with six inserts.

This third well began production in June 2019 at rates greater than expected, confirming the effectiveness of the design and making it the most prolific well in the EPS.

Both oil and water chemical-solid polymer tracers integrated into the sand-control screens confirmed effective gravel packing across the full length of the horizontal section. The data also showed equalized flow along the well caused by water-inflow restriction due to the use of AICDs located at the heel. As the water cut increased, the tracers showed a considerable increase in oil production from the mid-heel zone in detriment to the mid-toe zone.

Completion of the drilling of the sixth well, the last of FFD Phase 1, took place in September 2023 along with the issuance of an installation license for the FFD by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), Brazil's environmental-protection agency.

Subsea Development

"We're talking about moving equipment the size of buildings and buses."

Mara Souza,
Shorebase Coordinator

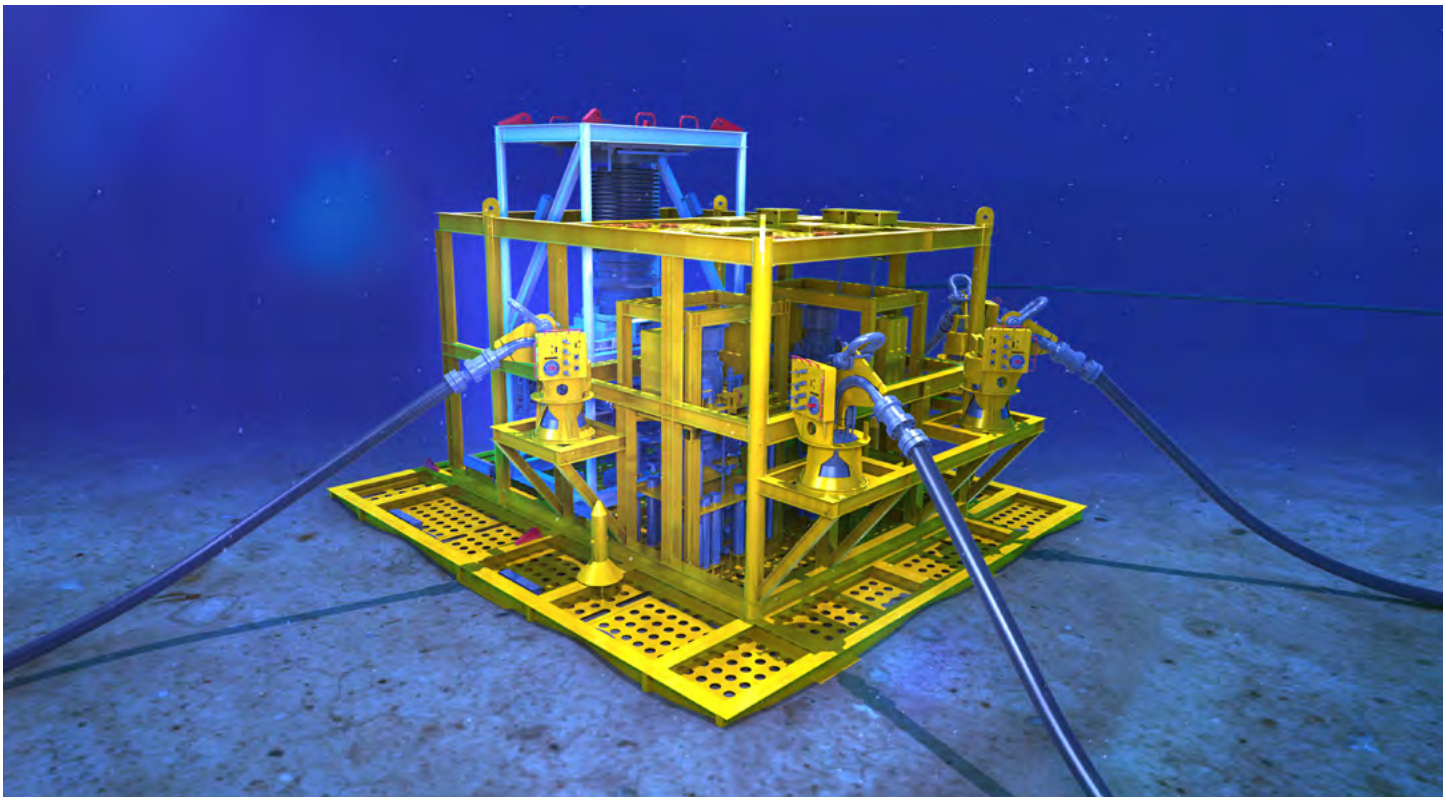
Building infrastructure in a field that lies more than 1.5 kilometers below the surface of the ocean brought its own challenges. Powerful seabed electric pumps were needed to lift the heavy oil — 14° on the American Petroleum Institute (API) scale — through the water column. Resilient flow assurance measures were required to prevent hydrates from forming and clogging the risers that channel the oil from the undersea wellhead to the FPSO.

At the same time, Brava had to marshal the manufacture and transport of massive equipment from suppliers around the world and coax it gently into place on the seabed. Careful planning, detailed monitoring, and strict technical and safety standards in such an environment were required to ensure long-term system resilience and success.

"We're talking about moving equipment the size of buildings and buses," said Mara Souza, Brava's Shorebase Coordinator. "The subsea installation required cranes, remotely operated vehicles (ROVs) and specialized robots. Even transporting the equipment on land was a challenge, requiring us to obtain authorization from highway police to close certain highways and roads."

Flow-Assurance Assessment

The flow-assurance strategy for both the EPS and FFD required the management of viscosity, scale, and hydrates. Ranking risks on a scale of 1 (low) to 5 (high), the Brava team classified the qualitative risk for crude oil and emulsion viscosity, sand production, erosion, and naphthenates at 5. The risk of forming hydrates, foaming, asphaltenes (through natural depletion or induced by diesel injection), and scale ($CaCO_3$, $BaSO_4$) were in the mid-range at 3. Wax deposition risk was the lowest at 1.



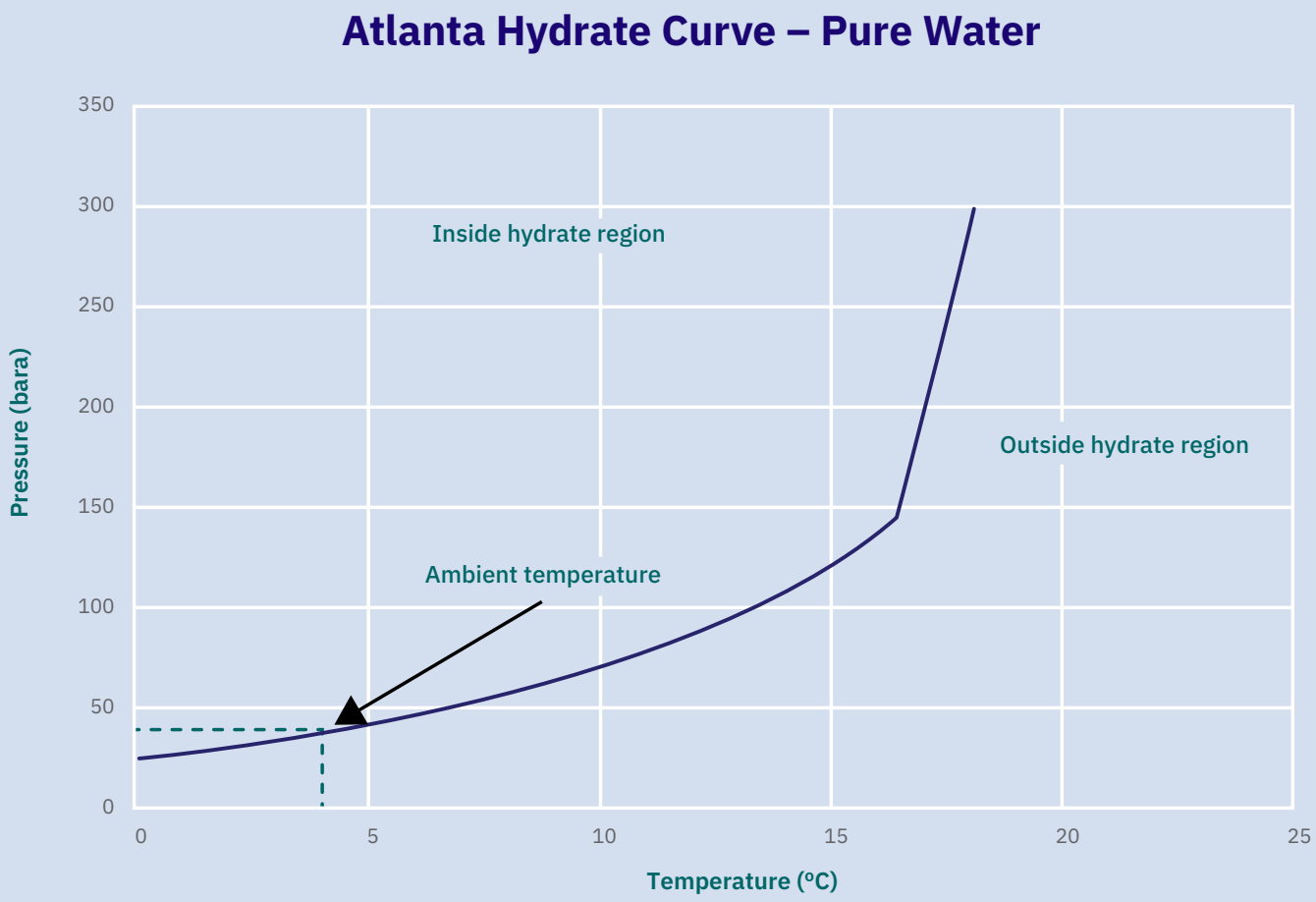
High-powered multiphase pumps (MPPs) installed on the seabed provide artificial lift for Atlanta's ultra-heavy crude, reducing backpressure and ensuring efficient production.

Viscosity Risk: The high viscosity of the Atlanta crude — 14°API, 228 centipoises (cP) at reservoir conditions — was determined to be the most significant threat to efficient production. In addition to an increase in viscosity at lower temperatures, the Atlanta crude displayed an increase in viscosity as pressure dropped below the bubble point.

Emulsion-Viscosity Risk: The Brava flow-assurance team performed emulsion-viscosity tests at various water cuts, pressures and temperatures. The test results revealed increasing viscosity with increasing water cut. At 60%-80% water cut; the emulsion destabilized. The peak viscosity occurred at about 40%-50% water cut, depending upon the temperature.

Hydrates: During normal operation, even at the maximum flow rate, the system is expected to deviate from the optimal hydrate curve. The greatest risk occurs at lower flow rates. During an extended shutdown, the flowlines will enter the hydrate region of the curve (see accompanying chart).

Produced Solids and Erosion: Due to high viscosity, Atlanta flowlines operate under laminar-flow conditions where there is no turbulence to suspend solid particles. Consequently, solids will settle at the bottom of the flowline.



The hydrate curve for the Atlanta crude shows the temperature and pressure values that define the hydrate formation region. Flowlines are likely to be plugged when the combination of pressure and temperature places the fluid inside the hydrate region.

The 6-in. unbonded flexible pipes with advanced TEC2 insulation layers, built to tackle ultra-deepwater challenges and ensure smooth flow even under extreme viscosity conditions.

Flow-Assurance Solutions

Viscosity Management: The subsea system is insulated to retain heat in the produced fluids, including heat gained by the produced fluids through electric subsea pump inefficiencies. Pressure is maintained in the lines during startup, steady-state production or shut-in. Under these conditions, downhole-diluent (diesel) injection is required to manage viscosity. The FPSO *Petrojarl I* provides coiled tubing access through the central turret to each riser/flowline to clean up any blockage by jetting diluent or ethanol.

Emulsion Mitigation: There are no plans to inject a demulsifier due to the low water cut. However, as the water cut rises, it will be possible to inject a demulsifier to protect the completion system, umbilicals, and FPSO, if necessary.

Scale Mitigation: Downhole scale inhibition was required upstream of the in-well electric submersible pump (IW-ESP) inlet during the EPS. For the near-wellbore and lower completion, the scale can be mitigated by occasional chemical dissolution, if required.

Hydrate Management: Insulation systems protect the flowlines from hydrates during routine operation. During an extended cooldown period, several options are available to prevent the system from entering the range of pressures and temperatures that can cause hydrate formation. These include depressurization of the lines through the wet Christmas tree (WCT) and artificial-lift-system (ALS) pumps. Fluid displacement with diesel circulation also removes the potential for hydrate formation. External heating of the produced fluids will allow the system to maintain temperature above the hydrate-formation point.

Flowlines and Umbilicals: For both the EPS and FFD, the wells were connected directly to the FPSO through satellite 6-in. flexible pipelines. This was intended to allow better control for tasks such as commissioning, flushing and cleaning, diluent circulation, hydrate mitigation with fast-line depressurization, and individual pigging if required. The line lengths were kept as short as possible to minimize pressure and temperature drops.

The flowlines are designed with a 6-in. internal diameter (ID), suitable for water depth of 2,000 m and a maximum working pressure of 5,000 psi, individually, based on an operating pressure of 3,000 psi, an operating temperature between 4° and 60°C, and a crude flow of 12,578 bopd. Due to flow assurance and topside requirements regarding fluid viscosity and temperature, the production lines were designed to minimize thermal loss over all line extensions.

The subsea flow path requires robust thermal insulation to achieve a cooldown time of 12 hours, which is necessary to preserve lines with the diesel circulation. The required thermal-insulation type TEC 2 is unusual in Brazilian fields, but it is necessary to guarantee flow assurance due to the oil stream's viscosity, which progressively increases with the lowering temperature as the oil passes from the reservoir up the well and through the frigid ocean waters near the seabed.

Service lines consist of individual 4-in. ID flowlines and risers for each well. None of these lines require thermal insulation. The Atlanta umbilicals provide the power supply, hydraulic controls and chemical-injection lines with the widest cross-sectional area manufactured in Brazil.


SAPURA ÔNIX
PANAMA
IMO 9702742

Artificial Lift: For the Early Production System (EPS), the ALS consisted of an IW-ESP installed into a capsule close to the reservoir with a backup of 1,600 HP ESPs installed at the mudline. In case of IW-ESP failure, the mudline ESP was to be the primary lift system. During FFD, a valve was installed to bypass the IW-ESP for the three wells constructed during the EPS.

For the FFD, the Brava team decided to use multiphase pumps (MPPs) installed on the seabed. Manufactured by OneSubsea Norway, one MPP is capable of providing lift for two wells simultaneously. As such, three MPPs were installed on the seabed to provide lift for six wells. Representing the state-of-the-art in artificial-lift technology, each MPP features advanced electric pumps and impellers with a maximum shaft power of 2,900 HP. This technology is particularly suited for handling the heavy (14°API) crude.

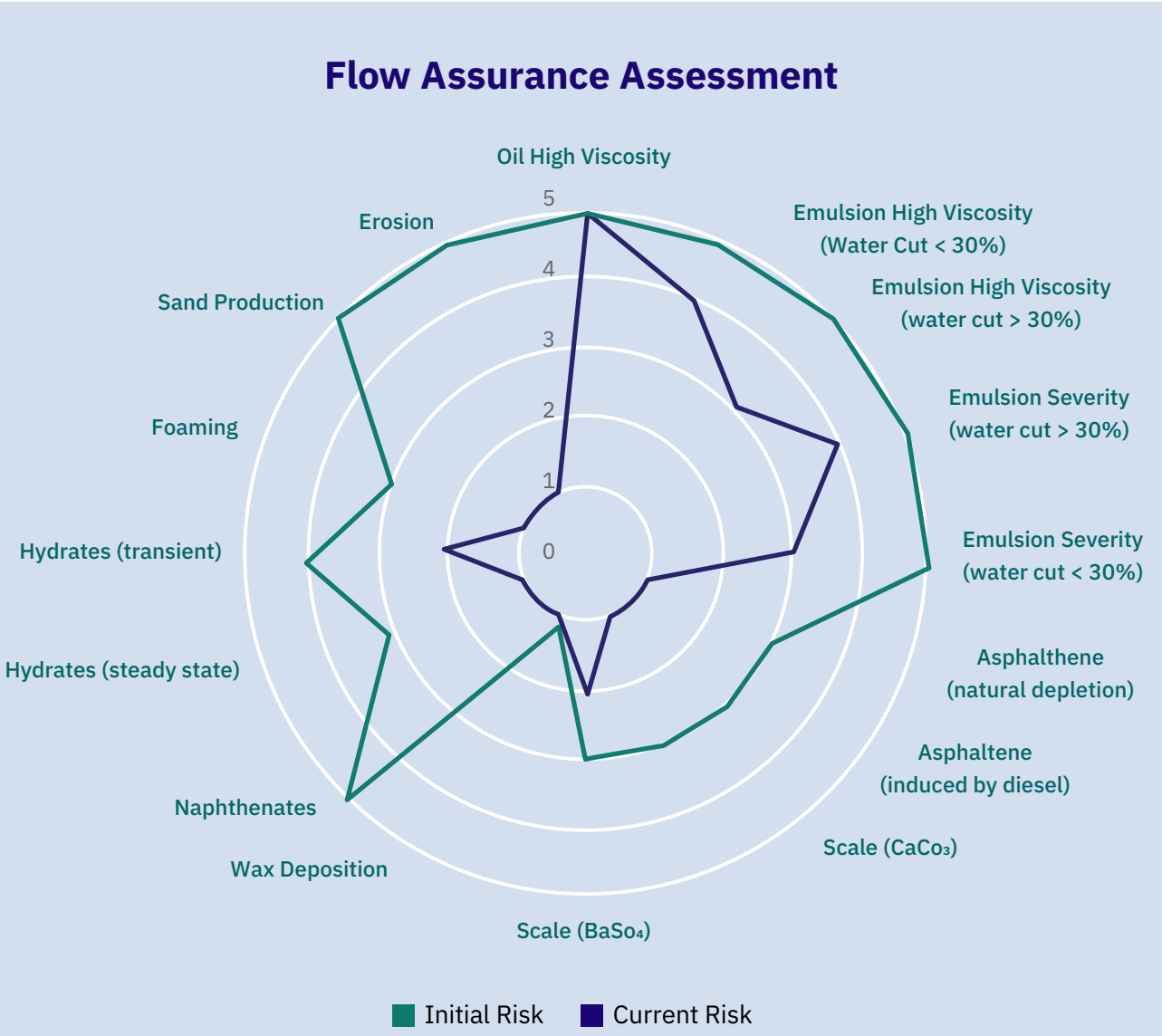
"The MPPs we selected have been installed worldwide and their reliability is very high," Subsea Boosting Specialist Monteiro Neto said.

The MPPs also reduce energy consumption and emissions when compared to topside alternatives.

Due to the large size of the components, each of the three MPPs was installed in three stages. First, a mudmat, weighing 60 tons, was carefully placed on the seabed. Next, the pump station, weighing 140 tons, was installed atop the mudmat. Finally, the 68-ton pump module was lowered into place on the pump station.

A tubing hanger in the wet Christmas tree (WCT) has a path for chemical injection. A depressurization panel in the WCT will be operated with an ROV if hydrate remediation is needed.

After the implementation of the flow-assurance measures, a new flow assessment was performed. It found that the only remaining high, "Category 5" risk is the intrinsic high viscosity of the crude.



Flow Assurance risk before (green) and after (blue) implementation of the flow-assurance strategy.

Despite its heavy nature, Atlanta crude has a low sulfur content, making it a desirable feedstock for marine bunker fuel under IMO 2020 regulations.

Tightly Coordinated SIMOPS: During the installation of the FFD, as many as 10 ships were involved in simultaneous operations (SIMOPS). Six vessels performed the hook-up of the FPSO. Shifting the output from the three EPS wells connected to the FPSO *Petrojarl* to the three additional FFD wells, MPPs and other systems linked to the FPSO *Atlanta* involved 10 to 12 ships.

Production Process: During production, the crude oil leaves the WCT at 30°C. The crude then passes through a production jumper and enters the ALS, where the MPPs provide the force needed to push the crude up from the seabed through risers to the FPSO on the surface 1,550 m above. The crude exits the pumps at 50° to 55°C and arrives at the platform at 40° to 45°C.

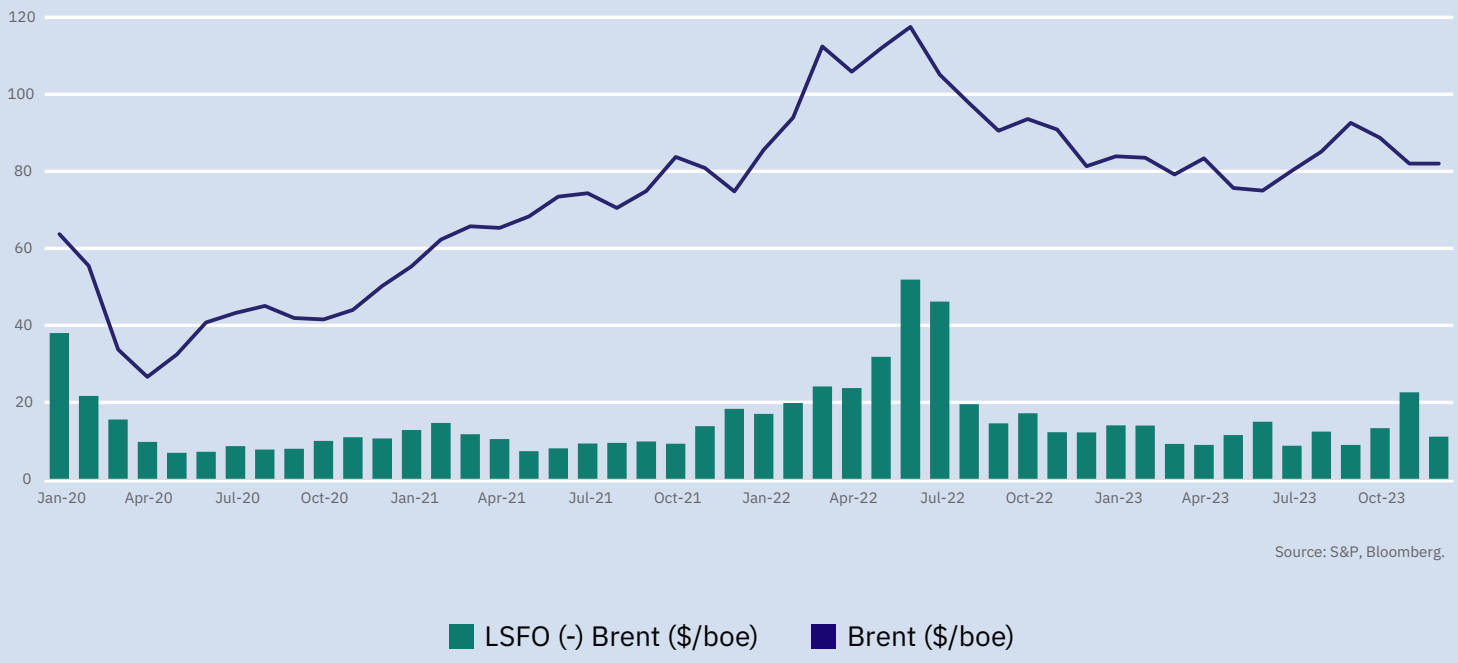
Trading: Brava entered into a Crude Oil Sales Agreement (COSA) with Shell Western Supply and Trading in 2015, and Shell bought the oil produced by the Atlanta field during the EPS. Because of low-sulfur content, Brava can get a premium price for its Atlanta crude from buyers seeking to use it as a marine bunker fuel in conformance with International Maritime Organization (IMO) 2020 international standards.

Atlanta Crude

HIGHLY COMPETITIVE

Low-Sulfur Bunker Fuel — Brent Crude

LOW-SULPHUR FUEL OIL (LSFO) — BRENT (US$/BOE)



Price comparison for Atlanta low-sulfur and Brent crudes.

Strategic Growth

for Atlanta and Beyond

In the coming years, Brava aims to boost its total crude oil production to 100,000 bpd. Increased production from the Atlanta field will be a critical component of this strategy.

Plans are underway for the development of the Atlanta NE field, where a pilot well drilled in 2023 uncovered an interval estimated to contain 230 million barrels of oil in place.

Brava is also evaluating an investment decision for Phase 1 of the adjacent Oliva field, a heavy oil deposit with an estimated 348 million barrels of oil in place, of which 60 million barrels are recoverable. In the third quarter of 2023, Brava approved detailed engineering for field exploration and development.

Additionally, in the third quarter of 2024, Brava approved the procurement of long-lead equipment to allow for drilling of two wells during 2025-26, with first oil expected in 2027.

In November 2024, Brava announced an integrated development campaign for Atlanta and Papa-Terra fields with an option to develop the onshore Malombe field, with a subsea tieback to the offshore Peroa field. Papa-Terra is a heavy crude oilfield in block BC-20 of the Campos Basin.

The campaign will consist of drilling and interconnecting two wells in the Atlanta field with two wells in the Papa-Terra field. To carry out the drilling and production work, Brava has leased an offshore drilling rig and will be purchasing subsea equipment valued at $200 million.

The Leadership and Vision Behind Atlanta

Bringing the Atlanta Field's Full Field Development to life wasn't just about technology and engineering—it was about the people who believed in its success from the start. At the heart of this achievement are Antônio Augusto de Queiroz Galvão (Founder, Chairman of the Board, and Board Member), Mateus Tessler (Board Member and Chairman of the Board), and Harley Scardoelli (Chairman of the Board). Their vision, determination, and entrepreneurial spirit turned an ambitious deepwater project into reality, helping shape one of Brazil's most significant offshore developments.

This milestone was made possible through the dedication of the Board of Directors, the financial leadership of CFOs Pedro Medeiros and Rodrigo Pizarro, and the essential support from BNDES, shareholders, and investors. Their contributions were instrumental in overcoming challenges and ensuring the project's success.

Atlanta stands as a testament to entrepreneurial initiative and strategic execution, reinforcing the growing role of independent operators in shaping Brazil's offshore industry.

From left to right: Pedro Medeiros, Rodrigo Pizarro, Décio Oddone, Jorge Boeri e Carlos Mastrangelo

Antonio Augusto de Queiroz Galvao

Mateus Tessler

Harley Scardoelli

"Sustainability is woven into the fabric of the project and company operations."

Rebecca Kiperman,
ESG Manager

A Commitment to ESG

Since its inception, the Atlanta field exemplifies Brava Energia's commitment to environmental, social and governance (ESG) compliance. According to ESG Manager Rebecca Kiperman, sustainability is woven into the fabric of the project and company operations.

In the arena of environmental responsibility, the company has focused on reducing greenhouse gas (GHG) emissions. The company measured, certified, and accounted for its emissions, becoming the first independent oil company in Brazil to achieve such a milestone. This effort earned the company a Gold Seal in the GHG Protocol Public Emissions Registry.

Another example is the conversion of FPSO *Atlanta* from an existing FPSO rather than building a new, purpose-built vessel. This avoided the CO_2 and other pollutants associated with the manufacture and transport of 55,000 tons of steel and helped set a benchmark for sustainable engineering in the industry.

During the conversion, FPSO *Atlanta* was further equipped with technologies to reduce carbon intensity, such as closed-flare systems and utilizing gas from the field to generate electricity, drastically reducing GHG emissions from operations. The converted FPSO was also designed to accommodate future technologies such as carbon capture.

In terms of governance, the company has published transparent sustainability reports following international guidelines. Brava holds the highest rating among Brazilian independents under frameworks such as the CDP (Carbon Disclosure Project).

Regarding social impact, Brava Energia has cultivated mutually beneficial relationships with surrounding communities. Its initiatives include long-term investments in marine and coastal research and development, particularly in mangrove ecosystems. Brava's latest R&D project, called 'Mangues do Rio', was conceived and carried out in the area influenced by the Atlanta field, specifically in the State of Rio de Janeiro.

A total of 19 mangrove forests were meticulously studied to understand their potential for capturing and storing CO_2. Brava discovered that mangroves could capture and store CO_2 at a rate ten times higher than tropical forests. More than 6 million tons of CO_2 have already been stored in mangrove forests in the State of Rio de Janeiro alone.

In terms of human resources, Brava reports that women made up 43.6% of its workforce in 2023 and 36.9% of them were in leadership positions.

Every year, as part of its compliance program, the company promotes training for all employees. These actions reinforce the values and principles established in Brava's Code of Ethical Conduct and address specific issues for improvement.

Throughout 2023, one of the main topics the Brava HR team worked on was harassment in the workplace. Conducting face-to-face training sessions for all employees, combined with targeted communication initiatives, enabled deeper discussions about behaviors that constitute moral and sexual harassment in professional relationships.

"It's an incredible feeling to see the Atlanta project come to life, knowing we've approached it ethically, transparently, and with utmost respect for environmental and social responsibility," Kiperman explained.

Leading the Independents

Brazil is a market with significant opportunities for independent oil and gas companies. Brava Energia was the first among the independents to successfully develop a deepwater E&P project from the ground up. After major oil companies gave up on the Atlanta field, Brava's accomplishment is a testament to what a small independent can achieve through an intrinsic ability to make quick decisions and build a fit-for-purpose team.

Brava's technical team, working alongside subject-matter experts from top-tier service companies and equipment vendors, overcame complex drilling, completion, and production challenges during Atlanta's development.

"Every time we encountered a difficulty, we were able to find a solution," explained COO Mastrangelo.

One of the reasons for Brava's success can be credited to building teams that combine the experience of industry veterans and younger team members with a drive for innovation. Through such strategic human resource development, Brava has created a pathway to preserve and expand upon its knowledge base to keep moving forward. This approach has positioned Brava Energia as a model for driving the future growth of Brazil's oil and gas industry, both offshore and onshore.

Company Profiles

PROFILE INDEX

Altera Infrastructure

The partnership between Altera Infrastructure and Brava Energia started almost 10 years ago, when both companies signed an agreement for the chartering and operation of one of Altera's most iconic units: the FPSO Petrojarl I.

Altera Infrastructure is a global energy infrastructure services operator with different business lines, and it is our vision to lead the industry to a sustainable future. We are doing that through leveraging on our history and know-how to develop innovative solutions and business models for our clients.

Redeploying the FPSO Petrojarl I for Brava is a clear example of that. Altera truly believes that sustainability has many facets, and that includes taking part in projects that provide secure and affordable energy. It is part of our sustainability culture to utilize our resources to the most, and this is a strategy we have followed for years through the redeployment of FPSOs.The story of Petrojarl I begins in 1984, when Altera (at that time Golar Nor) starts to build the FPSO. The unit was designed by Tentech and built at a Japanese shipyard. It was made to operate in the harsh conditions of the North Sea, and has since then had more than 10 reallocations, making it the industry leader in number of redeployments.

Petrojarl I has also proudly supported Brava as the early production system (EPS) in the Atlanta Project.

It was in 2015 that Altera's and Brava's long lasting and successful partnership began. Both companies entered into an agreement to upgrade the Petrojarl I for the Atlanta field. The scope was carried out in Europe, and the unit arrived at location in 2018, after a successful life extension and yard scope. The FPSO was originally intended to operate until May 2023, but both companies agreed that the unit should stay longer on the field. For that purpose, a life extension and upgrade work was required, but this time the scope had to be carried out offshore. The production was shut down for over 40 days, and a flotel was chartered to stay alongside the FPSO for 75 days. More than 150 people were mobilized and carried out activities for 24/7.

With all the outstanding efforts from Altera, Brava and the partnership with our suppliers, 75% of the life extension scope was completed within 8 months. "It was only possible to execute this challenging scope offshore without any LTI due to the dedication and good collaboration between Altera, Brava and DNV" remembers Ivan Rongel, Asset Manager at the time. The project was a great success, and the FPSO got a 5-year class renewal certificate that led to a contract extension.

In the Atlanta field, Petrojarl I has produced more than 25 million barrels of oil! Health, safety, environment and quality (HSEQ) have always been key priorities for Altera. All our activities, both on- and offshore, are guided by the highest standards of safety which are included and described in our management system. We proactively implemented different HSEQ campaigns that have led to different safety recognitions from our client – including Petrojarl I reaching the 1000 days LTI free mark in 2023!

But operations have not always been easy in Petrojarl I. Altera and Brava faced the challenge of operating during the COVID pandemic. However, due to the strong teamwork spirit between the parties, new procedures, and processes to follow the local authorities' requirements, and to ensure the safest environment for our offshore resources, were promptly implemented. The impact of COVID to Petrojarl I daily activities was minimized, and the unit operated safely during this demanding time. "In my view, collaboration, constructiveness and pragmatisms are clear traits of Brava's culture, and that has been instrumental for us to navigate unprecedented challenges like COVID while also generating a lot of value to our stakeholders and to the society" adds José Elias, managing director for Altera in Brazil.

Altera and Brava have made history together in Brazil. The redeployment of Petrojarl I has led the way for Brava to fully understand and further develop the Atlanta field, and Altera is extremely proud to have supported Brava in the first phase of this project!

altera INFRASTRUCTURE

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OneSubsea

A Story of Partnership and Success

The Atlanta field is an extremely challenging deepwater development, with high-viscosity heavy oil at a depth of 1,500 meters. Despite this complexity, Brava Energy managed to become the first independent operator in Brazil to develop a deepwater field from scratch. It is a great source of pride for OneSubsea to have supplied almost all the subsea equipment for the project. Our partnership with Brava began back in 2011, with field development and flow assurance studies and winning the contract for the initial four wet Christmas trees (WCTs) and control systems for Atlanta's Early Production System (EPS).

If we simply look at the WCT business in Atlanta, this would already be a success story: we exceeded expectations on deadlines by delivering equipment in half the originally planned time, demonstrating the efficiency and knowledge of our teams.

However, what truly sets Atlanta apart from other similar projects is the extensive collaboration we had with the client. The EPS was a true success. The lessons learned were paramount for the full development of the field. A fundamental lesson for the asset's performance was understanding the importance of the subsea pumping system.

Brava's initial solution was to use third-party electric submersible pumps (ESPs) in the well and on the seabed for production. Over the years, however, difficulties were recorded with the pumps' lifespan, production loss, and high intervention costs.

Given this scenario, the reliability track record of OneSubsea's lifting systems led us to propose subsea multiphase pumping systems (MPPs) as a solution, resulting in the largest contract of its kind ever awarded by an independent operator in Brazil and the first integrated award of subsea production systems (SPS) and processing in the country.

Once again, the close relationship with Brava and the level of exchange between the teams allowed us to anticipate the client's needs. Another proof of this synergy were the quarterly meetings we held with teams from both companies worldwide to share experiences and lessons learned.

As the work progressed, the performance of our technology, combined with our deep understanding of Brava's production challenges, made us the ideal partner to support the operator in the next phase of development, with an integrated scope in the Atlanta and Oliva fields.

The scope of the Full Field Development (FFD) for the Atlanta field includes delivery, installation, commissioning, and associated life-of-field services for pipeline connection systems, subsea structures, control systems, and two additional WCTs. It also covers three multiphase pumping systems with the possibility of extension to one more system that will support the entire development of the Atlanta field — an innovative and robust technical solution for heavy oil production in Brazil.

The project expansion leveraged the standardization of manufacturing and delivery processes for both parties, resulting in an earlier offer, improved logistics, and greater consolidation of field activities to reduce the overall life cycle cost of the field.

Another innovation was the inclusion of an innovative performance component in the contract, creating a win-win model that ensures system maintenance with high availability and minimizes the partner's production deferment.

Our subsea processing system technology offers a robust, compact, and cost-effective solution that will help Brava leverage the full potential of Atlanta. We are committed to delivering innovative solutions with high reliability and safety during the entire project execution, as well as installation and commissioning throughout the field's life.

This partnership, initiated in 2011, has already created opportunities regarding other Brava assets in Brazil, such as the Oliva field, a marginal reservoir 17 km from Atlanta, where the already designed solutions could be efficiently duplicated to enable rapid and economical field development.

Over more than a decade, collaboration and operational excellence have been the foundation of the relationship we have built with Brava. May the future hold more chapters in this story of partnership and success.

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Sapura Energy

Solutions Delivered Safely

At Sapura Energy, "Solutions Delivered Safely" is more than a mission statement — it's a promise we live by every day. As a global energy and solutions company, we operate across the entire upstream value chain, including renewables. Safety is not just a priority; it's our mission to ensure that everyone, whether offshore or onshore, returns home safely each day.

Sapura Energy is a global integrated energy services and solutions partner, offering an extensive range of capabilities. From exploration, development, and production to rejuvenation, decommissioning, and abandonment, we cover the full spectrum of the upstream value chain. Our skilled workforce, strategic world-class assets, and strong project management capabilities enable us to deliver integrated solutions in over 20 countries. In recognition of our efforts, we were named APAC Company of the Year for Energy Services, Offshore and Marine by the Energy Council in 2019.

Since 2014, Sapura Energy, through its joint venture company Seagems, has made a significant impact in Brazil's subsea construction sector. Our Brazilian fleet includes six Pipe Laying Support Vessels (PLSVs), each named after a national gemstone — *Sapura Diamante, Sapura Topázio, Sapura Ônix, Sapura Jade, Sapura Esmeralda,* and *Sapura Rubi*. These vessels, designed and built for highly complex subsea construction operations, have a storage capacity of up to 4,000 tons of flexible pipes. They are equipped with twelve remotely operated vehicles (ROVs) capable of operating at depths of up to 3,000 meters, showcasing

cutting-edge technology and a team that blends experience with youthful innovation.

Our operation in Brazil boasts an impressive track record, holding 36% of the region's market share for subsea flexible pipe interconnection and handling projects. Over the years, we have conducted numerous subsea interconnection operations, handling nearly 5,000 kilometres of flexible pipes and umbilicals. The joint venture also maintains a historic 97.64% operational uptime for its vessels, demonstrating the highest level of operational safety and reliability. This extensive experience highlights our commitment to delivering high-quality subsea construction services.

The Atlanta Field project is a testament to our Engineering, Procurement, Construction, and Installation (EPCI) capabilities. In addition to our PLSVs performing the construction and installation works, we deployed our in-house engineering experts from Peritus International and managed the procurement of essential materials such as flexibles, umbilicals, as well as supply base logistics and coordination; safely delivering the Atlanta Field project to our client.

A significant presence in Brazil, underscored by a fleet of state-of-the-art PLSVs and a commendable project execution record, highlights Sapura Energy's commitment to meeting the complex demands of the subsea construction industry. With a focus on safety, innovation, and sustainable growth, Sapura Energy continues to lead the way in providing comprehensive energy solutions worldwide.

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Baker Hughes

Baker Hughes is the leading energy technology company. We design, manufacture and service transformative technologies to help take energy forward — making it safer, cleaner, and more efficient for the people and the planet. For more than a century, our inventions have revolutionized energy. We harness the power of engineering, data, and science to redefine what's possible.

With business conducted in more than 120 countries, we work in partnership with our customers, wherever they are, to deliver better outcomes. We are proud that our people and our businesses are part of the fabric of the communities in which they work. We are committed to an inclusive and collaborative culture, helping our 58,000 employees develop their careers and thrive at work every day.

We are an energy technology company that has a diverse portfolio of equipment and service capabilities that span the energy and industrial value chain. Our two operating segments are organized based on the nature of our markets and customers.

The **Oilfield Services & Equipment** segment provides products and services for onshore and offshore oilfield operations across the lifecycle of a well, ranging from exploration, appraisal, and development; to production, revitalization, and decommissioning. The segment is organized into four product lines: **Well Construction**; **Completions**, **Intervention**, **and Measurements; Production Solutions**; and **Subsea & Surface Pressure Systems**. Beyond its traditional oilfield concentration, **OFSE** is expanding its capabilities and technology portfolio into new energy areas such as geothermal and **CCUS** to meet the challenges of a net-zero future.

The **Industrial & Energy Technology** segment combines domain expertise, technologies, and services for industrial and energy customers. Our solutions unlock the ability to transform, transfer, and transport energy efficiently, while capturing and cutting emissions, solving a fundamental challenge behind the energy transition: reducing environmental impact, while maximizing efficiency, productivity, and reliability. The **IET** organization consists of five product lines: **Gas Technology Equipment**; **Gas Technology Services**; **Industrial Products**; **Industrial Solutions**; and **Climate Technology Solutions**.

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Edison Chouest Offshore

Global Leader in Maritime Solutions

Founded in 1960, Edison Chouest Offshore (ECO) is recognized today as the most diverse and dynamic marine transportation solution provider in the world. Boasting a fleet of nearly 300 vessels, the largest network of shipyards in the U.S., as well as a prominent shipyard in Brazil, and top-tier port terminals across the U.S., Brazil and Guyana, ECO is renowned for its commitment to innovation. Recent breakthroughs in emissions reduction, subsea support, integrated bridge systems, remote monitoring systems and global communications underscore its dedication to staying ahead of the curve.

Expanding its offerings globally, ECO has grown through strategic acquisitions, complementing its core marine business. The Chouest family of companies includes GIS, Bollinger Shipyards, C-Innovation, ROVOP, Caltex Oil Tools, Marine Technologies and a host of other companies, broadening its reach and capabilities.

Backed by a robust leadership team and a legacy of success, ECO offers a comprehensive suite of services to its global clientele. Its track record in providing workforce opportunities and adherence to the highest safety standards further solidify its reputation.

ECO, along with its wholly owned subsidiaries, is able to offer its global customer base a strong leadership team as a proven, successful partner and community provider of maritime solutions. ECO's ability to design, build, own and operate state-of-the-art, mission-specific vessels, along with the industry-transforming efficiency provided by its port facilities, provide its international customer base a value unmatched in the global maritime industry.

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Constellation

Leading Offshore Drilling Excellence Since 1980

Founded in 1980, Constellation stands as a premier expert in the Brazilian drilling industry. The company's journey has been one of culture deeply ingrained in continuous improvement and upholding of core values. Constellation is committed to delivering exceptional services and innovative solutions, ensuring safe operations, building trustful relationships, and consistently surpassing client expectations.

Constellation boasts a versatile drilling fleet capable of operating across various water depths and scopes of activities. The fleet includes:

- 3 UDW high-end drillships
- 3 UDW DP semisubmersibles
- 1 anchor-moored semisubmersible

Case Study:
Brava Campaign in the Atlanta Field

During the Atlanta Field campaign, Constellation's UDW DP Semi, *Alpha Star*, successfully drilled and completed three wells, being a relevant contributor for delivering Brava's project ahead of schedule. In addition, Brava has found great benefit in using the rig for moving subsea flexible lines from one old well to a new location — an operation which exempted the operator from the financial burden associated by the specialized vessels which are usually hired for this sort of activities.

Constellation is very proud of the results obtained during the campaign, having achieved outstanding uptime and safety records, with zero lost-time incidents along the 327 days of operations. Such milestones result from a deep commitment of the rig crew with the maintenance of the systems, the creation of an environment of collaboration among the teams, the strong planning effort dedicated to the tasks and the seamless communication and transparency which enabled the performance and the quality of the operations to continuously improve during the entire project.

Constellation.

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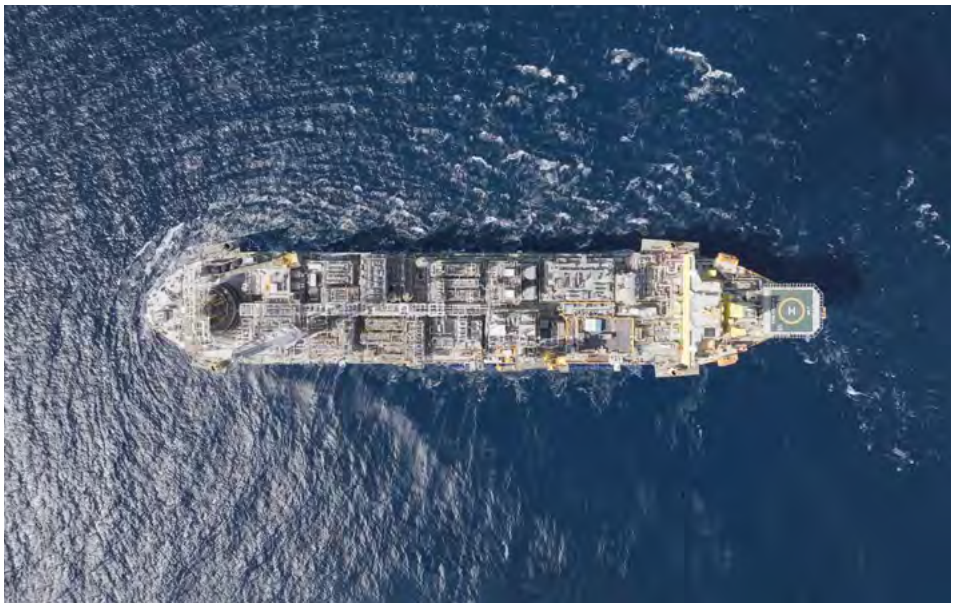
Yinson Production



Yinson Production's FPSO *Atlanta* is a cutting-edge vessel designed for offshore energy production in the Santos Basin, Brazil.

The FPSO *Atlanta* project is a collaborative effort between Yinson Production and Brava Energy to deliver a high-quality FPSO solution that prioritizes safety, efficiency, and environmental sustainability. With a production capacity of 50,000 barrels of oil per day and a maximum storage capacity of 1,200,000 barrels, the vessel features advanced technology, including an efficient carbon management process plant that reduces flare gas emissions.

The project's successful execution is a result of the dedication and expertise of the teams involved. Over 9 million man-hours were worked without a lost time incident, demonstrating the project's strong safety record. This achievement reflects the project team's commitment to upholding the highest safety standards.

The FPSO *Atlanta* is equipped with state-of-the-art facilities and systems, ensuring efficient and reliable operations. Its advanced carbon management process plant is designed to minimize environmental impact, aligning with Yinson Production's sustainability goals.

The FPSO *Atlanta* will play a significant role in Brazil's offshore energy landscape, showcasing Yinson Production's commitment to delivering innovative and sustainable solutions.

Yinson Production hopes to maintain a strong, long-term partnership with Brava, building on the success of this project to drive future growth and development in the industry.

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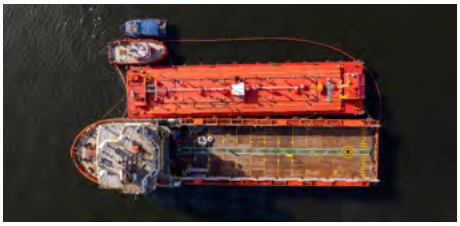

The oil and gas upstream supply chain relies heavily on trusted partners to meet their unique operational demands, partners committed to delivering excellence in every aspect. Since 2020, Bunker One has been proud to serve as Brava's preferred Marine Gas Oil (MGO) supplier at Guanabara Bay, Rio de Janeiro, its chosen onshore base location.

"With tailored solutions, a vertical-ized operation, and world-class service and support available at any time, we have continuously ensured the flex-ibility Brava needed to drive the Atlanta Project forward," says Filippe Fernandez, Commercial Director at Bunker One Brazil.

Bunker One operates using marine fuel barges from its subsidiary, Nova Offshore, offering the highest international safety and quality standards as an end-to-end package. Our verticalized operation makes us the only marine fuel supplier in Brazil with complete control over the sup-ply chain, which reinforces our dedication to providing market-leading service levels and HSSE standards, consistent with our established reputation in interna-tional markets.

Bunker One is a subsidiary of Bunker Holding A/S, the largest group specialized in the purchase, sale and supply of fuel and lube oil for ships, as well as risk man-agement and associated services. Bunker Holding operates globally represented by more than 60 offices in 32 countries. The local companies contribute with local knowledge and the head office, providing capital, system, and know-how.

At Bunker One, we are available 24/7, 365 days a year, to ensure your vessels stay on the move.

Bunker One

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A business unit of Delp, the global leader in torpedo piles for offshore applications.

With vast experience and a proven track record, we offer effective solutions in deepwater anchoring systems for a variety of applications, including FPSOs, floating units, steel risers, flexible flowlines, umbilicals, and offshore wind farms.

We manage and execute various projects from the initial phase, design, and engineering to offshore installation management with clients. Our commitment to technical and operational excellence enables us to provide customized solutions that meet the specific needs of each client. We are constantly innovating and improving our techniques and technologies to ensure maximum performance and reliability in every project.

Our highly skilled and experienced team works closely with clients to ensure that each project is successfully completed on time and within budget. We prioritize safety and sustainability in all our operations, implementing stringent standards and practices to ensure the well-being of our employees and the protection of the environment.

We are a trusted choice for high-quality offshore anchoring solutions, offering expertise, innovation, and a commitment to excellence in every project we undertake.

delp

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Halliburton collaborates with Brava to reduce unwanted water production, increase oil recovery and maximize returns in Atlanta Field

The Atlanta field is a deepwater oil field located in block BS-4 of the Santos Basin, offshore Brazil. The field comprises of an unconsolidated sandstone reservoir with a large aquifer below, which creates a water breakthrough challenge.

In 2019, Brava started utilizing Halliburton's EquiFlow® AICD Screens within the Open Hole Gravel Pack (OHGP) completions. The EquiFlow® AICD is a Fluidic Diode Autonomous Inflow Control Device that contains no moving parts but features a unique geometry designed to alter the flow path in a manner that selectively restricts the flow of unwanted fluids. After drilling and completing the first two wells with standard screens, Brava opted to deploy the EquiFlow® AICD Screens to enhance production efficiency and manage the inflow of undesired fluids more effectively.

The EquiFlow® AICD has proven in laboratory flow testing that it can reduce unwanted water by more than 50 percent by changing flow behavior. Lighter viscosity fluids take a longer route through the device than oil, which takes a short, direct route. EquiFlow® AICDs work as a system, to slow production from high water zones and promote production from adjacent high oil zones.

Post-job production results revealed that the EquiFlow® AICD enabled Brava to extract an impressive additional 6.7 million barrels of oil, significantly outperforming the standard screens used in the first two wells up until June 2022. With such success, Brava deployed additional completions with the EquiFlow® AICD systems, for a total of four AICD wells to maximize its asset efficiency and return.

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Powering Atlanta with Robotics and Subsea Distribution Solutions

Oceaneering was selected to provide a wide range of services for Brava Energy's ultra-deepwater Atlanta heavy oil field project offshore Brazil. Since 2015, we have supplied 20 km of power umbilicals, work class remotely operated vehicle (ROV) services, survey equipment, and expert personnel for multiple vessels, including the *Normand Pioneer, Normand Sagaris,* and *Laguna Star*. Our contributions have included inspection, maintenance, and repair (IMR), drilling and production support, long baseline (LBL) positioning, and other critical survey operations.

In 2022, we expanded our support with ROV services, an ocean bottom seismic survey, subsea pumping module swaps, and rig positioning onboard the *Alpha Star* vessel. By May 2024, we provided ROV services on the *CBO Endeavor* for survey, positioning and hook-up operations for the *Atlanta* Floating Production, Storage, and Offloading (FPSO) vessel.

Our ongoing support ensures the Atlanta Project upholds safety and operational efficiency, showcasing our commitment to excellence. With a presence in Brazil since 1973, Oceaneering operates three local facilities, including headquarters in Rio de Janeiro, a ROV, survey, and tooling center in Macaé and an umbilical manufacturing site in Niterói, solidifying our role in Brazil's offshore energy industry.

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Solstad Offshore

Solstad Offshore is a leading offshore shipping company. Our specialized vessels provide clients from all over the world with the capabilities they need, whether it is within Oil & Gas or Renewable Energy activities.

With 40 modern ships and 2,300 highly skilled employees worldwide, Solstad is one of the largest and most capable offshore shipping companies in the world.

Our vessels and expertise provide our partners in the offshore energy industry, both renewable and petroleum based, with the operational power, safety and reliability they need to grow everything but their environmental impact.

We have offices on four continents ranging from South America (Brazil) to Asia (Singapore), to Oceania (Australia) and of course, our home continent of Europe. Our ships cover even larger parts of the globe, sailing in most of the important offshore energy sectors on the Earth.

We became experts on saving costs by lowering fuel consumption and reducing emissions. Through the hugely successful program, Solstad Green Operations, we have a head start on the competition when it comes to improving our environmental impact.

Solstad has a clear vision of what lies ahead, and it starts with taking care of our most precious resources, our people and our planet, while sustaining growth and profitability.

SOLSTAD OFFSHORE

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Wilson, Sons

The Wilson, Sons Group is the largest integrated port and maritime logistics operator in Brazil with over 186 years of experience.

Pioneers in the private offshore support base, the company provides logistical solutions for oil companies along the Brazilian coast. Since 1999, they have worked with 26 oil companies on over 50 projects, with Brava as a key partner since 2013, supporting the BS-4 block and Atlanta Field.

Safety is a non-negotiable value for the Group, with DuPont's World Class in Safety and HSE standards endorsing their practices for over a decade. Both Wilson Sons and Brava share this commitment.

The Niterói base, a private terminal in Guanabara Bay, has 70,000 m² and 3 berths. Brava has its integrated logistics facility there, with a large warehouse and backyard.

The Rio base, their second base, is a private terminal with 65,000 m², 5 berths, and extensive storage area.

With 8 berths and a comprehensive infrastructure, the company ensures high standards of safety and efficiency in cargo management. They also handle heavy loads, including complex operations such as Mobo for the Atlanta Project. Both bases include mud plants and chemical storage.

Their 63,000 m² Pipe Yard offers heavy load storage, pipe inspection, and automated hydro cleaning. Brava stores casing strings and low-turnover equipment there.

Wilson, Sons is proficient in waste management, providing solutions for collection to final disposal, complying with regulations. They manage waste for Brava projects. For tank cleaning, a semi-automated system enhances safety and reduces vessel demurrage costs for operations.

Wilson, Sons

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