Case Study

Brazilian oil and gas company relies on ABB for offshore operations
Improving utilization of electrification assets

Using ABB automation professionals, this Brazilian oil and gas company has the comprehensive support needed to keep critical assets in operating condition.

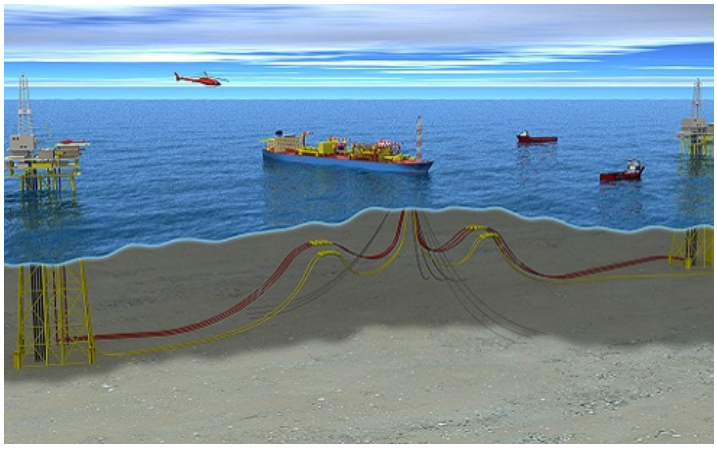
A global oil and gas company is using offshore technology expertise developed on the Norwegian Continental Shelf and applying these state-of-the-art processes to its Brazilian oil fields. The company is able to produce over 90,000 barrels of oil a day, and has reserves of 300-600 million barrels from the Campos basin. ABB has played an important role in helping company managers maintain these production goals, and is providing local resources to help maintain production levels.

The company is well-established in Brazil, where they operate the largest oil field outside of Norway, and operate in one of the most complex fields in the Campos basin, producing the heaviest oils in Brazil.

The heavy oil found in this Brazilian oil reservoir is perhaps the greatest challenge that company managers face. The oil viscosity is so thick that it must be treated before it will flow. The reservoir is located about 2,300 meters (approx. 7,590 feet) beneath the seabed. Each production well is artificially lifted using electric submersible pumps to bring the oil up from the reservoir to the wellhead platforms.

The intricate process of recovering the oil from the offshore reservoir and heating it in the separation unit and storage tanks requires vast amounts of electric power. To generate this energy and store the pumped oil, the company had a floating production vessel constructed in 2010. The Floating Production Storage and Off-loading (FPSO) can produce 72 megawatts of electricity, or enough to power 150,000 Brazilian households, and has a storage capacity of 1.6 million barrels of oil.

On a global level, ABB is engaged with the company in a joint industry project to develop power and automation for offshore factories. The five-year program is centered on the development of technologies required to power and control large-scale offshore pumping and gas-compression projects. Offshore pumping and gas compression contributes to improved utilization of oil and gas resources through greater recovery rates, reduced production costs and the further development of deep water production.



Well head platforms connected to the Floating Production Storage and Off-loading vessel

The ABB solution for the FPSO and wellhead platforms distributes power for the entire production process, including the electric submersible pumps in the production wells below the seabed. For the oil to flow between the platforms and the FPSO, it is heated in the flowlines. The two wellhead platforms transfer the produced liquids from the wells to the FPSO, moored in the middle. There are 30 horizontal production wells and seven water injection wells, which are connected to two drilling and wellhead platforms located about 10 kilometers (6 miles) apart. The platforms are connected to a FPSO with flowlines and power umbilicals. ABB supplies a multisystem automation solution, including field instrumentation and telecommunications systems. The solution includes a process control system, power management system, production information management system, fire and gas system, and emergency shut-down system.

The FPSO's system is operated from an ABB System 800xA Extended Operator Workplace (EOW-x) control room onboard the FPSO. EOW-x offers an ergonomic operator environment that facilitates operator decision-making and produces measurable improvements in plant productivity, safety, information flow, and operator job satisfaction. Some 14,000 integrated operations on the vessel and platforms are controlled by ABB AC 800M process controllers and AC 800M high-integrity controllers.

The solution also includes an 800xA Simulator, which contains adapted versions of all the site automation systems and connects them to a dynamic process flow model. The simulator provides realistic and safe process simulation for operator training. It enables engineering, testing, startup, optimization studies, and upgrading to be performed and mastered in the simulator prior to execution in the field.

800xA Electrical integration project

During the original project delivery phase, protection relays were connected via Modbus which offered very limited diagnostic capability. Low-level diagnostics and non-sufficient data were not helping the company to efficiently operate and quickly troubleshoot the platform's electrical system. Today's IEC-connected protection relays offer much improved networking and diagnostic capabilities.

To improve integration between the electrification and automation systems, and also provide long-term operational support for the electrical equipment on the oil field ABB proposed a protection upgrade and 800xA integration project package. The project consisted of scoping, planning and assembling the Global Positioning System (GPS) switches, fiber optic networking, and modifications needed to achieve the objective of electrical time synchronization for the FPSO, and well head platforms. The project consisted of an electrical system upgrade with focus on the lifecycle of ABB protection relays and IEC618501 integration synchronized by the GPS.

ABB supplies medium voltage protection relays for modernization of the electric power system using IEC61850 protocol on the two fixed platforms and the FPSO. This modernization, which provides clock synchronization, enables fast identification of the root cause of any system failure.

To complete this project, a team of approximately 40 ABB electrical telecommunications and automation professionals were on board to execute the project. ABB faced two critical challenges: avoiding an extended maintenance shutdown, and not harming production while operating under a very tight timeframe. The task of these professionals was to integrate the relay to System 800xA, to ensure synchronization between the functioning of product and the progress of activities on the platform.

For all these requirements to be met, the team developed a comprehensive plan which suited all customer needs. The order was issued in early November 2015, and in February 2016, approximately 99 relays passed the factory acceptance test. The installation proceeded with flawless execution over a period of 10 days. At the end of the project, the ABB team was highly praised by the customer.

> On behalf of the maintenance team, I congratulate all employees of ABB for excellent work, professionalism and competence. If it was not for the solid teamwork and the proactivity shown by these professionals, our work would not be feasible due to the short period of time available.

- Electrical Technician
company well head operations

After the automation upgrade on the oil field was completed, ABB showed the real benefits of a high level of integration between electrification and automation systems, and how it could support company operators.

Upgrade project scope included:

- GPS antennas in each well head platform and FPSO to have ABB System 800xA and electrical systems fully synchronized
- IEC 800xA servers
- Fiber optical and switches for IEC61850 network
- Engineering services:
    - Intelligent Electronic Device (IED) program conversion
    - 800xA reconfiguration
    - Hardware and software Factory Acceptance test at ABB facility
- On-site services
    - IED mechanical installation
    - Fiber optical cable network and switches installation
    - Server installation
    - GPS antenna installation
    - Complete IED site test
    - Commissioning

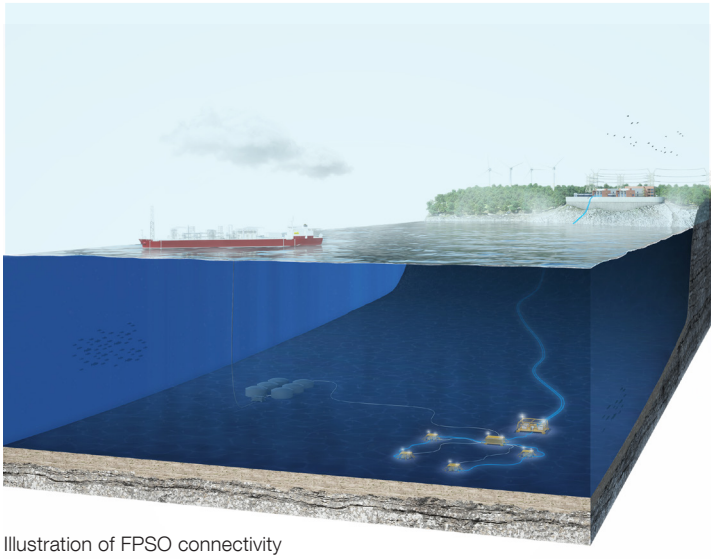


Illustration of FPSO connectivity

Collaborative services

ABB personnel conduct system health checks

ABB also provides automation and electrification support from a remote operation center in Brazil. Operating collaboratively, the two sites work on preventive maintenance and troubleshooting, with lower cost and faster customer response due to the remote nature of the service delivery. The work performed by ABB successfully contributes to more efficient production and cost savings at the two sites.

Remote monitoring and integrated operations are key. Authorized ABB personnel have remote access to the safety and automation systems on the FPSO through remote monitoring and operations rooms. So, ABB can safely implement changes, troubleshoot, support and conduct remote health checks. The first analysis of any electrical failure can be done using the 800xA without entering electrical rooms, increasing safety for personnel.

ABB's electrification solutions distribute electricity safely, reliably and efficiently throughout the production areas, ensuring fast, accurate data transfer from ABB's electrical equipment to the automation system, while improving root cause analysis for the maintenance team. ABB also supplies the company's onshore plant with electric drive systems that drive the gas compressors optimally at variable speed, thereby significantly reducing energy consumption and carbon dioxide emissions.

Thousands of hours of work are performed each year for the company by over 200 ABB specialists at remote centers worldwide, thereby reducing the need for this customer to deploy its own expertise at the sites. If an incident occurs, ABB has all the required skills to work on a solution immediately and implement it remotely.

[1] IEC 61850 is a communication standard for electrical substation automation systems. IEC 61850 is a part of the International Electrotechnical Commission's (IEC) Technical Committee 57 (TC57) reference architecture for electric power systems. The abstract data models defined in IEC 61850 can be mapped to a number of protocols.

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