COLLABORATION

Encouraging collaboration in the oil and gas sector

ABB recently launched its new global collaboration operations centre in Oslo, Norway, with a network of over 150 industry experts focused on digitalisation of the oil, gas and chemicals industries. *Brian Davis* also reports on key initiatives in the power and subsea sector.

The snow was still thick on the ground when a group of international oil and gas industry journalists were introduced to ABB's new collaborative operations centre in Oslo in March 2018. But there was a warm reception on all fronts for an initiative which aims to encourage cross-industry collaboration in the sector as it moves towards greater automation and digitalisation for operations in remote and challenging locations worldwide.

The warren-like ABB collaboration centre (one of 15 centres worldwide targeted at different industry sectors) is focused on the important push towards digitalisation today. ABB has a long-established reputation as a technology leader in industrial automation, power grids, infrastructure and robotics. Here in Oslo, the emphasis is on the oil, gas and chemicals industries, based on an integrated cross-industry digital platform called ABB Ability, which extends from the device level to the cloud, aimed at improving operations and sustainability.

The future of subsea power

The biggest project underway at the ABB Collaboration Centre in Oslo is the Subsea Power Joint Industry Programme (JIP), which ABB is carrying out in partnership with Statoil, Chevron and Total.

The JIP programme is focused on improving the capex and opex of subsea operations, with improved recovery rates for new offshore installations, as well as extension of the life of ageing assets. The aim is to use advanced, modular subsea installations rather than traditional platforms and floating production systems, for operation in remote regions in deep waters (up to 3,000 metres) and challenging environments like the Arctic.

ABB's first subsea power JIP project was to design and build a subsea compression system for Statoil's Asgard field in the Norwegian sector of the North Sea, which was delivered in 2014. In this case, advanced subsea compression systems were tied back to a floating topside system. 'The snag with this technology was that a separate cable had to be tied back for each pump and compressor needing power, because there was no power distribution on the seabed,' explains Kai Hansen, who is responsible for Subsea Electronics and Controls at ABB, Industrial Automation Division.

Today, the Industrial Automation team is working towards a future vision of offshore production that won't have any topsides or floating production system as all process equipment will be located at the seabed. Power, for example, will be supplied by a single cable as opposed to one for each load, with a modular power distribution 'factory' on the seabed to drive pumps, compressors and other process plant.

Statoil, in partnership with Chevron and Total, has invested $100mn in the JIP since 2013. The subsea power system will deliver up to 100 MW for gas compression and distribution. 'Significant savings can be made in capex and opex costs, with increased recovery rate, improved safety, reliability and productivity,' says Hansen. The cable itself (which is not manufactured by ABB) will give $500mn of savings on a long-distance power cable with eight 'consumers' (compressors, drives, etc). Efficiency will be significantly improved using a virtually maintenance-free seabed system, which will operate up to 3,000 metres depth in offshore basins in Brazil, the Gulf of Mexico, Asia, Africa, the North Sea, Australia and the Arctic.

The modular seabed system can be located up to 600 km offshore, reaching nearly all known assets. Power consumption will be reduced as the power distribution system will be closer to the reservoir. What's more, the new digital solution will enable intelligent remote control and unmanned operations.

Subsea laboratory at the ABB Collaboration Centre, Oslo, Norway
Source: ABB

Faced with a tight and challenging oil price environment, the express aim is to offer 20–30% capex (capital expenditure) and opex (operational expenditure) savings through an integrated automation, electrical and telecoms approach. In addition, ABB is promising hard-pressed offshore operators 25% quicker schedule completion, 40% fewer start-up and installation hours, 5–10% better uptime and 50% reduction potential in maintenance costs.

Sounds good, but what's the reality?

ABB has been working closely with Statoil, Chevron and Total on a jointly funded research and development project to develop autonomous subsea operations equipment able to withstand conditions in depths up to 3,000 metres, using modular equipment for medium voltage (MV) power distribution (see **Box**). As well as reduced capex and opex, advanced power, control and automation equipment is being developed to boost recovery rates, with increased safety, reliability and productivity using a digital solution which will enable intelligent (smart well), remote and unmanned operations.

'At this Oslo facility, we offer generic or specific collaboration rooms where the content can be widely applied or tailored to meet specific expert applications,' explains Per Erik Holsten, Managing Director for Oil, Gas and Chemicals in ABB's Industrial Automation Division (see also this month's **Perspective** on p2).

One collaboration room, for example, serves the remote operations of an (unnamed) oil major. 'That doesn't mean they give away all of their operational side to the collaboration room, but have an operational philosophy which allows movement of controls between the offshore facility and the collaboration room, which is served by ABB and oil company experts', says Holsten. To ensure security, an operator access card is required to enter the room.

The rooms feature a fully-fledged operator environment with full data highway security. The system can be used to change and optimise production of the offshore facility, supported by experts who communicate with operators offshore. The experts require work permits exactly as if they were on site. The collaboration room facilitates fast access to expertise, applications and digital solutions, in support of oilfield operators.

Admittedly, there has been some hesitation in the upstream sector about moving the control and integrity of an offshore plant to an external collaboration centre. Holsten doesn't expect that the hesitation will be easily removed, 'because most operators want to ensure that the integrity of the plant is maintained on site. But the collaboration centre gives the opportunity to address specific issues or problems, with over 150 ABB experts available to give insight into operational data.'

A host of issues can be addressed for single plants (upstream and downstream) and across an enterprise, including analytics, operational support, plant optimisation, predictive maintenance, cybersecurity, safety management and control.

'Typically, issues such as well optimisation were quite isolated,' remarks Holsten. However, using a platform like ABB Ability allows these issues to be addressed on a single platform.

New partnership

Today there is demand for vast data crushing, using advanced analytical tools. ABB has just teamed up with software company Arundo Analytics to create the first cloud-based virtual multiphase flow meters for the offshore oil and gas sector, which will be integrated with the ABB Ability platform. The software combines physical models with the latest data science and machine learning. 'Our aim is to offer a suite of expert applications across the board, down to inventory management with links to the ERP (enterprise resource planning) system,' says Holsten.

He notes: 'There is a great deal of loss of productivity throughout the value chain, from the time you start to design and build a plant through to operations. Digitalisation can lower operating costs in a low-price oil environment. We need to look at work process improvement (like predictive maintenance) to make sure that the oil and gas operator can take advantage of the productivity gains that digitalisation and collaboration can provide.' ●

The JIP has reached technology readiness level (TRL) 3. Shallow water tests are due to be carried out at Vaasa on the coast of Finland, to address thermal performance of the drives, etc. The modular ABB equipment (including power conversion, distribution and control modules, power cells, subsea transformers, circuit boards, semiconductors and capacitors) are also being tested under pressure in oil in high pressure labs in Oslo, and subsequently in pressure vessels at various locations for deepwater tests. Statoil's Trondheim test facility is able to test switching elements and other components in a power cell weighing up to 700 kilos in a large pressure vessel running for 3,000 hours of tests, simulating pressure at 3,000 metres water depth. Over 200 formal pressure cell qualification tests are underway.

Every component is tested extensively to ensure it can withstand high pressure and deepwater conditions. Control modules are configurable for different applications, including Arctic conditions. In ABB's pressure-compensated design, the containers are flooded with oil to maintain electrical integrity (at 300 bar), with no pressure difference between the components and seawater at the seabed. This is a different approach from conventional and competitor 'pressure contained' systems, where the components are sealed in a thicker container at atmospheric pressure. Consequently, ABB's systems allow easier penetration of electrical signals through thinner walls.

After thousands of hours of testing, the power systems should be virtually maintenance-free for the 30-year life of the reservoir. In other departments, ABB is also developing new systems for subsea automation and instrumentation. 'Clearly, the elimination of fixed or floating production topsides and the move towards remote subsea automation is the way to go,' says Hansen. 'Power and automation accounts for 10–20% of total capex costs, so the savings are significant.'

There are also potential benefits for existing oil and gas production installations, as asset life can be extended using subsea power systems. Subsea processing equipment can be added with minimal changes to topsides. Power can be supplied from the shore if required, and new/smaller assets can be tied into existing infrastructure.

Looking forward, Hansen maintains: 'Improved power productivity and better offshore production cost efficiency signals a new frontier in subsea operations.' ●