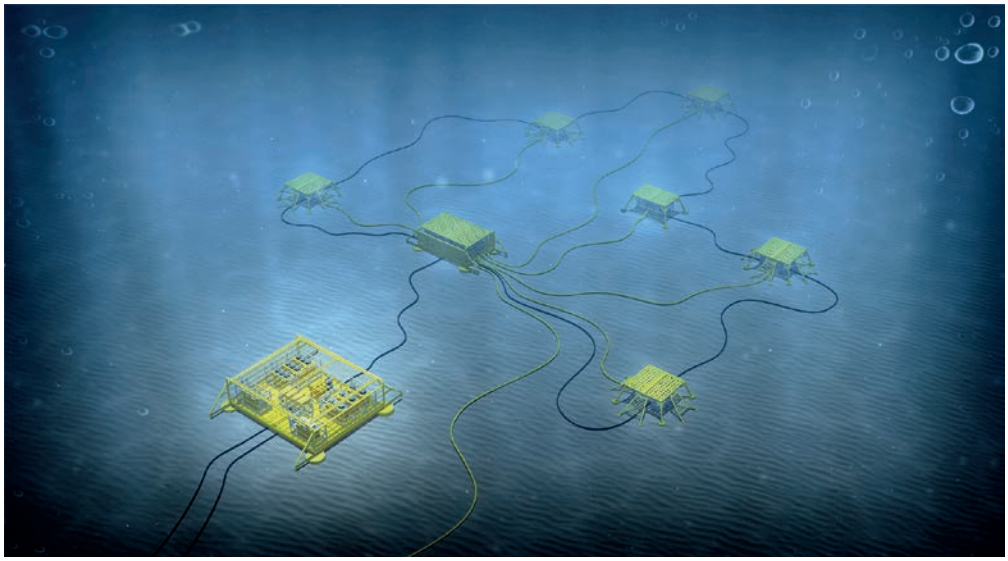
ENERGY TRANSITION

A matter of control

Digital technologies will play a vital role in the energy transition, faced with the energy trilemma of balancing security, affordability and sustainability. *Ian David* reports.



ABB, in partnership with Equinor, has been developing a subsea power distribution system
Photo: ABB

A robust digital strategy is required for energy transformation, driven by a culture of innovation and new technology. 'This digital roadmap will help energy companies achieve faster and better business decisions, higher production, fewer outages and reduced costs,' says Martin Kjall-Ohlsson, Global Marketing Manager, Oil and Gas, ABB Energy Industries.

For energy operators, there are many considerations when building a digital strategy, including retraining executives; exploring the potential of digital; supply chain collaboration; data architecture; talent investment and data optimisation.

It sounds like a big challenge. Kjall-Ohlsson admits: 'The transition will not be an easy one. For digitalisation to deliver all its potential benefits, the industry and systems must start sharing data and learning from one another.' What's more, he notes there is a lack of global standardisation in the industry, with a need to develop an efficient standard.

A strong foundation of data integrity is required, to ensure data confidentiality and security. Without adequate integration, new investments will not fully realise the potential of this transformation. Furthermore, much of the data coming from sensors is not standardised or integrated across platforms. Ownership of, or access to, data between suppliers, operators and contractors is often uncertain. Even when data is accessible, it is often too complex or large, obscuring clear insights. Indeed, there is an over-riding need to improve the integration of information technology (IT) and operational technology (OT) in order to reduce costs and boost efficiencies.

For a successful energy transition, the industry needs to continue to develop collaborative partnerships with fellow operators and suppliers to develop digital capabilities quickly and capitalise on new business models.

New MoU

New collaborative ventures are well underway. In July 2019, ABB and independent Norwegian oil gas producer OKEA signed a memorandum of understanding (MoU) agreement to leverage digitalisation initiatives using innovative business models. ABB is supporting OKEA to maximise operational excellence, reduce time-to-value and support cost-effective field developments, as a key partner for OKEA in realising its ambition to operate the Draugen field until 2040.

ABB and Rolls-Royce (R-R) announced a global partnership, in April 2019, for development of microgrid solutions that integrate digital technology and hybrid power solutions. Basically, a microgrid is a small-scale electric grid that combines power from distributed energy generation sources (see *Petroleum Review*, July 2019 and accompanying online articles at **bit.ly/2FhfFqa; bit.ly/2MXloHY; bit.ly/2KseWqm**) as diesel and gas-powered gensets, and renewable sources, with batteries and combined heat and power plants, etc. Under the MoU, R-R will combine its MTU diesel and gas genset system technology and control systems with ABB's modular microgrid solution, control capability and remote service.

'Microgrids can either function as a node off-grid or connected to the main power grid or operate in an islanded mode – near or where the power is being consumed; for example, on an onshore oil or gas drilling site or on an oil platform,' says Kjall-Ohlsson.

Increasingly, distributed energy systems integrate distributed energy sources and renewable power generation. The ABB Ability™ e-mesh can provide power generation asset owners with a unified view of distributed energy resources and renewable power generation for better decision making and reduced operational costs.

'The key issue we aim to address is to find the balance between energy security, affordability and sustainability,' remarks Kjall-Ohlsson. Looking ahead, he says there will be a mix between distributed energy systems and large-scale central sources of power supply. 'The pace at which it will all link up will be tougher than we think. There will be a mix of central energy supply and more generation closer to the point of consumption. The systems will be bi-directional, with consumers selling energy back to the grid. But it requires a lot of new solutions to manage that shift.'

Norway is notable for the pace at which it has taken up renewables and electric vehicles, in particular. As it happens, Kjall-Ohlsson was previously Project Manager for ABB's delivery of electrical systems for the Technology Centre Mongstad (TCM), a world class test centre for carbon capture.

Virtual power plant

'The first big challenge is to aggregate and dispatch the growing number of distributed energy resources, such as wind power and solar. If you are going to integrate renewables such as solar or wind, you need the ability to store that energy,' says Kjall-Ohlsson. ABB does not actually provide energy storage media but can advise on the right technologies in terms of batteries, supercapacitors or hydrogen systems. However, the company has developed the Optimix™ virtual power plant, which provides a pool to balance various renewable energy generation sources.

Using Optimix™, virtual power plant operators can pool and trade production from thousands of small-scale generators and microgrids to optimise their energy networks, with reduction of energy costs by 5–10%. The ABB Ability™ system collects plant production and grid balancing data and determines production schedules for each plant to ensure grid stability.

For example, Next Kraftwerke has used the ABB solution to create one of Germany's biggest virtual power plants, pooling the production of hundreds of small- and medium-sized renewable energy plants (including biogas, solar, wind and water) into a virtual power plant. Together the plants produce up to 796 MW of clean carbon-free balancing power.

Digital twin

There are also significant challenges for energy storage and power applications in process facilities. These operations can suffer costly blackouts and unintended trips, as well as complex electrical system and operational constraints. Kjall-Ohlsson says these issues can be addressed with a digital twin of the electrical system and control application.

ABB's Process Power Simulator enables operator training and electrical control system testing to be conducted in a realistic but remote environment. The digital twin of a plant's electric control system has been used on an LNG plant in Indonesia and offshore platforms (for an unnamed client) on the Norwegian Continental Shelf (NCS).The digital twin approach is also being used to simulate integration of floating wind turbines with a conventional gen set on offshore oil and gas platforms for load balancing.

Offshore microgrid

ABB has also been developing the world's first microgrid solution for offshore platforms. The company has developed a 1 MWh battery energy system that provides spinning reserve for Woodside's Goodwyn A platform off Western Australia. The PowerStore™ system provides a microgrid that reduces the 3.2 MW gas turbine generators required for a spinning reserve on Goodwyn A to three from the original six generators, for lower cost, higher efficiency and reduced maintenance. Fuel gas consumption has been reduced by 2,000 t/d, with 50% lower CO_2 emissions.

Subsea power solutions

In Norway, ABB has also been developing subsea power solutions, switchgear and transformers that can be installed on the seabed (see *Petroleum Review*, May 2018), for gas compression and boosting oil production where there is large power demand. 'This type of electrical switchgear could also be used to collect power from floating wind-power installations,' says Kjall-Ohlsson.

'Today there is a lack of equipment that allows power distribution subsea in medium or high-power voltages. Currently, you need three cables to the surface for three pumps, say, whether from a platform, floater or from land. So, if you have a lot of power consumers, you need a lot of cables. However, using switchgear on the seabed, you can use one cable and switch it for two loads, for example, saving a lot of cost and complexity. The seabed switchgear also saves space and weight on the platform.'

ABB, in partnership with Equinor, has been developing a subsea power distribution solution that will enable electricity to be distributed via a subsea power station. This is a fully functioning underwater facility that will transmit 100 MW of power up to 6,000 km from shore in depths of 3,000 metres below water. This technology is a major leap and promises to remove the need for topside platforms offshore and floating, production, storage and offloading (FPSO) vessels.

There are wider implications, including removing the need for local power generation from energy intensive gas turbines on offshore platforms, as the subsea station will connect to onshore where the power generation can be performed more efficiently than using gas turbines (providing maximum energy efficiency of 36%). In some cases, the system will tap into the grid and renewable power resources.

There is another challenge. 'Rotating equipment (like pumps and compressors) needs power and the best solution is a variable speed drive (VSD) together with a VSD converter to ensure the drive runs efficiently,' says Kjall-Ohlsson. In the past it was impossible to put a VSD on the seabed. Today, for fields in remote locations or very deep water, ABB has developed a subsea VSD frequency converter that is able to vary the speed and torque of a pump or compressor to aid energy efficiency. Having a pump or compressor located close to the reservoir requires significantly less energy than if it is located on a topside installation or onshore.

Subsea power distribution improves efficiency and reduces costs and maintenance, by conversion of mechanical and hydraulic systems to digital operations. These subsea power solutions are also a significant move towards autonomous operations offshore, with the promise of improved safety, increased efficiency, less errors and reduced costs.

Looking forward, Kjall-Ohlsson predicts: 'There will be a wide-ranging offshore grid integrating with the onshore grid. Today the operator owns the power infrastructure, but in the future there will likely be a big shift in the player landscape regarding who will operate the energy grid offshore.'

Digitalisation is clearly key for future offshore development. ●

Subsea transformer
Photo: ABB