GUIDE

Innovation to transform the energy future

How digitalization enables oil and gas operators to transition to a new energy ecosystem

Contents

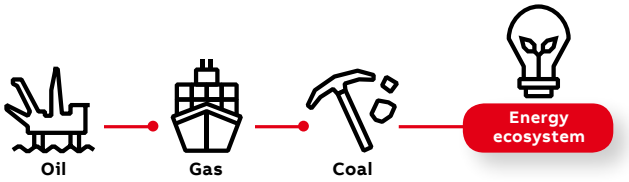
Energy transition

In 2016 the World Energy Council captured the energy transition challenge when it coined its "**energy trilemma**", which involves balancing three seemingly conflicting, yet intertwined objectives:

- **Energy security** – ensuring the reliability of energy supply to meet current and future demand
- **Energy equity** – ensuring the world has access to energy at an affordable cost
- **Environmental sustainability** – ensuring that global warming calls for improved energy efficiency and the development of renewable low-greenhouse energy sources are met

The realization that fossil fuels are a limited resource, however long supplies might last, and the growing awareness of the negative impact that their emissions have on the planet, has impacted every oil and gas major. Extreme weather conditions, such as those experienced during the summer of 2018, leading to heat waves, forest fires and torrential rainfall, all contribute to the urgency to improve the energy ecosystem.

These companies have now issued their own "energy transition" strategies that outline plans to migrate their core business to new energy sources between now and 2040.



"It is important to stress that it's the carbon dioxide and methane emissions that have a negative impact on the planet," says Charles McConnell from Rice University and former Assistant Secretary of Energy. "Don't hate the fuel, hate the emissions. We need to be developing technology that addresses these emissions."

Regardless, there is a realization among the majors that their dependency on oil or gas as their main source of revenue needs to evolve. Nearly 70 percent of respondents to a Wood Mackenzie survey[1] said investing in renewables to reduce carbon footprints was a more progressive pathway towards transforming the energy ecosystem.

Over the past year, European-based oil majors that include BP plc, Royal Dutch Shell plc, Equinor ASA (formerly Statoil ASA) and Total SA have emerged as leaders in alternative energies investments, a strategy highlighted as a priority by 15 percent of the survey's respondents.

CASE REFERENCE

Advanced technology enables clean wind power in Pakistan

Due to a surge in population and steady economic growth in Pakistan, the demand for electricity currently exceeds the available power generation. It is estimated that over 140 million citizens either have no access to the power grid or endure significant and daily power interruption. Meanwhile, demand continues to grow rapidly – at an average annual rate of 8 percent – with a current supply shortfall to its population of approximately 5,500 megawatts ("MW").

Fact 1: The country's total installed electricity capacity is some 28,000 MW, with the International Energy Agency forecasting that demand will hit 50,000 MW by 2025. To meet this demand and boost renewable energy from 5 to 25 percent of the country's energy mix by 2030, Pakistan's government is promoting technologies like hydropower, solar and wind power generation to alleviate this projected supply-demand imbalance.

Fact 2: ABB has been selected as the turnkey supplier (including design, supply and installation) for the electrical balance of plant substation and to integrate the wind turbine generators to the national grid. ABB will also provide the technology that will convert the wind energy from 22 kilovolts (kV) to 132 kV.

In fact, BP's annual review of world energy published in June 2018 revealed 17 percent of the world's energy growth in 2017 came from renewable sources, the largest increase on record. New renewable energy installations were equivalent to the energy output of 69 million tonnes of oil – the annual energy consumption of Sweden and Denmark.

What the oil majors also agree upon is that there is no single mix of energy sources that would be ideal worldwide. The energy transition is specific to each country or continent, with some advocating emission-free facilities, others opting to grow markets for hydrocarbons, while the rest aim to get people out of energy poverty.

"It doesn't matter how you view the future, we have a responsibility going forward to harmonize our energy mix – whether it be oil and gas, petrochemicals or electric power – by providing access, affordability and environmental responsibility through technology," states McConnell.

Energy transition is a slow process, but the enabler is most definitely today's technology and future breakthroughs supported by radical changes in energy use by consumers.

In fact, in the Wood Mackenzie survey, 60 percent of respondents claimed digitalization should have a "major" or "transformational" impact on business and is expected to result in faster and better decisions, more production, fewer outages and reduced costs.

As the world demands more energy, it also demands that it be produced and delivered in new ways, with fewer emissions.

According to the president of ABB's Industrial Automation division, Peter Terwiesch: "Oil and gas companies working in collaboration with their supply chain have the ability to make an impact on the world, bringing power and light to remote locations, improving energy efficiency, reducing raw material use, and running the world without consuming the earth."

Digital technologies are playing a key role in this.

NEWS UPDATE

Total actively develops alternative energy sources

Total is actively developing alternative energy sources, with a major drive into solar power and energy storage.

The $1.4-billion purchase of solar panel maker SunPower in 2011 helped turn the oil company into a major player in solar energy. Its acquisition in 2016 of battery-maker Saft reinforced this shift in strategy by propelling Total into the big league of companies offering solar-plus-storage and distributed-generation technologies[2].

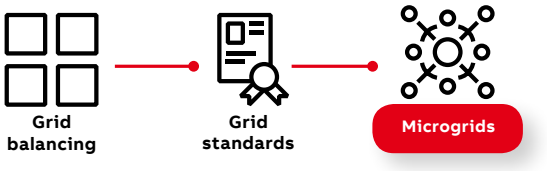
Changing landscape

For many years the oil and gas industry has confronted many diverse challenges, whether that be between onshore and offshore, different geographies or national versus international oil companies. As the industry looks toward transitioning to a different energy mix, adding to these challenges will be local versus global energy policies, the reliance on oil and gas for national budgets and employment, the skills shortage and the uncertainty over oil and gas prices and demand.

It is forecast that the shift to renewables, along with the emergence of electric vehicles, could lead to profits of $65-$70 billion[3] migrating from oil and gas companies to the broader energy ecosystem. Upstream players stand to be most at risk, with approximately $60 billion[3] of their profits potentially migrating to this broader ecosystem.

However, this shift is expected to benefit the environment, with a potential reduction of 900 million tonnes of CO_2 emissions[3].

Another positive is that an estimated 35,000 jobs[3] will be created, as generation from renewables tends to be more people-intensive than that from fossil fuels.



There are many trends accelerating the introduction of new energy sources and delivery platforms into the global energy system. Four stand-out developments can potentially transform the global energy landscape:

1. Global population growth brings new expectations and requirements

By 2025[4], the population born early 1980s to early 2000s – commonly known as millennials – are expected to make up 75 percent of the global workforce. They bring with them their own expectations about technology, collaboration with colleagues, the pace of work and accountability.

The impact of this generation can be felt today. They are already enthusiastically embracing the sharing economy as witnessed by new digital business models providing efficient solutions for transportation, accommodation and food delivery. This, in turn, is leading to greater use of assets such as shared vehicles.

CASE REFERENCE

Digital technology enables Dubai to develop smart solar strategy

ABB technology is supporting the development of new smart solar power systems for the city of Dubai, United Arab Emirates. Dubai Electric & Water Authority (DEWA) is using the ABB Ability™ Electrical Distribution Control System to maximize year-round solar energy production as part of the Smart Dubai initiative that aims to make Dubai the smartest and happiest city in the world.

Fact 1: Dubai aims to generate 25 percent of its energy from clean sources by 2030 and the development of a viable solar power infrastructure is key to this.

Fact 2: DEWA is fast-tracking the introduction of digital innovations that will help to better manage the city's energy consumption and production with smart grids and smart meters.

As energy consumers, this generation also have different preferences for energy sources and embrace the idea of energy from solar, wind and tidal. They are focused on global issues such as climate change and air pollution. They are prepared and willing to make bold changes, such as switching to eco-friendly energy providers or brands to help tackle these challenges.

These developments are already affecting demand for oil and natural gas.

However, it is not all about the millennial. Equally important, is the very different progress of developing countries. Africa, for instance, is the fastest growing continent with more than half of global population growth expected between now and 2050. It is highly likely that these countries will bypass, altogether, any involvement building a hydrocarbon-based energy infrastructure, turning instead to the power of renewables. International and national oil companies need to be very aware that such countries may not prove to be the untapped outlet for hydrocarbons that they envisage. “These nations are likely to skip copper and move straight to mobile phones. Skip petrol-driven cars and move straight to electric vehicles or bicycles,” says ABB’s Havard Devold, global digital lead, ABB Oil, Gas and Chemicals.

2. Electric vehicles
Road transport, aviation and shipping account for more than 60 percent of the world’s oil consumption and approximately the same proportion of emissions. Introducing a sustainable transport solution is seen as an important part of the strategy to limit the impact on the climate.

At the 2015 United Nations Climate Change Conference in Paris, the United Nations Environment Programme set a target for at least 20 percent of road transport vehicles to be driven electrically by 2030.

This would require an increase in the number of electric vehicles (including hybrids) on the road from the 1.5 million electric cars registered worldwide in 2017 to 100 million in 2030.

This could result in a reduction in demand for oil by 1.5 million barrels per day[5].

While e-mobility and e-transportation which will have a dramatic negative impact on the demand for oil, in the short to medium term global gas and coal demand could increase if the transition happens faster than the change to renewables and solar.

To meet increasing demand, the big automobile manufacturers are investing billions in the conversion of their product ranges and production facilities. Analysts predict that by 2040 more electric cars will be produced worldwide than petrol or diesel vehicles. Volvo has announced that as of 2020 all vehicles rolling off its production lines will be electrified.

Approximately 76 percent of millennials prefer an eco-friendly car, while 50 percent have plans to purchase an electric car.

It is now up to industries, infrastructure providers and policy makers to keep pace with developments and facilitate the transition to e-mobility.

3. Cost of power generation
Beyond the charging infrastructure, e-mobility requires a transformation of the energy system – an Energy Revolution, in fact – both to ensure that the grid can cope with the increased demand for power and to expand the contribution of renewables. Otherwise the world will simply be using fossil energy to power our new electric vehicles.

CASE REFERENCE

ABB keeps electric vehicles rolling

ABB’s fast chargers are connected in networks that can be linked to electronic payment systems and can enable remote monitoring and maintenance from central control centers. Two of the world’s biggest and fast growing networks of charging stations are being installed in the United States, with both employing ABB chargers.

Fact 1: EVgo operates in 66 metropolitan areas and already has 500 ABB charging stations in place.

Fact 2: Electrify America is the biggest electric vehicle U.S. infrastructure project planned so far. Electrify America plans to place hundreds of charging stations within and around 17 major metropolitan markets and at intervals of 120 miles or less along nationwide highway corridors.

According to Bloomberg New Energy Finance[6], $7.4 trillion will be invested in renewable energy projects by 2040. This makes up 72 percent of the $10.2 trillion that will go towards new power generation worldwide.

Utilities are successfully lowering the cost of generating power from renewables.

- Cost of solar panels has fallen by 26 percent each time global solar-panel capacity has doubled. The International Energy Agency estimates that solar will soon be the cheapest source of new electricity in some countries.
- Solar capacity has increased sevenfold over the past 15 years.
- Investment in renewables is expected to reach $7.4 trillion by 2040.
- $2.1 trillion is the predicted spending on fossil-fuel projects to 2040.
- Over the next decade, the average levelized cost of electricity generated from renewable sources, such as solar photovoltaics (PV) and onshore wind energy, is expected to come down by 59 percent and 35 percent, respectively[7]. As such, policymakers are moving away from subsidies for wind and solar and shifting toward auction-based systems to reward the lowest-cost producers of renewable electricity.

The preference among millennials for eco-friendly sources is also being followed in the broader energy landscape. An Accenture survey found that 56 percent of millennials are interested in investing in solar panels, and 69 percent in energy trading marketplaces (which enable peer-to-peer energy trading from distributed energy sources, such as solar PV systems).

This trend is driving start-ups to create platforms that give consumers the freedom to choose their energy source.

4. Distributed generation

Energy supply has shifted from large-scale, one-way and centrally-driven supply (from energy producers' large power plants to consumers) towards generation closer to the point of consumption and bidirectional in nature (consumers selling excess energy back to the grid), such as roof top solar and self-generation by industrial consumers.

These renewables need to be integrated into grids that are able to manage new complexities such as intermittent supply, more distributed power generation, demand management and electric vehicles. So, the evolving power system needs to be increasingly flexible and interconnected, as well as more reliable and intelligent – that is, a stronger, smarter and greener grid.

The transformation involves the application of advanced digital technologies. Through high-voltage transmission, it is now possible to integrate renewables into the grid by enabling the transport of vast amounts of clean energy with minimal losses.

Through technologies such as the ABB Ability™ digital offering, consumption data is collected and analyzed to provide for needs-based production and distribution of electrical energy.

CASE REFERENCE

Connecting the world's largest offshore wind farm to the grid

ABB is helping Danish energy company, Ørsted (previously Dong Energy), to supply a range of technologies that will help integrate and transmit renewable wind energy from Hornsea Project Two, slated to be the world's largest offshore wind farm.

Fact 1: The $150 million orders are the first tranche of a global five year frame agreement for the supply of electrical and automation equipment for offshore and onshore wind power connection and integration to the grid.

Fact 2: The Ørsted vision is a world that runs entirely on green energy. Ørsted develops, constructs and operates offshore wind farms, bioenergy plants and innovative waste-to-energy solutions and provides smart energy products to its customers.

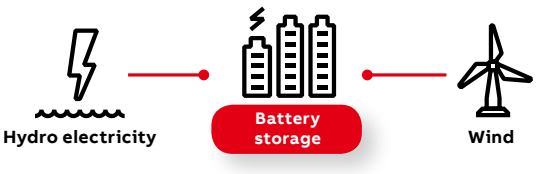
Technologies that enable effective energy transition

Headwinds over the past several years have taught oil and gas companies to maintain strict cost disciplines and be more efficient than ever. Organizations and budgets were cut, and investments were limited.

Yet, at the same time demand for energy continued to grow. And now as the oil and gas companies expand their portfolios towards future energy markets, like renewables, there is a realization that the need for efficient operations and maximized production uptime is more prevalent than ever.

As oil prices begin to rise, producers are firmly adopting digital technologies to impact planning, building and operations of assets while maintaining their capital discipline. Producers have already made great strides in technologies and applications in which plants with volatile processes or remote locations can be operated with low or no local human involvement. This trend will progress for more than just safety or cost reasons, but also for the productivity benefits.

It is these same technologies that will provide the transformational step change to enable oil and gas companies to move into the broader energy ecosystem.



However, the real game changer – or disruption – lies in integrating these technologies in a way that drives the evolution from connected operations, to collaborative operations and ultimately autonomous operations to achieve maximum value.

'Digital' has become more important than ever in today's industrial space. It has been shown that by properly using digital technologies, the oil, gas and chemicals sector can reduce capital and operating expenditures by up to 30 percent.

The same technology will have a massive impact on tying the entire energy ecosystem together. However, getting such results is not just about doing things better but rather doing things differently.

Visualization, analytics and machine learning: These technologies are moving companies to an era where critical assets equipped with smart sensors now tell people what is wrong, long before failures even occur. Providing operators with quick access to hundreds of years of data

CASE REFERENCE

BASF rotating machine digital service

BASF has many non-critical low voltage motors and pumps that are inspected manually during routine maintenance. However, this does not provide sufficient online information about the current state of degradation or about potential failures. Fleet management for rotating machines has been identified by BASF as a co-creation initiative which will help to further enhance overall plant availability, reliability and efficiency.

Fact 1: ABB has provided an end-to-end solution that goes from wireless sensors up to advanced analytics and an enterprise dashboard for a fleet of rotating assets. The solution aims to run complex fleet diagnostic algorithms to improve the overall fleet operation.

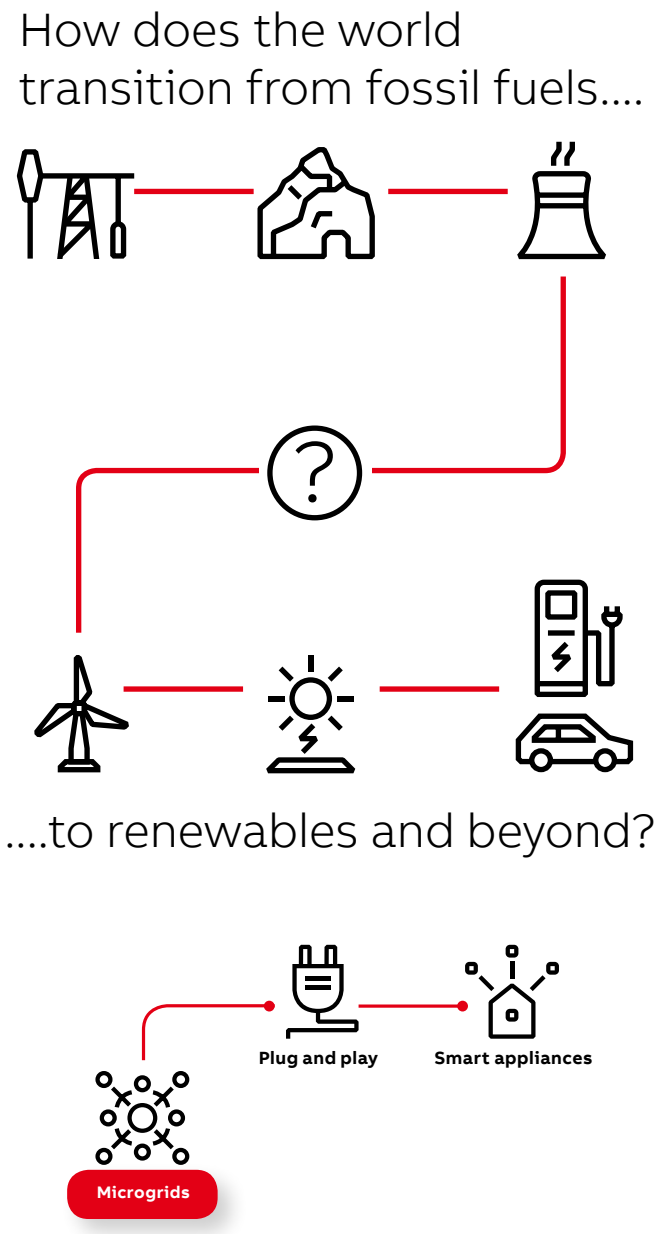
Fact 2: BASF has implemented ABB's wireless sensors at assets of pumps and motors.
By this, it can easily gauge the status of each component in the plant using analytic algorithms running on ABB Ability™ platforms.
This supports BASF operations to improve maintenance by detecting fault before failure.

and analytics, rather than relying on the experience of individual employees, increases efficiencies, reduces downtime and avoids costly shutdowns. When data and technologies across a plant, and even across enterprises, are integrated into a holistic view, this opens whole new approaches to how operators and experts collaborate and use asset information and process analytics for quick decision-making and lost time prevention.

Cloud-based technology: This technology creates an ecosystem connecting the workforce in a way that enables it to collaborate anywhere – and in real-time. For example, moving SCADA to the cloud allows managers and operators to have complete information for their facilities while on the go.

Connected operations: The future will bring more enterprise-wide use of remote-enabled condition monitoring technologies, predictive and descriptive data analytics, and advanced process control applications so that operational effectiveness of plants can be understood in near-real time. This provides the right blend of technology, expertise and information. Providing the correct information when it is most needed means the best decisions can be taken. By continuously collecting and analyzing data, and through special algorithms, early warnings can be in place to reduce any risk to a process or plant.

Artificial Intelligence: Furthermore, new digital technologies and the rise of artificial intelligence (AI) are enabling totally new designs and concepts. ABB, as one of the world's largest automation technologies providers and robotics manufacturers, and with its acquisition of machine and factory automation leader, B&R, will drive the integration of different automation technologies for an autonomous future.



CASE REFERENCE

Total team up with Google

Total has agreed a deal with Google Cloud to jointly develop artificial intelligence for data analysis in exploration and production. The AI solutions will be applied to subsurface data analysis for oil and gas exploration and production.

Fact 1: According to Total, the agreement focuses on the development of AI programs that will make it possible to interpret subsurface images, notably from seismic studies (using computer vision technology) and automate the analysis of technical documents (using natural language processing technology).

Fact 2: These programs will allow Total's geologists, geophysicists, reservoir and geo-information engineers to explore and assess oil and gas fields faster and more effectively

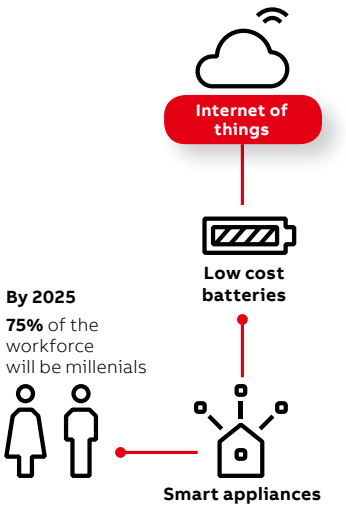
Industrial Internet of Things (IIoT): Connecting field assets and equipment using sensors enhances monitoring and diagnostics. The IIoT helps build real-time insights on the operation of assets and whole processes, thereby helping to optimize utilization and maintenance planning.

However, digital success, and ultimately the profitability of a business, hinges not on individual technologies but the integration of the IIoT. Key to this are collaborative operation centers and control rooms which pull the data from these sensors and devices together. They enable analytics reporting and monitoring, while presenting dashboards that are relevant to all stakeholders, including executives, production managers, operations personnel and maintenance staff.

Digital twin applications: A good digital infrastructure is almost impossible to implement without a digital model of the plant. A digital twin is a complete and operational virtual representation of an asset, subsystem or system, combining digital aspects of how the equipment is built (PLM data, design models, manufacturing data) with real-time aspects of how it is operated and maintained. The capability to refer to data stored in different places from one common digital twin directory enables simulation, diagnostics, prediction and other advanced use cases.

A typical modern industrial device already creates a formidable digital data-trail. This includes CAD drawings and simulations during the design phase, information on location, connected equipment and configuration from the integration phase, as well as subsequently collected utilization, diagnostic and maintenance data. In addition to such definable, measurable or observable data, algorithms can calculate or simulate non-observable parameters, both actual and predicted. These data and algorithms typically already exist in various locations or formats. If they can be accessed from one virtual directory – the digital twin – this provides a comprehensive digital image of the physical equipment. More than being just a static description, this information can be used to simulate the behavior of the physical object. 3-D visualization tools also allow virtual inspection and observation of the equipment and enhance understanding and insight.

Collaborative operations: This approach transforms how every member of the supply chain works together during operations. Collaborative operations enables remote operations and fleet wide management. It uses digital technologies to monitor and analyze assets and processes. Collaborative operation centers help to maximize productivity and ensure safety always. They achieve this through decision supporting tools and the 24/7 remote availability of process and data engineers located in collaborative operations centers globally. These centers pave the way for the application of further technology advancements such as AI.



CASE REFERENCE

On-site maintenance reduced by 97 percent

At an unmanned platform in the North Sea, 909 hours of maintenance work had typically been carried out annually. Following the introduction of ABB's new maintenance concept, only 27 hours of offshore work is now required each year, with 882 hours having been moved to an onshore location.

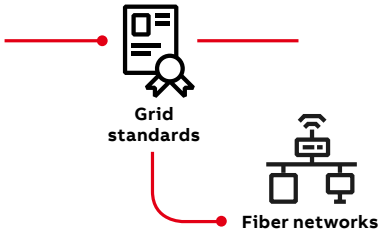
Intelligent project execution: In the plan and build phase digital technologies are successfully streamlining project execution and integrating traditionally separate systems in the planning and build phase. Studies show that 64 percent of oil and gas projects experience cost overruns and 73 percent of them have scheduling delays. Streamlining project execution uses smart engineering technology to combine people, processes, tools and standards. This not only results in 25 percent quicker schedule completion but can also reduce change orders by 50 percent and decrease costs up to 30 percent.

Because of cloud engineering, virtual factory testing and simulation, electrical, automation, instrumentation, and telecoms are no longer designed as separate systems, but instead are built into one collaborative environment, thereby optimizing customer objectives at every stage of the life cycle.

Taken together, intelligent projects and collaborative operations are perfectly complementary, spanning the full lifecycle of an asset with cost savings alone exceeding 35 percent if applied consistently.

Hurdles ahead

Oil and gas companies face significant hurdles to realizing the full value of the digital initiatives, not only in any future energy ecosystem, but also in their current exploration and production environment. Some of the more regularly debated barriers are detailed below. One common thread is that collaboration throughout the entire supply chain is critical to help overcome these hurdles.



Regulation: Some commentators believe that today's data security regulations are not fit for purpose and that much effort is needed to ensure this happens in the new world order. This can only be addressed through technology, as well as due diligence in the operational use of data and a recognition that compromise is not an option.

At CeraWeek 2018, it was recognized that the industry does not have global standardization and that there was a need to develop an "ISO-like standard" to which the high-performance industries can adhere.

Charles McConnell from Rice University explains: "We are evolving so fast regarding big data that every CEO wakes up worried about data and cyber security and very rapidly tries to think of something else to take their mind off it."

"No one has really got a great pathway or program, with everyone hunting in the dark. Everyone is searching for comfort, hoping that they are doing the right thing, with the right technologies and with support of the right companies and partners. Regulations do not exist and need to exist, and the leadership needs to be in place."

Also, intellectual property frameworks have not yet adapted to a new era of data sharing along value chains, in which companies must feel confident that, by dispersing their data, they are not compromising it.

Lack of standardization: Much of the data coming from sensors is not standardized or integrated across platforms. Moreover, ownership of, or access to, data between suppliers, operators and contractors is often uncertain. There is a lack of standardization and, even when data is accessible, it is often too complex or large, obscuring any clear insights.

ExxonMobil's work with Lockheed Martin, to develop an open standard, open architecture control system that runs on commercial software and hardware, is an excellent example of how the oil and gas industry can embrace the proven digital strategies of other industries to improve performance.

Wherever possible, ABB adopts and adheres to well-established international standards such as those set by ISO, IEC and Underwriters Laboratories (UL). Where these standards are ambiguous or too general, ABB develops internal standards that complement the international standards. Its control systems and digital services are built around open standards such as OPC-UA for digital communications, so interoperability between devices in multi-vendor environments is assured.

Energy ecosystem: For digitalization to deliver all its potential benefits, it must be integrated throughout an industry. For oil and gas, efficiency, productivity and health and safety will only be maximized if systems, equipment and sensors from across the industry's value chain are sharing data and learning from one another.

An integrated information system is essential as companies move into the digitalization age. The exploration and production (E&P) departments of oil companies often do not share data, even between themselves. This must change, especially as the transition is seeing a move from the once dominant "exploration" departments to an era where the "production" departments are the value drivers.

Business models: Unless work processes and business models are changed, oil and gas companies risk losing out to new rivals from inside and outside the industry. Companies from other sectors have often already adapted to changing markets by embracing new business models and integrating information technology (IT) with operational technology (OT) in an effort to reduce costs and boost efficiencies. According to Accenture "transforming current operating models to one increasingly enabled by technology might include narrowing the business scope to the most profitable assets; gaining efficiencies from repetitive, standardized designs and processes; increasing automation; outsourcing core functions; engaging in a more variable approach to cost (such as linking service contracts to wells and production instead of day rates); and using analytics to optimize day-to-day operations."

Culture and mindset: Oil and gas companies tend to be capital and technology-centric, while, at the same time, being people intensive.

Future concerns include how many people will be needed, the training that they should be given and the types of people that should be hired who are fit for purpose.

Charles McConnell from Rice University observes: “Today, the classic engineering degree only gets you in the door. In the next 30 years, an engineer is probably going to have to be trained and re-trained some half a dozen times as technology is evolving so fast."

“Today’s engineers are about to undertake a transformational educational process and those prepared for this are the ones that you will need to employ. This is the most difficult mindset change. Even if you hire your college graduates, in five years they will be obsolete unless they are re-trained.”

Executives can no longer afford to be sceptical about digital and de-prioritize automation in relation to other parts of the business deemed to be more critical, such as geology, well services or turbomachinery. When digital changes are proposed that challenge existing work models, it is imperative that the stakeholders most likely to recognize the impact are included in top table discussions about it.

In response to other technologies, many disparate small systems and solutions have cropped up to deal with local problems; and, lower down in the organizations, employees often use manual workarounds and are distrustful of technology and its proponents.

Furthermore, the industry is inherently unable to take more of an experimental, "fail-fast" approach because of its conservative nature and concern about the potential consequences of change. It is important to start now in preparing the workforce to manage and operate new technologies and digital plants of the future.

Talent: Technology and innovation often fail – not through lack of investment or weakness in the technology – but through a lack of cultural change.

Tomorrow's digital worker must be engaged and prepared today. However, the next generation of engineers often favor working in industries perceived to be "greener" than oil and gas.

It is important that today’s workforce is training in new technologies and to help them embrace and adapt to new technologies and the changing demands of their workplace and roles.

Furthermore, workforces, particularly in manufacturing and process industries, are aging, and consideration needs to be given on how to avoid the loss of valuable knowledge and experience to retirement. It is important to actively capture process knowledge by converting data collection and analysis practices into software applications that can be deployed remotely. These “advanced digital service” developments are fundamental to the collaborative operations way of working described earlier.

Aware of the challenges this brings, at Ceraweek 2018, ABB’s Peter Terwiesch outlined his company’s desire to “make manufacturing cool.” “Equally important to capturing the knowledge of our wise men and women is to attract the

CASE REFERENCE

ABB and The Economist publish Automation Readiness Index

Advanced automation can mean better, more meaningful jobs for humans. But even countries most ready for the future of work must rethink education and training to prepare people for the jobs of tomorrow, a new study finds.

Fact 1: The report, "The Automation Readiness Index (ARI): Who Is Ready for the Coming Wave of Innovation?" finds that even the best-prepared countries must develop even more effective education policies and training programs, as well as place a new emphasis on continual learning over the course of a career.

Fact 2: The report recommends that policies must ensure that the adoption of automation technologies and AI will not leave people unprepared for the new, more human-oriented jobs that will be needed as robots and algorithms take on the routine tasks that will be automated.

knowledge inherent among a generation of employees who don't know what the word 'analog' means and have never dialed a 'landline' telephone.

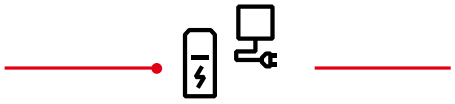
"We are investing in – and attracting young people to – technologies such as robotics, virtual reality and artificial intelligence – fields that are attractive to great young minds who will become interested and committed to our industries through the agency of great digital technologies."

Cyber security: Many traditional cyber security best practices do not apply to industrial control systems. For today's industrial control systems there is a greater scope of impact as systems expand to include connected computing devices, personnel, equipment infrastructure, applications, services and telecoms. In a control room companies cannot expect every user – at shift handover – to log off their system so that operators can track the actions of every individual. Use of cryptography to protect data in transit could mean time constraints are not met in control system communications. Many intrusion detection systems do not speak the communication languages of today's industrial control systems. A malicious command sent to an industrial device often looks identical to a legitimate command. There needs to be a better understanding of pattern of life analysis.

Generally, national and international oil companies adopt a "keep data within our gates" policy. There are many reasons ranging from close ties to government, sensitive commercial data and international conflicts. Many of these reasons are not related to cyber security issues but follow a "better safe than sorry" approach which, in effect limits the usefulness of the digital ecosystem.

IT/OT integration: A key benefit of IT/OT data integration is that it addresses the challenges of managing ever increasing costs, minimizing schedule overruns, mitigating risk, optimizing or maximizing production and controlling energy expenditure and efficiency. Unfortunately, many companies have little or no data integration across the value chain and still operate in silos, with data not being shared with other departments. Many still rely on spreadsheets combined with human expertise for crucial decision support. But, things are changing with companies now taking steps to implement IT/OT data integration. These players have a consolidated view of production systems and the most advanced can dynamically view and adjust operations across the value chain.

IT and OT cannot operate in silos if good shareholder returns are to be delivered in light of increasingly difficult and uncertain market realities. Companies are coming to realize that addressing emerging challenges effectively, means transitioning to an environment which provides remote asset diagnostics, continuous automation and production optimization made possible through a fully integrated approach to power, automation and telecom systems.



CASE REFERENCE

Innovation for the world's fastest upstream start-up

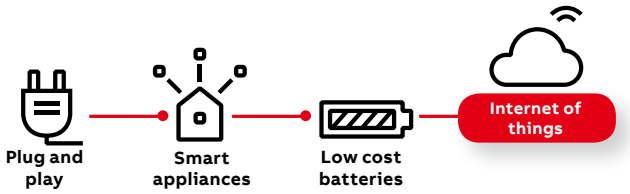
Working with Equinor, ABB is set to deliver the world's fastest ever start-up when Aasta Hansteen, a challenging field located in the Norwegian Sea, begins operating and produces its first gas later this year.

Fact 1: The Aasta Hansteen field is located in 1,300 meters of water in the Vøring area of the Norwegian Sea, 300 kilometers from land. The challenge from the customer to ABB was to help make the start-up process as quick and efficient as possible.

Fact 2: ABB teams worked with Equinor to identify and define obstacles and then used ABB Ability™ digital solutions to automate much of the process, reducing over 1,000 manual interventions down to just 20 and saving around 40 days in commissioning.

Building a digital strategy for energy transition

Success during the energy transition relies heavily on the creation of a robust digital strategy that has buy-in from the boardroom. Here are some key considerations that will help avoid investing scarce resources without realizing the benefits.



Prepare and retrain executives: The energy transition's success resides on an effective digital transformation roadmap, driven by a culture of innovation and technology adoption. Boardrooms need to act decisively and embrace digital by:

- **Setting a clear vision** – according to Accenture[8] those embedding digital and technology as a strategy beyond efficiency are finding that digital can create synergies across business, reduce duplications of investment and open their business to new opportunities.
- **Committing funding and resources**
- **Actively championing change management** and encouraging new ways of working
- **Accepting a flatter organization** where decisions can be made by well-informed colleagues deeper in the organization
- **Being receptive to new ideas** and ways of working by collaborating with the supply chain
- **Forming digitally-powered, multidisciplinary teams** with the freedom to think differently

Invest in talent: The fall in the oil price forced the industry to think differently. It introduced new technologies which depend on a new breed of engineer to fully understand the impact on a business. As the world transitions towards a different energy mix, this talent pool will evolve, and even more new skills will be needed. Companies need to continually assess the current skill levels and rapidly identify any gaps. They need to build a digital strategic workforce plan to address any shortage of skills. For example, social media crowdsourcing – asking a crowd of experts for ideas – has already proved useful in reserve analysis, where seismic data and other information is put into the cloud for crowds to suggest analytical technique improvements. This approach would work well in the sharing economy that oil and gas operators are now entering.

Continually explore the potential of digital: Building an end-to-end digital infrastructure that connects all data sources into a centralized platform, needs much investment – in time and resources. It is important to start now and identify the true cost implication so that realistic budgets can be set and a quantifiable return on investment established. Going forward, many oil and gas companies will not have full control over the supply chain, with distribution networks owned by partners. This alone will require a robust digital infrastructure where collaboration is essential.

Assess and benchmark current data architecture: Data and software integration is the number one area for consideration. There is an abundance of critical, yet disparate, software applications deeply embedded within operations. Using digital technology to integrate these software platforms is a significant area for improvement. However, unless highly reliable data is commonplace across systems and databases, users will mistrust it. Creating a strong culture of data integrity while ensuring data confidentiality and security concerns are effectively managed is, therefore, the most significant single digital investment companies can make. Without a strong foundation in capturing, safeguarding and sharing data, potentially business transforming insights are lost. Without adequate integration, new investments will be wasted as they will not be able to rely on historic data and will merely add fresh, high-quality, insufficiently used data to the rest.

Work the data harder: Today's analytics are more sophisticated at diagnosing, sorting, comparing and identifying cost savings and performance improvement areas than ever before, and certainly at a pace far faster than the average employee. These include visualization tools, predictive analytics, cloud-based analytics, machine learning and artificial intelligence. They simply allow oil and gas operators to do much more. Using digital insights to automate processes boosts throughput by eliminating delays from human decision-making and frees up employees to focus on higher value-adding activities.

Collaborate: Changing consumer preferences, such as the sharing economy, will bring challenges not yet apparent. Developing collaborative partnerships with peers and suppliers to innovate, develop digital capabilities quickly, and capitalize on new business models will be core to the success of the new world energy companies. Harnessing innovative ideas and, more importantly, turning them into reality will not be possible without industry collaboration both by production companies and suppliers along the value chain. Only in doing so will oil and gas companies drive innovation in the industry and secure competitiveness.

References

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