

September - October - November 2019

BP, Cognite and Equinor on how to move forward with digitalisation
The carbon and digital energy transition
Why OT cyber security needs more attention
A digital drilling operations portal
Better ways to work with inspections data
An AR platform for field workers



Opening



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The first training course for industrial drone operators was launched in Aberdeen in August 2019 by the Engineering Construction Industry Training Board (ECITB). The course was developed by Texo Compliance of Aberdeen, to ensure the next generation of drone operators can attain the skills they need to operate safely in heavy industrial environments with specific operational hazards and constraints

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The project management approach

Is it time we took more of a project management approach to digital technology projects for our organisations?

The Wikipedia page on project management says that civil engineering projects were generally managed by technical people - architects, engineers and master builders - up to about 1900. From 1950, organisations started to systematically apply project management tools and techniques.

We can say that digital technology projects for organisations are still generally managed by technical people - engineers and IT managers - and it may be time to apply project management tools and techniques.

To many people, project management means PRINCE 2 or Project Management Professional (PMP) - structured project management methods and practitioner certification programs. It breaks down the idea of a 'project' into themes, including establishing a business case, working out what organisation you need, deciding on the quality of the output and how you will verify it, making a plan for how you will do it, assessing risks, developing a change management plan, and monitoring progress.

We could say that the main difference between a project management approach, and the common way of doing digital transformation projects, is a relentless focus on the big picture, what we are trying to build. Where digital transformation projects often get bogged down in details, or trends, or trying to implement something which a software company persuaded you to buy, a project management approach continually looks at the big picture of what the organisation needs, and whether it is being achieved.

Digital transformation projects are not the same as civil engineering projects. There are many different risks and uncertainties, most projects are attempting to build something no-one has built before, and knowledge about which tools or 'platforms' can make a project easier is still evolving. Knowledge about how to give people information which helps them make decisions is still evolving. Knowledge about what exactly artificial intelligence can contribute - if anything - is still evolving.

Digital transformation project managers also need a good understanding of the various methods and technologies available – not just what they are, but what value they can add, and how to implement them to achieve this value.

For example, a project manager could recognise that 'Agile' is a good way to try out many different ideas quickly, and shut down ideas which are not working. But it is not suitable for all oil and gas digital projects. Many projects would work better with a more rigid approach, such as improving your master data management.

Digital project managers need to be aware of advanced technologies like machine learning. But as well as understanding what they can do, they need to understand how and where they can best add value, and how to implement them so this value is realised. Not many people have a good sense of this yet in oil and gas, but some people are learning, and you can see from the opening article.

Putting this all together, we can say that individuals and companies that take a project management approach ought to have a better likelihood of delivering on their project – but the full range of knowledge and tools of how to do it is very much lacking, since so much of this has never been done before. The learnings of how to make a project work (which is different from how to make technology work) is not very well shared.

We'll do what we can at Digital Energy Journal to put this right – with the articles in the magazine, and the exciting events we are planning for 2020 (you can see some of them listed on our back cover). We also had many exciting project management type discussions at our annual Kuala Lumpur forum in October, which we'll be reporting on shortly.

We hope Digital Energy Journal can make a useful contribution to helping digital technology projects work in oil and gas companies.

Karl Jeffery, editor



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BP, Cognite and Equinor on how to move forward with digitalisation

The "Digitalisation" forum at Offshore Europe in Aberdeen on Sept 4 included some interesting perspectives from BP's head of upstream digitalisation Rob Kelly; John Lervik, CEO of Cognite; and Rohit Singh, digital program manager with Equinor.

BP has been ruthlessly "screening" its upstream digitalisation projects, with the aim of only continuing the ones which are obviously going somewhere, said Rob Kelly, head of upstream digital with BP.

BP counted 440 in-house digital projects - but scrapped all but 80 of them. It had a debate on whether 80 was too many, he said

"A useful metric for judging digital projects turns out to be time - how long do you need to work on them before you make something valuable?"

Before the big shake-out, the general mindset was that it was OK if a project took 18 months to demonstrate value. This does not seem long when you consider the decade long time scales for field development projects. But worthwhile digital projects can usually show value much faster.

Now the criteria is 16 weeks to show value. The projects are scored on criteria such as whether there is good data available? Is there a full time "product owner" taking responsibility for making it work? Is the team able to work in an agile way to change direction quickly if the current direction is not working?

It realized the key part of making a project work is the data - and having a "data strategy end to end". "6 years ago, if you raise the word data everyone will fall asleep," he said.

The scope covers subsurface, wells, process and supply chain.

Work organisation

BP set up a "modern, open plan" office in central London for its digital work, away from BP's traditional office.

Staff are organized into project teams or "squads", who are focused on delivering the next stage of the product.

People are also grouped by discipline into "chapters", people who have the same technical interest or job role. This draws ideas from the 'agile' way of working.

There are two "chief product owners" covering all the digitalisation projects, who



John Lervik, CEO of Cognite

able product has been built. If not, the project goes onto the backlog of other projects to maybe consider again at a future date.

"The key thing is to ramp up the pace. It is really hard work," he said. "I haven't learned so much since university."

With the pace continually increasing, people like to say, "today is going to be the slowest day of the rest of your life," he said.

So far, none of the 80 projects have managed to "truly work in an agile way", he said.

BP brought in "experienced scrum masters" from outside the company, trained in Agile techniques, to try to improve the situation

An advantage of the agile way of working is that it stops the usual BP culture, based around big "waterfall" projects, where people would ask for everything they needed at the start of the project. They had an incentive to make the list of requirements as long as possible, to try to get more at the end.

Many of the problems in getting digital apps used in offshore operations are with the digital infrastructure or "foundation". For example, people say the wi-fi is too slow, or login times are too long.

Some of the shelved projects just weren't ambitious enough, with companies developing very "point" IT solutions. "Teams were looking through the wrong end of the telescope," he said.

It helps that BP's head of upstream Ber-

nard Looney has "lots and lots of ideas", giving the project a big "top down drive". But he cautioned that ideas are not the same as execution. Some analysts have told BP it ranks in the top quartile of oil companies for "ideation" and the bottom quartile for execution, he said.

The digital model has been copied by BP downstream.

Data and talent

The biggest challenges generally turn out to be the people. "Digital transformation is really about people transformation," he said.

BP is building up its internal digital talent, including software engineers, solution architects and designers, so it does not have to do so much outsourcing.

Spending money on the "right tech talent" can pay off, when you consider "a great coder gives you 100x an average coder," he said.

The company's digital HR director has been recruited from Google. "We've been trying to bring in external talent," he said. "They love the complexity of the challenge."

BP has been trying to improve the user experience, recruiting a new chief designer for digital apps, and asking to have a system which seems as easy to use as the apps on a smart phone.

In terms of protecting data, BP sees subsurface and wells data as its core intellectual property, so takes great care how this data is shared, he said.

But for topsides and facilities data, it would be useful to have more data from other companies using the same equipment. This could be used to build tools to assess equipment condition and identify problems. So, the company is much more open to sharing its own data there.

Cognite

John Lervik, CEO of Cognite, a company which manages operational data for industries, supported by Aker BP, talked about some of the challenges his company has

Reports from Offshore Europe, Aberdeen, September 2019

seen "helping operators solve their data push, people buying into the ideas. There problems."

Cognite's aim is to create a "digital representation of the physical world", which can then be "presented" to people within the company, or external companies, and used to find ways to get value from data. Or to put it another way, it is trying to "solve data in a scalable productized way."

One of the biggest challenges proves to be the number of "silos" in organisations, which makes it harder to integrate their data together, he said.

Mr Lervik says there is a "big hype" around artificial intelligence and machine learning. While it creates "fabulous value" in the consumer world, there are "very few examples that work" in the industrial world. This is partly because data from the industrial world is much less structured.

Before you can even consider AI and ML on the industrial world, you need to have some kind of a digital representation of the physical asset, he said.

AI can maybe best be seen as "sort of the holy grail", something you could use to optimise complex processes, once you had the data from different sources integrated together.

And for now, there is no way to easily link together different industrial data sets, he said.

However, companies don't need to try to optimise the whole company to get value, they can try to optimise parts of it, for example production, maintenance management or work management.

Although optimising all of this for a big company could take "years and years", he said.

Mr Lervik was asked the best way to get companies to collaborate. He replied that a challenge is that companies have different business models and so don't have incentives to change in the same way.

Also, vendors often make things more complex than they need to - because they don't get any rewards from making things simpler, he said.

Ultimately it needs to be driven by oil companies, as the customer, which can set incentives for the suppliers they work with to do what they want, he said.

Changing mindset is the hardest problem, he said. It is quite hard to do it without some top down control, orders from the CEO. But also, you need some bottom up

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may also be a need to "replace people" who do not adopt the right mindset, he said.

But while people may be the hardest, "we shouldn't underestimate the technical challenge. Nobody has done it before," he said. Gathering data from operations technology can be much trickier than information technology, with systems running 24 hours a day which cannot shut down.

In terms of attracting data scientists, Mr Lervik said it might be possible to attract them to work at oil and gas companies on the basis that they are "finding solutions to the world". In contrast, if they were working at a company like Amazon, they might find themselves using their skills to optimise ad placements.

Competence can prove very important in gaining traction as a start-up company – if you are able to differentiate between what customers actually need and what they say they want.

Mr Lervik does not believe oil companies are behind other industries. His company has been approached by banks and hospitals, because they have the same challenge. "Mining, utilities are working through exactly the same thing," he said.

One big help would be to have more standardised data APIs, standard ways for one digital system to connect with another. Tech companies like Google, Amazon and Netflix have an internal digital infrastructure designed to make it much easier to share data, with simple APIs enabling one system to be joined to another, he said.

Oil companies are more complex than tech companies, with lots more systems. "But if we can do it, it would be fabulous," he said.

Equinor

Rohit Singh, digital program manager with Equinor, said that people "at the top of the company" see digital to be "central to what we do".

They anticipate benefits from digital technology such as 15 per cent cost reduction in drilling, and 30 per cent capex reduction in future field development.

Equinor has a "roadmap" with six programs, covering the entire value chain, which it uses to prioritise what to focus on.

There is a project to set up a single data platform, called Omnia, which he describes as "a fairly aggressive approach to cloud and data".

Equinor has an integrated operations centre for the Norwegian Continental Shelf, looking at both production optimisation and preventative maintenance.

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Equinor's Mariner field, with first oil production in August 2019, turned out to be something of a big step for digital in Equinor, with "a lot of digital transformation in one step."

It is developing new types of automation, including for drilling, which is being rolled out "across multiple rigs".

Equinor thinks all its projects should be led by the business units, not the digital department. The business units set their targets and have accountability to reach them

There are also some "orchestration mechanisms" around the company to guide the digital work, and efforts to encourage innovation.

When digital teams work well, "you will feel a bit of a buzz," he said.

Most of the effort ends up being invested "mainly around people," he said.

Some advice is that "it is important to understand what you are looking at." There is a lot of jargon associated with digital technology, but it doesn't mean there is anything magical or beyond understanding. "It is important to de-mystify technology, then it becomes easier to see the opportunities. Try to understand what's underneath," he said.

Also bear in mind that the people with the best understanding are not necessarily working for the company. So, to get the best answers "you have to listen, get out more, have more interaction with smaller companies," he said.

Ouoting Intel co-founder Andy Grove, he said "execution is everything, ideas are important - it is execution that matters. Stick to your target."

The company treats some data as more sensitive than others but does not differentiate data into whether it is something 'owned' or 'shareable', he said.

Equinor works closely with Microsoft. Mr Singh likes the fact that Microsoft has been through several of the same challenges as Equinor, being itself a large and complex company.

One of the biggest challenges for the digital team is that its "access to domain experts is getting strained," he said.



The carbon and digital energy transition

Christina Figueres, former executive secretary of the United Nations Framework Convention on Climate Change (UNFCC) was joined on an Offshore Europe panel by speakers from AkerBP, Shell and TechnipFMC, discussing what the 'energy transition' means to them

Christiana Figueres, former executive secretary of UNFCCC, (United Nations Framework Convention on Climate Change) said that the oil and gas industry is seeing increasing competition, such as from oil in vehicle fuels being replaced by electric powered vehicles, and gas power demand being replaced by renewables.

She was speaking at the Offshore Europe plenary session in Aberdeen on September 3.

"Renewables have non-volatile marginal cost of zero," she said. Also, there are now \$6tn of assets which have "pledged to divest from fossil fuels," a huge increase over recent years.

Some insurance companies are pulling away from fossil fuel, she said.

The coal industry "has reached its full run of social license, no more tolerance. I would argue oil and gas follow them [with] social license and financial license issues."

The arguments that oil and gas people make against the move to renewables, such as that it will have a big impact on society, could be categorised as "defensive arguments," she said.

"There is an unavoidable transition of the business model. I would argue this is the moment to "strategically transition".

"The shelf life of oil is definitely not more than 30 years. By 2050 we will have net zero emissions. Or the survival of humanity is not in question, it is condemned."

There should also be a dramatic increase in carbon capture and storage. "In a net zero world, it is not oil and gas [which is the problem], it is emission, so that is what has to be looked at," she said. It offers a "huge possibility for business continuity."

The oil and gas industry does have capacity to contribute to the climate problem. "This industry is the single most privileged treasure trove of skill and experience to contribute to the world," she said.

If the oil and gas industry wants to maintain its license to operate, it "must stop lobbying against climate change regulation. Or you will totally lose whatever license to operate you have," she said.

Aker BP

Karl Johnny Hersvik, CEO, Aker BP, describes his company as a "tech company that just happens to produce oil".

"We want the same mindset that modern tech companies do," he said.

The company started in 2014, and so grew over a period when the oil price was plummeting.

It had to think hard about what the winning strategy would be, and decided it came down to maximising utilisation of its resources and minimising time. "You have to be allergic to waste in any form," he said.

Also, "we work as hard on reducing CO2 footprint as on reducing our cost."

Mr Hersvik is proud of a story of a company employee who was running to be elected as a local politician. An opponent from a green party asked him what he had done to reduce CO2 emissions, and he was able to say, he electrified the first jack-up rig on the Norwegian Continental Shelf. Then he could turn to ask his green opponent what he had done to reduce CO2 emissions.

Mr Hersvik sees that managing costs and sustainability go together. "You cannot do one without the other."

The company has a mission to "re-engineer the entire value chain – share knowledge, competency, targets, goals," he said. "We've been following a lean improvement journey. It is not easy to do."

"The business models need to be flexible. Easy to say and very hard to do."

AkerBP created the operational data management company Cognite, which now "may be the fastest growing IOT platform," he said. It is building ground in all areas of asset heavy industry, not just oil and gas.

Oil and gas problems are more complex than other sectors. If someone has managed to optimise an oil and gas compressor, going on to optimise a wind turbine or solar plant "feels like a breeze".

Aker BP developed an onshore control room for its offshore operations, which has led to both better uptime and better safety, he said. It is pushing for dual drilling operations, when a rig drills two wells at once. "I was amazed this hasn't been done before," he said.

It is trialling robotic tools on FPSOs which can inspect paint, remove paint, do high pressure washing and sandblasting, and apply new paint.

The industry should be sharing more of its data. It only uses 3-5 per cent of the data, so could at least share the 95 to 97 per cent of data it does not use, he said.

"We need to think like a tech company," he said. For example, a tech company person might ask why they can't access seismic data while drilling exploration wells, all on a smart phone.

On the carbon side, Aker BP has to pay carbon costs for emissions from its own operations, so gets a direct reduction from reducing these.

But it can work out more financially efficient to reduce CO2 emissions from other parts of the value chain, including CO2 emitted by oil consumers, the so-called "scope 3", he said.

"There's a lot of capital out there which would be better spent on scope 3. Scope 1 is pretty optimised."

TechnipFMC

One way the oil and gas industry can reduce carbon footprint is by using less steel, said Arnaud Pieton, President Subsea, Technip-FMC. The company claims that its "Version 2" subsea tree has half the carbon footprint of its "Version 1", achieved by using less steel in its manufacture. This leads to add-on benefits such as from being easier to transport and requiring smaller cranes.

TechnipFMC is trying to push customers to adopt more standard designs, but it is proving a struggle, he said. But standard designs should make it easier to reduce waste.

So far, customers have proven reluctant to pay more for a product which is less carbon intensive, he said.

In one project, the customer, an oil major, asked for the project to be "accelerated", which would mean ships going faster and using more fuel. The oil company agreed to plant 100,000 trees in Africa to compensate for the extra carbon costs.

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Shell

Wael Sawan, Upstream Director, Shell, said he sees the oil and gas industry making a "transition" to much more collaborative working happening in the oil and gas industry.

This has happened over the past 5 years, as a

by product of the industry's focus on removing waste. It found collaborative relationships could achieve much more efficiency than adversarial ones.

The industry needs to ensure it continues to make an attractive case to investors. Partly this is about technology, including using data

to be able to intervene at the right time and extend the life of reservoirs, he said.

Shell is making big investments in the North Sea, but the investment comes with "strings attached" - ensuring that the region is an attractive and safe place to grow, he said. digital energy

Total's CEO Patrick Pouyanné on carbon

Patrick Pouyanné, President and CEO of oil major Total shared his views on how the oil and gas industry should approach carbon - and what Total is doing - at an Offshore Europe plenary session in Aberdeen on Sept 3

"It is quite an important moment for industry, everything is changing very quickly," said Patrick Pouvanné, President and CEO of oil major Total, speaking at a plenary session at Aberdeen's Offshore Europe event on September 3.

"We can all see the scale of the challenge we face [delivering] reliable, affordable and clean energy. All these words are important, but society puts emphasis on the last one. All citizens are asking us to find ways to solve climate change," he said.

The North Sea oil and gas industry made big efforts to improve since 2014. A \$30 oil price "could have been an end to the basin. These efforts saved the basin [with the] principle of discipline. Barrels per head count improved 57 per cent from 2014 to today," he said.

"But it remains one of the most expensive places to operate. And the North Sea is not the best around the world for safety."

When it comes to carbon, "improving energy efficiency of operations is key," he said. "Everyone should know carbon dioxide emissions of every site. It is a way to motivate people to contribute to the challenge."

"I'm a supporter of what the UK government did for carbon prices. UK has demonstrated it is not so complex," he said. The price was "£20 tax per tonne - not \$100 - and it worked [in disincentivising coal]."

With carbon capture, "we could see a future of North Sea becoming a sort of giant cave of CO2." To get there, "we need to intensify activity, for pilots, R+D, CCUS chain."

"It will be fundamental if we want to produce steel, concrete around the world."

Mr Pouyanné was asked if the company can give dividends to shareholders and also be sustainable. "Shareholders will not just want dividends today, they want dividends tomorrow," he replied. "Dividends for me are a

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Patrick Pouyanné, President and CEO of oil major Total

consequence of being sustainable. We never increased a dividend in 30 years."

"If I want to be sustainable, I need to invest in oil, oil which is profitable, competitive. We don't explore in the Arctic, because it is not competitive."

"We have invested \$10bn in being a low carbon power producer [covering] gas or renewables. This will continue to grow. We invest \$1.5bn to \$2bn this year in this business unit. Some people tell me it's too small. But it is not so small compared to a utility."

"The challenge is finding [low carbon power] projects, he said. "You have to get access to land to make your projects."

Total has set up a purely online electricity retail company, which now has 6m customers in France and Belgium. It has a very low-cost model, with 600 staff, replacing a company which had 10,000 employees. "I can tell you we make money - we don't make big money," he said.

It needs a certain scale to work. "It is a business where you need to amortise fixed costs - marketing."

The company needs to continually improve its portfolio of oil and gas projects. "We are in commodity business. I don't set the price of oil. I can act on my break even," he said.

The company has "rotated" more than 30 per cent of its upstream portfolio over the past few years. "We replace high cost assets by low cost assets. It's fundamentally a business of assets."

The company acquired Maersk Oil in 2017 and Anadarko's operations in West Africa in April 2019, as part of efforts to acquire more low-cost assets. But now the company is more in a divestment phase. "We need to divest \$10bn" he said.

Total manages its risk to geopolitical upheaval by having operations in many parts of the world. It has a background of being obliged to develop outside its home country, France, because France did not have oil. At the moment, "number one for investment is Russia, number two is US. I try to balance between Mr Putin and Mr Trump." digital energy

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How EY and DNV GL see the future of energy

Paul Bogenreider, energy futurist with EY, and Liv Hovem, CEO of oil and gas with DNV GL, presented their vision of the future at the Aberdeen and Grampian Chamber of Commerce Business Breakfast at Offshore Europe on September 3

Paul Bogenreider, economist and 'energy futurist' with professional services firm EY, said he sees the future of energy as more evolution than revolution. "As much as we might want to have a rapid transition, the energy transition is going to happen one car at a time, one solar panel at a time," he said.

The key factor driving change - or not - is whether consumers can be persuaded to change, and what they really want.

The future of energy is ultimately determined by people's purchasing choices and what companies bring to the marketplace. Governments have some influence on this through their decisions about taxes and other policies, but maybe the climate change discussions focus too much on governments.

And we need to bear in mind that "people like energy pretty much the way that it is," he said. What people have now is what they like. Electricity from renewables has disadvantages over fossil fuels in terms of price, reliability and convenience. Persuading non climate enthusiasts to switch from a five minute gasoline fuelling of a vehicle to a 30 min electric charging won't be easy.

"The energy complex we have today has enabled enormous improvements in quality of life. It's going to be very difficult to give that up," he said. Today's energy industry is also "enormously profitable" for many companies.

In terms of technology, we are not far away from a point where electric vehicles can compete with gasoline vehicles, and society can function without climate change being a problem. But the bigger problem is likely to overcoming people's current habits, not technology.

The financial machine also needs to change. "Energy is an efficient machine which funnels money out of savings accounts into the oilfield.



Paul Bogenreider, energy futurist with EY

The energy transition is the most significant capital re-allocation in the history of mankind," he said. "Capital markets are not equipped to move that quickly."

The energy transition will not actually affect oil and gas people very much, Mr Bogenreider believes . Wells are already depleting faster than the demand for fossil energy is reducing, so the oil and gas industry still needs to attract investment for new developments, and so offer competitive returns.

Currently renewable energy is growing at a rate where it takes 10 years to supply a further 1 per cent of people's energy needs. To reach the targets, "you have to go up 1 per cent every year for the next 20 years," he said.

You don't need every business to become carbon neutral, because with carbon capture and storage, we can achieve zero carbon overall using offsets.

But getting CCS started needs "some brave projects to move forward", he said, so the costs come down.

And without any carbon price, "I struggle to visualise what the profit model [for carbon capture] looks like," he said.

"My intuition tells me biofuels will be fairly critical," he said. " If you transition from petroleum to biofuels, you create a closed loop system."

DNV GL's predictions

Liv Hovem, CEO oil & gas business area, DNV GL, said that the company wanted to make a single prediction of the future, not just a range of forecasts or scenarios.

In its 2019 "Energy Transition Outlook", published in September 2019. It predicts that global oil demand will peak in the mid-2020s. But gas will still account for 30 per cent of the energy mix in 2050 and oil 17 per cent. There will be "significant uptake" for solar and wind, and electricity consumption will double by 2050. 63 per cent of energy will come from renewables.

Gas demand in 2050 will actually be higher than it is today – although we will see gas and renewables working closely together. "Neither can make it by themselves," she said.

A growing number of countries are setting targets to be zero emission, including Britain – al-



though DNV GL predicts that Britain will miss this target.

Overall emissions will miss the Paris climate goals, leading to a 2.4 degree increase in temperature. DNV GL predicts

Liv Hovem, CEO Oil & Gas Business Area, DNV-GL

DNV GL believes that the main reason carbon capture has not been installed yet is cost, but if technology was installed on a similar scale to renewables and wind, these costs could come down.

"It is a bit of chicken and egg situation. This requires some bold decisions," she said.

"Our forecast says CCS will not be implemented at scale before 2040 unless there is a carbon price. So future lies largely in the hands of policy makers."

But "more than 40 per cent of oil and gas professionals believe there will never be a global carbon price," she added.

But can industry find other ways to implement carbon capture and storage? Ideas circulating include finding ways for hydrocarbons to support renewable energy, making hydrogen offshore by electrolysis from renewables or from gas + CCS,

She noted that offshore wind was barely being considered just a decade ago – that illustrates how fast things can change.

"Our industry is rapidly innovating towards a common goal. It is inspiring but we need much more of it," she said.

Ms Hovem is a little more optimistic about persuading people to change, saying that "people do adapt quickly to new technology. "I see people around me do this. It is just a mindset."

Ms Hovem said she is interested in technology which can be implemented using existing infrastructure – because one of the biggest obstacles to new technology is the need to build new infrastructure to support it.



Benefits from digital transformation "thin on the ground"

In an Offshore Europe conference session on Artificial Intelligence, analyst company Wood Mackenzie said it reckons the benefits from digital transformation are proving thin on the ground. Although Microsoft cited two examples

Martin Kelly, Vice President, and head of Corporate Analysis, Wood Mackenzie, said that there seems to be fewer "specifics" being shared by companies about the benefit of digital technology, or examples of successful digital transformation.

He was speaking at a conference session "Artificial Intelligence", at Offshore Europe in Aberdeen on Sept 3.

And where examples are shared, it isn't always clear that digitalisation is responsible for all of the improvements cited – there can be other factors.

"Industry is finding digital transformation at scale harder than they first thought," he said.

The big 'prize' is reducing costs, improving safety and value – and the challenges of achieving that with digital technology is proving to be "massive".

Meanwhile oil companies are not spending any more money on technology research.

There seems to be something of a disconnect between executive management and employees in expectations for digital technology – with managers expecting big gains, but employees more aware that the benefits are rarely meeting expectations.

How quickly analytics can scale depends largely on data, and how usable it is, Mr Kelly said. But the industry has traditionally seen data as more a liability than an asset, and not taken care of it very well.

Microsoft

Alessio Bagnaresi, AI Sales Lead in the Intelligent Cloud team, Microsoft EMEA, said that analytics systems should ultimately "support human beings to make decisions". And one of the biggest strengths of machines is that they are "very good at finding patterns in data."

Microsoft sees where "artificial intelligence" based technologies which can help the industry. For example, apps and agents with AI embedded in them, knowledge mining tools, and machine learning, running on domain specific pretrained models.

Getting value is "always a collaboration between data scientists, domain experts and IT," he said.

"We need to constantly monitor accuracy of machine learning models."

Mr Bagnaresi cited projects with BP to better forecast the recovery factor of wells using machine learning, and a project with Shell to analyze live video imagery from petrol stations to try to spot people smoking on forecourts.



Schneider Electric - Integrating power and process systems

There can be benefits to designing power systems and process systems in parallel, rather than doing the process systems first and then adding power as required, as it has been done until now, says Schneider Electric

Up to now, offshore plants have been largely designed on the assumption that power could be made available as required. Platforms were often built with more electricity generation than they needed in normal operations, just to handle a possible peak load.

But the emphasis on decarbonization, as well as carbon pricing, is making a different approach make more sense, where power systems are designed alongside process systems, with a view to a design which does not require so much power, says Eric Koenig, Vice President Strategy for Oil, Gas & Petrochemicals with Schneider Electric.

Process systems are about the flows of the gases and liquids around the plant, and how they are processed, for example cleaned, separated or dehydrated. They need power for heating, pumping and compression.

There can be big CAPEX and OPEX savings in reducing the maximum load which the generator needs to be able to provide, he says.

The power requirement of a refinery can be as much as 100MW, equivalent to a city of 50,000 people.

Reducing the power generation requirement by a couple of megawatts can mean big changes in capital and operational expenditure.

Perhaps savings of up to 20 per cent are possible on capital costs of the overall electrical package of a typical plant, he says.

There are savings multipliers. Every kg of weight which does not have to be installed on an offshore platform means saving 7kg of platform structure to support it. Every square metre on the deck of an FPSO costs about 40,000 Euros to construct – so there are big savings from having an electrical package which requires less space.

Different project approach

If companies want to design process and power systems in parallel, they may need to change the way they execute projects, he says.

Combining process and power design may mean a change to the way oil companies execute projects.

They may need to take more time on the upfront design – which is hard to do when there is pressure to get to first oil as quickly as possible.

The asset performance management systems have traditionally been quite siloed, for example a system to manage a distillation column. But for better energy savings we need to move to a more holistic and integrated approach, where you can see all aspects of the plant at once, including both power and process.

An integrated approach can also make the whole project run faster. An example is Egypt's Zohr project, getting a gas field into production in 18 months, where the industry norm was more like five, Mr Koenig says.

Schneider Electric supplied both the integrated control and safety system (ICSS) and the electric package for Zohr.

Integrated monitoring

Another factor in efficient operation of power and process systems is monitoring – how well people understand what is going on – and if they have an integrated view.

Consider the sophisticated monitoring systems routinely installed on aircraft engines. Nobody would consider flying on a plane without them, says Mr Koenig.

A good monitoring system would also include any information necessary to make fixes within the software, so there would be no need to access manuals.

On an ongoing basis, having a more integrated view of what is happening can mean the capacity to reduce energy consumption by 5-7 per cent.

A simpler, better managed system can mean a 15 per cent reduction in downtime – or typically 4 days downtime a year rather than 5, at a cost of \$1m a day, he says.

An impressive example of integrating data is a project Schneider Electric and AVEVA did for an oil company in Abu Dhabi. It built a screen 150 feet long and 10 feet high, and is set to eventually integrate millions of information points, with data being shown from "half a million" different points at the moment, with calculations such as the dollar value of different flows and outages. So, you can see your losses in terms of dollars per minute. It includes tools for operations staff and tools for executives.

Customers are increasingly making demands such as "I want any operator to solve any issue in 20 minutes, otherwise I have to stop the plant for a day," he says.

This drives a need for better integration of the various systems.

AVEVA

Schneider Electric merged its industrial software business with AVEVA, an industrial design and engineering software company, in March 2018. This means that AVEVA tools can be brought in to help manage electrical systems like those by Schneider Electric, together with process engineering software from AVEVA.

Schneider has a white paper on its website with more on these ideas which you can find by Googling "integrated process and power white paper"



ABB – reduce offshore fuel consumption and improve operations

Companies which make an effort to reduce their fuel consumption in offshore operations often find ways to improve their operations in other ways at the same time, says ABB

Oil and gas companies are coming under increasing pressure to reduce the fuel consumption in offshore operations, such as from running compressors and pumps, because they are required to pay for CO2 permits for the CO2 they emit.

But often, the effort leads to the discovery of other ways to improve performance at the same time, says Martin Grady, Vice President and Global Industry Manager, Oil and Gas at ABB.

Working out ways to reduce CO2 emissions is quite an analytical task, focussing on what would make a material difference to operations, and what you need to measure. It requires both data and people with the right understanding.

But "almost always, whatever you measure improves," Mr Grady says.

A big area where energy might be better managed is in rotating machinery, such as compressors and pumps.

Companies are bringing in advanced control systems for offshore equipment, something which has previously only been seen in refin-



Troy Stewart, Head of Energy Industries, UK and Ireland.

eries. "We can run a process much nearer to its limits," he says. Additional benefits are reducing costs and risks and improving scheduling.

The key could be described as "extended automation", with better analysis of data, says Troy Stewart, Head of Energy Industries, UK and Ireland.

The push to more analysis and insight of what is going on is also leading to different choices about who to bring into the business, Mr Stewart says. "It can be a different mindset. Some of this stuff is more maths."

The subject comes together with better needs to train and work with talented people, and continually explore the potential of digital.

"Virtual plant" systems can improve training, helping people make better decisions, find more efficient ways to operate the plant, and make fewer mistakes.

Electrifying offshore

Many companies are looking for ways to electrify offshore operations, either by bringing in high voltage DC electricity from onshore, or with offshore wind turbines. These replace diesel generators as a source of power.

There are projects in Aberdeen looking at ways to network offshore assets together, so they can share electricity generation capacity. "That's a real opportunity, Mr Stewart says.

Companies are working out better ways to use existing power supplies on new subsea wells, and to overcome the technical challenges with it.

Autonomous operations

There are big savings and safety gains achieved from finding ways to operate offshore platforms without people. Just removing one role can mean savings of millions of dollars over the li-



Martin Grady, Vice President and Global Industry Manager, Oil and Gas at ABB.

fecycle of the platform, even if the work is just moved to somewhere onshore. "I don't think we're doing enough of it," Mr Stewart says. "It's not a bad thing to take people out of the loop."

The switch to autonomous oper-

ations is not usually an all or nothing step, but more something which builds up layer by layer. And it can be very risky to jump too many layers at once, Mr Grady says.

Suppliers get involved in operations

Oil companies are shifting their approach with suppliers – instead of asking for ways to minimise the capital cost of the project, they are asking suppliers to provide a quote, including servicing the equipment for 10 years, Mr Stewart says.

This means suppliers are rewarded for making products with longevity, rather than finding products which meet specifications but may cause problems down the line.

It also means that industry suppliers like ABB are getting deeper involved in operations.

After the oil price crash, oil companies have become much more receptive to ideas from suppliers for how to reduce lifecycle costs, he says.

OT cyber security needs more attention in many companies - ABB

Operational cyber security needs more attention in many companies, says ABB's cyber security specialists Ben Dickinson and Gavin Doyle. Companies are on guite a wide spectrum for how 'mature' they are with it.

Recent studies have shown that many control systems are directly connected to the internet which would indicate that many industrial control system operators must address the basics of cybersecurity, says Gavin Doyle, Telecoms and Cyber Specialist - Projects, Energy Industries UK, with ABB.

Even if you're not connecting a control system to the internet, "an operator cannot afford to do nothing [on cybersecurity]," he says.

And the bigger the company is, the larger its "estate" is, which it needs to protect.

Many companies still see cyber security as an "IT issue", says Ben Dickinson, Digital Operations Manager, Cyber Security with ABB.

The fundamental principles of cybersecurity are the same for both information technology and operational technology, Mr Doyle says. Although, one difference is that IT tends to have a focus more on information security, while OT tends to focus more on operational integrity.



Ben Dickinson, Digital Operations Manager, Cyber Security with ABB.

Operators with overall safety responsibilities on offshore platforms are increasingly being asked about cyber security and may have to include it as part of their safety management systems, he says.

Companies are being pushed harder to focus on cyber security, as it is now a major focus of many enterprise risk management practices, as well as new regulation.

Putting in barriers

The general approach is "we put as many barriers in place as we possibly can," says Mr



Gavin Doyle, Telecoms and Cyber Specialist -Projects, Energy Industries UK, with ABB

Doyle.

The barriers need to be proportional to the target and the level of the threat - just like in the physical world, where valuable things are kept under stronger locks.

Where necessary, devices can be "hardened" - equivalent to adding another fence in the physical security world - such as locking down more interfaces, making controls on what specific people can do, adding firewalls, and adding more advanced tools, such as intrusion detection, and continuously monitoring the baseline network.

In areas of high threat, companies can tightly control the links between the various networks.

A key technique is network segregation, where you create a "demilitarized zone" or DMZ between networks - then carefully control what communications can travel between these "zones". The result is a number of zones with different security levels that have different levels of security controls implemented within them, according to their designated Security Level and criticality to operations.

If you have a high-risk system being targeted by sophisticated hackers, you need a sophisticated intrusion detection system in place.

Many attacks take place over a long period of time. For example, some nation state threat actors can spend several months penetrating one system, learning as they go whilst remaining undetected. During this time, there may be a possibility to spot someone is in there, before they have an impact on your system, says Mr Dickinson.

However, companies should not believe that

just investing in a "one box solution" will solve all their problems, Mr Dickinson says. "Cyber security is a journey and requires a defense-indepth approach."

Risk assessment and validation certification

You can see cybersecurity as a discipline about understanding different scenarios where something could be targeted, and thinking it through, Mr Dickinson says, just like in the physical security world.

It is a similar process to the "HAZOP" studies oil companies do in safety management, with a structured process to work out the various ways that something can go wrong, and what is a sensible method to mitigate the risks.

Companies can identify if any change they are considering making will also impact cybersecurity.

It is possible to certify or validate cybersecurity.

One route is to work with third-party penetrating testing companies to certify that they could not break into a system.

You can also follow one of the cybersecurity standards and ask someone to validate that the standard has been followed. The standards can look very onerous, but the basics are fairly straightforward, and reflect tasks everybody should do, Mr Dickinson says.

Technology changes

One technology change which can lead to an adverse impact on security is the movement of systems to the cloud, including sending equipment sensor data. This leads to cyber concerns about what is sent to the cloud and who owns the data which is there.

Companies are getting a lot more data-centric in general, with more applications and analytics in use, which raises further potential security vulnerabilities, Mr Doyle says.

On the positive side, standards and technologies are evolving to meet these challenges. For example, the movement to 5G communications can increase security, because this standard has been designed with security in mind and features many enhancements to existing standards, Mr Doyle says.



Claroty – how the OT threat landscape is changing

As OT looks more and more like IT, and is increasingly connected to the internet, the cyber risk levels go up. And compared to IT, the problems can be harder to fix, says Claroty

Cyber threats in operations technology, such as control systems, has become much more critical over the past few years, largely because operational technology is looking much more like information technology. But OT can be much harder to keep secure, says New York cybersecurity company Claroty

There's been a lot more attention paid to IT security over the past few years. But operations technology security has in some ways become more critical, largely because of the increased "convergence" between IT and OT systems, says Dave Weinstein, chief security officer with Claroty.

Mr Weinstein is a former chief technology officer for the State of New Jersey, and also previously served at U.S. Cyber Command.

Claroty has been in business for four years and is active in 15 different "vertical" industry sectors in 25 countries, focusing in operational technology in each sector.

OT systems have traditionally not been connected to the internet. Now they are, and they are being subjected to remote threats, he says.

And these systems were never designed to be secure. "There's no basic security feature like you see on the IT side [such as] encryption, authentication, monitoring."

Changing threats

The 'barriers to entry' to be a hacker are decreasing. "It is getting easier and easier for less sophisticated, less resourced non state actors to actually play in this space."

There are many examples of so-called "script kiddies" – people just messing around with code to see what happens – who have been able to gain access to a critical infrastructure network, although not necessarily disrupt it.

The "script kiddies" can be employees, but not always. But "insider threats are something organizations tend not to care enough about," he says. "Almost a taboo subject – they don't want to admit that there's people in their organization that would go to those extremes. But it does happen."

"Employees tend to have the greatest access, the best intelligence about the network, knowledge how to evade detection. It is a serious risk for organisations."

"But it is hard to say what percentage of the threats are insider vs external."

At the same time, the attack "surface" – the number of operational devices it is possible to try to attack – is "expanding rapidly", he said.

That is largely to the explosion of "internet of things" devices, which have IP addresses and internet connections – including sensors, surveillance cameras, badge readers and mobile tablets

"From the attacker's perspective they are new opportunities to gain and maintain persistent access," he says.

On the positive side, Mr Weinstein sees fewer operational technology attacks coming from state actors.

Consider that China, Russia, Iran, North Korea, are largely thought to have the capability to make attacks which can create downtime or potential damage to operations technology. But to date – none of those countries have "attacked" the US, "depending on how we define that word," he says.

Nation states "are clearly holding back. They have more capability than they have brought to bear."

The worst state supported OT attacks ever seen could be the Russian attacks against the Ukrainian electric grid in 2016-17. But the impact was limited to a combined total of 6-7 hours electric outages for around 250,000 people, hardly a nightmare scenario.

Another big state supported operational technology attack, called TRITON, was made on a chemical plant in Saudi Arabia. It is thought to have triggered a safety system leading to an emergency shutdown.

Mr. Weinstein describes it as a "failed attack really."

"It is unclear if it was intended to be an attack – or more of a test operation, or some bug in the code prevented it from fully executing," he says.

Mitigating the threat

The first step to mitigating the threat of an operations technology attack is to get a better understanding of what is on your network. You can't protect or secure what you can't see, he says.

Typically, companies which operate networks don't have any understanding about them at all, and don't have any means of understanding it.



It is important to know what devices you have, including the software versions and serial numbers. You have to know how they are all communication with each other.

Dave Weinstein, chief security officer with Claroty.

"The initial piece of just gaining

visibility can be done relatively quickly without much investment," he says.

Then you can monitor if any communications go outside the norm. Operational technology communications are nearly all machine to machine communications, which means they should be predictable and repeatable.

"If you can profile those communications, you can gain visibility into deviations from those communications, then you can really increase your chances of detecting anomalies or malicious behavior on the network," he says.

"It doesn't mean every potential threat is going to be discovered, but you can increase your chance of detecting anything malicious."

Once you have done that, you can move to the more sophisticated cybersecurity measures, including vulnerability and patch management.

"Vulnerability management is hard enough on the IT side, it is really hard on the OT side," he says. "You've got a lot of vulnerabilities, many of these devices are extremely old, and the risk to the operation of patching is usually high. You may need to shut a plant down to install a patch, which has big costs.

Claroty's offering

Claroty produces a product which can continuously monitor all OT communications, to try to detect anything bad happening. It has a device which can be connected to the network via a switch, and passively monitor all communications through the system.

Its software is trained in the different communications protocols used by different OT equipment, and so it is able to 'parse' the data traffic to understand which system generated each piece of data, and what it is for.

"You need to do all the hard work of reverse engineering the protocols so you can fully understand the communications," he says. Ultimately you can get "a very granular under-

standing of everything that goes across the wire."

This can still be difficult -a command, for example, to open a valve, can look the same whether it comes from the intended source or a hacker.

But you can then look for where the command is coming from, what time of day it is occurring, and other indicators. You can establish a 'baseline' of how the command normally looks like, then detect changes from the norm. "If it comes from a box that never issues that command, that would be an indicate that someone is on the network," he said.

The next question is what to do if anything is detected. In operations technology, it would be dangerous for a cyber security system to automatically shut something down. "We haven't met a customer yet who wants us making decisions about their network, and frankly I don't blame them," he said.

But you can give alerts to a plant engineer or security operations centre suggesting that someone looks in more detail at something and decide what to do. The system can follow rules to block certain communications in certain circumstances.

Mr Weinstein believes that in a few years, systems like this will be as commonplace as virus scanning on PCs today. In a few years, "we'll look back and laugh when we think about the fact that nobody was monitoring their OT networks," he said.

"The overall maturity level in our industrial ecosystem is going to increase drastically over the next couple of years."

Emerson – how automation can help improve operations

No oil company is leading the world in really every area of operations, and so we can say that every company has potential to improve, says Patrick Deruytter from Emerson. And automation can play a pivotal part in helping them, he says

All oil companies want to improve safety, production, energy consumption in production, and reliability of production processes, says Patrick Deruytter, vice president, Northern Region Europe, Emerson Automation Solutions.

No company "outperforms" in every one of these categories, and so we can say that every company has scope to improve, he says.

Today's technology and evenly aligned processes can play a big part in achieving this improvement. In fact, over the past years we have seen many technology improvements that sounded big from a technology perspective, such as increasing the number of colours on displays from 16 to 4,000. But these improvements, while important, did not "really change the dials" of how people work, or make it easier to run processes, he says.

The really big changes can come from rethinking the collaboration across the full life cycle of the project and the asset, automating workflows, building better systems to support decision making, upskilling the workforce, better supporting mobile devices, and better change management, he says.

Another big source of efficiency improvement could be finding ways to reduce duplication of work. "How many times is work not redone by someone else all because we don't trust each other?" he asks.

The way that experts work with data is changing. In the past, it was about 'bringing specialists to data'. This would create important delays and costs.

Now it is more about 'bringing data to the specialist'. There is instant collaboration between the end user, the local service team and the best support hub on the planet. As such based on the primary diagnostics and analyses the right person can engage and collaborate in finding a solution, he says.

New ways of measuring are giving us new opportunities in supervising and managing our plants. As an example, by measuring sound, we are opening a new understanding of the current state of the process. This means these measurements can do an equivalent role to the oldschool plant operator who said they could tell what was happening from listening the noises which all the equipment was making. These analytics are alike a "big ear over the plant," he says.

The new generation of digital twins are also easier to use, to engineer and to maintain. Therefore, these digital twins have an improved cost of ownership, he says. No doubt there are further benefits in our ability to feed these models with real time sensor data connected to cloud hosted software. Chevron does this, connecting sensors on 5,000 heat exchanges to Emerson software running on Microsoft Azure cloud, he says.

"The majority of our customers are thinking about digital transformation," he said. "Unfortunately, the overall adoption is still slow. Only 20 per cent have a clear road map. People talk about it but moving forward seems to be an issue."

Intelligent insight

Systems are also improving in terms of the level of insight they can provide, says John Hartley, director of sales and marketing, Process Systems and Solutions at Emerson Automation Solutions.

The technology to gather data from different sensor devices has been around since 1984,

with the development of HART ("highly addressable remote transducer) technology. But still today, not many people are using this data from their devices, he said.

Until recently, a problem was that there was a lack of infrastructure to transfer information onto and the true understanding of all the data. But this is getting solved. Now the main obstacle is the need to develop new work processes, he says.

As an example, consider the desalter, a piece of equipment in a refinery to remove salt from crude using electrolysis. With the data from the various sensors you can pinpoint where maintenance is required. You can use "pervasive sensing", a term which basically means using lots of sensors continually.

The challenge is working out how to make decisions with all of this data. Through deploying "human centred" systems and interfaces we create a step change in delivering and understanding data. It is one thing to know that there is high acidity which may cause corrosion, another to decide on a course of action.

It is also becoming possible to build much more sophisticated alarm systems designed to tell people exactly what they need and understand the information they are being provided, when something goes wrong.

Alarms used to be hardwired systems, which were costly, not particularly informative, and could lead to 'alarm floods' where a problem would trigger several alarms at once.

Now you can have an integrated control and safety system, with views at different levels, from overall picture to detailed vibration analytics, and data configured for people in different roles, he says.

Fieldbit – platform for field service visualisation

US / Israeli company Fieldbit has developed a 'platform' which companies can use to develop information visualisation systems for their field service staff

US / Israeli software company Fieldbit has developed a "platform" software system which companies can use to provide augmented reality / information visualization-based tools to their field service staff. These are people who do maintenance on equipment.

Fieldbit sees itself as an "Augmented reality multi-source knowledge platform for enterprise field service" – a platform which companies can use to apply augmented reality taking data from multiple data sources to provide knowledge to their field service personnel.

There are two target markets – people who work on complex expensive equipment, and large teams of field service technicians doing similar work. There is a strong business case for both groups to build better systems which give information to field technicians, says Evyatar Meiron, CEO of Fieldbit.

Within the oil and gas industry there are three target customers – asset owners, asset manufacturers, and service companies.

It could be considered a "maintenance information visualization system," he says.

The software is cloud hosted and provides an app which can be downloaded onto smart phones or smart glasses.

It does not need an always on internet connection to field workers to function – data can be uploaded to the device in advance of the work being done, so everything can be done offline.

Fieldbit sees its offering as a platform, which customers can use to build and manage their content – so can include enterprise knowledge, and maintenance troubleshooting information in one system.

The information can be provided via smart glasses (screens which people wear over their eyes, like Google Glass), or via smart phone.

The information is much more readily available than it would via pdf manuals or telephone calls. By having better information immediately available they field staff can improve productivity, he says.

The biggest challenge with the system is working out which is the right information to put in front of someone, Mr Meiron says. You need to really understand what customers need.

One idea is that augmented reality can be used, to reveal operations data in the smart phone screen, layered on top of the live camera image of the equipment. The operator can also add additional information. A system like this might be preferred by millennials, Mr Meiron says. "The way they learn, and think is completely different."

It is also possible for the 'smart glasses' to gather and stream live video to remote experts, who can then guide the technicians on what to do. Videos of the task can be kept on file, because they may be useful next time someone has a similar problem.

Setting it up

Setting up an augmented reality service involves connecting database information with visual images – so the computer system knows which piece of data to overlay on the image of which piece of equipment.

Setting it up is a similar task to pairing a Bluetooth headset to a computer, Mr Meiron says. You take a photograph of the equipment and then tell the computer which real time value from your database should be superimposed on the image in which place, next time someone has an image of the same equipment on their phone.

The data can be drawn from asset management software, GIS systems, or any other software.



Closer supplier relationships to reduce subsea development costs

If oil companies develop deeper working relationships with suppliers, there are ways to achieve big improvements in subsea field development costs, says Baker Hughes GE

If oil companies could be persuaded to work in a more integrated way with suppliers such as Baker Hughes GE, it might be possible to achieve big reductions in the costs of developing subsea oilfields, says Romain Chambault, manager of Baker Hughes GE's European oilfield equipment business.

By combining better decisions about equipment, finding ways to get fields online faster, using standardised equipment, developing new commercial models, and using digital technology working with real time data, there can be big savings. "It is a very powerful story," he says.

Baker Hughes GE estimates it might be possible to save 30 per cent of the costs over the life of the field – from studies of the reservoir to drilling, completion, and intervention. This aligns with the Oil and Gas Authority's drive to get more smaller reservoirs, or 'small pools' online – which requires reducing the cost of developing and operating them, to make it viable.

The move towards more integrated working relationships is already happening as North Sea oilfields gradually change ownership from traditional oil companies to private equity backed companies. These often look for more collaborative relationships with suppliers, he says. These operators often look for suppliers to provide technical expertise, having less among their own employees.

But this does not necessarily mean life is easier for suppliers – private equity backed companies are often looking for faster return on investment than traditional oil companies, as well as a continual drive for lower costs.



Romain Chambault, manager of Baker Hughes GE's European oilfield equipment business.

One way to reduce the cost of developing subsea fields is "to engage a lot earlier with suppliers," Mr Chambault says.

For example, if suppliers may be able to use their expertise to make better suggestions for layout of equipment or how to develop the field, so that both capital and operations costs are reduced.

In terms of commercial relationships, Baker Hughes GE is entering more arrangements with operators where it takes on some of the reservoir risk. The oil company pays the supplier less money upfront, but the supplier takes a cut of the returns from the reservoir.

It can also help companies work out ways to optimise equipment and field performance, working out the best time to upgrade equipment and do interventions. If clients provide access to real time data, it can monitor the equipment while it is in operation, he says. Sharing data "used to be very unusual" – but is being seen more and more."

To help clients make better use of digital technology, Baker Hughes formed a partnership in June 2019 with machine learning company C3 AI, to help it do more with well data, making predictions and working out how to optimise, including planning, staffing, sourcing and safety. The two companies plan to collaborate on "new integrated AI applications specific to oil and gas, and offer combined teams of oilfield and AI expertise deployed directly into customer environments to deliver AI solutions that meet specific business needs.

Shell is already a customer of C3.ai, using it for predictive maintenance. It also has a long-standing relationship with BHGE for oilfield services



Eigen – integrating drilling and equipment data

UK software company Eigen has built a digital drilling operations portal for Lundin Petroleum and a digitalized engineering support project for oil and gas operator Chrysaor

UK oil and gas software company Eigen has built a "digital drilling operations portal" for Lundin Petroleum, compiling data from 18 drilling reports into a number of integrated dashboards.

The aim is to give people a much easier way to understand current status, reduce "e-mail clutter", and make it easier to share accurate information between departments.

So staff will no longer need to work with the multiple reports and spreadsheets shared across different departments to find out what is going on.

"The portal will go a long way towards making platform operatives more efficient and helping them to spend less time looking for information," said Lundin's Project Lead, Martin Westeng.

Managers can get an overview picture of all their rigs, what they are doing, how far they have drilled, how productive they are (e.g. in feet per day) and associated financial data.

The portal can show the costs of various delays – so people can immediately see that the delay waiting for delivery of a part has cost hundreds of thousands of pounds.

For example, you can show details about flights, people on board and the names of key



Murray Callander, CEO of Eigen.

are sent from the rig every day. All the offshore crew need to do is send it to one more e-mail address, says Murray Callander, CEO of Eigen.

The hardest part of the software development work was bringing together multiple pieces of data together so you can display something clearly, such as the time depth curve, how the drilling progressed over time.

"Calibrating time-depth is an art," Mr Callander says.

To ensure reliability of the data, Eigen tries to minimize the number of links in the data chain, from the data source to the drilling portal, he said.

It is critical that the data in the report is accurate, otherwise "people stop trusting it really quickly."

The contract between Eigen and Lundin is defined as "Development as a Service (DAAS)," where Eigen agrees to continually develop the software, adding features which the client requests, for an ongoing fee, rather than a one-off contract to build to a specification.

Eigen has been Lundin's digitalisation partner since 2015, and has developed a number of operations dashboards, including giving real time visibility of people offshore.

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In September 2019, Eigen announced a "digitalized engineering support project" with oil and gas company Chrysaor.

Eigen will build process system monitoring, equipment performance monitoring and condition monitoring displays for Chrysaor's critical mechanical and process equipment.

It will be set of "asset overviews", including data about equipment performance and condition monitoring, and data from OSIsoft "PI" historians, based on a functional design developed by Chrysaor. The system is based on the Amanda Lomond and Everest platforms, and due to be completed in Q4 2019.

Mr. Callander envisages that in future there will be much more information available about equipment, including taking data from analytics systems actually on the sensors themselves, known as "edge models". These systems can make use of all the available data from the sensor, because there is no need to remove resolution from the data so it can fit through a communications pipe.

Eigen

Eigen sees itself as "at the intersection of engineering and IT", and an industrial systems integration specialist.

When it comes to predictive analytics, people talk a lot about monitoring compressors, and "that model is quite well proven," but they are not necessarily the most common causes of failures.

For example, one common cause of trips is loss of air pressure in the supply of compressed air to instruments, Mr. Callander said.

The sewage system is also critical, if it fails you may need to send all the offshore staff home.

Its platform, which it calls "Ingenuity", connects sensor data and stored data (drawings, barrier definitions, inspection reports and work orders).

Eigen works with specialist software supplied by Eigen, Aspentech, OSIsoft, ABB, Honeywell, Emerson, IBM and others (including inhouse developed applications). It has decades of experience enabling the connection and translation of information between systems.

Eigen has offices in Aberdeen, Leatherhead and Baku and supplies the oil and gas industry in UK, Norway and Azerbaijan.



Restrata – using data to track offshore people

Restrata is helping oil and gas companies better track the location of staff offshore, gathering data from multiple systems and using logic to resolve conflicts in the data

Restrata, a company with offices in of London, Aberdeen and Dubai, is helping companies to keep track of people working offshore, by taking data from multiple software systems and using logic where there might be conflicts, to present a single picture of where people are.

It can be used to keep track of people during evacuations, and for other safety and management purposes.

The same technology can also be used to track assets including equipment and spares, or for tracking vehicles.

In September 2019, North Sea operator Serica Energy signed a contract to use the Restrata software on its "Bruce" Northern North Sea offshore platform.

The software can be used to manage personnel safety and other operations, and to quickly locate people in an emergency situation. Serica's operating procedures will be integrated with the software.

Restrata had been providing emergency response support to Serica Energy over the past year, and the deal "reinforces the relationship between the two firms," Restrata says.

To support evacuations in real time, Restrata has a "global command centre" in Aberdeen, launched in 2011, a new centre opened in 2017, and another in Dubai in 2019.

The name Restrata comes from Latin "Res" for resilient and "Strata" meaning layers, signifying that resilience is achieved through a multiple layers approach.

Multiple data sources

The software draws data from a number of digital systems customers use which contain data about personnel location and status.

Companies can have software to manage travel and personnel logistics to the platform, then various hardware solutions to locate personnel onboard.

There are various positioning systems, including door card systems, RFID tags, and tracking via "Bluetooth Low Energy" or BLE, usually considered better than RFID. The Restrata Platform integrates with all of these technologies and more to create a holistic picture for the client.

ATEX approved BLE locators can be installed around an offshore platform, recording data as personnel walk past them.

Some companies still have personnel tracking systems which are largely manual or isolated and the response center checks where people are via radios and telephone calls, says Botan Osman, CEO of Restrata.

The software compiles a "single source of truth" from the various systems. If there is a conflict, i.e. the systems do not agree, then the platform resolves these conflicts automatically.

So, a location from a BLE beacon would be considered more reliable than data from a door card system, because it is possible for two people to enter the door on one person's card. A position data based on a mobile phone app needs to bear in mind that someone may have left their phone at home.

The resolution of the systems varies, with

Bluetooth typically having one "ping" a second, but door access control only recording data when someone goes through a locked door.

Ultimately, a data conflict can be sent to a human being for a decision, but this "hardly ever happens", Mr Osman says.

Further benefits

During evacuations, the software can monitor everybody's location, useful both in ensuring that all the personnel are at the muster station, and also for looking at ways the evacuation might be improved in future.

Counting 200 people at a muster station manually can take crucial minutes in an emergency – the software can tell you immediately who is there, but more importantly who is missing, and where they are.

It has proven very interesting analyzing evacuation data, making discoveries such that people sometimes go in the wrong direction, or walk slower in evacuations at different times of day or in different temperatures. "If you have a history of every muster, you can learn from that," he says.

The system could be extended, including incorporating gas sensor data to make sure people do not enter unsafe atmospheres, linking with permit to work systems to ensure people only do work they are authorized to do.

There are some issues with achieving integrations, such as hardware & software using proprietary standards, lack of communications bandwidth, but these can usually be overcome, he said.

Visavi – helping AkerBP with operational planning

Visavi Technology of [place] helps offshore oil and gas companies with their operational planning, gathering data from multiple software systems and presenting it on a large touch screen. It is doing an installation with Aker BP.

Visavi Technology of [place] is helping oil and gas companies with operational planning, showing large amounts of data on a single large touch screen.

It recently announced a deal with AkerBP to provide its software for use in streamlining operational planning, covering five offshore platforms.

Visavi calls the touch screen an "integrated work surface." It can be used to provide an

overview of all activities, and help people work out how they might be optimised.

It can draw data from work order management systems, activity planning systems, weather forecasts and logistics, and various 'silo' software systems developed for specific activities.

An offshore platform will typically have 10-12 software packages for planning, including MAXIMO for maintenance, Primavera for asset management, SAP for purchasing, WorkMap for planning work, and software for managing helicopters, says Erik Sverre Jenssen, senior industrial advisor with Visavi.

The Visavi software can take data from all of these.

The philosophy of having data on a large work surface comes from nuclear research, he says.

Another prominent customer is Repsol Sinopec, using the software in the UK Continental

Shelf. Visavi is currently discussing pilots with 4-5 companies, including companies in Australia.

Saving time

The value proposition for most clients is just making it easier to understand and find data. It all leads to higher "tool time" – the amount of time people are doing useful work. There can also be safety benefits, from everyone having the same view of what is happening.

Mr Sverre Jenssen has personally worked as an offshore installation manager (OIM) and has felt the frustrations "of getting the complete picture, running around looking for data," he said. The Visavi software can show all the information an OIM needs on one screen.

Views have been designed for people in dif-

ferent roles, such as operators and supervisors. One of the founders of Visavi is a psychologist and uses his knowledge to make better user interfaces.

The software has tools to drill down into different areas and disciplines, such as bringing up a list of work permits for tomorrow.

Aker BP

With the Aker BP installation, a company called Cognite provides an intermediate data management layer. Cognite collects data from all the sensors and software packages, cleans and integrates it, then making it available to other systems. LivePlan retrieves data from Cognite.

With data already integrated onto Cognite, it was possible to install the Visavi software in

just 2 weeks, Mr Sverre Jensen says. Although it would also be possible for Visavi to integrate directly with software like SAP.

AkerBP was using the Visavi software on its Valhall and Ula platforms by May 2019, with plans to add the Ivar Aasen, Skarv and Alvheim platforms.

"Our goal with LivePlan is to increase the quality of our plans and streamline the implementation of our activity set. This will mean saved costs and improved HSE," said Svenn K. Forfang, VP Operations – Improvement & Performance in Aker BP. in a press release.

"We look at Visavi's technology as very interesting in connection with the ongoing digitisation projects in Aker BP."



DNV GL - incorporating probability in digital twins

DNV GL has announced a concept of a "probabilistic digital twin", which can take the probability of risk factors into account, when modelling live operations

The risk models which oil and gas companies make are usually done as static "desk" studies, having a snapshot picture of risk. But in the real world, risk is continually changing – so risk models would be more useful if they were continually changing too.

Meanwhile, oil companies are making more use of 'digital twins' – digital models of physical objects – which provide digital information about how the physical object is behaving, using real time data from the physical asset. But these digital twins are often designed as though everything is working perfectly.

To resolve both of these problems, DNV GL is developing a concept for a 'probabilistic digital twin', which uses a digital twin combined with real time data from the physical asset, together with continually updated risk models.

This would enable operators to answer questions based on the changing risk levels. For example, they could determine if the failure of a certain component, were it to happen, would put the risk of the overall system above a certain threshold, given the current operating conditions.

The higher resolution you have of your changing risks as part of your ongoing operations, the less precaution you need to take, says Frank Børre Pedersen, vice president of oil and gas technology and research at DNV GL Group.

This is analogous to how banks are allowed to keep less cash reserves if they can demon-



A probabilistic digital twin might include models for how steel degrades over time, or reliability of equipment declines.

Risk models can also be developed for cyber physical systems, working out ways that a system could fail or be hacked.

The commercial model could be that DNV GL provides expert knowledge on the various failure nodes of the equipment which could be used by a client to populate a risk model on its equipment or systems.

Alternatively, DNV GL could develop the risk models itself, creating digital twin "platforms" which can be used as a basis for building a model for your own equipment.

It is possible that risk models could be shared. It may make sense for multiple wells to have different digital twins, because they have different configurations, but the basic risks to them are the same, so they can share a risk model.

DNV GL has a more in-depth paper showing how it can combine process models, quantitative risk models and structural reliability models. https://ai-and-safety.dnvgl.com/probabilistic-twin



IMRANND – better ways to work with inspection data

IMRANND of Aberdeen is helping oil and gas companies make better use of their inspection data, with a combination of data science and integrity engineering

IMRANDD of Aberdeen has developed AIDA, a suite of technologies designed to provide a new service that will help oil and gas companies better understand and manage the integrity of their assets. AIDA uses extraction, mining, cleansing, analysis and visualization of available data, starting initially with topside pressure system pipework on offshore structures.

The company employees are a mixture of oil & gas professionals, mathematicians, data scientists and domain experts – integrity engineers and corrosion engineers. With this breadth of experience, they use their combined competence to get a better understanding of what is happening on a given asset.

The aim of the new technology is both to better understand degradation and have more confidence in the readings. It enables companies to better manage their risks and inspection spending.

Oil and gas operators typically spend millions of pounds a year on inspection, gathering hundreds of thousands of wall thickness readings, but not all of the data is directly usable. The data needs expertise to be interpreted and effectively applied.

The analysis work begins by utilizing data cleansing tools to identify inaccuracies in raw data. The visualization tool then uses data clustering to identify hotspots and blind spots in need of attention.

Using AIDA, it is possible to take a very large, dense data set and group it on a single graph, enabling the user to zoom in on and interrogate specific areas within it, where the biggest concerns are.

Within the software, there are data visualisation tools which can easily show up 'blind spots' on an asset where there is not enough data, enabling operators to focus their inspection efforts where they are needed with greater accuracy.

AIDA can facilitate assessment of the quality of the gathered data and allow a user to cleanse the 'bad' data out, leaving only low variation, trendable data behind. The technology's data analytics give the user advice about threat levels on the asset, possible imminent failures, rate of degradation, and make estimates about remaining lifetime.

The user can see where problems are on the pipework – test points that look likely to fail



Innes Auchterlonie, managing director of IMRANDD

in the next few years, and where the risks appear highest.

The insight enables engineers to increase the intensity of inspections in areas of higher risk, says Innes Auchterlonie, managing director of IMRANDD.

Companies often plan to inspect at a point of half the estimated remaining life. So, if they expect a piece of pipework to have 10 years life, they'll inspect in 5 years. If they expect 5 years of life, they'll inspect in 2.5 years. It is a sensible method, which focusses most inspection on areas with the shortest life. But it only works if you have a good estimation to begin with.

IMRANDD says that its data processing algorithms are much faster than competitors. For example, one UK offshore asset had 103,000 pieces of wall thickness data acquired over 3 decades". One service company had spent a year looking at the data to try to assess its quality. "We took that same data set and processed it in under an hour, using AIDA" Mr Auchterlonie says.

IMRANND estimates that the better analytics of inspection data can lead to big reductions in the requirement to spend on inspections – perhaps 20 per cent savings. At the same time, companies have a better insight into pipework condition, so can avoid costly failures which can put equipment out of action.

Confidence in data

The lack of confidence in inspection data is itself a problem for oil companies, and a target challenge for IMRANND, says Mr Auchterlonie. Data can be poor both due to poor data collection on site, missing data, or compromises to data after it has been collected.

As a result of so much poor-quality inspection data being around, it is common for people to just disregard data which is outside the expected parameters, when it may have some important insights within it, Mr Auchterlonie says.

Spotting trends and patterns

Trends are very important in analysing corrosion – including spotting that a certain section of pipework is corroding much faster than would be expected, or if a corrosion area is spreading.

So analysing trends can also give a better prediction of remaining life of the element.

But oil companies tend to work by exception – taking action when something is obviously wrong, such as having corrosion to a dangerous level, rather than look for trends, Mr Auchterlonie says.

But often there is so much data missing, trends and patterns are very hard to see, he says.

The company

Innes Auchterlonie, CEO, formerly worked in asset management at Talisman (now Repsol Sinopec) and Hess.

So far, AIDA has largely been used to analyse pipework on offshore structures – work is going on to develop similar methods for pressure vessels.

The company reports that it has grown from 6 employees in 2016 to 40 now and has business development activities in West Africa and the Middle East, along with in its base in Aberdeen.

The product is currently offered primarily as a data analysis service, although it is possible that it could be sold as a software, together with coaching for how to use it, Mr Auchterlonie says.

The company is able to demonstrate its full methodology to clients. It is also able to show ways that its claims – such as to support reduction in inspection spending by 20 per cent - can be verified.



Blockchain – good for joint venture projects and chemical processes?

Finboot believes that blockchain based technology could be useful for joint venture E&P projects, and chemical processes, where there are many diverse elements to keep track of, many parties involved, and no-one in overall control

Two useful applications of blockchain in the oil and gas industry could be in joint venture exploration production projects with multiple partners, and in chemical processing chains with complex steps involved, reckons Juan Miguel Pérez Rosas, CEO and Co-Founder of blockchain company Finboot.

Both scenarios involve multiple partners, complex administration to keep track of everything, and no single party in control, he says.

In joint venture exploration and production projects, the partners could keep a blockchain-based record of everything which has been agreed in the project between the various owners, and also of every interaction.

The system can automatically provide validated information to regulators, other authorities, or shareholders as needed.

In the refinery and chemicals industry, it could be useful to have a blockchain based record of all the various steps in the chain, including certification, quality control and regulatory checks. This would provide a simple and immutable record of everything which has been done. It would avoid the need for phone calls and e-mails.

Finboot is doing a pilot with Repsol's refinery and chemical business units, managing records of all the various certification and quality control steps. This can include tests by external laboratories, or storage temperatures. The final customer can be provided with a digital 'trace' showing the entire background of the product being purchased.

Of course, blockchain is not the only technology which exists for sharing data. But it is a method of sharing data without any single party in control of the system, and where all parties can verify that nothing has been tampered with, says Mr Pérez Rosas.

The blockchain record also includes tools to verify the identity of people, or that documents are authenticated and not changed, Mr Perez Rosas says.

The process for authenticating people can be more than a standard login system. It can include similar technology to those used in digital signatures, or government identification systems. "It is as secure as someone showing their passport and drivers' license," he says.

The software can connect the identities of people with their authorised role in the various organisations.

Other domains

Another domain Finboot is looking at is the "circular economy", with products being recycled. There could be a blockchain record along with every batch of product, showing its history, and the people who have "touched" it.

For example, you could show how much of a supply of plastic came from fossil fuels and how much from biofuels. "We've got all that information digitised, certified and validated," he says.

Fuels can be tracked as a 'digital asset' - including if there are biofuels added, and where they came from. So, this 'digital asset' can be sold along with the fuel.

Getting such a system implemented might come across the obstacle of people being reluc-



tant to share data. These concerns would need to be balanced against the benefit of improved efficiency in cross company operations, Mr Pérez Rosas says.

Finboot's software, "MARCO", can be de-

scribed as middleware, sitting between the customer and the distributed blockchain record. It ensures data is appropriately formatted to be registered on blockchain.

"We are managing very clearly what informa-

tion is going to be in that distributed ledger,

and what data stays in the application controlled by the enterprise. We will only put there what is needed to be shared between different companies," he says.

How English courts can force you to reveal information

English courts are routinely ruling that information about oil and gas transactions must be made public, even in cases with no connection to England, so long as they have chosen that contracts are governed by English law, writes Simon Bushell, partner with Signature Litigation

In an era where capital is mobile, and billions can be transferred electronically, access to information to enable complex transactions to be reconstructed can be of enormous benefit to the victims of suspected corruption.

Major players in the energy sector continue to choose English law to govern their contracts and those with their intermediaries.

As a result, the English courts routinely hear energy sector disputes which have little or no connection with England.

Even before a dispute is crystallised, the English courts may order a party to reveal information exposing dubious activities in faraway places.

The English civil courts have remarkable powers to compel third parties to reveal vital information relating to secret commissions or other payments which might give rise to claims.

Disclosure orders, technically known as Norwich Pharmacal orders, can require an innocent third party such as a bank or advisor to reveal who is behind an offshore vehicle or trust, or to release information detailing bank transfers.

Countless frauds have been uncovered using such orders. These include bribery and corruption schemes, over-invoicing, or straightforward theft.

The oil and gas industry operates globally, often in countries where corruption is unfortunately all too common. In such places, it has become apparent that tender and procurement processes can be distorted by bribery, to the detriment of businesses that wish to participate legitimately.

The difficulty which honest parties face in obtaining redress is that it can be very difficult to obtain clear evidence of corruption.

In some such cases, disclosure orders may provide a powerful tool to obtain incontrovertible evidence of a corrupt payment from a rival bidder (or someone on their behalf). Norwich Pharmacal disclosure orders emerged from a landmark 1974 decision of the UK's highest court, the House of Lords.

These disclosure orders enable the English courts to require an innocent third party to hand over information relating to unlawful conduct, in certain circumstances.

The English courts have proven most willing to use such orders to get to the bottom of fraud and wrongdoing.

Such orders can also be sought from the courts in Cyprus, the British Virgin Islands, Cayman, the Bahamas and a host of other offshore jurisdictions where English legal principles apply extensively.

Where international companies are conducting business in jurisdictions where they do not have full confidence in the local justice system, many elect for arbitration clauses in their commercial agreements as the primary means of dispute resolution.

Norwich Pharmacal disclosure orders are not only available where the applicant intends to bring court proceedings, but also for a range of other legitimate objectives.

Therefore, there appears to be no obstacle in principle to a disclosure order being granted in support of an arbitration claim.

The fact that the eventual proceedings would be conducted via an arbitral process might be relevant as regards the court's decision as to whether to grant an order.

However, where a disclosure order would provide the best or only available means to identify wrongdoing, the court's discretion is likely to be exercised in favour of granting relief.

While the courts may be hesitant to trespass into areas that could overlap with a prospective arbitration, such arguments will carry less weight where there could be no arbitration without the relief first being granted.



Disclosure orders have been made to reveal the identity of overseas bank accounts. trustees settlors, and trust beneficiaries, as well as details of the

Simon Bushell, Partner at Signature Litigation

trust's assets and even of the relevant deeds.

The cold light of day can thus be shone on the hard detail of the legal mechanisms which are often used to disguise ownership, or to evade scrutiny and detection.

Norwich Pharmacal disclosure orders have for decades proven highly effective in revealing vital information about wrongdoing. They have been used to reveal both the identities of wrongdoers, and vital evidence, to assist in advancing remedies to a wide variety civil and criminal wrongs.

They have proven highly adaptable, and the courts continue to demonstrate a strong willingness to use them where the interests of justice require it. The remedy is both flexible, and continually developing.

Thanks to the existence of Norwich Pharmacal disclosure orders, the English courts are equipped to dispense powerful remedies.

For this reason, businesses operating internationally who have unsuccessfully participated in procurement or tender process, would be well advised to pause and consider their legal options where corruption is suspected.

Simon Bushell is a Partner at Signature Litigation, and specialises in civil fraud, asset tracing and commercial litigation. Simon is a co-author of "Disclosure of Information: Norwich Pharmacal and Related Principles", which is now in its second edition. **www.signaturelitigation.com**

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