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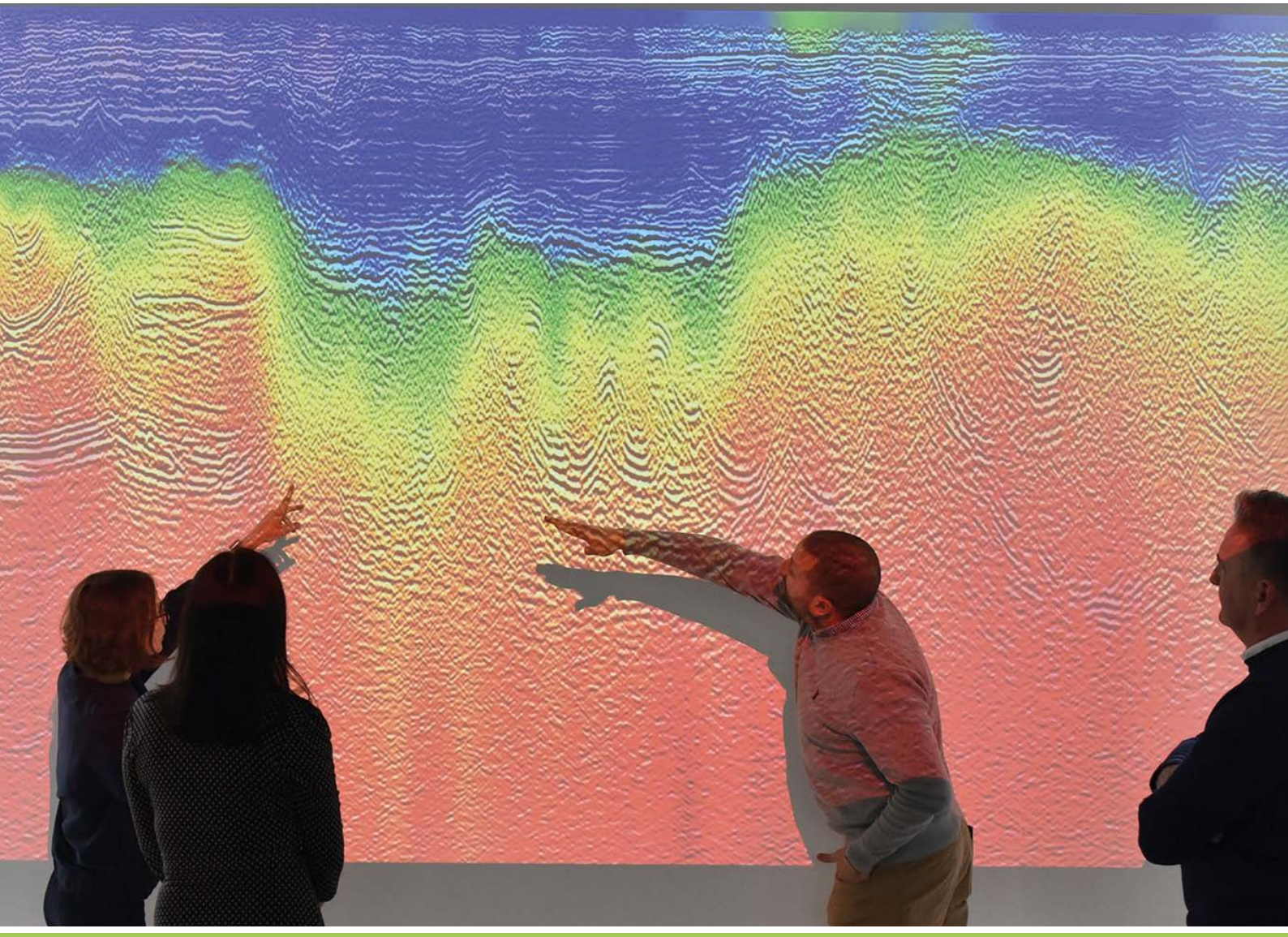

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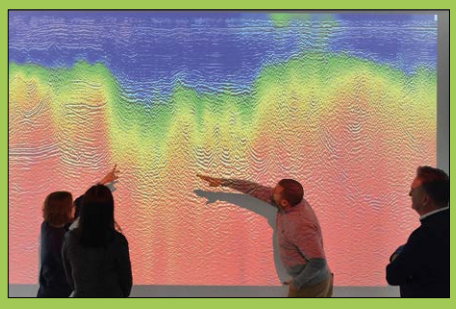
Cover image: *Land seismic data processed by STRYDE. The company has secured eight new land seismic data processing contracts, just five months after setting up the service*



Opening

AspenTech – how software can best support decision making

What is the best way that oil and gas software can best support people's decision making? We spoke to Ron Beck, senior director industry marketing with AspenTech, now one of the industry's largest software companies

What is the best way to make software to support people's decision making? We asked Ron Beck, senior director industry marketing with AspenTech, now one of the oil and gas industry's largest software companies.

AspenTech is a $1bn revenue company based in Bedford, Massachusetts, which provides a range of software tools for all areas of the energy industry. This includes oil and gas, both subsurface and production operations, also power, mining and CO2 sequestration. Its portfolio of products now includes subsurface software products formerly owned by Emerson and Paradigm, following a transaction earlier this year (see next article).

Better information

A big part of how software can best support decision making is how well it can provide better information to people, he says.

Having integrated systems helps, because they can show what is happening on fewer different screens or software tools, Mr Beck says.

As an illustration of the challenge of gathering data together, AspenTech has been working with a refinery in Europe which has to make complex operational decisions.

It has to meet goals which are difficult to reconcile, such as about CO2 emissions, keeping costs low, and making the most in-demand products.

It wants to gather data, such as CO2 emissions, from its operations around Europe. This data is theoretically in a standard format, but the EU guidance about how to present data is implemented differently in different countries.

It needs to answer complex questions like what percentage of all fuel and feedstocks used are biofuel and bio feedstocks.

While many companies like this have figured out ways to gather together the data they need to make decisions, it is rarely gathered in an timely way, Mr Beck says, due to lack of unified systems.

For example, a company might gather multiple spreadsheets, bring staff together with knowledge of the various domains for a Monday morning meeting, or try to find out what is going on by making phone calls or e-mails.

But with these methods, it can be hard to see your actual situation and what your options are, he says.

Ideally there would be one digital 'oversight' system, which gathers together the right data from the various systems and integrates it.

When information is better integrated and presented, people can much more quickly understand what is going on and the implications of any decisions they might make.

For example, people can then easily review why they are emitting more carbon than they planned to emit, or if they are over or under any other aspects of their plans, such as for profitability.

Good software can help 'rise to the surface' elements which someone should pay attention to. They can easily see if there is a bad actor in the system, for example a particular element which has a bigger negative impact on carbon emissions than was expected.

This can all be considered situation awareness, Mr Beck says.

The power industry is often doing well with integrated systems like this. In large distribution networks one problem can lead to another, and it can be hard to identify the cause which started it. Integrated software systems can be used to identify the cause, he says.

Data to understanding

Linked to this is the challenge of turning data into something people can use to make decisions. "Every executive tells you we're spending large amount of money collecting data," Mr Beck said.

AI and analytics can be helpful in synthesising the data, bringing it together into a manageable whole so it can be used to make decisions, he says.

Companies may also need to connect data from multiple software systems.

All software systems use different models because they are built to do different things. But this means the models use different as-

sumptions and have different levels of granularity, Mr Beck says.

One way different software can be brought together is by aligning their underlying models. "We believe we can map what's actually happening, integrating together modelling systems," Mr Beck says.

AspenTech developed a technology solution called "Model Alliance", which brings together multiple models from different software systems and makes them all consistent.

Easier to use

Another aspect of making software to better support decision making is ensuring that the software is easy to use.

For much usability discussion, the answer can be simply that something should be "well designed," he says. But there are a number of layers to this.

Many companies are seeing experienced people leaving the company. These people may be comfortable with more complex software because they have been working with it for many years, perhaps seeing the software gradually increase in complexity over a long period of time.

But if they get replaced by younger workers, they may find the complex software frustrating. They are used to using very simple smart phone apps. In a work environment they say, 'why this software, its too complicated.'

Industrial software cannot and perhaps should not be made too easy to use if it hides the underlying logic. The users still need to understand the real world which the software describes, and that can be complicated in industrial facilities, Mr Beck says.

AspenTech's software is often based on 'first principles' models based on the underlying chemistry and physics. A core component of much of its software is data about physical properties of each chemical or material.

Whoever is using the software should probably understand the chemistry and physics behind its models, in the way that we expect a pilot to understand how an aeroplane flies and what factors change its movement through the air.

Process engineering university courses today still often ask students to make manual calculations for a task which software could do very quickly. This is because by doing manual calculations someone can better learn how the underlying calculation is done, Mr Beck says.

One approach some companies successfully adopt is to re-organise their department structures, so that domain experts from different disciplines can work on the same digital model which covers multiple disciplines.

Ron Beck, senior director industry marketing with AspenTech

People also need to be able to understand and evaluate any suggestions the software makes, he says. For most industrial software applications today, nearly all final decisions are being made by a person, not a machine, with the advanced software making the people smarter in their work.

If it was ever possible to make software capable of making decisions autonomously, there would be a question of whether it should be used without human intervention, Mr Beck said. If the role of people is reduced to pushing buttons, it is harder to keep them motivated. "You'd like people to know what they are working on."

Visualisations

Another way to make software easier to use is to have better visualisation, so people can use the software to quickly see and understand what is going on.

An example of this is software AspenTech developed to help staff operating distillation columns in refineries, showing an image of the inside of the column with colour coding indicating possible problems or what was happening in each tray in the column.

"We introduced a visual system which tells you about what is happening in the column," Mr Beck says. "People needed to see a picture. We spent a lot of years figuring out how to make it easy to use."

"You can see the colour change from red to green. We use a combination of visuals and colours to guide operators, including visual cues and symbols."

This turned out to be the fastest adopted software which AspenTech had ever seen. For operators of distillation columns, big economic savings or gains are possible if the column is operated in the most efficient way (not to mention reduced carbon emissions), and the colour coded visualisation made it easier for operators to do this.

Use of simulators

Simulation software can be used both for understanding what is going on and for training.

Simulation tools can be used to help people understand what is going on and generate digital visualisation of it, as in the distillation column example.

They can also be used for training, helping people understand how something works, in the same way that pilots can train using a simulator.

They could be considered a "digital twin training environment," Mr Beck says.

AspenTech makes simulation tools for all aspects of process operations. Process simulation tools originally only handled static / stable conditions, working on the assumption that everything on the plant was in steady state. The simulation tools are now increasingly covering dynamic simulation (conditions which are continually changing).

Understanding GHG emissions

A simulator can be used to help people understand greenhouse gas emissions from a facility, including CO2 in the flue gas, and also identifying methane leaks.

A simple modelling system tells you how much fuel is being used, and so how much CO2 is being emitted from that.

A more detailed model or simulator can track all the flows through a facility, so it can identify any leaks by comparing inputs and outputs, such as with methane leaks.

A system like this was implemented in a refinery, which did a mass balance across the entire hydrocarbon site, Mr Beck says. Mass balances are typically used to track what you are producing but can also be used to find out if you are missing anything.

It has been used on a Middle Eastern gas field, to understand methane leaks, finding the 1 per cent of produced gas which is leaked.

"End to end" sustainability software

With AspenTech now providing software for both subsurface and surface operations, it can provide 'end to end' software, covering all aspects of a process. This can be particularly useful in CO2 management domains.

For example, companies doing carbon capture and storage can use its process modelling software for the capture part, and its subsurface software for the sequestration part.

AspenTech has identified 13 'sustainability pathways' where a range of software products can be used to work on a sustainability task.

AspenTech, Emerson and Paradigm Geophysical

Emerson Electric acquired 55 per cent of shares of AspenTech in May 2022. Emerson had also acquired Paradigm Geophysical in December 2017. Its products now form AspenTech "Subsurface Science and Engineering"

In May 2022, it was announced that engineering services and automation company Emerson Electric had acquired 55 per cent of the shares of AspenTech, although AspenTech continues as an independent traded company.

Emerson paid $6.0 billion in cash for the stake, a significant fraction of which was distributed to AspenTech shareholders, the rest reserved for future innovation.

As part of the transaction, two of Emerson's industrial software businesses, OSI Inc and its geological simulation software business, have been moved into AspenTech.

Emerson's geological simulation software includes the software products formerly developed by Paradigm Geophysical, which will be well known to many Digital Energy Journal readers. Emerson acquired Paradigm, and combined it with its Roxar software business, in December 2017.

Emerson's geoscience simulation software business will be renamed Subsurface Science and Engineering (SSE).

One benefit to E&P companies, AspenTech envisages, is that they will be able to use the subsurface software together with its process engineering software, to have an end to end solution covering subsurface and facilities / production operations.

Following the move, AspenTech's annual revenues are over $1bn, which supported a core goal of the company directors to attain the scale that would make them well positioned for further acquisitions and more strategic engagements with customers, says Ron Beck, senior director industry marketing with AspenTech.

OSI

OSI Inc (Open Systems International) was also moved to AspenTech following the acquisition. This is a company Digital Energy Journal readers may be less familiar with. OSI Inc's largest customer base is organisations which manage electricity grids.

It provides software for optimising power transmission and distribution systems. Its Advanced Distribution Management System (ADMS) product is for working with complex distribution systems such as with renewable energy and battery arrays. It has a product called Distributed Energy Resource Management (DERM), which can be used for microgrids. The website is www.osii.com.

This is not the same company as OSI Soft, a company which develops the PI software and was acquired by AVEVA in March 2021 (www.osisoft.com)

AspenTech was keen on the OSI Inc software because it saw it as a pathway into the electrification market. It also recognises that the challenge of managing electricity grids is getting much harder because many organisations are also generating their own renewable energy now.

"In the past, power grids were one way," Mr Beck says. "It is getting less predictable."

Micromine

Following the transaction, AspenTech has already announced a definitive agreement to acquire another software company in July 2022, MicroMine of Australia.

It makes design and operational management software for the mining industry.

This includes software for exploration, modelling, design, scheduling and operations of mines. The price was AU$900 million in cash (approximately $623 million USD).

AspenTech sees the transaction as a way to complement its existing asset optimisation solutions, and also to give the company a "leadership role" in delivering the "Digital Mine of the Future", with a high focus on safety, sustainability, reliability and efficiency.

The software could also be used to help satisfy demand for metals needed for the energy transition, including lithium and cobalt for batteries.

STRYDE – contracts for land seismic data processing

UK land seismic company STRYDE reports that five months after launching a seismic data processing service, it has secured eight new contracts. It has contracts in the US, Canada, the UK, the Middle East and Africa.

Until recently, STRYDE's focus was on-providing land seismic survey equipment, rather than data processing. The company was founded in 2019 and is owned by BP.

One of the new contracts is with a "prominent oil and gas operator in Africa", to process 900km of 2D seismic lines, 12 lines in total, gathered by STRYDE's "Node" seismic receivers.

The final processed images will be delivered in under three months, which is

Right: *STRYDE's expert data processing team. (L-R) Evgeny Kokoshin – research geophysicist, Celina Giersz – senior processing geophysicist, Amine Ourabah – head of processing, Zhongmin Song – senior research geophysicist, Eamonn Murray – senior processing geophysicist.*

"typically two to three times faster than conventional approaches," STRYDE says.

It is able to deliver the processed images so quickly because the data collected from STRYDE's sensors have a particularly high quality and density, it says.

"The operator was able to deploy more seismic receivers in the field, without incurring additional cost or time, resulting in a denser dataset, despite the numerous structural and environmental challenges the acquisition team faced in the field."

STRYDE's team also processed what is thought to be the world's densest land seismic survey, acquired in Canada in 2021 with Carbon Management Canada and Explor.

As well as for oil and gas production, the services have been provided for geothermal and CO2 sequestration projects.

Contract with Polaris

STRYDE has announced a "seven figure" contract with Polaris Natural Resources, a Canadian seismic services company. Polaris will buy a 13,000 node system, and use it for oil and gas exploration in Africa.

The contract follows Polaris' successful use of the system to acquire 2D seismic data in Namibia and Zimbabwe. The processed data was used by an unnamed independent oil and gas operator to identify prospects in the Cabora Bassa Basin, northern Zimbabwe.

Drilling of the Muzarabani-1 well is now underway, with the prospect considered to be the largest undrilled conventional oil and gas prospect onshore Africa, STRYDE says.

"As a direct result of using STRYDE Nodes we were able to reduce the size of the survey crew and decrease the number of vehicles and logistics required, and therefore the project timeline and associated costs and risk," said Bill Mooney, chief executive officer, Polaris.

Schlumberger's digital technology news

Schlumberger made a number of big announcements related to its digital offerings in September 2022. Here is a summary

Schlumberger has commercially released its "Enterprise Data Solution" for subsurface data.

It runs on Microsoft's Energy Data Services cloud service and is 'in alignment' with the OSDU standard.

Oil and gas companies can use the system to integrate subsurface data , technologies and workflows from different providers.

PETRONAS and Chevron have already signed up to be an 'early adopter' of the technology.

PETRONAS used the system to integrate 12 corporate data stores onto a single platform.

Cognite

Schlumberger announced a strategic partnership with Norwegian digital technology company Cognite in September 2022, where Schlumberger will integrate its Enterprise Data Solution (largely for subsurface data) with Cognite's Data Fusion software (largely for production data). The two companies will work together to develop applications and solutions.

By using both products integrated together, customers will be able to integrate data from reservoirs, well and facilities in a single platform. Then they will be able to use analytics tools on the data, to find ways to improve production and reduce costs. They will be able to improve flow assurance, better simulate process operations, and perhaps use the integration as a foundation for their own AI tools.

"Operational data in the production domain is a vastly underutilized customer asset due to its complexity and lack of contextualization at scale," said Rajeev Sonthalia, president, Digital & Integration, Schlumberger. By connecting Schlumberger software with Cognite Data Fusion, customers will be able to get "better and faster insights".

Wintershall uses OSDU software

Oil and gas operator Wintershall will use Schlumberger's DELFI Data Ecosystem on the OSDU platform running on Microsoft Azure. It has signed a one year contract. It has selected Schlumberger as its 'preferred partner' for its subsurface data transformation program,

"Signing with Schlumberger as a strategic partner marks the kick-start of Wintershall Dea's OSDU-enabled data-driven future," said Hugo Dijkgraaf, chief technology officer, Wintershall DEA.

"With the deployment of the OSDU Data Platform, Wintershall DEA aims to analyse data more efficiently, search and discover data more rapidly, and take advantage of new cloud-based applications and emerging digital innovations," said Kathrin Dufour, senior vice president, Digitalization & Technology, Wintershall DEA.

Schlumberger's "ProcessOps"

Schlumberger has launched a new cloud based software tool called ProcessOps, for improving performance and uptime of process equipment and facilities. The software can be used to make digital twins of a facility, based on physics based models, supported with AI analysis.

With this, customers should be able to find ways to maximize throughput for the asset, and reduce CO2 emissions. They can also use the software to set up automated workflows to make reports, and try out different scenarios.

As an example of how it can be used, Schlumberger cited a client in the Middle East who used the software to identify a damaged component on an electrostatic treater, which cost one dollar to replace. If it had not been replaced, the whole treater could have been damaged, leading to downtime of the whole facility.

Less data transfer in drilling

Schlumberger has launched a system called "Neuro Autonomous Solutions", to reduce the amount of data communication required between the surface and downhole, when steering a drillbit. It connects sensors and technology downhole with a surface advisory system.

It is difficult communicating data down a well which is being drilled, because there is no cable and radio communications are not possible; data is normally communicated using pulses sent through the drilling fluid, and only very limited data communications are possible.

By having more of the digital technology actually downhole, it is possible to reduce the data communication which is required with the surface, and so get more value out of the limited data bandwidth available. This can help reduce risk, improve precision, and so increase efficiency and reduce CO2 emissions.

The system has already been deployed on over 50 rigs in 10 countries and used on 131 wells, including in North America, South America, Middle East and East Asia.

Continued on page 18...

How Lundin moved to OSDU

Lundin Energy moved its subsurface data to the OSDU data platform. Michael van der Haven, VP consulting with CGI, worked on the project. He explained how disruption was minimised

In 1900, to switch from horse transport to a car would have been a disruptive change.

But if you had not switched to a car by 1913, particularly in somewhere like New York City, "it meant you were quite behind," said Michael van der Haven, VP consulting with CGI.

Similarly moving subsurface data to the OSDU platform can be quite disruptive, he said. But if people don't do it, they may feel behind in a few years.

He was speaking at an online forum organised by the Society for Professional Data Management (SPDM) in June 2022.

Mr van der Haven has been working on ways to minimise the disruption of moving to OSDU, with a project together with Lundin Energy, an E&P company based in Sweden with operations in Norway.

As well as Mr van der Haven, the project team included Els van Wenum from the data management team of Lundin Energy; Odd Kolbjørnsen, advisor in data science at Lundin Energy; and Eivind Rønnevik, CTO of oil and gas data management software company KADME.

The effort is justified by the benefit of OSDU, in having data at your fingertips. "In our industry, data is all over the place, even if you know exactly what you want to have, there's a lot of 'hunting for data' or 'finding data'," he said.

"If you have an analytics project, you don't want to deal with all kinds of obscure data formats."

Many companies have contributed to the OSDU architecture and data standards, including operators, suppliers and data integrators, making sure that the end result works for different companies, he said.

Michael van der Haven, VP consulting with CGI

But oil and gas companies are wondering how much they need to change in their digital environment to make their applications continue to work if they switch to OSDU. There are already stories circulating, "if you deploy OSDU it is quite a challenge."

Companies also wonder what level of knowledge they need to operate the platform, put data into the system, and get the right data formats.

"That can be quite scary at the moment," he said.

OSDU is "still relatively new," he said. "We're taking our first steps."

Lundin's use case

Lundin focussed its efforts around a specific 'use case' of developing an automated tool that would extract all gamma ray data available for all wells going through a certain formation, using OSDU.

It is easy to see how the problem could be solved in theory. If all the data was easily available, the well logs could be searched by searching through the well log files; the well top data could be searched using Petrel; formation data could be indexed using Kadme's WhereOil software.

The software would need to be able to understand that by 'formation' it means looking for data from a certain stratigraphic layer.

The query could be written in a language a computer could understand, such as to select the neutron density and gamma logs for all wells in a certain formation.

Moving metadata only

One concern is that if you move all your subsurface data into OSDU, all of your software applications will need to work with data on OSDU. It could be very disruptive either making sure the applications work with OSDU or otherwise changing them.

The project team found an alternative approach, where they kept the data where it was, but only moved the metadata onto OSDU.

So OSDU acts as the 'delivery mechanism', helping people access the files they want, rather than actually storing the data.

There may need to be some kind of data transformation for OSDU to serve the file, for example converting a LAS file to the WITSML format which OSDU uses, he says. But the existing applications could continue to work as before.

This way, you can still make use of the special abilities of OSDU, such as using it as a data platform for advanced analytics which involves multiple data sources, he says. "OSDU is acting as a spider in a data web."

It means that cloud users can access data from one central cloud location, even though some data may sill be stored on 'on premise' applications. "By using OSDU as a single end point, the actual data sources become completely transparent," he says.

"You don't know any more if it is a proprietary network share or a database. The user is not bothered any more. The user can find data instead of browsing all those data sources."

OSDU can keep track of the entitlements to access the data at the same time.

It means modern technical data management is becoming an 'agile' process, and we are moving to 'data operations', rather than data management, he said. "You quickly develop something, if you don't like it you throw it away."

Lundin's project

Lundin had been using KADME's WhereOil software before the project started. This is an integration platform for E&P data. It creates indexes of where the data is, without actually moving the data. These indexes could be uploaded into OSDU.

The work project was done in an agile way, planned to take just 6 weeks, although it ultimately took 8 weeks.

The project started with a discovery session, working out what data was needed. Then the first week's work was data gathering, and working out how to integrate WhereOil with OSDU.

The second week was development work, building the connection plug-in. OSDU is designed with an 'open architecture' so that components can be plugged into it, he said.

The team also worked on a system for search queries, using an open source tool called Lucene which allows free text search. "You don't have to worry about database query language, you can combine different data types".

This was the most complex part of the development. A simple question "give me all the gamma rays" is quite complex to set up as a query in Lucene," he said.

The project needed guidance from IT, data and analytics staff.

The last weeks of the project was making the functionality work, including getting firewalls opened up so data could be accessed.

"Never underestimate the IT, the security, you have to overcome," he said. "That was something that took a little longer than expected."

Every week, the project team gave a progress update to the end users, and received feedback on work done, so they could determine whether they had properly understood the queries which people wanted to make. "Developers don't always have the domain knowledge," he said.

"With a [relatively small] organisation like Lundin - the communication lines are very short, that makes life easier and faster," he said.

Having WhereOil, and its index of the company's data (metadata) proved "really vital," he said.

There was no need to use any external data services to aggregate the data, so long as any data sources were OSDU compatible. If not, they needed to be plugged into another tool to convert them.

Ultimately, no data was moved in this project. A follow up project is being considered where well log data might be converted into OSDU's well log format, while also retaining the data in its original format.

Other OSDU projects

CGI has been involved in a number of similar OSDU migration projects with other operators and seen a similar pattern of events.

Some companies want multi-cloud systems, where they want to combine an existing investment in a certain cloud solution with OSDU hosted by a different cloud system. Some companies want to combine separate OSDU deployments around the world. the data might stored in one location, and a subset of it used in another location. But they don't want to move data around.

OSDU's system of entitlements makes it easy to copy them from one instance of OSDU to another, so someone who is authorised to access a certain type of data in one OSDU instance can access these data types in another OSDU instance.

It proves very helpful to have a team of both domain experts and technical data management specialists, he said.

The open architecture of OSDU is very helpful, because it means it can function as a data mesh.

Data "virtualisation" tools can help, which let you search data which is stored in multiple locations, although it appears to be on the same system. "If you pick a vendor that has virtualisation capabilities, you can link and integrate with OSDU," he said.

Although OSDU was initially planned as a single data repository, it is increasingly seen as a tool for accessing or transacting with data. "I think more and more data in OSDU is ' data-in-flight ' or project data," he said.

"Data is going to exist outside OSDU; OSDU is the single end point where you can find the data."

Automating data uploads to OSDU

Can digital tools help upload data to OSDU? Sunil Garg from dataVediK presented his experience

OSDU (formerly Open Subsurface Data Universe) is a standard system developed by the Open Group for storing oil and gas data.

The aim is that oil and gas companies can store all of their data in the same system, rather than having multiple data repositories. There are standard ways for software tools to 'talk' to the data repository.

But moving data to OSDU "is not a quick switch," said Sunil Garg, founder and CEO of dataVediK, a start-up company specialising in machine learning and AI for oil and gas, based in Houston. He was speaking at an online forum organised by the Society for Professional Data Management (SPDM) in June 2022.

Mr Garg was formerly with Schlumberger developing data management products and machine learning. He spent his whole career as a data modeller, including working on data models with PPDM, POSC, Schlumberger's internal database, and Schlumberger's own data product Finder.

There are lots of continuously moving parts to OSDU, including the data 'footprint', foundational platforms, data migration plans, and data enrichment methods, he said.

As of 2022 we have hundreds of different enterprise software and data repositories running on different platforms. Some can exchange data with others, but some are completely isolated, he said.

And some of the data itself is very complicated. For example a data model for a wellbore is "pretty comprehensive," he said. "You need to spend some time understanding the data model. Some [of it] is structured, some is unstructured."

When you want to move data to OSDU, there is quite a long preparation stage, including getting the data in its original raw formats, checking the units and time zones are all the same, making sure you have the right version when multiple versions exist.

If automated methods can be developed to help with the data migration, that could be very helpful. For example, automated tools could move data between different places, predict matches between data, and automate the setting up of data access entitlements, he said.

"It will be very difficult to custom code all the movements of data."

The task is not only about moving data. You also want to track error rates, and have an audit record you can use later.

If the files are in industry standard formats and structures to begin with, perhaps you can map them to an OSDU format, and then make a tool to automatically convert them, using custom scripts, he said. But "there's a lot of hard work."

When moving data, there is an opportunity to make the data more useful or 'contextualised' by linking data together. For example, connecting text descriptions of well logs with the actual logs, or adding the well, field and spudding information to the well data. "It is not trivial work, but once perfected you can augment the data," he said.

Sunil Garg, founder and CEO of dataVediK

The work process typically starts by mapping data source repositories to where they would go in OSDU. This includes 'hierarchies' of data, not just the individual tables. For example, if the master data is the wellbore information, the 'child data' is about zones, or production from different zones.

"Mapping is the first part of the process. We can accelerate that mapping a bit."

At the end you validate "ingestion integrity", finding out if anything got lost in the process.

Mr Garg was asked which companies are showing most interest in moving to OSDU. "Shell and Chevron were the two initial ones," he replied. "I see a lot of movement from Shell, Chevron, ExxonMobil, BP. We are seeing interest from National Oil Companies trying to adopt OSDU. I see all sorts of companies trying to adopt it."

Schlumberger and ConocoPhillips' ETDX proof of concept

Schlumberger and ConocoPhillips have completed a 'Proof of Concept' of the PIDX ETDX standard, showing how emissions data can be exchanged between an operator and supplier, and what the challenges are

Schlumberger and ConocoPhillips have completed a "Proof of Concept" of the PIDX ETDX standard for exchanging emissions data between a buyer and supplier. David Shackleton from Schlumberger, and James Thompson from ConocoPhillips, explained how it went.

They were speaking at a PIDX webinar on August 31st, "PIDX Journey to Net Zero Webinar Series Part 1". The talk also covered Schlumberger's work to reach net zero emissions, targeted to be achieved by 2050.

David Shackleton is a business development manager at Schlumberger. He also chairs the PIDX business processes workgroup and is chair of the Calgary section of the Society of Petroleum Engineers.

James Thompson is a senior IT process consultant at ConocoPhilips, and a specialist in procurement and supply chains. He has experience with project management and e-commerce.

Schlumberger's emissions

Schlumberger plans to reach net zero with its emissions by 2050. That includes operational emissions of greenhouse gases, emissions from its supply chain, emissions from any electricity or fuel used, and customer emissions from use of its products and services, Mr Shackleton said.

The company is tracking is progress, looking at emissions reductions per year starting in 2019. So far "it looks like we're doing pretty well," he said. But he acknowledged that emissions reductions for the past 2 years were helped by the pandemic.

In calculating its emissions, Schlumberger has followed international standards such as from the Sustainability Accounting Standards Board (SASB) and the GHG Protocol, he said.

Emissions from use of Schlumberger's products count as both Schlumberger's Scope 3 emissions and Scope 1 emissions for its clients, such as ConocoPhillips.

It is helping customers reduce their emissions by developing a portfolio of "transition technology" products, he said.

To help customers reduce methane emissions and flaring, it has put together a portfolio of products, including some from its partners.

It offers services for drilling, well construction and field development companies to help manage or minimise their emissions, including advice on electrification of infrastructure.

"We've certainly learned things already through this process," he said. "We've learned about the sensitivity of passing on this [emissions] information, analogous to cost [data]. There's a need to keep some of this information secure, the same as you would do with price book cost."

"We've learned a bit about the [level of] variability of this information internally, the challenge of finding such granular carbon footprint data on the products and services we have."

ConocoPhillips perspective

ConocoPhillips and Schlumberger have been doing a 'proof of concept' of the PIDX emissions transparency data exchange (ETDX) standard, for exchanging data between buyers and suppliers in upstream oil and gas, said James Thompson, senior IT process consultant at ConocoPhillips.

The project aimed to explore the best options for exchanging emission data relating to purchase of materials and services, between an operator and a supplier, he said.

The aim is to provide emissions data in a dashboard with different levels, including by well, business unit, and geographical location.

The proof of concept should help show other organisations how they can do the same thing, he said.

ConocoPhillips recognised that persuading suppliers to provide emissions data would not be easy. The project began after it saw that Schlumberger, one of its major suppliers, was already gathering emissions data for its own purposes. It saw that the data could also be easily made available to ConocoPhillips for services it buys from Schlumberger.

"We're partnering with Schlumberger to capture whatever data values they have in the system," he said.

David Shackleton, business development manager at Schlumberger

"We know we can't capture everything. Our goal is to get started and determine what's available."

ConocoPhillips now aims to merge the emissions data with other data it has about the procurement, such as field tickets, invoices, items for downloading. "Once we get the data points from Schlumberger, we want to combine them with our upcoming transaction," he said.

"We explored what options we have to transit Scope 3 data points," he said. "We determined that we can modify the current PIDX schema to include data values related to Scope 3 emissions."

A draft version of this modified schema has been developed and is being reviewed.

ConocoPhillips has done work to try to marry data about its historical transactions with Schlumberger, with Schlumberger's data about emissions associated with those transactions. It is in early stages of capturing that information and integrating it in a dashboard.

"There's still more work to be done, but we're close enough with the proof of concept," he said.

"We're validating we can get the information and we can report on transactions as we go forward."

The project team are hoping to be able to share their findings from the data integration shortly and show an example dashboard of emissions between a supplier and operator.

It will probably not be possible to do this with all of its suppliers. For example, ConocoPhillips also works directly with many very small family owner or independent businesses, which are sometimes known as "mom-and-pop", which do not have sophisticated software systems to gather the data.

For bigger suppliers, the biggest question may be whether the management support it sufficiently. "You have to have organisation and leadership team alignment," he said. "Schlumberger's leadership team was open to proving out this concept."

ConocoPhillips also had enough confidence in Schlumberger's data that it felt it did not need to change anything, he said.

ConocoPhillips is now looking at gathering data from other categories in Scope 3, such as emissions from its freight use and staff travel.

US listed companies will be required to gather emissions data from suppliers by 2030, under regulations from the Securities and Exchange Commission, he said. It will take a long time

to put systems in place to gather this data, they may be better starting now, he said.

Selecting suppliers

ConocoPhillips' Mr Thompson was asked if suppliers are being selected on the basis of their emissions.

"We have an internal team doing a lot of work on Scope 1 and 2 data capture. Scope 3 is not on their radar. We're looking at the POC to see what's possible in Scope 3. So right now, I would say its not part of selecting suppliers," he replied.

Schlumberger's Mr Shackleton added that there are many analogies between the emissions and the costs of a product. Customers certainly take price into consideration when choosing suppliers.

"It would only make sense for buyers to be aware of the environment footprint as well as the cost of an item," he said.

Standards

It is important to collaborate with standards groups like PIDX and Open Footprint when developing systems to exchange emissions data, Mr Thompson said.

Mr Thompson is involved in the development of the PIDX ETDX standard. PIDX developed a Memorandum of Understanding to collaborate with standards body Open Footprint and keep in regular contact, so each party knows what the other is working on," Mr Thompson said.

"Open Footprint were focussing on the Scope 1 and 2 data model. We saw it more of the domain of PIDX to take that data model and get it into the supply chain so it can become Scope 3."

The PIDX project team was keen not to re-invent anything, and will keep looking at what is available, he said.

Many standards bodies, including the World Business Council for Sustainable Development (WBCSD), have specified data attributes for emissions which could be used for the data passed through a supply chain, Schlumberger's Mr Shackleton said.

PIDX's ETDX standard also specifies attributes. The PIDX ETDX Working Group is looking at the WBCSD model "to see what we've missed or to see if we can align the draft attributes with the attributes they have developed," he said.

One attribute is "the embedded emissions footprint of a product going right the way back up the supply chain to the mine," he said.

"Another attribute, if this is a product, is the expected emissions during the use of that product. If it's a service, what is the carbon footprint of that service on a per hour, per day, per 100m drilled basis."

"We thought it would be important to have a measure of the uncertainty," he said. It can be impossible to know emissions precisely, so an estimate of uncertainty should be included.

Another useful attribute would be the methodology used to calculate the footprint, such as the GHG protocol, he said. There could be an attribute for how the numbers were verified, such as by a specific organisation, or to a specific ISO standard.

There could be an attribute for what category of the customer's Scope 3 data the emissions data falls under, he suggested.

Trusting the data

Mr Shackleton was asked how he thought suppliers could best ensure that their data is trusted.

"I think with any numbers we see, we should be sceptical until we know a bit more about them," he replied.

One way to improve credibility may be to share the calculation mechanism. "I think the consumer wants to at least know they can see what standards were used to calculate those numbers," he said.

Microsoft, PIDX and supply chain emissions

Microsoft is involved in PIDX's work to develop a standard way to exchange emissions data between buyers and suppliers. Kadri Umay explained what it means from Microsoft's perspective

The ultimate goal of the PIDX ETDX (Emissions Transparency Data Exchange) project is to enable buyers to easily obtain carbon footprint data for any product and raw material they have bought or are considering purchasing, said Kadri Umay, principal architect with Microsoft, based in Redmond, Washington.

This includes the manufacturer's Scope 1 (directly controlled) emissions and its Scope 2 (mainly electricity) emissions. Also any other value chain emissions involved, such as emissions from products the manufacturer purchased and transportation emissions. This would then form part of the Scope 3 (value chain) emissions of the customer.

The carbon footprint data is flowed along the supply chain, as products are developed by a chain of companies until reaching the end customer.

"I think that's where we want to end up, that's the North Star," he said, speaking at a PIDX webinar on August 31st, "PIDX Journey to Net Zero Webinar Series Part 1".

The goal is "you can have one common scope 1 to Scope 3 reporting system," he said. Buyers "don't need to do anything, [they] just get scope 3 data from suppliers."

The system could be extended for products or services you are considering acquiring – so you can find out what the emissions footprint of those would be.

Mr Umay's role is working with large companies and Microsoft's partner ecosystem to deliver digital systems like this. He describes himself as someone with "[digital] architecture in his heart".

Why care about Scope 3

Many companies are asking themselves why they should care about Scope 3 emissions. A good answer is because most of the emissions associated with your company's activities are likely to be in Scope 3.

For example Microsoft has calculated its own emissions, and found that 98 per cent of its footprint is in Scope 3 This includes emissions from the use of Microsoft products, such as a computer made by Microsoft, or running its software.

By focussing on its Scope 3 emissions, Microsoft takes a bigger interest in ensuring that computers running its software use the power efficiently, he said.

"You cannot have any net zero plan without solving the scope 3 emissions problem."

It is not just software companies which have most of their emissions in Scope 3. Oil and gas products see much bigger emissions made by their customers than from their own operations. Schlumberger, also presenting at the webinar, also calculated that the bulk of its emissions were in Scope 3, Mr Umay noted.

Better Scope 3 data

For a company calculating all of its Scope 3 emissions, there are 15 different categories described in the Greenhouse Gas Protocol, covering both upstream (purchases) and downstream (customer use of products).

Scope 3 is harder than Scope 1 because it involves activities outside the company.

"You need to look into different standards, measurements, different ways of using it."

If the data is not 'flowed' across supply chains, then other people also need to re-do the calculations (although without the source data, so using more estimates). It "puts this complexity in every single company," he said.

That also means that different companies in the supply chain are using different data. "Everyone might have their own calculations which might produce further challenges into the process," he said.

Getting from estimates to measurements

The more data about emission that can be received from suppliers and used by operators, the less reliant operators will be on estimates.

Emissions data can only be directly measured at the point where the emissions are made, so if companies are to have accurate data about emissions made by their suppliers, the data needs to be provided by suppliers, he said.

Currently there are various calculations, methodologies and emission factors being used by operators to calculate the emissions, and very little measured data being sent by suppliers.

Today, "most" Scope 3 calculations is done with activity data, so you get data about activities done, such as car mileage, and use that to calculate the scope 3 emissions for driving.

"Some of it is like waving the hand, going from square foot of office space to emissions calculations," he said.

Companies are using what is known as "emissions factor libraries", which is another complexity, he said. For example, there can be an

Kadri Umay, principal architect with Microsoft

emission factor describing how much CO2 is emitted when a volume of a certain fuel is combusted. They might be different for different standards. There can also be constants or other attributes to be used in the calculation.

As an example, when calculating transportation emissions, the approach may be to multiply the miles travelled with various factors.

And when it comes to doing the calculation, there are many different standards for how to do it around the world.

All of us are trying to go to a more precise calculation, most importantly to a point where we can measure some of these things," he said.

if you have a provider for transportation fleet which calculates the emissions in a proven way you can get that information [instead].

Suppliers calculate the data as their own Scope 1 and 2 emissions, using sensors or other industrial devices, or pre-calculated data. They need to bring the data together, analyse and then distribute it.

If data is gathered from suppliers, the data could be brought through manually (re-entered into the system), or using spreadsheets. The data might be brought through multiple different technical "back ends" from multiple different sources.

Carbon border adjustments

One factor driving interest in supply chain emissions is carbon border adjustments, such as those being planned in the EU.

Carbon border adjustments are taxes paid when goods are imported, to cover the balance between the costs of producing the goods in a country which has carbon emissions costs, and producing the goods in a country which doesn't, and then importing it to the one which does.

If it was possible to demonstrate that a supplier has produced their goods with very low levels of carbon emissions, the importer could pay less tax compared to another supplier.

"When these regulations take effect, flowing Scope 3 emissions across the supply chain will be even more important," he said. "You need those supply chain systems that makes it visible across the suppliers and consumers."

It would be useful to have a reporting mechanism across industries and supply chains, which was "immutable and transparent" and could be validated by regulators, he said.

Microsoft's dashboard

Mr Umay illustrated how Microsoft is tackling the problem for its own customers, with a dashboard tool available for free download from its app store, built on the Power BI software, which calculates your Scope 1, 2 and 3 emissions from your use of Microsoft Cloud components.

This might include the electricity use (under Scope 2); the emissions from manufacturing the servers (in scope 3); and the customer use of the data (Scope 3).

The dashboard can provide data in the 15 Scope 3 greenhouse gas protocol categories, and then provide a further breakdown, such as by country.

The data can be imported into the customers' systems. "Its a pretty complicated system," he said.

Adding emission to the transaction

PIDX is an oil and gas data exchange standards body focussed on e-commerce. It provides standards for many aspects of digital transactions between buyers and suppliers, including for catalogues and electronic invoices.

Data can be sent in PIDX standard format from a suppliers' software system to a buyers' purchasing software system, whenever something is bought.

The ETDX program will add additional logic to the PIDX schema to describe emissions associated with purchases, Mr Umay said. Suppliers can send out their data so it becomes part of their buyer's Scope 3 data.

The challenge can be described as ensuring that the emission data can flow as a "first class citizen" in the data about the supply chain transaction, without ripping out and replacing the systems which are already in place, he said.

"Every single provider in the supply chain provides this emissions data and flows it through the scope 3 system," he says.

If this can be done, "there's a lot of competitive advantage you can get or the fleet provider can get," he said.

"Wouldn't it be nice if someone does these calculations for their own services and gives you that information. If it doesn't happen, you have to do the calculation for all the sub-categories, in all your geographies."

Not a new standard

The PIDX ETDX team is clear that it does not intend to develop a new standard for how data should be measured. There are plenty of other groups doing that. This was brought up as a goal in the initial ETDX 'ideation sessions' in February 2020, he said. "One of the first things we put on the board [was that] we don't want to reinvent the wheel."

"So many people come up with, 'I'm going to combine all standards and come up with a universal standard'. Essentially you get another standard which people have to work on."

The ETDX group works together with the Open Footprint team and aims to adapt its schemas. The mantra is "reuse, reuse," he said. PIDX is a member of Open Footprint, and Open Footprint is a member of PIDX.

Developments with ETDX

So far, the first pilot of the ETDX standard was conducted between Schlumberger and Chevron, described in a separate article in this issue.

"We have the Emissions Transparency Data eXchange team, we have the working group, we're partnering with other organisations to make this happen," Mr Uday said.

"We want to facilitate the same PIDX data exchange platform and schemas that we are using for your supply chains / procurement, with minimal interruption to your existing PIDX supply chain system."

The standard will make use of PIDX's existing data dictionary of standard product attributes. The emissions footprint components can be added to this data dictionary.

A standard data dictionary simplifies life, he said. You can compare different product offerings by their attributes, or check if one is compatible with another.

You can share 'static' emissions data about emissions from producing the product, and then add 'dynamic' emissions data describing how much CO2 is emitted when the product is used.

For any product, for example a drillbit, there can be two attributes to be added – the manufacturing footprint (emissions generated in manufacturing) and usage footprint (emissions generated from use).

The basic use case is the typical message exchange between a buyer and a seller, where there is a desire to embed emissions data in the messages, either as a separate message or in the message itself. "That's what we're testing here. We are adding those schema points to the PIDX messages."

Then, the data can be taken out and incorporated into downstream (customer) systems.

"In some of these supply chain transactions, people are already exchanging emissions data in free text fields," he says. "So there's clearly a need for 'flowing' this."

The emissions data can be line item based' (with emissions data for each item on an invoice), or 'summary based' (covering the whole invoice).

Trusting the data

Mr Umay was asked about the best way to ensure that supplier data can be trusted.

One pathway is for records to be validated by a third party, he said.

There is work going on to develop systems which do not allow data to be changed, such as blockchains and 'immutable ledgers'.

Data standards can also add a layer of transparency.

If regulators get involved in carbon emissions, including using the data as a basis for taxes or tax credits, they can enforce or give incentives for better transparency in emission reporting, he said.

Another method is to provide more information about the source of the data – where the input data came from, how the calculation was done, and what the outcome was. It will help "if you have a platform where you can transparently report these data points," he said.

Today, companies provide their environmental data in big annual reports.

"It is very hard to get into that and understand how its calculated, no matter how transparent it is," he said. "If you have a dashboard you can see where the data comes from."

There are some aspects of emissions data which companies may be sensitive about releasing, but it may be possible to find ways to provide transparent data without revealing any secrets. "We'll have a few more iterations until we have a fully transparent reporting mechanism," he said.

The video and slides of the PIDX webinar, "PIDX Journey to Net Zero Webinar Series Part 1", can be viewed free online at **www.pidx.org**, under the 'events' tab at the top see 'past event presentations' for slides and 'past event recordings' for video

Salesforce – software tools for oil and gas decarbonisation

Cloud organisational software company Salesforce is developing software tools to help oil and gas companies gather and report emissions data, following work it did to build software for its own emissions

Organisational cloud based software company Salesforce is developing tools oil and gas companies can use to manage their own emissions. It builds on software Salesforce developed to manage its own emissions.

The biggest problem companies normally face is finding and sorting data about emissions, said Georges Smine, VP sustainability solutions, Salesforce, speaking at a PIDX webinar on August 31st, "PIDX Journey to Net Zero Webinar Series Part 1".

Many companies are getting to grips with their Scope 1 and 2 data but haven't really started on their Scope 3 data. "The data is there, it's a matter of making sure you are able to find it," he said.

The work can involve doing an inventory of all data sources, working out where they come from, and then connecting them into a "single source of truth."

"Data becomes the foundation for embedding net zero," he said. You can't reduce emissions "until you are able to start measuring and assessing them across the business. You can't manage what you can't measure."

"The opportunities for all of us, and oil and gas in particular, are to look at building this repository or single source of truth of data."

Scope 3

Scope 3 emissions have 15 different categories, and it is a challenge keeping track of them all, he said.

The emissions data has multiple dimensions, so can be seen as a data cube, he said. For example, emissions associated with different types of assets such as buildings, pipelines and production facilities can be one dimension. Emissions associated with different stages of the lifecycle of producing hydrocarbons - exploration, extraction, shipping and pipelines, refining, and retail distribution – can be another dimension.

Georges Smine, VP sustainability solutions, Salesforce

"You're looking at how to map what is coming from your suppliers and how you report to your customers," he said.

"It is about solving an IT data problem, to orchestrate the data."

Growing pressure

Oil and gas companies face more and more demands from industry stakeholders to address climate change and other ESG issues, and "investors are leading the charge," he said.

"This is trickling down to all companies and their supply chain. You see that momentum go on."

ESG funds continue to be emphasised by a lot of investors, despite some backlash against them, he said.

Company CFOs are starting to get involved in emissions issues, seeing carbon emissions increasingly as part of their domain. They want to keep the company attractive to investors and existing shareholders. They are also increasingly aware of the costs of carbon taxes of various forms.

There is a growing interest in the use of standard tools for emissions data reporting, to enable investors to compare one company with another and get a much better sense of what is going on," he said.

197 states have signed up to the United Nations Framework Convention on Climate Change. This means they need to make plans to reduce their own emissions, so force businesses in their countries to do so.

Some banks are asking for emissions reporting as a condition for loans or a line of credit, and insurers are asking for data.

"We're seeing net zero find its way into contracts, where they could be potential disqualification rules if you are not able to adhere to net zero guidelines," he said. "You may incur penalties, you could be shutting yourself out from certain markets."

Salesforce's emissions

Salesforce has been working to gather its own emissions data and ensure it is on a pathway to net zero. It wants to reduce its direct and indirect emissions, including scope 2 (electricity) and scope 3 (purchased goods), emissions from data centres, one of its largest emissions, and emissions from business travel.

In doing this, it has learned a great deal about "the whole business of gathering emissions data," he said.

It wants to invest in CO2 removal technologies such as reforestation. The company wants every activity it conducts to have its emissions offset. It is looking at renewable energy consumption.

The company is using what Mr Smine calls its 'superpower' of software development to help "automate and accelerate" the process of managing emissions through the company.

It has produced a comprehensive carbon accounting and reporting solution. This "helps companies to automate and consolidate their emissions data, and produce all the necessary reporting to comply with different standards, frameworks and regulations," he said.

"It lets you build an emissions calculation based on libraries of emissions factors."

"The emission estimates [can] work well, but we need to get to a point where we're achieving actuals," he said. That happens when "we're able to facilitate the exchange of data between suppliers and customers."

"Also, you are able to capture calculations from your direct suppliers and partners."

Trusting the data

Mr Smine was asked what he thought was the best way to ensure the data is credible.

He replied that auditing is a crucial part of the process. "That's how we trust financial reports when we make investments with our retirement money, without necessarily knowing all the detailed standards. We trust the system overall."

Another way to build trust in the software is to make it easy to revise data if errors are identified, or a better method of data gathering is found.

It's critical to think not just about a onetime aggregation of the data, but make sure that the data can be revisited, recalculated and restated, he said.

"All of these factors would create a level of trust in the system," he said. "We have a lot of work to get there."

Sidetrade, Global Value Web and OFS Portal

Three technology companies with products related to supply chain emissions data are Sidetrade, Global Value Web, and OFS Portal

Sidetrade of France has products to manage electronic communication and communications between buyers and suppliers, including emissions data.

Sidetrade is headquartered in Boulogne, France, and has offices in Dublin (Ireland), Birmingham and London (UK), and Calgary (Canada). It acquired Amalto, a major North American "order to cash" company, in April 2021.

It has tools for order management, credit decision making and risk monitoring, all the way to cash collection.

The company makes tools to help suppliers manage disputes with clients over invoicing, including to co-ordinate input from staff members other than those in the debt collection department, says Brian Pederson, VP products with Sidetrade.

Its order management systems use dynamic data as well as static data. For example a company's debt collection staff can be notified if a client is starting to pay late, so they can start pursuing payment earlier. It can inform debt collection staff if a client has notified that an invoice is approved for payment, although it has not yet been paid, so that they do not chase it.

"What used to be a pdf invoice has become a very significant amount of data being supplied to customers and buyers," he said. "We see a constant drive for more information."

"The more we can collect data and use to our advantage, and start using technologies to power that data, we're going to be in a great spot."

Global Value Web

Global Value Web is a data management and analysis company focusing on the energy and health sectors, which provides services to manage emissions data. It is based in Liessel, Netherlands, and with an office in Milan, Italy.

"We are selling the tools the industry needs to effectively capture all product information and have those points of information properly flowing through your value chain," says Louis Hendricks, founder and CEO.

Mr Hendricks thinks that companies will soon be talking about Product Lifecycle Management (PLM) software, which can cover multiple companies in a supply chain, in the same way we are used to talking about Enterprise Resource Planning (ERP) software. "You need an extended value chain resource planning capability," he says.

The aerospace and automotive sectors are "really good examples" of companies advanced in doing this, he says.

The oil and gas sector has at least four 'value chains', such as from a well to a refinery, from a refinery to a pipeline, and then onto end customers in different forms.

OFS Portal

OFS Portal, a company owned by major oil and gas service companies, offers a number of services relating to managing supply chain and emissions data.

The company has a 'software as a service' platform for handling transactions using PIDX standards, which is used by 500 operators.

It provides a legal framework for transactions, so companies can agree to the whole framework without any further legal discussion.

It has tools for suppliers to manage a catalogue of products, including confidential pricing for individual clients.

It helps clients keep up to date with government / fiscal reporting regulations around the world.

It also offers services to gather Scope 3 data, integrate supply chain systems together and consulting services.

Models on models – a better way to manage emissions data

Rather than managing emissions data by gathering granular data and attempting to 'roll it up' into dashboards, we could develop many layers of intermediate models to make it easier to work with. Here's how it could work

Extract from a new book by Digital Energy Journal's editor, Karl Jeffery

To decarbonise, we need awareness of where our emissions are coming from and what we can specifically do to reduce them.

Having awareness is like standing at the top of a mountain and looking down at the world. Everything in the world feels like something we can work with and live in. Not a mess of complex unfriendly detail. Which is what most decarbonisation projects quickly become.

Digital technology could help provide this awareness. But it does not, not much anyway.

In the world of carbon emissions, decision makers may have tools which can tell them about one specific emission source, such as from their fuel consumption.

They may have an 'emission management system' they can use to handle data about multiple emission sources, make sure they have provided everything an emission reporting standard demands, and then generate reports.

But this is not really awareness of how your emissions result from your decisions, such as in purchasing, operations, scheduling, investment, across multiple emission types. You want to understand what would make emissions go up or down and by how much, and how the company's costs, productivity, or other factors important to the company are affected.

Such an 'emissions management system' will probably not do much to help you find the best course to achieve 3 per cent reduction in emissions each year over the next 30 years, as achieving net zero requires.

What about if you are a purchaser, bank lender, regulator, insurer or investor. In other words, a stakeholder in multiple companies. You want digital technology which will make it easy to get an aggregate picture of all of these companies, or show which companies are improving their carbon picture. The emissions management system probably won't do this either.

We propose a different way of building digital technology which does this, based on models designed to support people's awareness and decision making, built up of multiple smaller models.

Reducing emissions while life goes on

This approach can be useful because decarbonisation is unlikely to be about simple choices. We need to know the levers to reduce emissions, whether they are working, and how decarbonisation fits with our other objectives such as making profit or developing a business.

We have to understand the cause and effect of whatever domain we are working in, and develop stories about how it all works, taking carbon into account.

This all calls for much deeper awareness into how decarbonisation fits with the rest of our company's activities, while seeing how we can achieve continuous steady reductions.

Awareness is not data

Technology companies working in decarbonisation need to enable their customers to achieve awareness, not just provide them with data.

Human awareness means much more than data. Data plays a part in awareness, but not the only part, and it is filtered through what we already understand.

To illustrate the comparison, consider the difference between a parent's understanding of their child and what they can see in 'data', such as exam results or the child's food consumption.

The same goes for our relationships, our career, the state of our house, or anything else which is important enough for us to want a deep awareness of what is happening with it.

There may be data involved, but not everything we need is available as data, and there are many steps from data to awareness.

In 2022, digital technology companies are thinking about data, but they are not thinking about awareness.

They may think that, as technology companies, the most they can do to deliver awareness is to provide data.

Yet any other service provider to society you can think of – supermarkets, policing, schools, hospitals – would not judge their contribution purely in operational data.

The technology industry's focus on data leads to thinking about the 'user experience' but in a way which does not relate much to what the technology is meant to be delivering. We would not want any other service provider to society to ultimately judge its services based on the 'user experience'. It's like a train company asking us to judge it on how we felt when boarding the train, rather than whether it took us to our destination at reasonable time, cost, and comfort.

Mental and software models

The best way to decarbonise with digital technology may be for the models in the software to align with models used by the decision makers in their minds.

Software applications also build models about how things work, but the modelling is normally more complex and sophisticated in our minds than it is in software.

A model is a simplified version of reality. Reality itself is too detailed and complex to work with, so we simplify it by modelling the parts we need. All people do this. Dogs and cats do it too.

Modelling is not something you choose to do, or which you learn how to do, it is something you already do. But you have not needed to label it, because it is so obvious and there has never been any question of not doing it.

You have models in your mind for everything you are responsible for, seeking to achieve, care about or are interested in. Relationships, property, hobbies, career development, how anything works, with people, organisations, and machines.

A geographical map is a form of a model. It takes away detail of the geographical landscape to show what someone might want to know without giving them information they don't need.

Models aren't just for explaining things. Like geographical maps, they are also for finding our way somewhere or explaining it to someone else. They can be about showing how something works or showing how we are going to get somewhere.

A model can be for working out sub-goals which will help us achieve an overarching goal. We could call this 'goal modelling'. An example is the sub-goals pursued in warfare, such as supporting morale and maintaining supply of oil.

Consider the complex sub-goals our ancestors pursued in order to survive, including defending their town, growing crops, and religious rituals, which they thought had a big influence on their survival. They would have been continuously considering what works and what doesn't.

Models can be held in people's minds, written down, and programmed into computers. Computer systems can be developed to support the models which people have in their minds.

Break models into smaller models

A full 'digital-awareness-decision' model can be broken down into multiple components which we could call 'small models'. For example, there could be small models for gathering data, working with data, analysing it, moving it to the right place, presenting it, simulating it, or anything else. Each of these components could be made available separately as a small model.

Small models could be used to process certain types of data, make a certain data presentation, do a certain analysis, or work with data from a certain machine.

The small models can be put together like Lego bricks making a house, a person dressing themselves with different pieces of clothing to make an overall look, or a DJ mixing together elements of music.

These small models can be so simple that they can be shared freely, whilst the user companies pay digital technology developers to do the work of connecting small models together to make a big model which does what they want.

For an example how small models could be brought together to make a big model, consider all the decisions we make in our family life which involve emissions. They add up to a complex picture, but individually they are quite straightforward.

We could have a small model about deciding on the time we switch on central heating and the temperature, the maximum cost of a flight which we would pay to go somewhere, and when we decide something needs replacing. There could also be small models to do simple calculations for us.

A model to answer a complex but fairly common decision, such as whether to tear down a house and build a new one, can be built from small models such as for working out emissions from new steel and concrete, emissions from demolition costs, how the energy efficiency of the new home compares to the old one, and how it all adds up.

Consider a decision tool about the best temperature to use to run a tank wash. The full model would be very complex, but it could be built from small models, such as one to work out the emissions from washing the tank at a certain water temperature.

Technically there are plenty of challenges for a small decision-making model developed by one company to be used by another. You would need to have data gathered and stored in the same way as the person who made the small model for their own use. But there are ways to overcome this problem, such as from using data storage and exchange standards like Open Footprint.

From binary to complex choices

Much of the discussions about decarbonisation up to 2022 have been fairly binary, a choice between this and that. As the choices get far more granular and complex, digital technology and modelling gets much more useful.

Complex choices relating to carbon are about the temperatures we heat to or clean at, the trips we take, the purchases we make, the investments we make, the waste we have and

what we do with it, the skills we develop, the speed we go at, if we keep something well maintained. Whether to replace or rebuild, or continue with what we have. If we are to achieve decarbonisation without negative impacts on our lives, we need to take the right option in many complex choices.

An industrial example of a complex choice could be a company operating thousands of motors deciding which ones should be upgraded or provided with regulators. Enormous energy and cost savings are available by changing motors to recent models or adding regulators (known as 'variable frequency drives') to control the energy consumption of the motor.

Most motors in today's industrial use are not the most recent models, and are oversized for what is required, because they were installed in a time where energy costs did not matter so much. They also have no means of adjusting their power consumption and output.

But investing in upgrades to equipment is also expensive and will not pay off in all circumstances. The pay-off depends on the cost of the upgrade and the operational energy savings, which is based on expected future life of the existing motor. But if you can work out which motors should be prioritised for this improvement, it would make big dividends in both carbon and cost.

Carbon taxes are another factor which makes environmental decisions less binary. High direct costs on emissions are useful in achieving decarbonisation because it means we have more reasons to reduce emissions than just opinion, which can be limited in its force. But it means there is another factor to consider in how we make our choices. This then makes modelling more worthwhile doing.

The carbon footprint concept

The carbon footprint concept gets a lot of criticism. People rightly say, a footprint can never be completely measured. But it is the right concept. When we choose to undertake an activity, we create a mix of emissions, which would otherwise not happen. If we want to reduce emissions, we have to know what activities to stop and how to stop them. So, we need an idea of the carbon footprint.

Just like an actual footprint, it does not need to be completely defined, just understood well enough to see it is there. There is a clear enough difference between leaving a footprint and not leaving a footprint.

We call it a 'footprint' rather than a number about our emissions, because every real-world activity has a wide range of emission sources. Perhaps one large emission source, such as the emission from fuel combustion when driving a car, but lots of smaller emission sources, such as from manufacturing the car and constructing the road. Every carbon footprint has some version of the 80:20 rule - a small number of emission types are responsible for the bulk of the emissions.

It will never be practical to calculate our carbon footprint absolutely because a list of the emission sources related to any product will never end. But at some point, we can draw a line and say we have the most important emissions of our activity, and a manageable list of emission sources.

Ultimately a carbon footprint is provided as data, which is generated through a model using a mixture of calculation, estimates at varying degrees of granularity, setting boundaries, and omission.

Where we share this footprint with others, we would ideally also share the model behind it. If we are sharing it with our stakeholders, so we care about their view about this model, we should be able to discuss it with them. If the discussion leads to both parties agreeing to add extra emission calculations to a model, or improving an element, the digital technology should be extendable to allow this.

Data reporting to operational decisions

Most of the discussions and software around industrial decarbonisation so far have been about reporting.

Carbon reporting is important, such as for regulators to set limits, governments to understand the big picture, and for bank lenders to set conditions.

But it is also important to put it in its place. Decarbonisation is not achieved primarily through better reporting. It is achieved through making a series of good decisions and being able to factor carbon emissions into them. Reporting may help provide data to inform these decisions.

To illustrate the difference between reporting and decision making, consider what makes a supermarket chain successful. Good data collection, management and reporting is important in supermarkets. But what is more important is the ability to make continuous decisions based on this data.

A supermarket chain sees continual changes to supplier prices, customer demand and competitor activity. Its decision makers need to understand how customer demand changes with price, time of year, and other factors. As a result of this understanding, they can make good decisions about what to put on the shop shelves and how to price it. A customer sees it worthwhile to visit and give the supermarket its grocery spending.

Or consider how a family household becomes low carbon. Reporting is unlikely to play a major role. But perhaps this family has found a way of living which does not involve much emission. This may be a family which can be comfortable living in a small home, without a car, without family holidays involving long flights. With moderate heating, without too much food waste, or buying lots of clothing and other manufactured products. In other words, it has found ways to get into a low carbon position. No reporting has been involved.

Building on the dashboard

A technology developer may read this and think, the best way to serve a decision maker with technology and give them awareness is to provide a great digital dashboard. It will give you the most important information on the first screen. Then you can drill deeper to find more detail or see how the initial figures were calculated.

But in terms of delivering actual awareness, this only works if the dashboard is giving someone precisely what they feel they want at that point.

Giving someone a dashboard is like a teacher giving a textbook to a child. It is possible that the child will read the book and immediately understand the subject, but it does not happen very often.

The usual first reaction of a child given a textbook, or any adult given a random nonfiction book, or someone being shown a software dashboard, is that they feel it is not relevant to them.

People have very specific and diverse needs, interests and starting points. Even a classroom of students learning the same thing for the first time.

People working in a company with its own operational methods can have the same reaction, if they are shown a software dashboard, unless it was designed for their specific needs. And the awareness needs of people in two companies doing the same thing can be very different.

Also, the information someone in an operational role needs will not all be the sort of reported data provided from a dashboard. It might also involve what is happening right now in the company, what is required of them, what other people are doing elsewhere in the company that affects them.

This text is taken from a new book by Digital Energy Journal's editor, "Decarbonisation, situation awareness and better digital tools, and why the current technology approach isn't getting there." The full book is available online **https://bit.ly/DSADTSept22** or on Amazon Kindle store

Using 3D printed devices to fix 'total' lost circulation events

Drillers can use a variety of devices to stop drilling fluid getting lost for holes up to 6mm. For bigger holes, researchers at Aramco are experimenting with a 3D printed design. It sounds expensive, but the cost of the lost circulation is much higher, so it is worth doing

Lost circulation is where drilling fluid is lost into the subsurface. It is a well-documented oil and gas wellbore creation problem, stemming back to when oil wells were first drilled. It still represents a big challenge today when drilling an oil well.

Understanding lost circulation

To understand why 3D printed devices may be useful, it is first important to understand what lost circulation is.

Drilling an oil well uses a fluid to act as a safety barrier. The fluid also acts as a drill bit cooling medium and a well bore cleaning medium, to transport the drilling cuttings from the well as it progresses.

The drilling fluid is circulated constantly. The fluid circulation path is down the drill pipe, back to surface up the outside of the drill pipe. The fluid is cleaned and then pumped back down the drill pipe.

Lost circulation is exactly as the term describes in that drilling fluid pumped down the drill pipe no longer arrives back at surface but leaks into the formation through which is being drilled.

Lost circulation can cause safety issues and can add millions of dollars to the cost of well bore drilling operations annually.

The severity of Lost circulation is described by the volume of drilling fluid not returning to surface. It can be small, where just a small volume of fluid leaks into the formation, or large where all of the drilling fluid leaks into the formation.

Lost circulation severity is therefore categorized into 4 widely accepted categories: Seepage, Partial, Severe and Total Losses. Total losses are where all the fluid pumped down the drill pipe leaks into the formation being drilled and nothing returns to surface.

The standard method to remedy lost circulation during the drilling of a well bore is the use of Lost Circulation Materials (LCM). The concept of using LCM has been around since the beginning of oil and gas well drilling.

Simplistically LCM is an additive mixed into the drilling fluid which then blocks up the holes or cracks into which the drilling fluid leaks.

The most common types of Lost Circulation Materials are fibrous, flaky or granular materials such as bark, mineral fiber, hair, mica, plastic, wood, cotton husks or date husks.

Most LCMs are good for small to medium amounts of lost fluid (i.e. Seepage, Partial and low severe losses). Generally the maximum size of leak path standard LCM can block and seal is between 4mm to 6mm.

When losses are higher and a leak path is bigger than 4mm to 6mm the LCM is unable to block and seal the leak path. So LCM becomes an ineffective remedy for the lost circulation as the LCM just flows into the formation with the drilling fluid.

Stopping large loss circulation events remains a significant challenge.

3D printed devices for LCM

A new 3D printed concept patented by Aramco has been designed to be used with standard lost circulation material (LCM) solutions that Aramco have successfully tested and proven to plug and seal large 30mm - 40mm cracks and fissures.

The combined use of this new concept with standard LCM can effectively increase the crack plugging and sealing capacity of standard LCM by 6 to 7 times.

The new concept is to designed to reduce the loss leak hole or crack size such that the standard LCM can then plug and seal designed.

Reducing the leak path size is achieved by introducing a 3D printed Lost Circulation Material 'catcher'.

The catcher is introduced into the drilling fluid and flows with the drilling fluid down the drill pipe and into the loss leak path where it would become wedged, Figure 1 A.

Once the catcher is trapped within the leak path fissure, deployed Lost Circulation Material would collect and bridge on the catcher. This creates a formation pressure seal, stopping the drilling fluid leak as shown schematically in Figure 1 B.

The Lost Circulation Material Catcher concept has been called a Lost Circulation Shape (LCS).

The design of the Lost Circulation Shape is three-dimensional, faceted, hollow and perforated. The shape perforations are designed to 'catch' whatever LCM is used. So the the perforation form and size are matched to the optimum LCM plugging capability.

The external shape of the Lost Circulation Shape is a faceted to facilitate the stacking of individual shapes on top of each other.

The Shape is hollow in order to minimize the volume of material used in construction and create a neutral buoyancy effect within a flowing drilling fluid.

To maintain design change flexibility, and allow Lost Circulation Shapes to be manufactured at any location, 3D printing was selected as the most appropriate manufacturing method.

3D printing has become a widely accepted manufacturing process and allows the creation parts not possible to manufacture through traditional manufacturing techniques.

3D printing techniques allow the creation three-dimensional objects with complex geometry features (internal and external) by building successive layers on top of each other, each layer sticks to the preceding layer until a complete form is produced.

Many different materials can be used in this layering process including metal, thermoplastics, ceramics, composites, glass and even ed-

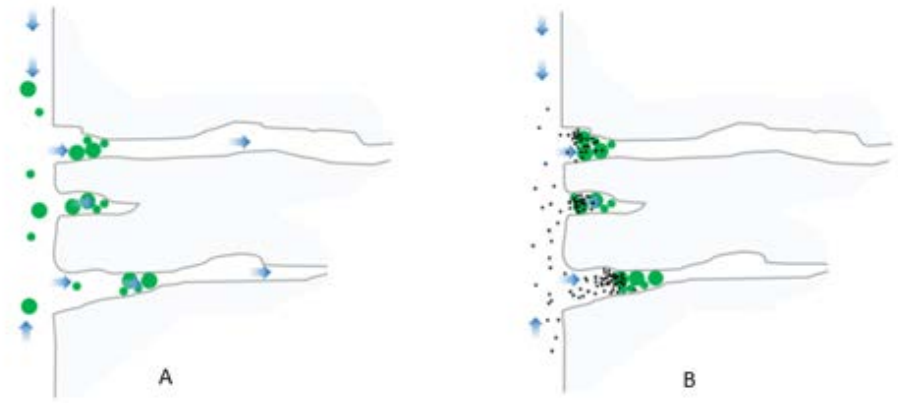


Figure 1 A - Deployment of Lost Circulation Shape
Figure 1 B - Lost Circulation Material deployment interaction

ibles and biomedical.

The ability to create complex geometry features (internal and external) in many different materials without the need for expensive molds or dies was one of main considerations for producing the Lost circulation using 3D printing.

The flexibility of the 3D printing manufacturing process will allow rapid bespoke design modification of the Lost Circulation Shape to suit specific loss circulation events as required.

The other key advantage of using 3D printing is that it allows the manufacture to be done local to where application is required.

The Lost Circulation Shape is designed using standard CAD software and saved in the standard 3D printing .STL file format.

The Lost Circulation Shape has been designed specifically for 3D printing manufacture such that no additional print support structures and so no 3D printing post processing is required.

The size tolerances and surface finish on the shapes has also been made non-critical.

These design considerations greatly facilitate the quality control and acceptance criteria of

Figure 2: 3D printed lost circulation shapes

the Lost Circulation Shape (Figure 2) such that simple email communication of the .STL file to any 3D printing factory that has the appropriate printers is all that would be required to produce the Lost Circulation Shapes without the need for prior knowledge or trial manufacture runs.

The Lost Circulation Shape form is relatively simple. But if it was manufactured using traditional manufacturing techniques, making the hollow chamber and perforations would require complex multi-cavity very expensive mold tools.

The current development of Lost Circulation Shapes is at a field-testing phase requiring unit volumes of thousands. Comparison of unit costs between 3D printing and the investment of mold tools for traditional manufacturing makes 3D printing the more economic choice for manufacture.

When the prototype testing of the Lost Circulation Shapes is complete and the use of the shapes becomes an operational requirement, the volumes would probably increase to tens of thousands.

This significant volume requirement would justify the use of traditional volume manufacture processes if considering only unit cost of manufacture. Although the advantages of multiple site manufacture and design change flexibility would be lost. The perceived value of these unique 3D printing advantages may justify the higher unit cost and continued use of 3D printing.

Practising your cybersecurity response

Cybersecurity is not just about having plans in place – it also means having staff well rehearsed in their response. UK cybersecurity training company Immersive Labs helps companies to practise

Being resilient to cyberattacks is not just about having plans or technology in place, but also having the capability to respond. And the best way to develop this capability may be to practise as an organisation.

When you are faced with what professionals call a 'dynamic risk', something continually moving, if all you have is a response plan in a file, this is not enough, says Kev Breen, Director of Cyber Threat Research at Immersive Labs.

The most important characteristic is being resilient to attacks, Mr Breen says. As with any war, the attacker starts with a first mover advantage, such as suddenly taking advantage of a weakness in an operating system. The more resilient you are, the harder you are to attack. If people understand the risks and the best ways to respond to them, they can be prepared for any kind of incident, he says.

Application security professionals talk about "shifting security left", which means thinking about security as early as possible in every process

The alternative, which happens too often, is that security is only thought about at the end, when a problem happens, he says. "You can never say its never going to happen to me unless you turn everything off."

Companies in the Critical National Infrastructure (CNI) sector, which includes oil and gas operators, take an average of 137 days after a threat to equip their cybersecurity teams with the necessary skills to defeat attackers, according to Immersive's research.

This was found to be much longer than other industry sectors. The second worst sector, leisure, took half as long, although any cyber threats may not have been so complex.

Lab environments

Immersive Labs is based in Bristol, UK, with offices in Boston (USA) and Düsseldorf (Germany).

To help company staff to develop the necessary skills before an attack happens, Immersive has developed "lab environments" where companies can go through a realistic simulation of a cybersecurity incident leading to a company crisis, and work through in a team what they would do.

People can do exercises and tests, and see how they compare with an average of other similar organisations.

The training is normally done either with a team of senior leaders or security professionals from the company seeking to improve its cybersecurity, both of which would be involved in any actual incident.


Kev Breen, Director of Cyber Threat Research at Immersive Labs

"It's all about people centric cyber resilience, that's the phrase we're using," Mr Breen says.

Cybersecurity simulation training isn't an exercise to do once a year – it should be repeated regularly, including with new staff members, he says. "It's key to making sure you are resilient across the whole organisation."

Immersive's research identifies trends in cybersecurity attacks, and can bring any new threats into the company's training courses and simulations.

Many cyber attacks have similar 'flows', so you don't need a separate plan for every possible method, he says.

Companies are increasingly providing information about past hacks into the public domain, after an incident has been resolved. Guidance is also released by bodies such as the UK National Cyber Security Centre (NSCS) and the US Cybersecurity and Infrastructure Security Agency (CISA).

The right response

Bear in mind that a company's response to a cyber incident can be just as damaging as the incident itself.

Consider the Colonial Pipeline hack in 2021. The attackers did not actually manage to get their hands on the OT network. "Colonial took the decision to make the OT systems offline themselves," he says. This led to the whole pipeline being shut down.

When the public were aware of the pipeline closure, it led to panic buying of fuel, so another problem not directly caused by the attack.

A better prepared team may have had a means to detect exactly what the hacker had got access to.

Operational technology

One challenge which the critical infrastructure sector faces more than other sectors is the large amount of operational technology (OT), controlling industrial equipment and processes.

This technology is sometimes operated with PCs running Windows software, but the software is not updated to the latest version due to concern that changing the software might change how the OT functions.

Sometimes the companies who provided the original software or technology no longer exist.

The CNI sector "has some real challenges in those spaces that contribute to them not being able to keep pace with cyber," Mr Breen says.

"We need to redefine the way people think about security, taking OT engineers and teaching them how cyber works, teaching cyber professionals how the OT space works."

Although there has been operational digital technology for many decades now, managing the cybersecurity of OT is still seen as a new discipline, he says. The challenge has grown in recent years as devices have become more interconnected.

Intelligent Plant – working with tidal data

Aberdeen data management services company Intelligent Plant is developing tools for working with data from an experimental tidal turbine in the Orkney islands, Scotland

Intelligent Plant of Aberdeen is making tools for handling data for a tidal research project, with the European Marine Energy Centre in the Orkney Islands, Scotland.

Intelligent Plant's main business is providing online tools for working with industrial time series data, mainly in the oil and gas sector.

The tidal research is taking place in a location in the Orkney Islands which has very unusual tidal flows. The tide goes sideways between two islands. But there is a very large, very predictable flow of water between each tide.

So it is a good place to test tidal energy generation technologies, said Steve Aitken, founder of Intelligent Plant, speaking at the Society of Professional Data Managers Mid Year conference online in June 2022. The world's most powerful tidal turbine has been installed, with a capacity of 2MW.

Power from the turbine comes back to shore on a subsea cable. The power is then used in three ways. There is a substation with a direct connection to the electricity grid; the power can be used to make hydrogen which is stored; or the power can be stored in a Vanadium Flow battery.

The tidal turbine has many sensors. The substation switchgear and battery onshore also have sensors.

Apps from Intelligent Plant can be used to gather, store, and work with data from sensors on the tidal turbine, substation and battery. Some of the analysis is actually done on a computer inside the tidal turbine.

Intelligent Plant provides a dashboard which shows the direction the turbine is facing, the tide's direction, the tidal speed, and the power output. It also has tools for calculating trends and checking for anomalies.

Data can also be seen remotely – so the battery manufacturer could see the same data if they wanted, and bring the data into their own systems via APIs.

The Vanadium Flow battery runs a reversible chemical reaction. It does not decline in capacity over time, as a normal battery does. It contains a 'charged' tank, a 'discharged' tank, and a reactor in the middle.

The actual power generation only happens for a few hours a day when the tide is moving in and out; the battery can be used to turn this into a constant power output.

Schlumberger's digital news contd from p5

Collaboration with Aramco

Schlumberger announced a collaboration with Aramco to develop a digital platform to "provide sustainability solutions for hard-to-abate industrial sectors" such as oil and gas, chemicals, utilities, cement and steel.

The platform can be used to measure, collect, report and verify emissions, evaluate different decarbonisation pathways, and manage offsets and credits.

"Aramco and Schlumberger are hoping to draw on our long history of collaboration and partnership to deliver a digital sustainability ecosystem that enables global organizations to manage their carbon emissions and realize ambitious sustainability goals," said Olivier Le Peuch, chief executive officer, Schlumberger.

Digital Partner Program

Schlumberger has launched a "Digital Platform Partner Program", for independent software vendors (ISVs) to build and sell software through Schlumberger's platform.

This means that Schlumberger's customers can more easily access a wide range of digital solutions.

Nine software companies were already offering their products through the platform at the time of launch. This includes Resoptima, which provides its ResX software for reservoir modelling; RoQC which provides its LogQA software to identify sub standard log data and fix it using machine learning; and Tachyus, which provides the Aqueon App for decision making in waterflood development..

Methane emissions

Schlumberger has joined the Aiming for Zero Methane Emissions Initiative, developed by the Oil and Gas Climate Initiative.

Signatories to the initiative include producers, refiners and marketers of oil, natural gas and other fossil fuels, excluding coal. They commit to achieving "near zero" methane emissions from operations by 2030. This includes "pursuing all reasonable means" to avoid methane venting and flaring, and to repair detected leaks.

Uncertain ROI "biggest barrier to technology adoption"

Uncertainty about the return on investment is the biggest barrier to digital technology adoption by energy companies, according to a survey by IFS

The inability to define and measure the return on investment in software was cited as the biggest barrier to technology adoption by 29 per cent of energy decision makers, according to a recent survey by Swedish enterprise software company IFS (Industrial and Financial Systems).

The survey was made of 600 senior decision makers at large 'energy companies' in France, Australia, Japan, the Nordics, USA, UK, and the Middle East, to try to determine the biggest drivers and barriers to digital transformation.

Other barriers to adoption of enterprise software include a lack of clarity about the resources and skills needed (cited by 26 per cent); a poor business case (19 per cent); and a lack of consensus on priorities within the leadership team (24 per cent).

In terms of drivers, 31 per cent said that the top driver for digital transformation is a desire for tighter integration and cross functional collaboration.

Other drivers for adoption of enterprise software systems include better project management (cited by 30 per cent), improved asset lifecycle management (29 per cent) and improved operational efficiency (29 per cent).

When asked what they thought was important, 72 per cent said data analytics, 70 per cent said 'virtual assistants', and 69 per cent said the internet of things.

The research found that 44 per cent of organisations with sustainability goals want to invest in more energy-efficient assets and infrastructure to meet the goals.

79 per cent said it is important for enterprise software to have the capability to set and measure critical key performance indicators. These could include improving resource utilisation (cited by 34 per cent), extending the lifespan of assets (30 per cent) and increasing asset reliability (28 per cent).

65 per cent of companies said they are approaching digital transformation "one function at a time".

37 per cent listed better asset management among the digital transformation outcomes that will have the biggest impact on their company.

74 per cent said it is important an advanced asset management system helps them to improve maintenance, such as by helping move from scheduled to predictive asset maintenance.

There was also big interest in tools that help maximise uptime and drive efficiencies through better asset management.

Other desired results from an asset management system were better scheduling and dispatch (71 per cent), improved supply chain management and reduced inventory costs (70 per cent), support for mobility / mobile phone apps (69 per cent) and support for compatible units (69 per cent).

When asked what they thought was having the biggest impact on their company from a digital transformation perspective, 38 per cent said 'sustainable energy'. New business models and asset management strategies were both cited by 37 per cent.

57 per cent of oil, gas and utility companies that have digital transformation projects said they are looking for an integrated 'composable platform' to support the entire journey, while 38 per cent are going down the niche solutions route.

"Companies in the energy sector are often very risk averse and are frequently dealing with regulators and other stakeholders that demand proof of ROI," said Carol Johnston, VP Energy, Utilities and Resources with IFS.

"These are barriers that more advanced software providers are overcoming, especially through composable platforms that help them to address their biggest pain points incrementally and build measurable return on investment steadily over time."

Geoteric's neural networks for subsurface

Seismic interpretation software company Geoteric is offering two new 'neural network' based tools for understanding the subsurface, and now offers six such tools in total. They will be added to Geoteric's "AI Faults – 3D networks" module, in a new release called Geoteric 2022.2.

The company says its AI Faults technology package can reduce the time needed to interpret faults by up to 95 per cent. It is used by 40 companies.

Mark Brownless, CTO at Geoteric

The software can be used to extract fault surfaces into other modelling packages, such as software for building geocellular models.

The "Acorn" tool can be used to train a neural network from scratch and then fine-tune it, on a company's own seismic data, or basin, reservoir or field data.

Users can choose between different pre-trained networks or use an untrained network. By starting with an untrained network, they can keep the entire ownership of the subsequent trained network within the company.

Users can share neural networks between projects and between colleagues and teams, but keep the company's intellectual property within the company.

The "Meranti" tool is a pre-trained network. Users can fine-tune their models, using "fault sticks", as they do on more traditional interpretation systems.

"Some users prefer to use the software straight out of the box to get instant results, knowing the time, effort and investment of training a [neural] network to a high standard using multiple data has already been completed," says Mark Brownless, CTO at Geoteric.

"Other users want to have more control over their data and results. They want to be able to choose how they educate the network to a particular style of geology or seismic data.

"We are empowering them with options so they can decide what is right for them and their project."

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