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A GOOGLE ASSISTANT FOR GEOSCIENCE?

Total's collaboration with Google leverages natural language processing across document data lake. BERT language model shows promise but currently a large, labeled geoscience corpus is lacking. Call for shared open source geo-ontology.

At a recent EAGE event, Jérôme Massot (now with **Schlumberger**) reported on his work for former employer Total on semantic AI and knowledge extraction in geosciences. The project, carried out in Total's embedded location in Google's TC3 building in Sunnyvale, CA set out to leverage natural language processing (NLP) to help Total's carbon capture and storage (CCS) researchers exploit the 'tsunami' of papers. A search for CCS on the Science Direct website retrieved some 40,000 papers in 2020.

Straightforward Google search is a good starting point when searching for specific information. At a general level, knowledge management tools can improve search with a degree of natural language understanding, intelligent ranking and summarization (à la Wikipedia). But for cutting edge topics, like CCS these generalist strategies fall short.

Enter the conceptual 'bibliography smart assistant for geosciences'. This works across a document lake, providing content extraction, understanding and NL-generated output. For an oil company the data lake will span private data containing documents with a high business value and quality. Alongside is the public data lake. This is bigger, but may be locked, 'science is not free'. There are licensing issues and doubts as to document veracity. On archive.org, 'anything goes, there is no peer review'.

Starting in 2018*, Total set out to create a geoscience-specific equivalent of Google Assistant for geoscience. It turned out that content extraction proved very challenging. Text was extracted from PDF documents with Apache TIKA, PDF2Text and Grobid, machine learning software for extracting information from scholarly documents.

Extracted text is then process into different 'representations' (words, sentences, paragraphs) cleansed and tokenized into 'n-grams', groups of words. Contextualized embeddings assign a value to each word based on context. Massot's team developed embeddings for geoscience using the FastText open source library. With some tuning, the system could return word neighbors. A search for 'migration' could return related concepts such as sandstone, beach, reef automatically. No 'fastidious' annotation of documents is required.

However, Google's native language model 'BERT' covers a general knowledge domain that is not fit for purpose on such specialist documents. Other communities (financial FinBert, biology BioBert) have retrained the model on smaller domain-specific corpuses. This has proved harder for geoscience as labeled data is generally lacking. 'There is no CCUSBert!' Trials with Google's GPT-2 library produced nice-sounding, meaningless text.

Massot believes that there is a need for a shared open source geoscience ontology and corpus of academic papers and technical documents. He sees a role for the EAGE here. Solutions need to be developed by geoscientists in collaboration with data scientists.

* See the 2018 release.

Those interested in geo-ontology should read Paul Cleverley's blog where he presents his work dating back to 2016 and points to a somewhat plagiaristic 2019 Schlumberger paper on 'GilBERT', Geologically informed language modeling with BERT.

STATE-OF-THE-ART DOCUMENT CAPTURE AND THE (NEAR-IMPOSSIBLE) "STRAIGHT THROUGH PROCESSING" KPI

2021 Petroleum Trade Network Oil and Gas Automation and Digitalization Conference event hears from Midstream Process Solutions on AI/ML-based processing of as-build pipeline paper records. Singularity Systems on the process automation pipeline.

Bryce Bjornvick (Midstream Process Solutions - MPS) has developed an expert-trained AI/ML solution to recover key metadata from scanned pipeline documentation. Operators of the 3-million-mile US natural gas pipeline network need to constantly access and review documentation covering construction, operating pressure, maintenance, and demonstrate compliance and realize financial value. However, documentation is frequently of poor quality or incomplete. Accessing these large document sets requires expert knowledge and is a 'tedious and repetitive' process.
MPS is developing AI/ML-based recognition technology to extract data and context from documents such as 'as-built' welding records, radiographic inspections and material test reports. The models were trained with input from engineers. The system provides a measure of data completeness and outputs the results to a map. Even with very poor quality scans or handwritten documents, the system can capture around half of the information required, speeding subsequent human auditing. Overall, the system has reduced material test report processing by 85%. MPS is now developing an application for data gathering during construction and maintenance.

Yingchao Zhang demonstrated Singularity Systems 'SingúAI' platform that sits between data in human-readable formats (Word, HTML, PDF...) and applications such as SAP, Appian, Pega, UIPath and others. SingúAI combines computer vision, optical character recognition, machine learning and natural language processing into a data pipeline. Models are trained through a proprietary human/AI interface, driven by domain specialists with 'no coding and no data science knowledge required'. Zhang concluded with some remarks on process automation. Few commercial business process solutions allow complex use cases to be fully automated. A key metric here is 'straight through processing', the percentage success rate of end-to-end data capture from document to source. 100% STP is almost impossible to achieve. The question then arises, what level STP can be considered success and how much effort and expense is required to achieve it. Zhang believes, 'the single biggest factor is whether you are using a world class solution, a legacy tool, or people dressed as robots!'

Watch the presentations on Youtube and visit the conference home page and Petroleum Trade Network.

SCOPE 3 EMISSIONS REPORTING AND VIRTUE SIGNALING

Editor Neil McNaughton tries to unpick corporate "net zero" pledges to conclude that the three scopes confuse GHG reporting and can lead to double counting. The GHG protocol is an invitation to "creative" GHG accounting.

Reading a recent release from Schlumberger which reported on the company's pledge to go 'net zero' by 2050. I was intrigued by the statement that the reduction of SLB's emissions 'included scope 3'. How could this be I thought. How can a company that does not sell carbon generate scope 3 emissions? I immediately pinged off a string of hot-headed emails to SLB's press folks who handled my rants with elegance. For sure, a company that does not produce oil, gas (or coal) can have scope 3 emissions. I was pointed to the Greenhouse Gas Protocol website for more.

How are the scopes defined? First the easy part. Scope 1 emissions are direct GHG emissions that occur from sources owned or controlled by the company, i.e. emissions from combustion in company boilers, furnaces, vehicles, and so on. That's fair enough. A company should be able to tally its fuel bills and figure something reasonable. Scope 2 covers, 'indirect GHG emissions' such as those 'emitted during the

generation of purchased electricity consumed by the company'. That could be a little harder to figure. A small manufacturer is unlikely to have a great handle on how 'green' its purchased electricity is. Modern markets may switch from different generation modes (coal, gas, nuclear, wind) as the day goes on and as the traders trade. But at least scope 2 is a noble goal, even if it's accuracy is questionable.

So how about scope 3. Well first I want to explain scope 3 in terms of how I understood it before I started my shindig with Schlumberger. Scope 3, I thought naively, covers the emissions produced when, for example, the oil produces by an oil company is burned. For an oil company, its scope 3 emissions are those generated when you and me, or industrial users burn the stuff and emit the CO2. The oil company's scope 3 are our scope 1. That's seems fair enough, but, as I said, Schlumberger and other 'net zero' reporters don't necessarily sell oil or any other carbon.

To understand this, forget naïve, or as they say over here, '*pourquoi faire simple quand on peut faire compliqué**? The GHG Protocol defines scope 3 as 'an optional reporting category' that allows for the treatment of all other indirect emissions. 'Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services'.

Only the 'sold products' falls into my 'naïve' category. The 'services' part is, well, rather nebulous. GHGP does warn that 'Scope 3 is optional, but it provides an opportunity to be innovative in GHG management'. 'Companies may want to focus on accounting for and reporting those activities that are relevant to their business and goals, and for which they have reliable information. Since companies have discretion over which categories they choose to report, scope 3 may not lend itself well to comparisons across companies'. That is putting it politely. Innovative GHG management sounds a bit like 'creative accounting'. Reporting scope 3 is rather like rolling bits of your clients' P&L into your own accounts.

The 'optional' scope 3 category contains 'around 95%' of Schlumberger's total emissions footprint (52 million tonnes CO2 equivalent). Schlumberger reports that 'nearly 90% of our Scope 3 emissions come from just two of these categories: emissions resulting from the use of our technology and emissions associated with purchased goods and services in our supply chain**'. I find this curious. How can a company know how much emissions are being produced from the 'use of its technology'? Much of Schlumberger's potential for scope 3 reduction comes from technology it is selling to reduce flaring. But will this technology be applied correctly or at all. Perhaps it will prove too expensive to avoid flaring in a future energy hungry world. Upstream activity often involves many service providers, all 'competing' for the same scope 3 emissions. If a company invents a better mousetrap that cuts its clients' emissions, how can it truly know if the new gizmo is used all the time, if its performance is always up to scratch? How is the improvement shared across all service providers? If 95% of a company's emissions are reported from this 'optional' and impossible to figure category, it is easy to imagine how 'net zero' could be gamed.

ESG reporting, thanks to these tortuous reporting 'standards', has blossomed into a cottage industry with a plethora of companies offering to hold hands and put their clients' enviro credentials in as best a light as possible. In this issue of Oil IT Journal we already have the longest 'going green' section ever. Do we now need to add an ESG report too? I am feeling weak at the knees.

My cursory spin through the GHG Protocol leads me to think that ESG reporting would be much better if there were no scope 2 or scope 3. This would eliminate the current virtue signaling that a 'commitment to net zero' announcement entails, based on a hypothetical reduction of (probably double counted) emissions outside the reporting company's control. One final thing. One ESG specialist we talked to, acknowledging the double counting problem, suggested that this could 'fixed' with some kind of blockchain! My weak knees have given way. I am now on the floor, not knowing whether to laugh or cry.

** Why do simple when you can do complicated?*

*** See the Schlumberger statement.*

CORRECTIONS, CORRECTIONS ...

TietoEVRY puts the record straight on our reporting of the Quorum/Aucerna deal. BP's Karen Scarborough corrects a quote we attributed to her and provides chapter and verse our "blockchain isn't working" report.

Duncan Irving points out that our recent item covering Quorum/Aucerna 'picking up **TietoEvry**'s oil and gas business' (Done Deals 2021/3) missed the fact that it was just the oil and gas software division that was sold (Energy Components/EC and da Winci). Irving reports that the consulting business is still alive, and that TietoEvry has grown its consulting work with the main Norwegian operators over the last 18 months.

BP's Karen Scarborough asks us to correct a quote that we attributed to her in our article 'Blockchain consortium model isn't working' (2021/4). We said, 'Only one new member has joined the consortium since it kicked-off'. What Scarborough actually said was, 'On average, in private blockchain consortiums, less than one new member has joined'. She also kindly provided the source for this statement, an article in Coindesk titled 'Enterprise blockchain is at a private public crossroads'. Our apologies for the misrepresentation.

BIG DATA PARIS

TOTALENERGIES PRESENTS PROJECT OPERA, A REAL TIME DATA PLATFORM TO SUPPORT ITS DIRECT ENERGIES UTILITY CLIENTS. SNOWFLAKE'S HOSTED DATA CLOUD UNDERPINS THE SOLUTION.

Total (now Total Energies) moved into the retail energy business with the recent completion of its acquisition of the Direct Energies electricity utility business. As TotalEnergies' Ridha Nabli explained in a presentation at BigData/AI Paris 2021, this has led to the development of a real-time data platform ready to accommodate a forecast growth of some 500k new clients/year by 2025. The Direct Energies platform was slow. Daily batch runs were too long to run overnight and infrastructure costs were growing at 40% per year. Quality was suffering as was user confidence in the data.

As a first step in 'Project Opera', Total deployed a data governance solution from French software house DataGalaxy. The company also decided on a completely re-engineered solution with a shared, cloud based data environment regrouping legacy databases, data lakes and business intelligence solutions. A benchmark proof of concept study looked into solutions from Oracle, Amazon, Google and Microsoft but finally settled on Snowflake's hosted Data Cloud offering.

Snowflake 'ticked all the boxes', with straightforward, scalable, centralized data access and query and has cut processing time by a factor of 10. A full time database administrator is no longer required. Snowflake's 'revolutionary' (this is France!) data sharing covers various data formats including Avro JSON and XML. Security-wise the system leverages the Azure Active Directory and implements column and row security 'by design'. All data, in rest and in motion, is encrypted and the solution is certified at ISO 27001/SOC Type II levels. Data in the Snowflake cloud feeds applications including Qlik business intelligence and Alteryx' Databricks data science offering. The system is structured such that data science resources do not affect production.

Keyrus Livingstone was systems integrator for the project which was apparently conducted independently of Total's in-house 'Digital Factory'.

More from Big Data Paris.

LUXATIA INTERNATIONAL WORLD OIL AND GAS DIGITALIZATION VIRTUAL SUMMIT

Shell's AI-driven in-vehicle monitoring. Petrofac predicts project outcomes. EDF on mega project contract management. Tenaris' Rig Direct suite. Kent's "8 dimensional" digital twin.

Speaking at the World Oil and Gas Digitalization Virtual Summit, Girish Gopal reported on **Shell**'s 20 plus year history of work on in-vehicle driver monitoring. Driver fatigue is a major risk factor in the road traffic accidents that cause 1.35 million deaths per year. Fatigue increases the risk of an accident fourfold. An in-vehicle monitoring system (IVMS) can detect fatigue, record bad driving habits and help improve fuel consumption. Following early work on an IVMS in the 2000s, Shell's effort went quiet until recently when new AI technology has rekindled research interest. Gopal's team is working to build an AI-driven IVMS from 'proven off-the-shelf' components including multiple inward and outward facing cameras and leveraging road traffic and weather data feeds. The new system is designed, inter alia, to combat data manipulation that has occurred in the past, leading to low confidence in trucking data from IVMS service providers. Machine vision and AI analyzes driver behavior patterns to derive a 'complexity index' of driving situations and extreme events that can be used in driver training.

Alex Robertson described Petrofac's approach to the successful prediction of project outcomes. Currently organizations are confronted by 'too many dashboards'. Dashboard proliferation and fatigue has led to uncertainty as to what data can be trusted. Ideally a dashboard should present a user with 'their three most important actions'. This means continuously improving the rule set and triggers, using AI/ML to better predict future outcomes. This means predicting safety incidents instead of just reporting them. By studying large and varied data, such a people on site, engineering activity, weather etc. it should be possible to send an automated warning that 'today is a high risk day' to all assets. Robertson gave a shout-out to the UK Engineering and Construction Training Board which is offering a project data analytics academy, a five month, part time training 'for people like you and me, not IT folks!' Another development of note is the Project Data Analytics Task Force which has just launched to 'seize the immense opportunities enabled by project data and the power of analytical tools to, in five years, deliver a 10-fold improvement on project performance'.

Marc Lachaise presented ***Electricité de France**'s* (EDF) approach to contract management. EDF Group's 250 contract professionals manage some 900 contracts of over 10 million Euros value. The marketplace is relatively new and suppliers may have a more mature contract culture that EDF. Teams were asking for a new tool for contract management. EDF has built its own system around, 'Cemar' a commercial contract event management reporting tool that supports New Engineering Contracts (NEC). The tool has been in use for five years at EDF's Hinkley Point C new build twin EU pressurized water reactors. Wolters-Kluwer's Legisway also ran.

Alejandro Lammertyn advocated 'digital integration' between customer and suppliers with a plug for **Tenaris**' Rig Direct. Rig Direct is a constellation of applications spanning well planning, supply chain integration and well integrity. Customers include Pioneer, BP, Ecopetrol and others.

Wassim Ghadban presented Kent*'s '8D Digital Twin' a.k.a. 'Digital Asset 4.0'. The Digital Twin is billed as a system-of-systems with eight digital dimensions from metadata, through original format documents, models, scheduling, cost, real time data, live streaming, and ML/predictive. The DT can be delivered through HoloLens visualization, tablets, mixed/virtual reality and more. Use cases span FEED through 'autonomous operations.'

** Kent recently completed its takeover of SNC-Lavalin's oil and gas division.*

*More from the **Luxatia International** conference home page.*

SOFTWARE, HARDWARE SHORT TAKES …

New Actenum Upstream. Becip EasyTrace 2021. Paradigm RMS 13. IHS Analytics Explorer 7.0. Ikon RokDoc 2021.4. Rock Flow Dynamics tNavigator 21.3. NORCE Lime V2.3. Schlumberger Periscope Edge. RealWear's Zoom-enabled headset. Schlumberger Optiq fiber. Thermo Scientific's Delta Q IRMS. Hexagon's BLK reality capture. MODS Reality 2.0. myQuorum Pipeline Management. Implico Avalara Tax Connector.

UPSTREAM

The latest release of Actenum Upstream, (Version 6.7.1) notifies stakeholders of schedule updates, deadlines and KPIs. Actenum's scheduling software is used to plan and optimize construction, drilling, fracturing, workovers and more.

Beicip's EasyTrace 2021 adds rock physics model building, new graph analyses and 'Quick Sets' for organizing well data. More from Beicip.

Emerson/Paradigm's RMS 13 enables fast updates of facies models. Data types can be grouped into user-defined classes, projects can be tagged with comments, and a new 'big loop' workflow provides integration with an external orchestrator. RMS project data and jobs are now programmable using Python.

IHS Markit's Analytics Explorer 7.0 incorporates machine learning predictive models including 'factor contribution analysis' for model 'explicability', 'Winerack' visualizations of lateral wells, and a new XGBoost prediction algorithm.

Ikon Science has released RokDoc version 2021.4. with improvements on performance, user experience, and expanded functionality. More from Ikon Science.

Ikon has also added new, user-centric enrichments to its Curate subsurface knowledge management solution. New features include increased data usability and document search, improved functionality of the well and seismic viewers and a new attribute analyzer for users of Ikon's QI inversion products.

Rock Flow Dynamics has released tNavigator 21.3 with updates and improvements of the simulator kernel, graphical interface, history matching and uncertainty modules, geology and model designer, PVT designer and more.

The **NORCE** Virtual Outgroup Group has released LIME V2.3 and a new release of V3Geo with over 100 new features and improvements. Users can contribute geological models to the geoscience community and work on them in LIME, 'making 3D geomodelling accessible to all'.

DRILLING

Schlumberger's 'PeriScope Edge' multilayer mapping-while-drilling service introduces new measurements and an 'industry leading' inversion process for geosteering in reservoirs with multiple thin layers. More from Schlumberger.

OPERATIONS

RealWear has teamed with **Zoom** to expand the use of its RealWear assisted reality headset devices to frontline workers globally at ExxonMobil. The RealWear HMT-1Z1 is an ATEX-certified head-mounted Android computer for use in explosive environments. ExxonMobil has been using the devices since 2017, but began using the devices with Zoom earlier this year for remote expert guidance. More from RealWare.

Schlumberger's new Optiq fiber-optic solutions, deliver distributed sensing capabilities for a wide range of applications and environments across the energy industry. Optiq can be installed permanently behind casing or on tubing, along pipelines and on to midstream and downstream infrastructure. Schlumberger claims that processing the large volumes of fiber-optic measurements is 'up to 18 times' faster than current industry practices. More from Schlumberger.

Thermo Fisher Scientific has launched the Thermo Scientific Delta Q Isotope Ratio Mass Spectrometer, the first product developed under the 'IsoFootprint initiative' to tackle CO_2 emissions for more sustainable science.

CONSTRUCTION

Hexagon claims to 'revolutionize' reality capture with the launch of the Leica BLK ARC and Leica BLK2FLY autonomous reality capture solutions. The BLK ARC is a laser scanning sensor that improves robot and other carrier platforms, performing 3D point clouds and panoramic imagery. The BLK2FLY is an integrated, autonomous flying laser scanning sensor. Both systems connect to Hexagon's cloud-based visualization platform, HxDR, with real time data upload from the field. More from the release.

MODS Reality 2.0, a 'next-generation' tool for managing asset visualization data offers 'immersive 360-degree site visits from anywhere in the world'. Reality is an is an add-on to the MODS Connect suite of apps. The solution provides 'improved safety and sustainability through increased awareness, fewer site visits better analysis and mitigation of avoidable risks'.

MIDSTREAM

The latest release of **Quorum**'s myQuorum Pipeline Management software meets the North American Energy Standards Board (NAESB) 3.2 standards recently approved by the Federal Energy Regulatory Commission (FERC). FERC Order No. 587-Z includes updates to existing cybersecurity-related standards developed in response to the Department of Energy-sponsored cybersecurity surety assessment. The new release also updates the nominations-related standards and the Quadrant electronic delivery mechanism.

DOWNSTREAM

The Avalara Tax Connector 1.0, jointly developed by **Implico** and **Avalara**, is now certified for integration with SAP S/4HANA and SAP S/4HANA Cloud. ATC connects AvaTax Excise with the SAP ERP system to support excise tax calculation for North American downstream users. More from Implico.

AMERICAN BUSINESS CONFERENCES 2021 VIRTUAL PIPELINE LEAK DETECTION CONGRESS

Crestwood Midstream, "small leaks still challenging". Williams on stress corrosion cracking. Siemens' Pipeline 4.0. ProFlex on offshore leak detection. Leak detection in Gulf of Mexico. Black Bear Transmission's best practices for monitoring. Marathon Pipeline on leak detection regulations. Flyscan's hyperspectral airborne survey. Case histories from Kairos Aerospace. HiFi Engineering's fiber optic monitoring. Intelliview's AI/smart camera.

Speaking at the **American Business Conferences** 2021 virtual Pipeline Leak Detection Congress, Reagan Nguyen (**Crestwood Midstream**) presented a 'pro-active approach' to pipeline leak detection. While it might seem obvious, the best leak prevention is having no leaks at all! The approach includes 'call before you dig' advocacy, keeping landowners on board and maintaining up to date data on your assets. Threat assessments, leveraging the API 1160 methodology for hazardous liquids and ASME B31.8S for natural gas, will lead to appropriate monitoring and mitigation strategies.
Today's leak detection systems are challenged by small leaks below the sensitivity of the system. Identification and isolation of a leak can take time. Advanced systems can perform well but they are expensive to install, test and maintain. They do not 'prevent', they help mitigate.

Amy Shank (**Williams**) presented on stress corrosion cracking, a 'time-dependent' threat and a hard-to-model issue. SCC is generally found withing 20 miles of compressor stations where heat and stress is highest. 2015 was a wake-up call for industry, and PHMSA reporting has shown a significant subsequent increase in crack tool mileage. Shank gave a shout-out to Rosen's EMAT detector, capable of finding smaller cracks than hydro tests.

Nico Jansen van Rensburg (**Siemens Energy**) asked 'what does digital technology bring to the table?' Siemens Pipeline 4.0 promises an 'integrated approach to optimizing midstream assets'. Pipeline 4.0 embraces a slug of digital goodies, from the digital twin, AI, wireless, IoT and cyber security. So why aren't all pipelines @4.0? Digital transformation faces barriers from the 'feature shock' of maintaining complex technology, reliability issues, and the new skills required. The solution is not just technology but requires a paradigm shift in the way operators, technology providers and service personnel interact.One P4.0 example is Siemens' IoT-based ' spontaneous leak detection as-a-service', a solution that embeds leak detection technology from ProFlex.

In a follow-up presentation, **ProFlex Techologies**' Scott Bauer drilled down into the partnership that combines PFT's Pipe-Safe solution with Siemens' IoT. The system leverages remote pressure monitoring and artificial intelligence to locate leaks with a 20-50 foot accuracy. The system uses a 'modified negative pressure wave' approach. A burst creates a back-propagating pressure wave that can be caught with acoustic monitoring at monitor stations. Edge-processed data is sent to the SE cloud for further analysis to pinpoint the rupture. SMS/emails are sent to key personnel with the location. The SLDS* system is on show at Siemens' closed loop demonstrator in Houston.
** Spontaneous leak detection system.*

Stuart Mitchell (**ProFlex**) presented a case study of an offshore leak detection system deployed on EnVen Energy's 'Lobster' Gulf of Mexico platform. The Siemens/ProFlex negative pressure monitor described above was installed on the platform's subsea pipelines with the SLDS computer on the platform. Testing involved short duration simulated leaks over a two week period. A millisecond sampling rate produced some 4.5 gigabytes of data. An ML model was trained on the data and deployed on four risers in 2021, integrated with the platform's control system.

Ronda Louderman (**Black Bear Transmission**) outlined best practices in effective pipeline monitoring and material validation. Over time, regulation has evolved from a 'best efforts' stance to a more prescriptive

approach requiring more technical expertise, contractor qualification and attention to field personnel's attention and attitude. Inspectors want to see 'safety as a priority, transparency and honesty'. This may include owning-up to past issues, along with mitigation plans in place.
Operators need to develop different plans for new-builds, legacy assets and acquisitions. Louderman outlined a methodology spanning assessment of what needs to be captured and a plan of action. The latter needs to prioritize high consequence areas, but also lines with a history of leaks, maintenance issues and third party strikes. Lines with missing documentation and acquisitions without due diligence need special attention. Senior management needs to be kept in the loop on audits and new regulations. Louderman suggested inviting management along to conferences or at least providing a post-event write-up. She concluded with some pointers to resources including regulation status, the PHMSA community toolbox and the Federal Register.

Jason Dalton (**Marathon Pipe Line**) reported on the current situation of leak detection requirements. PHMSA's 49.CFR 195.444 states that operators must deploy a leak detection system on HCA*s. Systems are evaluated in terms of their effectiveness and how quickly a leak can be addressed. Alongside regulations, the public perception is one of near perfect leak detection capability and 'immediate' mitigation. Dalton suggested that the API RP 1175 could form the basis of a leak detection program. But such programs can be challenging, especially for smaller operators, as they are resource-intensive. Expectation management is needed, as not all leaks can be detected instantly. Detection timeframes can be as much as days or weeks. In summary, while the midstream has better leak detection than ever before, implementation is not straightforward and industry benchmarking is difficult due to operator hesitancy to share leak detection system performance.
* *High consequence areas*.

In a follow-up presentation, Dalton drilled-down into the use of pattern recognition to characterize leaks from pressure data. He advocates training ML models to recognize all operational events, not just leaks, from the data. Models should predict what behavior will result from an operation and deviations from expected behaviors should trigger an alarm. Historical data on slack line events (degassing) and pump performance will provide baseline records against which future, possibly anomalous, behavior can be recognized. This kind of pattern recognition does not require 'buzzwords' or fancy ML/AI supercomputers*. It all boils down to understanding how your system operates and empowering the people closest to the action.
* *Similar real-time pattern recognition software can run on a Raspberry Pi. See for instance 'BP Lower 48 - failure analysis on the Raspberry Pi'.*

Eric Bergeron presented Flyscan's 'next generation' airborne right-of-way inspection and slow leak detection technology. Initial Flyscan development was funded by PHMSA. Equity funding to date totals $11 million, notably from Enbridge. Flyscan's dual mission is to catch leaks and threats early. The UV laser Raman detector is said to detect a single cup of crude oil mixed with topsoil from a distance of 500 feet. Three RGB cameras feed onboard real-time pattern recognition software that distinguished facilities and threats. A hyperspectral camera provides further leak detection capability.

Steve Deiker reported on some case histories from Kairos Aerospace's pipeline emissions monitoring program. Kairos performs large-scale repeat methane monitoring over an area of interest. Data is exclusive to the operator. A combination of spectral imagery and optical cameras feeds a data pipeline into the cloud. Most central and western US petroleum basins have been surveyed in 2021. Leveraging the survey results has enabled operators to eliminate 18.3bcf of methane emissions, with 'a greater GHG impact than Tesla!' The surveys have shown huge variations in per-mile of pipe emissions between operators. Using Kairos' technology, operator DCP Midstream received an environmental excellence award from the GPA Midstream Association.

Steven Koles (Hifi Engineering) presented a different approach to monitoring, combining high fidelity fiber optic monitoring with machine learning. Fiber deployed along the length of a pipeline beats conventional point monitors, providing a continuous measure of pressure, temperature and other variables along the whole length of the line. HDS, HiFi's distributed sensor offering combines specialized fiber, big data acquisition systems and an AI/ML data processing back end. The system can detect leaks and encroachments (landslips) along with normal events such as pigging runs. HiFi is also working on flow rate estimation from the fiber data. In conclusion, fiber can be an important element of ESG strategies that align with API 1175.

Also of note at the event were, **Intelliview**'s AI/smart camera system as used by Chevron and Enbridge, Atmos International's leak detection solution and Pipeline Project Services' drone methane mapping system that feeds data into the Esri GIS cloud.

More from the ABC Congress home page.

FOLKS, FACTS, ORGS ...

Cegal/SYSCO. Aveva. Longitude Engineering. Asset Guardian. Lawrence Berkeley National Laboratory. BP. Boston Consulting Group. Chevron. Data Gumbo. Element. Enbridge. Endeavor Business Media. Enterprise Products Partners. Expro Group. Genasys. Graham Corporation. Helmerich & Payne. Houlihan Lokey. IOGP. Metrix. Milestone Environmental Services. Climate Nucleus. MIT. Northeast Gas Association. NGL Energy Partners. NOV. NSI Technologies. UK Oil and Gas Authority. Gibson Technical Services. Orbital Energy Group. Petrofac. Redline Communications. Railroad Commission of Texas. Seeq. SEG. Siemens. Spectris. SPOC Automation. TietoEVRY. Trellis Energy. Velo3D. Shell. OSDU, B3 Insight, Peloton. SEAM AI. PESGB. SPDM.

Dagfinn Ringås is CEO of the newly merged **Cegal/SYSCO** company. Svein Torgersen is executive chairman of the board.

Peter Herweck is now CEO of **Aveva**, he hails from the Schneider Electric parent company.

Nicolas Cazeres is the new managing director at **Longitude Engineering USA** (ABL Group).

Asset Guardian Solutions has appointed Eve O' Hagan as technical consultant and Suzanne Campbell as marketing assistant.

Lawrence Berkeley National Laboratory has split. The data science research division is led by Deb Agarwal. David Brown heads-up computational research.

Anja-Isabel Dotzenrath is now EVP at **BP**'s gas and low carbon energy business. She succeeds Dev Sanyal who is leaving BP at the end of this year.

Christoph Schweizer is now CEO at **Boston Consulting Group**. He succeeds Rich Lesser who served the maximum three full terms as CEO and now becomes BCG's global chair. Matthias Tauber is to head BCG's Europe, Middle East, South America, Africa Region succeeding Schweizer.

Joe Geagea is to retire as **Chevron**'s EVP, technology, projects and services. He continues as senior advisor to chairman and CEO Michael Wirth.

Jason Mitchell is the new chief customer success officer at **Data Gumbo**.

Nancy Flores (McKesson) has been appointed to **Element**'s independent board member. Singh Garewal is VP marketing, Bill Keeshen is VP sales.

Vern Yu has been appointed EVP & CFO at **Enbridge**, taking over from Colin Gruending who is now EVP & president of liquids pipelines.

Teresa Hansen has joined **Endeavor Business Media** as VP content for its energy brands.

Carrie Weaver has been named VP, commercial, evolutionary technology at **Enterprise Products Partners**.

Karen David-Green is now chief communications, stakeholder and sustainability officer at **Expro Group**.

Susan Lee (Vericast) and Caltha Seymour (Eaton Corporation) are now **Genasys**' board members.

Daniel Thoren is now President and CEO at **Graham Corporation**. He succeeds retiree James Lines.

Belgacem Chariag (PQ Group Holdings) is now a member of **Helmerich & Payne**'s Board of Directors.

Tom Carlson has joined **Houlihan Lokey** as MD of the oil & gas group. He hails from BMO Capital Markets.

Johana Dunlop has been named **IOGP**'s Membership Engagement Manager. Harvey Johnstone is the new Environment Director succeeding Wendy Brown who returns to TotalEnergies after a four year secondment.

Debbie Holton has been appointed President of **Metrix**, an ASME company.

Chris Davis is now VP of Carbon Sequestration at **Milestone Environmental Services**. He hails from ExxonMobil.

MITEI Director Robert Armstrong and deputy director for policy Christopher Knittel are to form the '**Climate Nucleus**' a new committee established by the Fast Forward climate action plan.

MIT's head of the Department of Chemical Engineering, Paula Hammond, will also serve on the US President's council of advisors on science and technology.

Charles Crews is now the **Northeast Gas Association** President and CEO. He succeeds Thomas Kiley, who has served as NGA president for thirty-six years.

Linda Bridges has been promoted to EVP and CFO at **NGL Energy Partners**.

Scott Duff is to step down as **NOV**'s VP, corporate controller and chief accounting officer. He is succeeded by Christy Novak.

Dario Stemberger has joined **NSI Technologies** as Engineering Project Manager.

Sara Vaughan (Elexon) and Malcolm Brown (ex BG Group) are now non-executive directors of the UK **Oil and Gas Authority** succeeding, Mary Hardy and Frances Morris-Jones. Helena Charlton is now shareholder director, taking over from Emily Bourne.

Scott Stokes is the new CTO at **Gibson Technical Services**, an Orbital Energy Group subsidiary. He hails from Jacobs.

Jerry Sue Thornton and La Forrest Williams are now members of **Orbital Energy Group**.

Khalid Al Jahwari is now **Petrofac**'s Country Manager, Oman. He hails from Shell.

Richard Yoon has joined **Redline Communications** as President, CEO, and director of the board. He was previously with ZTE Canada.

Wayne Christian was unanimously elected Chairman of the **Railroad Commission of Texas** for a second time. Aaron Krejci is Director of Public Affairs. He previously served in the Trump Administration.

Seeq has appointed Mariana Sandin to industry principal, oil and gas.

Ken Tubman is **SEG** President-elect.

Lynette Jackson is the new head of global communications at **Siemens**.

Alison Henwood (Shell) is now a Non-executive Director at **Spectris**.

SPOC Automation has named Brad Schweikart as Quality Assurance Manager.

Rohan Haldea has resigned as a member of **TietoEVRY** Corporation's Board of Directors.

Trellis Energy has promoted Archana Srivastava to Chief Product Officer.

Michael Idelchik (former GE), Ellen Smith (FTI Consulting) and Gabrielle Toledano (Keystone Strategy) are now members of **Velo3D**'s board of directors.

Wael Sawan has been appointed as Integrated Gas and Renewable and Energy Solutions (R&ES) Director at **Shell**. He succeeds Maarten Wetselaar who will join Cepsa as CEO. Zoë Yujnovich is now Upstream Director taking over from Wael and will join the Executive Committee.

PROJECTS AND ORGS

B3 Insight is now a member of The Open Group **OSDU** Forum. **Peloton** has also joined OSDU.

The **SEG/SEAM** Artificial Intelligence project has released two competitive requests for bids on the preparation of field and synthetic geophysical data sets for use in applications of machine learning and artificial intelligence. More from SEG.

The members of the **Petroleum Exploration Society of Great Britain** (PESGB) are to vote in the AGM 2021 if the Society should widen its representation and whether it should change its name to the Geoenergy Society of Great Britain (GESGB). More from PESGB.

The **Society for Petroleum Data Managers**' board of directors is to propose the change of name of the Society at its EGM 2021 to Society for Professional Data Managers.

DONE DEALS

Emerson's software combines with AspenTech. BCG Digital backs MISC Berhad, Solution Seeker. BP backs Ryd. Cegal, SYSCO merge. Data Gumbo series B funding. New Energy Capital Ventures fund. Hexagon buys Koch's Infor unit and Atlas' Jovix. Zeev leads Imubit fundraising. Ivanti acquires WIIO's IIoT platform and RiskSense. News Corp bags OPIS. PetroFunders launch. OneNexus to P&A aging wells. Schlumberger acquires IDS.

Emerson is to acquire a 55% stake in a new **AspenTech** company, created by the merger of AspenTech and Emerson's industrial software businesses (Open Systems International and the Paradigm/Roxar geological software). AspenTech shareholders will receive some $6.0 billion in cash, putting an enterprise value of some $11bn on the new company. OSI, a provider of 'open' automation process control software, was acquired by Emerson last year for $1.6 billion in an all cash transaction. Paradigm was acquired in 2017 for $510 million. More on the transaction from AspenTech.

BCG Digital Ventures, the 'innovation arm' of **Boston Consulting Group** has teamed with energy-related marine services provider **MISC Berhad** on three ventures set to 'disrupt' the maritime solutions space with 'deep tech'. The startups, that have just emerged from 'stealth mode', are to apply digital and deep tech, such as AI, ML, and IIoT, to create 'massive operational efficiencies' across the shipping value chain. BCG has also taken a stake in Solution Seeker, a developer of AI solutions for upstream oil and gas. More from BCG.

BP Ventures has invested €10 million in Ryd, an EU in-car digital payments solution for services such as fuel purchases, EV charging and car washing. The Ryd box, an OBD2 connector, 'turns every car into a smart car'. Ryd was developed by Munich-based ThinxNet.

Cegal and **Sysco** are to merge, creating a 'global tech company for the energy sector'. For Cegal, the move heralds a shift from its traditional oil and gas industry focus to a 'transformed' sector moving towards renewable energy, where Sysco has a focus on hydropower and grid companies. The merged company will provide software and data integration and analysis services. More from Cegal.

Data Gumbo has closed a $7.7 million series B funding round, financed by repeat investors Equinor Ventures, Saudi Aramco Energy Ventures and L37. The monies will be used to scale-up Data Gumbo's GumboNet and GumboNet ESG 'blockchain-based' payments networks. Data Gumbo is also to establish a presence in the Middle East. More from Data Gumbo.

Energy Capital Ventures has launched a new fund to support 'ESG imperatives' and 'digital advancement' of the natural gas industry. The fund will focus on early-stage ESG investments in decarbonization, renewable natural gas, hydrogen and other clean energy solutions, along with transformative digital capabilities for natural gas local distribution companies. Some $45M in capital commitments has been received from five publicly-traded natural gas and diversified utilities.

Hexagon has completed its acquisition of **Infor**'s EAM business. Infor EAM is used to track assets, digitize maintenance operations and enable customers reach optimum operational efficiency. Hexagon paid $792 million in cash and issued 132.6 million series B shares to Infor, a Koch Industries unit. Hexagon has also acquired the Jovix material tracking solution from Atlas RFID Solutions. Jovix is a cloud-based, IoT-enabled, mobile, configurable workflow platform that provides status and location of materials throughout the EPC lifecycle. More from Hexagon.

Imubit, a provider of artificial intelligence process optimization for refiners and chemical operators, has raised $50 million to bring its closed-loop neural networks to 'every process manufacturing plant around the

globe'. Zeev Ventures led Imubit's latest $30 million growth round alongside Insight Partners and existing investors Spider Capital and UpWest.

Ivanti Wavelink has acquired an industrial internet of things platform from **WIIO Group**, one of Ivanti Wavelink's technology partners based in Paris, France. The WIIO platform will enable customers to get a 360 degree view of their IIoT equipment, proactively identify and remediate issues, and build scalable applications that drive operational efficiency. More from Ivanti and WIIO. Ivanti has also acquired RiskSense, a provider of risk-based patch management vulnerability assessment and prioritization.

Rupert Maxwell's News Corp is to acquire the Oil Price Information Service (OPIS) and related assets from S&P Global and IHS Markit in a $1.150 billion cash deal. OPIS will become part of News Corp's Dow Jones Professional Information Business which includes Dow Jones Risk & Compliance, Dow Jones Newswires and Factiva.

PetroFunders has launched a 'fintech-powered' platform for oil and gas investors along with a 'royalty interest fund' designed to provide income from oil and gas royalties. Minimum investment on the platform is $10,000. Investors can track investment performance and view associated tax documents through a dashboard. FWIW, the website is a 'funding portal' registered with the Securities and Exchange Commission and a member of FINRA, the Financial Industry Regulatory Authority. Read the fine print.

Tony Sanchez, founder of Sanchez Energy has launched **OneNexus Environmental** to 'remedy the trillion-dollar aging oil and gas well infrastructure problem'. OneNexus plans to offers clients an 'universal life insurance policy' for oil and gas wells. When production ends, an operator can transfer asset title to OneNexus which assumes the financial and operational responsibility for plugging and abandoning the well and performing environmental remediation. The company leverages 'data science, predictive analytics, risk mitigation and cutting-edge plugging and remediation technologies' to the P&A problem. All of which is to be financed by a 'fintech model'. More from OneNexux.

Schlumberger has acquired **Independent Data Services**. As a Schlumberger company, IDS will be offered both as a standalone solution and as an integrated cloud-native solution, to offer customers end-to-end digital drilling solutions enhanced with AI and machine learning. More from Schlumberger.

THE GREENING OF OFFSHORE PRODUCTION

NORCE Modelica library reduces offshore gas turbine use with wind power, microgrid and battery storage. Modelica proposed as digital twin meta model.

At the 2021 Modelica Conference in Linköping, Sweden, researchers from Norce, the Norwegian Research Centre, presented an approach* to reducing offshore gas turbine use with wind power and energy storage to 'accelerate the shift towards lower greenhouse gases emissions'. The methodology accommodates variable wind resources and power demand and limited battery storage capacity. An embryonic Modelica library** has been developed to simulate the system with simplified components connected through a micro grid. Modelica is a meta-model programming environment that has recently been proposed*** as well-suited to digital twin applications. The environment has seen earlier oil and gas applications from Equinor, ENI and IFPen.

Offshore wind resources in Norway are put at some 12,000 'terawatt hours per year' (*1.5 terawatts to our way of thinking!*), representing a significant opportunity to reduce greenhouse gas emissions from the gas turbines used to generate electricity. The researchers have developed a 'simple to configure and fast to run Modelica model' that quantifies GHG reduction under operational conditions over a long period. An autonomous control system balances the micro grid as wind resources and demand vary. The remaining issue is, what to optimize, GHG emissions, battery life cycle, gas turbine usage or what? Equinor provided

the datasets and the work was financed from the Research Council of Norway's 'Electrification of Oil and Gas Installation by Offshore Wind' project.

** An Approach for Reducing Gas Turbines Usage by Wind Power and Energy Storage by Nejm Saadallah and Yngve Heggelund in Proceedings of 14th Modelica Conference 2021.*

*** The 'ELOGOW 2021' model is available from the Norce Git repository.*

**** See 'Creating and Using Digital Twins within Simulation Environments', Springer 2019.*

NORWAY'S VIRTUAL INVENTORY EQUIPMENT EXCHANGE.

TietoEvry provides Virtual Inventory of available oil country equipment assets for Norwegian operators.

Norwegian IT service provider TietoEVRY has developed an inventory management and exchange solution for Norway's oil and gas operators' association NorskOlje&Gass a.k.a. NOROG. TietoEvry's Virtual Inventory solution now sits alongside NOROG's EqHub technical equipment information library. Virtual Inventory provides Norwegian operators with a shared catalogue of equipment inventory available from the digital warehouses of Norway's oil and gas supply chain.

Operators can search for and trade equipment items, rather like Norway's geoscientists search and retrieve seismic and well data via Diskos. EqHub continues to evolve as a repository for equipment information with standardized stock keeping units as used in companies' ERP systems. Equipment vendors can register documents and data on valves and other items, and the Hub acts as an information register of approved items. Ownership, location and availability of equipment is held in the Virtual Inventory.

An 'emergency button' in the Virtual Inventory, a.k.a. a critical material request, helps operators to locate parts that are out of stock at the supplier. In the first six months of operating this was used 60 times, 'saving an estimated 1.4 billion NOK in downtime'.

NOROG is a regrouping of three Norwegian operators association, GeoTrade, EPIM and legacy NOG. The Virtual Inventory and EqHub have been commissioned and are managed by NOROG's digital division Collabor8.

GOING, GOING ... GREEN

Geothermal: RyderScott audits Cyrc; Babors backs GeoX, Sage. CCUS: ExxonMobil and Rosneft; Houston initiative; Denmark's Greensand; Gassnova's lessons learned at Longskip; Alberta Carbon Grid; Baker Hughes/Borg CO2 back Viken; Navigator CO2 hikes capacity; NPD opens subsea areas; Shell announces Polaris; Talos Energy, Storegga investigate GoM CCS; Qilu-Shengli oilfield project. Hydrogen: Green Hydrogen Coalition; Chevron/Caterpillar team; US H2@Scale; PosHYdon; Aukra Hydrogen Hub. R&D: Processes4Planet; Battelle and the MRCSP. Resources: CO2 Storage Resource Catalogue 2.0; OPIS Carbon Market Report. Emissions: Tachyus' Aurion; Avande tracks Duke's emissions; EQT joins O&G Methane Partnership 2.0: Mirico's Libra platform; SoCalGas signs with Bridger Photonics; TotalEnergies and GHGSat. Miscellaneous: Bloom and MiQ; BP and CleanBay; Canada's Just Transition Advisory Body; CGG, PGS multi-client seismics for CCUS; Chevron and Brightmark; Energi.AI to 'unf**k the planet'; OGC call for climate change pilot; Quidnet's pumped hydro energy storage; U Houston executive program; UK Energy digitalization strategy and carbon reporting; BCG backs Breakthrough Energy Catalyst. On the other hand: '50% of IPCC scenarios don't work'; 'Electrification is not enough' for net zero; Study reports 'cracks in the foundation of energy transition narrative'; IOGP members say, 'stand up for our industry'.

GEOTHERMAL

Ryder Scott has performed a reserves audit of a potential geothermal energy acquisition by client **Cyrq Energy**. The audit involved thermal modeling with the CMG STARS simulator and decline-curve analysis using a modified version of PHDWin. The work has led Ryder Scott to suggest that the SPE extends its PRMS resources management system to cover geothermal evaluation and reporting*. More from Ryder Scott.

** See also some prior art from Indonesia's Ametis Institute.*

GeoX Energy has secured an $11 million investment from **Nabors Industries** to fund a part of a 50 MW supercritical geothermal pilot project that GeoX plans to complete by the end of 2022.

Sage Geosystems has secured a $12 million financing from Nabors ($10 million) and Virya ($2 million) to accelerate the commercialization of geothermal energy.

CCUS

ExxonMobil and **Rosneft** are to cooperate on the assessment of lower-carbon technologies to reduce greenhouse gas emissions from their operations. The companies will new CCS projects and the development of lower-carbon fuels, such as hydrogen and ammonia. More from ExxonMobil.

Eleven companies* have 'expressed interest' in supporting the large-scale deployment of CCS technology in Houston, with plans for 'up to 50 million metric tons of CO2 per year by 2030 and about 100 million metric tons by 2040'.

** Calpine, Chevron, Dow, ExxonMobil, INEOS, Linde, LyondellBasell, Marathon Petroleum, NRG Energy, Phillips 66 and Valero.*

Ineos Oil & Gas and **Wintershall DEA** head-up Denmark's Greensand CCS Project which is to inject CO2 into the offshore Nini West reservoir. Partners include Aker Carbon Capture, and Welltec which is to provide well materials testing at its new full-scale CO2 test loop at Esbjerg.

Gassnova has just published its lessons learned report to the Norwegian Ministry of Petroleum and Energy on the Longskip CCS FEED project.

Pembina Pipeline and **TC Energy** have partnered on the Alberta Carbon Grid, a 'world-scale carbon transportation and sequestration solution'. The ACG will leveraging existing pipelines and a newly developed sequestration hub with a capacity of over 20 million tonnes of CO2/year. The ACG will connect the Fort McMurray region, the Alberta industrial heartland, and the Drayton Valley region to key sequestration locations and delivery points across the province, serving multiple industries. More from Pembina.

Baker Hughes and Borg CO2 to are to develop a carbon capture and storage hub in the Viken region of Norway. The facility will have a 630 kilotonne/yr capacity. CO2 from an industrial cluster will be liquified, shipped and stored by the Northern Lights joint venture.

Navigator CO2 Ventures is planning to expand pipeline capacity and proceed with multiple sequestration sites, creating an injection capacity of 'up to 12 million metric tonnes per year'.

The **Norwegian Ministry of Petroleum and Energy** has announced two areas for CO2 storage. Parties interested in subsea CCS on the Norwegian have until 9 December 2021 to apply for permits. NPD has also updated its CO2 storage atlas for the continental shelf.

Shell's proposed 'Polaris' large-scale CCS project is to capture CO2 from its Scotford, Alberta refinery and chemicals plant. The initial phase is expected to start operations around the middle of the decade, subject to a final investment decision by Shell expected in 2023. The initial phase has a 750 kilotonne/yr CO2 capacity, reduce plant emissions by 30-40% and creating 2,000 jobs. Polaris CCS is also to contribute to Canada's first 'hydrogen hub' with the potential for large-scale blue hydrogen production in future phases. More from Shell.

Talos Energy and **Storegga Geotechnologies** have formed a joint venture to source, evaluate and develop CCS opportunities on the US Gulf Coast and Gulf of Mexico. Storegga is an EU CCS specialist and lead developer of the Acorn CCS and Acorn Hydrogen Projects. More from Talos.

Sinopec has initiated the Qilu-Shengli Oilfield CCUS project, a demonstrator for large-scale CCUS in China. The project has an estimated megaton/year capacity. Chinese oilfields' large initial oil in place are said to be suitable for CO2-flood enhanced oil recovery (EOR).

HYDROGEN

Endress and Hauser is sponsoring the 'Green Hydrogen Coalition', supporting the vision of at-scale green hydrogen deployment and multi-sectoral decarbonization. More from Endress and Hauser.

Chevron New Energies and **Caterpillar** are to develop hydrogen demonstration projects in transportation and stationary power applications. The collaboration is to confirm the feasibility and performance of hydrogen for use as a viable alternative to traditional fuels for line-haul rail and marine vessels. The collaboration also seeks to demonstrate hydrogen's use in prime power.

McDermott has joined the US Government's H2@Scale project. H2@Scale is a demonstrator for hydrogen and fuel cell technologies run from the US DoE's Office of Energy Efficiency and Renewable Energy. The project is to show that renewable hydrogen can be a cost-effective fuel for multiple end-use applications, including fuel cell electric vehicles, along with large, baseload consumers that use hydrogen for clean, reliable stationary power.

The **PosHYdon** project, said to be the world's first offshore green hydrogen pilot on a working platform, has received backing from RVO, the Netherlands Enterprise Agency, to the tune of €3.6 million. PosHYdon aims to validate the integration of offshore wind, offshore gas and offshore hydrogen in the Dutch North Sea with a green hydrogen (electrolysis) plant on Neptune Energy's Q13a-A platform. The 1 MW electrolyser can produce up to 400 kg of hydrogen per day. Hydrogen will be blended with natural gas and transported to the shore by pipeline. Q13a-A platform, located approximately 13 km from the coast, was the first fully-electrified platform in the Dutch North Sea. More from PosHYdon and watch the animated video.

Aker Clean Hydrogen and **CapeOmega** have signed a memorandum of understanding with **Norske Shell** to develop the Aukra Hydrogen Hub into a large-scale production facility for clean hydrogen, using natural gas from the local gas processing plant at Nyhamna. More from the release.

R&D

A.SPIRE and the **EU Commission** have signed a memorandum of understanding covering the Processes4Planet partnership, part of the Horizon Europe R&D program for research and innovation. The €1.3 billion program targets R&D to 'transform Europe's process industries'.

A team of researchers led by the Battelle R&D organization has given a thumbs-up for the Midwest Regional Carbon Sequestration Partnership (MRCSP), 'paving the way forward for commercial deployment'. Since an initial phase in 2003, MRCSP has undergone multiple small-scale validation pilots that culminated in 'large-scale development' in 2008. The focus now is 'commercialization and expanded regional initiatives'. More from the announcements page.

RESOURCES

The **Oil and Gas Climate Initiative** (OGCI) has published a new edition, 'Cycle 2' of its CO2 Storage Resource Catalogue, covering some 715 CO2 storage sites in 18 countries. CO2 storage capacity is rated against the SPE Storage Resources Management System (SRMS). Some 90 gigatonnes of storage 'resource' has been identified within defined projects, a fraction of the 13 teratonnes* of estimated global storage capacity. Of the global total, 4.3% is classed as discovered and less than 0.002% assessed as 'commercial resource'.

** actually reported as an absurdly precise '12,958 gigatonnes'!*

OPIS, an IHS Markit company, has launched an expansion to its OPIS Carbon Market Report pricing services. The report covers carbon policies such as cap and trade, low carbon fuel standards, renewable fuel standards and emissions reduction programs.

EMISSIONS

Tachyus Corp has announced 'Aurion', a 'data physics-driven' solution to measure a carbon footprint and monitoring critical sources of emissions. Aurion uses OPGEE, Stanford's oil production greenhouse gas emissions estimator.

Accenture and **Microsoft** are working with Duke Energy on a 'first-of-its-kind' methane-emissions monitoring platform. Methane tracking data will stream into a cloud-hosted platform from satellites, fixed-wing aircraft and ground-level sensors. The Azure data platform was built by the Accenture/Microsoft AI/cloud computing joint venture 'Avanade', More from Duke Energy.

EQT Corporation has joined the Oil & Gas Methane Partnership 2.0, a United Nations' Environment Program to 'enhance robust methane emissions monitoring and credible reporting'. Read The Sniffers' 'how to' guide to the OGMP2.0.

Mirico's new Libra provides gas analysis solutions for applications including CCUS. Libra Laser dispersion spectroscopy to measure isotopic gas concentration. In a case study, Libra tracked δ13CO2 isotopic variation in CO2 at plant using the Carbfix process to mineralize atmospheric CO2.

RigCloud's eponymous drilling emissions reporting solution delivers emissions and performance data to drillers and operators to optimize engine utilization and reduce carbon footprint. The solution is used and endorsed by Nabors Drilling Solutions.

SoCalGas has signed a $12 million deal with Bridger Photonics for use of its gas mapping Lidar solution.

TotalEnergies is partnering with GHGSat to develop a satellite imaging technology to monitor potential methane leak occurrences at offshore facilities. The novel 'glint mode' technology uses sun glint on the ocean surface. Images are combined with local measurements made by the CNRS/Total-developed AUSEA1 drone-mounted spectrometer.

MISCELLANEOUS

Bloom Energy has partnered with **MiQ**, a non-profit partnership between RMI and SystemIQ, to test and refine the certified gas marketplace. Certified natural gas 'differentiates gas production across a range of environmental, social and governance practices through a focus on verified methane performance and associated company practices'. Bloom has issued an RFP for certificates representing gas production jointly approved under both the MiQ Standard and the Equitable Origin EO100 standard for responsible energy development. More from Bloom and MiQ.

BP has signed a 15 year deal with **CleanBay Renewables** to purchase 'renewable natural gas' derived from poultry litter, a mixture of manure, feathers and bedding. The fuels will be sold for use in the US transportation sector. More from CleanBay.

The **Canadian government** has launched a survey of stakeholders, such as labor, non-governmental organizations and industry to provide feedback on potential elements of proposed 'just transition' legislation. The results will inform government decision-making and lead to the creation of a Just Transition Advisory Body.

CGG and **PGS** have signed a memorandum of understanding with a view to repurposing their seismic multi-client products and technical capabilities for use in the CCUS industry. The idea is to 'unlock the value of existing seismic data for carbon storage evaluation'. More from the release.

Chevron is expanding its joint venture with Brightmark covering the production and marketing of 'carbon-negative' dairy biomethane.

Energi.AI, an 'AI-driven net zero platform' launched recently, to 'unf**k the planet', removing carbon and accelerating net zero solutions with artificial intelligence. The startup collects data from ERP systems and

uses machine learning to develop carbon negative solutions. Energi.AI is a startup out of Norway's Propell Group, 'dedicated to building a better world ... by harnessing the power of data'.

The **Open Geospatial Consortium** is calling for sponsorship to support its Climate Change Services Pilot 2022. The pilot is to accelerate access, fusion and analysis of climate and non-climate data. The pilot will demonstrate the use of climate data in a standards-based process that starts with raw data from satellites and climate change models and produces decision-ready data in support of achieving climate resilience. Sponsorship offers due by December 31st, 2021.

Quidnet Energy and **Emissions Reduction Alberta** have proposed storing energy in water underground. With $5 million funding from the Government of Alberta, the partners are to develop an multi-gigawatt geologic energy storage resource in Alberta, utilizing Quidnet's geomechanical pumped hydro storage technology. GPS stores energy in the form of water compressed between layers of shale, enabling excess renewable energy to be stored for extended periods of time and released when the grid needs power. More from Quidnet.

The **University of Houston** has announced a CCUS Executive Education Program. The six day distance learning program costs $2,500.

The **UK government**, Ofgem and Innovate UK have just published a 44 page Energy Digitalization Strategy examining the use of energy data, and how 'cutting-edge technologies' can drive decarbonization. These include solar panels, wind turbines and battery storage, heat pumps, electric vehicles and smart appliances. The new publication follows Ofgem's earlier 'Smart systems and flexibility plan 2021' which outlines plans to transition to a 'smart, flexible, decarbonized energy system'. Ofgem is also funding a new Energy Digitalization Taskforce, led by Laura Sandys and the Energy Systems Catapult.

The **UK**'s Streamlined Energy and Carbon Reporting (SECR) legislation requires large UK companies to report on their annual energy use, greenhouse gas emissions and energy efficiency measures, with optional XBRL reporting. More from SECR.

Boston Consulting Group has become a founding partner of Breakthrough Energy Catalyst, to accelerate the development of the 'climate-smart' technologies necessary to achieve net-zero emissions by 2050.

ON THE OTHER HAND ...

A new study published in **Environmental Research Letters** finds that half of the IPCC scenarios to limit global warming don't work, and all require the world to take a wide array of very bold actions. Scenarios include 'questionably optimistic' technology deployments and behavioral shifts. Many modeled scenarios rely too much on bioenergy with carbon capture and storage. Read the EOS summary article and the original paper.

In a similar vein, **DNV**'s Energy Transition Outlook 2021 warns that 'electrification is not enough' to meet the net zero target. Hydrogen could take 20 years and 'arrive too late to have the impact needed'. The current pace of energy transition is making for a 2.3°C global temperature increase by end of the century. The global pandemic is a 'lost opportunity' to speed up the transition as Covid-19 recovery packages are 'protecting rather than transforming existing industries'.

A paper published in **Energies**, 'Through the eye of a needle: an eco-heterodox perspective on the renewable energy transition*' highlights 'cracks in the foundation of the mainstream energy transition narrative'. Numerous 'collectively fatal' problems are found with 'so-called' renewable energy technologies. The pat notion of 'affordable clean energy' is blind to the economic, ecological, and social

costs. What is required is a 'contraction of the human enterprise'. 'Society must embark on a planned, cooperative descent from an extreme state of overshoot in just a decade or two'.

* *Energies 2021, 14, 4508*.

The UK-based **IOGP** completed a strategic review of industry challenges, finding that while 'climate change and the energy transition is on top of the agenda', members 'want IOGP to stand up and speak for our industry more', and further its advocacy work. A new Energy Transition Directorate is to be created, led by Energy Transition Director, Concetto Fischetti. More from IOGP.

SALES, PARTNERSHIPS, DEPLOYMENTS

RMS for Digital Geologi. FPT/Halliburton Digital Factory. GeoSoftware, AWS in China. Kongsberg Digital and Shell. Eye-bot Aerial and Veerum. BHC3 for MEG Energy SAGD. NexTier and Silixa. Nanjing Recon and CNPC. Synergistics and Seeq. Schlumberger and Aveva. Equinor and Rosneft. Equinor and MiQ. Shell, Windward. Unioil, Chevron and P97 Networks. Shell, Bentley Nevada. Texas A&M, ConocoPhillips.

UPSTREAM

Norwegian consultancy **Digital Geologi** has used **Emerson**'s Emerson RMS Modeling software to interpret a ground penetrating radar site survey of an industrial reclamation project. A waste oil handling facility is to be transformed into a 'bijou' residential and commercial complex. The 3D model eliminated the need to acquire costly extra geotechnical ground penetration data, 'leading to savings of some 25-50% of the subsurface analysis cost'. More from Emerson.

Vietnam-based system integrator **FPT** has entered a collaboration agreement with **Halliburton** to launch a dedicated Landmark practice of over 150 developers, data scientists, and cloud engineers. The 'digital factory' will build and deploy customer-specific AI/ML solutions, extending DecisionSpace 365 cloud applications. The collaboration leverages FPT's workforce in 26 countries, mixing on-site, nearshore, and offshore delivery models. More from FTP.

A deal between GeoSoftware (formerly a CGG unit) and **Amazon Web Services** heralds the availability of the eponymous portfolio of reservoir characterization and petrophysical interpretation solutions on AWS China. The services are operated by local Amazon partners **NWCD** (Ningxia region) and **Sinnet** (Beijing region).

DRILLING

Kongsberg Digital and **Shell** have entered into a partnership agreement to 'collaborate and accelerate digital solutions and transformation for well delivery and performance'. Shell has utilized Kongsberg Digital's real-time data products in its global wells portfolio for several years. No mention of OSDU in the release although Kongsberg is an OSDU Forum member.

CONSTRUCTION

Eye-bot Aerial Solutions and **Veerum** have formed a partnership to deliver 3D datasets to the oil and gas, construction and infrastructure sectors. The datasets, derived from drone and ground-based data collection combine with Veerum's asset management and visualization software. More from Eye-bot.

PRODUCTION

Baker Hughes and **C3 AI** have deployed an 'enterprise AI solution' at **MEG Energy** to improve the efficiency of thermal production operations. MEG Energy is working to reduce energy and water use and greenhouse gas intensity. BHC3's AI solutions 'improve the efficiency of steam-assisted gravity drainage (SAGD) production'.

NexTier Oilfield Solutions' newly-launched IntelliStim fracturing optimization system has completed its first project for an unnamed major operator in the Mid-Continent region. IntelliStim includes NexTier's NexHub digital technologies that allows users to monitor completion operations in real time, including downhole visualizations, to verify that a frack is performing as planned. The 'Corva' visualization and Carina fiber sensing solution from Silixa also ran.

OPERATIONS

Recon Technology unit **Nanjing Recon Technology** has won a maintenance contract for a combustible toxic gas alarm system from **CNPC**/Yunnan Petrochemical Co. Total contract amount is RMB 4.08 over four years. More from Recon.

Synergistics Digital Solutions has partnered **with** Seeq on advanced analytics solutions for process industries including oil and gas. More from Seeq and Synergistics.

Silixa has deployed what is claimed to be the world's first subsea DAS* installation, Carina Subsea 4D, on **BP**'s Atlantis Phase 3 development. The system has been installed in two wells, and installation is continuing over the rest of the field.

** Fiber optical digital acoustic sensing.*

Schlumberger and **Aveva** are teaming on 'edge, AI and cloud solutions'. Initial focus involves streaming data from the Aveva PI System (formerly OSIsoft) into Schlumberger's Delfi E&P environment to 'better manage equipment health and optimize performance'. The Schlumberger-backed Agora 'Edge AI and IoT Solutions' provider is also involved.

Equinor and **Rosneft** have signed a strategic partnership agreement to develop low carbon solutions and reduce the carbon footprint from joint projects to support the goals of the Paris Agreement. More from Equinor.

ExxonMobil has signed an agreement with non-profit MiQ, a partnership between RMI, 'formerly' the Rocky Mountain Institute, and SystemIQ, to begin the certification process for natural gas produced at its Permian Basin facilities at Poker Lake, New Mexico. Certified natural gas validates emissions reduction efforts and helps customers meet their emissions goals. ExxonMobil has expanded the use of aerial LiDARTM imaging and SOOFIE methane detection technologies in the region and is evaluating additional next-generation applications, including satellites and artificial intelligence, as part of its ongoing initiatives to find 'smarter and faster' ways to detect and mitigate emissions.

DOWNSTREAM

Shell International Trading and Shipping is to integrate Windward's AI-powered predictive intelligence solution to streamline trade compliance. The solution provides a 'know your vessel' due diligence process to ensure that potential business partners are not a compliance risk. Windward's algorithms are based on '300 behavioral analytics models and over 10 billion data points'. Windward also recently signed with BP, OQ Trading and Freepoint Commodities.

RETAIL

Unioil Petroleum Philippines has selected P97 Networks to enhance its Unioil Mobile App with point of sale to fuel pump integration, loyalty card integration, mobile payment integration, offers, rewards, station locator and fuel price comparison functionality.

Chevron is also to deploy **P97 Networks**' technology 'to make every-day transactions for purchasing fuel and food or participating in loyalty offers as simple as unlocking your smartphone'.

Shell announces the launch* of VitalyX, 'powered by Shell' and Bentley Nevada, a Baker Hughes business. VitalyX combines Shell Remote Sense lubricant analysis expertise with Bently Nevada's 60-year experience in condition monitoring and protection to offer an early warning system that remotely monitors oil quality to increase machine uptime.

** Curiously, VitalX was announced at the 2019 GE Oil and Gas event as 'co-developed by BHGE and the Emirates National Oil Company'.*

TRAINING

Texas A&M Institute of Data Science (TAMIDS) has received a $1 million grant from **ConocoPhillips** to support the development of an Undergraduate Certificate in Data Analytics for the Petroleum Industry (CERT-DAPI). TAMIDS and the Department of Petroleum Engineering in the College of Engineering are to manage the program. More from ConocoPhillips.

STANDARDS STUFF …

Infrastructure Digital Twin Maturity. Energistics Transfer Protocol V1.2. EU AI Watch: AI Standardization Landscape. IEEE AI/ML terminology standard. IOGP GIGS 2.0 spatial data integrity test tool. IIC name change. OGC API for Environmental Data Retrieval approved, API - Features 1.0 beta roll out. OSGEO PROJ 8.1.1.

The **Digital Twin Consortium**, a unit of the Object Management Group, has just published a whitepaper, 'Infrastructure Digital Twin Maturity: A Model for Measuring Progress'. The 17 page whitepaper labors its way through a distillation of marketing terminology and paints a picture of a digital world that probably does not really exist. The DT is defined as 'a virtual representation of real-world entities and processes, synchronized at a specified frequency and fidelity' which is fair enough as a stretch goal, but to claim that 'for a typical infrastructure project, ... we would normally have several virtual representations ... seamlessly connected into a single Digital Thread' is a little adventurous. DT maturity is evaluated along a spectrum from 'dinosaur' through 'average', to 'leader, 'evangelist' and eventually to 'pioneer'. The authors (from Microsoft, Gafcon and AsBuilt) state that the 'evolution of the digital thread starts with company and industry standards'. But, although there are 23 mentions of 'standards', none are actually cited. No more are any real world chapter-and-verse examples of a digital twin in action.

The soon-to-be shuttered **Energistics** upstream standards body has released Version 1.2 of the Energistics Transfer Protocol. ETP provides an 'efficient full-duplex connection between two digital data systems'. Initially targeting the real-time transfer of data from drilling systems to central monitoring facilities, the standard is also used to exchange data between different platforms or applications. The binary format is said to use a tenth of the communication bandwidth used by legacy solutions. Energistics reports that ETP will be integrated into the OSDU data platform. More from Energistics.

The **EU** has published a 137 page document titled, 'AI Watch: AI Standardization Landscape state of play and a proposal for an AI regulatory framework'. The report elaborates on the role of standards, but the section on 'AI standards' appears is empty. The study provides input to the upcoming EU Artificial Intelligence Act (AIA). After working their way through the smorgasbord of international and EU standards that could impact their work, the authors conclude that 'many relevant standards exist (already published or in the pipeline). Therefore, the AIA requirement operationalization can build on existing efforts'. Why are we thinking Don Quixote?

In case you all take this to be EU bashing, we note that the **IEEE AI Standards Committee** is likewise tilting at the AI windmill with a new Project Approval Request for 'Standard for AI/ML Terminology and Data Formats'.

The **IOGP** has updated GIGS, its geospatial integrity of geoscience software test tool. GIGS 2.0 is an open-source framework for evaluating spatial data integrity in geospatial software. The framework comprises qualitative evaluations of software functionality and data-driven tests to quantify the accuracy and robustness of geodetic engines and libraries. The 2.0 update makes GIGS simpler to use, more flexible in its application and automates testing. More here.

The Industrial Internet Consortium (IIC) has changed its name to Industry IoT Consortium (still IIC!). The change is accompanied with a new logo and tagline, 'technology innovation, business transformation'. The IIC's mission is now to 'bring transformative business value to organizations, industry, and society by accelerating the adoption of trustworthy IoT systems'.

Membership of the **Open Geospatial Consortium** has approved the OGC API for Environmental Data Retrieval specification as an official OGC Standard. The EDR API 'makes it easy for users to access subsets of spatial big data through a web interface that hides the complexities of data storage'. Enviro data can now be unambiguously specified by spatio-temporal coordinates, allowing retrieval of small subsets of environmental data from large collections such as weather forecasts or climate models. The API can also be used to retrieving data from computer tomography scans or digital microscopy records. More from the release.

The **OGC** has also announced that the OGC API - Features 1.0 executable test suite on the Beta OGC Validator now includes tests from OGC API - Features - Part 2: Coordinate Reference Systems by Reference. More here and more on OGC compliance certification here.

On the topic of coordinate reference systems, OSGEO, the **Open Source Geospatial Foundation** has released PROJ 8.1.1 with bug fixes and an update to the EPSG CRS database (Version 10.028).

CYBER SECURITY ROUND-UP

Petronas security training. US Pipeline security update. ISA on IT/OT security. Dragos and DNG-ISAC initiative. 2021 Microsoft vulnerabilities. EU moots joint cyber unit. Honeywell USB threat report. University of Waterloo and critical infrastructure cyber security. Top 20 PLC coding tips.

A blog from the ISA reports on how **Petronas**' has leveraged training programs based on the ISA/IEC 62443 specification covering control system component security. Petronas' Sharul Rashid describes the 'ever-increasing threat of cyber-attacks', the ongoing strategy of IT-OT convergence and the formation on an IT/OT cybersecurity taskforce, guided by ISA/IEC 62443 best practices. Following a review of OT cybersecurity trainings, Petronas selected the ISA's Cybersecurity Fundamental Specialist (CFS) ISA/IEC 62443 and Expert Level (Risk, Design, and Maintenance) qualifications for task force members. Task force members communicate Petronas' cybersecurity goals to stakeholders and vendors. The standards have also informed the company's cybersecurity governance framework.

The **Transportation Security Administration** (TSA) of the US Department of Homeland Security has announced new cybersecurity requirements for critical pipeline owners and operators, issued 'in response to the ongoing cybersecurity threat to pipeline systems'. A new security directive requires owners and operators of TSA-designated critical pipelines that transport hazardous liquids and natural gas to implement 'a number of urgently needed protections against cyber intrusions'. The Department's Cybersecurity and Infrastructure Security Agency (CISA) advised TSA on cybersecurity threats to the pipeline industry, as well as technical countermeasures. These include the implementation of measures to protect against ransomware attacks and other known threats to IT/OT systems and the development of contingency and recovery plans and an architecture review. An earlier security directive issued following the Colonial Pipeline ransomware attack called for improved cyber incident reporting and the designation of a cybersecurity coordinator, available 24/7.

Those wishing to look further into the **ISA**'s cyber security offering* should download a new ISA publication, Applying ISO/IEC 27001/2 and the ISA/IEC 62443 Series for Operational Technology Environments. Securing both IT and OT systems has proved challenging with potential issues of operator screen locking creating unsafe conditions, incompatible antivirus products and patching practices that disrupt production. ISA/IEC 62443 series addresses such issues and helps an organization conform with the overarching ISO/IEC 27001 approach to information security. The white paper also addresses the issue of remote access to OT systems, with ISO 62443-specific requirements extending the approach to teleworking.

** ISA also issued a position statement in response to President Biden's Executive Order 14028 (12 May 2021) that charts a 'new course to improve the Nation's cybersecurity'.*

Industrial control system cybersecurity specialist **Dragos** has teamed with the Downstream Natural Gas Information Sharing and Analysis Center (DNG-ISAC) on an initiative to 'strengthen security and community-wide visibility for industrial cybersecurity in the North American natural gas industry'. DNG-ISAC is an information sharing facility between distribution companies, the federal government and other stakeholders. Dragos's Neighborhood Keeper is scheduled to be deployed via the DNG-ISAC, providing analysts with 'greater visibility into industrial control system cyber threats facing the natural gas sector'.

** Incredibly the DNG-ISAC entry point is non https and gives a 'site not secure' warning. The portal ('powered by Cyware') fortunately is!*

The 2021 Microsoft Vulnerabilities Report from **Beyond Trust**, a compilation of Microsoft security bulletins, provides an overview of the threat landscape of the Microsoft ecosystem. Vulnerabilities are on the rise, a record 1,268 vulnerabilities were discovered in 2020, up 48% year on year. One simple way of

mitigating some 56% of all critical vulnerabilities is to remove 'elevation of privilege' from users' software, the number 1 vulnerability category. But be prepared for some push-back as, 'tension between security and productivity is often the barrier that prevents the removal of users' admin rights'. Enter Beyond Trust's Endpoint Privilege Management solutions that promise 'granular control of access to applications, tasks, and scripts, elevating application access but not user privileges'. Other interesting findings from the report... In January 2020, Microsoft Edge moved to a Chromium-based engine so now it shares the same flaws as Google Chrome, there is now 'no safe mainstream browser for Edge vulnerabilities. While Windows 10 was touted as the most secure Windows OS to date when it was released, it still experienced 132 critical vulnerabilities in 2020. Covid-induced remote working has also introduced a 'greatly expanded digital attack surface; phishing attacks are up 600%, including Covid-19-themed attacks aimed at workers mixing personal and work devices over non-secure Wi-Fi networks'.

The **EU Commission** has published a Recommendation to build a 'Joint Cyber Unit'. Currently there is no mechanism for providing assistance to EU cyber communities or for combating cybercrime and conducting cyber-defense. The JCU is to provide a technical and operational cooperation in situational awareness, preparedness as well as response, between all communities. More from the pitch.

Honeywell has just published the 2021 Industrial Cybersecurity USB Threat Report. Covid-induced work from home has led to increased movement of digital data, mostly via removable media and network connectivity. The Honeywell study found a 30% hike in the use of USB in 2020 in industrial control/OT environments with concomitant rise in threats. Honeywell's USB security solution: Honeywell Forge Secure Media Exchange (SMX) analyzes USB devices used in industrial facilities across oil and gas, energy and chemicals. The threat of USB-borne malware is a 'serious and growing concern'. USB-specific threats rose from 19% in 2019 to just over 37% in 2020 with Trojans (76%) the main risk. Often these provide remote access, acting as an initial attack vector from which hackers can 'download additional payloads, exfiltrate data, and establish command and control'. USB removable media are being used to penetrate the air-gapped environments found in many industrial and OT environments. To mitigate such risks, active USB cybersecurity controls are needed, perhaps leveraging early detection from the Honeywell Forge cybersecurity platform.

Natural Resources Canada has awarded a $407,000 grant to the **University of Waterloo** to develop a cyber security system to protect Canada's critical energy infrastructure. The hardware assurance system will detect compromised components and devices, 'ensuring the safety and reliability of Canada's energy delivery by mitigating supply chain risks'. Bruce Power will provide equipment, evaluate machine learning processes and the overall performance of the new system, while Palitronica, a Canadian cyber security hardware and software company and part of University of Waterloo's innovation ecosystem, will provide hardware sensors for technology development. The University of Waterloo and Bruce Power also contributed to the project, bringing the total investment to over $830,000. More from NRC.

PLC Security has just published a 44 page document outlining the 'Top 20' secure PLC coding practices. These could be summarized as 'validation, validation and validation', along with advice on modular coding with function blocks (sub-routines), independent testing of modules, tracking and alarming operating modes and more. The Top 20 list was compiled by the Secure PLC Programming project running on an ephemeral platform, top20.isa.org hosted by ISA.

IT'S A MAD, MAD, BLOCKCHAIN WORLD!

A caveat! Guild One and Blockchain for Energy. The Solar Oil Project. Data Gumbo's GumboNet pilot, Kongsberg Digital, Well Expertise partnerships. Hopium hypes hydrogen blockchain. Voice Life and Verge Currency. BlockApps' TraceCarbon net zero platform.

First a caveat .... Here at Oil IT Journal we are unashamed blockchain skeptics. Not (just) because we believe that the whole cryptocurrency thing is a boondoggle that will end in tears. But also because, as Editor Neil McNaughton has argued previously there is no mechanism to unambiguously tie a token on the blockchain to anything in the physical world. This means that use cases such as emissions reporting, financial reporting with real currencies, process control data cannot be 'certified' by their corresponding digital representations on the blockchain. As we revealed in our last issue, our Cassandra-style predictions with regard to blockchain in trading were borne out by BP's revelation that the 'Blockchain consortium model isn't working'. With all that in mind, as faithful recorders of what is happening in this most peculiar domain, we provide you with the latest developments, to 'consume with moderation'.*

Calgary-based **GuildOne** is teaming with the Huston-headquartered Blockchain for Energy on a blockchain-based integrated joint venture management pilot. The pilot will be built on R3's Corda blockchain platform and GuildOne's 'ConTracks' smart contract technology. The IJVM pilot extends an earlier AFE balloting trial. The BfE Corda blockchain business network will provide participating energy companies with access to blockchain nodes for both sandbox development and commercial implementation, promising 'at-scale' blockchain adoption in the energy industry. BfE members include Chevron, ConocoPhillips, ExxonMobil, Hess, Pioneer Natural Resources and Repsol.

Blockchain For Energy has also announced a smart contracts-focused R&D program to give consortium members hands-on experience of blockchain implementation and smart contract interoperability across different platforms. The program will test and certify 'industry-grade' smart contracts and create a library of templates. The R&D program is a collaboration with Data Gumbo, developer of the GumboNet SC network.

Beyond Oil has announced the Solar Oil Project, a 'revolutionary tokenization platform' to support oil well operators with an innovative solution to reduce the carbon footprint of oil production, while 'recycling' abandoned or underutilized oil wells. SOP provides automated solar-powered pumps that 'give a fresh breath of life' into profitable production. Interested parties can 'participate' in the activity by purchasing 'non-speculative' Solar Oil Access Tokens (SOAX). The 'ERC-20' Ethereum tokens can be assigned by their owners to selected oil well sites. They are paid back in Solar Oil Production tokens (SOPX) which can be traded on the SOP exchange.

DataGumbo reports the outcome of a 'successful pilot' of its GumboNet blockchain-powered smart contract network with an unnamed, Texas-headquartered, oil gas and chemicals multinational. The project involved a chemicals supply chain spanning some 200 locations operating over a 30-day period. The project automated invoice matching from internet of things/scada data integrated with the ERP systems.

Kongsberg Digital has partnered with **Data Gumbo** to make blockchain smart contracts available from its Kognitwin digital twin environment. The addition of automated GumboNet smart contracts will allow customers, vendors and suppliers to integrate transactional data and achieve 'real-time, predictive digital replicas of industrial heavy assets'.

Randaberg, Norway headquartered Well Expertise, a provider of plug and abandonment, exploration, appraisal and development planning services and software has adopted Data Gumbo's GumboNet for use in its frame agreements and well contracts with Wellesley Petroleum. The solution is said to improve workflow processes, automate invoicing and payments and provide real-time operational cost control.

French putative hydrogen-powered car manufacturer, Hopium has opened a blockchain technology development subsidiary, UNA, based in Venice Beach, CA. UNA is working on an 'encrypted ultra-secure and decentralized' software and data solution for deployment in Hopium's future 'Māchina' supercar. First phase of the technology will focus on the vehicle's ecological impact with a digital passport and ownership records to 'guarantee security, and traceability throughout the supply chain'.

Voice Life has signed a memorandum of understanding with Verge Currency and rLoop. The companies are to build a far field wireless transmission system for continuous, clean and 'limitless' charging of smart phones, IoT devices and autonomous vehicles. Voice Life is the developer of the wireless charging solution. Verge Currency is a 'volunteer-driven' cryptocurrency created in 2014. rLoop is a 'decentralized autonomous organization' (DAO), conceived in the SpaceX hyperloop competition, that acquires, supports and finances early-stage innovation projects in an ecosystem of 'limitless and permissionless innovation'.

BlockApps has announced 'TraceCarbon,' a 'net zero' blockchain network for emissions compliance. TC leverages the BlockApps STRATO blockchain platform for sustainability tracking and corporate reporting. TC tracks CO2 emissions for compliance and transparency in corporate reporting and product lifecycle analysis. TC also leverages AI from FuelTrust to validate carbon emissions and help reduce their environmental footprint. More from BlockApps.

** See also Neil's recent letter published in the Financial Times on crypto craziness.*

OTTR, NORWAY'S 'REASONABLE ONTOLOGY TEMPLATES' LANGUAGE

Inaugural meeting of semantic web/linked industrial data research group hears from DNV on READI/CFIHOS. University of Western Australia on reasoning from engineering spreadsheets for failure mode and effects analysis. Sirius&' 'SIndAIS4' scaling Industrial AI in 4 dimensions to address wellbore information management.

The curiously acronymized 'Reasonable Ontology Templates' (OTTR) organization* continues the somewhat Norwegian predilection for applying semantic web technology to industrial contexts including oil and gas. The inaugural OTTR get-together was held virtually in January 2021. DNV's Johan Klüwer presented work done in the READI** Joint industry project to apply the OTTR approach to interpret an 'existing' industrial vocabulary, the CFIHOS RDL and data dictionary. Klüwer has leveraged the venerable ISO-15926-14 upper ontology to 'enrich' CFIHOS' tabular-format (CSV) data such that it is 'ready for dissemination' as linked data.

Another presentation, from Melinda Hodkiewicz, (University of Western Australia), covered 'Digitalization and reasoning over engineering textual data stored in spreadsheet tables' presenting the 'case for OTTR'. Hodkiewicz addresses a very general problem in how engineering data is handled in the real world where a 'vast amount of engineering text data is stored in spreadsheet tables' and is therefore 'not machine-interpretable'. Using an example from the IEC60812 standard for failure mode and effects analysis (FMEA), Hodkiewicz showed how knowledge captured in the FMEA tables can be extracted to support quality control and re-use. The result recalls earlier work on ISO 15926 where the tabular data is transformed into a spaghetti-like graph of objects and relationships amenable to semantic-style processing. The work was originally presented at the 2020 IFAC Workshop on Advanced Maintenance Engineering, Services and Technologies, AMEST 2020.

Comment: We have been tracking the ups and downs of semantic technology in oil and gas for over 20 years. In a nutshell, the early work on ISO 15926 proved too complex for the common mortals and a few years ago, CFIHOS, the capital facilities information handover standard was proposed by the Netherlands-based USPI-NL to simplify ISO 15925 by reducing its essentials to a set of spreadsheets. It is therefore

rather curious that OTTR is now transforming CFIHOS's spreadsheets back to the original semantic/linked data paradigm.

** OTTR is described as 'a language with supporting tools for representing and instantiating RDF graph and OWL ontology modelling patterns'. The main contributor is Martin Skjaeveland from Norway's Sirius Labs.*

*** READI Joint Industry Project (2018-) that targets digitalization of requirements for the Oil and Gas on the Norwegian Continental Shelf.*

Presentations are available on the OTTR event website.

***Extra, extra** ... Sirius continues with its valiant attempts to find a use for semantic technologies with recent announcement of work, 'blending AI and semantics' in the Bosch-supported 'Scaling Industrial AI in 4 dimensions' SIndAIS4 project. One use case is semantic oil and gas data management. This is to combine information from wellbores, seismic investigations, and general geological knowledge to 'assess what types of rock are in the reservoir and intersect the wellbore' and to explore 'semantic approaches to improve data integration and analytics'. OSDU brace yourselves!*

PETRONAS CENTER OF EXCELLENCE DEPLOYS CLOUD-BASED MONITORING AND MAINTENANCE

Aveva Predictive Analytics asset performance management underpins "P-MMPD", the Petronas machinery monitoring and prescriptive diagnostics program.

Microsoft reports* that Petronas has 'saved $17.4 million in just 12 months' by deploying Aveva predictive analytics in the Azure cloud. Petronas was at risk of unexpected rotary equipment failures which could potentially shut down an entire plant and lead to 'catastrophic consequences'. To optimize equipment reliability, Petronas deployed Predictive Analytics (PA), a.k.a. Aveva's asset performance management (APM) solution, following a six-month trial at four upstream platforms and two downstream plants.

Systems integrator Trisystem Engineering deployed the solution using an agile/sprint methodology leveraging Aveva's 'no-code' artificial intelligence, customized for the energy industry. A templated approach saw the solution operating in under two months. PA ingests data from the PI System from OSIsoft (now part of Aveva), already deployed on Petronas' critical assets.

The solution works in parallel with the 'traditional' plant control (DCS) system. Operation engineers use the DCS system to operate the plant, while maintenance and reliability engineers use PA for their daily tasks and monitor assets across the sites. In the first year of pilot implementation (2020) with 200 models deployed, PA gave 51 early warnings of impending equipment failures, including 12 high-impact warnings. These were resolved ahead of actual failure, significantly decreasing unscheduled downtime, saving an estimated $17.4 million. The solution is also said to improve collaboration between operators and specialists at the Petronas remote monitoring center, a.k.a. the Petronas Center of Excellence.

Azizol Kamaruddin, Petronas' head of rotating equipment said, 'The solution deliver early detection of anomalies and failure and captures years of our machine operation experience into a digital platform. We have integrated our own failure mode and effects analysis methodology into PA'.

Following the pilot, the system, branded as the Petronas machinery monitoring and prescriptive diagnostics (P-MMPD), is now running on an additional 10 plants with a total of 150 equipment trains. The company is rolling-out Aveva APM across its assets along with the cloud-based Aveva Unified Supply Chain to optimize its supply and distribution network, 'cutting crude evaluation time and lowering margins' (sic).

** In the Autumn 2021 Microsoft Technology Record.*

ON THE TRUE COST OF THE CLOUD

Andreessen Horowitz opinion piece warns of the 'trillion dollar paradox' and the 'flexibility tax' of a move to the cloud.

An article, The Cost of Cloud, a Trillion Dollar Paradox by Sarah Wang and Martin Casado from Andreessen Horowitz provides some answers to Oil IT Journal Editor Neil McNaughton's musing on 'why the cloud?' when he supposed that 'the unstated aim is to reduce or eliminate the cost of an on-premise data center'. The findings of the AH investigation back this up with some interesting caveats.

It turns out that for a startup, more interested in 'innovation, agility, and growth' than in costs, the cloud is a great choice. But as the company matures, this situation evolves. As the business model stabilizes, the cost of maintaining the flexibility of the cloud turns into what AH call the 'flexibility tax'. For large companies, the tax can equate to 'hundreds of billions of dollars of equity value'. And this tax is levied 'after the companies have already, deeply committed themselves to the cloud and are often too entrenched to extricate themselves*'.

The cost of the cloud itself becomes more material as time goes on and AH speculates that the '30% margins currently enjoyed by cloud providers' is unlikely to go away 'given that the majority of cloud spend is currently directed toward an oligopoly of three companies'. AH concludes that, for a startup, 'You're crazy if you don't start in the cloud' but that as things progress, 'you're crazy if you stay on it'. Repatriation is then a consideration, BH reports that one large consumer internet company found public cloud list prices to be '10 to 12x the cost of running one's own data centers'.

But oil and gas companies are rather mature in IT terms so the 'startup' argument may not apply. A simple 'lift and shift' of a mature datacenter to the cloud may just mean ponying up for the 'tax'. Read the full AH analysis on a16z.com.

** This recalls the situation a couple of decades ago when outsourced document management led to prohibitively expensive information retrieval.*

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