SPE Review London March 2024

SPE Review London

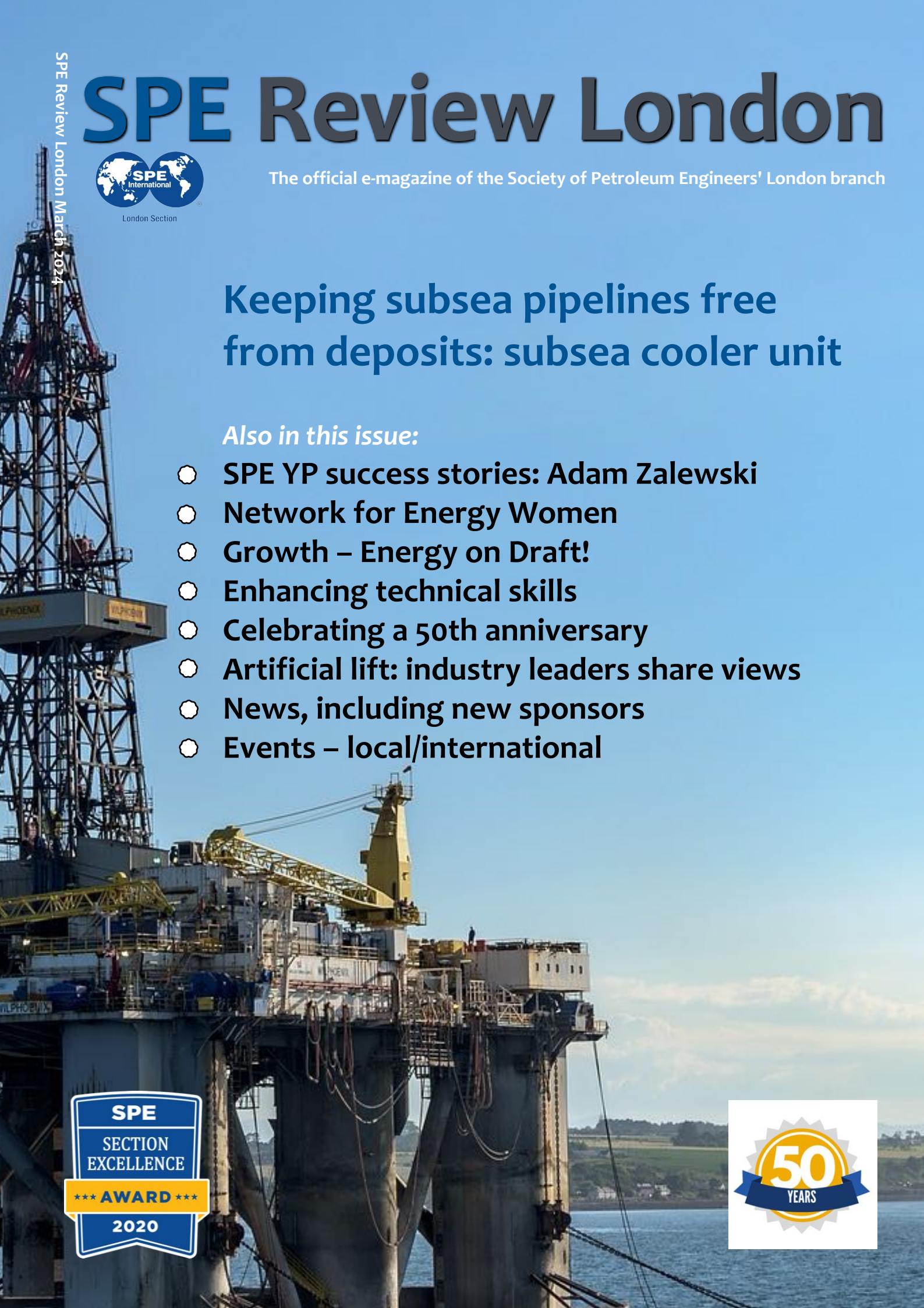
The official e-magazine of the Society of Petroleum Engineers' London branch

London Section

Keeping subsea pipelines free from deposits: subsea cooler unit

Also in this issue:

- SPE YP success stories: Adam Zalewski
- Network for Energy Women
- Growth – Energy on Draft!
- Enhancing technical skills
- Celebrating a 50th anniversary
- Artificial lift: industry leaders share views
- News, including new sponsors
- Events – local/international



SPE Review London

The official e-magazine of the Society of Petroleum Engineers' London branch

ABOUT US

The Society of Petroleum Engineers (SPE) is a not-for-profit professional association whose members are engaged in energy resources, development and production. SPE is a non-profit professional society with more than 156,000 members in 154 countries, who participate in 203 sections and 383 student chapters. SPE's membership includes 72,000 student members. SPE is a key resource for technical knowledge related to the oil and gas exploration and production industry and provides services through its global events, publications, events, training courses and online resources at www.spe.org. SPE London section publishes SPE Review London, an online newsletter, 10 times a year, which is digitally sent to its 3000+ members. If you have read this issue and would like to join the SPE and receive your own copy of SPE Review London, as well as many other benefits – or you know a friend or colleague who would like to join – please visit www.spe.org for an application form.

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SPE SECTION EXCELLENCE *** AWARD *** 2020

In this issue

FEATURES

Cover image: Mustangloe/ Pixabay

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Behind the Scenes: SPE Review Editorial Board

Elizaveta Poliakova, Editor in Chief

Elizaveta is a Reservoir Engineer at Trident Energy. She has an M.Sc in Petroleum Engineering from Imperial College London and a B.S. in Petroleum Engineering from the University of Leeds.

Elizaveta has been with SPE for more than seven years. She was the President of SPE Imperial College Chapter and the President of SPE Leeds Chapter. She was the SPE London Board Chair in 2022/23.

Ffion Llwyd-Jones

Ffion is a business editor and writer, with a BA Honours in Environmental Studies / Language, and a Business/Corporate Communications degree from York University in Toronto, Canada. She is also edX certified for ChatGPT.

Ffion has extensive writing and editing experience in the technology, health, automotive and environmental sectors.

Malvika Nagarkoti

Malvika currently leads the Global Brownfields Development and Production Enhancement segment at Baker Hughes. Previously, she was responsible for reservoir management in E&P companies and a petroleum economist in a consultancy organisation. Malvika has a B.Tech (Applied Petroleum Engineering) from UPES, and an MBA in International Oil and Gas Management from the University of Dundee.

Credit: Benjamin Davies

A big Thank You! to the organisations supporting the SPE London section

Gold — RFD Rock Flow Dynamics

Silver — OPC

Bronze — SERICAENERGY

Letter from the Chair

We reconvene amidst a transformative period within the oil and gas industry, marked by notable developments since my last letter in October 2023:

1. Increase in mergers and acquisitions (M&As) across operators such as ExxonMobil Pioneer Natural Resources, Chevron Hess Corporation and Harbour Energy Wintershall DEA. These strategic manoeuvres underscore the industry's concerted efforts toward portfolio optimization and diversification, and consolidation at considerable scale.

2. The persisting conflict in the Middle East has catalysed disruptions in vital oil and gas supply routes, notably in the Strait of Hormuz. This geopolitical tension has heightened concerns over supply chain vulnerabilities, further compounded by recent announcements of production cuts by OPEC and the ongoing war in Ukraine.

3. The prominence of technology, particularly GenAI (next-generation artificial intelligence), has emerged as a focal point in the agendas of energy industry leaders. A significant percentage of stakeholders recognize GenAI as pivotal for future advancements.

The oil and gas industry's dynamics significantly affect organizations and SPE members, demanding vigilance. Staying informed is crucial for adapting to future changes. Within SPE London, our ongoing efforts aim to highlight key technical topics and connect experienced professionals with emerging talents, fostering collaboration and innovation amid industry shifts.

My key highlights

We were honoured by a visit from SPE Regional Director Pierre Emmanuel, who participated in our February board meeting and DL Technical talk, sharing insightful perspectives, regional plans, and encouragement for local initiatives. His invaluable insights from recent regional visits enriched our understanding of how we could address synergistic global challenges facing the SPE.

Our Net Zero Gaia committee organised talks focusing on energy and carbon capture storage challenges in the UK, focusing on technical, commercial aspects, and project progress. The Geo-Energy and ML program highlighted data science's crucial role in advancing the Energy Transition.

In its 15th year, our annual *Introduction to Upstream* course featured discussions on the energy transition and the crucial role of upstream operations in decarbonization. Under the leadership of Chair Adam Borushek, the event drew 50 diverse professionals, providing invaluable insights. It was truly enriching to connect with colleagues from various disciplines and backgrounds, and to engage with industry leaders, fostering meaningful discussion and networking opportunities.

Our Technical Talks program kicked off the year with engaging discussions on chemical enhanced oil recovery and the influence of oil and gas expertise on low carbon technologies. Special thanks to Andrew

Letter from the Chair... continued

for organizing these insightful sessions. The March talk in central London focused on global oil and gas projects and drilling activities. Our goal is to foster face-to-face interactions, and we have exciting talks lined up for the next 6 months.

Our Student Development Chair, Mehdi Alem, orchestrated a successful career workshop at Imperial College London, providing career highlights with guest speaker Natan Battisti, and opportunities to review CVs. Additionally, we're broadening our support for students, extending invitations to participate in our London mentor program. Your input will be invaluable in shaping the program's direction, empowering students and providing comprehensive support across various disciplines, ensuring their success in diverse career paths. Please register your interest **here** to be part of this impactful initiative.

The Young Professionals committee arranged a visit to AbTC slb, where leaders discussed energy transition efforts and showcased technological advancements. Students also learned about internship opportunities with slb.

I would like to commend the editors of the SPE London Review, Elizaveta Poliakova, Ffion Llwyd-Jones and team for their outstanding work in assembling a formidable team and consistently producing an essential and impactful publication month after month. Their dedication and expertise have ensured the continued success and relevance of this publication within our community.

As always, if you perceive any opportunities where we can add value to you as members, wish to volunteer with us or to sponsor the section, your contribution is warmly welcomed to strengthen our Section. Please feel free to get in touch; we're open to any helping hand that can further empower our Section.

Best wishes,
Shwan Dizayee

Letter from the Editor

Dear Readers and Colleagues,

I'm excited to share with you our latest issue of SPE Review London!

In this issue, we feature (on page 10) a technical paper *Keeping Subsea Pipelines Free from Wax and Hydrate* by M. Kvernland, F. Lund, and L. Strømmegjerde. This paper, presented at the SPE Offshore Europe Conference & Exhibition in Aberdeen, Scotland, UK, in September 2023, discusses cutting-edge approaches to subsea pipeline integrity.

On page 20, Adam Zalewski, Principal Researcher in Production Technology at Equinor and former SPE London Section Chair, shares his *YP Success* story, highlights the importance of volunteering and shares valuable advice to those who aspire to join our industry.

On page 19, *Energy on Draft!* is a reminder of how our shared knowledge and experiences enrich us all, encouraging connections that extend beyond the workplace. Do not miss out on the next gathering!

In this issue, we also celebrate a milestone – the *50th anniversary* of the SPE Imperial College London Chapter. On page 24, you'll find an engaging article detailing a commemorative site visit to SLB's Abingdon Technology Centre, organized and hosted with the support of the SPE London Young Professionals

Turning to page 26, we delve into the world of *artificial lift*. Experts from the field share their insights and look ahead, providing a comprehensive overview that's as educational as it is inspiring.

A heartfelt thank you to our Editorial Team members, Ffion Llwyd-Jones and Malvika Nagarkoti, for your ideas, insights, energy and time spent preparing this publication.

As we move forward, I encourage you to reach out and get involved – whether you have feedback, ideas, or wish to contribute!

Warm regards,
Elizaveta Poliakova

NEWS DIGEST... NEWS DIGEST... NEWS DIGEST

New Perenco CEO Armel Simondini

Armel is an oil and gas industry veteran. He was previously at Total (now Total Energies), before joining Perenco in 2011. Most recently, he was President of Perenco Cameroon.

Past CEO Benoît de la Fouchardiere is now on the board of Perenco Group and will take over the management of the company's subsidiary, Dixstone; it is responsible for the oil and gas services, including drilling, logging, piping, platform design and construction, plant management and decommissioning.

Chairman François Perrodo commented: "It has been a long journey since I appointed Benoît as CEO in 2016. Together we have successfully led the company through difficult times as the lower Brent price environment and the pandemic, making the group stronger than ever thanks to bilateral reserves, safety data, research and projects, including the flagship Cap Lopez LNG project.

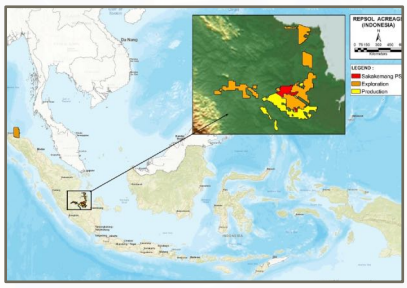
The second chapter now begins with its own challenges. We never rest on our laurels and must regularly reinvent ourselves by injecting new energy."

Perenco is an independent hydrocarbon producer involved in the life cycle of projects from exploration to decommissioning. It was founded in 1994, is active in 14 producing countries with a workforce of more than 7,000 people. Its gross production is more than 510,000 boepd.

More information: **Perenco**

Indonesia gas discovery

Two trillion cubic ceet of recoverable resources are anticipated at Indonesia's largest gas discovery in 18 years.



The KBD-2X well in South Sumatra was completed by the operator Repsol together with its partners PETRONAS and MOECO.

The discovery was in the Sakakemang block in South Sumatra, where the company will continue exploratory work.

More information: **Repsol**

Shell billion dollar investment

The company's new ambition seeks to reduce customer emissions from the use of its oil products by up to 20 per cent by 2030. The plan is part of Shell's first energy transition update since 2021. Shell published its *Energy Transition Strategy 2024* in March.

Shell confirms it will invest $10-15 billion between 2023 and 2025 in low-carbon energy solutions.

More information: **Shell**

Varying targets

Reuters has published a comparison table showing details of the world's biggest oil and gas companies' varying targets to reduce greenhouse gas emissions.

However, it adds that the different approaches taken by oil companies' climate plans makes comparison difficult.

More information and the table: **Reuters**

NEWS DIGEST... NEWS DIGEST... NEWS DIGEST

Tri-level celebration
SPE London is happy to announce new sponsors at three levels:

Gold level: **RockFlow Dynamics**
Subsurface modelling experts.

Silver level: **OPC**
Service provider and consultants.

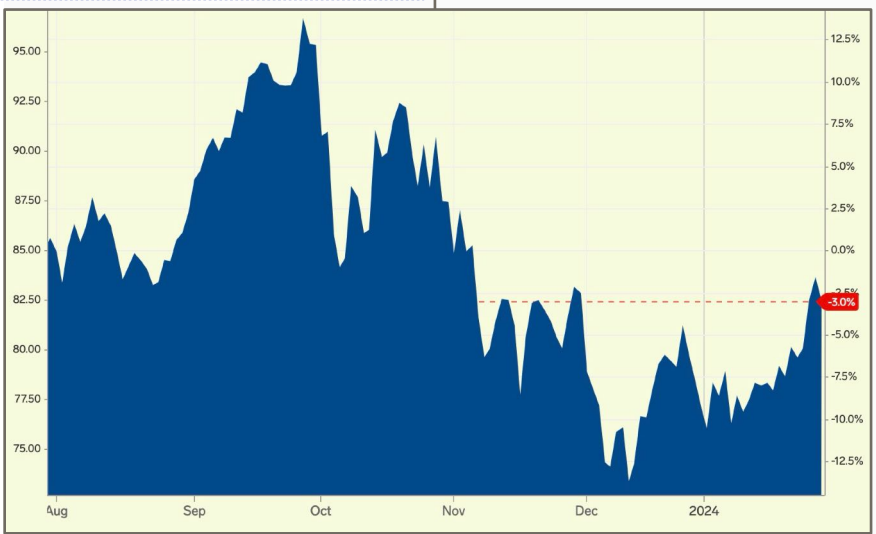
Bronze level: **Serica Energy**
An E&P operator focused in the North Sea.

More information:
RockFlow Dynamics
OPC
Serica Energy

Oil and gas drilling expertise
Robert Borne is the new CEO of Neo-Oiltools. The company makes drilling technologies for the industry. Robert was previously the Executive Director-North America Wireline Service, Baker Hughes.

Neo-Oiltools Chairman of the Board, Pascal Bartette, said that Robert's "deep experience and market knowledge make him well-positioned to lead the company through the next phase of growth".

More information:



Oil (Brent) 87.50 +0.02 (+0.02%) – 30/03/2024 (**Credit: Market Insider**)

Neo-Oiltools
Upbeat trajectory in March
The rise in oil prices resulted in energy stocks outpacing the technology sector in March, according to a euronews business report.

Both Shell and BP's shares were up by more than 6 per cent.

The report said that global stock markets remained on an upbeat trajectory with robust European stock markets in the first quarter. Major European indices showed the fifth consecutive monthly gains.

More information:
euronews

Midstream highest of new projects in 2024-2028
A detailed analysis of announced and planned European projects reveals that more than 400 oil & gas projects are expected to start operations in Europe during 2024-2028.

Projects projections are for midtream at 183, upstream at 127, refinery at 65 and petrochemicals at 59.

More information:
The Europe Oil and Gas Projects

NEWS DIGEST... NEWS DIGEST... NEWS DIGEST

SPE Policy on AI-Generated Content in Publications

The SPE Board has approved a new policy allowing AI-generated content to be used within SPE publications but under specific conditions.

AI-assisted language tools (such as ChatGPT) have gained widespread attention recently, particularly for their capability to assist in drafting scientific papers. While these tools have the potential to enhance the efficiency and speed of academic and technical writing, the ethics and best practices for their use are still evolving. These tools may generate useful information and content but are also prone to errors and inconsistencies.

The SPE Board has approved a new policy for authors who use AI language tools to generate content for their papers. The policy states that AI- generated content may be used within SPE publications but under specific conditions.

- AI language tools may not be listed as an author. The AI tool cannot sign publishing agreements or transfers of copyright.
- Any AI-generated content that is used within a manuscript should be thoroughly vetted, fact checked, and disclosed.
- If AI language tools are used within a manuscript, their use should be clearly explained within the methodology or acknowledgment section of the paper. If AI-generated content is included within a manuscript without an explanation, this can be grounds for rejection of the work at the discretion of SPE and may result in a code of conduct review.
- The authors of the manuscript will be held responsible for any errors, inconsistencies, incorrect references, plagiarism, or misleading content included from the AI tool.

It is important to note that technology for AI language tools is advancing rapidly. SPE plans to periodically review and update this policy to ensure its relevance and effectiveness. Any modifications to the policy will be communicated transparently and in a timely manner.

Userba011d64_201/Getty Images/iStockphoto

Keeping subsea pipelines free from wax and hydrate deposits by use of a subsea cooler unit

This paper presents the 'cold flow' technology and tests performed to qualify a subsea concept as a step towards taking the technology into use. By combining subsea cooling and the traditional cold flow seeding method with a novel inductive heating mechanism, all hydrate and wax potential can be converted into small and inert solid particles in a subsea cooler downstream of the wellhead. The particles will travel suspended in the bulk flow at ambient seabed temperature towards the host facility without any additional flow assurance measures, like pipeline insulation, heating, or chemical injection. The paper contains a description of the Empig cold flow technology, and the initial concept launched by SINTEF. Furthermore, a description of a hydrocarbon flow loop used in the testing of the technology together with a brief description of test results. A subsea cooler unit used for a pit test is then presented. This section contains a discussion on its design principles, a description of the marinized heating system, and test results.

Authors: M. Kvernland, F. Lund, and L. Strømmegjerde, Empig AS, Trondheim, Norway

Introduction

Wax and hydrates are two of the main flow assurance challenges in transporting oil and gas in subsea pipelines over longer distances. Hydrates start to form when liquid water and natural gas are in contact at a certain pressure and temperature. Similarly, wax starts to precipitate when the fluid temperature reaches a certain temperature. If no measures are taken to deal with these solids the pipeline can be plugged.

Conventional technologies to deal with these challenges include pipe insulation and pipe heating, chemical injection, and internal mechanical scraping of the pipe (pigging). Pipe insulation and heating techniques keep the fluids along the pipeline above the precipitation temperatures; wax appearance temperature (WAT) and the hydrate equilibrium temperature (HET). The most common chemicals used to prevent hydrate plugging are so-called thermodynamic inhibitors that shift the precipitation temperature, so that the fluids can be transported at a lower temperature. Low dosage hydrate inhibitors (LDHI), like anti agglomerants (AA), are becoming more common. These chemicals affect the formation and agglomeration properties of the hydrates. Large capital and operating costs are related to the conventional flow assurance technologies and these costs determine whether a potential field development is economically viable or not. Wax inhibitors are also developed but with high cost and reliability challenges. The cold flow technology enables production flow at ambient temperature in bare un-insulated pipelines without the use of other flow assurance measures. It lowers the CAPEX and OPEX significantly compared to conventional technologies and can enable production from new fields economically viable. The technology enables ultra-long tie-ins and can open for production to shore. Due to a lowered energy demand, the technology lowers the CO_2 emissions related to the production by 20-30 % for a 100 km tie-back case (Eyni et al., 2022).

Cold Flow

Cold flow was initially proposed as a concept by SINTEF in the 1990s (Lund et al. 1998). A considerable amount of research, testing and development has been done since the concept was introduced (Lund et al. 2000, Larsen et al. 2001, Gudmundsson 2002, Argo et al. 2003, Wolden et. al 2005, Larsen et al. 2007, Larsen et al. 2009, Lahance et. al 2012, Kvernland et al. 2022). The initial concept was developed for gas hydrates, and further developed to include wax, asphaltenes, and other solids by use of the same principle (Argo et al., 2004).

The cold flow concept is to do a controlled cooling of the fluids downstream of the subsea wellhead and form a non-adhesive and non-cohesive slurry that contains solid micro particles. The particles can be transported at ambient temperature to the host facility (Straume et al. 2018).

The basic idea is to take a portion of the cold outlet stream downstream to a cooling section and reinject it upstream into the cooling section. This reinjection is referred to as seeding. The seeding contains cold hydrate and wax crystals that initiates a controlled growth of new hydrate and wax particles in the bulk flow instead of on the inner pipe surface.

Keeping subsea pipelines free from wax and hydrate... continued

The water will coat the hydrate seeding particles with a thin water layer due to their hydrophilic surface (Lund et al., 2000). As the water coated particles are further cooled, they will absorb the water film and become dry hydrate particles. Since the water is converted to hydrates by growing on existing hydrates, no free water will be encapsulated into hydrate particles. The result downstream the cooler section is small, dry, and inert particles that can be transported along the pipeline with the remaining liquids to the host facility. Figure 1 shows the cold flow principle for gas hydrates. Figure 2 shows the formation of gas hydrates through agglomeration for an oil-dominated system.

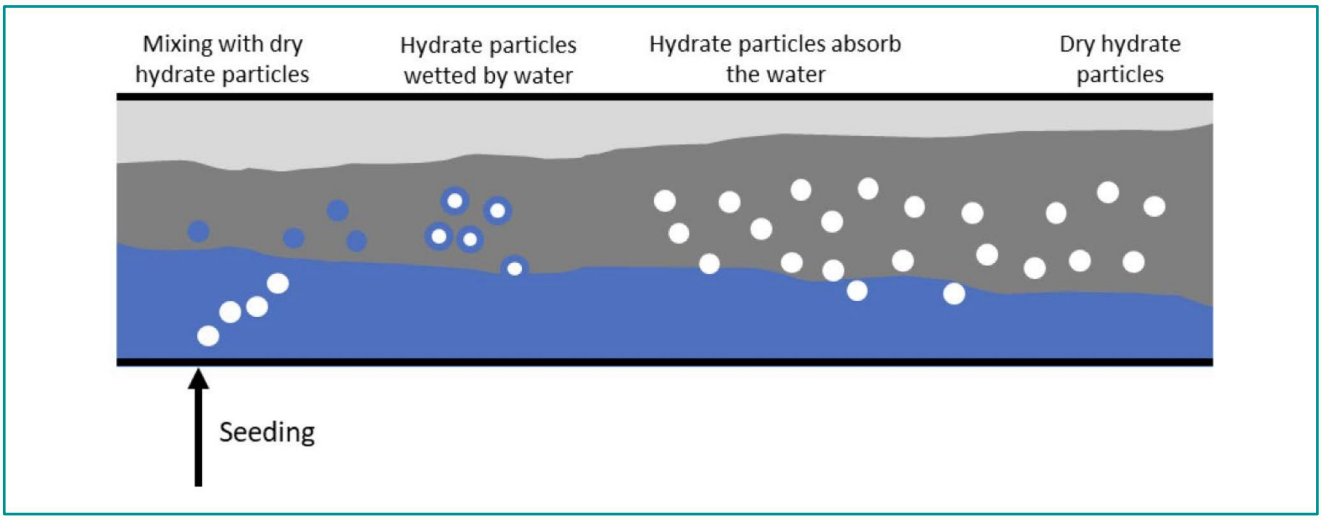


Figure 1. Conversion of hydrates into dry particles in bulk flow with the seeding method.

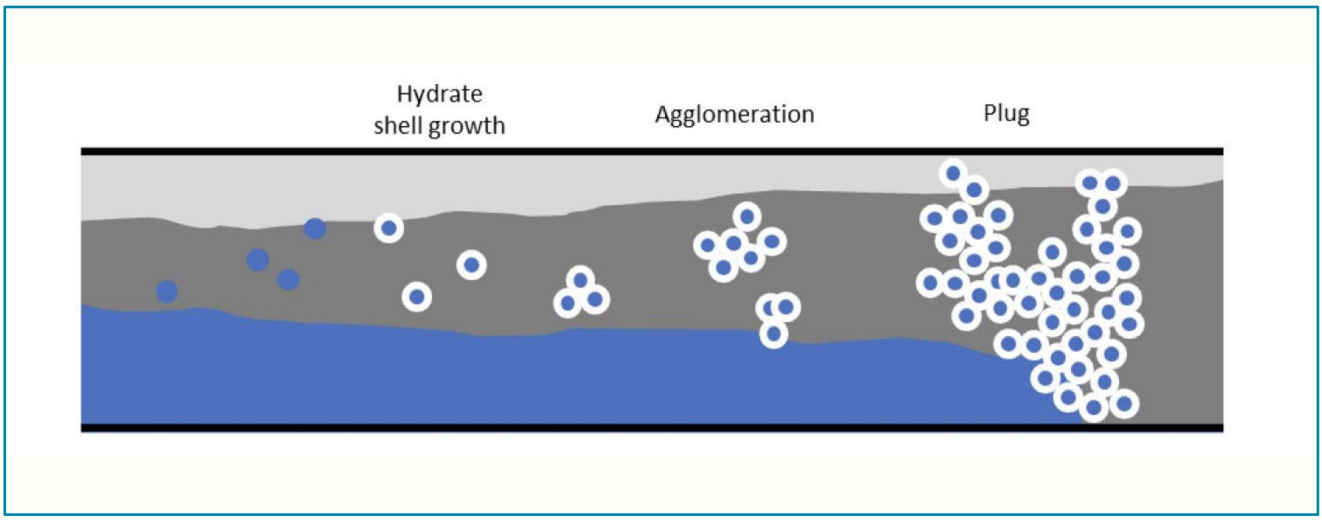


Figure 2. Formation of hydrate plug through agglomeration for an oil-dominated system (Sloan & Koh, 2007).

The particles will be transported by the remaining liquids in the pipeline. Stanko et. al (2022) proposes an operational envelope of the cold flow system based on the amounts of hydrate solids versus the remaining liquids.

Cold Flow Concepts

The initial cold flow concept by SINTEF was named "Saturn" and was based on a long hypothetical recycle loop (1 km). The large size of the recycle loop, installability, and the subsea recycle pump were some of the challenges with the concept. Also, tests showed that the cooling section had some build-up of deposits on the inner pipe walls, i.e., the seeding method was not 100 % effective with respect to particle solidification. To deal with these challenges an improved subsea concept was proposed by Empig. The cooling section was reduced to a compact subsea cooler unit with a smaller recycle pump than the original concept. To manage the inner pipe deposits, a low energy heating inductive coil is moved along the cooler pipes during normal

Keeping subsea pipelines free from wax and hydrate... continued

production flow. The heat from the coil loosens the deposits still in solid state, and they are torn off by the shear forces of the flow. The coil is continuously moved along the cooler pipes by a robot that cleans the cooler sequentially. The inductive heater does not disturb the outlet temperature of the cooler to any challenging degree since it is heating only a small pipe segment at the time.

Hydrocarbon Flow Loop Testing

To test the new cold flow concept, a relatively large flow loop was built by Empig at SINTEF Multiphase Flow Laboratory. The flow loop consists of the following components:

1. An 11 m3 heated, pressurized, and insulated tank containing natural gas, crude oil and water simulating a reservoir. The reservoir conditions were around 80 bar and 70 °C. The hydrate equilibrium temperature (HET) was at roughly 20 °C at the operating pressure.
2. Pumps for oil and water flow into the loop. No gas compressor was used but the oil was saturated with gas so that hydrates could be formed in the flow loop.
3. A 300 m long passive spool cooler inside a 40-foot container basin. Pipe dimension is 2-inch. The container was filled with water and the water was continuously replaced to simulate a subsea ambient temperature of roughly 4 °C.
4. Recirculation pump connecting the cooler outlet with the cooler inlet for seeding of particles.
5. Downstream pigging section to test for downstream pipe wall depositions.
6. Heater to re-heat the fluids back to reservoir conditions.

In addition to the components above, a 5-axis robot was installed inside the container to move the Ushaped inductive coil along the cooler pipes, from inlet to outlet, see Figure 3.

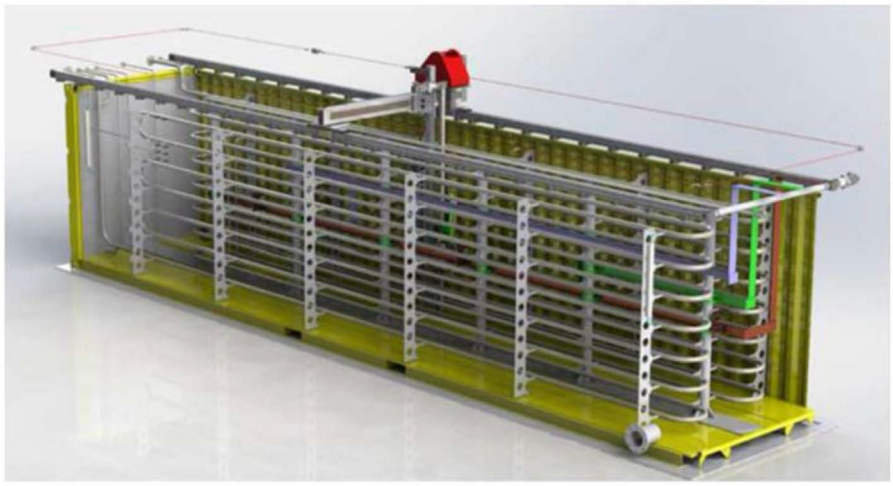


Figure 3. Container with the cooler pipes and the robot system used in the hydrocarbon flow loop tests.

The coil is powered by an industrial induction machine. The induction machine is an off the shelf item and delivers high frequency power to the coil.

Test Results

Kvernland et al. (2022) summarized test results from a test campaign conducted at the flow loop. The results showed that the cold flow seeding method combined with the inductive cleaning method performed well. The flow loop produced cold flow slurry and inner pipe deposits were removed entirely by the robot. This was confirmed by pressure drop and temperature flux measurements. Only small amounts of deposits were measured by the downstream pigging section after each cold flow test compared to tests with no flow assurance actions taken. Shut-in and restart tests were done, and the cold flow slurry proved to be stable during the shutdown, i.e., no change in the flowability after the shutdown.

Keeping subsea pipelines free from wax and hydrate... continued

Tests done in a recent test campaign (2023) show similar results. To qualify the system a wider range of water cuts were successfully tested. The slurry proved to be stable downstream the cooler unit when it was exposed to variations in the ambient temperature. This is an important finding with respect to the downstream qualification of the system. To have an efficient cold flow process in the unit, tests show that high velocities are preferential. This is probably due to a better mixing of the particles at turbulent conditions.

Pit Testing

A pit test is done to do a marinization of the technology and is an important part of the technology qualification process. A downscaled subsea cooler was therefore built to test its performance in a simulated subsea environment. The tests were done in a dry dock facility where the whole unit could be submerged into seawater. The focus of the test was on mechanical design, robotic design, and the heating system. The pit tests were done without any hydrocarbons in the pipes.

To overcome the complex robotics used in the hydrocarbon flow loop tests, a newer cooler design was introduced for the pit tests.

Design Principles

Apart from the novel mechanical drive system and robotics, and heating system, most of the parts follow a subsea standard in the final product. As many off-the-shelves components as possible have been used in the design. Standard subsea canisters are used for electronics that need dry conditions including the induction machine. Standard ROV handles are used to operate manual functions during launch and recovery of vulnerable parts.

Helix Cooler

A helix cooler design (see Figure 4) is introduced to simplify the robotic system. The robotics can now be reduced to a single axis movement placed vertically in the middle of the helix cooler. The heating coil is mounted on a sled that will use the cooling 3-inch pipes as rails when moving along the cooler (see Figure 5). The sled is pushed a support axis fastened parallel to the rotating central axis. The central axis is mounted to a large cog wheel driven by a standard torque tool. The torque tool is programmed to rotate the central axis and move the sled along the pipes from top to bottom, and opposite.

Figure 4. Picture of the helix shaped cooler used for the pit tests.

Keeping subsea pipelines free from wax and hydrate... continued

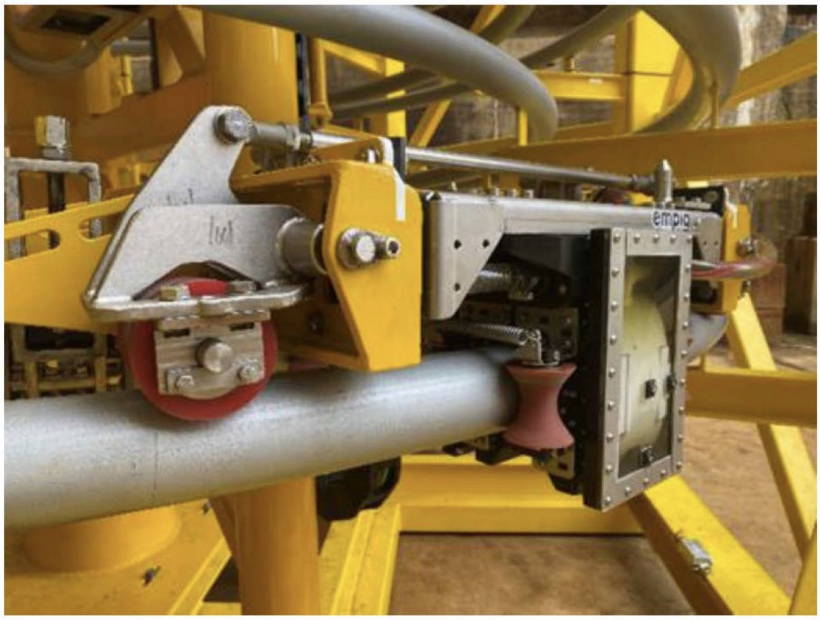


Figure 5. Picture showing a part of the sled that uses the pipe as rails. The sled has wheels made in soft polyurethane elastomer/ plastic. Tests did not reveal any wear and tear on the parts (wheels or pipe coating).

Replacement of Vulnerable Parts

The robotics, seeding, and heating system are considered vulnerable components with a lifetime expectancy of roughly 5 years. The cooler pipes themselves are considered to have a much greater lifetime expectancy, probably through the whole production lifetime of a field. To deal with this the cooler unit is made such that these vulnerable parts can be retrieved and replaced by a light offshore vessel. A central unit including the clamp sled and the top frame can be lifted out of the helix cooler. The top frame includes the cog wheel, slip ring, torque tool and the necessary power and control units. The induction machine is mounted on the central axis close to the clamp.

Clamps and Heating System

The heating coils are designed as clamps and can be lifted off the pipes with the clamp sled in case of a retrieving operation. Two U-shaped inductive coils are in the clamp housing (see Figure 6), and these are connected to the induction machine. The clamp housing contains pressure compensated oil and can theoretically be submerged to any sea depth. The induction machine is placed in a 1 atm. air-filled subsea canister.

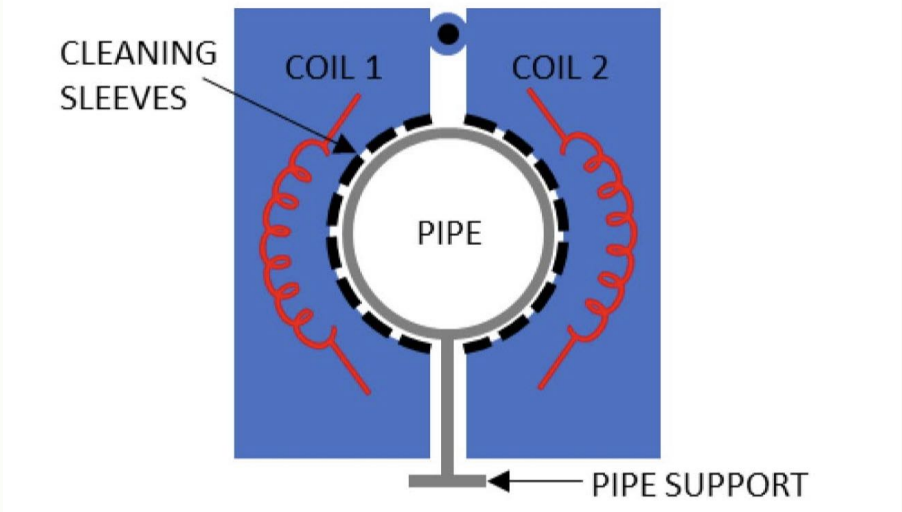


Figure 6. Cross-sectional view of the pipe clamps (blue) illustrating the two cleaning methods. The inductive coils (red) heat the pipe locally to loosen inner deposits, and the outer cleaning sleeves scrapes off outer pipe fouling.

Keeping subsea pipelines free from wax and hydrate... continued

In addition to the inner cleaning handled by the induction heat, small cleaning sleeves are mounted on the pipe clamp to remove any outer fouling on the pipes (Figure 7). This can be dust or marine growth that are common in a subsea environment. The fouling particles will not have sufficient time to stick to or establish on the surface when the clamp is passing frequently. Due to the outer cleaning method, the cooler can be designed with a reduced external fouling factor making it effectively shorter than a conventional subsea cooler.

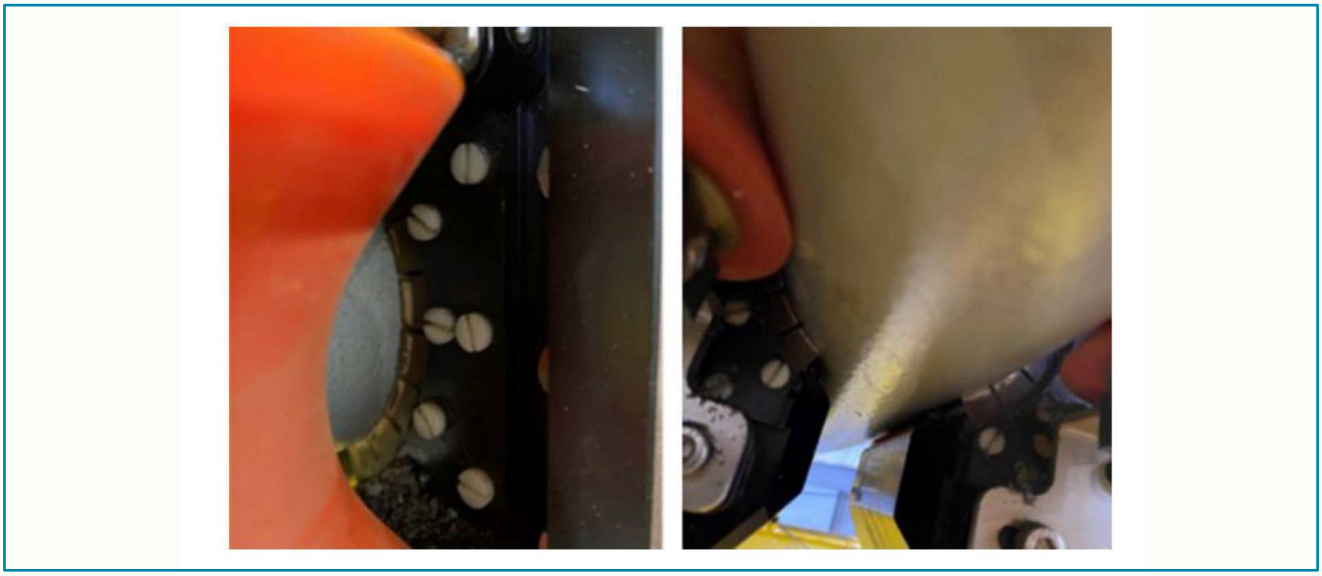


Figure 7. Pictures showing the outer cleaning sleeves mounted on the clamp.

Results from Testing

Different tests with different sled velocities along the pipe, and applied heat from the induction machine were done to monitor the pipe temperature. The experiments are summarized in Figure 8. The vertical line indicates the necessary heat to remove a wax layer of 1 mm with a flow velocity of 1.3 m/s based on earlier experiments.

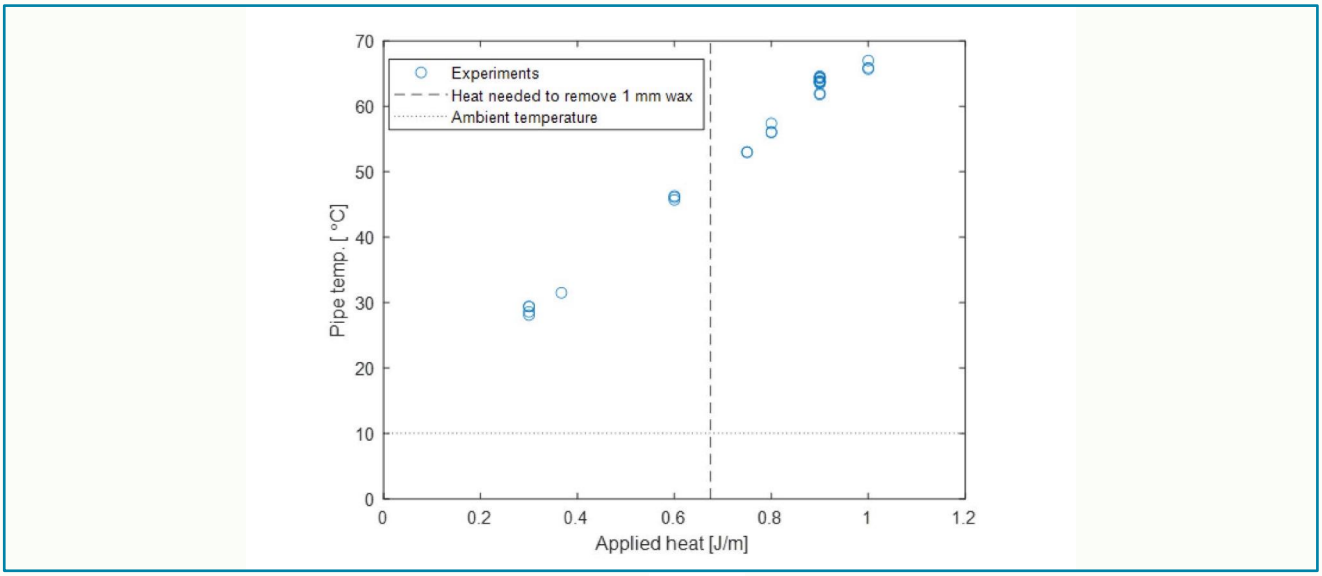


Figure 8. Pipe temperatures vs. applied heat (heat per pipe length, $\frac{P_{induction}}{v_{clamp}}$).

The heating system worked as intended throughout the testing period and no wear and tear were found on the heating clamps or pipes. Figure 9 (next page) shows the effect of the outer cleaning sleeves.

Keeping subsea pipelines free from wax and hydrate... continued

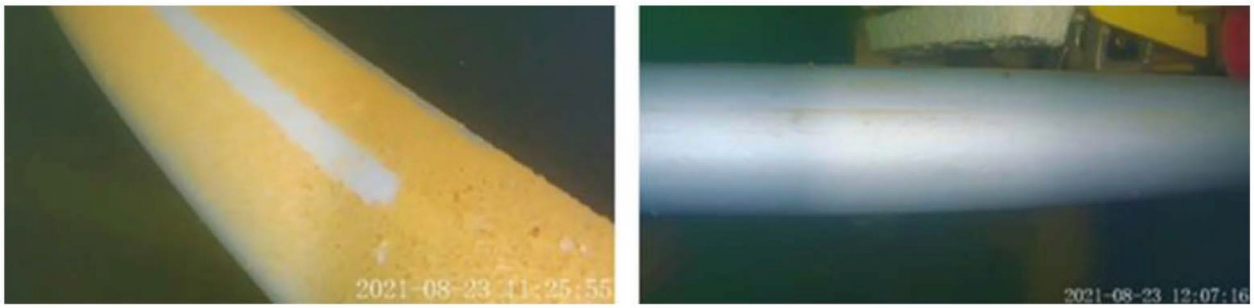


Figure 9. Pictures showing the effect of outer cleaning.

Launch and recovery of the vulnerable components was also successfully tested, see Figure 10. The retrievable part is guided into the center of the cooler frame using guide pins.

Figure 10. Launch and recovery of vulnerable parts.

No extensive wear and tear were found on the moving parts. The torque tool data log did not show any increase in the torque during the test period, indicating low wear and tear on the rotating parts. The total time underwater was more than 100 days and the robotics was rotating for almost 1000 hours.

Conclusions

Hydrocarbon flow loop tests show that the cold flow seeding method combined with the inductive heating technique works and the cooler unit remains clean. The slurry that goes out of the cold flow unit contains inert and dry particles that prove to be stable during temperature changes and shut-in situations. This is an important part of a downstream qualification of the technology.

Pit tests prove that the technology can be marinized for subsea use. A new heating coil design allows for

Keeping subsea pipelines free from wax and hydrate... continued

outer cleaning of the cooler pipes in addition to the inner cleaning. Vulnerable parts, like the robotic system and the heating system can be retrieved and replaced when needed. Extensive testing in shallow water conditions shows that the unit can withstand operation without wear and tear on moving parts.

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Making valuable contacts in a social environment

Network for Energy Women (NEW) is an informal, London-based network for professional women working in the energy sector. We provide a warm and welcoming atmosphere for women to expand their network and make valuable contacts while enjoying a social event.

NEW started out as a conversation in June 2022 between Clara Altobell (VP ESG and Business Innovation, Serica Energy) and Marwa Hassan (SEES Business Development Manager, SLB) about how there should be more purely social events for women, just to chat, get to know each other and enjoy a cocktail or bite to eat. This resulted in a meal for six, hosted by SLB in September 2022.

After a short hiatus, Emma Luke (Digital Account Manager, SLB) took over the reins and arranged the second event in June 2023, once again sponsored by SLB, and this time for 10 people. Word got around and we continued to expand our network, inviting our contacts and receiving requests to join. The next event followed, this time with Serica Energy sponsoring, and now we were up to 22 with 50 on the invitation list.

Most recently, NEO Energy hosted a 'winter warmer' on 30 January in the Gherkin, where we had 40 women attend (despite a badly timed train strike).

Our network has women with a wide variety in seniority, experience and roles, and from a broad range of companies, from the more traditional oil and gas through to financial institutions, technology and new energy. We believe this diversity in backgrounds helps cultivate the vibrant and convivial atmosphere for which our events are now known.

We have reached a membership level of over 100 women and started a LinkedIn group to more professionally manage the communication and organisation involved. There are conversations ongoing about starting a sister network in Aberdeen, so watch this space!

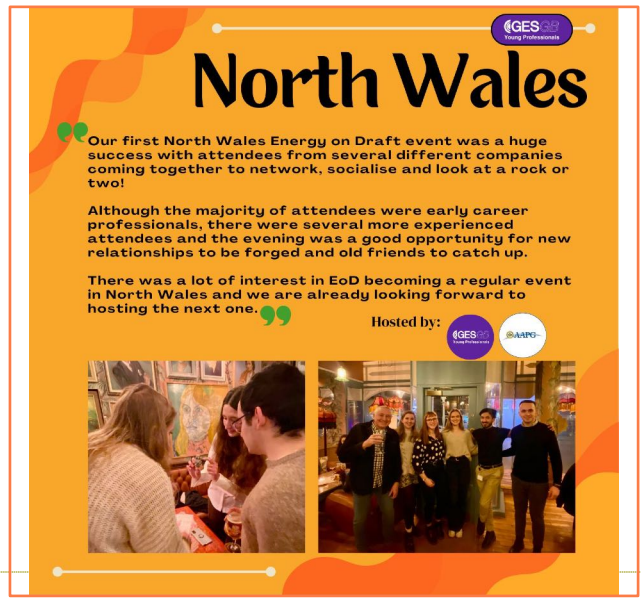
Our next event is in Spring, and kindly sponsored by Perenco. We hope to continue to grow and expand our network of wonderful women!

Successful, highly anticipated quarterly events

Originating from a desire to rekindle local geo communities and foster informal networking, this event attracts professionals from diverse backgrounds, including service companies, operators, consultancies, and aspiring students entering the energy sector.

GESGB's Energy on Draft was launched in four hub locations across England, Scotland and Wales this month. There were more than 250 attendees across the four locations and Energy on Draft has become a highly anticipated quarterly event on the GESGB YP calendar.

Organized by an enthusiastic committee of volunteers (GESGB Young Professionals, SPE London Section & SPE Aberdeen, London AAPG YP, EAGE Local Chapter London, London Petrophysical Society (LPS), and IChemE London Young Members Forum), the event welcomes professionals at all experience levels. Early career enthusiasts and students get an unique opportunity to connect with senior professionals and share their valuable insights.



Fostering growth and expertise through volunteering

Adam Zalewski is a petroleum engineer who is experienced in production optimization, digitalization and well completions. He has track record of delivering digital products.

Adam also has proven leadership experience across many corporate and volunteering roles. He is excited about getting extra barrels through production optimization using digital tools!

Who is Adam Zalewski? Tell us what inspires you.
Who am I? I identify as a Petroleum Engineer. I am originally from a small village in Eastern Poland. Apart from work, I enjoy spending time gaming on my PC and playing board games.

When it comes to what drives me, I find more motivation than inspiration. I like feeling useful, especially when it benefits others or the environment. Making improvements in how we produce oil or reducing our carbon footprint gives me a sense of purpose. It is as well easy to put evaluate in barrels added or tons of carbon removed. Seeing the impact of our work keeps me motivated to keep pushing forward.

The Society of Petroleum Engineers is instrumental in helping me to learn and grow in my field. Especially when it comes to understanding different disciplines and technologies that we depend on and interact in the Subsurface projects.

It's also the everyday challenges and successes that keep me going. Whether it's solving a problem at work or trying out a new solution, each step forward fuels my desire to do better.

I work as a Principal Researcher in Production Technology working for Equinor, Norway. I am involved in implementing new technologies across our assets and as direct secondment to support Subsurface operations. This is a perfect mix for me of having access to develop the deep technical expertise and being close enough to the front line to deploy technology and best practices for direct benefit.

You have volunteering experiences across various roles and organizations. Can you share what importance volunteering holds for you personally and professionally?
Volunteering has been instrumental in my journey, serving as both a learning platform and a way to give back. Initially, transitioning from academia to industry was challenging. It was especially difficult to quickly developing soft skills like communication and leadership, Polish education focused almost solely on academic achievements at the time and region I studied at.

Volunteering with organizations like the Society of Petroleum Engineers (SPE) and Toastmasters International provided invaluable opportunities to hone these skills in a supportive environment. Making mistakes within this space allowed me to learn and grow, fostering confidence and resilience.

Moreover, volunteering isn't just about personal development; it's also about giving back. I've benefited greatly from the guidance of SPE volunteers early in my career, and I'm committed to paying it forward through mentoring schemes and supporting student initiatives.

Additionally, in our knowledge-based profession, formal leadership opportunities often come after years of individual contributions. Volunteering with SPE allows me to cultivate and refine leadership skills, preparing me for future leadership roles.

Over the past decade of leadership within SPE, I've realized that volunteering is a continuous learning process. It enables individuals to start with smaller projects and gradually take on larger responsibilities, fostering growth and expertise.

You've had various positions within the SPE London, SPE Aberdeen and SPE Stavanger sectors. What have been the most rewarding aspects and challenges of these roles?
Working within the SPE London, Aberdeen, and Stavanger sectors has been a fulfilling journey, marked by both rewards and challenges.

Fostering growth and expertise through volunteering... continued

One of the most rewarding aspects has been the positive feedback received from members. Seeing attendees enjoy our events, learn something valuable, and forge new connections is truly gratifying.

Witnessing students and new volunteers grow and progress, sometimes even transitioning into professional opportunities, is particularly satisfying. For example, initiatives like the Aberdeen Simplified Series, which I supported while serving on the SPE YP Committee in Aberdeen, have flourished over the years, providing valuable insights into various industry elements.

Moreover, it's been a pleasure to witness ideas I've contributed to take root and expand. Collaborating with other societies to host events like Energy on Draft, which originated with the SPE London Section, and seeing it grow across the UK has been rewarding. Similarly, maintaining the quality and legacy of event series like TechNight in Stavanger as a Programme Chair has been a fulfilling responsibility.

However, volunteering comes with its challenges. The workload can be substantial, often involving less glamorous tasks that require significant time and effort. I recall a particularly demanding situation involving SPE's banking in the UK, which required extensive hours and problem-solving. For all the SPE projects I found that it is a valuable skill to translate ideas into actionable plans within limited resources.

Another challenge is ensuring inclusivity and sustainability within the organization. It's essential to engage the entire membership and make them feel valued contributors to the local SPE Sections and SPE International.

Actively seeking feedback and creating diverse volunteering opportunities are strategies I'm currently exploring within the Stavanger Section. I firmly believe in practicing Servant Leadership, striving to serve the community through my volunteering roles.

You have a demonstrated capability (technical and commercial lectures, field trips and international events such as the ATCE Program Committee) in event management. How have these experiences refined your organizational skills and ability to execute large-scale projects?

My involvement with the ATCE Program Committee has provided clear lessons in event management, improving both my organizational skills and ability to execute large-scale projects.

The ATCE, or Annual Technical Conference and Exhibition, stands as the flagship event within SPE, boasting technical paper presentations, a sprawling exhibition floor showcasing cutting-edge technology, and pivotal volunteer gatherings such as award ceremonies and leadership transitions. Despite its immense scale, organizing the event as a volunteer feels smooth, offering me insights into SPE's operational practices that I've sought to apply within my own organization and local section.

Three key lessons that I gained from this experience: clarity of responsibilities, servant leadership, and the importance of succession planning. Upon joining as a volunteer, clear roles and responsibilities are explained, and transparent leadership structures and well-defined deadlines are presented. This clarity fosters a common understanding among volunteers, ensuring efficient operations.

Moreover, the supportive leadership culture exists within ATCE. In times of challenge or opportunity for improvement, there's a culture of assistance and guidance, empowering volunteers to address issues and enhance processes over time.

One of the most valuable aspects of the ATCE experience is its meticulous succession planning. Volunteers progress through structured pathways, from subcommittee roles to higher-level leadership positions, ensuring that leaders are well-versed in the event's intricacies and challenges. This long-term approach to leadership development underscores the importance of continuity and expertise in executing large-scale projects.

Drawing from these insights, I'm committed to implementing similar practices within my own volunteering efforts. By prioritizing long-term succession planning and knowledge transfer, we can ensure the sustainability and effectiveness of our projects over time.

I am trying to bring it into my own volunteering

Fostering growth and expertise through volunteering... continued

experiences to ensure that we capture lessons learned and best practices through long exposure in similar way.

You have a strong track record of mentoring, demonstrated through your roles in the SPE and Toastmasters International. How has this contributed to your personal growth, and what lessons have you learned from these experiences that have been pivotal in your development?

My journey as a mentor involved various programs, including SPE eMentoring, the University of Aberdeen Alumni program, and company scholarship initiatives. I have been a mentored for over seven years with numerous completed mentoring relationships. Throughout this journey, my mentoring style has evolved significantly, with a growing emphasis on empathy and listening skills.

Initially, I had a massive blind spot, as if everyone faced similar challenges to my own and that success followed a universal formula. However, over time, I've come to realize the importance of understanding each mentee's unique starting point, aspirations, and preferred methods of achieving success. This shift has led me to adopt a more listening-oriented approach, focusing on exploration and understanding rather than offering direct advice.

On a personal level, this experience has driven me to try comprehending the motivations, objectives, and diverse perspectives involved in multidisciplinary technical projects. Recognizing the varied definitions of success across different functions and disciplines has been instrumental in fostering collaboration and achieving common goals.

Recently, I embarked on a mentoring relationship as a mentee for the first time since my student days. This experience has provided valuable insights into the dynamics of the mentor-mentee relationship, allowing me to reflect on how to optimize the experience for both parties.

I am eager to apply these insights to my future mentoring engagements, ensuring that I can contribute effectively to the growth and development of others. Our professional life is intertwined with our personal situation and ambition. It is something that I would have to take into consideration in future.

Your involvement in diverse committees and roles, from technical to educational, across different geographic locations, shows a broad scope of engagement. How have these varied experiences contributed to your understanding of global industry challenges and cross-cultural communication?

When it comes to industry challenges, my experiences in the UK and Norway have highlighted the significant impact of location-specific factors such as taxation regimes, policies, and subsurface potential and challenges.

Norway's state regulations foster a culture of long-term thinking and research, with a pragmatic approach to decision-making. In contrast, the UK faces challenges in balancing short-term and long-term decisions driven by and much bigger exposure to the outside market forces and changing taxation policies.

Additionally, diversity and inclusion efforts have been prominent in both locations, albeit with varying focuses. While both countries share a commitment to the Energy Transition, Norway's approach to reducing carbon intensity feels more pragmatic and actionable from a production engineer's perspective. Ultimately, while global challenges are universal, the way individual engineers experience and address them is heavily influenced by their location-specific contexts.

Regarding cross-cultural communication, exposure to different locations has equipped me with a diverse set of communication tools. In the UK, communication is often seen as a sign of competence and is characterized by diplomacy and an avoidance of direct confrontation.

Conversely, discussions in Norway tend to be more direct and pragmatic, with a focus on substance rather than style. However, this expectation of directness may sometimes lead to nuances being lost in translation when communicating with outside.

The clash between these communication styles can result in differing interpretations of meetings and interactions. Therefore, being adept in both styles of communication can prove invaluable in bridging cultural divides and fostering positive interactions.

Fostering growth and expertise through volunteering... continued

If you could guide your younger self, what would you focus on? Would you do anything differently?
Reflecting on my journey, I've encountered numerous challenges that have shaped me into the person I am today. I find myself content with where I am.

Looking back, one aspect I would guide my younger self on is the importance of early career planning. I stumbled into petroleum engineering somewhat by chance, lacking clear direction when choosing my university path. While this decision turned out well for me, it could easily have gone differently.

In hindsight, I realize that my early focus was primarily academic, with little consideration for career prospects or the practical applications of my education. This lack of clarity made it challenging to stay motivated and engaged in my studies. I was fortunate to have chosen a path that suited me, but I recognize that I could have easily made a different decision.

If I could advise my younger self, I would emphasize the importance of exploring career options and understanding the potential outcomes of different educational paths early on. By focusing on the destination and the practical implications of my education, I believe I could have approached my early years with a greater sense of purpose and direction.

While I may have been overly cautious and pessimistic in the past, these traits have also prepared me well for the uncertainties and challenges of the industry, particularly during difficult periods like the downturn in 2015. So, while there are things, I wish I had done differently, I am grateful for the lessons learned and the person I have become as a result.

What advice would you offer new graduates aspiring to enter the oil and gas sector?
For new graduates aiming to break into the oil and gas sector, navigating the industry's recruitment landscape can be daunting. Here are some insights to help you chart your course:

Secure Transferable Skills:
Consider seeking roles that offer transferable skills, both within and outside the industry. This not only demonstrates your ability to deliver value and solve problems but also enhances your employability. Remember, having a job makes it easier to secure another.

Embrace Volunteering:
Organizations like SPE and Toastmasters International provide excellent platforms for networking and skill development. Volunteering not only expands your network but also exposes you to opportunities that may not be readily available through traditional job searches.

Explore Diverse Opportunities:
While big companies may seem like the obvious choice, don't overlook smaller organizations that offer opportunities to develop specialized expertise. Building a niche skill set could make you a sought-after candidate in the future, even by larger firms.

Stay Flexible:
The oil and gas industry is notorious for its cyclical nature and geographical variability. Today's boom may turn into tomorrow's bust, and vice versa. Be open to exploring opportunities across different locations and remain adaptable to changing circumstances.

Continuous Learning:
Invest in continuous learning and development to stay relevant in a dynamic industry. Whether it's pursuing further education, certifications, or staying abreast of industry trends, a commitment to lifelong learning will set you apart in a competitive field.

Network Strategically:
Build and nurture your professional network strategically. Attend industry events, conferences, and webinars to connect with industry professionals, mentors, and potential employers. Your network can be a valuable source of guidance, support, and job opportunities throughout your career journey.

By following these insights and staying proactive in your career development, you can position yourself for success in the changing landscape of the oil and gas sector.

Celebrating fifty years of student chapter excellence

In February, the award-winning SPE Imperial College London Chapter celebrated its 50th anniversary. Awards during those years include the Presidential Award for Outstanding Student Chapter 2020 and the Student Chapter Excellence Award 2023.

To commemorate the half-century milestone, a site visit was organized for March 7, 2024. It was hosted by SLB at the Abingdon Technology Centre (AbTC), with support from the SPE London Young Professionals.

After a safety briefing from the host, attendees were introduced to the SPE YP professionals. The country manager at the Abingdon Technology Centre delivered a captivating welcome address, setting the tone for the day. The visit included informative sessions on various aspects of SLB's business and contributions to societal progress in the energy transition and energy security goals. Topics included SLB – For a balanced planet, Energy transition and innovation, and New energy/AI/ML/CCS, providing valuable insights into SLB's efforts towards achieving net-zero targets.

SLB, renowned as an industry leader and provider of widely used industry software, offered insights into the history and evolution of the Intersect Software, a widely utilized simulator.

The visit included a networking lunch, which facilitated interactions between SLB staff from Imperial and attendees and enhanced the overall experience.

A hands-on session allowed participants to engage with Petrel software, enabling them to build models, import data, generate tables, and derive detailed insights for informed decision-making.

Additionally, attendees gained insights into career opportunities at SLB, receiving guidance on navigating recruitment processes and further networking opportunities.

The event concluded with a question-and-answer session, inspiring participants to pursue their aspirations within the industry.

Special thanks to the SPE for facilitating this enriching experience.

Enhancing technical skills, ideas and concepts

The SPE London Technical Talks cover many technical ideas and concepts and ideas. Talks are open to both members and non-members working in the energy sector.

Dr Rita Esuru Okoroafor

Technical talks provide an ideal environment to enhance technical skills and knowledge, while also providing an opportunity to network and make valuable industry contacts. The speakers are all professionals from various sectors.

Past speakers have included Distinguished Lecturer **Dr Rita Esuru Okoroafor**, who is an Assistant Professor at Texas A&M University. She spoke about how oil and gas competencies are shaping low-carbon energy technologies.

Mike Cooper

A recent (March) speaker was **Mike Cooper**, perhaps becoming best known for his social media video postings on YouTube, known as TROVE News. His topic was 'Technical Talks: Major oil and gas projects and drilling activity in 2024. A global perspective.' Topics in the upcoming season range from 'Interpretation of 4D Seismic Date in DW Turbidites in West Africa' and 'Drilling Complex Wells in the 1990's', through to 'Bid Rounds and Deal Flow'.

The SPE London website has more information on costs and registration details.

Here is the complete schedule for 2024:

April 24	Interpretation of 4D Seismic Date in DW Turbidites in W Africa
May 22	Lower C Footprint Production by utilising Autonomous Inflow Control Tech
June 26	TBN
July 31	Drilling Complex Wells in the 1990's
September 25	Bid Rounds and Deal Flow
October 30	From Resource to Reserve
November 27	TBN

Artificial lift: Seven industry leaders share insights on the rapidly evolving segment

Image credit: Brian A Jackson/Getty Images/iStockphoto

In the past 25 years, the artificial lift industry has seen incredible changes, making hydrocarbon production smarter and more efficient. In this Q&A article, JPT talks with seven industry leaders from this field about its past, present, and future. This conversation showcases the technological progress such as materials, digital tools, and automation and the strategic leadership that has guided the industry to new heights. Join us as we dive into the world of artificial lift and discover the innovation and expertise shaping the future of energy.

This roundtable Q&A includes the following participants:
Greg Stephenson, chief production engineer, Occidental Petroleum
Michael Romer, principal artificial lift engineer, ExxonMobil
Laura Labrador, senior production engineer, Ecopetrol, and 2023–2024 chairman of the SPE Artificial Lift and Gas Well Deliquification Technical Section
Shauna Noonan, Oxy Fellow and senior director global supply chain initiatives, Occidental Petroleum
Jose Ernesto Jaua, global product champion, SLB
Kevin Leslie, vice president artificial lift solutions, Weatherford International
Dana Meadows, global portfolio director, artificial lift systems, Baker Hughes

JPT: Can you recall an experience, technical paper, or mentor that significantly influenced your early career in artificial lift? How did it shape your approach?


Greg Stephenson

Stephenson: Numerous individuals impacted my early career, the most noteworthy being Herald Winkler, who was in the first class of SPE's Legends of Artificial Lift awarded in 2014. I traveled to my first ATCE in New Orleans as a first-year petroleum engineering student. I distinctly remember walking the exhibit floor and seeing this little guy get mobbed by people asking him questions. I asked one of my fellow students: "Who is that guy? Tom Cruise?" He told me: "No. That's Wink."

I then learned that Wink was one of the pioneers of gas-lift technology and wrote the first definitive book on the subject. At that moment, I realized that artificial lift might

Artificial lift: Seven industry leaders share insights... continued

offer a viable career path for me. Eventually, I got to know him personally, first as a student and then as an artificial lift professional. One of the most impactful conversations I had with him was one in which he told me: "I am not a gas-lift expert. You cannot be an expert in gas lift – the field is too complex. I'm still learning things, and I've been doing this for over 60 years!" That encounter taught me to be humble in approaching my craft and never assume I knew everything.

Michael Romer

Romer: My first role in artificial lift was two years after I started with ExxonMobil. There was a US production artificial lift team at the time. Some people I worked with closely were Pat Underwood, Mike Johnson, Rodney Bane, and Mark Johnson. Pat was our subject matter expert (SME) for ESPs and rod pumps, and Mike was the SME for gas-lift systems.

Rodney was the group manager and had a strong artificial lift background. He was responsible for turning the group into a global one. Mark was a global artificial lift engineering resource. Most of the artificial lift team came up through the field and had great hands-on experience. My background is in electrical engineering, not petroleum, so I was fortunate to learn from them.

Laura Labrador

Labrador: Although it is not exactly an early influence on my career, I can say that it's the one that most marked my history in the industry. Around a decade ago, when I was working for an operator company in Colombia, a pivotal moment occurred when I presented our progressive cavity pump (PCP) results to the worldwide artificial lift system (ALS) team.

In the audience was a remarkable woman, Shauna Noonan, the head of the worldwide ALS team for that company. Her knowledgeable comments and insightful questions left an indelible impression on me. From that day forward, I was inspired to keep working on ALS professionally and take her as a role model. Her guidance continues to shape my career, driving me to strive as a professional woman.

Shauna Noonan

Noonan: During one of my co-op internships, Kevin Grondin was my manager with Mobil Canada, and the fields he was responsible for were gas-lifted wells. My assigned project from him was to install the first plunger-lift system in the area. That was my introduction to artificial lift; his enthusiasm made me want to learn more about it.

My very first SPE event was the ESP Symposium, and it was women-led. Karen Draper and Carol Magney-Grande convinced me to join the committee. That started with attending and coordinating artificial lift events and realizing that there were strong women leaders in the artificial lift space.

Jose Ernesto Jaua

Jaua: I have been fortunate in my career to have had many great experiences in the artificial lift world. I grew up professionally in the discipline, starting in the field and working up to managing entire geographies and products at a global scale.

If I must select one incredibly enriching period, it was in 2011 when I was assigned to work in Ecuador, managing the artificial lift business covering the Andean region. I had the incredible opportunity to be part of the board of directors of the SPE local chapter, meeting many top industry and government authorities. I developed many initiatives

Artificial lift: Seven industry leaders share insights... continued

that positively impacted the industry and promoted technologies and local talent. I also took that platform to coach and mentor young professionals.

Those moments in which I have been able to impact and contribute to a higher cause have always been the ones I have the best memories of. That experience was transformative for me, and since then, every time I change position or location, I invest effort and time to be engaged with the communities and mentor others whenever I can.

Kevin Leslie

Leslie: Thinking back to my early career, one person stood out as an influence in my artificial lift career: Larry Hoes, the vice president of oil field for Lufkin Industries. Larry spent most of his career at Cameron but moved to Lufkin in the early 90s.

During my career transition, Larry allowed me to showcase my abilities while working as the scheduler/planner of the Pumping Unit Facility in Lufkin, Texas, and then moved me to west Texas to manage sales and business development. Larry was a strong mentor who allowed employees to do what was needed as long as the results came through in the end. By providing this freedom, I developed my talent for sales, operations, and growth in the Permian Basin while learning multiple forms of artificial lift and the benefits of automation in the field.

Dana Meadows

Meadows: Early in my artificial lift career, a mentor taught me to look for the value of just one more run day to an operator. That person taught me to listen and work to shape a tailored solution around the customer's needs – not just sell them widgets.

That made me view technology and development differently by asking the right questions, focusing on the business case from end to end, and framing it in a real-world application to provide a disruptive solution.

JPT: How have you seen knowledge sharing and best practices evolve within artificial lift applications over the years?

Stephenson: Artificial lift has experienced a metamorphosis while I've been in the industry. During the early portion of my career, virtually every technical presentation on artificial lift was delivered at a non-SPE event. This meant that most knowledge sharing was via PowerPoint, and there was never an accompanying manuscript that might find its way into OnePetro or JPT. If you weren't physically present in the room where the presentation was delivered, you had virtually no way to access the information being shared.

That all changed with the creation of the SPE Artificial Lift Conference and Exhibition (ALCE) events in the Americas and the Middle East. These events were the brainchild of Shauna Noonan during her first term on the SPE Board of Directors. Those who work with artificial lift owe Shauna an enormous debt for this. When Shauna was the JPT technical editor for the topic she had relatively few papers to draw from. My job was significantly easier when I served in that role. The ALCE events and the ESP Symposium provided a wealth of papers from which to choose. The requirement to write a manuscript increased the technical rigor of these works and made them more useful to industry professionals.

Romer: There are more avenues for sharing now, including SPE technical sections, SPE regional artificial lift conferences, the Artificial Lift Research and Development Council (ALRDC), and through joint industry projects

Artificial lift: Seven industry leaders share insights... continued

like C-FER's ESP Reliability Information and Failure Tracking System, LSU's Gas Lift Valve Performance Clearinghouse, and the ALRDC's Horizontal Well Downhole Dynamometer Data Acquisition Project. Internally, knowledge sharing has increased with virtual events with video. Unfortunately, this has made in-person events less likely.

Labrador: Knowledge sharing has positively increased over the years. It is evident when you look back and see we have more events related to artificial lift systems and we recently got a specific SPE technical section for artificial lift (and gas well deliquification). The operators are working together to share the learning curve. Also, both operators and oilfield service (OFS) companies are documenting and publishing the lessons learned, best practices, and the knowledge acquired over time more frequently than before.

Noonan: Initially, most artificial lift events were not SPE-organized events, and the presentations/papers were not publicly available. I made it my mission to change that when I joined the SPE Board as the Production & Operations Technical Director. I created new AL events, converted the SPE Gulf Coast Section ESP event to a symposium so papers could be formally published, advocated for the AL Tech Section, and created the Legends of Artificial Lift Awards.

Jaua: Knowledge sharing has grown tremendously in the past 20 years, along with the evolution of digital technologies. In the 'not that far' past, we had to travel to congresses to meet peers and be exposed to newer technological developments. Nowadays, we have all the information and much more at the tip of our fingers and in every format we can imagine. From microlearning content to fully immersive technical conferences, all delivered remotely. In parallel, more communities and interest groups have been formed because now there are more domains and subdomains within the artificial lift space and, in general, in industry.

Leslie: From personal experience, the oil field grows through knowledge sharing and best practices in all facets of the industry. In the artificial lift space, engineers and supply chain utilize their knowledge of products to secure better pricing and activity. In contrast, other OFS companies utilize knowledge sharing and best practices to produce wells at a higher volume with a better mean time between failures. By sharing the learned knowledge, the OFS and E&P companies can produce at a higher production level with fewer problems. Without knowledge sharing and best practices, today's oil and gas market would be totally different.

Meadows: Unlike in previous years, where the person who had the document in their filing cabinet was considered the expert, we now have multiple applications for data sharing on global internal operations that allow answers to pop up, lessons learned to be elevated quickly, and field instances to be shared and trended with actions.

This allows us to help our customers with solutions gained from actual cases worldwide and to develop the best technologies to address their needs using real-time operational feedback. Eagerness to share, learn, and collaborate is a large part of our culture at Baker Hughes. Technology has allowed that to advance quickly in the artificial lift field and beyond.

JPT: Is there a specific paper that helped you or your team solve a challenging problem in artificial lift? Could you elaborate on the problem and the solution?

Stephenson: The paper that has specifically influenced my work the most in recent years is an old one: SPE 179, Evaluation of Valve Port Size, Surface Chokes, and Fluid Fall-Back in Intermittent Gas Lift Installations by Kermit Brown and Frank Jessen.

Artificial lift: Seven industry leaders share insights... continued

This paper was published in March 1962, and more than 60 years later, it is still the most extensive exploration of intermittent gas-lift performance available to the industry. Brown explored the relationship between slug height, gas passage, surface opening pressure, and slug recovery in intermittent gas lift wells.

This is particularly relevant today because the industry has thousands of wells in unconventional resource plays that produce via continuous flow gas lift and experience rapidly declining production rates in early life. As the wells mature, the artificial lift system becomes less efficient and requires some lift revision. One of the most likely is conversion to intermittent gas lift, often using a pilot valve.

Unfortunately, the methods for designing and analyzing these wells are often antiquated and rely heavily on rules of thumb. The results can be unpredictable and/or suboptimal well performance. When I first read this paper, it inspired me to explore the issue further, ultimately leading me to Ali Hernandez' textbook, Fundamentals of Gas Lift Engineering, published in 2016.

Using the knowledge gained from Ali's textbook and the original paper by Kermit Brown, I built an in-house simulator for intermittent gas lift wells. This work also inspired the formation of the newly created Texas Tech Gas Lift Consortium in Lubbock, Texas.

Romer: We were looking for ways to improve gas lift and came across SPE 21639 (1991), Foamed Gas Lift, by M.G. Bernadiner from the University of Michigan. The project presented an interesting way to improve gas lift using surfactants, with both laboratory and oilfield experiments showing that it could be an effective means for producing oil from depleted reservoirs.

We thought it could be an interesting way to improve gas lift, and it led to research testing at C-FER in Edmonton, a pilot in the Gulf of Mexico, a presentation at ALRDC, and later pilot testing and application in the Delaware and Midland basins. No SPE papers were written on the ExxonMobil project, but the original paper demonstrated how somebody had done it once and that it should work.

Leslie: One of the most influential technical papers impacting my team and colleagues to solve the goal for lifting higher production with rod lift continues to be SPE 176041(2015), Electric Submersible Pumping Systems vs. Long-Stroke Pumping Units: A Case Study of Economic Comparison in a Low-Volume Well. The paper captures the topic of shifting to rod lift sooner by transitioning from an ESP to a long-stroke Rotaflex pumping unit and the benefit of saving workover costs while increasing production well above traditional beam pumping systems.

The shift to rod lift sooner had been successful due to the long, slow stroke of the vertical system, allowing for increased pump fillage and higher production rates. In this case, the long-stroke system proved to reduce power costs by 37%, reduce workover costs by 91% and combined reduced opex by 62%, all while producing a fluid rate of 1,180 STB/D in either system. This has been a fantastic paper to show the benefits of transitioning to rod lift sooner with huge success.

Meadows: Permanent magnet motors (PPM) are a step change in the ESP industry. They generate high torque on startup, are highly efficient, and have a wider operating range than traditional motors. However, they can generate electricity anytime fluid flows through the pump and forces system rotation, even when powered off, energizing the power cable to the surface. A major limitation to global field adoption is the danger of this hazardous back-EMF associated with motor rotation and energization during installation, retrieval, and workover operations.

Artificial lift: Seven industry leaders share insights... continued

In response to this industry-wide HSE problem, our team has developed the industry's first engineered PMM safety barrier that prevents the ESP pump from spinning the PMM, eliminating voltage generation at the surface. We were excited to present this HSE innovation at the 2023 SPE Gulf Coast Section – Electric Submersible Pumps Symposium in SPE 214745, Permanent Magnet Motor Safety – The Big Short Question.

JPT: How have advancements in technology impacted artificial lift? Are there any technologies that you find particularly promising for the future?

Stephenson: Mostly, advancements in artificial lift technology have been incremental improvements. The most-used artificial lift methods have existed for decades or even longer. Technologies I think could make a difference include permanent magnet motors in ESP, sucker rod pump, and PCP installations, improved downhole gas separation and gas-handling devices, improved surveillance software, and the application of artificial intelligence/machine learning techniques.

Romer: I see technology advancements have impacted artificial lift in several ways, including:
Remote monitoring and control improvements, including accessibility and cost—variable frequency drives versus pumpoff controllers, for example

- Ability to optimize more with less effort, providing quicker transfer of knowledge
- Data storage, communication, and sensing improvements
- Once unheard of to run bottomhole pressure gauges onshore and now they're almost standard with gas-lift completions
- Extra digital surface sensors once required justification, but now they're expected
- Surface-controlled (electric or hydraulic) gas lift has the potential to bring optimization to a lift method that's notoriously difficult to optimize with additional benefits over mechanical valves. The decreasing cost of downhole electrical devices and improving reliability are spurring adoption.
- High-speed ESPs, particularly for offshore installation through-tubing, which may be able to increase the life of offshore wells as the technology increases in maturity
- Electric rod pumps are in early development, but a few vendors are working on them

Labrador: Artificial lift technology advances have allowed us to install and run the systems in more complex trajectory wells and produce them reliably. Additionally, it has allowed us to be aligned with the commitment to care for the environment.

Also, AL technology has impacted the artificial lift world positively. Who could imagine we would have more efficient motors installed at the surface and the bottom of the well? Or that we could challenge the boundaries of each AL according to the needs of the field and sufficiently produce them?

We must keep challenging our boundaries and making bigger efforts in this important part of the oil and gas industry. The relationship between OFS and E&P companies plays an important role: the operator's needs and the service companies' constant solutions to save on downtime and lost production.

Noonan: Instrumentation advancements allowed us to understand the physics of how artificial lift systems work internally. Before, we didn't have the advancements in instrumentation to put sensors inside the various pumps or lift systems to really measure and understand what was happening inside. It was always theories and rules of thumb. But once we understood the fundamentals of each basic lift system, we knew how to design it properly – whether it was how we sized it or the materials used – to ensure it was the right design for the right environment. Also, permanent magnet and linear motors will make an impact (extinction of the rod string).

Artificial lift: Seven industry leaders share insights... continued

Jaua: We see the dramatic increase in lifting systems' average run life and their survivability operating under extreme environments in the past 20 years; it is evident that technological advancements have had a huge impact on the artificial lift industry.

Artificial lift systems are installed faster, safer, last longer, and operate in wells that were impossible to operate not long ago. All thanks to improved designs, advanced materials, and evolved processes and practices. The lifting system with the most promising growth potential is PCP, particularly the rodless version powered by downhole permanent magnet motors, which is more suitable for deviated wells.

Current elastomer compositions and manufacturing processes prevent the PCPs from surviving temperatures above 200°F and produce fluids with high aromatics content, frequently found in lighter oils.

New technologies and manufacturing processes are under development that will allow PCPs to perform in hotter wells and produce lighter oils. This will result in a viable alternative to efficiently producing wells, replacing rod lifting systems with a higher frequency of failures in deviated wells.

Leslie: The artificial lift market continues to see new technology in many shapes and forms. Whether it is advancement in a long-stroke system, a beam pumping system, advancement in ESP technology, or advancement in downhole technology, there continue to be new developments and products every year.

The one technology that continues to advance rapidly with huge impacts on field operations is the digital/automation space. The future of field operations will be centered around automation. The future will continue remote monitoring with autonomous control and failure prediction well ahead of where we are today. The autonomous field of the future will utilize sensors and monitors to detect failures before they happen, allowing operators to save on downtime and lost production. Digital integration and automation are the most impactful technologies for artificial lift in the future.

JPT: What are the most pressing challenges and opportunities facing the artificial lift sector today?

Stephenson: The most pressing challenges I see include the application of artificial lift in unconventional shale oil wells and in subsea/deepwater installations. Shale oil wells can be challenging to lift due to their high gas-to-liquid ratios, sand production, sharp production decline in early life, and horizontal well trajectory. All these issues can decrease equipment reliability and/or deferred production.

Applying artificial lift systems in subsea installations can be challenging because of the high intervention costs associated with these wells. In a perfect world, we would like to install an artificial lift system in these applications that can survive for 10 years or more while boosting production.

Romer: I see the most pressing challenges in the following areas:

Unconventional wells: How do you extend the economic life of wells when they aren't designed for late-life lift: crooked wells, high gas, small casing, low rates, and long horizontals
Lift methods designed for rapid reservoir depletion as current methods are not
Lift method changes: knowing when it's the right time and what to do
Subsea: improving through-tubing options and applying artificial lift at the beginning of the well's life because you may not be able to come back later to retrofit

Labrador: The challenge will always be to be better than yesterday and to have better performance and efficiency in ALS equipment than the previous year. Reducing the carbon footprint through ALS is a

Artificial lift: Seven industry leaders share insights... continued

commitment we all have right now for the planet and future generations. The opportunity is to continue developing technology to make artificial lift systems more efficient and cleaner for the environment. Moreover, digital integration and automation technologies will help us to impact the future for artificial lift. Also, being competitive in quality, performance, and price is something that can't be left behind.

Noonan: Advancements in manufacturing have not kept pace. Many facilities have old equipment and still rely on too much human interaction, which can lead to quality-assurance issues. The technical differentiation between vendors has shrunk, so the battle for business will rely on manufacturing, assembly, and service quality.

Jaua: All oil wells eventually require artificial lift systems to produce, meaning millions of wells operating globally, requiring a constant power source available 24/7. This makes lifting systems one of the industry's largest emitters of carbon dioxide. The greatest challenge will be the evolution of lift-system selection and sizing that puts efficiency levels as a top priority. It also represents an opportunity for those technology companies committed to developing new solutions to reduce their carbon footprint.

Leslie: There are several key challenges facing the artificial lift sector today, including limited resources, the need for consolidation, and, most importantly, a consistent supply chain with minimal reductions in delivery.

The oil and gas market has received a bad reputation as dirty and cyclical, driving young talent to avoid the industry. This reputation limits the amount of new talent in the industry, creating challenges for both E&P and OFS companies. We must find a way to recruit and retain talent better going forward.

The artificial lift landscape has too many competitors. There is a major need for consolidation, ultimately benefiting the end user and OFS companies. Finally, most artificial lift market products are produced outside North America due to the high production cost and the demand for lower-cost products. This creates an incredible challenge for OFS companies to work diligently to find alternative countries and manufacturing centers to supply products to all customers in artificial lift. These three areas are just some of the critical challenges facing the ALS market today.

Meadows: In terms of challenges facing the artificial lift sector today, the main concerns we continue to hear from our customers are centered around increasing the run life and reliability of ESP systems, reducing costs and downtime of artificial lift systems in general, and maximizing and optimizing production. Our customers all want to unlock the lowest-carbon, shortest-cycle barrels possible. To do this, they need a partner to help them better manage power consumption and costs and boost pump speeds and production.

We all know new drilling is slowing down while the world's energy demands grow. New energy sources can only pick up some of that demand, which means we'll need to get better at getting more out of the reservoirs we've already drilled, and ESPs will be a critical part of that.

JPT: Where will artificial lift applications be heading in the next decade? Are there any emerging trends or technologies that will shape the future?

Stephenson: In the next decade, I expect to see a greater emphasis on

- Lifting low-rate, mature shale oil wells.
- Reducing emissions.
- Minimizing lift costs.
- Improving overall system reliability.
- Applying artificial lift and subsea boosting to extend the life of deepwater installations.

Artificial lift: Seven industry leaders share insights... continued

Romer: I expect to see in the next decade

More PMM applications on, for example, surface pumpjacks and PCPs.
Closed-loop optimization of surface-controlled gas-lift systems.
Through-tubing high-speed ESPs.
Data-driven, fieldwide artificial lift system optimization.
Optimization and artificial lift selection based on emissions/power usage. The industry is already seeing this in some parts of the world, for example, in thermal lift applications in Alberta.

Labrador: The technologies that allow us to produce complex wells efficiently and cleanly for the ecosystem will be what will govern the next decade. The world is changing, and we must change with it.

Noonan: Material advancements will make all the difference. Rod strings will be obsolete.

Jaua: I see artificial lift applications accelerating the adoption and implementation of artificial intelligence and machine learning solutions. For instance, until today, designing, selecting, and optimizing lifting systems required a technical staff to make and control decisions.

It is already happening today – but not fully adopted – that machines are gathering and processing vast sources of historical data and, in seconds, without human interaction, selecting the best lifting system, sizing, and features required for every well. Allowing a fully autonomous operation and increased failure predictability levels make the entire operation more efficient. Digital solutions are still in the infant stages in the artificial lift sector, but without any doubt, they are destined to lead a more efficient and sustainable O&G industry.

Leslie: The future for artificial lift will be centered around digital technology and operator energy consumption. The evolution of PMM will be significant for operating all artificial lift forms more safely and energy efficient. PMMs have already been installed on basically every form of lift today with much success, but adoption has been slow as operators are still in the testing phase. In addition, the digital space will bring new technology with capacitors and storage of excess energy to maximize efficiency and productivity in the field. These technologies are just arriving to the market and producing significant energy savings, and the future will only get better as we move forward with this new technology.

Meadows: Automation simplifies decision-making. Digital will continue to shape the future by optimizing and increasing production. Variable speed drives (VSDs) will also play an important role in reducing power consumption. We're testing a new VSD slated for release later this year to reduce power consumption by up to 20% over our most-efficient drive. A virtual VSD interface will also be integrated, enabling operators and service companies to adjust drive settings from anywhere in the world remotely.

The switch from induction motors to PMMs is also where the future is headed. We want to ensure we're positioned to ensure this happens as quickly and safely as possible, so we are excited to champion the industry's first engineered PMM safety module. This new module prevents the ESP pump from spinning the PMM, eliminating voltage generation at the surface for safer, simpler operations.

Jennifer Presley is a senior technology editor for SPE's Journal of Petroleum Technology. She has been a communications specialist and editor for 23 years, most of which have been spent covering the upstream oil and gas industry. She can be reached at jpresley@spe.org. This article is part of a 3-part artificial lift series as part of JPT's 75th Anniversary content. Read more in Experts Give Career Advice for Future Artificial Lift Professionals: "Do Not be Scared to Try Something Different" and Artificial Lift: 25 Years of Change Tracked in the Pages of JPT.

SPE events calendar – local and international

LOCAL – in the UK

April 24, 2024 (Online)
SPE Live Distinguished Lecturer Series: Early Kick Detection: Sensors, Data Acquisition, and Analysis
One key message from this SPE Live: Kicks can be catastrophic, but recent and future developments in sensor technology, data processing, and telemetry are enabling timely identification and mitigation plans. Some innovative ideas on sensor design and real-time data processing for event detection and uncertainty quantification are discussed.
SPE Distinguished Lecturer:
Jaideva Goswami, Retired
More information: **SPE Live DL series**

June 05-06, 2024 (Aberdeen, Scotland)
SPE Oilfield Scale Symposium
Welcome to the prestigious SPE Oilfield Scale Symposium, a premier event tailored for the global oil and gas industry. Prepare to embark on a two-day immersive experience, meticulously designed to cultivate knowledge, foster innovation, and encourage collaboration. Join us as we gather esteemed industry experts, thought leaders, and visionaries under one roof. Prepare to be captivated by the insights, discoveries, and best practices shared by key players across the field.
More information: **SPE Oilfield Scale Symposium**

INTERNATIONAL

April 16, 2024 (Alberta, Canada)
SPE/CHOA Slugging it Out
Now in its 32nd year, this one-day event looks to provide a forum to explore how the heavy oil sector can no only continue to grow but thrive over the years and decades to come. This year we look at how the industry has progressed – from new developments to optimization of current projects. Some of the topics include innovations in areas such as environmental impact mitigation, production enhancement, and government/regulatory updates. And updates to ongoing industry projects.
More information: **SPE conference**

April 17, 2024 (Bergen, Norway)
SPE Norway Subsurface Conference
Meet with innovators and leaders across the Norwegian Continental Shelf as we welcome you to the 2024 edition of our renowned SPE Norway Subsurface Conference. Running for more than 30 years, it is the perfect platform for collaboration and learning. Focusing on innovation, technology, and the rapidly developing energy transition, it is the place to be to expand your technical knowledge and delve into the key issues facing upstream E&P professionals today.
More information: **SPE conference**

May 6-9, 2024 (Texas, USA)
Offshore Technology Conference
Since 1969, the Offshore Technology Conference (OTC) has served as a central hub convening energy professionals from around the world to share ideas and innovations, discuss, debate, and build consensus around the most pressing topics facing the offshore energy sector. As the world transitions to a more sustainable and low-carbon future, no other event provides attendees with more diverse conversations focused on the latest developments needed to accelerate the global energy mix.
More information: **SPE conference**

May 22-23, 2024 (Rio de Janeiro, Brazil)
Carbon, Capture, Utilization, and Storage (CCUS) Latin America
An Emerging Field for Energy Professionals. Exciting keynote speakers and lunch panels will drive the discussions of the future of energy. Technical speakers will represent industry, research institutions and universities. The work presented at the event will demonstrate the ongoing need for skilled petroleum geologists, geophysicists, and engineers to help define the future of carbon management.
More information: **SPE conference**

For a complete listing of all events on the SPE Global Events Calendar: spe.org/en/events/calendar/
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Meet the SPE London Board

The Society of Petroleum Engineers (SPE) is a not-for-profit professional association whose more than 140,600 members in 144 countries are engaged in oil and gas exploration and production.
The SPE London board oversees the SPE London activities including our evening programme and other events. Our different committees have specific focus for the members including Young Professionals, Women in Energy, Net Zero, and associated student chapters. As well as engineers who make up our core, we also welcome qualifications in geology, geophysics, earth science, environment, health and safety, mathematics, information technology, as well as management and economics.


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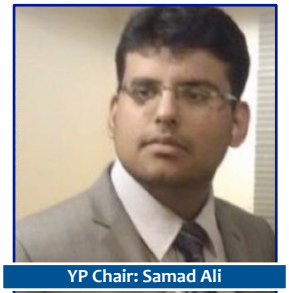
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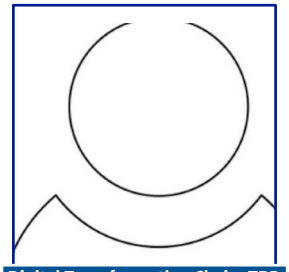
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