# SPE Review London

December 2025

Solutions.
People.
Energy.

London Section

The official e-magazine of the SPE London branch

## Bridging worlds and leading the energy conversation

- Africa's landlocked countries
- Meet the student chapters
- Survey results! We asked, you answered
- From feasibility to reality

- International oil companies and the net-zero transition
- Industry evolving through the energy transition

**Plus:**
News, SPE events, local and international

SPE SECTION EXCELLENCE AWARD 2020

50 YEARS

# 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, 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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## In this issue



### FEATURES



Photo by Zach Theogu / Unsplash

**Share your experiences and stories online**

# Behind the Scenes: SPE Review Editorial Board

**Elizaveta Poliakova, Editor in Chief**
Elizaveta is a Senior Petroleum Engineer at Trident Energy, now in Operations after 5.5 years in Subsurface. She holds an M.Sc. (Imperial College London) and a B.Sc. (University of Leeds), and has served SPE for 9+ years - President at Imperial and Leeds, Board of SPE YPs, and Chair of SPE London in 2022/23.

**Ffion Llwyd-Jones**
Ffion is a senior 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.

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# Letter from the Chair

**It's an honour to serve as the new Chair of the SPE London Chapter!**

**My name is Mehdi Alem and I am a reservoir engineer with bp. I have been an active member of the SPE for the last eight years.**

**Dear SPE London members and colleagues**,
I am very glad to represent members of SPE London as the Section Chair for 2025–26.

To start, I extend my thanks to Adam Borushek for his excellent work as Chair for 2024–25. He was supported by our dedicated board and volunteers in providing a wide range of events. For the 2025–26 activities, I aim to maintain the momentum we have built to continue serving the membership with a diverse activity set as we work towards delivering the energy the world needs today and tomorrow.

'The Energy Trilemma' remains a key theme as we enter the second half of this decade. This term describes the complex task of finding a balance between energy security, affordability and sustainability. The Energy Trilemma is an ongoing and complex challenge for the UK, with no easy solutions. Each aspect of the Trilemma is crucial for any nation's energy future, with innovative approaches required for governments and the industry. Many commentators highlighted the 2020s, and in particular the latter part of the decade, as a key period when the foundations of the UK's energy transition to net zero would need to be established. Recent years have provided many challenges, meaning pace has slowed down. These include energy security, technical challenges and stakeholder alignment. There is a wide scope for involvement of SPE members in tackling these challenges, so I encourage everyone to contribute their unique perspectives and expertise.

Events held by SPE London have focused on sustainability topics such as Net Zero, Carbon Capture and Storage, and New Energies. An understanding of these topics is vital as we progress with the energy transition. The other two parts of the Trilemma – energy security and affordability – are also essential for us to build a sustainable and secure global economy. SPE London will additionally direct our attention to these topics.

Throughout the year, we will organise events that explore various aspects of the Energy Trilemma. We aim to provide valuable opportunities for our members to engage with experts, share knowledge, and expand our professional networks. I encourage all members to participate and contribute their insights and expertise.

I have benefited greatly from my membership and involvement with the SPE. I hope you, too, will build your knowledge and your network through your own association with the SPE. Working this year as the Section Chair, I am keen to continue serving the members of SPE London. Please reach out if you would like to volunteer or have thoughts and ideas to share.

**Kind regards,**
**Mehdi Alem**

# Letter from the Editor

**Dear SPE London members,**

Welcome to the final publication of SPE Review London in 2025.

Over the past few months, we invited you to share what you value most in this magazine. Many of you took the time to respond to our reader survey and your feedback is already shaping how we plan future issues – from the balance of technical features to the way we cover careers, policy and local activities.

I would like to start by highlighting our interview with the SPE President, Jennifer Miskimins, who shares insights from her technical career and her perspective on where the industry is heading (page 8).

This edition brings together several perspectives on the energy transition and the future of our industry. We continue to discuss the role of international oil companies in the net-zero energy transition, looking at how existing skills and infrastructure might be repurposed for new energy carriers such as hydrogen, ammonia and synthetic fuels – refer to page 24. Complementing this, the 'From feasibility to reality: accelerating CCS commercialization with techno-economic simulations' Tech Talk summary on page 12 explores how robust modelling can help move carbon capture and storage projects from studies into executable, bankable developments.

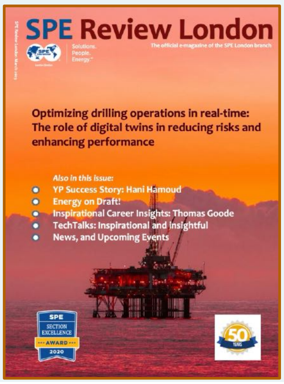
On page 13, we step away from the usual offshore and deepwater focus to look at the potential of Africa's landlocked countries. In this event summary, Ian Cross (Managing Director, Moyes) revisits his recent SPE London evening talk, outlining exploration and development opportunities across the continent's interior – reminding us that some of the most interesting plays lie outside the usual headlines.

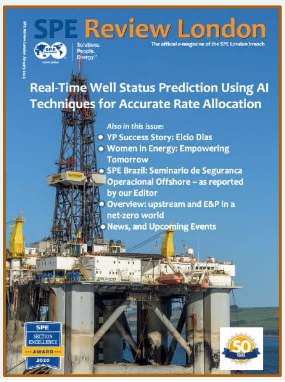
We also share discussions and insights (page 15) into how the industry is evolving through the energy transition, via this year's Introduction to Upstream Oil and Gas for the Net Zero World seminar.

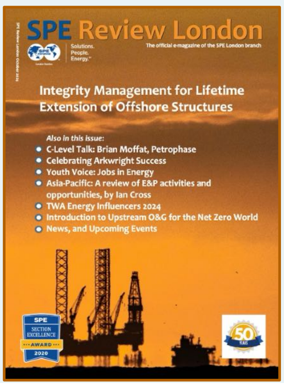
This issue also introduces the newly formed 2025–2026 SPE Imperial College (page 17) and SPE Coventry committees (page 18), highlighting how they engage students and young professionals.

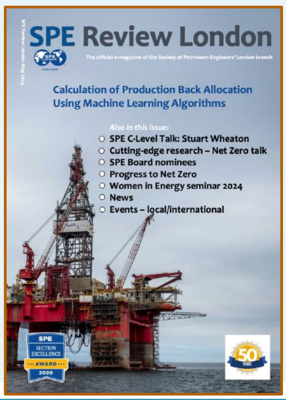
Thank you for reading, for supporting the survey, and for being part of the SPE London community. As always, I would be glad to hear what you found most useful in this issue, and what you would like to see more of in the year ahead.

**Sincerely yours,**
**Elizaveta Poliakova**



# NEWS DIGEST... NEWS DIGEST... NEWS DIGEST


### Odfjell acquires Deepsea Bollsta

Odfjell Drilling has signed an agreement for the acquisition of the harsh environment semi-submersible drilling rig Deepsea Bollsta from Northern Ocean for USD 480 million.


Kjetil Gjersdal,

Kjetil Gjersdal, CEO Odfjell Drilling, said: “Having managed and operated the Deepsea Bollsta for over three years, we have seen first-hand the potential of this rig and her crew. Having drilled successfully in both Namibia and Norway in recent years, Deepsea Bollsta has impressed us and its clients through good, predictable operations and efficiency and is recognised as one of the most capable units in the harsh environment sector."

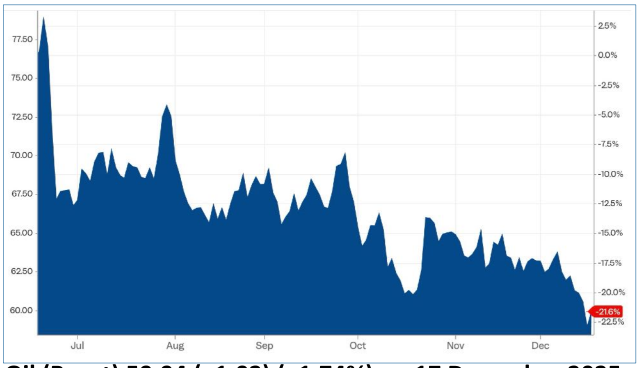
Read more

### Neighbour of the Year


Ithaca Energy was awarded Neighbour of the Year at the Offshore Energies UK Awards in November.

The company is an independent oil and gas operator in the North Sea with a strong track record of material value creation. It is the largest oil and gas operator in the UKCS by resources and the second largest independent operator (UKCS) by production.

Read more




**Oil (Brent) 59.94 (+1.02) (+1.74%) on 17 December 2025**
[52-week low: 59.91 / 52-week high: 82.63]
(Credit: Business Insider)

### Second Deepwater FPU contract

Seatrium Limited has won a contract from bp for the engineering, procurement, construction and onshore commissioning of the Tiber Floating Production Unit project in the Gulf of America. The project is the company's second consecutive deepwater project for bp.

Read more

### Shell completes acquisition

Shell Nigeria Exploration and Production Company (SNEPCo), a subsidiary of Shell plc, has completed the previously announced agreement and increased its stake in the OML 118 Production Sharing Contract (OML 118 PSC) from 55 per cent to 65 per cent.

This acquisition represents another significant investment in Nigeria deep-water, and is part of Shell’s strategy to further invest in competitive existing assets that contribute to sustained liquids production and growth in its Upstream portfolio.

Read more

### Driving global tech growth


Luke Johnson

OPC has appointed Luke Johnson as Subsurface Director.

He has more than 25 years of international subsurface experience and will have a central role in strengthening OPC’s subsurface capability, expanding regional partnerships, and re-establishing a refreshed technical training programme.

He said: "From the outset, OPC felt like a natural fit for me. There’s a strong technical core here and a culture that values honest, practical problem-solving."

Read more

# Jennifer Miskimins: Bridging worlds and leading the energy conversation


Jennifer Miskimins

**Career paths often follow a predictable arc, but some industry professionals follow their passion and curiosity to cross boundaries between technical mastery and human connection. Jennifer Miskimins' 35 years in the petroleum industry have included taking the challenging path from field production to academia and beyond, to become the SPE International President for 2026.**

**She is a professor and the Department Head of the Petroleum Engineering Department at the Colorado School of Mines and holds the Mick Merelli/ Coterra Energy Distinguished Department Head Chair. Jennifer specializes in well completions, stimulation, hydraulic fracturing, and associated production issues.**

**Taking time from her hectic schedule, Jennifer shared with us what shapes that unusual career path, what she sees as the industry's major challenges and opportunities, and what she's looking forward to during her presidential year.**

## Falling in love with petroleum engineering

Jennifer didn't plan on a career in petroleum engineering.

"I went to college not knowing what petroleum engineering was, necessarily. I knew I wanted to be an engineer, but I always thought I'd be a chemical engineer. Then I figured out chemical engineers really don't do chemistry."

It was an internship with Marathon Oil between her first and second years of college that changed everything. Working in the field, she discovered the excitement of the oil and gas industry.

"I absolutely fell in love with the people and how each day was a little different," she says. "That's held true throughout my career. I consider myself very lucky to find something that I had a passion for so early."

## From industry to academia

After several years in production engineering, Jennifer decided to return to university, where she gained both a master's and a PhD degree. She admits to being curious about where an advanced degree might lead, as well as thinking it might be fun.

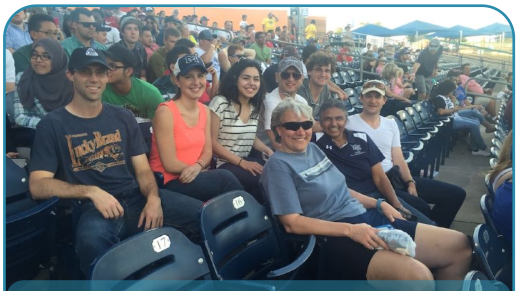
"I always thought getting a PhD would be fun," she says. "Hindsight tells me that was a little naïve, but it was also incredibly rewarding."

Doing the degrees naturally included teaching and research, which led Jennifer to a new passion: "I realized I loved the research, the mentoring, the ability to help students grow. People often ask me which I prefer, industry or academia, but I don't think there's a definitive answer to that question, as both have pros and cons, like many things. It just fits well with some people and doesn't with others."


Research group at Mines, circa 2018

The dual perspective has proven invaluable, particularly in her leadership within SPE.

"Having experience on both sides helps me see both sides of the coin," she says. "SPE is industry-focused, but there's a strong academic component, from research publications and curriculum development to student chapters. My understanding of both worlds helps people from each of those worlds to accept me. Sometimes when you move between sectors, you risk belonging to neither. But in my case, it's been the opposite because it's allowed me to move in both spaces."


Taking students to their first baseball game, Midland, TX

Both worlds also contribute to her role as an educator, where Jennifer draws on her field experience, realizing how well students respond to someone with real-life industry experience.

"To be able to walk the walk and talk the talk gives you a bit of 'street cred'," she explains. "It helps with developing that talent because you can't underestimate the power of experience. When you can tell a student, "Here's what the equation says, but here's what it looks like in real life," that just sticks."


Kagan (one of my students) and I at his defense

## Adapting to the future energy landscape

Working in education also enables Jennifer to relate to the skill adaptations required by both students and mature engineers, facilitating successful transitions into new fields within the fast-evolving energy industry.

"Upskilling looks very different depending on where you are in the world," she explains. "Countries vary in their development of energy sources, and that's one of the challenges faced by an international association such as SPE. When I travel to certain regions, they're not thinking about upskilling because they're focused on traditional core petroleum engineering. In others, they're moving into areas such as geothermal or carbon capture and storage (CCUS)."

Jennifer sees an interest in these types of topics among students, young professionals, and more senior professionals, with benefits for the latter, especially in geothermal and CCUS.

"These areas are so new that companies are not necessarily going to hire new college graduates, preferring somebody with experience that can understand some of the challenges," she explains. "However, senior professionals need to understand the differences between areas that they've previously worked in and these new areas. People need to remember that, when upskilling, they can't take for granted that it will be the same. There is a reason that geothermal is different. There is a reason that CCUS is different."

She adds that people should understand that they need to upskill and make that effort. "People can't think that because they're good at one thing (Y), that it will translate directly over to something else (X). It doesn't work that way. Sometimes, you need to take a step back to move forward and fill in knowledge gaps – and that can mean facing income challenges if the role is lower paid. But it's part of the process of growth."

Reflecting on the various factors that accelerated her own development, other than upskilling, Jennifer credits volunteering. "Probably what accelerated my growth the most was being willing to volunteer for any role. I mean, I didn't suddenly become a board member overnight. I didn't become president overnight, nor did I ever really think I would be in this role. It was not intentional by any means. It wasn't a planned thing. But I think all committees need people to do the grunt work. My first role as an officer in my first section after college was to collect prizes for the golf tournament, where I had to ask companies for sponsorship. In hindsight, it was fun. I got to meet new people. I got to make new relationships. Everything's going to be a learning opportunity if you make it into one."

## AI: promise and caution

Turning the conversation to artificial intelligence, Jennifer believes that while AI is here to stay, it needs to be carefully embraced, developed and used.

"It's a tool that can enhance engineering but not replace human judgment," she says. "AI can handle repetitive tasks, but it still needs human eyes – engineers who can decide whether something makes physical sense, and if it does, then decide what to do with it."

She adds that, as an educator, it's one of the things she focuses on with her students:

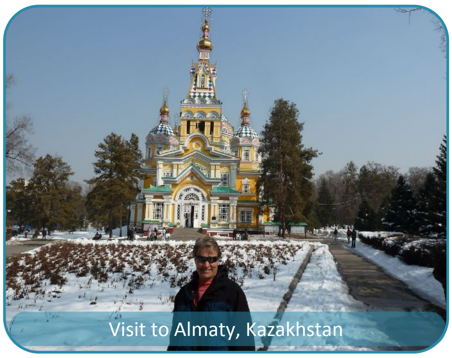
"It's simple to ask AI to do something for you, but then you're responsible for anything that you report out of that request and sorting out what's real and what's not. That's where humans come in."

She adds that training data sets are crucial for AI to draw on, and the petroleum industry faces a significant limitation – specifically, the issue of data availability. "Our industry doesn't have as much open data as others," she says. "That means AI can only go so far, at least at this point in time"

She offers an example: "I ask a student to design a hydraulic fracturing job for a company in Colorado, and they decide to go to AI to do it. However, there's only so much information that an LLM (Large Language Model, such as ChatGPT) can draw on that is specific to a region or basin. So, the AI might design a frac job, but is it a design that is specific to Colorado, or did it base it on data from another country, such as the UK? There isn't a lot of publicly available information about our industry. In contrast, a mechanical engineer can say, 'design me a working car,' and the LLP could probably find reams of data. That's why human oversight is critical."

## Solutions. People. Energy.

That awareness of the need for the human touch carries over into the SPE tagline 'Solutions. People. Energy.', which has gained new traction under her leadership.


Visit to Almaty, Kazakhstan

"I'm finding that the tagline inspires people of all different age groups," she says. "When I visited universities in Oman, I saw paper cups with the tagline on them. Then, you look at a mature area like London, both in terms of industry and population, and it goes down equally well there. It allows us to recognize different membership entities and the things they do well, but it really comes down to providing solutions. We're about people and we're here to provide energy for the world."

Jennifer explains that it also helps with career development for younger people considering a career in the industry, as it helps them understand that they can be part of the solution: "Maybe the tagline speaks more to people about just what we can be. The tagline touches on and addresses every aspect of SPE, who we are, and what we do. Whether you're in a mature market or a developing one, it reminds us of our shared purpose."

Again, it comes back to humanizing the conversation: "It's not just about turning on lights in a first-world country. It's about helping someone cook their next meal safely. People don't respond to facts; they respond to something that causes a passion in them. Those are the conversations that resonate."

She encourages small, personal advocacy in addressing public perception: "What we need to do is start talking to people about the benefits that our industry brings to humanity. It happens one conversation at a time, with neighbours, friends, teachers. If you can sway one person, that's progress.


Lunch 3 lunch with Kazakhstan alumni, Almaty, KZ

"I'm not so naïve as to say that we're going to be able to convince every person. There are some you're never going to convince. Instead, we can try to find people who are curious and open-minded. The goal should be to talk to people who are willing to listen. That includes speaking with young people in school, along with teachers and guidance counsellors. If we can get people to start thinking about discussing it in a neutral way, that would be a great start."

The tagline is also how Jennifer sees SPE engaging new members, especially young professionals. The challenge, she says, is showing value: "Declining membership among young professionals is not unique to us at SPE. The same trend is reflected in many professional associations, such as IEEE and AIChE and others. Younger generations find community in social media, not societies.

"In the past, joining SPE was just what you did. Now we need to show what's in it for them, including things such as career support, learning, community and purpose. People want to belong to something bigger than themselves. We must be willing to be more agile, to understand that if something works, great. If not, we try again. Our younger members have creativity and passion, and we need to give them room to run."

## Balanced life

When she's not travelling and teaching and sharing her ideas, Jennifer lives in Colorado (although she admits she's probably the only Coloradan who doesn't ski), where she relaxes by hiking in nature and being with her animals.

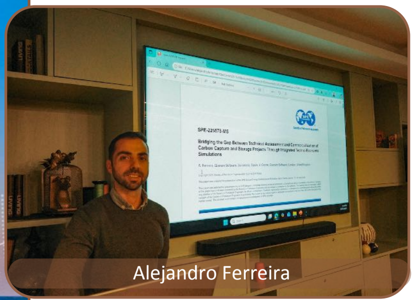
"I'm an animal person through and through," she says. "I've got dogs, cats, chickens and horses, it's a whole little farm. They keep me grounded and remind me to slow down. They bring balance with their unconditional love and simplicity. It's good for the soul."

That balance is something she also seeks to define in her leadership philosophy, which was reshaped by the COVID-19 pandemic. "Before COVID, everything was in person. Then, suddenly, it was all online, and now we're trying to find a balance. Some things, such as interviews or updates, work well online. But for meetings that require focus, collaboration, or creativity, you need to be face-to-face. Body language, connection are all things that matter."

She carries that changing philosophy into reshaping how the industry communicates its story. "We're not great at telling our story," she admits. "Engineers love facts, but people respond to emotion and meaning. We need to show how our work improves lives, and how energy brings opportunity, health, and stability."

**As Jennifer concludes: "Engineering is about solving problems, but it's also about people. That's why I love SPE's tagline so much. We are solutions. We are people. We are energy."**


Jennifer at a recent Energy4Me event in Indonesia



Alejandro Ferreira

# From feasibility to reality: Accelerating CCS commercialization with techno-economic simulations

**Alejandro Ferreira's technical talk (October 2025) examined the comprehensive techno-economic assessment methodology applied to Carbon Capture and Storage (CCS) projects, simulating the entire project value chain.**

Alejandro is a Senior Solutions Architect with Quorum Software, and the live presentation was at the Hotel Xenia, Autograph Collection at160 Cromwell Road in London.

His integrated approach enables the evaluation of both technical performance and economic outcomes, offering a framework to optimize CCS project design and identify critical factors that influence overall project success.

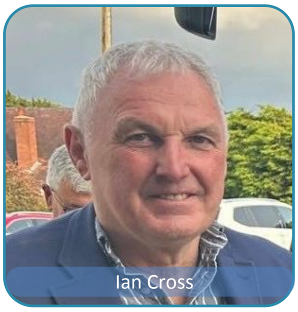
He emphasized that CCS is key to achieving net zero emission targets in energy, industrial production and manufacturing, and carbon capture capacity must increase 100-fold to meet 2050 objectives, equivalent to ~ 1,280 billion in capital investments.

Alejandro also showed how software solutions are key to accelerating the momentum of CCS projects, with key project challenges including uncertain stortage capacity, interconnected and variable generation and storage, and an emerging regulatory framework.

In conclusion, Alejandro affirmed how the CCS project model would provide:

- critical insights into the interdependencies of the different CCS project parts
- improved planning in CCS development
- an effective solution to enhance decision-making
- better strategic planning and resource allocation
- effective methodology for helping mitigate greenhouse gas emissions and achieving net-zero targets.

# The often-forgotten potential of Africa's landlocked countries



Ian Cross

**While most of the focus is on the offshore of Africa and, in more recent years, the deepwater, the landlocked countries of the vast continent are often ignored.**

**Earlier this year, at an SPE London meeting, Ian Cross (Managing Director, Moyes) gave an updated report on the continent's potential, and the overview provided below.**

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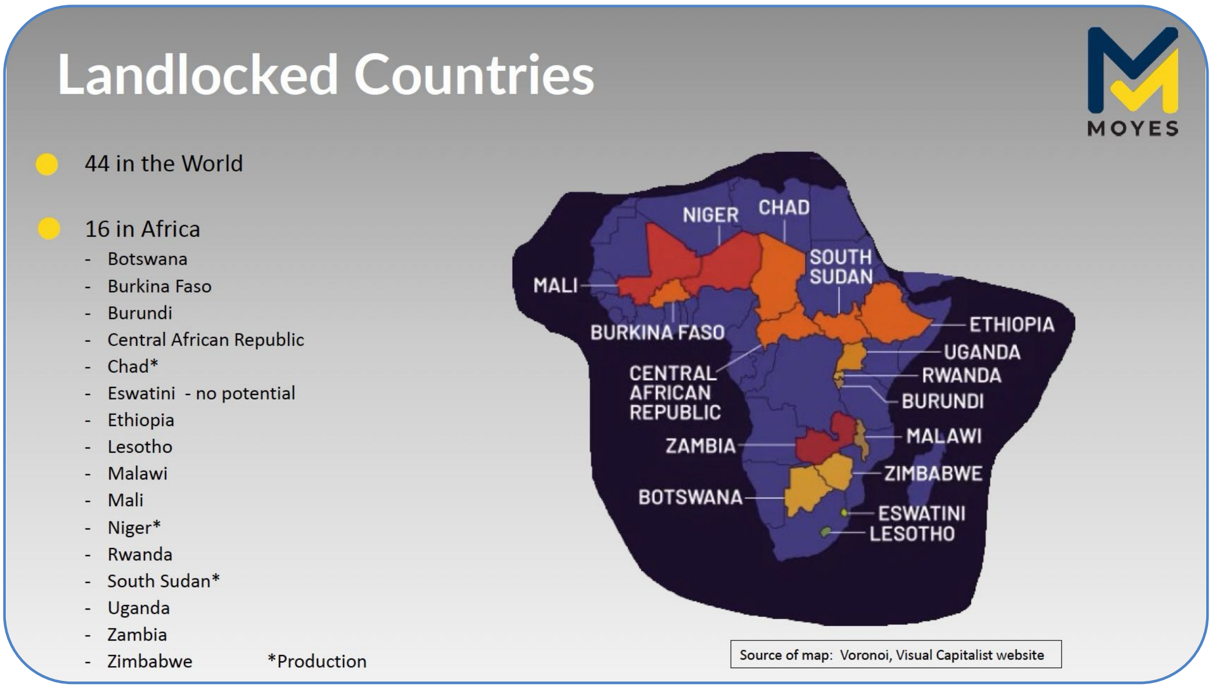
There are 16 landlocked countries in Africa: Botswana, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Eswatini (former Swaziland), Lesotho, Malawi, Mali, Niger, Rwanda, South Sudan, Uganda, Zambia and Zimbabwe. Being landlocked poses issues with the production and export of hydrocarbons but the E&P potential of several of these countries remains high. Most have a history of oil and gas exploration including Coal Bed Methane (CBM), and three are significant oil producers. Published production numbers understandably vary and should be treated with caution.




**South Sudan** is the biggest landlocked producer in Africa with an estimated production of ~90,000 to 160,000 BOPD (unclear). However, the country earns a lot less from this production due to high evacuation tariff and other fees as the oil passes through Sudan to the ports. Exploration acreage held by Oranto, Ascom and Strategic Fuel Fund (SFF) seeking partners.

**Chad**, the largest landlocked country in Africa, produces an estimated 120,000 BOPD with most exported through Cameroon to the coast. CGIP to start oil production from Block H end 2025.

After pipeline issues, **Niger** is understood to be producing round 90,000 BOPD and capacity to reach 110,000 BOPD, with significant undeveloped discovered resources. CNPC is the dominant operator, with Savannah Energy holding significant acreage where it is planning development of several discoveries made in recent years.

**Uganda** boasts significant oil reserves but is yet to join the list of producers. The country's first oil discovery was made in 2006 in Lake Albert, but start-up of production has faced an unprecedented series of much publicised delays. However, oil production from the Tilenga project operated by TotalEnergies and the Kingfisher project operated by CNOOC is optimistically expected to start in 2026 and reach a combined 230,000 BOPD according to reports. One of challenges of the project has been how to build the 1,500 km electrically heated pipeline needed to export the crude via Tanzania. When completed it will be the world's longest heated pipeline.

**Ethiopia** has a series of gas discoveries in the Ogaden Basin at Calub, Hilala and El-Kuran. China's Poly-GCL was the operator of the multi-TCF Calub and Hilala fields and had been working on plans for an ambitious pipeline taking the gas across Ethiopia to Djibouti. However, Poly-GCL has now exited the country, and plans are back to the drawing board for this project.

In **Zimbabwe**, Invictus Energy's exploration of Cabora Bassa Basin led to the Mukuyu gas discovery. The follow-on potential is exciting with over ten prospects and leads identified, and new play type. It is touted as the largest known undrilled prospect onshore Africa with an independently estimated 20 Tcf and 845 million barrels according to Invictus. To continue the positive news for Invictus Al Mansour Holdings (AMH) has acquired a strategic 19.9 per cent equity stake in Invictus.

More recently, Canadian company Reconnaissance Energy Africa (or Recon Africa) announced that it has been granted a petroleum licence in **northwestern Botswana** contiguous with its Namibia licences. At the same time, in Zambia Geo Petroleum Ltd secured rights to Block 31 and the transfer of Tullow Oil's equity to them. CBM activities intensified in 2024 leading to licenses awarded to companies, focusing on the central Kalahari Desert.

Meanwhile, Burkina Faso, Burundi, Central African Republic, Eswatini (former Swaziland), Lesotho, Mali, Malawi and Rwanda have all seen varying levels of interest from the upstream industry. Some of it is stop-start as the smaller companies seek farm-in partners and funding to carry out exploration work. In Malawi, RAK Gas had been planning seismic work over its acreage in the Lake Malawi Graben.

**Summary: Landlocked Africa (in order of hydrocarbon and geopolitical risk)**

| Country | Method | Comments |
|---|---|---|
| 1. Chad | Direct Negotiation and farm-ins | Outside exploited areas considered frontier low entry cost |
| 2. Niger | Direct Negotiation and farm-ins | Palaeozoic untapped potential |
| 3. Uganda | Bid round and farm-ins | Delayed production, potential funding opportunity |
| 4. South Sudan | Direct Negotiation and farm-ins | Remaining potential in frontier regions |
| 5. Central African Republic | Direct Negotiation | One well. Extension of Doseo and Salamat Basins in north |
| 6. Zimbabwe | Direct Negotiation and farm-ins | Karoo Basin potential, CBM activities |
| 7. Botswana | Direct Negotiation and farm-ins | Kavango-Karoo Basin potential, CBM activities |
| 8. Mali | Direct Negotiation | Open blocks, southern extension of the Taoudeni Basin |
| 9. Rwanda | Direct Negotiation | No wells, Lake Kivu rift basin |
| 10. Burundi | Direct Negotiation | No wells. Under-explored with two East African Rift basins |
| 11. Zambia | Direct Negotiation | Underlain by Karoo Basin, Tertiary rift basin in the north |
| 12. Burkina Faso | Direct Negotiation | Extension of Taoudeni Basin in the north |
| 13. Ethiopia | Direct Negotiation | Political instability, conflict, and inadequate infrastructure |
| 14. Lesotho | Direct Negotiation | Underlain by Karoo Basin, volcanics thick |
| 15. Malawi | Direct Negotiation | Policy unclear, boundary issue |
| 16. Eswatini | Direct Negotiation | Dominated by Basement subcrop |

MOYES

# Industry evolving through the energy transition


**This year's Introduction to Upstream Oil and Gas for the Net Zero World seminar brought together professionals from across the sector for a full day of learning, discussion, and insight into how the industry is evolving through the energy transition.**


Khaled Al Marei

The programme covered the full upstream value chain, beginning with an introduction from **Khaled Al Marei** (Storegga) and a look at the energy trilemma from **Adam Borushek** (RISC), before moving into core technical sessions on geoscience, drilling, reservoir engineering, and production facilities. The afternoon shifted toward commercial and strategic themes, including upstream economics, sustainability and reporting, and digital transformation, led by speakers from across industry. The day concluded with **Alison Isherwood**'s practical guidance on careers in the energy transition, rounding off a seminar that balanced technical depth with a forward-looking view of the sector's future.

Starting the day, **Adam Borushek** (RISC) provided an overview of how exploration and production fit within today's energy trilemma, highlighting the ongoing balance between sustainability, security and affordability in the transition to net zero. He explained why oil and gas continue to underpin global energy systems and how factors such as geopolitics, market volatility, and shifting demand shape the sector's outlook. Adam also noted that while renewables will grow rapidly, most long-term scenarios anticipate a role for hydrocarbons as global energy needs evolve. His session effectively set the day's scene, emphasising the complexity of the transition and the need for pragmatic, balanced decision-making.

**Dr Paul Wilson** (Perenco) delivered an accessible overview of the geological foundations of exploration and production, outlining the key elements of the petroleum system and the datasets such as core samples, logs, and seismic, that help geoscientists understand the subsurface. He showed how these inputs are integrated to assess prospectivity and guide field development, before shifting to the growing role of geoscience in the energy transition. Dr Wilson highlighted how the same subsurface skills underpin emerging low-carbon technologies, from geothermal and hydrogen storage to offshore wind and CCS, illustrated through Perenco's Poseidon project. His session reinforced geoscience as a core discipline supporting both today's oil and gas industry and the UK's evolving clean-energy landscape.

**Iain Hutchison** (Merlin Energy) delivered an engaging introduction to drilling, tracing its evolution from early wells to today's sophisticated vertical, directional, and extended-reach designs. He outlined the purpose of exploration, appraisal, and development wells, and walked through the key stages of drilling while explaining how rig types and well architecture vary across onshore and offshore settings. Iain also highlighted the high cost and operational complexity involved, underscoring drilling's pivotal role in safely and efficiently accessing subsurface resources for oil and gas, geothermal, and CCS projects alike.

**Frank Folorunso** (Star Energy) delivered a session on reservoir engineering and its role across the full field life cycle, from appraisal through to production and abandonment. He explained how engineers integrate geological, economic, and production data to forecast performance, optimise wells, and improve recovery beyond the 10–20 per cent typically achieved through primary mechanisms. Frank also highlighted the discipline's expanding relevance in the energy transition, with reservoir expertise now central to $CO_2$ storage, geothermal projects, and underground energy storage. His session underscored reservoir engineering as a foundational skillset for both today's E&P operations and the evolving low-carbon future.

**Omer Khoshnaw** (INEOS) gave some technical insight into how production facilities process raw well fluids into safe, saleable products, outlining the role of wells, flowlines and surface equipment in separating and treating oil, gas, water and solids to meet commercial and environmental standards. He highlighted the operational challenges of varying well-fluid compositions and demonstrated how onshore and offshore gathering systems bring production together efficiently. Omer also touched on the industry's net-zero journey, showcasing practical measures such as electrification, methane-leak detection, improved energy efficiency and emerging CCS projects, illustrating how production infrastructure is adapting to support a lower-carbon future.

**Long Wang** (Harbour Energy) delivered an engaging, interactive overview of upstream economics, highlighting how investment decisions are shaped by global energy demand, commodity price volatility, and the long, capital-intensive nature of E&P projects. He outlined the core economic tools used to assess project viability, from NPV and breakeven analysis to scenario planning and probabilistic methods, and explained how technical inputs, fiscal terms, and macroeconomic factors come together in economic modelling. He also emphasised the growing influence of ESG expectations and geopolitical risk on project outcomes, noting that effective decision-making increasingly requires balancing financial returns with environmental and societal considerations.

**Charlie Wilson** delivered a great introduction to ESG, outlining what environmental, social, and governance factors really mean for oil and gas companies and why they remain central despite public debate over whether "ESG is dead". They broke down the expanding regulatory landscape, from UK Sustainability Reporting Standards to Scope 3 expectations, and highlighted the rising scrutiny around emissions, greenwashing, and climate litigation. The session also emphasised practical guidance on materiality, credible disclosures, and building a defensible ESG narrative, encouraging companies to focus on what truly matters to their operations and stakeholders while avoiding overstatement of achievements.

**Alejandro Primera** (SLB) delivered an overview of how data and AI are reshaping upstream operations, highlighting their growing importance in tackling subsurface uncertainty, optimising drilling, forecasting production, and improving facility performance. He outlined the industry's shift toward continuous real-time data acquisition, cloud collaboration, and advanced analytics, showing how disciplines across the asset life cycle are increasingly supported by big-data platforms and AI-driven tools. Alejandro also illustrated the practical benefits of digitalisation through case examples, demonstrating how automation, predictive modelling, and generative AI can unlock efficiency gains, reduce emissions, and enable smarter, faster decision-making in both mature and emerging basins.

**Alison Isherwood** offered a pragmatic overview of careers in the energy transition, highlighting growing opportunities in areas such as geothermal, CCS, hydrogen, and GHG accounting, while stressing the strong relevance of skills developed in oil and gas. She also noted the challenges of early-stage project uncertainty, complex regulation, and industry 'greenwashing', encouraging professionals to approach the transition with both optimism and realism as the sector continues to mature.

**Many thanks to the following people (all from Meren Energy ) who contributed this article: Mussannah Chowdhury, Emily Verhoeven, Shrina Gohel, and Artwell Njunga.**

# Imperial College London student chapter board

**Through local student chapters and international programs, SPE serves more than 64,000 student members globally. Local chapters organise lectures and networking opportunities, provide students with hands-on experiences in the oil industry, and enhance collaboration with the wider SPE.**

### President

**Ahmad Firdaus** is a Reservoir Engineer at SLB with experience supporting subsurface projects across Southeast Asia. He is pursuing an MSc in Geo-Energy with Machine Learning at Imperial College London and has been an active SPE member for nearly a decade. Firdaus is passionate about integrating AI to enhance subsurface efficiency.

### Vice President

**Muhammad Sidqi** is a geoscientist pursuing an MSc in Geo-Energy with Machine Learning and Data Science at Imperial College London. With five years in the geothermal industry, he specializes in data science, digitalization and subsurface evaluation. His track record covers R&D, technical consulting and edu-tech outreach.

### Secretary

**Ario Bhismo Nugroho** is a MSc Mining & Metals Finance candidate at Imperial College London. Three+ years' experience as a Metals Processing Engineer at Toyota, with a strong interest in sustainable energy transitions and resource finance. Eager to apply analytical skills and industry insight to drive innovation in the metals & energy sector.

### Treasurer

**Ruslan Fezidov** is an MSc Advanced Chemical Engineering student at Imperial College London with experience in process optimisation, sustainability, and data-driven engineering. He previously served in the SPE ASOIU Student Chapter, contributing to technical events, member engagement and academic-industry collaboration.

### Membership

**Aidana Kairly** is a petroleum engineering graduate (Kazakh-British Technical University, 2024) pursuing MSc Geo-Energy with Machine Learning and Data Science at Imperial College London. She is passionate about leveraging programming and data science to tackle complex challenges in subsurface engineering and the wider oil & gas industry.

### Communications

**Rza Abdullayev** is an MSc Geo-Energy with Machine Learning and Data Science student at Imperial College London and a distinction Petroleum Engineering graduate from Baku Higher Oil School. With experience at SOCAR and bp, he applies AI to subsurface characterisation, reservoir modelling and CCS to advance energy transition solutions.

# Coventry University student chapter board

**Through local student chapters and international programs, SPE serves more than 64,000 student members globally. Local chapters organise lectures and networking opportunities, provide students with hands-on experiences in the oil industry, and enhance collaboration with the wider SPE.**

### President

**Samuel Essien** is an analyst and versatile professional with experience in sales, trademarketing and cross-functional collaborations with engineers, analysts, HSE and production operations teams. With a BSc in Chemical Engineering and an MSc in Oil and Gas Management underway, he is driven by optimisation and data-led process design for a sustainable energy future.

### Vice President

**Enoch Nii Armah Quaye** is an MSc Oil and Gas Management graduate with strong interests in sustainability, carbon and energy trading, and the wider energy transition. With a chemistry background and growing expertise in low-carbon pathways, he's focused on contributing to innovative, future-focused energy solutions.

### Secretary General

**Iheme Chibuike Emmanuel** has a rich public service perspective working with the Nigeria EITI, and is a Next-Gen focused energy professional interested in the nexus between data, innovation, sustainability and frontier technologies and the dynamics that play out, with the aim of contributing to sustainable energy development and economic abundance.

### Treasurer

**Aisha Sidi Bage** is an aspiring professional in the energy and sustainability sector with keen interests in the critical intersection of project execution, risk management, and sustainable development. She is driven by the goal of translating her academic foundation into resilient, high-impact strategies that contribute to a new era of global energy solutions

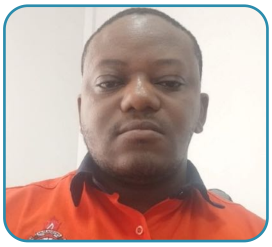
### Award and Reception Chairperson

**Dimgba Godswill Chiemena** is a forward-thinking professional focused on modern energy systems, with key interests in data-driven, sustainable technologies. A member of the Nigerian Society of Engineers, he holds a degree in Petroleum and Natural Gas Engineering and is currently pursuing an MSc in Oil and Gas Management.

### Membership Chairperson

**Victor Joseph** is a geologist, FX analyst and welding engineer, integrating his skills into an MSc in Oil and Gas Management. His interests lie with construction, commodity trading (especially carbon trading), safety risk assessment and control.

### Program Chair and Webmaster



**Karoli Blazi Massawe** ( is a Tanzanian Chemical and Process Engineer, registered as a Professional Engineer, currently pursuing MSc in Oil and Gas Engineering. He has extensive experience in natural gas processing and brewing industries, with strong skills in plant operations, quality control, and safety management.

### Communication and Outreach Chairperson

**Oluwaseun Femi-Pidan** is a results-driven professional with project management experience and a background in industrial physics, he is expanding his expertise through an MSc in Oil and Gas Management. He is currently applying his interests in carbon trading, aiming to contribute to sustainable energy practices and emerging low-carbon market opportunities.

# We asked for your help to make the SPE Review London even better, and you told us. Thank you. Here are the results.

**Earlier this year, we sent out emails asking for SPE London members' feedback on the SPE Review London magazine. We wanted to know how what you liked, what you didn't like – in short, how we could make the magazine better. Many of you generously gave your time to give us some answers. Some were suprising. Here they are, below.**

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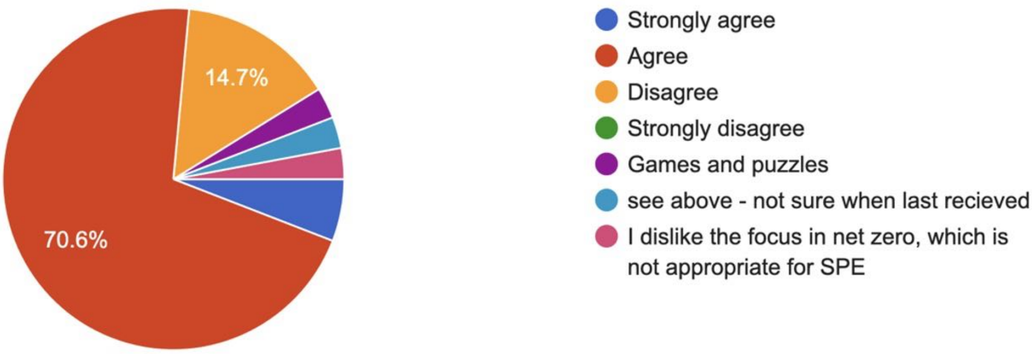
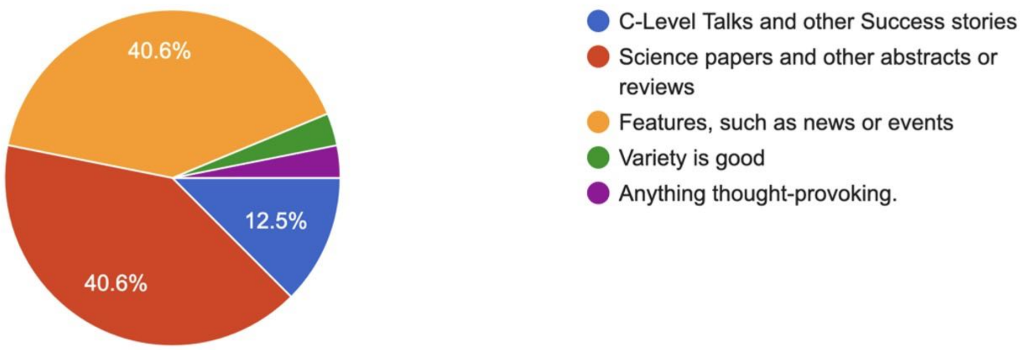
**Q1: How often do you read the SPE review London magazine?**

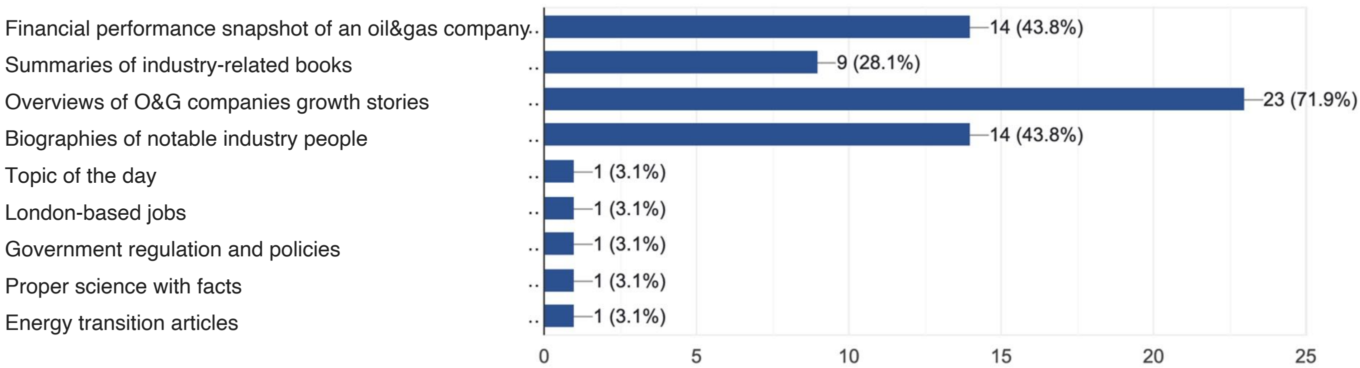

**Q2: I am satisfied with the overall quality of the magazine.**



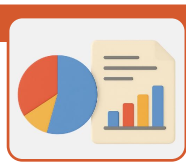
### Q3. Which type of content do you find most valuable?




### Q4. Which of these new topics would you like to see in future issues?




### Q5. Would you be interested in contributing to SPE Review London as a writer, editor or reviewer?



This next, and last question, elicited many responses, ranging from a suggestion to have a printed magazine (sorry, cost are prohibitive), cutting it to a two-page leaflet, including an industry-based cartoon (any volunteer cartoonists out there?), and focusing on engineering's contribution to a healthy, planetary society.

**Q6. What else would you like to see in future issues?**

Would recommend to significantly shorten to a couple of pages with links and concise summaries.

More content on sustainability.

Shorter length articles.

General news about future events.

Information on university and student views on the energy business.

More regional face-to-face events on topical issues.

An oil&gas-based cartoon.

Information about when members move to other companies.

Initiatives relating to geothermal and so-called Blue H2 in UK.

Evolving technologies.

A better balance between $CO_2$ sequstration (there is too much), hydrogen and reservoir engineering.

News on UK drilling and companies.

More focus on surface facilities, e.g., FPSOs / FLNGs.

Information on the energy transition; CCUS; Electrification; lobbying/interaction with policy makers.

Information about North Sea activities, new discoveries, fields coming online, P&A.

UK oil and gas service company success stories and news.

More technical articles.

Maybe a technical snippet.

It's fine as it is – regularity is the essence but becomes the problem as work must take priority even when there is or deadline over getting the newsletter out.

Interviews of London-based senior leaders or board members of energy companies.

UK O&G sector performance within the overall energy market.

Printed magazine.

Development case histories.

Some article about sensible geothermal projects.

More focus on London-specific events and news rather than the industry in general.

Technology developments .

Discussions regarding the possibility of relaxing the current UK restrictions on hydraulic fracturing of unconventional gas sands. They may be some regions of the UK where the restrictions may be removed or relaxed because either the gas sands are deep or they are far from cities, towns and villages.

As we are not allowed to explore any more in the UK waters it's time for EOR to take the stage. I would like to see focus on how we can maximise recovery in our current reservoirs – especially polymer floods in our heavy oil like captain, use of $CO_2$ for miscible gas injection instead of hydrocarbon gas, and updates on new tech such as low salinity water flooding as used in Clair ridge. It would also be good to see how bright water and organic oil recovery demonstrations are progressing. One other thing – gas to electricity offshore with integrated $CO_2$ storage.

Less of net zero and more oil and gas. We need to support young engineers and help them choose oil and gas careers not renewables.

Communications skills.

UK regulatory and policy updates, or member discounts.

Oil and gas price predictions for UK and elsewhere.

Clear examples of how geos and engineers can contribute to a society that lives within planetary boundaries, without unbridled techno-optimism taking centre stage. How do we plan for the worst outcomes?

A return to the industry job of producing the reliable oil and gas energy and products that people need and not failed renewable technologies that people do not need. SPE needs to stand up for the industry not pander to extremism. The damaging and false ideologies of man-made climate change need to be soundly refuted.

New technologies and industry M&A summary.

More technical content related to wells.

Clear focus on oil and gas and not distractions on energy transition, CCS, and other non-core areas.

Reprints of articles from other European SPE Chapters.

We welcome comments on this survey – and any other articles in the SPE Review London. We would also like to hear any other suggestions for content. This is your membership magazine, and we want to make sure it is relevant and helpful to all SPE London members.

Please contact us at **spelondon@spe-london.org**

# Role of international oil companies in the net-zero emission energy transition (part 3 of 3)

**Scientific and engineering capabilities in hydrocarbon supply chains developed over decades in international oil and gas companies (IOCs) uniquely position these companies to drive rapid scale-up and transition to a net-zero emission economy. Flexible large-scale production of energy carriers such as hydrogen, ammonia, methanol, and other synthetic fuels produced with low- or zero-emission renewable power, nuclear energy, or hydrogen derived from natural gas with carbon capture and storage will enable long-distance transport and permanent storage options for clean energy. Use of energy carriers can overcome the inherent constraints of a fully electrified energy system by providing the energy and power densities, as well as transport and storage capacity, required to achieve energy supply and security in a net-zero emission economy, and over time allow optimization to the lowest cost for a consumer anywhere on the globe.**

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The increased optionality and flexibility to connect primary resources to more diverse markets (with high- and low-power density energy consumption processes), and in principle without constraints on distance, allow the development of supply chains optimized to the lowest cost. This is critical for scale-up of net-zero processes to global scale. System optimization considers access to the best sites for renewable or clean power and ability to deliver and store energy carriers at the required scale. Chemical energy is attractive because it can be stored and transported stably, as is done today with oil, coal, biomass, and natural gas (30). Molecules can be stored for long periods, transported across the sea in ships, burned to provide heat and power, reformed to generate hydrogen for low-emission combustion as fuel, and used in zero-emission fuel cells. These uses can support existing infrastructure, business models, and jobs for systems originally designed around competitive markets for fossil fuels, or to establish economic activity for a new location.

From this perspective, a net-zero system even without fossil hydrocarbons is not dissimilar to a net-zero emission system and, in fact, is well understood by IOCs. Systems innovation has always been important for IOCs and central to their technology development strategies. It will become even more important with increased optionality and choices. Accurately predicting future customer behavior in such a system will be impossible, even aside from geopolitical events that may impact optionality. Hence, for a stable system to exist, comprehensive systems design, operation, and analyses, driven by data (and hence digital technologies) to assess trade-offs, will become imperative.

Energy transport and storage will require the synthesis of hydrogen, ammonia, methanol, and perhaps other synthetic fuels or carriers, such as liquid organic hydrogen carriers (31), depending on choice and availability of energy resource and carrier feedstock as building blocks, alongside large chemical storage solutions of these energy vectors. This poses three questions:

1. Where would the power and/or process heat be sourced from to make the carrier?

2. What energy or heat sources are acceptable to the consumer in the trade-offs they are willing to make?

3. What is the source of carbon used for single-use energy vectors like methanol or other higher synthetic hydrocarbons, for their use as energy or chemical products to substitute those currently made from fossil hydrocarbons?

Current insights are that this will come via bio- or agricultural feedstocks, including residues or wastes, and eventually from $CO_2$ via direct air or sea capture (32). Substantial hydrogen and energy in the form of electricity or process heat will be needed to upgrade bio-based feedstocks or reverse $CO_2$ into usable fuels and chemicals.

Of the chemical carriers (33), hydrogen perhaps holds a special role. It is a fuel and can be combusted (burned) or reacted electrochemically via fuel cells to form water as a zero-emission co-product. It can also be a chemical building block for future uses that extend far beyond traditional markets today to produce ammonia for transport (which in some cases may be preferred over transporting hydrogen). And finally it is a building block for fertilizer or may be used to upgrade refinery products in reduction of hazardous impurities (sulfur, metals) and to improve the performance of gasoline, diesel, and jet fuels, and manufacture chemical products (methanol, aromatics, and derivatives). Both hydrogen and electricity can be produced via various clean energy routes, including electrolysis, reforming, or pyrolysis of hydrocarbons with carbon storage as $CO_2$ or as a solid carbon product. If solid carbon products are formed, the product must be sequestered for more than 100 years for the co-product hydrogen to be considered clean (34). Hydrogen can thus play multiple roles in the future energy and chemicals economy via direct storage and use in zero-emission (at tailpipe) fuel cells, or via reaction with nitrogen or carbon to produce molecular energy carriers such as ammonia, methanol, or synthetic hydrocarbon fuels that are easier to transport and store than hydrogen itself.

Hydrogen or its derivatives can provide the storage needed to accommodate abundant VRE (wind and solar) but cannot be economically stored as electrical energy via batteries or capacitors for durations beyond daily cycles (35). Most industrial operations and many commercial transportation services require 24/7 operation, as do electrical grids, and load balancing alone is not a solution for an energy economy where VRE grows from less than 10 per cent, as it is today, to the dominant form of energy (36, 37). Hydrogen and its derivates are key to increase flexibility and optionality to develop affordable clean solutions. Indeed, molecular energy storage via hydrogen can contribute significantly to energy system resilience.

Molecular or chemical energy vectors can themselves be manufactured efficiently via multiple clean production routes, for example, either through VRE coupled with storage of the carrier to provide 24/7 operation or via natural gas reforming with CCS, and via nuclear heat sources provided by advanced (i.e., not pressurized water reactors) small modular reactors (SMRs). High-power density users require a very high production rate, i.e., large volumes per unit time, putting a significant condition on the minimum required scale of renewable power infrastructure if only renewable power is to be used. The electrical efficiency of electrochemical routes to produce hydrogen can be improved via operation of solid oxide electrolyzers at higher temperatures, where overpotentials are reduced. The ability to use thermal heat integration from exothermic industrial processes, such as ammonia or methanol synthesis, can lead to 30 per cent gains in electrical efficiency versus low-temperature alkaline or polymer electrolyte membrane (PEM) electrolyzers (38).

Combinations of renewable power and small-scale dispatchable nuclear reactor technology could enable lower consumer costs. Such modular compact reactors (SMRs) have high power densities and hence, potentially, can provide both heat and power across low- to moderate- temperature regimes (39, 40) in an off-grid fashion, dispatched on site. Reactor construction would be factory based, and thus potentially lower cost via standardization of manufacturing, safeguarding, and permitting relative to separate approvals for each new power plant (41, 42). On-site SMR deployment could therefore complement and allow direct integration of renewable power and heat for industrial processes operating at low to moderate temperatures (43, 44). Developmental hydrogen production via solid oxide (steam) electrolyzers operates at 750–900°C, which is too high a temperature for current nuclear SMRs (45). Lower-temperature heat can, however, be used for latent heat of steam generation (46), which is a substantial portion of the net energy required. Recent research at the Idaho National Laboratory (47) on novel catalyst and electrode assembly materials indicates that operating temperatures as low as 600°C may be plausible. This can be realized via heat integration and direct electrical heating to provide a means for partially integrating nuclear-derived heat into high-temperature electrochemical water splitting to generate hydrogen. New gas-cooled technologies in early stages of development may provide a future pathway to fully integrate H2 production via a nuclear energy source to deliver heat at the high temperature required to drive endothermic water electrolysis (48). If the hydrogen is used for exothermic ammonia synthesis operated at 350–500°C, then developmental molten salt- or liquid metal-cooled nuclear reactors could be used to augment reaction heat integration to provide a portion of the energy required. Integration of nuclear SMRs with renewable power grids makes load following in these grids an attractive alternative to purely electrical storage solutions. Such developments are now entering trial stages (49).

In some regions (the Middle East or US Gulf Coast), low-cost natural gas combined with accessible CCS can be used to produce clean (blue) hydrogen or its energy carrier derivatives (ammonia, methanol), requiring only incremental costs for required infrastructure (50). Government incentives may stimulate this for CCS,but the infrastructure needed, as well as the geological formations to store $CO_2$, must be studied for risk of loss of containment, as well as subsurface instabilities like earthquakes resulting from the injection process. Stricter measures to avoid methane leakages in the manufacturing process, and especially the upstream supply chain, are needed, as evidenced by current measures for responsibly sourced gas (51).

Scale-up of production of energy carriers like hydrogen via electrolysis also could benefit from novel colocation with other industrial efforts. Desalination is projected to grow in the next decade (52) from a mere 1–2 per cent of the world energy consumption (similar in size to the aviation industry) to about 6–7 per cent. Hydrogen produced from (partially) desalinated water is plausible at a low cost increase and would avoid the use of freshwater from aquifer systems (53). This may be attractive, because advances in $CO_2$ recovery techniques from seawater, potentially colocatable with desalination (32), could therefore provide raw materials for production of methanol or other synthetic hydrocarbon products. The location of these plants may be driven by vicinity to both urbanized areas and renewable production sites.

Relatedly, hydrogen, ammonia, and methanol could be produced via compact offshore modular platforms moored close to offshore wind farms, or by using small modular nuclear reactors. IOCs have pioneered modular offshore engineering platforms for several decades, leading to innovations including floating production storage and offloading platforms, which may become attractive as compact, offshore integrated chemical plants to synthesize energy carriers for storage and transport solutions made from renewable or nuclear power. Such modular platform-integrated engineering is being researched actively at various engineering institutes, including the Chinese Academy of Science Shanghai Advanced Research Institute and the Massachusetts Institute of Technology. Chemical plants producing hydrogen and other carriers will be driven by availability of and proximity to renewable power. There will be a demand to modularize production for these energy carriers in compact plants concentrated in areas where more flexible production of clean or renewable hydrogen, ammonia, and methanol may be advantageous. A significant enabler will be systems engineering solutions for optimally integrating renewable power with nuclear energy provided by microreactors (e.g., nuclear batteries) or SMRs (54). These engineering challenges have become the subject of research and development programs in IOCs (55).

Reforming of natural gas allows scalable hydrogen production, which can extend to production of ammonia and methanol. Addition of CCS to produce clean hydrogen requires large-scale centralized production, integrated with a growing hydrogen business. Access to technically and socially acceptable $CO_2$ storage sites may restrict deployment to a few regions, such as the US Gulf Coast or the Middle East (50). CCS, optionally in combination with geothermal heat extraction to offset costs using supercritical $CO_2$ power cycles (56), could become an integral part of IOCs' hydrogen production business. The choice of energy vectors gains strategic importance for an IOC to ensure access to markets that demand clean or green energy and products. Part of the delivery system includes the need for large-scale storage. Hydrogen storage in salt domes has been known for more than 50 years (57). Storage techniques build on IOCs' experiences with natural gas storage, including subsurface expertise that in fact is not too dissimilar from hydrocarbon recovery and CCS. However, although the practice of salt dome storage of hydrogen is well understood, acceptable storage locations are limited globally and must be proximal to hydrogen production. Depending on the source of the renewable or low-carbon power, the best locations for hydrogen production and storage could be mismatched.

This brings us to an important aspect of how and where on the globe clean energy production will develop. Although some renewable power can be produced almost anywhere, areas advantaged for solar and wind production, along with the ability to produce hydrogen from natural gas with CCS, stand out as attractive areas to invest energy system infrastructure (20, 58). Large-scale production of chemical carriers is initially done most effectively in those areas where chemical manufacturing already takes place, or where new production can be introduced with low-cost advantage. This creates the opportunity to establish new beachheads for geographic locations that combine access (via existing or low-cost new development) to renewable (solar and wind) or clean (fossil, CCS, nuclear) energy, facilities for manufacture of chemical carriers or energy-intensive products, and bulk transportation (ports for shipping, pipelines, and rail).

Manufacturing facilities, including those used to make energy carriers, will benefit from relocating to areas with high resource intensity, low land costs, and access to ports for global shipment of products to market. However, the converse may be attractive too: Products with high embedded energy, such as steel, or large-volume hydrocarbon chemicals in liquid or solid form, can be shipped to market from remote distances, as an alternative to shipping energy carriers at lower efficiency to markets adjacent to local manufacturing.

### Example: Clean energy supply for a large US truck stop

Supply of energy to a large truck stop modeled after one in Walcott, Iowa (https://iowa80truckstop.com/), serves as an example of the value of energy density and storage (*see Table 1*),as well as the trade-offs with land use and local air quality for local emissions. The lowest-cost refueling is from instantaneous solar PV with no storage, but five-day storage costs via battery are high. First-generation bioethanol is competitive with instantaneous solar PV and provides low-cost storage, but biofuel generation requires large land use (42 square miles). Advanced biofuels require half the land of first-generation ethanol but higher production costs, and hence are notpracticed commercially. Battery electric vehicles (BEVs) and hydrogen fuel cell vehicles are zeroemission, whereas biofuel internal combustion engines are sources of particulate matter and smog, impacting local air quality.

| Parameter | Energy source | PV-solar | | Bio-EtOH | Advanced biofuel | Nuclear | |
|---|---|---|---|---|---|---|---|
| | Vehicle | BEV | $H_2$-FCV | ICE | ICE | BEV | $H_2$-FCV |
| Land use (square miles) | | 2 | 5 | 42 | 5 | 0 | 0 |
| Five-day storage ($/gge) | | 16.7 | 1.2 | 0.1 | 0.1 | 0.0 | 0.0 |
| Cost at pump ($/gge) | | 1.2 | 2.5 | 2 | 5 | 3.5 | 7.0 |
| Cost with storage ($/gge) | | 17.9 | 3.7 | 2.1 | 5.1 | 3.5 | 7.0 |
| Tailpipe emissions | | none | none | HC, PM, NOx | HC, PM, NOx | none | none |

[a]Note 1 kg H2 equals 1 gallon of gasoline equivalent (gge). Assumptions: 5,000 trucks/day with average 25 gal (gge) diesel refueled per truck; 5 days on-site supply storage. 75 MW power plant for BEV; 150 MW for electrolysis to make on-site H2. Energy costs: $30/MWh PV-solar and $120/MWh nuclear power. Dispensing cost $/gge D $0.50 BEV; $1.00 H2; $0.10 liquid fuel. Sources (60–67).Tailpipe emissions are zero for electric vehicles powered by battery or hydrogen fuel cell; hydrocarbon, particulate matter and nitrous oxide emissions occur with use of internal combustion engines using ethanol or advanced biofuel.

Abbreviations: BEV, battery electric vehicle; EtOH, ethanol; FCV, fuel cell vehicle; gge, gallon of gasoline equivalent; HC, hydrocarbon; ICE, internalcombustion engine; MW, megawatt; NOx, nitrous oxide; PM, particulate matter; PV, photovoltaic.

Manufacture of hydrogen via water electrolysis is half as efficient as direct use of electricity in vehicles, but allows five-day storage at lower costs. Nuclear energy can power recharging of BEVs with 24/7 power availability (no storage needed), or to generate 24/7 hydrogen without the need for hydrogen storage for use in trucks requiring longer range and faster refill times (20 min versus 2 h for BEV). As nuclear technology develops, the cost of supplied power is expected to reduce by 50 per cent by 2030, such that costs for fueling BEVs ($2/gge) and H2 ($4.50/gge) will potentially approach the option of solar PV with H2 storage (59).

### Transitioning to net zero in industries with high emissions

The use of high-density chemical energy carriers is driven by a demand from high-power density users. We highlight specific industry decarbonization pathways for the petrochemical, steel, and cement sectors. The chemical and petrochemical sector is the largest energy user in the manufacturing industry,with a total consumption of 46.8 exajoules (EJ) or 13,000TWhin 2017 (67). Oil and gas dominated the sector's total consumption with approximately 10 per cent of global natural gas supply and 12 per cent of all oil consumed by this sector.

The chemical and petrochemical sector is unique, because significant amounts of fossil fuels are used as raw material feedstock and for non-energy use, which leads to customer emissions (Scope 3) from product use (68). For products such as methanol and plastics, the embodied energy exceeds the process energy used in production, which is also true for other heavy industries like cement, steel, and ammonia (with embedded hydrogen). This has profound consequences for strategies to abate emissions in the life cycle of the sector's products. Related to this is the complexity in carbon accounting for chemical products not used as fuel, which poses challenges in effective emission-reduction strategies for this sector (69).

#### A shift to non-fossil-based low-carbon feedstocks.

The focus of the industrial sector will have to shift to extraction and processing of carbon from feedstocks other than fossil resources. Such feedstocks would be bio-/agricultural waste, municipal waste, and eventually $CO_2$ from direct air or seawater capture. This will require an increase in hydrogen and process heat to produce and separate hydrocarbon products from oxygen-rich feedstocks, and in some cases nonlinear carbon chains (lignin). Estimates show that this may be leading to four-times-higher energy intensities (70).

#### Circularity and material footprint.

For $CO_2$ and bio-feedstocks, the feedstocks cannot be used to provide process energy ($CO_2$ is energetically depleted, and bio-feedstocks are often too valuable) but rather are used as sources of carbon (71). Chemical product manufacturing will require a substantial repurposing and circularity of by-product material resources (including what is now considered as waste). Such a systems change or materials transition would require more effective separation techniques and heat integration in manufacturing. It is estimated that for Europe alone, where approximately 75 per cent of all industry emissions come from manufacturing processes of steel, cement, plastics, and aluminum, emissions may be reduced by more than 50 per cent via application of circularity concepts for material use and product sharing, such as shared car ownership (72).

#### Need for more government-led collaborative frameworks.

Industries with complex processes and multiple sources of $CO_2$, such as petrochemicals, exhibit higher abatement costs compared with many other economic sectors. Hard-to-abate sectors would benefit from an orchestrated approach leading to a longer term collaborative effort involving government and large industries to drive research, pilots and demonstrations for development, and scale-up of new, low-carbon technologies.

### Decarbonizing steel and concrete

Steel, concrete, and chemicals (described above) are the three largest industrial sources of $CO_2$ emissions (21). Steel production traditionally has used coal or coke with oxygen to generate the heat needed to reduce iron ore to metallic iron, coproducing $CO_2$. Metal briquets or recycle scrap can be processed in an electric arc furnace, which can directly employ renewable or clean power (but requires storage for 24/7 low-cost operation). Future technology seeks to forgo the reaction of carbon for the initial reduction step and instead deploy decarbonized hydrogen (73–76). Iron oxide can be readily reduced by hydrogen, and there are opportunities to heat integrate the process technology to obtain costs that can become competitive with current carbon-based energy feedstocks.

As we mentioned earlier, the hydrogen demand in low- or zero-carbon steel plants is large, and although hydrogen-based steel making in combination with electrification could reduce emissions by more than 50 per cent, use of recycle scrap demands less energy. Substitution is also possible, as in introducing carbon fiber into steel products to retain or even increase its strength (76, 77).

Cement decarbonization requires a different approach (78). Concrete is a mixture of aggregate rock bound by cement that is produced from limestone and other minerals to form clinker via high-temperature heating (1,500°C). Fossil $CO_2$ from limestone is a necessary by-product of cement manufacture. However, more than half of the $CO_2$ emissions result from the energy required to drive the endothermic reaction, which typically is provided as diesel fuel or natural gas. Production sites are thus located within 150 km of limestone and mineral quarries. The resulting clinker can be stored long term and traded internationally.

Production requires high temperature and should operate 24/7 for economics. Conventional biomass as a clean fuel may not achieve sufficient temperature, carbon capture after use of natural gas as fuel can be expensive given the smaller-scale distributed production, and pipeline connections for $CO_2$ storage may be needed to obtain economies of scale.

Decarbonization may be enabled by use of distributed nuclear sources, concentrated solar power with energy storage and heat integration, synthetic diesel (which has high energy intensity), and also hydrogen (produced from nearby wind or solar) with storage to allow 24/7 operation. IOCs can evaluate systems options to select between these choices, as well as provide integrated deployment of supply chains for energy and materials. Given the cost of projects and infrastructure needs, government policy support is likely needed. The scale of 24/7 operation and need for integrated clean energy infrastructure and supply chains for both cement and steel make these markets potentially attractive for IOCs to provide services in CCS or hydrogen supply.

## Summary and conclusions

The core strengths IOCs have built up over decades are highly relevant to accelerating a net-zero transition in many markets of diverse energy consumers, especially where large projects and high energy density are needed. Two important aspects are crucial to understand in scaling an energy system of which instantaneous and intermittent primary energy sources likely form the largest fraction: the capacity factor of the production system and the power density of many consumers of energy. Renewable solar and wind energy from many geographical locations offer power density and capacity factors that are too low to meet consumer and industry needs. As such, decarbonization will suffer delays until affordable long-term (seasonal) storage and high–power density alternatives are available.

Chemical energy carriers such as hydrogen, ammonia, or methanol can provide affordable and high-power density energy to applications with low tolerance for inter-mittency, to service consumer markets that are farther away from the production of the primary energy resource. The role of molecular or chemical-dense energy carriers is not new. They are, in fact, nature's preferred way to store energy over seasonal timescales or longer, as well as to transport energy over longer distances. For those customers near primary clean energy production sites and requiring lower power densities, direct electrification is often the lowest-cost option, but storage is often needed and expensive, and (chemical) energy carriers can again provide a service.

Several clean routes to producing these chemical energy carriers are already possible to an extent using existing technologies in chemical industries. However, to scale up faster, more advances in electrochemical technologies and ensuing engineering of production systems based on such technologies are needed, in conjunction with infrastructure development. For example, efficient electrolysis including technologies at gigawatt scale is required, as well as lower-cost, DC-powered electronics. Renewable power with storage may be augmented via dispatchable power from advanced, small modular nuclear energy systems.

From a customer perspective, the increase in optionality and flexibility in both storage and transport using chemical carriers in concert with power transmission allows more demand-driven choices in energy, allowing multiple pathways to decarbonize processes and consumer markets. From a supply side, the production of chemical energy carriers is strategic for a net-zero emission system. Production of these carriers is in essence an extension of the current IOC business model, which thus also becomes more consumer centric. Consumers may opt for specific energy carriers balancing renewable resources to produce these versus alternative routes depending on trade-offs among security and affordability. To assess the viability of such potential choices more robustly, a comprehensive understanding of the underlying large-scale thermodynamics of a coupled climate and energy system would be in order. Emerging models would thus consider the climate system as a giant heat engine out of thermal equilibrium with striking new insights on the role of irreversible processes and their potential impact on energy production (79, 80).

IOCs' knowledge and expertise can thus be directed to accelerate flexible pathways to ramp up low-capacity renewable energy production systems to enable faster decarbonization of high–power density industries such as steel, cement, and base chemical products. Over time, the mix of energy resources may change as a result of different societal trade-offs in cost, energy security, and the environment and shift more to renewables, but this would not change the basic service or the need for chemical or molecular energy carriers. Areas of the world that allow low-cost generation of large-scale renewable or clean energy, including use of natural gas with CCS, can be integrated with manufacturing of energy-intensive products such as chemicals, steel, and cement and the synthesis of energy carriers for transport to the rest of the world.

Given the resounding global challenge of sustainable sourcing and delivery of future energy and chemical products and services, opportunities abound for IOCs to leverage existing competencies and deliver on stakeholder needs for energy, security, and the environment. To do so and accelerate the transition to net-zero emissions, IOCs must have bold vision and strong commitment to actively create and pursue attractive opportunities in decarbonization of the global energy system.

**Disclosure statement**
D.J.S. is Corporate Chief Scientist and Vice President for Research Strategy, Shell. J.B.P. is former Shell Chief Scientist – Chemical Engineering and is now Founding and Executive Director for the Energy Transition Institute at the University Houston, which is partially funded by Shell.

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# Meet the SPE London Board 2025

**The Society of Petroleum Engineers (SPE) is a not-for-profit professional association with more than 140,600 members in 144 countries engaged in oil and gas exploration and production. The SPE London board oversees SPE London activities, including evening programmes. Our various committees have specificocus, including Young Professionals,Women in Energy, Net Zero and associated student chapters. As well as engineers, we also welcome qualifications in geology, geophysics, earth science, environment, health and safety, mathematics, information technology, management and economics.**

The SPE London Board brings together a diverse group of professionals from operators, service companies, consultancy and academia. The team's expertise spans reservoir engineering, wells, consulting, CCUS and digital transformation, and it is united by a commitment to advancing knowledge, supporting members, and driving the energy transition through collaboration, education and community engagement.

## Chair

**Mehdi Alem** is a Reservoir Engineer at bp with experience across the North Sea, North Africa, and the Middle East. A graduate of Imperial College London (MSc) and UCL (MEng), he has been active in SPE for over eight years and is passionate about the role subsurface plays in building a sustainable energy future.

## Past Chair

**Adam Borushek** is a London-based Reservoir Engineer with 25 years of international experience.

As Principal Advisor at RISC, he supports clients on asset acquisitions, reserves reporting, and field management. A long-standing SPE leader, he is also active with SPEE and GESGB.

## Chair Elect

**Shwan Dizayee** is a Manager at Accenture, combining consulting expertise with hands-on petroleum engineering experience in Iraq and the UK. He helps energy companies bridge the digital gap, with a focus on downstream retail and unlocking value through technology.

## Treasurer

**Farid Hadiaman** is a Senior Wells Engineer at bp and previously worked with TotalEnergies, Petronas, and Maersk. With degrees from ITB and Robert Gordon University, he has been an SPE member for 20+ years, has published extensively, and is a proud recipient of an SPE Regional Award.

## SPE Review London Editor

**Elizaveta Poliakova** is a Senior Well Performance Engineer with subsurface background at Trident Energy. She studied Petroleum Engineering at Leeds (BSc) and Imperial College London (MSc) and has been involved with SPE for more than seven years. A former SPE London Chair, she previously led both the Imperial and Leeds student chapters.

## Net Zero

**Max Richards** is Group Business Development Manager at OPC, where he leads the energy transition practice and carbon storage projects.

He holds an MSc in Geoscience from UCL, where his research focused on $CO_2$ mineralisation in partnership with CarbFix and Aramco.

### Young Professionals Chair

**Yazir Mumtaz** is an experienced reservoir engineer who has worked with operators and in the service sector.

He is currently advancing CCS simulation projects while drawing on his background in production optimisation and mature oilfield development.

### Continuing Education

**Khaled Al Marei** is Principal Reservoir Engineer at Storegga, with 20 years of experience in reserves audits and CCS subsurface modelling.

He is passionate about professional development and supporting young geoscientists through education and mentoring.

**Alejandro Primera**
(more information coming soon)

**Frank Folorunso**
(more information coming soon)

**Hani Hamoud**
(more information coming soon)

### Inter-society

**Carolina Coll** is Head of Reservoir Development, CCS & Energy Storage, with more than 25 years of global experience.

She plays a leading role in international committees on reserves, CCUS, and energy storage, and has been a driving force in SPE initiatives.

**Malvika Nagarkoti** leads Global Brownfields Development for a major consultancy, with experience across Europe, Asia and Africa.

An MBA petroleum engineer, she thrives on finding efficient, practical solutions for mature assets.

### Programme Chair

**Andrew Mynors** is Business Development Manager at Geolog, bringing 30 years of upstream service experience.

After working in the North Sea, Middle East and Far East, he now focuses on geothermal, CCS, and lab-based solutions for global clients.

### Women in Energy Chair

**Isabel Asenjo** is a Senior Reservoir Engineer at Sasol with 13+ years of experience worldwide.

A long-time SPE volunteer, she now chairs Women in Energy, encouraging a more gender-balanced workforce.

She received the SPE London Outstanding Service Award in 2014.

### Communications

**Afrah Siddique** is an energy professional with 10+ years international experience in reservoir engineering, oil and gas, $CO_2$ sequestration, geothermal energy and hydrogen storage.

She holds an MSc in Petroleum Engineering from the Colorado School of Mines and has worked across the USA, UK and Middle East. Afrah is deeply committed to advancing the net-zero energy transition and brings this passion to her role on the SPE London Section board, and her contributions to several SPE committees.

### Students

**Omer Khoshnaw** is a Reservoir Engineer at INEOS, working on a gas asset in the UK Southern North Sea.

With a background in consultancy and training, he enjoys collaborating with teams and helping students connect with the industry.

### Sponsorship

**Phuc Truong** is an engineer with Perenco, passionate about solving upstream challenges from artificial lift to well interventions.

Having worked across four countries with Canadian, Japanese, and French operators, he thrives on tackling the complexities of ultra-mature fields.

### Social Chairs

**Clairet Guerra** is a Senior Geomechanics Engineer with SLB, now working as a product analyst in software and technology development.

With a strong interest in space exploration, she recently completed a degree in Space Resources to explore technology transfer from Earth to space.

**Joshua Kruger** is a Junior Petroleum Engineer at Perenco. He holds an MEng degree in Chemical Engineering from the University of Nottingham.

Joshua's technical interests are centred on well enhancement and production optimization, and he has already gained valuable early-career exposure to offshore well intervention operations in West Africa.

### Membership

**Arsenij Fiodorov** is an Imperial College MSc Petroleum Engineering graduate, eager to apply his skills and grow his career.

Known for his focus and initiative, he enjoys tackling complex problems with a practical mindset.

**Lester Clark** (more information coming soon)

## We need your innovative ideas!

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# SPE events calendar – local and international

## LOCAL – UK

### Ongoing through 2025–2026 (London, England)
### London SPE events

**Energy on Draft!**
Quarterly social evenings open to all experienced professionals and career starters within the energy industry. Come along to catch up with friends and make new connections over drinks!
**Tech Talks**
Monthly events on various topics of interest to industry professionals. Speakers include Distinguished Lecturers.
**Net Zero webinars:** Insights and more.
More information: **SPE London**

### May 20–21, 2026 (Aberdeen, UK)
### SPE Scale Symposium

The inorganic scale challenges within energy technologies are receiving more attention as these elements of the energy transition receive increased focus and so the committee are keen to hear about these industries challenges and solutions. This event offers an opportunity for you to share challenges and solutions to inorganic scale control management, from fundamental research to hands on experience of tackling such challenges in field applications within the energy sectors.
More information: **Workshop**

## INTERNATIONAL

### January 13–14, 2026 (Dubai UAE)
### IPTC Summit

This summit serves as a vital platform for fostering collaboration and innovation. It provides a unique opportunity to exchange knowledge, share best practices, and gain insights from industry leaders and technical experts.

Hosted in Dubai, a global hub for AI technologies and digital transformation, the event underscores the city's strategic role in advancing technology solutions for the energy industry.
More information: **Conference**

### February 03–05, 2026 (Texas, USA)
### 2026 SPE Hydraulic Fracturing Technology Conference and Exhibition

This event will convene industry pioneers from around the world to explore groundbreaking developments and best practices in hydraulic fracturing. It offers an unparalleled opportunity to connect with influential professionals, gain insights into emerging trends, explore the latest technologies on the exhibition floor and shape the trajectory of your career through exceptional networking opportunities.
More information: **SPE conference**

### February 03–05, 2025 (Kuwait City, Capital Governorate, KWT)
### Kuwait Oil and Gas Show

At a pivotal time for the sector, KOGS serves as a catalyst for energy transition, digital transformation and sustainable development, while safeguarding operational excellence and security of supply. Through five strategic panel sessions and a high-caliber technical program, KOGS 2026 will spotlight breakthrough innovations, national strategies, and global partnerships shaping tomorrow’s energy ecosystem.
More information: **Conference**

### February 18–20, 2025 (Louisiana, USA)
### The 2026 SPE International Conference and Exhibition on Formation Damage Control

The one aspect of the petroleum industry that has remained constant during decades of its pendulum existence has been the desire to optimize oil and gas production with minimum cost. This conference is an excellent venue to share your expertise, experience and knowledge through the exchange of ideas in technical and poster sessions, exhibitor presentations, panel discussions, and continuing education courses.
More information: **Conference**

**For a complete listing of all events on the SPE Global Events Calendar: spe.org/en/events/calendar/**
**And, for more information about SPE training courses, calls for papers, and opportunities for SPE London sponsorship: SPE London**

# 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 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.

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