SPE Review London July 2023

SPE Review London

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

London Section

Machine learning guide: Part 2

Also in this issue:

- C-Level Talks: Antony Maris
- Energy transition, digitilisation and networking
- SPE YP Sucess Stories NEW!
- SPE Coventry Student Chapter field trip – Norway
- Energy on Draft
- Bite size and beer –SPE London Net Zero Gaia
- News
- Events – local/international

SPE SECTION EXCELLENCE *** AWARD *** 2020

50 YEARS

LETTER FROM THE EDITOR and SPE LONDON CHAIR

SPE Review London

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ABOUT US

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

CONTACTS

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SPE encourages open and objective discussion of technical and professional subjects pertinent to the interests of the Society in its publications. Society publications shall contain no judgmental remarks or opinions as to the technical competence, personal character, or motivations of any individual, company, or group. Any material which, in the publisher's opinion, does not meet the standards for objectivity, pertinence, and professional tone will be returned to the contributor with a request for revision before publication.

SPE SECTION EXCELLENCE *** AWARD *** 2020

In this issue

FEATURES

Photo credit: Unsplash

Behind the Scenes: SPE Review Editorial Board

Elizaveta Poliakova, Editor in Chief

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

Elizaveta has been with SPE for more than seven years. She was the President of SPE Imperial College Chapter and the President of SPE Leeds Chapter. Previously, she was also on the committee of SPE YP.

Ffion Llwyd-Jones

Ffion is a business editor and writer. She has extensive experience in writing and editing (digital and print), with international experience in technology, health, automotive and the environment.

Mark Beleski

Mark is an experienced engineer, with deep understanding of industry practices, trends and challenges. He is an Energy Loss Adjuster with AqualisBraemar, in London.

Shalom Amakhabi, Editorial volunteer

Shalom is a graduate gas transmission engineer with National Grid Gas Transmission and metering. She has an MSc in Petroleum Engineering from Imperial College London and a BEng in Petroleum and gas engineering from the Nile University of Nigeria. She has been an SPE member for 5+ years.

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

Letter from the Editor and SPE London Chair

Dear SPE London Members and colleagues,

Welcome to the May-July 2023 publication of SPE London Review. In this issue, we are excited to present a variety of captivating content about the latest events within SPE London and knowledge exchange within our industry.

Starting on **page 7**, we have the honor of featuring 'C-Level Talks' with **Antony Moris**, Chief Executive Officer at **Hurricane Energy**, highlighting Antony's success story.

Page 10 takes us on an exciting journey as we join the **SPE Coventry Student Chapter's Field trip to Norway**. Explore the trips to Northern Light Project in Oygarden, Halliburton Upper Completion facility in Tananger, Ulrigg Drilling facility in Stavanger, Halliburton multilateral workshop in Bergen and Norwegian Petroleum Museum in Stavanger together with us.

For those eager to join our community, don't miss the opportunities on **page 12** highlighting volunteering initiatives with SPE London. **Get involved and make a positive impact** together with us!

On **page 13**, we are thrilled to introduce **a new feature** that highlights the remarkable success stories of young professionals in the industry. Learn from the experiences of **Nihal Mounir Darraj**, Researcher at Imperial College London, with rich volunteering background within and outside of SPE! **If you would like to share your story with us – please get in touch!**

Page 15 offers a delightful flashback of our first '**Bite size and beer social event**' organised by SPE London Net Zero Gaia Committee. Savor the memories through captivating photos!

Join us in reminiscing the joyous moments through an array of photographs on **page 17** from the latest '**Energy on Draft**' event.

For those keen on expanding their knowledge, turn to **page 18** for the second part of '**Machine Learning Guide for Energy Professionals**'. Advance your expertise together with SPE!

Lastly, on **page 24**, don't miss the comprehensive summary of **upcoming SPE events**. Stay up-to-date with the activities of our society.

As always, I encourage you to share your thoughts, feedback, and suggestions with us. Enjoy reading the latest edition of the SPE London Review!

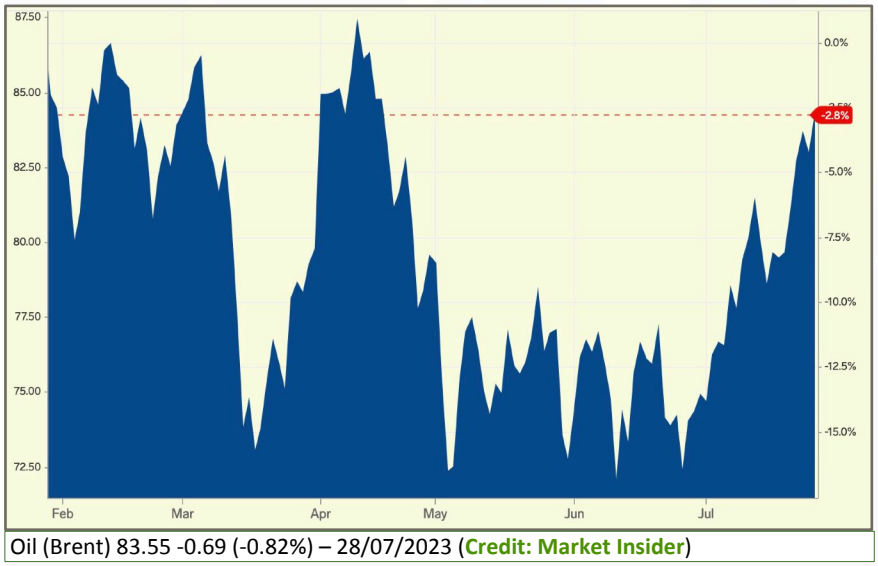
Sincerely Yours,
Elizaveta Poliakova

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

Double Recoverable
Hydrocarbon volumes in recent Shell's discovery in the North Sea Initial resource expectations of the recent Shell's North Sea discovery (Pensacola Project) have almost doubled following the post-well analysis. Shell (65%) operates Pensacola together with Deltic Energy (30%) and ONE-Dyas (5%) as its partners.
Read more

Afentra Plc to increase stake in two Angolian offshore blocks
In agreement with Azule Energy Angola production, Afentra Plc will buy an additional 12% interest in Block 3/05 and a 16% interest in Block 3/05A offshore Angola.
The company highlights that the acquisition offers exposure to significant production optimisation opportunities with long-term and low-cost production base line.
Read more

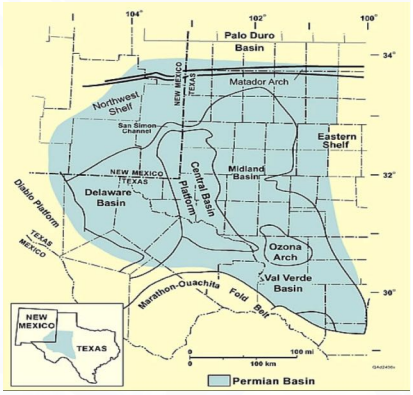
Central North Sea Hydrocarbon Discovery Announced by Ithaca Energy
Ithaca Energy discovery, K2 prospect, is located Block 22/14c of the Central North Sea on the UK Continental Shelf.
Hydrocarbons were identified in the 45ft net thickness reservoir rock during drilling the Forties Member Sandstone. Ithaca operates the prospect together with its joint venture partner, Dana Petroleum.
Read more
And here



Oil (Brent) 83.55 -0.69 (-0.82%) – 28/07/2023 (**Credit: Market Insider**)

BP to supply LNG to Europe for the next 10 years
BP has signed a ten-year sale and purchase agreement with OMV to supply 1 million tonnes of LGN to Europe. LGN will be received and re-gasified in Rotterdam through the Gate LNG Terminal.
Read more

Increased Growth



Chevron Corp and ExxonMobil Corp are both on course to grow production by 10% this year in the Permian basin in Mexico, USA. Taken together, the two companies' production (Chevron increased output to 772,000 bbl and Exxon produced around 620,000 bpd in the second quarter) makes up nearly a quarter of the world's largest shale basin.
Both companies have a goal of accelerating production to more than 1mm bpd before 2030.
Read more

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

SPE Policy on AI-Generated Content in Publications

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

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

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

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

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

Userba011d64_201/Getty Images/iStockphoto

Safeguarding people and the environment are key principles in guiding future industry contributions

Antony Maris is the Chief Executive Officer at Hurricane Energy, which was acquired in June 2023 by The Prax Group in the United Kingdom.
Antony is a professional executive with a strong management, commercial, technical and operational background in drilling, reservoir, development and production engineering. He also has an in-depth knowledge of company and asset strategy formulation, asset and portfolio management, contract strategy, economic evaluation, commercial negotiation and legal issues associated with the E&P business. He was awarded the Friendship Order Medal by the Vietnam Government for significant contribution to the exploitation, exploration and production activities.

Who is Antony Maris? Please tell us about yourself.
Norfolk born and with Dutch family connections, I am a product of what might be called an "oilfield education". My father left the family market gardening business and joined the energy industry when I was very young and we moved location, and schools, many times. I worked on drilling rigs before and during my B.Sc. (Eng) in Petroleum Engineering, and I have an MBA. My partner is also from the industry, and we have two grown up daughters, the youngest with cystic fibrosis.

With now nearly 40 years of upstream and midstream experience, both with Majors and smaller independents, over the years I have been fortunate enough to work alongside and learn from some of the best individuals in the business, while working in just about every department the upstream energy industry has to offer.

Or, as my CV says, I have a strong management, commercial, technical and operational background in drilling, reservoir, development and production engineering together with an in-depth knowledge of company and asset strategy formulation, asset and portfolio management, contract strategy, economic evaluation, commercial negotiation and legal issues associated with the E&P business.

You were awarded the Friendship Order Medal by the Vietnam Government for your significant contribution to exploration and production activities. Could you tell us more about this time as Chief Operating Officer with Pharos Energy?
My first trips to Vietnam were as a joint venture partner representative. After a short spell as General Manager of the Joint Operating Company, I used my frequent visits to work with the Vietnamese and Thai partners in a consensual or "no-cap-badge" approach, to encourage a joint vision of delivering value and success, taking into account cultural differences.

The reservoirs we worked on were either fractured basement or highly layered thin and faulted sandstones, and therefore complex, challenging and difficult to interpret, model, develop and produce. Being able to work with and talk to each department in its own technical and commercial language helped pull together and deliver – on time and on budget – two development projects that enabled SOCO (now Pharos Energy) to become one of the largest oil producers in Vietnam.

Encouraging all parties to believe in and deliver a single goal was challenging and rewarding. Being recognised for helping Vietnam and its people benefit from their resources was both a humbling and proud moment.

What were your biggest challenges while working as COO in Vietnam and Yemen?
The operating model we chose at SOCO was to work as a very small team, utilising consultants as and when required. While Vietnam and Yemen were different, with state companies in Vietnam and energy majors in Yemen, the principle was the same. We had to be more aware technically, more astute commercially, and the SOCO team trusted in the judgements and abilities of each other.

The greatest challenges were making sure we were all on top of the technical and commercial issues, making sure we were all confident in our solutions and then staying calm as we executed the plan and delivered the results. We were not always in the

Safeguarding people ... continued

same county and although video conferencing is easy now, then it was long phone calls or long flights.

Keeping everyone believing in and focussed on solutions that worked for all participants had its moments, both of frustration and of joy.

As former COO of Pharos Energy, what were your best strategies to balancing short-term financial goals with long-term development strategies? Did you use different approaches/strategies from country to country?

We would all love to have a balanced asset portfolio with each having a life cycle in sync to deliver a nice smooth return, but balancing a company's short, medium and long-term requirements is an enormous challenge. The cyclical nature of oil and gas prices, long investment timings and near-term shareholder return requirements are not straightforward.

What works best is probably more asset-specific than anything else. Each country is different but, regardless of which country it was, we focussed on the assets and what could be the best solution to maximise the value of that asset for both country and company.

At a company level, we worked on growing the value of the company rather than its size, having a balance between current production and future growth, but also returning cash to shareholders so future investments were challenged in the same way.

As former Chief Executive Officer at Hurricane Energy, you went through some rapid transitions before the acquisition by the Prax Group. What have you learned from this process?

The team delivered an on time/on budget project in a harsh environment, West of Shetlands – a tremendous success for a small company.

Unfortunately, a combination of external influences, such as COVID and an oil price crash, did not help. Shareholders, debt holders, the regulator and other stakeholders had all bought in on a vision that no longer existed. Each had their own view on the causes, the solutions and the route to delivery – each was different, and all were certain of their own view!

As a team, we developed alternative plans that ran in parallel with investment in the field, corporate growth and shareholder return. It was a testament to the team's professionalism and commitment that we were able to demonstrate to the industry, and potential new investors, delivery on all these key areas, despite the challenges from outside the company. The acquisition by the Prax Group, who recognised the value of the team as well as the asset, was a natural progression for the company to create unique opportunities for synergies with existing Prax-owned assets.

What did I learn?

Getting a deep understanding of your assets is key to laying a foundation for what is possible going forward. A CEO can sometimes feel isolated. Having family, colleagues and mentors whose challenge you respect and judgement you trust is a great help in getting things straight in your own mind, and giving belief that you have made the right decisions, for the right reasons.

With more than 35 years of experience in various engineering, commercial and management roles, what have been the greatest changes you've seen in the industry?

The expanding environments and cyclical nature of oil and gas prices have, over the years, brought great political, technical, operational and environmental challenges but with them, great innovations. I have worked with teams and taken on projects that are deeper, hotter and further away, but, most importantly, made them safer, cleaner and more efficient, adopting new technologies and applying them in different areas. Computing technology is definitely one of the greatest changes I have seen, as is better regulation and greater knowledge sharing (as we do in the SPE).

Regardless, despite all the changes, one consistent factor has remained. Without the dedication and commitment of the people within the industry over the years, the improvements in safety, environment and performance would not have happened. My experience tells me that if you get good people together, use them in the right way, and focus on the right outcomes then whatever the challenges, they deliver great outcomes.

Looking to the future, what do you consider the most important steps in reducing the carbon intensity of oil and gas developments?

Safeguarding people ... continued

Early in my career, I worked for and with a group of people who wanted to improve the reputation of the industry by reducing the impact we left behind. It was a good lesson to learn, and I believe that the vast majority of us in the industry think along those lines and look at any project with that, and safety, as underlying principles.

At the moment, oil and gas, and related products, are a fundamental part of our society. Eventually there will be other products that do the same job but, in the meantime, having the safety of people and of the environment as absolute key principles will help our industry contribute what and where it can.

At Prax, for example, the Group's aim is to provide the highest standards in products and services, by managing activities to minimise, wherever practicable, their effect on the environment. In this, we are committed at all levels and within all functions of the Prax Group to continual improvement.

What career advice would you give to oil and gas professionals about navigating the energy transition?

The best suggestions I can make are:

1. **Be open to ideas and thoughts**. You never know where, or from whom, a good idea might come.
2. **Listen**. There are different views and ways of achieving the same thing, but the key is finding the one that works best.
3. **Contribute**. Offer positive alternatives. You may have to execute a programme you do not agree with, and it is not always your decision or choice. However, if you do not say anything, the chance to do it in a better way is lost.
4. **Be honest**. We all make mistakes, and we tend to learn more from them, than from successes.
5. **Talk and trust**. Having people externally or in your team you can talk to, whose judgment you trust, helps work things out and often keeps you sane as well!

Elevate the volunteer experience: be the driving force with your ideas!

Volunteer with the e-magazine most eagerly anticipated by SPE London members.

SPE Review London welcomes your ideas for captivating content! Do you have great ideas for fascinating oil & gas features? Or perhaps compelling news stories, specifically highlighting the accomplishments of the industry professionals like yourself?

Share your brilliance and make an impact today. Everyone is welcome – from students to experienced professionals! You'll hone essential skills, get the chance to chat with C-Level industry executives, and be an essential team member with an innovative digital publication.

If you're a young professional engineer, we need your help to make the SPE Review London even better. Are you up for the challenge? Contact Elizaveta Poliakova: elizaveta_poliakova@outlook.com

Contributing to understanding and future endeavours

The field trip to Norway was organised by The SPE Coventry Chapter for Coventry University's MSc Oil & Gas Engineering and Management students, from 8-13 May 2023.

The trip included visits to various sites and facilities related to the oil and gas industry, providing valuable insights into the latest advancements and projects in the field.

Northern Light Project in Oygarden (May 9)

Northern Light Project CO^2 Buffer Tank

This joint venture between Equinor, Shell, and TotalEnergies, with its objective being the storage of liquid CO^2 in an offshore reservoir, which is obtained from different industries such as cement plants, refineries, steel plants, and waste plants. After temporarily stored in tanks of buffer solutions, the liquid CO^2 is pumped through a 100km pipeline for permanent storage in a 2800m deep saline aquifer.

Northern Light Project offices

The first phase of the project is set to begin in the fall of 2024, aiming to store 1.5 million tons of CO^2. A commercial agreement has been signed with Yara.

The second phase involves project expansion through drilling more wells and installing additional pipelines, with the potential to store 6-7 million tons of CO^2. Shipping constitutes the major source of project emissions accounting for only 2% of the stored CO^2 emissions.

The Halliburton Upper Completion facility in Tananger (May 10)

This facility serves as a workshop for testing and evaluating Halliburton's smart completion equipment, including valves, sensors, direct hydraulics with Accupulse, Opsis gauges, and the LinX monitoring system. We had the opportunity to view the Halliburton Completion kits and gain insights into their functionality and applications.

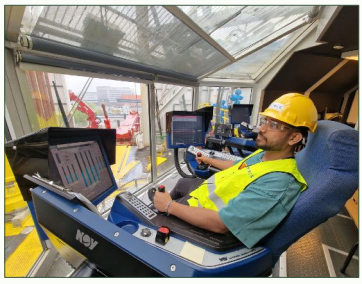
The Ulrigg Drilling Facility in Stavanger (May 11)

Derrick at the Ulrigg Drilling Facility

The Ulrigg Drilling Facility is purpose-built for conducting tests on drilling various types of wells, including the complex process of multilateral drilling.

The rig comprises various components such as the derrick, rotary table, standpipes, drill pipes, BOP stack, control rooms, and driller rooms.

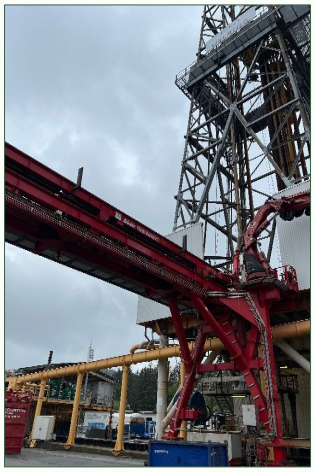
The circulation systems are two mud pumps, mud pits, and mud tanks.



Ulrigg Drilling Facility control room

This visit provided us with hands-on experience and a deeper understanding of the drilling processes involved.

Contributing to understanding and future endeavours... continued


Another derrick at the Ulrigg Drilling Facility


Ulrigg Drilling Facility


Mud pumps at the Ulrigg Drilling Facility

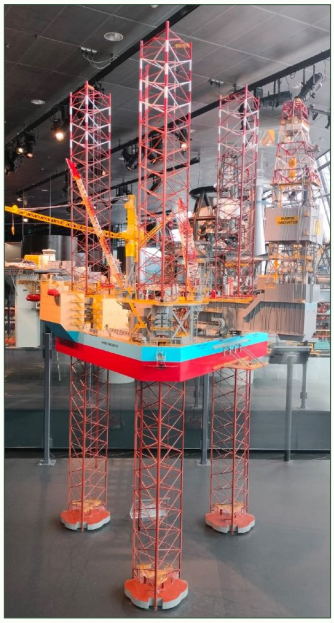
Halliburton multilateral workshop in Bryne (May 11)

The workshop featured a presentation covering different types and classifications of multilateral drilling equipment, along with the associated benefits and procedures of multilateral drilling.

The students had the opportunity to observe various Halliburton multilateral drilling equipment, including whipstocks, millers, deflectors, and multilateral junctions.

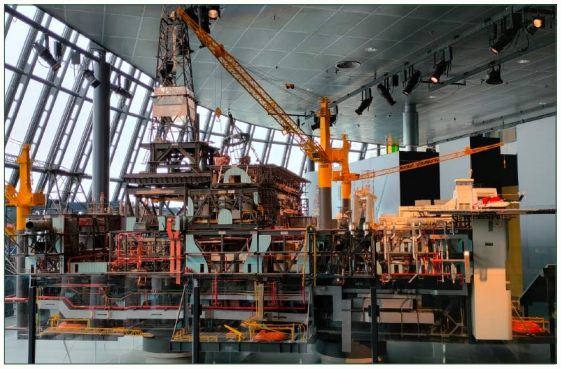
The Norwegian Petroleum Museum in Stavanger (May 12)

The museum exhibits the history of Norway's oil and gas exploration and industry.


Offshore oil rig model at the Norwegian Petroleum Museum

It provides insights into major oil and gas accidents throughout history, along with technological advancements in the industry over the years.

Additionally, the museum highlighted the current oil and gas fields in the North Sea and Europe's gas pipeline network, and featured displays of drilling equipment used in the past.


Another offshore oil rig model at the Norwegian Petroleum Museum

Overall, the Norway field trip was an enriching experience. It offered valuable insights into ongoing projects, cutting-edge equipment, and the historical context of the Norwegian oil and gas industry.

The knowledge gained from these visits will undoubtedly contribute to our understanding and future endeavors in the field of oil and gas engineering.


The Christmas Tree at the Norwegian Petroleum Museum

In these challenging times it is more important than ever that SPE members continue to inspire and support each other locally, regionally, and globally.

SPE has evolved to provide unparalleled insights, shared expertise, life-long learning and community strength to fuel the success of our members and the future of the industry. As a member, you are part of that!

Renew your 2022/2023 SPE membership to keep your valuable member benefits.

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Renew your membership today

Future success: Learning new technologies, sharing ideas, and developing empathy and understanding

Nihal Mounir Darraj is a full-time CCS researcher at Imperial College London, working on carbon capture and storage.

Her academic background includes an MSc in Petroleum Engineering from Imperial College London and a BA in Natural Gas and Petroleum Engineering from Alexandria University in Egypt.

Who is Nihal Mounir Darraj? Please tell us what inspires you?
Prior to pursuing my MSc, I worked as a reservoir geomechanics engineer for seven years. Additionally, I have been a volunteer with SPE for over 12 years locally, regionally, and internationally. Whether through my research or volunteering activities, I am inspired to wake up every morning and contribute towards a positive impact in the world while pursuing my passion.

You have received many honours and awards. How did you feel on being awarded the Giovanni Paccaloni Young Professional Service Award 2022?
I was excited and pleasantly surprised to receive this recognition. This award motivates me to continue my service and contributions to SPE, the profession, and the community. Additionally, I highly appreciate my SPE colleagues who nominated me and helped support my nomination. It truly shows how strong the SPE community is in supporting, uplifting, and advocating for each other in various aspects of life, including personal and professional relationships.

How do you believe your volunteering experience has helped you become a better leader in your professional life?
Getting the opportunity to start and lead international teams at a young age was a life-changing experience for me. I helped start the Women in Energy (now known as D&I) committee back in 2016 and chairing it for 3 years after was great! A year after that I have had the opportunity to lead young members engagement committee (YMEC) looking after 60% of SPE membership.

Doing this allowed me to build on my communication skills as my work involved working with people from diverse backgrounds and cultures, develop my teamwork skills to accomplish a common goal, strengthen my problem-solving skills as we were always exposed to new challenges and problems that require creative solutions, and finally, building empathy to be able to understand peoples' struggles and needs to inspire and motivate my team.

SPE Women in Energy Session, Cairo, Egypt. Steering Committee co-chair and main host. With Egyptian Minister of Petroleum and Mineral Resources Eng.Tarek El-Molla.

What advice would you give to your younger self? Would you do anything differently?
Surprisingly, I wouldn't change a thing! Every failure or mishap I have had taught me a great deal of things and shaped who I am today. Coming to this realisation took me a long time! Failure is a part of life, and it can provide valuable lessons and opportunities for growth. Don't be discouraged by setbacks, but instead, learn from them and use them as motivation to try again, at least now you know that the previous approach won't work.

You have had more than 17 volunteering roles – how important is volunteering to young professionals in the oil&gas industry? What are the benefits of volunteering?
In an industry as dynamic as oil and gas you will need to have the edge, the knowledge, the interpersonal skills, and to stay up to date. SPE – among other membership societies – provides this for students as well as young professionals.

Moreover, a very important success factor in our industry is networking – volunteering helps young professionals build their professional network by connecting with other volunteers and leaders in the industry. This can lead to new job

Future success ... continued

opportunities, mentorship, skills development, and professional growth.

What are the three most important things that young oil&gas professionals need to do to be successful in today's competitive world?

1. Consistently seek opportunities for learning and skill development:
The industry is changing rapidly, and to stay competitive, you should be willing to learn and adapt to new technologies, ideas, and ways of working.

This ensures you stay relevant with a competitive advantage in the job market.

2. Build a strong professional network:
Building a strong professional network can help in finding opportunities, gaining insights into industry trends and best practices, and access mentorship and guidance.

3. Build a personal brand:
When your area of expertise is discussed, your name should be listed among the people mentioned.

Even if you have a diverse experience, it is very important to create a clear and consistent image or perception of yourself that reflects your values, skills, and expertise.

Offshore Europe, Inspire program in Aberdeen, Scotland.
Committee member and Guest Speaker on inspire program held alongside the Offshore Europe Conference.

Bite size (and beer) discussions and networking

There were lively discussions on energy transition subjects ranging from geothermal, to CCUS to lithium extraction at the SPE London's Energy Transition Bite-Size and Beer networking event in June.

Computer Modelling Group Ltd. (CMG) were sponsors for the evening, and **Susan Fellows** of CMG provided some talking points around how their software could be used to model these aspects of the transition. The attendees enjoyed the event and found it useful, so we hope to make these a regular feature of our programme.

Thanks to Susan, and to organisers Alison Isherwood and Max Richards.

Energy Transition Bite-Size and Beer is a networking event for those interested in the Energy Transition and Net Zero. Each event will have a short talk or poster presentation from a company or group working in the Energy Transition space. This is a great opportunity for industry professionals to connect.

Watch out for e-mails and LinkedIn posts for our next event!

SPE London section sponsorship opportunities

The SPE International London Section (SPE London) is a not-for-profit technical organisation. Its main purpose is the support of SPE International's mission and vision statement. In fulfilling this purpose, SPE London provides a diverse range of technical and non-technical events to its broad membership base and to non-members.
Strong industry support allows SPE London to fulfil its purpose.

SPE is a well-recognised brand within the broader energy industry, and businesses can leverage their support through many communication channels.

- The section's digital platforms, monthly and Special Interest Groups (SIG) events offer visibility to the association's wide audience of members and non-members.
- Supporting business logos are prominently displayed on the SPE London section website, in the bi-monthly e-magazine (*SPE Review London*), and during SIG events and monthly evening meetings.
- By partnering on shared topics of interest, a business can demonstrate its commitment to Social and Corporate Responsibility (CSR).
- The section offers complimentary access to all live monthly evening and continuing education events, with 4 tickets per £1,000 of financial or equivalent support.

Ways in which your business can support SPE London

- **Traditional direct financial contributions**, which start at £1,000 and are generally of 12-months' duration from January to December.
- **Supporting a specific evening lecture program** is £500, and is offered when a business is presenting at the event or wants to be associated with a particular topic or theme.
- **Special Interest Groups (SIG's)** offer an opportunity to partner on specific industry themes. Support can be for venue/ hosting and may also include promotional materials and 3rd party services.

Key contacts – for more information about how your business can support SPE London

Annual Sponsorship and specific evening lecture support:
Sponsorship Chair, Adrian Southworth, oleumventures@icloud.com

Special Interest Groups

- **Net Zero**: Barny Brennan, *barny.brennan@gmail.com*
- **Diversity and Inclusion**: Isabel Asenjo, *Isabel.Asenjo@eu.sasol.com*
- **Continuing Education**: Adam Borushek, *Adam.Borushek@riscadvisory.com*
- **Young Professionals**: Samad Ali, *sali72@slb.com*
- **Arkwright Engineering Scholarship**: Adrian Southworth, *oleumventures@icloud.com*
- **Digital Transformation**: Ragab Gadrbough, *Raghd.Gadrbouh@cgg.com*

Energy on Draft – making connections

The second (for 2023) **Energy on Draft social event** earlier this year provided a great opportunity to meet like-minded professionals within the industry.

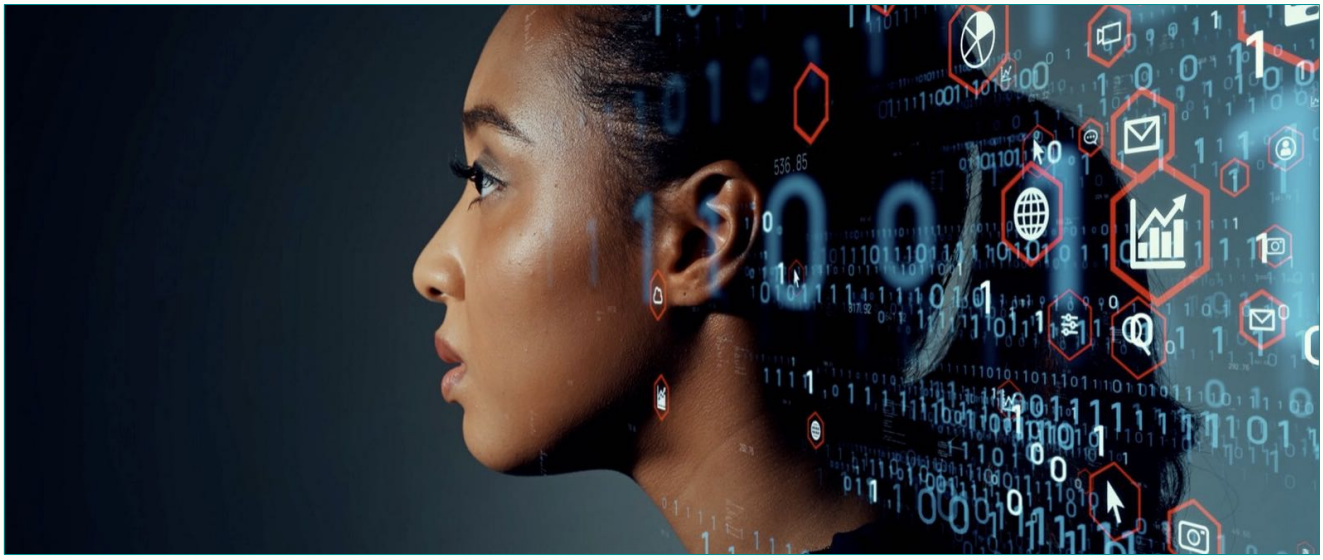
Jointly organised by SPE London, PESGB, EAGE, iChemE and AAPG, the early-evening event was at The Thirsty Bear in Waterloo, London. The group enjoyed some drinks, made new connections and caught up with old friends.

Energy on Draft events are for people starting off in the industry and for experienced industry professionals, offering the opportunity to network with a diverse group of professionals in engineering, geoscience, finance, and business development.

Machine Learning Guide for Petroleum Professionals: Part 2

This is the second part of a four-part series focused on addressing the implementation of AI in the petroleum industry using a real case study.

Written and illustrated by Saif Ur Rehman, this article was first published (February 2023) in *The Way Ahead*, which is written by and for young professionals in oil and gas, covering career development, along with business and technology.



In Part 2, we dive deep into nonlinear activation functions and understand why we need these functions. metamorworks/Getty Images/

I am glad to have you back. In Part 1, we explored the linear regression model having a linear activation function. In Part 2, we will dive deep into nonlinear activation functions and understand why we need these functions. By the time you complete this and Part 1, you will have a background to understand deep learning from scratch, which will be presented in Part 3 of this series. Let's begin.

Previously we covered the linear activation function, $\hat{y} = wx + b$, which can only predict linear correlations while performing poorly when applied to nonlinear functions. That's why we need nonlinear activation functions which help machine learning models to fit complex and real-world data.

Before delving deeper into the different types of activation functions, it's important to note that in Part 1, we discussed linear regression models with one layer, as illustrated in **Fig. 1**.

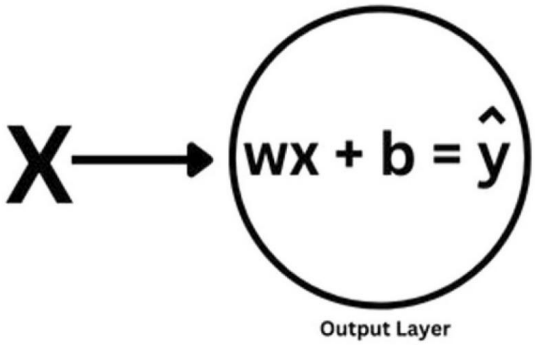


Fig. 1—Linear regression model. All images by author.

Machine Learning Guide ... continued

This model has input *X* and its corresponding output layer. A circle denotes a neuron, and a single circle means a single neuron. Here, $\hat{y}$ is the output of the last layer (final output). However, when we have hidden layers (layers between input and output), it's important to understand the notation used to represent multiple hidden layers. In a model with multiple hidden layers, the output from the first hidden layer is denoted by *a1*, which then becomes the input to the second hidden layer. Similarly, the output from the second hidden layer is denoted by *a2*, which then becomes the input to the third hidden layer, and so on. The output from the last layer is the final output and is denoted by $\hat{y}$ (**Fig. 2**).

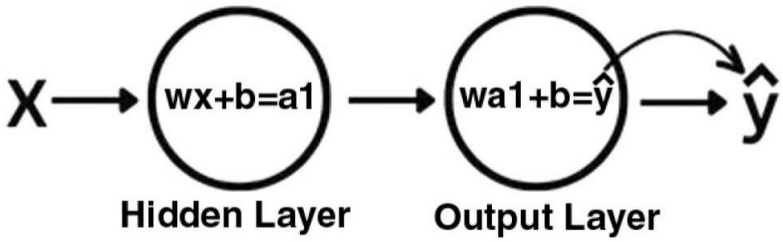


Fig. 2—One hidden layer model.

Additionally, we previously denoted a linear activation function with $\hat{y}$ ($\hat{y} = wx + b$), but now we are replacing it with *z* ($z = wx + b$). We combine this linear activation function with a nonlinear version, denoted by *g(z)*, read as *g* of *z*. Here, *g* represents the nonlinear activation function and *z* represents the linear activation function. This combination results in the output, denoted by *a* (specifically, *a*1, *a*2, *a*3, etc., according to its corresponding hidden layer). That's a lot of new things to take in. To summarize, the new notations introduced in this section are:

z is the output of the linear activation function.

g is any nonlinear activation function (discussed below).

g(z) is the output after the nonlinear activation function is applied to (or combined with) the linear activation function.

a(n) is the output of a particular nth hidden layer. Mathematically, it is a = g(z).

$\hat{y}$ is the final output (output of the last layer).

We will discuss this in more detail in Part 3. For now, take a moment to visualize **Fig. 3** and familiarize yourself with the concept of multiple hidden layers.

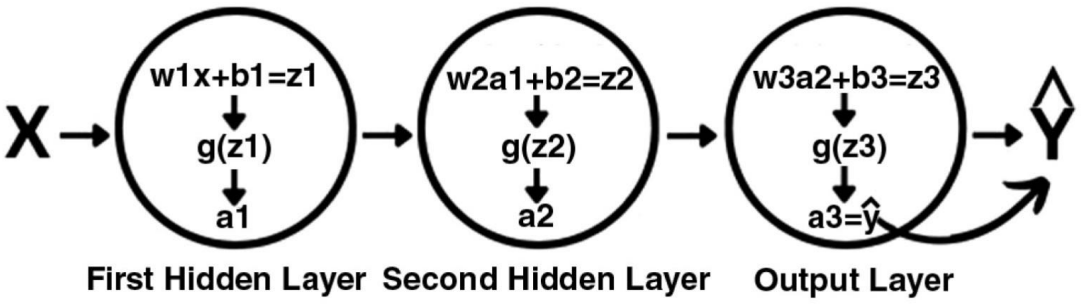


Fig. 3—Two hidden layer model.

Machine Learning Guide ... continued

With a solid understanding of the notation used in machine learning, it is now time to explore the various types of activation functions and understand when to use each one. Activation functions play a crucial role in machine learning by introducing nonlinearity, allowing the model to fit complex, real-world data. In this section, we will take a closer look at several popular activation functions and examine their unique properties and suitability for different types of data and model architectures.

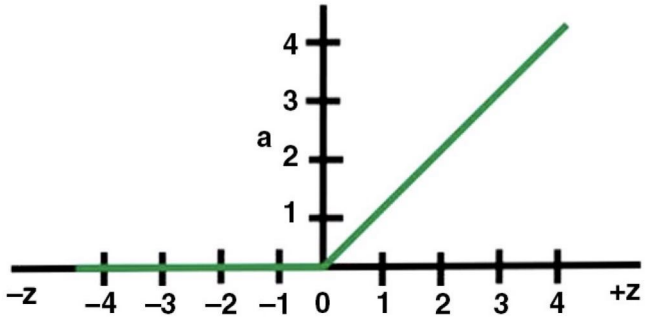


Fig. 4— ReLU activation function.

In **Fig. 4**, we can see that for zero and all the negative values of *z*, the output *g(z)*, or *a*, is equal to zero (nonlinear) and for all positive values of *z*, *g(z)*, or *a*, is equal to the value of *z* (linear function). This combination makes it suitable for fitting nonlinear functions. Therefore, if we are certain that our final output, $\hat{y}$, cannot be negative, ReLU is a great choice. Mathematically, it can be represented as:

$$a = g(z) = \max(0, z)$$

Leaky ReLU Activation Function

Leaky ReLU (LReLU) activation function is an improved version of the ReLU activation function. It differs from ReLU in that instead of setting all negative values to zero, a small slope value is used to maintain some information from negative inputs. This is represented in **Fig. 5**.

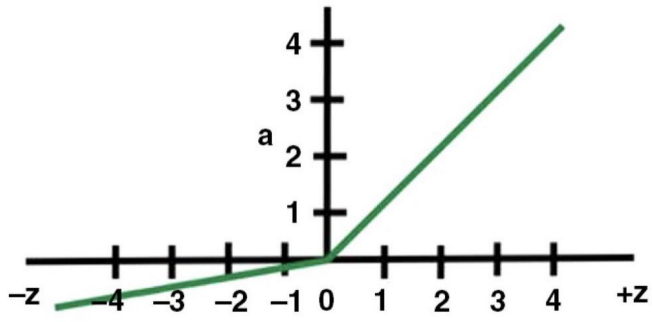


Fig. 5—Leaky Relu activation function.

The mathematical representation of LReLU is defined as follows:

$$a = g(z) = \max(\alpha z, z)$$

Where α is a small slope parameter, typically set to 0.01. This makes LReLU a suitable choice when the output of a function can be positive, zero, or have small negative values.

Machine Learning Guide ... continued

Tanh Activation Function

Tanh activation function (also known as a hyperbolic tangent function) is commonly used when the output range is -1 and +1. It produces an S-shaped curve, as can be seen in **Fig. 6**.

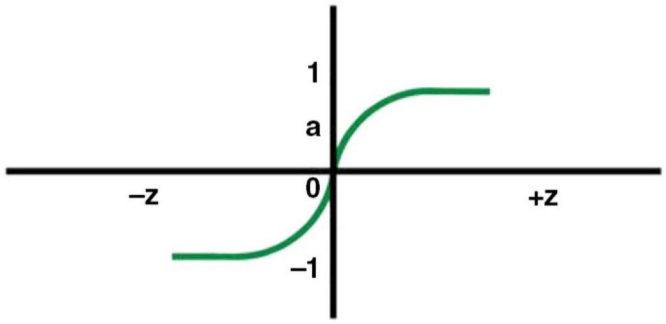


Fig. 6—Tanh activation function.

Mathematically, it is defined as:

$$a = g(z) = \frac{e^z - e^{-z}}{e^z + e^{-z}}$$

Here, *z* is a linear function equal to *wx* + *b*, and e^z can be written as *e* (*wx*+*b*). For large values of *z*, such as 10, *ez* (e^{10}) will be a very large number and e^{-z} (e^{-10}) will be a very small number. This means the numerator and denominator will be approximately equal, resulting in a final value of 1. Similarly, for small values of *z*, such as -10, the final result will be -1.

Sigmoid Activation Function

Sigmoid activation function, also known as logistic function, is used for binary classification (logistic regression problems). Its output is the probability, range from 0 to 1, and, like Tanh, it is an S-shaped curve (**Fig. 7**).

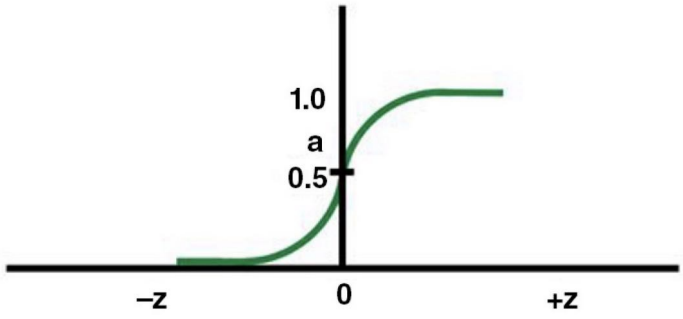


Fig. 7—Sigmoid activation function.

Mathematically, it is:

$$a = g(z) = \frac{1}{1+e^{-z}}$$

When the input value, *z*, is a large number such as 10, the value of e^{-z} becomes very small (0.000045), making the denominator approximately equal to 1, resulting in a final output of 1. On the other hand, when the input value is a small number, such as -10, the value of becomes very large (22026.46), making the denominator a

Machine Learning Guide ... continued

very large number, resulting in a final output close to 0. At $z = 0$, the output is 0.5. To use the sigmoid function for binary classification, we can set a threshold such that values equal to or greater than 0.5 are classified as one class (for example, oil), and values less than 0.5 are classified as the other class (for example, gas).

Softmax Activation Function

Softmax function, also referred to as multiclass logistic regression, is used for multiclass classification problems where we need to predict more than two classes. It is designed to provide the probability of each category, where the sum of the probabilities for all categories equals 1. Similar to sigmoid, the output range of the softmax function is from 0 to 1, and it is visually represented as a curve that maps the input values to the probabilities of each category, as shown in **Fig. 8**.

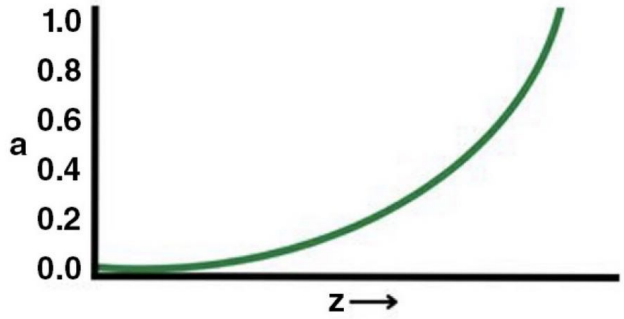


Fig. 8—Softmax activation function.

Mathematically, it is:

$$a = g(z) = \frac{e^{zi}}{\Sigma e^{zj}}$$

Where *zi* is the *i*-th element of the vector *z* and the denominator is the sum of the exponential of all the elements of the vector *z*. This equation ensures that the sum of the output is equal to 1 and each output is between 0 and 1, which can be interpreted as a probability of each class. The class with the highest probability can be selected as the prediction.

For example, for three classes, we have:

$$a1 = g(z1) = \frac{e^{z1}}{e^{z1} + e^{z2} + e^{z3}}$$

$$a2 = g(z2) = \frac{e^{z2}}{e^{z1} + e^{z2} + e^{z3}}$$

$$a3 = g(z3) = \frac{e^{z3}}{e^{z1} + e^{z2} + e^{z3}}$$

Let's say *a1* is oil, *a2* is gas, and *a3* is water and we calculated the values as *a1* = 0.2, *a2* = 0.25, and *a3* = 0.55 for a specific region. In this case, *a3* has the largest value, so that region is water.

Conclusion and Key Takeaways

This concludes our discussion of the five commonly used activation functions. While there are other activation functions, these five are the most widely used. When choosing an activation function for your model, it is important to consider the specific requirements of your problem and the properties of the

Machine Learning Guide ... continued

different functions. Consider the following.

For the output layer:

If you have a binary classification problem, use a sigmoid activation function.

If your problem involves multiclass classification, use the softmax activation function.

For outputs that are zero or positive, use the ReLU or linear activation function.

For outputs that can be negative, zero, or positive, use the Leaky ReLU or linear activation function.

If the output ranges from -1 to +1, use the Tanh activation function.

For hidden layers:
ReLU and variants of ReLU (such as Leaky ReLU) are the most commonly used activation functions. These activation functions have the advantage of being computationally efficient and easy to train. Tanh and sigmoid functions are also sometimes used in hidden layers, although they are less common as they can make the training process slow and difficult.

In Part 3 of our machine learning journey, we will delve into the mathematical concepts behind deep learning, such as artificial neural networks.

See you there!

Saif Ur Rehman
Saif Ur Rehman is a deep learning mentor volunteer at DeepLearning.AI. With a background in petroleum engineering, he is passionate about merging machine learning with reservoir simulation to provide AI-driven solutions to petroleum industry challenges. He holds a BS in petroleum engineering from Dawood University of Engineering and Technology (DUET), and has been actively involved with SPE since 2015. He is currently serving as the International PetroBowl Question Writing Volunteer for 2023 and held the same role in 2022. He was also an Ambassador Lecturer for SPE in 2021 and served as president of the SPE DUET Student Chapter in 2017.

SPE events calendar – local and international

LOCAL – in the UK

September 5-8 (Aberdeen, Scotland)
SPE Offshore Europe Conference and Exhibition
Theme: *Accelerating the transition to a better energy future – securing sustainable and equitable energy for the next 50 years and beyond*
Celebration of 50 years of innovation within the energy industry. This event will bring together the energy sector's value chain to drive forward the oil & gas sector, with an exhibition that showcases the industry's innovative solutions. The theme ties in four key themes: energy security, energy transition, innovative technology, and future talent.
More information: **SPE Conference and workshop**

February 20-21, 2024 (London, UK)
SPE Workshop: Fiber-Optic Sensing Applications for Field Development, Integrity and Optimisation
Delve into the world of fiber-optic monitoring technologies, unlocking their immense potential in optimizing reservoir and field development and operations. Join us at the forefront of innovation and exploration into in-well fiber-optic sensing. Together, let's unlock the potential of these ground-breaking technologies for unparalleled field development, integrity, and optimization.
Register and book in advance.
More information: **SPE workshop**

INTERNATIONAL

August 15-16 (Galveston, Texas, USA)
Gas & Oil Technology Showcase and Conference
This is a great opportunity to connect the global oil & gas industry to discuss challenges and best practices across the oil & gas industry. Focus will be on the use of technologies and innovative solutions to address key technical topics such as well designs & completion, R&D in EOR, role of analytics and AI solutions for field development, production enhancement, new concepts in geoscience & reservoir characterisation, and polymer flooding and low salinity technologies.
More information: **Gas & Oil Workshop**

September 12-14 (Oman, Muscat)
SPE International Hydraulic Fracturing Technology Conference and Exhibition
With the theme 'Fracturing – Growth Engine for Developing Global Oil and Gas Resources', this edition of the conference (In its third edition in Oman and the Middle East) will discuss the hydraulic fracturing technologies and methods advancements that are enabling growing the oil and gas energy resource base, and how hydraulic fracturing can contribute to achieving more cost and carbon resilient oil and gas development.
More information: **SPE conference**

October 2-5 (Abu Dhabi, United Arab Emirates)
ADIPEC Technical Conference
The Conference is the single largest technical meeting place for oil, gas and energy engineers and professionals worldwide, providing unprecedented access to the latest industry knowledge, innovations, technical expertise, applications, products, solutions and services. Organised by SPE, the technical conference sessions cover technical and engineering insights that will drive ideas, overcome challenges, create new value, and highlight innovation.
More information: **ADIPEC conference**

October 24-26 (Rio de Janeiro, Brasil)
OTC BRASIL 2023
One of the main offshore events in the world, in the heart of Rio de Janeiro.
OTC Brasil is an event organized by IBP in partnership with OTC. It aims to attract leading experts, offshore E&P and technology companies to share knowledge, generate new business and showcase best practices.
Along with emerging trends and methods with proven solutions that are emerging in the evolving landscape of the industry.
More information: **OTC Brasil conference**

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

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. The SPE London Section, with an average 2,000 members and seven associated student chapters, is an active section with an aim to connect, engage and promote the exchange of knowledge within the London energy community of technical and commercial professionals. The SPE London board is the governing body for the SPE London section. The different committees oversee the chapters various activities including the evening programme, various SPE events, Young Professionals, Women in Energy and associated student chapters.

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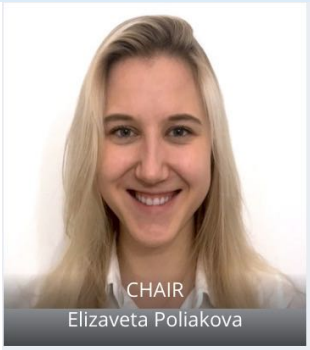
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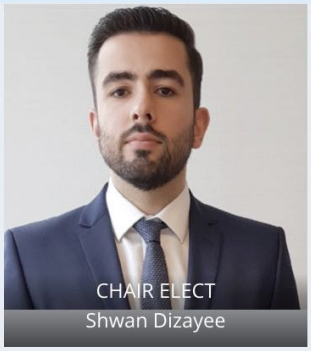
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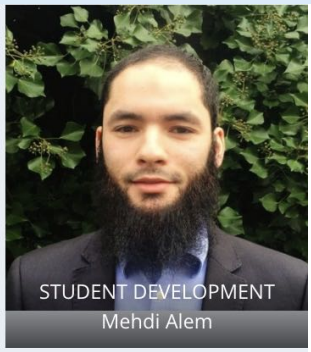
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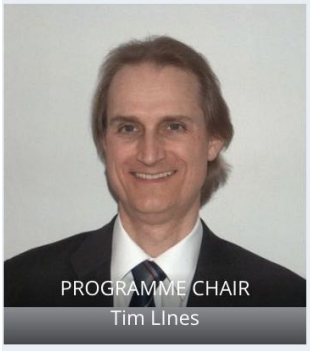
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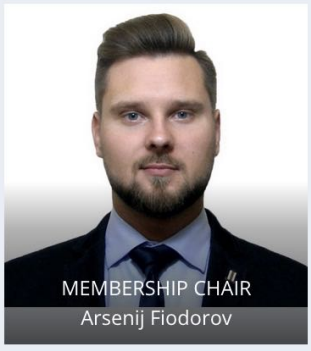
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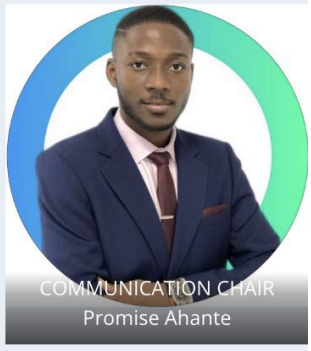
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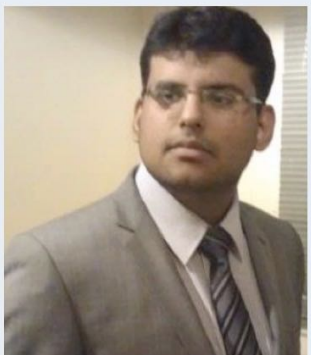
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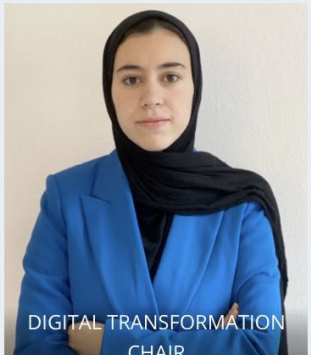
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