March 2019

SPE Review London

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

BE A PETROLEUM DETECTIVE!

Gathering data and evidence to make a defensible case

PLUS+

* Tackling the 150-year-old practice of 'flare and forget'
* Letter from the Chair
* What's happening? Upcoming events

BEHIND THE SCENES MEET THE BOARD EVENTS

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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 serves more than 143,000 members in 141 countries worldwide. SPE is a key resource for technical knowledge related to the oil and gas exploration and production industry and provides services through its global events, publications, events, training courses and online resources at www.spe.org. SPE London section publishes SPE Review London, an online newsletter, 10 times a year, which is digitally sent to its 3000+ members. If you have read this issue and would like to join the SPE and receive your own copy of SPE Review London, as well as many other benefits – or you know a friend or colleague who would like to join – please visit www.spe.org for an application form.

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Share your experiences and stories online http://london.spe.org/home

Behind the Scenes: SPE Review Editorial Board

Jonathan Ovens

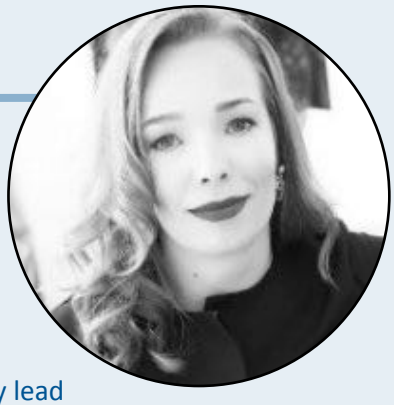
After graduating from Cambridge University with a Ph.D in Physics, Jonathan joined Shell in 1986. Reservoir Engineer – hydraulic fracturing, pressure transient analysis and reservoir simulation.
1997 - 2012: independent consultant: North Sea, North Africa and the Middle East. Experience: Exploration and Development planning to Reserves Evaluation.
2013: Senior Reservoir Engineer at JX Nippon E&P (UK) Ltd.
2009 and 2015 served with SPE Europec Technical Committee.
Member of the SPE London Board.

Josh Beinke

Graduated from University of Adelaide in 2008 with a Petroleum Engineering degree. Worked various roles with Chevron, Origin Energy and Santos, including as a Production Engineer on the Gorgon Field during First Gas. Following move to Europe in 2016, consulted on European and African assets (specialising in data room and field development advisory) before current position working in Amsterdam as a Production/Exploitation Engineer with Vermilion Energy.

Ffion Llwyd-Jones

Editor and business writer, with 15+ years experience in North America/ UK.
Editor for several trade and consumer magazines (print and/online).
Provides industry-related case studies, and detailed, research-driven B2B Designer reports and technical white papers.
Accomplished photographer, and videographer.
Educated in Canada, and in the UK, with BA (Hons) from The Open University.



Letter from the SPE London Chair

Dear colleagues and friends!

Welcome to the March edition of the SPE Review London.

As you might remember, at the beginning of the Section's operational year we announced plans to set up a Senior Professionals (SP) Liaison that could potentially lead to establishing the SP Committee.

I am happy to announce that we now have a dedicated officer (Vincent Penasse) whohas taken over the challenge of representing the needs and interests of Senior Professionals. You can review the SPE London board organogram on page 11 of the magazine.

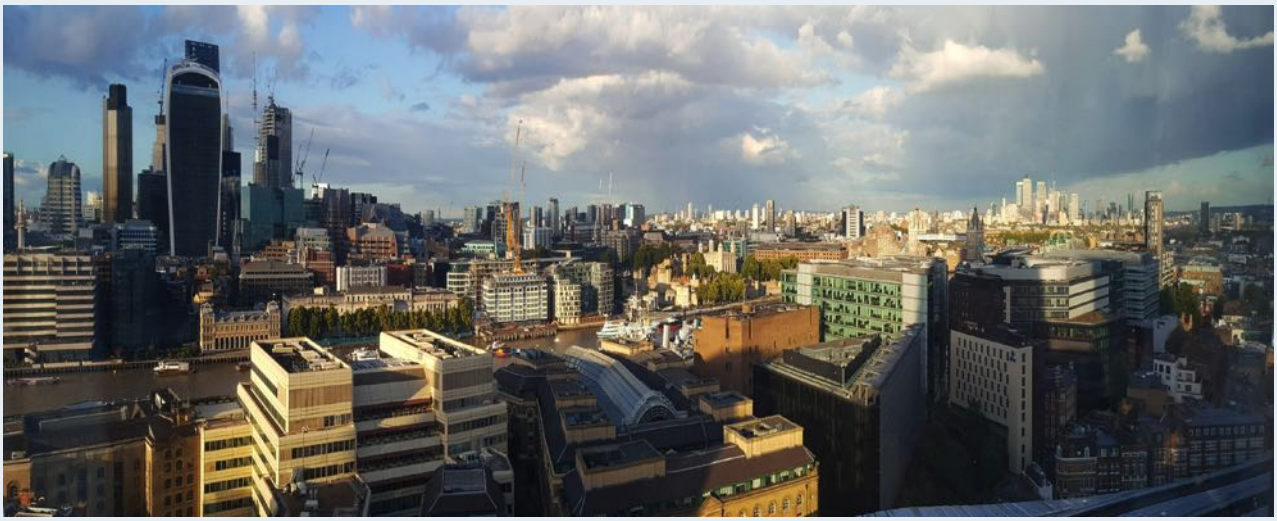
In order to formally introduce this new initiative to our members, we are thinking of running a joint Young/Senior Professionals event. The next step is to set up a topic. It is quite clear that Young Professionals often seek support from their senior colleagues while growing into their technical roles. On the other hand, we realise many Senior Professionals might sometimes struggle to keep up with the wave of digitalisation – for example, machine learning techniques, social media and high-tech simulation. Hence, the collaborated event would be quite helpful. But on which topic? What do you think Young Professionals can learn from Senior Professionals? And vice versa – what would be the subject that Senior Professionals would need to learn from their younger peers?

Please let us know by completing the following survey (**LINK:** https://docs.google.com/forms/d/e/1FAIpQLSdkEW6xMiga9MDsXeEZX56ZeJ_mfTrUDrt5UlHSeOHw69SjoQ/viewform?usp=sf_link) online.

As always, your feedback is very important for us. The topics with the most votes will be selected for our collaborative evening event to be announced soon.

Best regards,

Dr Olga Bradulina
SPE Chairperson



How to be a Petroleum Detective

At the March London Section evening meeting, Brian Moffatt, CEO Petrophase provided a talk about how Exploration and Production projects can benefit from a different perspective taken by assuming the role of a Petroleum Detective, who questions the data and gathers evidence from a wide variety of sources to build a credible and defensible case. This overview explains why it's not just about rounding up the usual suspects!

Determining the fluid properties needed for a field development study can feel like being a Private Detective trying to get the truth out of unreliable witnesses. It's fine when the samples are clean and the PVT studies are consistent, but when sample compositions vary or surface and downhole samples contradict one another, who is telling the truth? When we can no longer accept the data at face value, we need to examine more deeply, to investigate the context and history of each sample. We can treat each piece of information as a jig-saw piece; and see if all the pieces build a coherent picture that makes sense. This is why many reservoir systems are wrongly characterised; it is not simply a problem of QC-ing a sample but of making sense of samples and data in context. And then when we finally get the stories straight, we don't only get the most representative fluid data. Other valuable information such as reservoir connectivity and the prospectivity of other intervals is gained, and this information can actually have the greatest value.

In the Exploration and Production industry, we view technical challenges through the lens of our home discipline; we deem oil properties and reserves estimation belong to petroleum engineering while biomarkers lie in the domain of geochemistry. However, Mother Nature sprinkles her clues indiscriminately across all disciplines so many technical problems spill across several technical, indeed the expertise from several perspectives may be needed to understand the placement and properties of petroleum.

In the talk 'How to be a Petroleum Detective' Brian gave several examples of how data could be interpreted, corrected or eliminated to characterise the reservoir fluids by acting as a Petroleum detective. The study with the greatest impact was to understand a stacked reservoir system.

A fascinating case study requiring inputs from several disciplines was presented. A single well intersected 20 different zones of different compositions and formation sampling tools recovered samples with varying degree of mud contamination. The operator was unsure of how representative the decontaminated samples were, and the relationship between the different zones. What was the story of the varied fluids?

The deepest zone contained a near critical rich gas condensate above which lay a 14° API heavy oil with an exceptionally high bubble point, nearly 11,000 psia. Stacked above this heavy oil lay several different condensates. The problem was to assess the quality and nature of the fluids. Geochemical and isotopic analysis discounted biodegradation and confirmed only two charges; an oil and a late mature gas.

The generation of this wide range of fluid types was accurately modelled using phase equilibrium calculations. It was found that a local oil plus gas became two-phase under the reservoir conditions. The addition of a late

mature gas phase stripped out intermediate components from the oil. The modelling of successive gas stripping steps modified the initial oil composition until it gave a remarkable match to the observed 14° API oil (Figure 1).

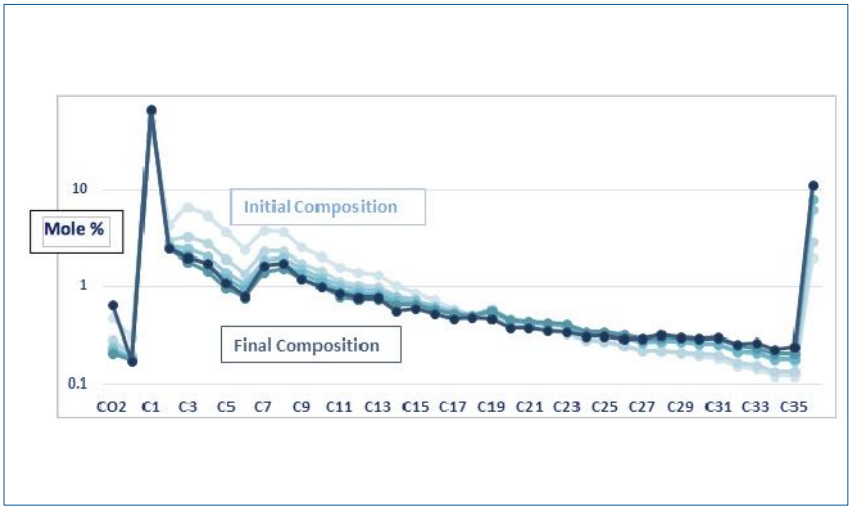


Figure 1: Evolution of the heavy oil by gas stripping

The compositions of the upper interval lean condensates were found to closely match the composition of a dry mature gas enriched by intermediate components from the regional oil.

The deeper condensate reservoir was at a pressure high enough such that the local oil had first contact miscibility with the secondary gas charge. The condensate fluid composition was found to be a simple arithmetic combination of the local oil composition and the late mature gas (Figure 2).

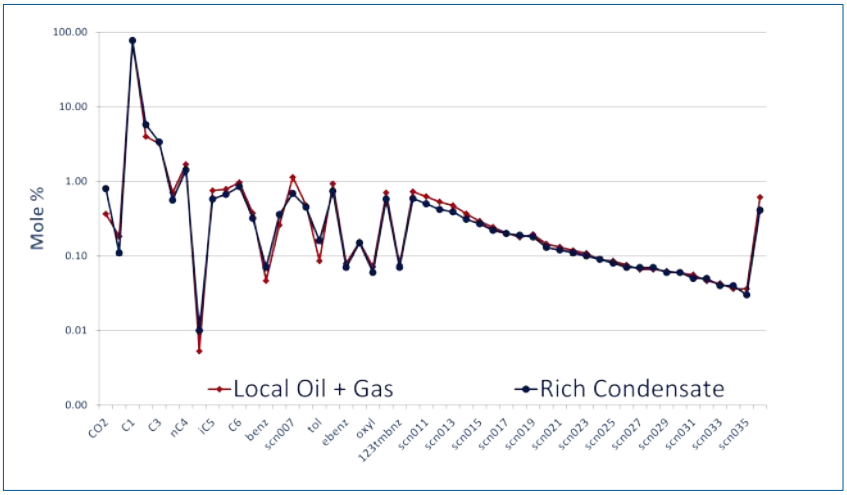


Figure 2: Comparison of discovery Rich Condensate composition (blue) and combined local oil with late mature gas (red).

The mystery of the oil was solved and provided both useful EoS models of the oil and gas for Petroleum Engineering and explained the migration and evolution of the different zones for the reservoir geologists.

The project could not have worked using geochemistry alone nor phase behaviour alone. The combination of both unlocked the secrets to understand the petroleum migration and gave a basis for calculations of recovery of oil and gas for sales predictions which is normally independently calculated from PVT studies. In the final assessment all pieces of information fitted together to give a single coherent story which spanned across Geochemistry, Phase Behaviour, Geology and Petrophysics. No additional tests were run; the solutions were achieved solely from a reassessment of the data under the detective's magnifying glass.

Time to adopt the Petroleum Detective's approach?

Brian Moffatt (Petrophase Ltd, brian@petrophase.com) started in the oil patch commissioning a PVT laboratory and operating well site sampling before managing a team focused on petroleum fluids research. Later Brian worked as a petroleum engineer with BG Group and Helix-RDS before founding Petrophase in 2004 with a vision to link disparate disciplines under petroleum fluid studies. By combining expertise with joined-up thinking across PVT, thermodynamic modelling, sampling, geochemistry, petroleum engineering and surface processing, Petrophase has achieved a dozen world first solutions and won four industry awards. Brian has presented many industry talks especially at YSPE events and Petrophase has managed student MSc projects at Imperial College, Heriot-Watt and Portsmouth University. Many scientific papers on oil and gas behaviour have been published usually with an interdisciplinary twist.

SPE London Evening programme Spring 2019

Join us for the London Section evening meetings!

In addition to lectures by renowned industry professionals, including Distinguished Lecturers, you can enjoy drinks and a networking buffet.

Be sure to look out for email alerts with registration and ticket details, or *check out the SPE London website events page*.

We look forward to seeing you at the next event!

Steve Cuddy (Distinguished Lecturer) presented at the March 2019 meeting.

Schedule: April - May 2019

30 April 2019

Before Dinner Topic/Speaker: **The fluid dynamics of multiphase displacement in reservoir rocks**
Alessio Scanziani, Imperial College; Catherine Spurin, Imperial College

After Dinner Topic/Speaker: **Deep QI - a machine-learning approach to quantitation interpretation**
Ehsan Naeini, PhD, Ikon Science

28 May 2019

The afternoon will start at 4pm with a presentation of this year's two best Field Development projects by the MSc in Petroleum Engineering students from the Centre for Petroleum Studies, Imperial College London. The Field Development project is a group integrated study of the evaluation and development of a North Sea oil field (currently, Wytch Farm).
Each team will have 20 minutes for their presentation, plus five minutes for questions. The audience will then help select the best presentation, which will be awarded the Colin Wall prize, named after one of the founding petroleum engineering professors from Imperial.
The prize (£300 in £1 coins) will be given at the dinner.

Before Dinner Topic/Speaker: **Creating a Worldwide Unconventional RevolutionThrough a Technically Driven Strategy**
Dr Basak Kurtogli, Distinguished Lecturer, 2016-17 and Quantum Partners

After Dinner Topic/Speaker: **'Near Real-Time Updating of Production Forecasting'. Machine learning/data driven modelling/production forecasting**
Martha Stunell, Resoptima

Associated Gas - Now it's your turn to stand up and be counted

By Safina Jivraj – Technical Director Environmental Consulting, Stephanie Ng – Principal Consultant Development Engineering and Rhodri Blake – Associate Advisor at io oil & gas consulting.

The Problem with Associated Gas

Oil production involves the processing of petroleum before subsequent processing and onward transportation / shipment to market. Gas is often found either dissolved within petroleum or as a 'gas cap' situated above petroleum, hence the term 'associated gas'.

Traditionally associated gas was often seen as a waste or by-product. Operators would settle this 'thorn in the side' problem in the easiest way possible – it was sent to flare and burnt. Flaring however, not only wastes energy, it releases contaminants into the atmosphere including toxic volatile organic compounds (VOCs), smog forming nitrogen oxides and particulate matter, namely black soot, a rather potent climate warmer. In addition, flaring of associated gas massively contributes to increases in the greenhouse gas, such as CO2.

Environmental impact is only one side of this problematic coin. The loss in a potential feedstock to the world's energy needs is also amiss. Especially at a time when fossil fuels are becoming increasingly more difficult, not only to find but, to extract and process. Solutions for projects should seek to tackle both the environmental and energy supply problems.

The Size of the Problem

In 2015, the National Oceanic and Atmospheric Administration (NOAA) USA used satellite data and undertook a study to build, what was termed the most comprehensive global gas flaring picture to date [1].

Within the NOAA study, over 7,400 sites were identified with a total flared gas volume estimate of more than 140 billion cubic meters (BCM) annually. The study showed that of the total gas flared, 90% could be attributed to upstream production areas.

Besides this, cold flaring is also an issue. Rather than being flared, methane, the primary component in natural gas, is vented directly to the atmosphere. Although methane currently only accounts for between 10% - 15% of overall emissions globally it traps up to 72 times more heat than CO2 over a 20-year period [3].

The World Bank estimates that for around 150 BCM of flared gas every year this causes around 400 million tons of CO2 in annual emissions. Or to put it another way, this flared gas is enough to provide about 750 billion kWh of electricity; or more than the entire African continent's current annual electricity consumption [4, 5].

Current Commitments

A number of global agreements have tried to move countries onto a path of emission reduction and sustainable development. A key summit was that of Kyoto, where an international treaty was agreed and signed.

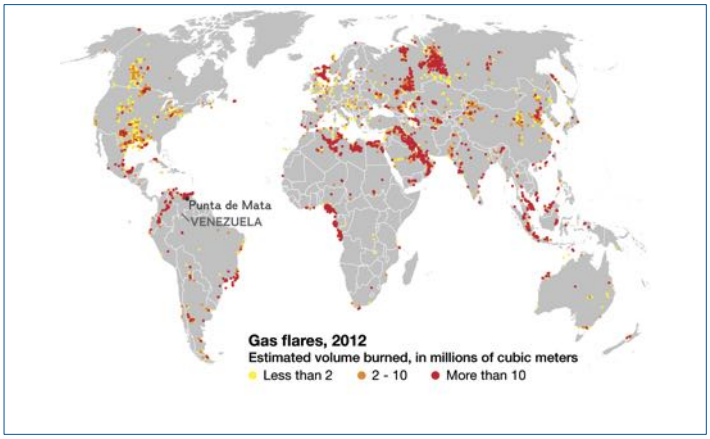


Figure 1: Gas Flaring, 2012, courtesy National Geographic [2]

Of the oil producing countries that are signatories to the Kyoto Protocol, only 18 have set overall emission targets, with only a further three having developed policy guidelines and / or specific emission targets for gas flaring and venting.

Countries	Overall Emission Targets	Flaring & Venting Targets
Argentina	✓	
Bolivia	✓	
Brazil	✓	
(Alberta) Canada	✓	✓
Denmark	✓	
Ecuador	✓	
Italy	✓	
Malaysia	✓	
New Zealand	✓	
Netherlands	✓	
Nigeria		✓
Norway	✓	
Peru		✓
Poland	✓	
Romania	✓	
Thailand	✓	
Trinidad and Tobago	✓	
United Kingdom	✓	
Uzbekistan	✓	
Vietnam	✓	

Courtesy of Global Gas Flaring Reduction

Figure 2: Flaring and / or Venting Targets by Country [6]

Such is deemed the threat of climate change that the L'accord de Paris (Paris Agreement) has all but superseded the Kyoto Protocol. The Paris Agreement allows individual countries to independently evolve and adjust their climatic strategies. But, unlike the Kyoto Protocol, the Paris Agreement offers no legally binding terms.

Flaring reduction incentives

There are a number of ways to reduce flared emissions. One way is by direct regulation, e.g. Norway has an enforced policy of zero flaring in place via the Norwegian Petroleum Directorate, 2013 whereby gas flaring, other than volumes necessary for safety reasons during normal operation, is not permitted. In North Dakota oil producers are required to meet gas capture targets or face having their oil production rates capped [7].

The World Bank recognises that associated gas can be used in several productive ways or conserved (re-injection). As such it launched the 'Zero Routine Flaring by 2030' initiative which aims to bring together governments, oil companies and development institutions who recognise the current global flaring situation and agree to cooperate to eliminate routine flaring no later than 2030. Currently there are 76 endorsers of this initiative (Figure 3) including 27 governments, 34 oil companies and 15 development institutions. As the World Bank initiative gains traction it will, in io's view, become part of the private investment Equator Principles guidelines. These guidelines form a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in project finance. When this happens private investment funding for new projects will become extremely difficult, if not impossible, to obtain unless associated gas flaring meets the World Bank initiative.

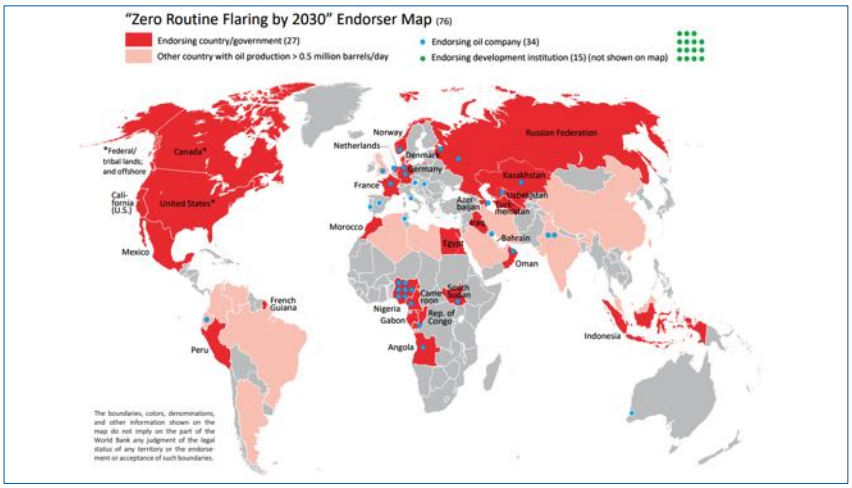


Figure 3: Endorsers of the Zero Routine Flaring by 2030 (ZRF) [8]

When associated gas becomes an asset

For any new project, or indeed existing asset, economic consideration is typically the driving factor to investment. The very essence that associated gas is predominantly being flared globally, suggests that, flaring is more commercially viable than consuming or exporting it. However, io believes that reducing flaring from associated gas goes far deeper than economics alone. Any new project or facility that is undertaken typically undergoes an initial due diligence study. This would involve an analysis and understanding of four key principle areas, without which the true risk profile of the project would not be fully understood and a decision to proceed would be more uncertain.

While economics is the main force for a commercially driven operator to decide whether to flare associated gas or put it to commercial use, a large part of this is derived from the actual technological solution put in place. Firstly, oil and natural gas require separate technologies and equipment for production and processing, secondly the end use of associated gas will ultimately determine which technology is required. One initiative to aid in determining final commercialisation and technology selection would be to, where possible, cluster small and medium associated gas flaring sites. Using economies of scale to justify investment is often a key trick adopted to finalise investment.

An area that is often overlooked, is the legal and regulatory framework that an operator will find themselves in. It is easy to argue that making associated gas commercially attractive is reason enough to ensure a reduction in flaring. Investment opportunities rarely turn into profitable investments automatically and often many hurdles need to be overcome. The role of both a fair and predictable legal and regulatory environment is key to ensure a successful step towards continued associated gas flaring reductions.

One thing is now certain, the way in which our industry deals with its associated gas is being taken away from us. We are being made to tackle our 150-year-old practice of 'flare & forget'!

Figure 4: Associated Gas Flaring Reduction – The Four Key Areas

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5. "New data reveals uptick in global gas flaring", 12 December 2016, **http://www.worldbank.org/en/news/press-release/2016/12/12/new-data-reveals-uptick-in-global-gas-flaring**
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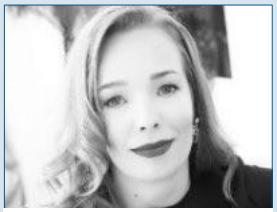
8. "Zero Routine Flaring by 2030", **http://www.worldbank.org/en/programs/zero-routine-flaring-by-2030**

Meet the SPE London Board

SPE is a non-profit professional society with 164,000members in 143 countries. 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 policy-making and governing body, consisting of volunteers who devote time to overseeing many of SPE London's administrative and operating responsibilites.



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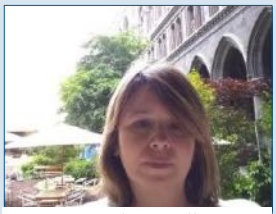

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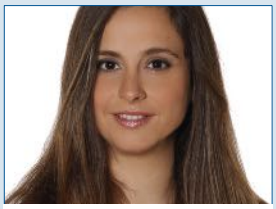

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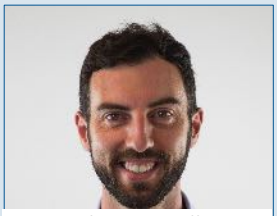

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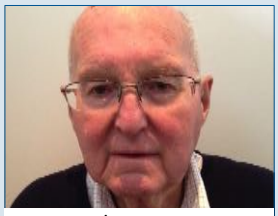

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Jonathan Ovens
Director/SPE Review Editor

Arnaud Mille
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Vincent Penasse
Senior Professionals Liaison

What's happening: Events March to June 2019

Mark the dates! SPE events 2019 - and see page 7 for local London events

09-10 April	IADC/SPE Managed Pressure Drilling and Underbalanced Operations Conference and Exhibition	The Hague, The Netherlands
14 May	SPE Norway One Day Seminar	Bergen, Norway
26-27 June	SPE Workshop: Digital technologies & solutions	Paris, France
06 September	SPE Offshore Europe Conference and Exhibition	Aberdeen, UK

Quick two-question survey for all SPE London members

Background: we, at SPE London are a wide community of students and professionals. On one side, Young Professionals (YP, all SPE members, including students below 35 yo) are growing into their roles and sometimes seek support from Senior Professionals (SP), but the opposite is true.

We fully realise that SP (all of us 36 yo and above) also sometimes struggle to keep up with the wave of digitisation, for example social media, high tech numerical simulation or machine learning techniques.
A possible solution: more collaboration between Young Professionals and Senior Professionals, within companies and within SPE London.

But on which topic ? what topic matters most for us in SPE London?
This is why we are asking you: follow the survey link HERE to take part in this multiple-choice survey.

Thank you very much for your time. The topics with the most votes will be selected for our collaborative evening event to be announced soon.

13th Annual SPE Women in Energy seminar

Negotiating a gender-balanced future

An inspiring seminar where you will have the opportunity to explore how to improve your negotiation skills, discuss and take action on issues of gender balance, learn from industry professionals with a wealth of experience, share your experiences and meet peers during the workshops and networking sessions. *You can get a flavor of the event by following this link..*

Tickets: £30 (including lunch & networking drinks), £15 for students and unemployed people (VAT and Eventbrite fees not included).
M**ore information:** London SPE: Women in Energy; join our LinkedIn group SPE Women in Energy; or follow us on Twitter @Women_in_Energy