Review London

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

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Have we now run out of excuses for not developing our geothermal resources?

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Letter from the Chair

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International

BEHIND THE SCENES MEET THE BOARD EVENTS JOBS

SPE Review London

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ABOUT US

The Society of Petroleum Engineers (SPE) is a not-forprofit 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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Behind the Scenes: SPE Review Editorial Board



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1997 - 2012: independent consultant: North Sea, North Africa and the Middle East.
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Educated in Canada, and in the UK, with BA (Hons) from The Open University.



Letter from the SPE London Chair

Dear colleagues and friends!

The SPE London Section has had a successful past few months. Our team of volunteers has continued to work hard towards delivering another exceptional programme. We would like to thank all our members and guests for such a great interest in our events!

One of the highlights of the past month for us as a Section and for myself, as a Chairperson, was meeting the 2018 SPE International President Darcy Spady, who took part in the SPE London Annual conference on the 23 October.

It was very beneficial for the board to meet him to learn and share some of the best practices in delivering the SPE mission. As the London Section is in close proximity to the City, it has always been recognised by Darcy as supporting his belief in the importance for engineers to understand financial matters. In line with this, we are always trying to diversify our technical program with Business Development seminars. Such seminars are prepared by our Special Interest committees for the benefit of oil and gas professionals and the financial sector. We are open to any of your suggestions on the topics you would like us to cover in future. Please contact us: SPELondon@spemail.org if you have an idea in mind.

At London South Bank University, Darcy also met with our Students Chapters from the universities supported by SPE London, including Leeds, Portsmouth, Coventry, Manchester, LSBU and Imperial College.

It was great to hear his inspiring thoughts on our industry that provides the most of the world's energy needs as well many other life improvements. Such a message aligns with the optimistic outlook on the future of the oil and gas industry, and was well received by students. I hope this message has provided them with a very important mindset to start the academic term!

We would all like to thank Darcy for being such an open and motivational leader of our Society. We wish him all the best for his future after successfully stepped down from his role after such a remarkable year!

Kind regards,

Dr Olga Bradulina SPE Chairperson



Darcy Spady meets students from SPE London's various University Chapters while at Southbank University



Coming of age? Geothermal energy in the UK

As the UK's hydrocarbon resources decline, geothermal energy presents as part of the solution to fill the energy void. Conveniently, there is considerable overlap in the technical skillsets required to develop, execute and operate a geothermal project and that of an oil or gas development, and opportunity exists for both industries to draw from a shared knowledge base. Dr Jon Busby, Geothermal specialist at the British Geological Survey discusses the potential for cutting carbon emissions for power generation and benefiting from the UK's considerable geothermal resources.

The potential for utilising geothermal energy in the UK has been discussed since the 1970s when an extensive review of resources was undertaken. Despite a research project to investigate the deep geothermal power potential of granitic rocks and further reviews, there is still only one deep geothermal project at Southampton



Figure 1: Distribution of the geothermally significant Permo-Triassic sandstones displayed by depth from shallow (red) to deep (blue). These rocks are also found in Northern Ireland, but their detailed depth extent is less well known, but do not occur at depth in Scotland.

that contributes hot water to a district heating scheme in the city centre. However, with the realisation that we need to urgently cut our carbon emissions for both power generation and heating, UK geothermal energy may be about to come of age.

UK geothermal resources can be broadly classified into three categories. The most familiar to petroleum engineers will be the deep onshore sedimentary basins where rocks with advantageous porosity and permeability are found at sufficient depth for the temperature to be high enough for direct use applications. Given that the average UK geothermal gradient is about 26°C/km, at depths of 2 – 3km temperatures will be around 60 - 90°C, sufficient for green house heating, balneology and district heating. These direct use geothermal reservoirs are dominated by the Permo-Triassic sandstones found in five major Mesozoic basins across the UK land mass (see Figure 1). The second category of geothermal resources are those found in the tighter sandstones and carbonates of Carboniferous and Devonian age where secondary fracture permeability is often the dominant pathway for fluid flow. Although less predictable, this category of resources has the advantage that these Upper Palaeozoic rocks are more prevalent at depth beneath UK urban centres than the Permo-Triassic sandstones.

Where fracture permeability can be identified, e.g. palaeokarst within the Carboniferous Limestone, these resources could supply significant energy to urban district heating schemes. Since temperatures within the sedimentary column are not high enough for power generation, the final resource category is for regions where temperatures in excess of 160°C occur within the economic range of deep drilling, currently around 5km depth. Water (or brine) extracted at these temperatures can be utilised in binary cycle power generation. In the UK, heat anomalies at these depths are found in the radiogenic granites, due to slightly raised levels of the radiogenic isotopes of potassium, uranium and thorium (*see Figure 2, overleaf*). The most prospective granite is found in Cornwall, in southwest England, where temperatures at 5km depth are expected to be around 200°C. Exploitation of these resources requires dual borehole systems that intersect natural, deep fracture permeability, or may require enhancement of the natural permeability by stimulation. Where stimulation is required this geothermal play is usually referred to as an Engineered Geothermal System (EGS).

There are a number of exciting geothermal projects currently under development, the largest of which is the United Downs Deep Geothermal Power project located on the Carnmenellis granite in Cornwall. This project will drill two deviated wells to intersect the Porthtowan Fault Zone, a major NW-SE striking regional structure, at depths of 2.5 and 4.5km respectively. Water will be circulated through the fracture system from the shallow injection well to the deep production well, mining heat from the rocks. It will be pumped to surface

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TECHNICAL FEATURE



Figure 2: Distribution of granite within the crust of the UK. The Cornish, Weardale, Northern England and East Grampian granites are the main regions of high heat producing granites.

where it will supply a demonstration power plant to produce 1–3MW of carbon free electricity. If pumping rates are as expected, the power plant will be upgraded to higher capacity. If successful, this demonstration project could open the way for geothermal power generation from UK granites and if drilling to 7km depth becomes economically feasible, then much of the UK crystalline basement could be similarly developed.

At the opposite end of the temperature scale, but also with large potential impact is the heat contained within the waters of disused mines. At first glance, these resources may appear to be of little interest since the mine waters are often at groundwater temperature, around 12°C. However, they have a number of advantages. The mining has created enhanced permeability in rocks of usually low permeability making available a large body of readily accessible groundwater. In some cases convection within the mine water network will allow warmer water to rise from depth to near surface raising the temperature. And, in the UK, coal mining was often located in urban or peri-urban areas creating a ready market for this low grade geothermal heat. The temperature of these waters would need to be upgraded for heating purposes with heat pumps and a number of proposed city district heating schemes are considering innovative solutions along these lines. The Coal Authority have already created some mini heat networks at sites where they already pump the mine waters for environmental reasons and the British Geological Survey are establishing a research site for shallow

geothermal within flooded coal mines in Glasgow. This research site will be accessible by both the academic community and industry.

It is perhaps of surprise that given the success of the project at Southampton, where brine at 76°C is pumped from the Triassic Sherwood Sandstone, there are still no other geothermal schemes developed within the Mesozoic basins. The most cited reason for this is that natural gas is still a cheap form of energy so it is difficult to build a business case for the drilling of deep boreholes, despite there being a deep geothermal tariff under the Renewable Heat Incentive scheme. Some exploitation of geothermal reservoirs within porous permeable rocks might be possible from hydrocarbon wells in depleted onshore oilfields where temperatures are often in the 50 - 60°C range. Co-produced water generally increases towards the end of life of a field and it may be possible, given that oilfield infrastructure is already in place, for the oilfield to have an extended term as a geothermal system. Once again location to users is critical as the cost of building extensive pipelines to transport heat is prohibitive.

Finally, at the forefront of geothermal research are very hot or magma geothermal systems. Water pumped through wells into these systems will be become supercritical and it is estimated that the power generation capacity of a supercritical well is 10 times that of a conventional well. Clearly there are no very hot geothermal systems in the UK, but they are being actively developed in Iceland and an electricity interconnector between the UK and Iceland could see us benefiting from this new geothermal resource.

The UK has had a long love affair with fossil fuels, especially natural gas that has held back renewables; perhaps we have now run out of excuses for not developing our geothermal resources.



Dr Jon Busby is the team leader for Renewables, Energy Storage and Clean Coal at the British Geological Survey in Keyworth and leads BGS' geothermal research. Jon has research interests in both shallow and deep geothermal. He has been working to improve shallow thermal properties from analyses of disparate data sets, most notably mineralogical and soil temperature. He is leading the BGS input to a European project to provide suitability maps for shallow geothermal ground collector systems. Jon has researched the temperature and heat flow field of the UK and worked on projects for deep geothermal assessments, and is currently leading a project to re-evaluate the deep geothermal resources of the UK. He currently represents the UK on the executive committee of the International Energy Agency Geothermal Implementation Agreement.

FEATURE

SPE Week 2018: knowledge and communication





The Society of Petroleum Engineers Portsmouth Student Chapter is a very active and enthusiastic student chapter in the London Section and has been a part of various events, competitions and programs for the past seven years.

Every year, the chapter organizes SPE Week for all the students in Petroleum Engineering, and this year was no exception. Guest Speakers from various companies were invited to engage with the

students and help them in experiencing real-life industrial challenges and operations; there were around eight industrial talks and three social networking events.

Gareth Brown from Baker Hughes demonstrated Production Well Logging tools and explained the uses of Well logging and Logging Software. Tim Lines (Oil Fields International) conducted a debate session on Assessing Investments in Oil and Gas Industry, which was an interesting task for all the students. Miles Cudmore gave an interesting presentation regarding the Future of Oil and Gas. Brian Moffatt's talk 'Petroleum Engineer to Petroleum Detective' was an interactive session. Important 'Well Engineering and Fluid Characteristics' talk was led by Amit Madahar, and Jaimar Maurera was very helpful and useful for Fluid Analysis and Wells Test Applications featured in a talk by Silvia Rey-Gomez.

There were also social events where students and the teaching staff had a wonderful time playing football and bowling. Multiple outcomes from SPE week included students and professionals engaging with each other, developing additional petroleum knowledge and enhancing soft skills such as communication and team work.

The week could not have been organised without the dedication of the SPE student chapter and the staff at the University of Portsmouth. We look forward to the remainder of the technical events at Portsmouth and to another successful SPE Week in 2019!





Avoiding a 'rat's nest of a mess': the need for a coherent big data strategy

At the the Opening session of the 2018 Annual Technical Conference, the discussion considered the impact of big data on our business. This is a summary of the discussion taken from the November 2018 JPT Article by Matt Zborowski.

Upstream companies that don't have a coherent strategy around managing and interpreting their data can find themselves in 'a rat's nest of a mess'.

This aptly Texas-flavored warning came from Melissa Suman, Schlumberger vice president, data and digital, during the opening session of the SPE Annual Technical Conference and Exhibition (ATCE) in Dallas. The panel discussion commingled executives from big oil and gas firms and big tech – a gathering that was representative of a broader merger of disciplines and technologies currently taking place in the upstream space.

Suman explained that the industry has 'a data wrangling issue' after more than a century of drilling wells and producing oil and gas. Data over that time period have been acquired, sorted out, and presented in many different methods, formats, and media. She said that bringing them together in a central platform is 'one of our biggest challenges'.

With digital enablement taking hold across the industry at a rapid pace – especially over the next year or so as deployment ramps up – she predicts issues stemming from the large volume of new incoming data. She advises her clients to have a scalable data strategy from the onset of digital adoption to accommodate this expansion.

Newly implemented data strategies should incorporate data compliance, data entitlement, and data source integrity. Companies must understand global data ownership and classification standards, determine who can access the data within their organizations and how the data are shared, and begin storing and transforming data as soon as they're received.

Offering the big tech perspective, Darryl Willis, Google Cloud vice president of the oil, gas, and energy sector, reiterated what many outside and inside the industry have observed: Oil and gas is lagging behind other industries in digital adoption. "But it is also one of the



most data intensive and data-rich industries, which creates an amazing opportunity," he said. This is especially the case for Google.

He adds: "One of the things we see at Google Cloud is that it's not the company with the best algorithm that's going to win – it's the company with the most data." The caveat to that, he said, is actually using that data, given the oil and gas industry only uses 1-5% that it collects.

Supermajor Shell collects oodles of data, and they're filtered through a technical data management group that's considered a discipline within the company just like those populated by engineers and scientists, noted Alisa Choong, chief information officer, projects and technology, at Shell Global Solutions International: "Their job is to make sure the data is where they're supposed to be and we can get access to it quick."

Finding What Works

Operators working in the unconventional plays of North America have long struggled to generate free cash flow given the difficult and expensive nature of their work. But there are big rewards to be had through efficient development, and big data, properly utilized, can help.

Encana, which has a core position in the Permian Basin, is trying to figure out how to "optimally develop this incredible resource that has more oil per section than almost anywhere on Earth – but it's very complex and exists in lots of layers," said Doug Suttles, Encana president and chief executive officer.

In an effort to develop in 3D, or refine what the company calls 'cube development', Encana examined whether it could pull data from different sources to pinpoint the zone from which oil was produced. It takes a massive amount of data to do that, Suttles said, adding: "And just to give you a sense of the scale: What we can now do in 1 day used to take 7 years to do. That's the processing of all this information."

Data are leveraged in Encana's two North American operating centers that monitor 24 hours per day every well the company has drilled. From there, wells can be started or stopped, and analytics can be applied to figure out how to improve their performance. This is where the company is in the process of ensuring personnel are assigned to more complex tasks instead of the daily minutiae of oil and gas operations.

With these advancements, Suttles takes umbrage with the characterization of shale development as a manufacturing process. "We think it's an innovation process," he said. However, repeatability is an essential aspect of innovation. He added: "When our team comes up with a great idea, whether it's a different completion design or it's a new way to use information to improve the performance of a gas compressor, if it works, we can then do it over and over again."

But he warned against fixating on existing data alone. For example, in an effort to improve well performance and recovery on a piece of land in the Permian, Encana collected data from 430 wells and examined 31 different variables, simultaneously changing multiple parameters to determine what affected performance. After much work, the team gleaned the aspects that it thought moved the needle the most.

"They lost sight of the fact that we had no data on what we hadn't tried yet," Suttles noted. "And when our best experts came in, they said what you're telling from that data isn't right—it doesn't match up with our understanding of the physics." The company then tested additional concepts. "We probably had our most significant breakthrough in

performance," he said.

While some companies aren't doing enough to evolve their digital strategies, Willis said, many are doing too much. In his experience, the industry "has mastered the art of POCs—proofs of concepts. We do that masterfully well. But what we don't do well is scale." Companies should "identify one or two or three things that they think could be transformational for their business."

Suttles said Encana has to pick and choose what digital technology works the soonest because personnel, capital, and time are limited. The company encourages collaboration between the teams within its organization to leverage ideas that do work.

Internal and External Collaboration

The panel agreed that, externally, companies should break through their competitive and secretive barriers to collaborate with each other on big data and technology development.

Suman noted that, earlier this year, Schlumberger collaborated with Woodside Petroleum to test traditional workflows around interpretation and modeling by incorporating cloud and digital technologies. The result, she said, was that stratigraphic interpretations were performed in 3 days instead of 2 weeks. "One of the real step changes has been allowing our people more time to focus on the more important parts of the process and taking a lot of the repetitive and timeconsuming elements out."

Schlumberger and Anadarko also this year worked on machine learning in geoscience, with Anadarko sharing and using a proprietary algorithm for the automatic interpretation of seismic and well logs.

Willis urged companies to seek unconventional partnerships both inside and outside the industry. "One of the things that I find very interesting in my current role," he said, "is that I sit with the healthcare and life sciences team [at Google] and there are all kinds of similarities between energy oil and gas in particular—and healthcare."

For example, an MRI or PET scan can be seen in the same way as a seismic line. The brain can be analogous to an oil and gas reservoir. In other words, there could be transferrable lessons between the industries, Willis said.

Introduction to E&P seminar - communicating complex ideas to a non-technical audience

The 14th 'Introduction to E&P' seminar in November provided an introduction to the full life cycle of oil and gas fields, and covered the basics in exploration, geoscience, drilling, operations, reservoir management and commercial terms. Engineers and managers often suggest this seminar to nontechnical staff so they can better understand the content of reports and budgets. Pictures by Glyn Genin.



Adam Borushek introduces the day



Miles Cudmore provides the overall E&P framework



Tim Bass reflects on Project Management



Lecture theatre audience



Rebecca Jones presents Deal making

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Lame Verre considers Economics



Geoff Boyd discusses Safety



Ian Bennett presents Facilities



Ahmed Salem introduces Geology



Ian Hutchison discusses Drilling concepts



Having a break in the Library

Meet the SPE London Board

SPE is a non-profit professional society with 164,000 members in 143 countries. The SPE London Section, with average 2000 members and seven associated student chapters, is an active section with an aim to connect, engage and promote exchange of knowledge within London energy community of technical and commercial professionals. The SPE London Board is the policy-making and governing body consisting of volunteers who devote their time to oversee many of SPE London's administrative and operating responsibilities.



Chair



Arnaud Mille Director



Director

Jonathan Ovens

Director, Editor SPE Review



What's happening: Events, videos and jobs

Mark the dates! SPE events November-December 2018

28-29 November		SPE Middle East Artificial Lift Conference & Exhibition	Manama, Bahrain
10-12 December		SPE Annual Heavy Oil Conference & Exhibition	Kuwait City, Kuwait
And, looking forward to 2019			
5-7 February	SPE Hy	draulic Fracturing Technology Conference and Exhibition.	The Woodlands, Texas, USA
5-7 March	SPE/IA	DC International Drilling Conference and Exhibition.	Hague, The Netherlands
18-21 March	SPE Mi	ddle East Oil and Gas Show and Conference	Manama, Bahrain

Women in Energy (WiE)

WiE hosts events throughout the year, including the annual one-day seminar, all focused on gender balance in the oil and gas industry.



Companies such as BP, Shell, Total and Schlumberger sponsor WIE events, while industry partners/collaborators include UK-based UK POWERful Women and SPE WIE South Central Europe Region. The annual WiE conference attracts a wide audience with high-profile speakers including senior VPs from Total, VPs from BP, CEO Oil and Gas UK, Shell UK chair.

Here's a taster video of events and opportunities with SPE WiE: Two-minute SPE WiE video

Live Jobs (at print)

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