

DEVEX 2023

20-21 JUNE 2023, P&J LIVE, ABERDEEN

UNITING THE INDUSTRY FOR A SECURE AND SUSTAINABLE FUTURE

Abstracts Programme

Organisers



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Organisers

DEVEX is a not-for-profit conference run by industry professionals and is the only technical conference of its size which is focused on reservoir discovery, evaluation, development, and recovery in the UK. The event is jointly organised by the Society of Petroleum Engineers (SPE Aberdeen), Geoscience Energy Society of Great Britain (GESGB), and Aberdeen Formation Evaluation Society (AFES).



About SPE Aberdeen

SPE is the largest individual-member organization serving managers, engineers, scientists, and other professionals worldwide in the upstream segment of the oil and gas industry.

Formed in 1957, The Society of Petroleum Engineers (SPE) is a not-for-profit professional association whose more than 124,800 members in 134 countries are engaged in oil and gas exploration and production. SPE is a key resource for technical knowledge providing opportunities to exchange information at in-person and online events and training courses, publications, and other resources.

The Aberdeen Section is one of the largest of the SPE Sections across the world and won the President’s Award for Excellence for 8 consecutive years and numerous Gold Awards. The section has around 1500 members ranging from drilling and completions engineers to production and operations specialists, HSE practitioners, and other professionals. The section also serves 550 student members from 5 student chapters.

www.spe-aberdeen.org



About AFES

As a chapter of the SPWLA, AFES is actively involved in the promotion for the public benefit, education and knowledge in the scientific and technical aspects of formation evaluation. AFES focuses its financial sponsorship of education in formation evaluation at three main Scottish universities which teach petrophysics and formation evaluation, namely Heriot-Watt, Robert Gordon and Aberdeen universities. Over the years, AFES has donated thousands of pounds to these establishments for equipment and research. In addition to this we have supported a number of student forums, field trips and equipment requests.

www.afes.org.uk



About GESGB

The PESGB was established in 1964 by a group of like-minded professionals keen to create a community of geoscientists for networking and sharing ideas. Over 50 years later we have members in every element of the subsurface energy industries, and they are active in six continents. As the result of a landmark member vote, the society changed its name to be more inclusive of the careers of the members, now and in the future, of this exciting industry.

In March 2023 the PESGB became the Geoscience Energy Society of Great Britain (GESGB). The society will gradually broaden its technical programme while continuing with the current activities. The GESGB welcomes all who work in subsurface energy related fields and is keen to explore the exciting technologies that continue to develop across the sector.

This member led organisation serves our industry by providing, networking and knowledge-sharing events, conferences, and workshops. Though careers in ‘energy’ are constantly evolving, the GESGB aims to be relevant, useful, and beneficial to members at every stage of their careers within the ‘energy’ industry.

www.ges-gb.org.uk

Our Sponsors

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EXHIBITORS



Chairperson's Welcome



On behalf of AFES, GESGB and SPE Aberdeen, it is my pleasure to welcome you all to DEVEX 2023!

The industry has taken a bit of a battering these last few years - a global pandemic, low oil prices and an increased societal focus on ESG has made even the most optimistic professional question their career choices at times. When I was asked to chair this year's conference, I really wanted it to be a pick-me-up, a celebration of all the things we do well, sharing our technical achievements and to highlight how crucial we are to this country and the world. Not just today, but also for decades to come.

I hope that with over twenty operator technical presentations, four masterclasses and countless service companies showcasing new technology, you'll all find something here to pique your interest and leave you feeling energised - ready to take on the challenge of energy security and sustainability!

If that's not enough, there are networking opportunities, core viewings and a dedicated event for YP's to help navigate their early careers. This conference couldn't happen without the continued backing of our sponsors who are all listed in this program. Thank you all so much for your generous support. I'd also like to thank Steve Adams of Balgownie Geoscience for organising our field trip to the Angus coast to look at continental clastics. I'd also like to thank BP for agreeing to lend us some core for our core display. For those not able to make the field trip, there is an excellent opportunity to see those Devonian red beds at core scale in the exhibition room – I encourage you all to check it out. Thank you also to our numerous speakers, keynote presenters, the brilliant folks at Mearns & Gill and of course the DEVEX organising committee – I have enjoyed every minute of working with you to create this year's conference. Finally, a big thank you to you, our delegates! Thank you for coming and I really hope you leave this conference with some new ideas, new contacts, and renewed energy to solve the industries continually evolving challenges!

Grant Kelly
Chair of DEVEX 2023

DEVEX 2023 Important Information

Registration Opening Times

The registration desk will be open for registration and general enquiries between 08:00 – 17:00 each day.

Refreshments & Lunch

Tea/coffee and lunch is available during the scheduled breaks throughout the conference. If you have any food intolerances or specific dietary requirements, please inform a member of the P&J Live catering staff.

Core

On display will be North Sea Devonian classics from the Lower Clair Group of the Clair and Clair Ridge Fields. Building on the field trip, the core will allow discussion on the impact and challenges of developing a naturally fractured field. Thank you to bp for arranging the Core this year.

Masterclasses

We have some excellent training-based talks, known as 'Masterclasses' which will take place over the two days. Taking place in parallel:

Day 1 – 1320

Well Stimulation Masterclass: managing uncertainty and making better production enhancement decisions, presented by Bogdan Bocaneala, Opecs

The Well Stimulation Masterclass will act as an introduction into the world of production enhancement touching on subsurface requirements, materials and products used, completion technologies and operational aspects. It will also provide an understanding on how we handle subsurface uncertainties and how we make better multidisciplinary decisions or predictions using Swarm AI. At the end of the Masterclass, we will organise a SWARM AI session for the participants.

AICD Masterclass - John Costaschuk, Equinor

Equinor has been an extensive user of autonomous inflow control devices (AICD) for more than a decade. In the early years the challenge in choking back unwanted fluids from the reservoir to the well led to the development of an in-house autonomous inflow control technology, which later was licensed to several service companies. Today, Equinor collaborates with the service industry and has implemented autonomous inflow control in more than 150 wells, including technologies from 6 different service companies. This masterclass will address important topics in the qualification program and how Equinor builds a business case and justify implementation through in-house flow modelling of the effect prior to installation. The masterclass will also include several field cases and show how AICD technologies prove to increase the recovery.

Day 2 - 1320

Reserves Booking and Portfolio Management Masterclass, presented by Gavin Ward and Adam Borushek - RISC Advisory

With a few differences in detail, we can view our portfolio of upstream assets in the same way we view our personal investment portfolio. Most of the material in the presentation/MASTERCLASS session has been shown to the investment, commercial and technical community over the last thirty years and it forms one of the fundamentals in understanding uncertainty and financial return.

The session will describe what portfolio management is all about and how small, medium and large energy companies assess and select drilling candidates (investment opportunities). We'll cover the theory and show examples of what happens in practice using methodologies in place at a few companies in the energy sector. The presentation/Masterclass will cover:

- Theory of portfolio/investment management
- Small v large portfolios (Focus v Diversification)
- Trade-off between financial & oil field metrics (ROCE, NPV, VIR, Reserves, \$/Boe)
- Deterministic ranking V Probabilistic modelling
- Efficient Frontier & investment selection process
- Examples of portfolio management In practice
- Pitfalls (theory v practice)

The session will describe what portfolio management is all about and how small, medium and large energy companies assess and select drilling candidates (investment opportunities). We'll cover the theory and show examples of what happens in practice using methodologies in place at a few companies in the energy sector. The presentation/Masterclass will cover:

Shell UK Upstream's Energy Transition Journey - Rob Cullen, Shell U.K. Ltd

The global scale challenge of the energy transition is to align with the goals of the Paris agreement. The practicalities of how this will be achieved will vary across different industries and geographies depending on their unique contexts. This session will discuss the journey Shell's Upstream business is on to develop its contribution to the energy transition based on its own context within the UK's complex energy system – both today and into the future. It will discuss the challenges and opportunities that have emerged along the way and how the context continues to evolve.

DEVEX Young Professionals Event - Day 1, 14:45

Energy Security in a Mature North Sea Basin

Keynote Speaker: Brenda Wyllie (NNS/WoS Area Manager, NSTA)

Mentor Panel: Brenda Wyllie (NSTA), Simone Silcock (Equinor), Ruth Thomas (Well Safe Solutions), Mattheus Uijttenhout (TotalEnergies) Henk Kombrink (North Sea Core)

The DEVEX 2023 Young Professionals Committee invite you to attend this year's YP Event, which focusses on the future of oil and gas-related careers in the North Sea Basin. Whilst the industry continues to support the move to Net Zero, there will still be a strong need for petroleum-based disciplines for many years to come, and this event offers the opportunity to meet and get advice from experienced industry professionals in a speed-mentoring and networking activity.

This is a free event, following which, all attendees are invited to attend the networking reception.

TECHNICAL PROGRAMME

Networking Reception

Day 1, 17:45

A networking reception will take place at the end of day 1. All delegates are welcome to stay and network with fellow delegates, speakers, and sponsors within the exhibition hall. Our core display will still be available for viewing during this time.

Abstract Programme

Abstracts from DEVEX 2023 have been published in this programme. Approved final presentations will be uploaded to the Knowledge Section of the SPE Aberdeen website after the event. In our efforts to keep DEVEX 2023 a sustainable event, we are not printing the abstract programme, it will be available digitally only.

Language

The official language of the conference is English and all presentations will be given in English. No simultaneous translation service is available.

Security

You will be issued with a name badge on arrival at the registration desk. Please ensure you wear this at all times. Entrance to sessions will not be permitted to those without a badge.

Delegates are advised to look after their own belongings. Neither the organisers or P&J Live can be held responsible for any loss of items.

Contact Details

Organisers – Mearns & Gill

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20 JUNE The opening keynote session and all presentations down the left-hand-side of the technical programme, will take place in Conference Suite 2B. The other parallel sessions (highlighted on the right-hand-side of the programme) will take place in Conference Suite 2A, next door.

08:00	09:00	Registration		Technical Talks Masterclasses Techbytes YP Event
09:00	10:15	Opening Remarks and Keynote Discussions		
10:25	10:55	Coffee Break + Core Display & Exhibition		
		Session - Maximising Recovery	Field Case Histories and Redevelopments	
10:45	11:10	Maximising Recovery in the Brodgar Field; a Mature Gas Field with Water Handling Constraints - Abbas Delavar, Harbour Energy	Understanding the matrix impact on the development of the Lower Clair Group of the Clair Ridge Field, West of Shetland - Adam Poptani and Luke Wooldridge, BP	Young Professionals Session 14:45-16:55
11:10	11:35	Orlando – Trials, Tribulations and Eventual Success of a Single Well ESP Supported Subsea Tie-Back - Ross Cameron, Tailwind	The benefit of seismic re-processing to identify late life opportunities in the Buckland field - Rachael Crowe, Apache	
11:35	12:00	Gannet subsea Infill - Framing to Execution Phase in 10 months - Charles Ileagu, Shell	Exploiting Field margins: An example from the East Everest Field - Peter Wood and Kevin Angus, Harbour Energy	
		Techbytes		
12:00	12:10	A Digital Platform to Enhance Emissions Management for the Oil and Gas Industry - Mohammad Yasir, Halliburton	Optimizing Sampling Workflow & Hardware for Fluid Scanning & Sampling Success in Unconsolidated Formations - Marcus Turner, SLB	
12:10	12:20	Geosteering Techniques Integration to optimize well placement. Case studies from the Norwegian Continental Shelf. - Alexandra Zaputlyaeva, ROGII	Re-risking Reservoir and Fluid Data Acquisition in South East Asia Using Fluid Mapping-While-Drilling Technology - Marcus Turner, SLB	
12:20	13:20	Lunch + Core Display & Exhibition		
13:20	14:20	AICDs Masterclass	Masterclass - Well Stimulation Masterclass: managing uncertainty and making better production enhancement decisions - Bogdan Bocaneala, Opecs	
		Session - New Energy		
14:20	14:45	From a modest gas play to a world class CO2 storage site? Injecting life into the Triassic of the SNS? - Graham Tarn-Dyson, Equinor	Challenges of the Conversion of a Mature Natural Gas Storage Facility to Hydrogen Storage using a Carbon Dioxide Cushion Gas - Heikki Jutila, Exceed	
14:45	15:10	Evaluating the geological case for the natural accumulation and storage of CO2 in the East Irish Sea Basin, UK - Sam Head, Heriot Watt University	Decarbonising the UK North Sea - Theory vs. Practice - Ian Gladman, RISC Advisory	
15:10	15:35	The application of AI to a Southern North Sea seismic interpretation of depleted and virgin reservoirs for CCS site investigation - Ryan Williams, Geoteric	Operational Parametric Evaluation of the Underground Hydrogen Storage Efficacy in a Deep UKCS Aquifer - Prashant Jadhawar, University of Aberdeen	
15:35	16:00	Coffee Break + Core Display & Exhibition		
		Session - Production Enhancement		
16:00	16:25	The First Application of Autonomous Outflow Control Devices in a Water Injection Well in Norway - Geir Frode Kvilaas, AkerBP	Injection Above Fracture Pressure: Verifying Cap Rock Integrity and Evaluating Conformance - Sergey Prosverkin, TGT & AkerBP	
16:25	16:50	Enhanced Oil recovery by controlling the water production with the Application of Autonomous. Inflow Control Valves: A Case Study - Ismarullizam Mohd Ismail, InflowControl	Well clean-up optimisation using advanced numerical modelling processes - Michael Byrne, Axis	
16:50	17:15	Understanding the Source of Pumps Off Gas in Impermeable Rock - Dean Thorpe, Shell	High pressure-difference eline perforation on a declining subsea well in the North Sea. Forvie North Light Well Intervention - Helene Berthet, TotalEnergies	
17:15	17:40	If don't find natural fractures, create your own: Clair Ridge hydraulic stimulation - James Hoad, BP	Can Lost Circulation Materials (LCM) Cure Losses Across Fault Damage Zone? - Alvin Chan, Shell Global Solution U.K.	
17:45	19:00	Networking Reception + Core Display & Exhibition		

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21 JUNE

08:00	09:00	Registration	
09:00	10:15	Opening Remarks and Keynote Discussions	
10:15	10:45	Coffee Break + Core Display & Exhibition	
		Session - Applied Technology	Session - Future Focus
10:45	11:10	The Culzean Field: Application of DFOS (Distributed Fibre Optic Sensing) Technology for Layer Contributions - Hamish Dunnett, TotalEnergies	Global Exploration: Which Barrels Win? - Patrick Rutty, Enverus
11:10	11:35	Supporting critical well delivery decisions by utilising machine learning to aid interpretation of wellsite XRF data - Robert Webber, CNOOC International	Subsurface basis of design is the most important part of well decommissioning. Discuss - Ruth Thomas, Well Safe Solutions
11:35	12:00	Fiber optics VSP survey acquired in record time during sonic and formation pressure testing, offshore UK - Rafael Guerra, SLB	UK future energy supply: what future opportunities exist for domestic oil and gas? - Yvonne Telford, Westwood Global Energy Group
		Techbytes	
12:00	12:10	Safely Bringing Wells Back Online; Leak and Corrosion Diagnostics for Planning Remedials - Sergey Prosverkin, TGT	
12:10	12:20	Increasing Asset Value Through Using Along-hole Depth, Inclination and Azimuth Measurements To Define 3D Positional Uncertainty - Harald Bolt, DwpD Ltd., Depth Solutions	
12:20	13:20	Lunch + Core Display & Exhibition	
13:20	14:20	Masterclass - Shell UK Upstream's Energy Transition Journey	Reserves Booking and Portfolio Management Masterclass - Gavin Ward and Adam Borushek - RISC Advisory
		Session - Production Enhancement	Session - New Energy
14:20	14:45	In-situ microwave-assisted catalytic upgrading of heavy oil, a new route for hydrogen production from heavy oil reservoirs - Hossein Anbari, University of Nottingham	Plotting a route to net zero whilst maximising production – a challenging win-win for industry - David Moseley, Welligence
14:45	15:10	Enhanced Oil Recovery and CO2 Storage by Carbonated Water Injection - Mehran Sohrabi, Heriot Watt University	CCUS & the North Sea: a stepping stone towards net-zero - Bruce Walker, Enverus
15:10	15:35	Integrated Geo-Dynamic Modelling and Investigation of Pressure-Dependent Permeability to Increase Working Gas Capacity of Reservoir Repurposed for Underground Gas Storage - Tim Salter , Baker Hughes	Big Data: What is a significant sample size? - Gavin Ward, RISC Advisory
15:35	16:00	Coffee Break + Core Display & Exhibition	
		Session - Production Enhancement	
16:00	16:25	Restoration of a late-life high sand producing oil well no downhole sand control using a topsides sand filtration package. - Steven Scott, Shell U.K. Limited	Thermodynamics Synthesis and EOS Modelling of Water of Condensation bringing value to a mature Gas Condensate subsea asset - Obuekwe Mogbo, TotalEnergies
16:25	16:50	A case study of Organic Oil Recovery in the Scott Oil Field - Andrew Bostock, CNOOC International	Collaboration is the key to success: Unlocking the value in the Leverett Field - Steve Kenyon Roberts, Harbour Energy
16:50	17:15	Stress Testing – Measuring Insitu Stress - Emilie Peyret, SLB	
17:15	17:40	The Kinnoull Field: Unlocking production enhancement by revisiting accepted “facts”. - William Bottomley, bp	
17:40	17:45	Closing Remarks	

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Day 1 Keynote Presenters



Clara Altobell is Vice President for ESG and Business Innovation at Serica Energy. She has over twenty-five years' experience in the upstream oil and gas industry, starting out as a petroleum engineer, working globally and managing different aspects of the industry. More recently her focus has been closer to home in the UK North Sea, with Serica's Erskine, Bruce, Keith and Rhum fields. With her role in ESG and business innovations, Clara is now helping to steer Serica through the energy transition, looking at ways to reduce emissions and make a positive ESG impact. Clara holds an MSc in Petroleum Engineering from Imperial College, London and is a fellow of the Energy Institute.



Graham Davis is the Chief Petrophysicist at Harbour Energy where he is responsible for petrophysics for the company's global assets in the North Sea, Gulf of Mexico, Indonesia, and Vietnam. He is particularly interested in productivity prediction, thin-bed analysis, and saturation height modelling. Graham has more than 30 years of experience, and before joining Harbour (nee. Premier Oil), he was the Chief Petrophysicist at Canadian Natural Resources International, Local Petrophysics Network Leader at BP, and held positions both in the UK and internationally for Shell and Enterprise Oil. He holds a BSc in geology from London University and is a member of the SPWLA and SPE.



Wiens van Zeil UK Director of Subsurface. Wiens has 20 years of international oil and gas industry experience. He holds a BSc and MSc degree in Petroleum Engineer from Delft University of Technology and started his career in the North Sea working for Total and Chevron on gas, gas condensate and oil fields. Subsequently he moved to the United States where he worked deepwater oil fields responsible for field management, infill drilling and strategic development planning. Following on he moved to Australia to work on LNG projects as a team & opportunity lead responsible for the Greater Gorgon development portfolio. After his return to the UK in 2016 he became the project manager for non-operated Clair South project, followed by the Technology Manager for Chevron Upstream Europe and finally subsurface manager for the Captain oil field implementing and scaling up the tertiary recovery flood with Ithaca Energy. Wiens moved into his current role as Director of Subsurface with Neptune in August of 2021 and is responsible for all subsurface aspects from exploration, appraisal, development and carbon storage projects in the United Kingdom.

Day 2 Keynote Presenters



Carlo Procaccini is the Chief Technical Officer of the UK North Sea Transition Authority, and his remit covers technology and innovation for the UKCS, ranging from oil & gas projects and operations to emerging net zero solutions. Carlo has over 25 years of experience in oil and gas industry, having worked in both downstream and E&P. Prior to joining the OGA, he was at Schlumberger focusing on projects to improve asset performance in mature offshore basins, in the UK and internationally. Carlo holds a PhD in Chemical Engineering from MIT and is a Chartered Petroleum Engineer.



Malcolm is a Vice President and Head of Wood Mackenzie's Upstream Consulting division for Europe, the Middle East, Africa, and Caspian. Malcolm has more than 25 years energy industry experience joining Wood Mackenzie's Upstream Consulting Team in 2007, having spent ten years working across the world in the oilfield service sector. Malcolm started his career in North Sea drilling operations, leading to running projects across the world and setting up operations in Nigeria and Brazil. At Wood Mackenzie Malcolm uses his operational experiences to support his commercial advisory work. He has advised a wide range of clients on due diligence, transaction support, strategy, and market analysis across multiple market sectors including conventional oil & gas, tight oil & gas, gas markets, infrastructure, decommissioning, OFS, and low carbon. In recent years this has become increasingly focused on the energy transition with particular focus on the North Sea basin. Malcolm has an MSc in Petroleum Engineering from Heriot Watt University, a BSc in Environmental Sciences from UEA and recently completed the Cambridge University course Business and Climate Change: Towards Net Zero Emissions

Day 1 Abstracts – 20th June

10:45 Maximising Recovery in the Brodgar Field; a Mature Gas Field with Water Handling Constraints

Gareth MacMillan, Harbour Energy

The Brodgar field was developed with four horizontal subsea wells in block 21/3a operated by Harbour-Energy. Production fluids flow through a 40km subsea pipeline to the Britannia platform. Water handling capacity in the Brodgar field is limited due to issues in the topside facilities.

The original development wells (H1 & H2z) were shut in at low water cuts due to water handling constraints. However, in the two subsequent wells (H3 & H4), ICVs (inflow control valves) were installed at the heel and toe sections of the lower completion to manage future water breakthrough. Closing the toe ICV in well H4 resulted in the successful isolation of water, and the well has been producing water free from the heel section for over one year. A mechanistic simulation model was built to determine the optimum offtake rate/forecast water production and aid the ICV operating strategy.

Work is ongoing to increase the water handling capacity by reducing the pipeline pressure to push flow conditions outside the hydrate envelope. This is being facilitated by re-routing the Brodgar gas to the low-pressure compressor to prolong production. Work is also continuing to identify new drilling locations on Brodgar using recently acquired 4D seismic.

10:45 Understanding the matrix impact on the development of the Lower Clair Group of the Clair Ridge Field, West of Shetland

Adam Poptani & Luke Wooldridge, bp

The Clair Field is the single largest hydrocarbon accumulation on the UK continental shelf. The principal reservoir interval is formed of the heavily fractured, Devonian clastic red-beds of the Lower Clair Group.

The pre-2020 development plan on Clair Ridge focused on achieving production rates via targeting natural fractures. Challenges with open fracture prediction (from early-water-breakthrough to low productivity wells) lead to a significant production gap vs. forecast.

A cross-functional strategy was created to increase production. The strategy included accelerating producers and drilling shorter duration wells. This placed focus on developing largely matrix only wells.

Despite the high net-to-gross nature of the fluvial - aeolian sands, the reservoir interval can be considered a diagenetic play with calcite cement the dominant control matrix quality.

A study integrated a range of reservoir quality analysis with sedimentology, core observations, petrophysical log-, heavy minerals-, and climatic- data. Analysis unveiled a unique relationship between climatic shifts, the resulting sedimentological characteristics, and the contrasting styles of reservoir quality across the LCG which ultimately revealed a predictive depositional order.

The successful implementation of this production-increasing strategy, supported by the predictive depositional model of the matrix resulted in production on Clair Ridge being increased from 40mboed to 80mboed in 2021.

11:10 Orlando – Trials, Tribulations and Eventual Success of a Single Well ESP Supported Subsea Tie-Back

Ross Cameron, Tailwind

The Orlando field is located in Block 3/3b and was discovered in 1989 and appraised in 2011/12. It was eventually developed as a single well subsea tie-back to the Ninian Central Platform between 2017-2019 with 1st production achieved in March 2019. Initial production performance was lower than expected and a workover was required to replace the upper completion in 2022. Following successful completion of the workover, production has been re-instated and the remaining Orlando reserves now have the potential to be recovered.

This talk will focus on some of the challenges faced during development and early production and learnings applied to maximise the chance of success of the Orlando workover and which are applicable to other well tie-backs, particularly subsea tie-backs, to avoid some of the Orlando pitfalls.

11:10 The benefit of seismic re-processing to identify late life opportunities in the Buckland field

Rachael Crowe, Apache

The Buckland field is located approximately 12 km southwest of the Beryl Field and lies within block 9/18a. Last year's talk focused on the BK7 well which was drilled in 2019 as a twin to the original horizontal producer, BK1, in the northern half of the Buckland Field. The tidal estuarine Beryl reservoir is stratigraphically divided by several thin shale horizons that can be correlated field wide. The incorporation of these shales in the static and dynamic models identified attic and cellar targets above and below BK1 which drove the decision to drill BK7.

In contrast, BKSX was drilled primarily as a result of recent seismic re-processing. The field is covered by a 3D broadband seismic survey which was re-processed in 2020 using full waveform migration to define the PSDM velocity model. The primary target was the Beryl reservoir in an undrilled fault block in southwest Buckland. The significantly improved seismic imaging over the BKSX structure increased confidence in the trap and the updated mapping of the Beryl indicated that the reservoir would be preserved within the BKSX structure. BKSX was drilled in 2022 and successfully logged a total of 285 ft TVD net pay in high quality reservoir.

11:35 Gannet subsea Infill - Framing to Execution Phase in 10 months

Charles Ileagu, Shell

As our world continues to grapple with dilemma of establishing what the most effective Energy Transition pace should be, ensuring reliable near-/medium-Term energy supply is increasingly crucial. One of the key levers to sustain and drive this important Transition, is ability to further sweat existing producing assets through efficient in-field opportunity identification and maturation.

A subsea infill well development opportunity was identified in Gannet cluster satellite fields (GF), a relatively mature producing asset. Following 2020 unsuccessful GF infill outcome, this opportunity required a renewed maturation approach to help generate an investible proposal in timely

manner consistent with energy transition objective. Combination of learner mindset, process simplification, and visible decision quality enabled the Gannet team to mature this CNS UK opportunity in, moving from concept to investment decision within 10 months, less than half the typical maturation time. Early and purposeful collaboration across Development, Wells, Subsea, Project Services and Service providers were particularly effective to maintain a razor-sharp focus on key technical and non-technical risks.

This presentation describes how team applied innovative thinking and behaviours in developing a high technical POS solution and rapid opportunity maturation. Well is currently on schedule for first oil Q3, 2023.

11:35 Exploiting Field margins: An example from the East Everest Field

Peter Wood & Kevin Angus, Harbour Energy

Recent infill drilling on the northern margins of the East Everest field has demonstrated the value in understanding and exploiting the peripheral areas of the field. A horizontal infill well was drilled and completed from a subsea template and tied back to the North Everest platform in 2021/22. The well targeted reserves in the gas bearing, Paleocene, Mey and Maureen Formations. Static well results were broadly positive and initial production has been good. The project has demonstrated that application of the correct well design and tie-back via existing infrastructure can yield a profitable project. The initial wellbore drilled encountered hole stability problems which necessitated a mechanical sidetrack that paralleled the initial wellbore some 50 feet up dip. This revealed unforeseen localised structural complexity and provided a useful lesson in the resolution limits of seismic data and in the fault seal capacity in this location.

TECHBYTES

12:00 A Digital Platform to Enhance Emissions Management for the Oil and Gas Industry

Mohammad Yasir, Halliburton

The oil and gas industry and operators are increasingly facing investor, public and peer pressure to show traceable and auditable progress towards emissions targets and goals. It is becoming apparent that companies need help navigating this new reality and connecting it to their current way of doing business, driving meaningful decisions on reducing their carbon footprint with the greatest efficiency and within their budgets. A platform to track, forecast and report companies' greenhouse gas emissions will help address these challenges. Halliburton has developed such a platform, Envana™ Catalyst, which has three fundamental pillars:

- * A comprehensive library of emissions sources, managed centrally by corporate sustainability experts, to ensure company-wide alignment of emissions calculations.
- * Direct connection from individual business unit software to the central emissions platform via a fully documented API, that easily ingests data and removes the need for manual data entry.
- * Top down and bottom-up portfolio emissions tracking and forecasting to facilitate decision making at all levels of the business.

By leveraging the pillars for the Envana™ Catalyst platform, Halliburton gains a way to begin embedding an understanding of emissions throughout the business, benefiting Halliburton's journey to its reduction goals, as well as its customers.

12:00 Optimizing Sampling Workflow & Hardware for Fluid Scanning & Sampling Success in Unconsolidated Formations

Marcus Turner, SLB

Assessing reservoir fluid properties in real-time, with a Formation Mapping While Drilling (FMWD) technology is becoming an accepted practice with clear advantage of reducing operational risk and limiting stationary time due to smaller depth of invasion. This has opened a wide range of opportunities for operators to evaluate fluids in wells with complex trajectories. However, there are some technical restrictions that limit the applicability of the technology in unconsolidated formations where the risk of mobilizing formation fines and plugging the tool.

A holistic approach, based on a combination of optimized sampling tool hardware, bit hydraulics, petrophysical, granulometry and geo-mechanical evaluation, combined with pretest mobility analysis, has resulted in a new workflow that can significantly reduce the risks of deploying the FMWD technology into unconsolidated Sandstone environments. The methodology is based on four pillars:

1. Predicting potential fines migration and formation collapse during pump-out stations.
2. Design pump-out operations such that sanding is prevented, and formation integrity is maintained.
3. If shear failure occurs, prevention of mobilized fines from entering the tool.
4. If fines enter the tool, the workflow then focuses on reducing the negative impact of the solids on the hardware within the tool.

12:10 Geosteering Techniques Integration to optimize well placement. Case studies from the Norwegian Continental Shelf

Alexandra Zaputlyaeva, ROGII

Complex well targets require advanced geosteering methods. During the last decade, the application of the Deep and Ultra Deep Azimuthal Resistivity tools has largely increased the accuracy of the well placement. Resistivity inversion results are often the main method that guides the decision-making of the geosteering engineer in conventional reservoirs. While some of the other geosteering methods (for example, stratigraphy-based geosteering) are not commonly applied in conventional formations. The integration of all the geosteering methods (model-based, stratigraphy-based, image log Interpretation, and resistivity inversion) in one geosteering software can enhance the geosteering workflow and increase the coverage of the pay zone. This work aims to show several case studies from the Norwegian Continental Shelf where an integrated geosteering approach using our software was applied for real-time and post-job analyses. While mapping the fluid contact and placing the well close to targeted fluid contact is more efficient using the azimuthal resistivity inversion calculation, the reconstruction of the formation structure and understanding of the stratigraphical well position in the reservoir could be better performed using the stratigraphy-based method. Therefore, the integration of all the geosteering methods can lead to more accurate well placement and should not be overlooked.

12:10 Re-risking Reservoir and Fluid Data Acquisition in South East Asia Using Fluid Mapping-While-Drilling Technology

Aldrick Garcia Mayans, SLB

Downhole fluid analysis (DFA) has proven to be an effective technology to assist in understanding reservoir dynamics, fluid distribution, reservoir compartmentalization and in-reservoir processes. Until recently DFA technology was only available with wireline conveyed tools. This was typically performed after the well had been drilled, limiting the ability for real-time decision making. The recent advent of logging while drilling (LWD) DFA technology - also known as fluid mapping-while-drilling (FMWD) - now allows operators to make informed and timely decisions on well construction, landing, geosteering and completion early in time and without pulling out of hole. This presentation is an aggregate of case studies from South East Asia demonstrating the benefits of the technology to operators in exploration, conventional reservoir management and even geosteering.

14:20 Stress decoupling and seismicity assessment for containment risking of planned CO2 storage on the Horda Platform

Graham Tarn-Dyson, Equinor

Containment Risk Assessment and Management is a critical component when developing a CO2 storage project, where the overall purpose is to understand, communicate, and manage containment risks during screening, project development, site operation and after site closure. Within CRAM, it is important to quantify the geomechanical effects associated with CO2 injection, both due to pore pressure build-up and possible thermal effects on caprock seals and bounding faults. The Horda Platform in the northern North Sea stands in a key position to provide significant CO2 storage capacity, both as part of the ongoing Northern Lights project and also for large scale-up potentials such as the recently licensed Smeaheia project. In this study, we illustrate our current understanding of the in situ stresses, fault reactivation, and seismicity risks of the study area by integrating structural/neo-tectonic configuration, detected seismicity and earthquake focal mechanisms (EFM), and recently acquired high-quality stress measurements from the sedimentary package. The work shows, amongst other things, that the stresses in the sedimentary package are only weakly coupled to that in the basement in this region and that the fault reactivation and induced seismicity risk are considered low in a suitable managed CO2 store.

14:20 Challenges of the Conversion of a Mature Natural Gas Storage Facility to Hydrogen Storage using a Carbon Dioxide Cushion Gas

Heikki Jutila, Exceed

The central objective of this work was to evaluate the feasibility of “change of service” of the Rough Field natural gas storage facility to Hydrogen Storage using the primary candidate cushion gas; Carbon Dioxide. The work highlighted several challenges which led towards an improved understanding of the process characteristics arising when hydrogen (H2) is stored in subsurface porous media. These challenges were associated not only with the geochemical and hydrodynamics of the hydrogen (H2), but the timing and operational status of the asset and the optimisation of the transition program.

In particular, we will present the generalised optimal injection conditions of the CO2 in order to maximise recovery of the remaining cushion and working gases (Enhanced Gas Recovery) prior to storage conversion, together with challenges associated with maintaining the purity of the stored hydrogen during back production. In addition, the presentation will review aspects of working gas thief mechanisms both geochemical and bacteriological, asset integrity assurance studies both geological and mechanical, and gas migration pathways, materials selection and possible microbial interactions, both detrimental and beneficial.

Detailed work included the construction of a fully compositional dynamic and chemical models for investigating various interactions between the components in the reservoir.

14:45 Evaluating the geological case for the natural accumulation and storage of CO2 in the East Irish Sea Basin, UK

Sam Head, Heriot-Watt University

A subsurface characterisation of CO2 accumulations and nearby fields in the East Irish Sea Basin, western UKCS, has been undertaken, identifying geological parameters suitable for storage and informing prospective site selection. A diverse dataset has been utilised, integrating geophysical logs, pressure measurements and seismic volumes. CO2-rich fluids are limited to the Keys sub-basin, yet igneous intrusions, the suspected source, have been mapped across the northern sector. Followingly, the caprock, in addition to the source, is deemed crucial to CO2 distribution. The Mercia Mudstone Group overlies the Sherwood Sandstone reservoir and serves as the caprock for all fields in the basin, consisting of halite and mudstone members. The lowermost Fylde Halite Member is thickest in the Keys sub-basin, yet is limited in extent to the northern and central East Irish Sea Basin, replaced elsewhere by the Ansdell Mudstone Member. A distinct pressure regime exists within the Keys Basin and fault interpretations and water salinities suggest isolation from the wider aquifer. Combined with the Fylde Halite Member, block isolation has allowed the accumulation and preservation of natural CO2. As such, CO2 containment within the Keys Basin is considered secure, although the depleted pressure cell impacts the estimated capacity of storage sites.

14:45 Decarbonising the UK North Sea - theory v practice

Ian Gladman, RISC Advisory

Using the example of the Pilot field, UK N.Sea the presentation describes how the author helped the development concept achieve up to 80% reduction in GHG emissions (depending upon final development concept selected): GHG emissions associated with the development reduced from 14.4 to 2.64 kgCO2/bbl (80%). The presentation describes the steps taken in the FDP:

- * Reciprocating gas engines – primary on-board power generators, more efficient than open cycle.
- * Heat pump technology – front end well fluids process heating & low salinity water heating, using seawater as the heating medium.
- * MVDC bus electrical architecture – reduces weight and space,
- * Power slip ring - Enabling power import on the FPSO & WHP to use renewable energy and provide 12 MW of power,
- * Floating Power Plant (FPP) - Leasing of a single floating wind turbine,
- * Drilling of a gas storage well on the Pilot East cap, ensuring no gas is flared
- * Wash tank technology - separating the oil and water in wash tanks instead of using electrostatic coalescers.

The presentation concludes with examining costs associated with reduced emissions and RISC’s experience that developments in the N. Sea won’t be approved by NSTA without demonstrating how they have:

- 1) Reduced GHG emission intensity of the development
- 2) Considered potential net zero pathways

15:10 The application of AI to a Southern North Sea seismic interpretation of depleted and virgin reservoirs for CCS site investigation

Ryan Williams, Geoteric

Carbon Capture and Storage is seen as a vital component in reaching our 2050 Net Zero goals. To achieve our target in this time frame we need to work smarter and quicker than previously, whilst building on the knowledge and learnings from past studies. Artificial Intelligence (AI) has the potential be a solution for interpreters across the new energy sector, or wherever subsurface understanding is required, be it for shallow boulder detection or trap/seal analysis.

This presentation illustrates how AI was used to reveal and extract highly detailed geological information from the Permian to the sea bed, including fault analysis, horizon interpretation, geobody extraction and facies classification across a legacy Southern North Sea dataset. This presentation highlights the potential of CCS over both depleted reservoirs and new virgin structures and shows how AI can be used to assess the risks associated with both targets. De-risking structures for CCS site classification is the first part of the CCS story, but is also one of the most important. With AI, interpretation can be achieved more quickly and accurately than ever before enabling interpreters to fully reveal the complexity of the subsurface.

15:10 Operational Parametric Evaluation of the Underground Hydrogen Storage Efficacy in a Deep UKCS Aquifer

Prashant Jadhawar, University of Aberdeen

Underground Hydrogen Storage (UHS) in geological geoformations is expected to play an important role in stabilising energy supply fo meet the variable seasonal demand. This study investigates the technical feasibility of storing hydrogen in a deep North Sea aquifer to evaluate the effect of injection and production rates, number and length of storage cycles, and shut-in periods on the efficiency of the UHS process using CMG-GEM.

Results show that increasing the Hydrogen injection and production rates decreases the aquifer’s storage capacity and Hydrogen recovery during withdrawal phase, thus negatively impacting the overall UHS. This is believed to be a result of the dominating Hydrogen viscous fingering and gravity override of the native aquifer water leading to unstable displacement process when the operational Hydrogen injection and production rates are high. Moreover, the shut-in periods may lead to a reduced Hydrogen recovery. Also, longer and less frequent storage cycles led to higher storage capacity and a decreased Hydrogen recovery efficiency. Clonclusion is that a UHS in this associated sector-aquifer model is technically feasible. A thorough evaluation of the operational rates and storage cycles in UHS process is essential to maximise storage capacity and H2 recovery efficiency prior to its implementation.

16:00 The First Application of Autonomous Outflow Control Devices in a Water Injection Well in Norway

Geir Frode Kvilaas, AkerBP

Several techniques have been applied to improve the performance of injection wells and eventually improve field oil recovery. Passive flow control devices have been successful in improving the conformance in the wells, however, they may fail in the reservoirs with complex/dynamic properties including propagating/thermal fractures. There, the continuously increasing contrast in the injectivity of a section with the

feature compared to the rest of the well causes diverting a great portion of the injected fluid into the thief zone thus creating short-circuit to the nearby producer wells. The new autonomous injection device chokes the injection fluid into the growing fractures crossing the well. Once a predefined upper flowrate limit is reached at the zone, the valves autonomously close.

Since its introduction in 2019, the benefits of the valve have been recognised by several operators worldwide. This presentation brings the results from the first installation of the devices in an injection well in Norway for AkerBP. The presentation discusses the applied completion design workflow and well performance data including ILT data and several tests performed. The lesson learned from this initial installation also would be shared.

The well performance outcomes show that new completion has successfully delivered the target rate and desired conformance performance.

16:00 Injection Above Fracture Pressure: Verifying Cap Rock Integrity and Evaluating Conformance **Remke Elliss, TGT & AkerBP**

Initiating fractures through reservoir cap rocks can have serious consequences. When injecting fluid into reservoirs at high rates, often the injection pressure can be above the minimum sigma of cap rock. If the cap rock is not properly isolated from the wellbore by cement, such injector wells have the potential of fracturing the cap rock. Consequences here include out of zone injection into overburden. This paper focuses on a water injector well for which there was a concern that such out of zone injection (OOZI) into cap rock and overburden was occurring.

A well has a high perm zone positioned just 4 meters above the target formation. This led to the concern that injection could be “swallowed” by this interval, or flow up passed caprock positioned just 8 meters above target. A spectral acoustics and temperature survey was conducted under a low and high injection rate to identify where the fracture(s) were opening, and evaluate any out of zone injection, either above the target zone into the cap rock and overburden, below target into underlying layers, or into the target formation itself. This survey also enabled evaluation of how fully the targeted interval was accepting injection fluid.

16:25 Enhanced Oil recovery by controlling the water production with the Application of Autonomous Inflow Control Valves: A Case Study **Ismarullizam Mohd Ismail, InflowControl**

Premature water breakthrough in mature heavy-oil reservoirs is a challenge. Due to the mobility ratio, water tends to flow much easier compared to oil, leading to premature water breakthrough which pushes water cut values to over 95% in short period of time. High volumes of water production limit the oil production due limited water handling capacity.

A mature heavy-oil field located in a tropical rainforest area in the Pastaza province, east Ecuador (17-19 °API and 25 cP). The field has been mainly developed with horizontal wells, where several inflow control technology have been trialed however none of these technologies have been able to provide effective water control .

After a technical evaluation, the AICV technology was chosen, and installed mid-2021. Due to its ability to autonomously restrict water flow based on the fluid properties (viscosity and density),

The AICV has shown superior water control compared to other technologies used in the field. The well began its high early oil production with 4% water cut which is approximately double the initial oil rate compared to modelling. Production rates have been very stable for over a years with water volumes produced from the AICV are 60% less than the neighboring wells.

16:25 Well clean-up optimisation using advanced numerical modelling processes **Michael Byrne, Axis**

As part of the well construction process, most wells are cleaned up by allowing flow from reservoir to surface. The clean-up process and efficiency is impacted by multiple factors such as near wellbore damage, well completion, fluids in the well and production fluids. To predict and optimise the clean-up process a new workflow has been developed.

Flow from reservoir to the well and through the lower completion is modelled using 3D Computational Fluid Dynamics (CFD). This enables a fully coupled reservoir to well system to be simulated and allows the completion to influence reservoir flow and the reservoir to influence well flow for the entire reservoir section length. Simulations are run over a range of rates and pressures.

The CFD output is then used to generate inflow performance relationship for a 1D dynamic multiphase simulator which simulates flow from the lower completion to the surface (and beyond). The 1D simulator can include all wellbore fluids (including gas lift) and the reservoir fluids and enabling the transient well clean-up to be modelled and optimised.

The “handshake” between the CFD and the multiphase well simulator is critical. Several examples from oil and gas production wells and water injection wells will be shared.

16:50 Understanding the Source of Pumps Off Gas in Impermeable Rock **Dean Thorpe, Shell**

This presentation will focus on the pumps off influxes seen while drilling through the impermeable overburden section in one of our recently executed wells. The well experienced pumps off gas 300 ft from the previous casing shoe through to total depth. We demonstrate that the gas was from the same depth interval and had the same composition. No clear candidate for the source of this gas was apparent from real time data, however after recovering the borehole assembly, memory data demonstrated the clear presence of a fault/fracture; this was not clearly visible on seismic data. The presence of this fault/fracture network provided a candidate for the observed gas influx. We have examined if fault reactivation can be a potential mechanism of these gas events. Utilizing Mohr-Coulomb Failure criteria, we noted that the estimated fault reactivation pressure, given our uncertainties, was within the range between our pumps-off ESD mudweight and the ECD. As a result, the reactivation of this fault/fracture network appears to be consistent with the observed pumps-off gas response.

16:50 High pressure-difference eline perforation on a declining subsea well in the North Sea. Forvie North Light Well Intervention

Helene Berthet, TotalEnergies

Forvie North is a subsea development well in the North Sea, 35km south of the Alwyn North platform. First gas started in 2005 with the opening of the Upper Brent reservoirs Tarbert and upper Ness, though the well was drilled down to the Broom reservoir. In 2015, a Reservoir Performance Monitoring log was performed, and the Lower Brent reservoirs were found to be still at virgin pressure after years of production of the upper layers.

Six years later, we planned the perforation of these virgin reservoirs in a multi-well, multi-job Light Well Intervention Campaign with Helix and Schlumberger. The main challenges included a very high-pressure difference between the virgin and depleted reservoirs (+500 bar), a standing-water column in the well and the risk of differential sticking. With a multi-disciplinary joint effort between TotalEnergies, Schlumberger and Helix, we managed to safely perforate the Lower Brent, breaking the record of differential pressure eline perforation, and multiplied the well production by a factor of seven.

17:15 If don’t find natural fractures, create your own: Clair Ridge hydraulic stimulation

James Hoad, bp

The Clair Ridge field started up in 2018 as the second Phase of the Clair area development. Well performance in the lower permeability Unit V and Unit VI intervals is driven by natural fracture presence – while there are mappable trends not all wells successfully intersect productive features. On Clair Phase 1 the potential for hydraulic stimulation had already been demonstrated with a 1mbd Unit VI well seeing a peak rate uplift of 6.5x and long term uplift of ~2.5x after a 4 stage hydraulic stimulation in 2019.

The first candidate on Clair Ridge was a well with an initial rate of 1.4 mbd that had declined to ~0.8mbd. This contained both Unit V and Unit VI zones so would prove Unit V stimulation and ability to connect to the Unit VI interval above. A range of fracture and reservoir modelling work supported the planned stimulation optimising fracture design, developing profile ranges and testing sensitivity to intersecting nearby natural fractures.

Post stimulation initial well PI increased by ~5.5x reaching a choked back peak rate of 4.5mbd, unlocking the ability to maximise recovery from lower rate wells on Clair Ridge.

17:15 Can Lost Circulation Materials (LCM) Cure Losses Across Fault Damage Zone?

Alvin Chan, Shell Global Solution UK

Severe lost circulation events have been observed from various assets across our global portfolio while drilling and completing through fault damage zones in recent years. Common characteristics of these events include: (1) pressures at which losses occurred in the proximity of fault zones appear to be significantly lower than the estimated lost circulation threshold (or fracture gradient, FG) for tensile failure of the intact formation; (2) most of these lost circulation events are dynamic in nature; (3) the more severe losses happened when crossing fault damage zone in more permeable reservoir rocks; and (4) LCM have been deployed in attempts to cure these losses with minimal success when drilling resumed. In this paper, we will present a few examples of our more severe fault-related losses where LCM had been used with various degree of success. At first glance, these LCM deployments can only temporarily cure the losses and improvements disappeared as soon as drilling resumed. However, several phenomena similar to our extensive wellbore strengthening experience from drilling through depleted reservoirs can be made upon closer examination. As a result, a more pragmatic LCM deployment strategy has been developed to combat future losses while drilling through fault damage zones.

Day 2 Abstracts – 21st June

10:45 The Culzean Field: Application of DFOS (Distributed Fibre Optic Sensing) Technology for Layer Contributions

Hamish Dunnett, TotalEnergies

The Culzean field is an Ultra-High Pressure/High Temperature lean gas condensate accumulation found within the Jurassic Pentland and Triassic Skagerrak Formations. The field was discovered in 2008 by Maersk Oil in block 22/25a of the UKCS, and represents one of the largest UKCS discoveries in the last 15 years. First gas was produced in June 2019 and the field is currently producing with the original six development wells.

In March 2022 mPLT's and Distributed Fibre Optic Sensing (DFOS) surveys were acquired in three wells. The mPLT's could only be acquired in static conditions due to the condition of the wellbores. DFOS tool enables the acquisition of flowing passes to identify zonal contribution and reservoir conformance that was not possible with a conventional PLT. The data gathered is now being used in the history matching process to constrain the new reservoir models. The use of the DFOS tool enabled the acquisition of layer contributions at rates closer to the full well potential than a conventional mPLT without the risk of blocking a spinner. This data acquisition has proved the value in testing this new technology and it will be implemented in future PLT campaigns on the asset.

10:45 Global Exploration: Which Barrels Win?

Patrick Rutty, Enverus

Over the last 50 years, exploration drilling has correlated closely to oil price. True to form, persistent low prices since 2015 drove global exploration activity to historic lows and prompted dire predictions that supply would fall below demand, forcing either a costly scramble to re-balance supply or reductions in consumption. Finally, in 2021 Brent Crude price averaged over \$70/bbl, but relatively few exploration wells were drilled. With 2022 approaching \$100/bbl and exploration still sputtering, has the energy transition changed the dynamics of the exploration business, even in the face of acute energy security issues? Will long-lead projects fall further out of favor as concerns over peak demand persist?

In this talk, we will distill these themes into key takeaways at smaller scale to see if we can divine what promise the future holds. The journey will include:

- * Analysis of current and anticipated exploration activity based on drilling, block awards, A&D, and pre-drilling studies
- * Expectations of historical and future oil production and reasons that it might continue to consistently outperform simplistic PDP decline models
- * Examination of exploration inventories and which regions, countries, and operators are best positioned for success if peak demand does indeed materialize

11:10 Supporting critical well delivery decisions by utilising machine learning to aid interpretation of wellsite XRF data

Robert Webber, CNOOC International

The success of a recent infill drilling campaign on a major UK North Sea oil field required a real time assessment of which reservoir units had been encountered, and an indication of reservoir quality. This was necessary in order to decide whether and how to complete each well. Wellsite XRF data was acquired as a critical component of the formation evaluation programme to address both of these questions.

This paper describes how a machine learning algorithm was developed that took as input the wellsite XRF data from cuttings and provided an interpretation of clay and sand units, with associated uncertainty. The timeframe for interpretation was reduced to minutes, compared to much longer timeframes for manual (expert) interpretation. Limitations in the strength of the interpretation were clearly identified so that decisions could be made with full knowledge of the inherent uncertainty. The algorithm was further improved by post-processing the results and applying stratigraphic rules – in effect developing an electronic geologist.

In this instance machine learning has proved its utility in application to a subsurface interpretation challenge. As well as improving on an existing process, the application of data science techniques provided significant insight into the dataset and previous interpretation biases.

11:10 Subsurface basis of design is the most important part of well decommissioning. Discuss.

Ruth Thomas, Well-Safe Solutions

Well-Safe Solutions, a UK-based well decommissioning specialist, have recently made strides towards establishing the subsurface basis of design as the foundation upon which safe, smart and efficient well decommissioning is based. We will explore how is this achieved and why is it so important.

The industry is fully versed in subsurface quantification for exploration, appraisal and development drilling, with a particular focus on reservoir-level subsurface principles. The overburden is generally considered an inconvenience on the journey to the top reservoir. However, this much overlooked interval, is of key importance when it comes to the abandonment philosophy, and provides the greatest opportunity for optimisation and cost-savings in well P&A.

Fundamentally, the overarching subsurface principles of zone permeability and contents, reservoir pressure (recharge prediction) and caprock availability and quality underpins all the subsequent decisions regarding barrier placement. Through a series of case studies demonstrating collaborative working between subsurface disciplines, wells engineers and clients, this paper will unearth the secrets behind well P&A optimisation and highlight the benefits of engaging a subsurface team throughout the well decommissioning process from project conception through to execution.

11:35 Fiber optics VSP survey acquired in record time during sonic and formation pressure testing, offshore UK

Rafael Guerra, SLB

A new torque-balanced fiber-optic wireline conveyance system reduced the cost of seismic acquisition by eliminating the need for a dedicated run. Faster acquisition time and reduced number of shots minimized impact to marine biodiversity and reduced CO2e emissions by 33 metric tons. It was the first time this logging technology, with improved optical specifications and a safe working load of 18 klbf, was deployed in this geographic area.

The system delivered high-quality DAS data, accurately measuring the velocities and the seismic response of the rocks drilled and away from the well. The high-density DAS seismic traces optimally sampled every 17 ft both P- and S-waves, with a seismic bandwidth of 4-64 Hz around 9000 ft TVD. Based on the data quality the operator decided to eliminate a contingent conventional VSP run with a geophone array tool, saving 12 hours of rig time.

This novel logging technology demonstrated its capability to record accurate DAS VSP data in minimum rig time, reducing HSE risks and also the environmental footprint.

11:35 UK future energy supply: what future opportunities exist for domestic oil and gas?

Yvonne Telford, Westwood Global Energy Group

The UK Government considers the oil and gas sector to be important for energy security and a key part of the energy transition. However, the introduction of a windfall tax in 2022, albeit with an allowance to encourage investment, has created further uncertainty within the industry.

While UKCS production is in decline, opportunities still remain. Westwood will review how the industry can continue to play a vital role in the energy transition and look at the opportunities that exist within undeveloped discoveries and near field opportunities. For example, in a recent joint study with OEUK, Westwood looked at the prospectivity of the UKCS. The study revealed that the UKCS still contains significant prospective resources, of which a large proportion is within tie-back range of existing infrastructure. The challenge however will be to ignite E&P activity for future developments to access infrastructure in a timely manner. Westwood will also evaluate the potential impact of changing commodity prices and/or changes to emissions charges on which processing hubs will remain operational and what that could mean for the UK's energy security in 2030.

TECHBYTES

12:00 Safely Bringing Wells Back Online; Leak and Corrosion Diagnostics for Planning Remedials

Remke Ellis, TGT

Oil producers shut-in due to integrity issues need to be comprehensively diagnosed to ensure relevant remedials are carried out to bring them safely back on-line. When multiple leaks exist simultaneously between different wellbore envelopes, a challenge with leak detection surveying is how to manipulate the well in a way that distinguishes one envelope's leak signal from another. Furthermore, when one of the leakages is on an acid filled chemical injection there is concern of corrosion happening within the A-annulus envelope; on the outside of tubing and inside of casing. This paper details a method of well integrity diagnostics using spectral acoustics to identify multiple leaks between annuli and an acid filled chemical injection line leak, and electromagnetics for evaluating tubing and casing condition. This is the first time six primary hydrophones have been run in tandem, acting as one to reduce logging time. Challenges included detecting leaks in the noisy shallow interval close to the seabed.

12:10 Increasing Asset Value Through Using Along-hole Depth, Inclination and Azimuth Measurements To Define 3D Positional Uncertainty

Harald Bolt, DwpD Ltd., Depth Solutions

Along-hole depth (AHD) is the most fundamental subsurface measurement made. Together with inclination (I) and azimuth (A), the three-dimensional (3D) position of the wellbore and hence the 3D position of the recorded subsurface parameters are defined using way-points. These way-points represent calibrated 3D positions, each having its own specific positional uncertainty. Well geometry, drilled geological horizon locations, reservoir descriptions and models, and fluid contacts and gradients are described in terms of way-points at north, east and vertical separations from the zero depth point. Operators are presented with a model for managing their 3D positioning and positional uncertainty based on AHD, I and A measurement values and accuracies. Depending on rig-state, geo- and petrophysical data can be logged to measured depth and then matched to specific 3D positions while providing bespoke 3D positional uncertainty. Correlations between wells can be made more accurately, and reservoir geometries and fluid volumes can be described with operator required uncertainties. The operator's 3D positional uncertainty is managed through defining the well survey parameters, the measurement method chosen, and equipment accuracy specifications. Examples show how this results in more accurate, and more valuable, reservoir geometry and fluid volume descriptions for different well geometries.

14:20 In-situ microwave-assisted catalytic upgrading of heavy oil, a new route for hydrogen production from heavy oil reservoirs

Hossein Anbari, University of Nottingham

Extra-heavy oil and bitumen (EHOB) could play an important role in a secure transition towards net zero emissions (NZE) by 2050. Technological developments, such as toe to heel air injection (THAI), have been shown to efficiently recover heavy oil with a reduced environmental footprint. In-situ heavy oil upgrading (by up to 10 °API) could be achieved through the THAI process. The catalytic add-on of THAI (CAPRI) potentially provides additional in-situ upgrading by surrounding the

horizontal producer with a catalyst packing. Temperatures of around 425 °C are needed for a successful CAPRI process. In this study, microwave heating is proposed to provide the requisite additional heating and increase the temperature at the catalyst packing and/or the oil in its immediate vicinity. It was demonstrated that temperatures up to 425 °C could be achieved with no need for adding a supplemental microwave susceptor. Upgrading with more than 3.2° increase in API gravity, a reduction in viscosity to less than 100 cP, and a more than 12% reduction in sulphur content were achieved using a commercially available CoMo/γ-Al₂O₃ catalyst. In addition, nearly 20% hydrogen was detected by analysing the gas composition arising from the use of CoMo/γ-Al₂O₃ and CuZnO/Al₂O₃ catalysts.

14:20 Plotting a route to net zero whilst maximising production – a challenging win-win for industry David Moseley, Welligence

E&P companies will be critical in steering the UKCS towards the NSTA's target of net zero emissions, as part of its North Sea Transition Deal. In the short term this will include maximising production, to ensure both security of supply and reduced emissions intensity. Ceasing oil and gas production is simply not an option given current demand, however decarbonising this production will be vital as part of achieving net zero goals.

The presentation will assess some of the methods available for plotting a route to net zero for the UK upstream, whilst maximising production. This includes understanding the potential for improving recovery from current fields based on well-by-well production analysis, adding new volumes through exploration and reducing emissions at key infrastructure. More than this, electrification will play a big part, which along with wind potential, will be quantified with a view to understanding the opportunities and challenges in meeting what is currently, at least, an aspirational target.

14:45 Enhanced Oil Recovery and CO₂ Storage by Carbonated Water Injection Mehran Sohrabi, Heriot-Watt University

There is great interest in developing technologies for improving oil recovery and reducing the CO₂ footprint of the recovered oil. One such technology is injection of carbonated water in oil reservoirs. In carbonated water injection (CWI), CO₂ is dissolved in flood water rather than injected as a free phase. Carbonated water has a much better sweep efficiency than CO₂ injection and results in significant additional oil recovery and CO₂ storage.

We will present a comprehensive series of experiments and assess the performance of CWI under various injection conditions and scenarios. Both sandstone and carbonate rocks were used as well as both model oil and real crude oil. The results reveal that the extent of the improvement in oil recovery obtained by carbonation of water is affected by whether the crude oil is classified as saturated or under-saturated oil. A much higher response was obtained where the oil was either saturated or close to its bubble point pressure. We present detailed breakdown of oil recovery for each case studied. Significant amount of CO₂ was retain in the rock during carbonated water injection, which highlighted the potential of CWI as a method for permanent storage of CO₂ in oil reservoirs.

14:45 CCUS & the North Sea: a stepping stone towards net-zero

Bruce Walker, Enverus

As the European energy market continues to readjust following the one-two punch of the COVID-19 global pandemic and Russia's invasion of Ukraine, natural gas is set to remain an important part of the continent's cleaner energy future. Additionally, countries are facing growing emission reduction/net-zero commitments, as well as declining production in the North Sea, where petroleum output is expected to tumble by up to 15% a year. Against this rather bleak backdrop, Carbon Capture Utilisation and Storage, otherwise known as CCUS, offers a mechanism to balance energy pragmatism with decarbonisation objectives.

This talk will assess the current state of the North Sea region's burgeoning CCUS sector: which companies are the early-movers and which countries have the most to gain?

European energy producers are beginning to investigate schemes for storing captured CO₂ in the depleted offshore gas fields of the North Sea. Several countries have already conducted CCUS tenders, with Norway having already issued four CCUS licences and Denmark recently awarding the country's first carbon storage permit in December 2022. Consequently, Belgium and Denmark are set to shortly kick-off Europe's first full-chain climate CCS pilot project: Greensand.

15:10 Integrated Geo-Dynamic Modelling and Investigation of Pressure-Dependent Permeability to Increase Working Gas Capacity of Reservoir Repurposed for Underground Gas Storage

Tim Salter, Baker Hughes

Natural gas consumption will grow significantly in coming decades in response to cleaner energy initiatives. Underground gas storage (UGS) will be key to addressing short term supply and demand dynamics during this energy transition.

This paper presents a study on the XiangGuoSi (XGS) fractured carbonate, gas reservoir onshore China which had been converted to UGS. The focus is on how integrated studies around a shared subsurface model including coupled simulation can be used to maximise working gas storage capacity and hence increase deliverability to meet future peak gas demand. Critically, the robust integration of this study raised confidence sufficiently to propose that reservoir pressure during future gas storage cycles could be increased above the original (pre-production) pressure.

15:10 Big Data: What is a significant sample size? Gavin Ward, RISC Advisory

What best distinguishes human beings from other animals is our foresight, so why do we get forecasting so wrong and so frequently and don't learn from our mistakes? For example, man is the only animal that trips twice over the same stone. We are used to saying that our portfolio will deliver a P90, P50, Mode, Mean or a success rate of X% but that is only credible, or approaching credible, if the portfolio contains a statistically significant number of samples. One of the problems with our continuous surprise with failed predictions mostly derives from our lack of understanding of sample sizes.

This presentation looks to discuss common pitfalls in sampling oil and gas data and really does answer the question of what is a significant sample size.

The presentation examines the difficulty of assessing uncertainty when oil and gas professionals look at subsurface data or investment portfolios, and many are often mis-guided by natural bias when they think they're using seemingly robust statistical methods to make decisions.

16:00 Restoration of a late-life high sand producing oil well no downhole sand control using a topsides sand filtration package

Steven Scott, Shell U.K. Limited

During 2022, production was successfully restored from a late life oil well which had been shut-in since 2012, improving energy security. The well had suffered from unmanageable sand production issues (~160kg/d) succeeding an intervention where shallow perforations were added to in reservoir zones of weak sand. Despite the well having demonstrated the ability to flow, the decision was made not to progress a restoration of the well at the time due to concerns around available technology, solids handling and fragile economics.

In early 2022 as part of the Annual Well Review process, the production optimisation team (operations, engineering and subsurface) had identified and brought focus to this well as a key restoration opportunity. The team progressed and delivered the restoration in the space of 8 months, through taking advantage of the current favorable commodity price and improved sand control technology. A feasible solution was selected, which involved the installation of a topsides modular sand filtration package to facilitate production whilst preserving topsides asset integrity.

Through flawless planning and delivery, the well has now safely been restored and is producing >1000 boe/d with produced sand (660kg/week) successfully being conditioned, handled and transported as per an end-to-end waste disposal effort.

16:00 Thermodynamics Synthesis and EOS Modelling of Water of Condensation bringing value to a mature Gas Condensate subsea asset Obuekwe Mogbo, TotalEnergies

TotalEnergies operates four offshore fields in the West of Shetlands area. The reservoir simulation models use compositional modelling to capture the fluid dynamics in these mature, turbiditic, gas condensate fields. The project aimed to improve the reservoir characterization by investigating the source of monitored water production, overcome lack of water production in compositional models and achieve accurate matching of the water cut of 12% as observed during Field monitoring.

Material balance studies indicated absence of active aquifers. Linearization of relative permeability curves and permeability anisotropy sensitivities failed to yield water production. Historically low salinity of the produced water compared to appraisal well aquifer salinities predicated produced water was majorly water of condensation.

The lumped EOS was modified, introducing water as a component in the EOS in the order to capture the condensation phenomenon. Water vapor was introduced into the initialized Fluid Column without compromising

earlier fluid properties matched to PVT lab observations, allowing wells to produce this water element as part of the liquid stream after condensation.

The simulation results were positive with excellent match to historical water cut. Increased confidence in ability to predict water allowed significant volume and cost optimization in MEG injected for Subsea Network Hydrate prevention.

16:25 A case study of Organic Oil Recovery in the Scott Oil Field Andrew Bostock, CNOOC International

In 2014 a screening study concluded that none of the traditional EOR technologies were suitable for the Scott field and subsequent EOR studies were stopped.

However, in 2017 CNOOC were approached to consider organic oil recovery (OOR). A technology that could enhance recovery by activating microbes that pre-exist in the reservoir. Despite the temperature of the Scott field being above the known operating envelope for OOR, both the simplicity of the offshore implementation and the low capital requirement, were sufficient justification for the Scott partners to consider a technology trial. Between 2018 and 2020, CNOOC, in collaboration with OOR, undertook sampling and analysis of the Scott field produced water. The microbes in the samples were identified, counted, and underwent laboratory trials. Return permeability core flood testing was also completed. Finally, in 2020 an offshore trial was performed in production well 15/22-J17.

The production increase during the J17 trial showed promise, which although offset against production deferment during the trial and the challenge of unravelling the impact of OOR from the impact of water injection, encouraged the Scott partners to move to the next stage of the technology rollout. During 2022 and 2023 an injector – producer trial is taking place.

16:25 Collaboration is the key to success: Unlocking the value in the Leverett Field Steve Kenyon Roberts, Harbour Energy

The Leverett field is a Lower Cretaceous Britannia Sandstone gas discovery with an oil rim located immediately north of the Brodgar field. The original discovery well, 21/2a-2, was drilled in 1975, with three further wells drilled in the structure since then, in 1977, 2013 and 2015. Despite each of these wells having found hydrocarbons, development of Leverett has to date eluded multiple operators.

The field is long (18km) and narrow (c. 1km wide), with reservoir sands thinning onto the Rattray High. Seismic definition is relatively poor, and a large part of the volume in Leverett remains un-appraised, leading to significant subsurface uncertainty. Over-printed on this has been a commercial environment where ownership of the field has been split across different JV groups with divergent drivers.

Recognising that without a collaborative approach the Leverett discovery would very likely remain undeveloped, the current licensees (Harbour, NEO & Ithaca) entered into a joint collaboration agreement in 2022. The results of the collaborative work and the shared vision to potentially unlock the value in this 48-year-old discovery will be summarised.

16:50 Stress Testing – Measuring Insitu Stress

Emilie Peyret, SLB

Stress testing or micro hydraulic fracturing measures minimum horizontal stress insitu at a specific depth. A direct measurement of the minimum horizontal stress of the cap rock relates directly to the maximum safe injection pressure that can be used in the reservoir layers below said cap rock or it can directly impact production, and/or the amount of fluid that can be stored in an underground storage. This measurement is a calibration point for the geomechanical models, reducing uncertainty that exists, and derisking the reservoirs and projects.

Characterizing the current state of stresses with a formation tester over a caprock and a reservoir or even over an entire lithological column is becoming more in demand with the increase in storage projects and the energy transition underway. The complexity of the formations to be tested, from deeper, harder rocks, to tighter more impermeable formations such as caprocks means that new workflows need to be built to maximize data accuracy as well as efficiency. Current day stress testing capabilities and improvements in the hardware will be discussed as well as different methods available to evaluate tight formations in order to estimate closure stress.

17:15 The Kinnoull Field: Unlocking production enhancement by revisiting accepted “facts”

William Bottomley, bp

The Kinnoull field is a 3-well subsea tieback to the Andrew platform in the CNS and has been producing since 2014. The results of a 2016 water shut off (WSO) were presented at DEVEX 2017. Following the intervention a 4D seismic dataset was acquired across the field. This dataset tied well with the data from the WSO, but also highlighted a second well where a potential WSO looked promising.

However, the legacy field understanding of zonation was at odds with any WSO being viable - the well was believed to be completed in a single sand and any WSO plug would be ineffective. As part of a static model re-build, a revision of the biostratigraphic zonation of Kinnoull was undertaken. This re-imagining of an accepted fact combined with re-visiting our understanding from log and pressure data, acquired at field development, highlighted that the well contained two different aged sands separated by a shale interval, providing the crucial isolation required for successful WSO.

The identified WSO was executed in 2021. Post clean-up, the well now produces 50% water cut, down from >95%, giving an increment of ~2000 bopd. How many production enhancement opportunities could be out there if we revisit accepted facts?

Exhibitor Profiles



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What we will be exhibiting – Rock Flow Dynamics are the developers of tNavigator software, which provides integrated static and dynamic reservoir modelling technology for all energy sectors.

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TorolfWedberg, Physiq.AI - 16th August – Virtual

SUBSURFACE EVALUATION FOR NUCLEAR WASTE STORAGE

Rodney Garrard, NAGRA, Switzerland - 5th September

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Adesoji Adedamola – HLB, Norway – November 2023

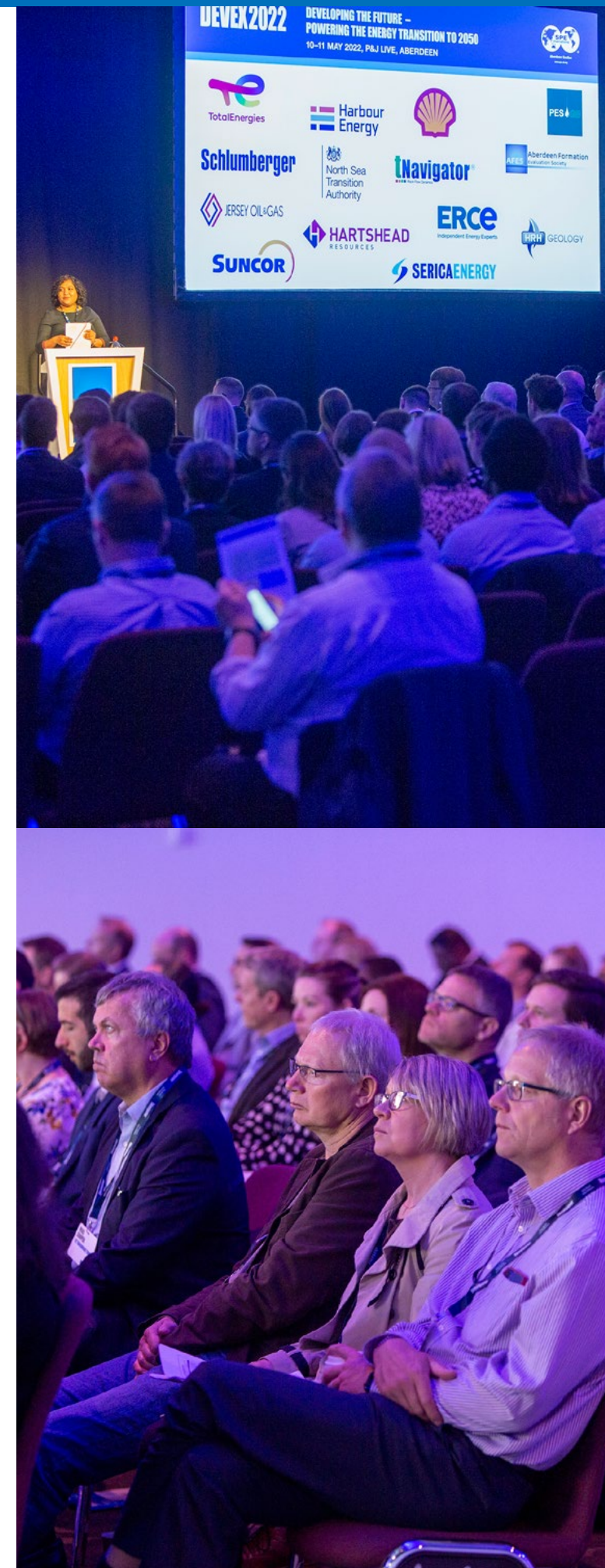
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