Aberdeen Section
www.spe-uk.org

EuALF 2021 EUROPEAN ARTIFICIAL LIFT FORUM

8th – 12th February 2021, Virtual Events

“Artificial Lift Intelligence”



Final Abstracts Programme

The organisers reserve the right to amend the programme as necessary – see website for updates on the programme timings or further details -

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Contents

Event Organisers

Aberdeen Section
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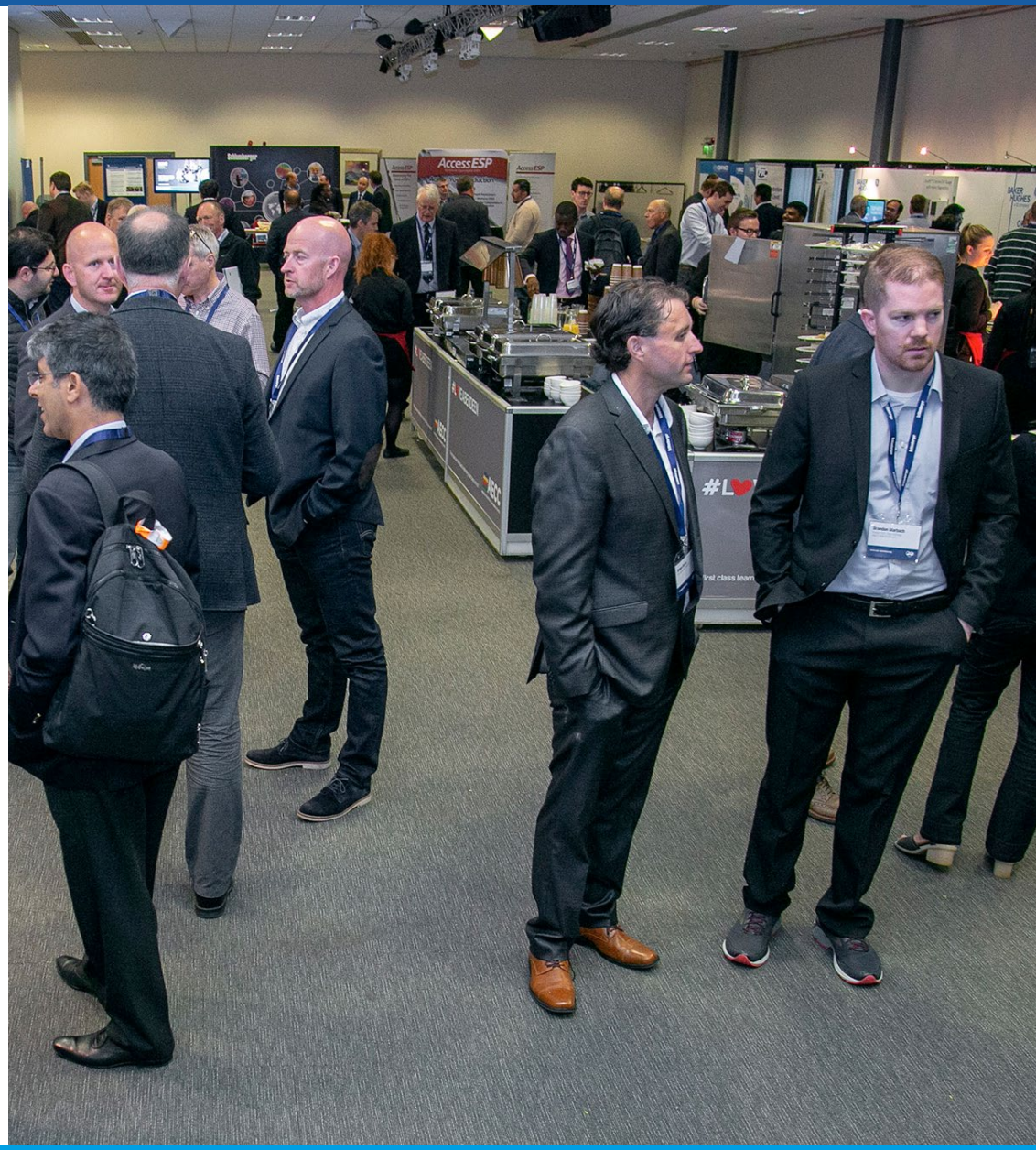
About SPE Aberdeen

SPE is the largest individual-member organisation serving managers, engineers, scientists and other professionals worldwide in the upstream segment of the oil and gas industry. Formed in 1957, the SPE global membership has now reached over 156,000 members in 154 countries participate in 203 sections and 383 student chapters. SPE's membership includes more than 72,000 student members. The Aberdeen Section is one of the largest of the SPE Sections across the world and has won the President's Award for Excellence for 8 consecutive years and last year won the Gold Award – the only section to ever do so. The section has over 2500 members ranging from drilling and completions engineers to production and operations specialists, HSE practitioners, and other professionals. The section also serves nearly 600 student members from 5 student chapters.



Chairperson's Welcome

On behalf of the SPE EuALF committee, I warmly welcome you all to this online event. We decided that with such a good programme of presentations lined up for the physical conference, it was essential that we went ahead with the 2020 EuALF in some form. Whilst I will miss the face-to-face contact, the online format has allowed us to present the best of the material in concentrated, subject specific segments over the course of the week. This will hopefully allow those of you who previously wouldn't have the time or budget to attend a 2-day conference to find learning points to take back to your own work over just a few hours.

Artificial Intelligence was a natural choice of subject for the conference opening. An awful lot has been written and said about Artificial Intelligence in other aspects of the oil and gas industry, but relatively little on the subject when it comes to artificial lift. Over the course of the conference we'll explore why this is, what the barriers are, and hear about some examples of where and how AI could make a difference.

I believe we have a varied and interesting programme of talks so that whether you are an experienced practitioner or just want to get a feel for the state of the technology, there is a session for you. Or why not take advantage of the heavily discounted 5-day pass and dip into the whole conference? You will find a wealth of knowledge and past experience from our speakers, but critically, an eye to the future as technology moves forward.

I hope you all enjoy the event, but, most importantly, improve our collective knowledge of how to do more with Artificial Lift.

Craig Durham, CNOOC International
2020 SPE EuALF Conference Chair

Virtual Conference Information

EuALF goes virtual

The biennial EuALF is a well-established forum organised by SPE Aberdeen for artificial lift professionals that will take an informed look at what the brave new world of Artificial Intelligence means to the established world of Artificial Lift. After having to postpone the event from June 2020, we are delighted to be able to bring you a week-long programme of digital events. Each day consists of 2.5 hours of high quality and insightful presentations, Techbytes and Q&A sessions.

Our Sponsors

The organisers would like to thank our sponsors. We are very grateful for your support, particularly in these challenging times.

AccessESP Simply Conveyed

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CNOOC

Baker Hughes

HALLIBURTON

NOVOMET

PTC PETROLEUM TECHNOLOGY COMPANY

Schlumberger

Abstract Programme

Abstracts from EuALF 2021 have been published in this programme. Approved final presentations will be uploaded to the SPE website after the event.

www.spe-aberdeen.org/events/eualf-2020-european-artifical-lift-forum/

Language

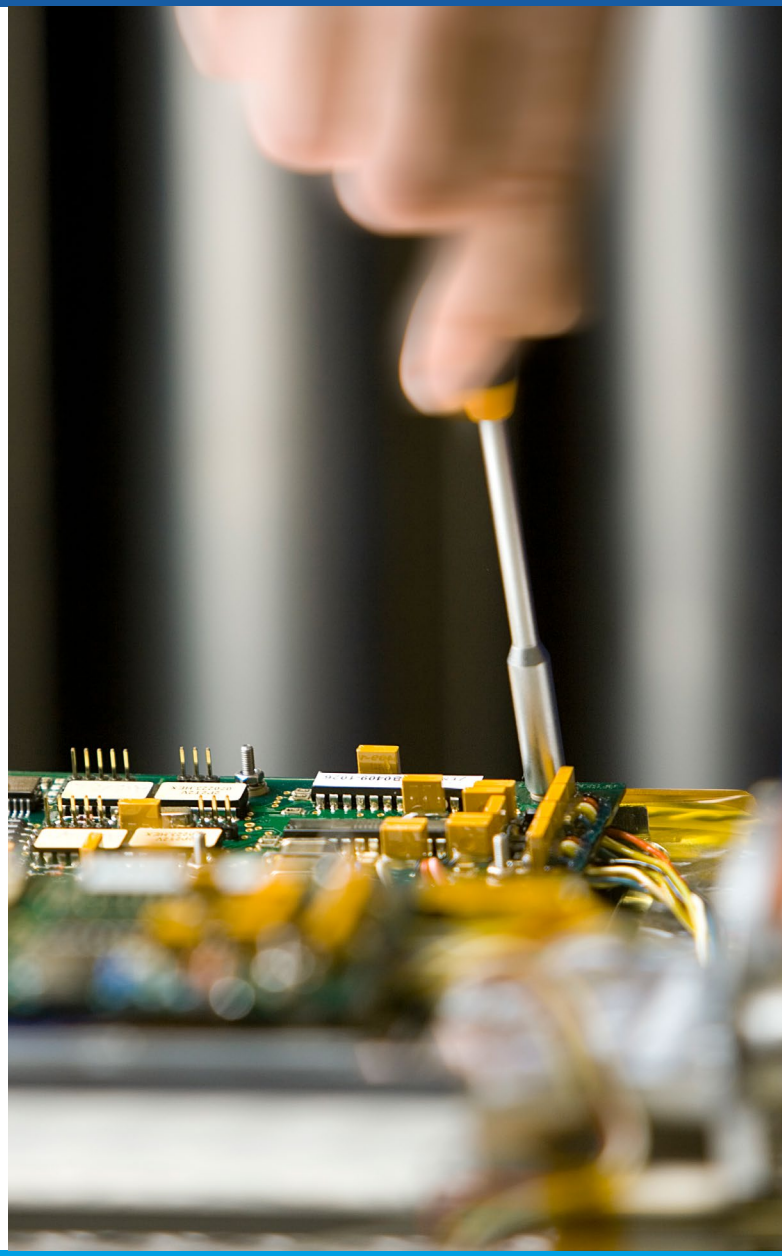
The official language of the conference is English and all presentations will be given in English. No simultaneous translations service is available.

Contact Details

Organisers – Mearns & Gill

01224 646311

aberdeen.events@spe-uk.org



Keynote Speakers

Hans-Christian Freitag,
VP Intelligent Software Solutions, Baker Hughes

Hans-Christian (HC) Freitag currently holds the position of Vice President – Intelligent Software Solutions for Baker Hughes.

He joined Atlas Wireline Services in 1989 and worked in geoscience, operations, and P&L management positions around the world. In 2002, he moved to Baker Hughes INTEQ to oversee the development and market introduction of advanced Logging While Drilling (LWD) technology, managed operations in North America and held a number of senior and executive management positions with Baker Hughes in the Middle East and Asia Pacific. From 2014 to 2016 he returned to the global technology organization as VP Integrated Technology. Prior to his current role, he led the global Geoscience & Petroleum Engineering team of 600 subsurface experts, addressing customer opportunities related to formation evaluation, well construction and production and recovery.

HC has authored publications on Open Hole and Cased Hole formation evaluation with SPWLA and SPE. He holds an MSc in Geophysics from University of Technology Clausthal, Germany and a BSc in Physics from University of Technology Berlin, Germany.

Raphael Jaramillo Arvelaiz,
VP Drilling & Operations, Equinor

Raphael Jaramillo Arvelaiz is vice-president of drilling and wells operations for Equinor in the UK & Ireland. He has over 20 years of experience in the industry, having worked for several major oil and gas operators and in multiple international locations. Raphael's priorities are ensuring safe and efficient operations; empowering and developing people; capitalising on innovations, continuous improvement, and working as One Team with suppliers and rig contractors. He holds a MEng degree in Mechanical Engineering from Universidad Simon Bolivar; and MSc in Drilling and Well Engineering from Robert Gordon University.

Conference Programme – Day 1 and 2

MONDAY 8TH FEBRUARY 2021 - ARTIFICIAL INTELLIGENCE FOR ARTIFICIAL LIFT – sponsored by Baker Hughes		
12:00	**Welcome & Introduction**	Craig Durham, Conference Chair, CNOOC International & Co-Chair, Ed Stephenson, CNOOC International
12:05	KEYNOTE	Hans-Christian Freitag, VP Intelligent Software Solutions, Baker Hughes
12:25	Automatic ESP control system – Chasing barrels with automation, efficiency and safety	Kjetil Fjalestad, Equinor
12:45	Digital Intelligent Artificial Lift – Technology Readiness & Production Results	Graham Makin, Silverwell
13:05	**BREAK**	
13:15	A Live Optimization Tool for Sucker Rod Pumping System	Codrut Stefan Sararu, Petrom
13:35	KEYNOTE	Raphael Jaramillo Arvelaiz, VP Drilling & Operations, Equinor
13:55	**PANEL DISCUSSION - HOW COULD AI IN AL DO MORE FOR YOU? INCLUDING REALTIME AUDIENCE POLLING**	
14:15	**CLOSE**	

TUESDAY 9TH FEBRUARY 2021 - YOUR GAS IS LIFTING ME HIGHER – sponsored by Schlumberger		
12:00	**Welcome & Introduction**	Session Chair - Kerr Nelson, BP & Co-Chair, Rowan Knight, BP
12:05	A Life-of-Field approach to Gas Lift Design	Atholl Campbell, PTC
12:30	Inverse Gas Lift System Installation in the UK North Sea	Neil Smith & Alun Whittaker, Weatherford
	Techbytes	
12:55	Downhole foamer injection via gas lift: laboratory and field challenges	Ernesto Petteruti, Chimec spa
13:05	High pressure gas-lift equipment design validation testing	Krister Bye, PTC
13:15	**BREAK**	
13:25	Practical Application of Asheim Stability Criteria when Troubleshooting Gas Lift	Craig Durham, CNOOC International
13:50	Slugging Reduction by Emulsion Breaker Injection in Ekofisk Gas Lifted Wells	Danila Shutemov, Conoco Philips
14:15	**CLOSE**	

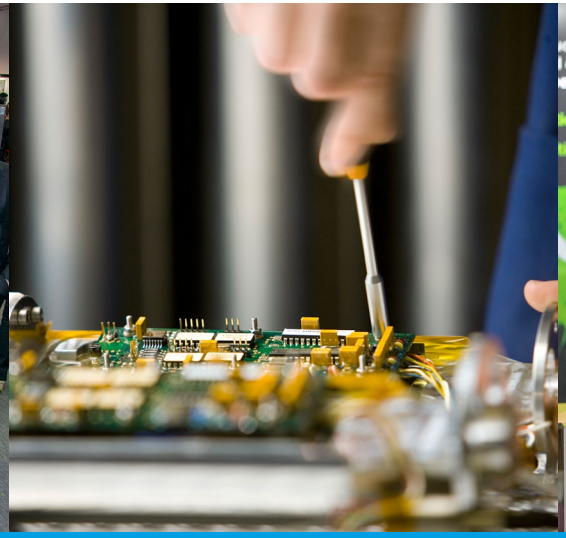
Conference Programme – Day 3 and 4

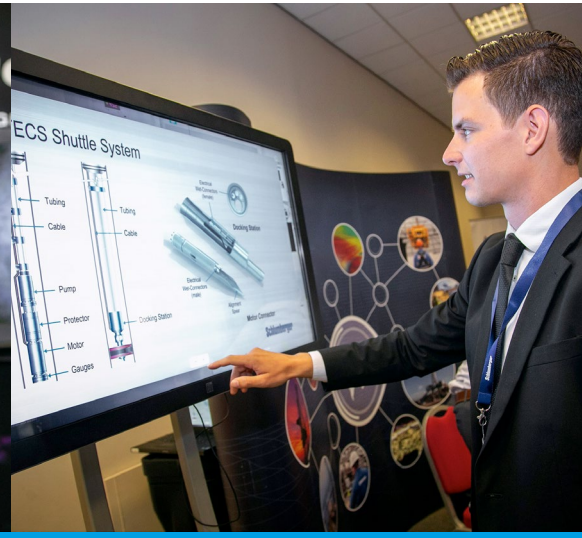
WEDNESDAY 10TH FEBRUARY 2021 - FIT LIKE? FIT THROUGH TUBING AND OTHER ESP DEPLOYMENT OPTIONS – sponsored by Novomet		
12:00	**Welcome & Introduction**	Session Chair - Stewart McIntosh, McIntosh Technical & Robert Imbrae, Weatherford
12:05	Extending ESP Applications Through Cable deployed technology	Vijay Nambiar, Novomet
12:30	The first offshore slickline deployed ESP project in Asia	Ed Sheridan, AccessESP
	Techbytes	
12:55	A novel isolation packer for a cable deployed pumping system	Jamie Cochran, Zilift & Chris Wrighton, Aramco
13:05	Compact, pressure-actuated downhole safety valve for cable-deployed ESPs	Mark Wiltosz, Pragma
13:15	**BREAK**	
13:25	Design & Testing of a High-Powered, Live-Well, Cable-Deployable ESP	Mike Rushby, Zilift & Chris Wrighton, Aramco
13:50	**PANEL DISCUSSION - UNCONVENTIONAL ESP DEPLOYMENT KNOWLEDGE SHARING WITH AUDIENCE FEEDBACK**	
1430	**CLOSE**	

THURSDAY 11TH FEBRUARY 2021 - KEEP ON RUNNING: GETTING A BETTER RETURN ON INVESTMENT FROM YOUR ESPS – sponsored by Halliburton		
12:00	**Welcome & Introduction**	Session Chair - Chris Wrighton, Aramco & Co-Chair Adam Downie
12:05	A history of Artificial Lift on the Captain Field	Jenni McBeath, Ithaca Energy
12:30	Completion and Production Challenges in Offshore Heavy Oil – Lessons Learnt from Peregrino	Luiz Fernando Pastre, Equinor
12:55	ESP Mechanical Shaft Seal Run-Life Extender Performance Enhancements	Hassan Mansir, COREteQ
13:20	**BREAK**	
13:40	Slips, Trips and Pitfalls – A Lifecycle Approach to Extending ESP Run Life	Gordon Kappelhoff, Kapelhoff Assoc
14:05	ESP Failure Analysis & Reliability for Step Change Improvement	Jeff Dwiggins, Artificial Lift Solutions
14:30	**DISCUSSION AND CLOSING REMARKS**	
14:35	**CLOSE**	

Conference Programme – Day 5

FRIDAY 12TH FEBRUARY 2021 - NEW SOLUTIONS FOR OLD PROBLEMS		
12:00	**Welcome & Introduction**	Session Chair - Ed Sheridan, AccessESP & Graeme Fyfe, Baker Hughes
12:05	A world first: Installation of an ISO-15551-1 compliant ESP string in the Statfjord Field	Max Bilfinger, Schlumberger
12:30	Galapagos Field Artificial Lift Selection	Jeb Tyrie, Bridge Petroleum
12:55	What No MLE Splice Below the Packer? Retrievable ESP Packer Solves Reccurring Electrical Failure Issue	Jinjiang Xiao, Aramco
13:20	**BREAK**	
13:30	Using ultra-slim, high speed ESPs in wells with narrow casing	Vijay Nambiar, Novomet
13:55	Magnetic Drive System enables greater reliability of ESPs	Herman Artinian, Upwing Energy & Shuhei Sasaki
14:20	**DISCUSSION AND CLOSING REMARKS - STEVE CROMAR, SPE ABERDEEN**	
14:30	**CLOSE**	



Abstracts

Monday 8th February

12.25 – 12.45 Automatic ESP control system – Chasing barrels with automation, efficiency and safety

Kjetil Fjalestad, Equinor

The Peregrino Field is an accumulation of 13-16° API oil in the Carapebus Formation in the Campos Basin and it is thereby one of the heaviest oil offshore developments in Brazil. All Peregrino producers are completed with ESPs to provide artificial lift and enable heavy oil production. The ESP Digitalisation Project comprises three main workstreams: (i) the ESP Dashboard and Analytics, which consists in new tools to improve data visualization and, therefore decision making, besides enabling anomaly detection; (ii) Manage & Operate, encompassing the insourcung and a new operating model for the ESPs; and (iii) the ESP Automatic Control System (ACS). During the test phase ACS has proven to be efficient to respect well constraints, and a useful tool for efficient production. During the pilot test, ACS managed to increase oil production by 2.14%, besides reducing power consumption in approximately 5%, leading to reduction in OPEX and CO_2 footprint. In addition to this, it was satisfactorily received by offshore operators who believe they can focus in more urgent tasks while ACS is on. Therefore, ACS is well aligned to Equinor's strategy, contributing to a Always Safe operation, providing High Oil and Low Carbon improvements. The successful pilot test made ACS elegible for full-field implementation, in which all Peregrino existing wells will receive the system to automatically operate the ESPs.

12.45 – 13.05 Digital Intelligent Artificial Lift – Technology Readiness & Production Results

Graham Makin, Silverwell

The majority of the world's gas lifted wells are under-optimized. This incomplete production optimization, coupled with associated intervention costs, risks and deferred production, presents an opportunity to re-imagine gas lift well design and operating principles. It has been estimated that addressing this opportunity delivers a production uplift approaching 20%.

Traditionally it was not possible to make on-demand in-well adjustments to gas lift injection depth and rate to address these challenges. Compounding this, it was not possible to easily make data-driven decisions about these adjustments to assure continuously maximized and stable production.

Silverwell overcomes the production constraining limitations of existing gas lift technology with a digital in-well integrated interventionless gas lift optimization system that is now at a high technology readiness level.

This presentation will describe in holistic terms the twelve-year development journey from concept to reality. The author will touch on technology adoption process, development of business use cases, recent field installations (dual and single string), and subsequent production optimization results.

13.15 – 13.35 A Live Optimization Tool for Sucker Rod Pumping System

Codrut Stefan Sararu, Petrom

Real time monitoring and diagnosis of the sucker rod pumping system is one of the main objectives of the Production Technology engineers in their endeavor to optimize the wells production. The main challenges are the complexity of the production system and the large variety of artificial lift systems, which the process needs to encompass.

The first challenge is to set out the optimum pumping regime, which is a result of a large number of combinations of rod pumping parameters.

The second one, with special reference to thousands of producing wells, brings in the importance to have the main operational parameters that characterize the sucker-rod pumping system under only one sequence.

The above remarks have been the starting point for the development of the special application designed to calculate for each well, the actual operational parameters, fluid proprieties for different conditions (P, T), sucker rod string design and recommendation of the optimum pumping regime.

The web application allows the PT engineers from all the assets to access the application and run the real time monitoring and diagnosis process for thousands of wells within a short period of time.

Abstracts

Tuesday 9th February

12.05 – 12.30 A Life-of-Field approach to gas-Lift design

Atholl Campbell, PTC

Petroleum Technology Company (PTC) have developed a holistic approach and workflow for gas-lift system design. This workflow employs a combination of proprietary PTC and industry recognised software tools. It allows the engineer to rigorously cater for uncertainties and changes in the reservoir, well and operating conditions over the life of the well to determine how the gas-lift system will perform over the life of the well. As a result, clients are provided with the information they require, to make informed gas-lift design selection decisions, balancing well lifecycle production optimisation, with well intervention and operability requirements. Key areas evaluated in the methodology are the prevention of multi-point injection and rigorous port sizing analysis to ensure optimised injection rates at the operating valve, which in turn aids in equipment reliability and longevity. A drawback of any gas-lift design is that the valves must be set up on a specific set of pressure and temperature conditions (the design case). However, in the methodology adopted, the selected set up is stress tested over all scenarios considered to provide clear definition of the operating window for the installed valves (unloading guidelines, turndown rates and unloading / kick-off ability are all considered). This presentation will describe the workflow employed by PTC with examples.

12.30 – 12.55 Inverse Gas Lift System Installation in the UK North Sea

Neil Smith & Alun Whittaker, Weatherford

As the UK North Sea enters its fifth decade of oil and gas production more and more of the fields in the area are considered brown field or mature, the problems associated with these mature fields can lead to reservoirs not being fully exploited. Many assets in the North Sea have been through several production cycles and lack the necessary reservoir drive to naturally produce. The major North Sea operator sought enabling technologies from service providers to help maintain production from this flagship platform.

With safety at the forefront of any concept evaluation, the operator focused on a technology which retains full safety valve functionality whilst injecting gas through an insert string. An Inverse Gas Lift System (IGLS) was chosen and tailored to the field's specific requirements, enabling concentric gas lift.

IGLS allows operators to install gas lift in wells not currently capable of supporting traditional gas lift, due to casing integrity issues, or a cemented completion. The operator looked towards gas lift, which has been utilised in the oil industry to artificially produce.

Techbyte Session

12.55 – 13.05 Downhole foamer injection via gas lift: laboratory and field challenges

Ernesto Petteruti, Chimec spa

Artificial lift methods are used to extend the lifetime of brown fields. Gas lift is widely used worldwide, since natural gas is available and relatively inexpensive in many situations. The application of foamer can improve the efficiency of gas lift in depleted reservoirs, reducing the weight of the liquid column in the tubing and reducing flow instability, given by the slug flow pattern.

The presentation will focus on the challenges of chemical injection via gas lift system, associated to the chemical formulation, the field operation and production parameter optimization.

The chemical formulation shall be specifically designed in a laboratory phase, to address the requirements of product stability and injectivity. An appropriate operative procedure is described to ensure that the injection via the gas lift stream will be safe and effective. Nonetheless some unexpected challenges came out during the field trial, like a time delay of foaming effect in the production tubing.

Optimization of foamer via gas lift is ongoing since it has been observed a stabilization in the flow pattern of the production throughput from slug to continuous, giving the possibility to evaluate the well performance analysis in a new way.

Abstracts

13.05 – 13.15 High pressure gas-lift equipment & design validation testing: A Gulf of Mexico case study

Krister Bye, PTC

Petroleum Technology Company (PTC), developed and validated a customised High Pressure Retrievable Dual Barrier Gas Lift System for a Gulf of Mexico, Deepwater Subsea asset. Over 7 years PTC completed product feasibility, design, prototype manufacturing, validation testing and final product delivery. Due to the extreme requirements for high gas-lift injection pressure and rates as well as extreme operating wellbore conditions, a specific equipment validation program was created by the operator for each part of the Gas-Lift System (SPM, Barrier Valve, Shear Valve and Kick-over tools). It was essential that the system was validated together to ensure that in event of a subsea intervention any downtime is limited. PTC performed a land-based total system test with the PTC Gas Lift products, third party E-Line and Stroker at depth. This presentation details the project challenges which required the development of a new high-pressure Gas-Lift System and the PTC solution.

13.25 – 13.50 Practical Application of Asheim Stability Criteria when Troubleshooting Gas Lift Instability

Craig Durham, CNOOC International

The Asheim gas lift stability criteria were developed over 30 years ago but are not widely used today as it requires a number of simplifying assumptions related to system behaviour. Although commercial software is available to more accurately model gas lift instability, most gas lift engineers do not have the time or access to use this for day-to-day troubleshooting. The advantage of Asheim is that it is mathematically simple and readily accessible in most commonly used nodal analysis software.

The Golden Eagle field came on stream in 2014. All the production wells are supported by continuous gas lift. Due to changing reservoir conditions, some of the wells are now operating outside the original gas lift design operating envelope. This has resulted in gas lift instability in some cases.

In this presentation, different gas lift instability examples will be described, and the Asheim criteria for the initial gas lift design set up and the current conditions will be compared. The results support the Asheim criteria theory and this has now been integrated into all new gas lift design workflows.

13.50 – 14.15 Slugging Reduction by Emulsion Breaker Injection in Ekofisk Gas Lifted Wells

Danila Shutemov, Conoco Phillips

Injection of emulsion breaker (EB) via gas lift (GL) system (called GLEBI) can lead to reduction of slugging and increase in liquid production. Two ten-day pilot trials were performed at Ekofisk Complex on a total of 11 wells allowing good basis for comparison.

The methods include experiment and field observations. The paper describes preparation and execution process of two GLEBI pilot trials. Preparations include candidate selection, an evaluation of EB stability under GL conditions, and compatibility with well materials such as soft goods. Details of the preparations (such as lab tests for compatibility) are described in detail as well as the procedure for the field trial execution. Readers can follow described process in order to replicate same GLEBI pilot for their oil fields with GL as artificial lift method.

RESULTS: Concluded that GLEBI is a successful technique but is not applicable for all wells and the candidate selection method is critical. In the two trials, sustained slugging reduction and variable production uplift was observed in some wells: 25% of wells in the first pilot and 70% of wells in the second pilot. A numerical model improved candidate selection resulting in the higher success rate during second pilot. Liquid production uplift was sensitive to minimum EB concentration, typically 200-300 ppm. This concentration is derived

experimentally and unique for each well. Where successful, 4-8% liquid uplift was achieved. GLEBI didn't result in any change in production or slugging on low water cut (WC) wells. No well integrity or performance of topside process systems issues were observed during either trial as determined in the pretrial assessment. The numerical model is now being used to predict GLEBI potential for the whole field.

GLEBI injection was documented in past for different fields (SPE 29487, OMC-2011-015, OTC-28132-MS). Current paper expands applicability of EB injection in GL system for slugging wells in the field with low viscosity and light oil.

Wednesday 10th February

12.05 – 12.30 Extending ESP Applications Through Cable Deployed Technology

Vijay Nambiar, Novomet

BACKGROUND

Recent advances in high-speed pump technology and permanent magnet motor efficiency make it possible to produce larger volumes of fluid through an ultra slim ESP. With the reduced size and weight, the system can be deployed and retrieved on a internally reinforced power cable, eliminating the need for a rig. This design not only makes ESPs a viable option on many offshore wells, it also extends the usefulness of ESPs to new applications such as well unloading, well reactivation, well testing, and back-up production.

Most of the Rigless technologies are not fully rigless and are not able to meet the Operator expectation of eliminating Rig Use for ESP applications. Theses technologies still needs rigs for the initial phase of technology introduction as a minimum and Well kill. This becomes cost prohibitive for onshore as well as offshore wells and adds up to the production down time.

OBJECTIVES

The main objective is to reduce operator lifting costs by optimizing capital and operational expenses.

1. Reduce capital expense and operational expense required for production, well unloading, and well testing
2. Lower costs for enhancing production in brownfield applications
3. Reduce the surface deployment footprint for installation and workover operations for ESP, well unloading, and well testing applications

METHODS

A high-speed permanent magnet motor was coupled with a high-speed pump to reduce the size of the ESP system. A reinforced power cable provided the mechanical strength required to deploy the ESP on modified Slickline Unit in live-well conditions. The design borrows heavily from deployment methods used in live-well interventions. and deployment footprint considerably.

RESULTS

1. Installed the world's first cable-deployed rigless ESP in an offshore well under live-well conditions.
2. Conducted well testing in an offshore well using ESP technology (Planned for May 2019).

CONCLUSIONS

The combination of a high-RPM permanent magnet motor and a high-speed pump in an ultra slim ESP reduced the size of the ESP. Using a reinforced power cable enabled the system to be deployed and retrieved entirely by cable, reducing considerably the deployment footprint. This solution eliminates the need for a rig (saving time and money), reduces deferred production, and gives operators more options for producing offshore assets. It also extends the use of reliable ESP technology to common live-well applications like unloading, testing, and reactivation. This cable deployed rigless ESP cuts capital requirements and operating costs, helping reduce overall lifting costs for operators.

12.30 – 12.55 The first offshore slickline deployed ESP project in Asia

Ed Sheridan, AccessESP

A field offshore Brunei has been producing for over 40 years with 50 platforms and over 400

wells. Historically the only method of artificial lift has been gas lift with significant gas compression infrastructure on the main producing complex. the project is part of a new larger waterflood project that's expected to increase recovery from this field. The B2/B3 phase in particular aims to produce an under developed, shallower area of the field using Electrical Submersible Pumps (ESP) as the lift method.

The well jackets in B2/B3 are small and the use of a workover rig require a barge for support. This increases the costs of a traditional ESP work-over, the long-term economics of the offshore ESP project were marginal and relied on more than industry standard average ESP runlifes. In 2016 it was decided to do a review of an alternative deployment using slick line deployed ESP systems. A pilot project of 4 wells was commissioned, this paper will discuss

- Equipment technical qualification
- The equipment design and selection
- Manufacturing process
- Installations
- Ongoing operations

Techbyte Session

12.55 – 13.05 A novel isolation packer for a cable deployed pumping system

Jamie Cochran, Zilift & Chris Wrighton, Aramco

This presentation describes the development of a packer system for a new well intervention service tool.

The Well Initiation Service Tool (WIST) is a high efficiency, slim hole pumping system that is conveyed through tubing and powered by a wireline power cable to appropriate depth in order to lift high density kill fluid, thereby lightening the fluid column and allowing the well to flow naturally.

This service is for lifting naturally flowing wells back into production as an alternative to coiled tubing and nitrogen kick off jobs, which can often be expensive and logistically challenging, requiring large amount of equipment and personnel.

A multi resettable inflatable packer system has been developed to work in conjunction with the permanent magnet motor submersible pumping system, which allows the pump to be positioned and repositioned in the well as required. The presentation will describe a novel hydraulically activated sequence control valve assembly, which has been developed to inflate and deflate the isolation packer, activated solely with pump rotation, thereby allowing the packer/pump system to be conveyed in/out of the well as one assembly.

13.05 – 13.15 Compact, pressure-actuated downhole safety valve improves safety and efficiency for cable-deployed ESPs

Mark Wiltosz, Pragma

Pragma is developing an advanced downhole safety valve to create an improved well control solution for slim-line, cable deployed ESPs. The ESP safety valve enables operators to meet all safety regulations whilst simplifying deployment and retrieval.

Traditionally, when an ESP is installed using a rig, the production tubing in the well is also replaced, allowing control lines to run outside the tubing, in the annulus. However slim-line ESPs are retrofitted through existing production tubing, which means the conveyance cable and control lines can cause an obstruction to the sub-surface safety valve (SSSV). To conform to API 14A regulations an additional safety valve is then necessary.

Currently, a modified valve can be fitted into the profile of the existing one, which is designed to seal around these obstructions. However, this option is limited to wells with wireline retrievable safety valve nipple profiles with associated control lines. The new valve must be dropped precisely into the insert profile and relies on the integrity of the existing seals and control lines, which may have been in-situ for more than ten years.

Pragma's valve does not require any control lines and uses a novel method of differential pressure to open and close it. The valve sits below the ESP and opens when it is pumping with a fail-safe closing

mechanism when the ESP is switched off. It can be deployed in varying configurations to suit the well set-up, either as an integrated part of the lower ESP assembly, or separately. The technology can also be used in other artificial lift systems.

13.25 – 13.50 Design and Testing of a Premium High Powered Live Well Cable Deployable ESP

Mike Rushby, Zilift & Chris Wrighton, Aramco

This paper describes the overall system architecture, key enablers, functional testing and an SIT for an ESP rated at up to 500hp (372kW). The ESP can be live well deployed through existing 4.5-in tubing without the need for a rig at any point. The design work included changes required to facilitate cable deployment and eliminated many of the common failure modes of conventional ESPs. The ESP is sour service capable and optimised for length to be under 60ft ensuring ease of deployment in offshore environments. The motor control, high speed operation and pump performance were successfully tested in a horizontal flow loop. The live well deployment and retrieval method was successfully demonstrated in a test well, using a bespoke 1-in solid sheath cable which allows coil tubing methods to maintain well integrity.

Thursday 11th February

12.05 – 12.30 A History of Artificial Lift on the Captain Field

Jenni McBeath, Ithaca Energy

The Ithaca operated Captain Field, discovered in 1977 with first oil in 1997, is in Block 13/22a in the UKCS, approximately 130 km north-east of Aberdeen in approximately 100m water depth. The crude is relatively heavy (19.3oAPI) and viscous (up to 150 cP) deposited in unconsolidated, primarily Lower Cretaceous age sandstone, within a thin reservoir but spread over a large area (10.5 km by 5.0 km). The first phase of the field development consisted of a Wellhead Protection Platform (WPP) and FPSO. During this phase, all wells were platform drilled and completed with ESP's. The first expansion phase in 2001 consisted of a subsea tieback, 5km from the WPP and the installation of a Bridge Link Platform (BLP) to process the additional fluids. Hydraulic Submersible Pumps (HSP's) were selected as an alternative to ESP's due to the presence of a gas cap combined with limitations in subsea electrical technology. This presentation will demonstrate the reliability of both AL technologies and will provide an overview of how they have been successfully used to develop Captain since first oil.

12.30 – 12.55 Completion and Production Challenges in Offshore Heavy Oil Brazil – Lessons Learnt from Peregrino

Luiz Fernando Pastre, Equinor

Peregrino is a heavy oil offshore field discovered in 1994 and is located 85Km off the Brazilian coast. Although there are high volumes of oil in place (estimated reserves of more than 400 million barrels of recoverable oil), challenges related to well construction and high viscosity oil production delayed field development for over a decade. Equinor took the challenge to develop the field which produced first oil in 2011 utilizing ESP's as its artificial lift method.

Peregrino was Equinor´s first large-scale operation outside of Norway. To successfully develop the field, Equinor has pushed boundaries drilling and completing the wells. Optimizing ESP operation and extending reliability are also of paramount importance.

Every pump stage type is qualified in a high viscous flow loop test prior to being deployed in the field. This enhanced understanding of ESP behavior producing high viscous fluids allows for a more robust approach to the design, operation and protection of the ESP's. Failure analysis is performed for every string pulled from Peregrino and improvements are proposed after the root cause identification.

Abstracts

Challenges to develop the heavy oil field and lessons learnt regarding ESP operation and reliability will be presented. This information can be used as reference for similar heavy oil developments in the North Sea.

12.55 – 13.20 ESP Mechanical Shaft Seal Run-Life Extender Performance Enhancements

Hassan Mansir, COREteQ

A previous paper presented a device to protect an ESP mechanical shaft seal from fines suspended in the wellbore fluid [1]. The device is used in conjunction with an ESP Protector and flushes continuously the shaft seal with filtered fluid and only this fluid comes in contact with the critical sealing surfaces. The device was validated in a flow loop and several devices are now operating in SAGD producing wells with the long running unit has been operating since February 2019.

The talk will present improvements to the device undertaken since the first installation on such aspects as enhancement to the rate of solid separation, gas handling and fluid conditioning characteristics.

The presentation focuses on an extension of the device's proven performance (i) by further increasing the efficiency of solids separation, (ii) by confirming that sand separation still occurs in fluids with high gas volumes and lastly (iii) by demonstrating the ability of the device to pre-condition the fluid prior to entering the pump.

The enhancements were shown both by CFD and by test to further minimise the solids fraction from the clean area to traces, achieving significantly more than the 25:1 reduction that was previously reported.

13.40 – 14.05 Slips, Trips and Pitfalls – A Lifecycle Approach to Extending ESP Run Life

Gordon Kappelhoff, Kapelhoff Assoc

A pitfall is a trap that is known by some and not others. When an ESP is installed it is done so with the understanding that everything has been into account. When it runs for a shorter time than expected the postmortem investigation often reveals that not only did the same problem occur elsewhere, but the solution was known prior to installation – a pitfall.

There are eight ESP run life influences which include: 1) Reservoir; 2) Design; 3) Manufacture; 4) Handling/Installation; 5) Operation; 6) Monitoring; 7) Dismantle Inspection and Failure Analysis (DIFA); 8) Contract. Each contain pitfalls.

Quality Assurance and Quality Control (QA/QC) will also affect run life. There are two organizations that have recommendations for ESPs – the American Petroleum Institute, with the API 11S RP series and the International Standards Organization with ISO 15551-1. Can these be used to avoid pitfalls?

Some of the main areas where pitfalls lie are as follows:

1. Assumptions – within the eight run life indicators there is ample space for making assumptions about the well, equipment, operations, etc. At the time these assumptions are they are known to be just that but as time moves on often, they are assumed to be fact.
2. QC – a supplier can change a part and are under no obligation to disclose this or change the part number of the ESP component. That change could result in a short run life in a particular environment, where the previous part did not.
3. QA – the parts and the assembly are two of the biggest factors in determining the run life of the ESP. Having a plan in place to ensure this is done correctly is key to reducing short runs.
4. Testing – there are three levels of testing ESP equipment, each serves a different function and will have an increasing effect of lengthening the run life.
5. Handling/Installation – not knowing how to handle ESP equipment can result in damage before the equipment is installed and any mistake during installation will result in a short run.

This presentation will expose some of these pitfalls.

This presentation will be a useful introduction for companies who do not have experience with ESP's, companies that want to review their current ESP life cycle operations and companies installing an ESP in a new field.

Abstracts

14.05 – 14.30 ESP Failure Analysis & Reliability for Step Change Improvement

Jeff Dwiggins, Artificial Lift Solutions

In the ESP industry, repetitive failures are all too common and often can be avoided. However, many operators fail to determine root cause and therefore failures recur without corrective actions. While not all failures are preventable, proper analysis and training can favorably impact overall performance. These savings can be significant. All too often, these failures are simply categorized as mechanical, electrical or well-bore conditions. Key data is often missed during the workover process due to an emphasis to get the well back online.

Effective failure analysis to determine the root cause of failure of an ESP system consists of

1. Rigorous methods that are embedded into the organization such that evidence is not lost
2. Proper collection of data prior to the failure analysis
3. Effective methods for conducting failure analysis
4. Effective methods for implementation of change

This presentation will outline a general overview for effective failure analysis and discuss methods that have been successfully applied by operators around the world. This presentation will also discuss how such data may be digitized in an effort to apply common principles for failure analysis and continuous improvement.

Friday 12th February

12.05 – 12.30 A world first: Installation of an ISO-15551-1 compliant ESP string in the Statfjord Field, Norway

Max Bilfinger, Schlumberger

Discovered in 1974 and brought into production in 1979, the Statfjord field is the largest oil discovery and one of the legendary hydrocarbons producing fields in the Norwegian continental shelf.

The Statfjord Field is at its late life stage targeting efficient production in order to decrease reservoir burden and ease production of gas. Equinor Norway partnered with Schlumberger to achieve this objective by deployment of state-of-the-art ESP technology that is qualified to the highest Norwegian and Industry Standards. This achievement is major milestone representing the successful installation of the first ever ISO-15551-1 V2:F2:Q2 compliant ESP System.

This presentation will detail the steps of this major accomplishment by Equinor and Schlumberger and will provide an overview on:

- Equipment selection strategy
- Testing, qualification & validation measures to meet ISO-15551-1 requirements qualify
- Deployment & Installation, surveillance & monitoring strategy

12.30 – 12.55 Galapagos Field Artificial Lift Selection

Jeb Tyrie, Bridge Petroleum

Bridge reviewed existing Field Proven technology for the re-development of the NW Hutton Field and Darwin, Galapagos. Using a static model and full field simulation model to assess the best development options and subsequently the most appropriate Artificial Lift.

The development is large with 12 producers and 6 injectors in Stage 1, and a target of 80 mmstbo but its not an easy field. It was completely abandoned with only 14% of the full field STOIIP recovered (124 from 883 mmstb).

The development could be FSPO or Tie-Back to a fixed installation. 4-5 subsea centres had already been selected.

A number of questions had to be answered:

1. ESPs or Gas Lift?
   a. How reliable?
   b. What acceleration do they provide?
   c. What extension to the production profile will they bring?
2. RISK
   a. Can they last that long in the field?
   b. Can we avoid subsea well intervention?

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3. Lower Completion
   a. Flow control valves
   b. AICDs
4. Reservoir Access
   a. Scale squeezes
   b. Acid Washes?
   c. Re-perfing
   d. Cleaning
5. Alternative lift options?
6. What Data is available?

We have the answers and Field Development Plan number 3.

12.55 – 13.20 What No MLE Splice Below the Packer? Retrievable ESP Packer Solves Reoccurring ESP Electrical Failure Issue

Jinjiang Xiao, Aramco

The motor lead extension (MLE) electrical splice below the production packer can be a source of electrical failure in electric submersible pump systems. Recent failure rate analysis indicates almost 50% of all ESP system failures can be attributed to either Packer Penetrator or MLE/ Pothead failures in harsh environment wells.

A retrievable production ESP packer has been developed and successfully field tested to eliminate this failure mechanism. The packer was developed for slimhole applications due to corroded production casing remediated with 4-1/2" and 5" liner. The packer features metal-to-metal, field-testable, packer-penetrator connections.

The ESP packer is part of an upper completion subassembly which incorporates the ESP packer, a packer setting tool, the MLE, and the ESP motor pothead. Fitting within a standard offshore basket, the upper completion subassembly is compact in length. This upper completion subassembly is fully pressure and electrical tested in the workshop prior to shipment to the rig speeding the ESP installation.

13.30 – 13.55 Using ultra-slim, high speed ESPs in wells with narrow casing

Vijay Nambiar, Novomet

Because of their dimensions, conventional ESPs have limited application when deployed in wells with casing sizes under 7 inches. These limitations often force operators to use alternative artificial lift options and/or accept lower production rates.

The development of permanent magnet motors has widened the ESP application window. Ultra-slim, high-speed ESPs can now accommodate narrow downhole completion configurations while satisfying operator expectations for target production.

Ultra-slim, high-speed ESPs have been successfully implemented in applications that were considered difficult or not possible for conventional ESPs.

1. Successful implementation in a 5-in. liner producing 5000 BFPD
2. Successful implementation in 7-in. casing with a Y-tool bypass system and a 2⅞-in. ESP
3. Dual ESP system installation in 5¾-in. casing
4. Rigless deployment inside 2⅞-in. tubing in a 4-in. monobore well
5. Successful implementation in 4½-in. casing for gas well dewatering
6. Geothermal exploratory wells with 4-in. casing

The technology discussion will focus on how ultra-slim, high-speed ESPs benefit operators dealing with narrow casing and downhole configurations where larger ESP dimensions limit production.

13.55 – 14.20 Magnetic Drive System (MDS) enables greater reliability and retrievability of Electrical Submersible Pumps (ESPs)

Herman Artinian, Upwing Energy and Shuhei Sasaki

The MDS contains two main parts- one residing in the permanent completion and the other as a retrievable string inside the production tubing. The rotating parts of the ESP on the retrievable string are magnetically driven by the stator in the permanent completion without any electrical links or mechanical connections. A magnetic coupling with the permanent magnet (PM) motor enables high-speed and high-torque operation through a large gap

Abstracts

aided by magnetic bearings. An MDS feasibility study shows that a 10,000 BPD pump can be achieved in a tool that is less than 20 meters (including the deployment and pump sections). Analysis on the MDS topology demonstrates that the Mean Time Between Failures (MTBF) of ESP reliability can be improved from 3 to 10 years when the failures of the electrical components are eliminated by completely isolating them in the permanent completion. ESP retrievability can be significantly improved by the MDS due to the rig-less slickline intervention of the retrievable string. Magnetic modeling of the MDS PM motor presents higher motor efficiency and power density, which increases the motor horsepower and shortens the motor length, thus pushing the upper limits of ESP production gains to the next level for offshore production.

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Contact Details:

info@accessesp.com

william.standifird@accessesp.com

(+1) 713 589 2599

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Contact Details:

info@accessesp.com

william.standifird@accessesp.com

(+1) 713 589 2599

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Qualification and Verification – Past, Present and Future

Seismic 2021 – w/c 17th May 2021, Virtual Events

The Role of Seismic in Unlocking Value in the Energy Mix

Abstracts deadline extended to 15th February

DEVEX 2021 - w/c 7th June 2021, Virtual Events

Transitioning To A Low Carbon Industry: Maximising Economic Recovery, Infrastructure Value & Skills Development

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