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5TH EDITION OF
INTERNATIONAL CONFERENCE ON

OIL, GAS AND PETROLEUM ENGINEERING

SEPTEMBER 17-19, 2026 | ROME, ITALY

"Foundations and Frontiers in Oil, Gas & Petroleum Engineering"

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5TH EDITION OF

International Conference on

OIL, GAS AND PETROLEUM ENGINEERING

HYBRID EVENT

17-19 SEPTEMBER 2026

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Chellapandian Kannan

Manonmaniam Sundaranar University, India

Cleveland M Jones

Fronteira Energia Ltda, Brazil

Deinar Agudelo Ortiz

Natural Motos sas, Colombia

Javier Garrigos

Técnicas Reunidas, Spain

Marco Ludovico Marques

Universidade Politécnica de Setúbal, Portugal

Keynote Speakers

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United State

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Australia

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Sanyou London Pvt Ltd,
United Kingdom

Selim Sanad Shaker
Geopressure Analysis Services,
United States

Stanislaw Dzwigaj
Sorbonne University, France

Welcome Message

Askold Belyakov PhD, Senior Researcher

Institute of Physics of the Earth, Russian Academy of Sciences, USGS & LRNL, United States

Dear participants of the congress!

It is a great honor for me to present a new device that allows us to hear and record acoustic signals with previously unattainable quality. It became possible when the sensitive element o1 the sensor was made from an iron alloy doped with aluminum and magnetixed by a high-energy permanent magnet. Any acoustic signal perceived by the sensor causes a change in mechanical stress and the electromagnetic field with in it, which is converted into a voltage whose amplitude is proportional to the acoustic signal, with the sensitivity increasing cubically with the signal frequency. These qualities allow a single device to observe and record such diverse processes as Seophysical and astrophysical events in any accessible location on Earth and in space, which was previously impossible.

Welcome Message

Prof Cleveland M. Jones, DSc

Technical & Innovation Director, Fronteira Energia Ltda. (Brazil)

Researcher, Instituto Nacional de Oleo e Gas/CNPq/ Brazil

As a member of the Scientific Committee of GOPE 2026 (International Conference on Oil, Gas and Petroleum Engineering), I offer a warm welcome to all who can participate in this hybrid event, held between September 17 and 19 in Rome, Italy. There will be exceptional presentations on topics such as advances in upstream operations, O&G exploration, the downstream sector, emissions in the O&G industry, how AI and big data have entered the industry, and the role of hydrogen in the energy transition. With respected speakers and presenters, GOPE 2026 will be an opportunity to learn about and showcase new developments, technologies and trends in the petroleum industry. The sessions, workshops, and panels of GOPE 2026 are a must for professionals involved in the petroleum industry. As in past years, attending key industry players and leaders represent important networking opportunities for participants.

I look forward to meeting you and sharing valuable petroleum industry experiences at GOPE 2026!

Welcome Message

Nur Hassan

Central Queensland University, Australia

It is a pleasure to welcome you to offer a few words on transforming waste plastic into hydrogen. At a time when the world is striving to meet rising clean energy demand while addressing escalating plastic pollution, solutions that address both challenges are more vital than ever. Pyrolysis-driven hydrogen production offers a powerful dual-impact pathway, turning mixed and contaminated plastic waste into valuable syngas, recovering liquid hydrocarbons, and unlocking low-carbon hydrogen through advanced techniques such as catalytic reforming, hydrotreatment, or plasma-assisted upgrading. This approach not only advances sustainable energy but also reimagines how we manage our plastic waste.

Welcome Message

Saim Memon

Sanyou London Pvt Ltd, United Kingdom

Dear fellow participants and presenters of GOPE 2026, I am proud to express my genuine enthusiasm for the quality of this thematic conference, which I have participated in and witnessed over the past three years. It is extraordinarily well organised, and I warmly welcome you to this year's programme. GOPE consistently brings together industry and academia to exchange work with candour, rigour and practicality. Today, I invite you to ask searching questions, share what truly works (as well as what does not), and forge collaborations that continue long after we leave this room. Let us keep the conversation evidence-led, respectful and focused on real-world impact. If you see me, do say hello. I am keen to learn about your work and explore how we can turn ideas into outcomes. I wish you a rewarding GOPE 2026.

Welcome Message

Selim Sanad Shaker

Geopressure Analysis Services, United States

It is my honor and pleasure to invite you for wide spectrum of presentations, ideas and innovations from highly qualified multinational scientists and engineers. The 5th Edition of the International Conference on Oil, Gas and Petroleum Engineers hybrid convention will delve into exploring the hydrocarbon potentials and hazards.

Oil and natural gas will remain the lifeline of human civilization for long time to come, in spite of the opposing calls. Exploring and exploiting these precious resources in the subsurface geological formations require drilling wildcats. The exploration processes of selecting the location, drilling depth, test targets, setting producing pipes are intricate. Drilling safely and successfully to the hydrocarbon trap is contingent on the subsurface geopressured profile.

The highlights of my presentation will be on the interpretation and monitoring well's geopressure before and during drilling. This plays an essential role of the success or failure to find hydrocarbon and most importantly is reaching the reservoirs safely.

Welcome **Message**

Stanislaw Dzwigaj

Sorbonne University, France

Dear congress visitors,

It is my honor and great pleasure to write a few welcome notes to you. Through centuries people were fascinated with the possibilities of synthesis of new materials with extraordinary properties. New materials are practically needed in all domains of life. Design and synthesis of new materials is one of the most important and interesting part of material sciences. Particularly a synthesis of new active and selective catalysts is a very important challenge. Our main aim concentrates on the new methods of the synthesis of single-site hierarchical porous zeolite catalysts with acid-base and redox properties. Such zeolite catalysts with active sites formed by incorporation of heteroelements in their framework are perspective as catalysts of protection of environment and biofeedstock conversion into valuable chemicals.

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About
Magnus Group

About

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of Share, receive, grow, Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of Share, receive, grow, Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains.

About
GOPE 2026

About

The **5th Edition of the International Conference on Oil, Gas and Petroleum Engineering (GOPE 2026)** will take place from **September 17-19, 2026,** in **Rome, Italy,** and via virtual participation, bringing together petroleum engineers, geoscientists, researchers, academics, industry professionals, and energy experts from around the world. Under the central theme "*Foundations and Frontiers in Oil, Gas & Petroleum Engineering*", GOPE 2026 provides a global platform for exchanging knowledge, presenting innovative research, and exploring emerging technologies shaping the future of the energy industry.

The hybrid conference will feature keynote lectures, technical presentations, scientific discussions, industry insights, and networking opportunities, covering a broad range of topics including reservoir and production engineering, drilling and well engineering, enhanced oil recovery, pipeline integrity, corrosion management, gas processing, LNG technologies, methane emissions reduction, digitalization, artificial intelligence, digital twins, carbon capture and storage, hydrogen, and sustainable energy strategies.

GOPE 2026 encourages collaboration between industry and academia, highlighting practical solutions, technological advancements, and innovative approaches to address evolving challenges across the oil and gas sector. The conference also provides a forum to discuss operational efficiency, energy transition, emissions management, and sustainable resource development.

About
CPD Accreditation

About

GOPE 2026 is officially accredited for Continuing Professional Development (CPD) by The **CPD Group (UK),** a globally recognized provider of continuing education certification. CPD accreditation ensures that professionals continue to enhance their knowledge, skills, and competencies through structured learning activities.

At GOPE 2026, participants can earn **1 CPD credit for every hour of attendance** in conference sessions. These credits formally recognize the time spent in professional learning and support ongoing professional development across clinical, academic, and research fields.

Earning CPD credits demonstrates a commitment to maintaining high professional standards and staying updated with the latest developments in oil, gas, and petroleum fields. CPD participation can also support **career advancement, license renewal requirements, and academic or professional portfolios,** depending on the policies of individual institutions or regulatory bodies.

In addition to educational value, the conference provides opportunities to engage with experts, researchers, and peers from around the world, encouraging knowledge exchange and professional networking.

Attending GOPE 2026 not only offers a high-quality scientific learning experience but also provides internationally recognized CPD credits that reflect participants' dedication to continuous professional growth.

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KEYNOTE PRESENTATIONS

Askold Belyakov

Schmidt Institute of Physics of the Earth, Russian Academy of Sciences, Moscow, Russia

Biography: Askold Belyakov was born in 1932. He holds higher technical (1950-1956), economic (1963-1964), postgraduate (1968-1970), and political (1978-1979) degrees, a Candidate of Technical Sciences degree (1971), and the title of Senior Research Fellow (1975). In 1956, he graduated from the Moscow Power Engineering Institute (MEI) with a qualification as a thermal engineer. After graduation, he worked in the field of automation in the mining and metallurgical industries. From 1960 to 1968, he headed the automation laboratory at the Zaporozhstal plant in the Ukrainian SSR. In 1968, he entered full-time postgraduate studies at the Moscow Institute of Chemical Engineering (MIKhM), which he completed ahead of schedule in 1970 by defending his candidate's dissertation. He was then hired through a competitive process as the head of the automation laboratory at the All-Union Research Institute of the Chemical Industry. In 1975, he was awarded the title of Senior Research Fellow. In 1980, he was hired through a competitive process as a Senior Research Fellow at the Institute of Physics of the USSR Academy of Sciences, and in 1997 he was appointed to the position of Leading Research Fellow. He retired in 2016. The total number of publications is 160, including 43 author's certificates for inventions in the USSR and patents in the Russian Federation. Since 2013, I have been living in San Francisco, California, USA.

Localization of acoustic signal sources using a device based on a novel physical principle

I have previously touched upon the subject of astrophysicsspecifically, when events with waveforms and frequencies atypical of geophysics, seismology, or seismic exploration began appearing in data streams obtained from high-resolution (over 260 dB), wide-bandwidth (1 Hz to 50 kHz) monitoring of Earth's crustal acoustic noise. At the time, my focus was on validating a proposed algorithm for analyzing microseismic noise, and I viewed these high-frequency bursts merely as troublesome interference. However, similar waveforms appear in research regarding the detection of acoustic signatures from neutrino interactions in water and ice. Discussions have also taken place concerning ways to enhance sensitivity when taking measurements in solid media. Furthermore, underwater and underground facilities utilizing Cherenkov radiation are currently under construction. All these methods require complex, extremely expensive, and massive installations. Even acoustic measurements conducted in water or boreholes are labor-intensive and costly; more importantly, they are permanently tied

to a specific location. Consequently, developing a lightweight, compact, and mobile instrument to detect the acoustic signatures of neutrino interactions is a pressing challenge. Solving this problem would enable detection in not only water and the Earth's crust but also in the atmosphere, in space, and on other planets and moons-wherever human reach extends.

Keywords: Innovative Magnetoelastic Geophone, Narrowband Acoustic Spectra, Neutrino Decay Traces, Nyquist Frequency, Earth's Surface, Space.

C. Kannan

Environmental Chemistry and Catalysis Lab, Department of Chemistry, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India

Biography: Prof. Dr. C. Kannan completed a PhD in 1999 from Anna University, Chennai, and now works as a Professor and Head, Department of Chemistry, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India. Kannan has a research and teaching experience of 26 years and currently conducts research in the fields of Catalysis, Environmental Science, Energy and Material Synthesis. Kannan has published 106 papers in reputed international and national journals, with two patents granted, along with two further achievements regarding a shaving lubricant and corona virus control. The Kannan group has synthesized novel integrated framework catalysts named Kavlite, Karalite, Kangolite, Kankarlite, Kanshabalite, Karalite-A and Kankarlite-A, and published them in international journals. Kannan has invented a new formula for the pillared catalysis for CO_2 decomposition over the novel integrated framework catalyst.

A novel integrated framework catalyst synthesized (Karalite-A) and applied for biodiesel synthesis at room temperature

Repeated usage of cooking oil is a hazard to health due to the free radical formation during reuse. So the used cooking oil to biodiesel conversion through transesterification reaction is a solution for the effective utilization of cooking oil. The conventional method of biodiesel synthesis has many drawbacks such as time consumption, product separation difficulties which makes the process expensive. To rectify all these issues, and to synthesize biodiesel at lower cost, need an effective catalyst for the biodiesel synthesis. In this view, integrated framework of $AlPO_4$-Cristobalite (orthorhombic), $CoAl_2O_4$ (Cubic), and $Co_2P_2O_7$ (monoclinic) catalyst is synthesized at room temperature. The novel integrated framework material is named as Karalite-A. It is stable up to 1200 °C and has three types of nanosized pores with a diameter of 3, 5 and 18 nm. It is an acidic solid material (1.06 mmol/g). This acidity will not cause any environmental pollution and corrosion. The total conversion of the reaction at 50 °C is 82%. The conversion at room temperature is 70% at 1 hour and the remaining 12 % is at 50°C. In the Karalite-A framework, monoclinic $Co_2P_2O_7$ is active at room temperature. So the 70% of conversion is caused by the monoclinic crystal system of $Co_2P_2O_7$ and the remaining 12% is due to the other two frameworks. The integrated framework, thermal stability, Pore characteristics and acidity are confirmed by XRD, TGA, BET and Chemisorption studies respectively. There is no pore blockage in this catalyst during the reaction. So, we can run the reaction in batch method without regeneration of the catalyst.

Cleveland M Jones

Fronteira Energia Ltda, Brazil

Biography: Prof. Cleveland M. Jones, DSc. holds a bachelor's degree in Physics and Economics (Cornell University, Ithaca, NY, USA, 1974), a postgraduate degree in Petroleum and Natural Gas Engineering (UERJ – 2007), and a master's degree (2009 – analysis of basins and mobile belts) and a doctorate (2014 – MEOR – Microbial Enhanced Oil Recovery) in Geology from UERJ. He is currently a researcher at INOG (National Institute of Oil and Gas - INCT/CNPq). He is an independent international consultant, providing services in Brazil and abroad to Public Prosecutors' Offices and multinational and oil companies. He is a member of the Geosciences Advisory Board of NXT Energy Solutions Inc., Canada. He has experience in the areas of Energy, Sanitation, Sustainable Development, and Environmental Auditing and Assessment. He was the founder and director of several environmental and biotechnology companies, and Coordinator of the Postgraduate Course in Environmental Management (FUNCEFET-RJ). His main areas of expertise include: oil and energy geopolitics, energy resource assessment (yet-to-find-oil), applied biotechnology (bioaugmentation, bioremediation and MEOR), socio-environmental diagnostics, effluent and solid waste treatment, and shrimp farming. He is a frequent speaker and author of several articles on energy resources, the environment and applied biotechnology. He is fluent in Portuguese, English and Spanish. He is a member of several professional associations in Brazil and abroad, and a member of Mensa Brasil. He is currently involved in assessing the potential for new discoveries in the Brazilian pre-salt layer and in studies on oil geopolitics.

Hydrogen production from depleted or unproductive oil and gas reservoirs

Ensuring energy generation with environmental responsibility and clean erprocesses is one of the most relevant challenges today, especially in view of the increasing energy demandforecast for the coming years. In this scenario, hydrogen represents an attractive complementary energy source, not just a new energy carrier. Despite the high operational, economic and environmental challenges that mature fields all over the world face, the O&G industry can potentially turn immensede commissioning liabilities in to new energy production assets, by embracing hydrogen production from depleted and unproductive oil and gas reservoirs (gold hydrogen – H2Au). The high levels of residual hydrocarbons in such fields can be converted by autochthonous microorganisms into useful and highvalue-added compounds, such as methane, surfactants and polymers, but could be especially important as a source of clean hydrogen (H2Au). This presentation describes some state-of-the-art initiatives and Proposals for H2 Au production. A technical overview of H2 Au

production is provided for some of the key factors and mechanisms involved, such as the H2 Au microbiota, their identification, selection, stimulation and bio augmentation, key metabolic path ways, and the role and control of production conditions and coadjuvants.

Introduction: Fossil fuels cause serious environmental concerns due to the emission of various pollutants released into the atmosphere by their combustion. Some lower emission alternatives to conventional fossil fuels are butanol, ethanol, methanol, methane, biodiesel and hydrogen. Of these, hydrogen is the most promising fuel, as it has a higher energy density per unit weight than any other fuel (143 GJ/ton), being the only one that does not have carbon chemical bonds. When burned, it generates water vapor and thermal energy, and does not contribute to the greenhouse effect, to the depletion of the ozone layer or to acid rain.

At the same time, the oil and gas industry faces a situation where the reservoirs of many fields exhibit declining production, or are already depleted, unproductive or uneconomical to operate. Typically, these reservoirs will still hold a large part of the oil initially present (up to 60% or more), since recovery factors are generally 20%-40%, and the residual oil cannot be produced. Current climate policies of decarbonization provide incentives to produce cleaner fuels and lower CO2- equivalent emissions, while making the production of residual oil less and less attractive.

Decommissioning costs associated with a abandoning producing facilities are also driving demand for technologies that can delay decommissioning and increase the productive life of these reservoirs. Theseoiland gasfields also typically face operational,economicand environmental challenges in relation to their operation, such as the presence of carbon and nitrogen oxides, hydrogensulfide (H2S), etc. However, new approaches to microbiological conditioning of these reservoirs allow the production of biologically mediated hydrogen production, from the conversion of residual hydrocarbons in the reservoirs (gold hydrogen – H2Au).

These reservoirs can often be easily adapted for H2Au production, since the existing infrastructure-rigs, pipelines, wells, etc. is generally compatible with the requirements for H2Au production and reinjection of the associated CO2 produced (for reduced emissions from operations). There is usually also sufficient access to subsurface formations, and adequate knowledge about subsurface characteristics, conditions and behavior, thanks to a variety of monitoring methods employed during reservoir development and production, such as 3D/4D seismic surveys, well tests,etc.

To achieve H2Au production from these reservoirs, industry players now have the possibility of developing and applying innovative technologies to convert residual hydrocarbons into hydrogen, and mitigating emissions through locally implemented CCS strategies, as well as mitigating H2S, when present at significant levels. For these processes, the microorganisms already present in the reservoir can be stimulated or complemented to convert residual hydrocarbons into hydrogen, methane and/or other compounds.

Deinar Agudelo Ortiz

Natural Motos, Colombia

Biography: Deinar Agudelo Ortiz is a Senior Strategic Advisor in energy transition and sustainable mobility and CEO of Natural Motos in Colombia. With over 15 years of experience in the energy and transport sectors, Agudelo Ortiz has worked across technical, commercial, and strategic roles promoting cleaner mobility solutions. This expertise focuses on alternative fuels, productive transport systems, and inclusive energy strategies in Latin America. Agudelo Ortiz was recognized as Oil & Gas Woman of the Year 2025 at the She Is Global Forum for leadership in advancing sustainable mobility and energy solutions. This work emphasizes practical pathways toward a just and economically viable energy transition.

Inclusive energy transition through productive small-scale mobility: Natural gas and LPG solutions for two- and three-wheel transport

Across many developing regions, two- and three-wheel vehicles form the backbone of productive mobility, supporting millions of livelihoods through delivery services, passenger transport, and micro-entrepreneurship. However, these vehicles often rely on high-emission liquid fuels that impose significant economic burdens on low-income populations while contributing to urban pollution and climate challenges.

This keynote explores the role of Compressed Natural Gas (CNG) and LPG (Autogas) as practical transition fuels for small-scale transport systems, particularly motorcycles and three-wheel vehicles used as income-generating tools. Drawing from Latin American experience, the presentation analyzes how alternative gaseous fuels can simultaneously reduce greenhouse gas emissions, lower operating costs, improve air quality, and enhance energy affordability for vulnerable populations.

The discussion emphasizes the concept of an inclusive and just energy transition, highlighting how technological solutions must align with socioeconomic realities. By reducing fuel expenses and stabilizing operating costs, gas-powered mobility can increase productivity, support formalization of informal transport sectors, and contribute to poverty reduction through sustainable economic participation.

Furthermore, the presentation examines policy frameworks, infrastructure requirements, safety considerations, and scalability potential for expanding CNG and

LPG adoption in small-vehicle fleets. Particular attention is given to the role of these fuels in strengthening energy security by diversifying transport energy sources while leveraging existing gas resources.

The keynote concludes that small-scale productive mobility represents a critical yet often overlooked pathway toward decarbonization. When supported by appropriate regulation, financing mechanisms, and technological innovation, gas-based solutions can serve as an immediate, cost-effective bridge toward cleaner transport systems while ensuring that no segment of society is left behind in the energy transition.

Javier Garrigós

Técnicas Reunidas, Spain

Biography: Javier Garrigos is a Senior Inspection & Digital Transformation Leader with 25+ years of experience delivering global EPC projects across Oil & Gas, Energy, Industrial, Rail, and Telecommunications sectors, combining hands-on expertise in inspection, quality management, and auditing with leadership in digital transformation and process optimisation. At Técnicas Reunidas, Garrigos leads Inspection Digitalisation initiatives, driving the implementation of the Inspection Management Application (IMA), digital workflows, and KPI-based reporting, while supporting global inspection teams. An ASME DTOG speaker, Garrigos is recognised for delivering practical, field-oriented solutions to complex challenges.

Reinventing global inspection: Digitalization and advanced reporting in oil & gas

Inspection of Oil & Gas equipment and bulk materials at manufacturers' premises is a critical activity in global EPC projects, traditionally characterised by fragmented processes, limited visibility, and manual, time-consuming reporting. This paper presents a practical approach to transforming inspection into a data-driven, value-generating function through digitalisation and advanced reporting.

At Técnicas Reunidas, Inspection Digitalisation initiatives have been implemented through an integrated Inspection Management Application (IMA), enabling end-to-end control of inspection processes—from planning and expediting at vendor locations to execution, reporting, and performance monitoring. The solution incorporates digital workflows, real-time data capture, and advanced dashboards, providing full visibility over inspection status, quality metrics, and project KPIs across global supply chains.

In addition, the paper outlines the ongoing development of AI-based agent solutions aimed at future implementation. These initiatives are focused on improving process efficiency and reducing execution time by automating repetitive tasks, streamlining reporting, and supporting data analysis. The approach is designed to ensure that automation will be complemented by human monitoring and validation, maintaining full control and reliability in critical inspection activities.

The results demonstrate significant improvements in efficiency, reporting accuracy, traceability, and decision-making speed, while enhancing collaboration among inspection teams, vendors, agencies, and stakeholders worldwide.

This work highlights how the combination of digital platforms, data-driven reporting, and future AI-assisted automation can transform vendor inspection into a strategic asset for project delivery and operational excellence in the Oil & Gas industry.

Marco António Ludovico Marque

Universidade Politécnica de Setúbal, Setúbal, Portugal

Biography: Marco Ludovico-Marques is a Geological Engineer, MSc in Soil Mechanics and Ph.D. in Geotechnical Engineering (Rock Mechanics) at the Universidade Nova de Lisboa in 2008. Marco is an As. Prof. at Barreiro School of Technology of Polytechnic Institute of Setúbal since 2010, Head of Department of Structures and Geotechnics since 2014 till 2021 and is also Coordinator of Petroleum and Gas Technologies courses (E&P) since 2014. Marco teaches at Higher Education Institutions since 2005 and has been responsible for twenty subjects (different curricula units). Editorial board member of seven scientific journals and Reviewer of another twenty-seven journal. He is an expert assessor for R&D and Innovation Project applications. Marco research interests and practice are Geotechnics, Petroleum, and Gas Engineering, CCUS, Transition scenario of Energy, Fuels and Gas underground storage & engineering, Stone conservation.

Salt weathering effect on oil and gas sandstone formations

Sandstone rocks are important reservoirs of water, petroleum, gas and other fluids of Geoenergy. In the Western Region of Portugal, there are surface and near surface sandstone reservoirs close to salt formations. Sandstone samples collected from these surface reservoir formations were used in the present experimental study. An automatic salt crystallization accelerated ageing chamber prototype was developed and physical and mechanical tests were carried out on samples before and after sodium chloride crystallization ageing in order to evaluate the behavior of sandstone during accelerated weathering. The results of physical tests, i.e., effective porosity values showed an increase of more than 5%, whereas water absorption tests at low pressure (flow rate) revealed a reduction lower than 25%. The mechanical tests, i.e., compression and microdrilling resistance results highlighted a clear trend of decreasing values of mechanical parameters during salt crystallization weathering progress. Modes of failure were assessed, having monotonic and cyclic compression tests showed a decreasing difference of results between them, with salt crystallization weathering progress. The onset of degradation pattern of alveolization also was reached on specimens of the lower-porosity variety, through cycles of crystallization and dissolution of salts.

Matthew Godfrey

Enventure Global Technology, Houston, TX, United States

Biography: Matthew Godfrey is the Chief Engineer at EnventureGT (B.S., M.E., Texas A&M, Mechanical Engineering) with 15+ years in oil & gas new product development, focused on drilling and completions and eight years in expandable liner hanger technology. Godfrey presents a radically new, commercially proven expandable liner hanger platform that Godfrey invented and engineered. The system integrates novel expansion mechanics to dramatically simplify a liner hanger platform to enable liner drilling and reaming, improving run-in reliability and operational efficiency with field installation case studies.

Novel expandable liner hanger platform for advanced liner drilling and reaming

A novel bottom-up method for expanding liner hangers has been developed and field proven. Unlike conventional top-down expansion systems, this approach leverages a controlled combination of applied pressure, liner weight, and overpull to achieve reliable expansion from the bottom upward. By expanding in this direction, the system inherently eliminates common failure mechanisms such as liner buckling and hydro-locking, while simplifying deployment and improving operational robustness. The design incorporates both primary and secondary hydraulic expansion methods and intentionally removes all mechanical actuation components and moving parts, resulting in a simple, reliable system with minimal operational complexity.

The bottom-up expansion methodology supports a fully modular liner hanger architecture. The lengths of both the sealing and anchoring sections can be customized to meet or exceed API 19LH gas-tight sealing requirements while providing hanging capacities greater than the liner's tensile capacity. The use of long, modular expansion sections also enables the post-expanded Inner Diameter (ID) to function as a Polished Bore Receptacle (PBR). For the first time, the functions of a liner hanger, liner-top packer, and PBR are integrated into a single, continuous solid steel tubular, eliminating interfaces that traditionally limit pressure integrity and mechanical strength.

Using the post-expanded ID as a PBR removes unsupported burst and collapse regions between the axial positions of the seal stem and liner-top packing elements. This

architecture maximizes both burst and collapse resistance and provides a continuous pressure-rated bore through the liner top. The absence of moving parts, combined with the use of wrapped and bonded elastomer sealing elements, allows the system to tolerate high circulation rates, elevated torque and rotation speeds, and substantial set-down weights. These characteristics make the system particularly well suited for drilling liner applications and challenging wellbore conditions.

Multiple field case studies validate the system's performance across a wide range of demanding environments. In wells experiencing massive lost circulation, liners were successfully reamed through Lost Circulation Material (LCM), cemented, and installed without compromising hanger performance or sealing integrity. Additional case studies include extended-reach horizontal wells in which liners up to four miles in length were installed in lateral sections without floating the liners into the wellbore. In these applications, high set-down weights combined with high applied torque were used to mechanically work the liners to bottom. Following installation, these wells were successfully hydraulically fractured with up to 100 stages, demonstrating the system's ability to withstand severe axial, torsional, and pressure loads.

These field results confirm that the bottom-up expanded liner hanger system provides a robust, mechanically efficient, and operationally flexible solution for modern well construction, including severe loss environments, long lateral wells, and high-intensity completion operations.

Nur Hassan[1]*, Mohammad Rasul[2], Ashfaque Ahmed Chowdhury[3]

[1]Central Queensland University, Cairns, Queensland 4868, Australia

[2]Central Queensland University, Rockhampton, Queensland 4701, Australia

[3]Central Queensland University, Gladstone, Queensland 4680, Australia

Biography: Dr Nur Hassan has a strong track record of undertaking and supervising projects dealing with fundamental and applied research in fluid mechanics, sustainable energy systems, and technologies, focusing on the modelling and experimental investigation of fluid flows and flowing materials, production, modelling, and analysis of renewable energy technology, including the production of biofuels. Hassan's research and expertise include sustainable climate change by reducing carbon emissions, energy savings by passive air cooling, wastewater treatment, and a renewable energy source - biofuels that offer benefits including reducing greenhouse gas emissions and pollutants, increasing energy diversity, and economic security.

Transforming waste plastic into hydrogen: Progress, challenges, and future directions in pyrolysis-based integrated pathways

The rapid growth of the global plastic waste burden and the concurrent demand for low-carbon energy have driven research into thermochemical routes that convert post-consumer plastics into hydrogen. This review will provide a comprehensive analysis of the integrated pyrolysis, distillation, hydrotreatment processing chain and examine the current state of depolymerising mixed plastics, fractionating condensates, and upgrading intermediates. The study will also focus on innovations in reactor concepts and catalyst design that improve yield and mitigate issues such as coke formation and tar production. Critical barriers to industrial scale-up are feedstock heterogeneity, catalyst poisoning, and high energy intensity. This study will provide a roadmap for future research centred on heat-integrated modular processes, robust catalyst regeneration strategies, and rigorous techno-economic assessments to overcome the challenges and realise the potential of plastic as a viable circular feedstock.

Saim Memon

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Jiangsu Sanyou Dior Energy-saving New Materials Co., Ltd (SANYOU DIOR), No.10 Guoxiang Road, West Tai Lake Science and Technology Industrial Park, Changzhou 213149, Jiangsu, China

Biography: Professor Dr. Saim Memon, CEO and Industrial Professor of Renewable Energy Engineering, unifies academic R&D, industrial manufacturing and product distribution worldwide. Memon transformed ideas into inventions, then into R&D, followed by mass production and market-ready products, exemplified by the world's first Vacuum Insulated Wallpaper (VIW), Vacuum Insulated Heatable Curtain (VIHC) and Vacuum Insulated Curtain (VIC) for energy savings. Memon has taught 41 modules (mostly as module leader) in electrical, electronic, mechanical and renewable energy engineering and supervised numerous PhD, MSc and MEng projects, holding roles across leading UK and global institutions such as Huddersfield, Loughborough, London South Bank, Staffordshire, Aberdeen (NESCOL/University of Aberdeen), Arden, Lancaster, Manchester Metropolitan, Hokkaido, British University in Egypt, University of Mauritius, Hunan University of Science & Technology and Birmingham City University. These collaborations continue to grow in service of the worldwide learning community. On 24 July 2025, after two years of AI/DeepMind and LLM development, Memon launched the world's first Digital Twin AGI Professor, AISaim, in Electrical, Mechanical and Energy Engineering—a hyper-realistic, multilingual, always-on educator that fuses pedagogy, research and industrial practice to elevate learners worldwide. Memon built an academic career in the UK, earning a PhD in Mechanical, Electrical & Manufacturing Engineering (Loughborough University), a Postgraduate Certificate in Teaching (University of Aberdeen), an MSc in Mechatronics (Staffordshire University) and a BEng (Hons) in Electrical Engineering (Distinction), and is a Chartered Engineer and a Fellow of Advance HE, holding Qualified Teacher status (GTCS). Memon has world-leading multidisciplinary research expertise across Electrical, Mechanical and Renewable Energy Engineering, spanning net-zero energy buildings, vacuum insulation, thermal management and fast charging of EV batteries, photovoltaic solar-thermal collectors and thermoelectrics, and is ranked top 0.96% worldwide in Energy and 0.86% overall over the past five years (ScholarGPS), with 150+ publications, 37 industry articles, 120 presentations/videos and 2,200+ citations (h-index 28+, i10 57+). Memon has served as Editor-in-Chief and Guest Editor for 5+ journals and reviewed for 40+ impactful journals, and has delivered 100+ invited/keynote/visiting lectures and led research and industrial collaborations across 40+ countries.

The Vacuum Insulated Heatable Curtain (VIHC): From conceptual invention to market deployment as a costeffective dual solution for window heat loss reduction and localised radiant comfort

The Vacuum Insulated Heatable Curtain (VIHC), invented and industrially advanced by Professor Saim Memon, represents the world's first curtain system that simultaneously reduces heat loss through windows and provides targeted low-power radiant heating. This invention has progressed from Technology Readiness Level (TRL) 1 to TRL 9, with successful 23 transition from initial laboratory proof-of-concept to mass manufacturing and commercial launch. The VIHC comprises a 7 mm composite assembly integrating a 3 mm vacuum insulation layer ($\lambda \approx 0.013$ $W \cdot m^{-1} \cdot K^{-1}$) with an ultra-thin electrically powered heating mesh. The curtain functions as a portable retrofit technology, requiring no glazing replacement, structural works, or professional installation beyond a conventional curtain pole and power connection. Experimental evaluations indicate that an average power input of 333 W (≈1 kWh over 3 hours) provides gentle radiant warmth while mitigating cold downdraughts, enhancing mean radiant temperature near the occupied zone, and reducing reliance on central heating systems. Its dual functionality allows users to lower thermostat set-points or shorten heating runtimes, leading to reduced energy consumption and improved comfort, particularly in heritage buildings, rental properties, hotels, schools, and domestic environments where glazing replacement is impractical. Unlike conventional thermal curtains or portable heaters, the VIHC uniquely combines advanced vacuum insulation with decentralised, user-controlled radiant heating in a single lightweight unit. This research-to-industry pathway exemplifies how academic innovation can deliver practical, scalable, and sustainable energy solutions for the built environment.

Keywords: Vacuum Insulated Heatable Curtain, VIHC, Heating, Insulation, Buildings, Net Zero Energy, Energy Savings, Sustainability.

Selim Sanad Shaker

Geopressure Analysis Services (G.A.S), United States

Biography: Dr. Selim Shaker is a Principal Consultant for Geopressure Analysis Services (G.A.S), with over 40 years in the oil industry and worldwide exploration experience in North America (in particular the Gulf of Mexico), South America, Egypt, NW Australia, Algeria, North Sea and China. Shaker established G.A.S after retiring from Phillips Petroleum following 20 years of service as a Senior Exploration Geologist. Shaker has published over 50 papers and articles regarding pressure predictions and their impact on exploration success or failure and drilling challenges, and received a Ph.D. from Assiut University, Egypt and a Diploma in Hydrogeology from Prague University/UNESCO.

Predicting drilling challenges and hazards due to subsurface pressure's drifting

Objectives: Drilling for oil and gas is an intricate process that required subsurface geoscience in coordination with engineering to complete the task of reaching the prospective trap. The open borehole formation - fracture pressures dictate the Mud Weight (MW) that controlling the drilling trip margin and the kick tolerance window. The pressure generated by Static (SMW)/ dynamic (ECD) mud density against the wellbore wall formation pressures plays an essential role in drilling performance and safely. In this research, a brief description of the adequate pressure modeling and methods that support combating the anticipated flows, hard kicks, blowouts, lost circulations etc. before drilling.

Procedures: In clastic sediments where sand, sandstone, clay and shale dominate the stratigraphic column, sedimentation process goes from deposition, compaction to lithification. This impacts the formations petrophysical properties (acoustic velocity, electric conductivity, density) vertical changes with increasing depth. Analyzing the meandering of the interval seismic velocity (Pvi) at the wildcat proposed location in association with sequence stratigraphy exhibit a great deal of the expected drilling challenges and their depth. Selecting the adequate modeling that concurs with the geological building blocks helps depth identifying and assess combating of the drilling challenging.

Results: In general, the subsurface pressure profile can be divided hydrodynamically to four segments: a) normal static, b) compaction hydrodynamic c) pressure ramp, and d)

geopressured. In the Deepwater shallow zones (a-b) where sediments start the process of compaction, a hazard of Shallow Water Flow (SWF) can occur due the differential pressure created by fluid expulsion. Drilling through the compaction zone (b) Mud Weight increases gradually to accommodate for the dehydration process. Deeper at the competent high stand shale seal (c) where compaction seized, a notable pressure ramp exists. This is usually associated with well flows, kicks, mud cuts and a notable Mud Weight increase to battle the abnormal excess pressure shift. The intermediate casing seat usually installs at this depth.

The sediments section (d) below the pressure ramp shows a succession of compartments in a cascade fashion form in the reservoir type formations. These compartments exhibit hydrostatic gradient and yield notable different excess pressure envelopes. It is referred to it as the geopressured sediment column. The presence of compartmentalized reservoirs charged with excess pressure and alternating with seals in this geopressured section makes open hole very vulnerable to flows, kicks, lost circulations and borehole instability.

Conclusion: Before drilling, analyzing the pore pressure profile deduced by the carefully processed seismic velocity can be a great help in predicting possible drilling hazards. Introducing the geological building blocks in collaboration with the pore pressure modeling algorithms is a game changer. Most of the flows, kicks and blowouts, lost circulations take place when the drill bit crosses the lithological boundaries between shale (seal) and sand (reservoir), especially if geopressured pay zones present.

Stanislaw Dzwigaj

Sorbonne Université, UMR 7197, Laboratoire de Réactivité de Surface, France

Biography: Professor Stanislaw Dzwigaj received a PhD degree in 1982 at the Jerzy Haber Institute of Catalysis and Surface Chemistry, Krakow (Poland). After two years of postdoctoral stay at the Laboratoire de Réactivité de Surface, Université P. et M. Curie (Paris), Dzwigaj obtained in 1990 a position of contracted researcher in the same laboratory, devoted to surface reactivity in relation to catalysis phenomena. In 2008, Dzwigaj obtained a permanent position in CNRS as a researcher. On February 19, 2014, for outstanding scientific achievements, Dzwigaj received the title of professor. The published work includes more than 170 papers in reputable international journals.

Application of vanadium and tantalum single-site zeolite catalysts in heterogeneous catalysis

The metal ions well dispersed at zeolite framework are considered to be active sites of catalytic processes. Therefore, the incorporation of these metals into zeolites as isolated tetrahedral sites appears to be the important task. We have earlier shown that the incorporation of transition metal ions into vacant T-atom sites of framework zeolite is strongly favored when, in the first step, zeolite is dealuminated by treatment with nitric acid solution and then, in the second step, the incorporation of transition metal ions results in the reaction between the cationic metal species of the precursor solution and the SiO-H groups of vacant T-atom sites created by dealumination of zeolite. During my keynote talk the design of single-site zeolite catalysts with transition metal will be described and characterized by different physical techniques both at the macroscopic (XRD, BET, TPR, TEM) and molecular level (FT-IR, NMR, DR UV-Vis, XPS, EPR, XAFS). The application of metal single-site zeolite catalysts in environmental catalysis will be discussed. This two-step postsynthesis method applied in this work allowed obtaining vanadium and tantalum single-site zeolite catalysts active in different catalytic processes such as oxidative dehydrogenation of propane into propene, selective catalytic reduction of NO_x to N_2, production of 1,3-butadiene from renewable sources, including ethanol obtained from biomass. Their catalytic activity strongly depended on the speciation and amount of vanadium or tantalum incorporated into zeolite structure as well as their acidity.

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ORAL PRESENTATIONS

Abdalla Ali Estuti

Exploration Department, Headquarter Burj Boleila, El Shat Street, Tripoli, Libya

Digital twin framework for pipeline systems using the Post-Extrapolation Method (PEM): Real-time prediction of water–air two-phase transients with experimental and OLGA validation

This paper presents an integrated Digital Twin framework for real-time monitoring and prediction of two-phase transient flow in pipeline systems, with specific relevance to the operational environment of the National Oil Corporation (NOC) of Libya. The proposed framework incorporates the Post-Extrapolation Method (PEM) into a Method of Characteristics (MOC) structure to overcome the numerical interpolation limitations typically encountered in conventional transient solvers. The PEM-enhanced formulation allows accurate prediction of water–air transient behavior over a regular computational grid while maintaining numerical stability under variable wave celerity conditions.

Model validation was conducted using comprehensive experimental data from the National University of Singapore (NUS) air–water multiphase flow loop, demonstrating strong agreement across a broad range of gas volume fractions (GVF = 0%–90%). Comparative analysis against industry-standard OLGA simulations further confirmed the effectiveness of PEM, achieving a Mean Absolute Percent Error (MAPE) below 4% across all test scenarios while reducing computational runtime by approximately 60%. These results position PEM as a computationally efficient alternative that retains physical fidelity without the intensive computational demands of full multiphase solvers.

The Digital Twin implementation highlights significant potential for improving pipeline integrity management, enabling early detection of surge events, tracking of flow-regime transitions, and real-time operational optimization. The framework is readily adaptable

to oil–gas systems through fluid-property mapping and provides a practical pathway for real-time deployment within NOC's pipeline infrastructure.

Keywords: Digital Twin, Transient Two-Phase Flow, Post-Extrapolation Method (PEM), Pipeline Integrity, OLGA Simulation, Real-Time Monitoring, National Oil Corporation (NOC).

Biography

Abdalla Ali Estuti is a senior engineering consultant and researcher with more than four decades of professional experience across a broad range of engineering disciplines. His expertise includes engineering analysis, numerical modelling , infrastructure systems, fluid mechanics, and applied computational methods, with involvement in energy, industrial, and large-scale infrastructure projects. He is the developer of the Post-Extrapolation Method (PEM), an advanced numerical approach for simulating unsteady single- and two-phase flow, with applications in real-time prediction and digital twin frameworks for engineering systems. His research interests focus on transient phenomena, numerical stability, and the integration of physics-based models with operational and decision-support environments. Mr. Estuti has contributed to international conferences and peer-reviewed publications and continues to bridge advanced engineering theory with real-world applications.

Abhishek Tyagi*, Akhil Agrawal
Central University of Rajasthan, India

Development of surface-functionalized tailored polymer blend for enhanced oil recovery for non-producing reservoirs

Maximizing hydrocarbon recovery from mature reservoirs demands advanced Enhanced Oil Recovery (EOR) technologies to meet global energy requirements. This study reports the chemo-selective synthesis of a novel Polymer Blend (PB) composed of Acetylated Guar Gum (aGG) and Native Guar Gum (GG). FTIR analysis confirmed the formation of ester groups (1733 cm^{-1}) and the polymer combination (3467-3600 cm^{-1}). Among four blend ratios, the aGG 4:1 GG composition was identified as the most stable with the lowest crystallinity, based on electrode potential and Gibbs free energy calculations. Rheological analyses revealed desirable pseudoplastic and viscoelastic behaviour critical for enhancing sweep efficiency. The optimal PB exhibited sweep efficiency of 3.37 mm^2 s^{-1}, low interfacial tension (IFT) of 27.0 dyne cm^{-2}, and an injection pressure of 2700 Pa. Contact angle measurements confirmed the most effective wettability alteration, reducing the angle to 61.1°, followed by aGG (74.2°) and GG (82.3°), indicating water-wet characteristics. Floatation and two-phase separation tests verified wettability reversal, with PB-treated carbonate rocks rapidly settling in the aqueous phase. Emulsification studies demonstrated that PB produced small, densely packed oil–water droplets, whereas aGG yielded moderately larger droplets and GG formed fewer, larger ones, reflecting lower efficiency. Oil Reservoir Simulating Bioreactor (ORSB) trials validated PB performance, achieving the highest incremental oil recovery of 8.31% OOIP (total recovery enhanced from 47.6% to 55.9%), surpassing aGG (3.59%) and GG (2.98%). These results establish PB as a novel, cost-effective, and eco-friendly biopolymer capable of outperforming existing synthetic polymers in EOR.

Biography

Abhishek Tyagi is a Ph.D. Scholar in Microbiology at the Central University of Rajasthan, specializing in petroleum microbiology, microbially influenced corrosion, and the chemical modification of polymers for enhanced oil recovery. His research contributions encompass bioethanol production, cyanobacterial pigment studies, and the development of advanced polymers designed to improve oil recovery under challenging reservoir conditions. With an interdisciplinary academic foundation in Chemistry, Botany, Zoology, and Microbiology, he brings a broad and integrative scientific perspective to energy and environmental research. A national awardee of the SMART India Hackathon 2023 and the YUKTI Innovation Challenge 2024 by AICTE and the Ministry of Education's Innovation Cell, Government of India, Abhishek Tyagi is dedicated to translating innovative laboratory research into practical, sustainable technologies for the petroleum and energy sectors.

Aiyda Ibrahim Fourgani*, Amir Mohammed Ayub, Mohamed Haman

Exploration Department, Headquarter Burj Boleila, El Shat Street, Tripoli, Libya

Beyond the eastern fringes of Sirte Basin: Prospectivity evaluation and petroleum system assessment of Concession 31, Cyrenaica Platform, Libya

Concession 31 (Con31) is sandwiched between the Ajdabiya Trough, the Amal Platform, the Maragh Trough and Al Quaneen Troughs, and the eastern part of the Cyrenaica Platform (Fig. 1). This paper explains the potential pathway to migrate hydrocarbons from the mature Ajdabiya Trough and Maragh Trough to Con31 and the Cyrenaica Platform.

This study aims to integrate various data to provide a clear picture of how the tectonic provinces and associated petroleum systems interact and to identify the potential prospectivity and areas attractive for exploration in Concession 31 and adjoining areas. The integrated geological interpretation based on 3D seismic and other datasets allowed us to explain how the eastern part of the concession as well as the Cyrenaica Platform can be charged and de-risked.

Geochemical work helped us to identify and map several petroleum systems, including Sirte, the lower Cretaceous Middle Nubian Shale, and the Triassic Hamin Shale (local source rock). The Hamin Shale correlates geochemically with oils that are produced from the F Field, suggesting the presence of the Triassic source rocks in the southern kitchen area. In the Gicherra area to the south of Con31, the Triassic to Jurassic shales lie within the oil window. The shallower Tertiary carbonates and Oligocene sandstones (Najah Group) are better reservoirs due to shallow burial. The deeper reservoir may have experienced deep burial diagenesis, resulting in moderate reservoir quality.

Structurally, this area is shaped by deep-seated basement-involved normal faults that extend into the shallow stratigraphic horizons and provide the vertical conduits for hydrocarbon

migration from deeper to shallower stratigraphic intervals via non-sealing faults. The adjacent Cyrenaica Platform has experienced multiple tectonic episodes and remains underexplored with a well density of approximately 1:2000 km². It contains a thick Paleozoic to Tertiary succession, hosting several promising clastic and carbonate plays.

Keywords: Sirte Basin, Cyrenaica Platform, Con31, Hydrocarbon Migration, Petroleum System, Hydrocarbon Plays, Geochemistry, Basin Modeling, Exploration Potential.

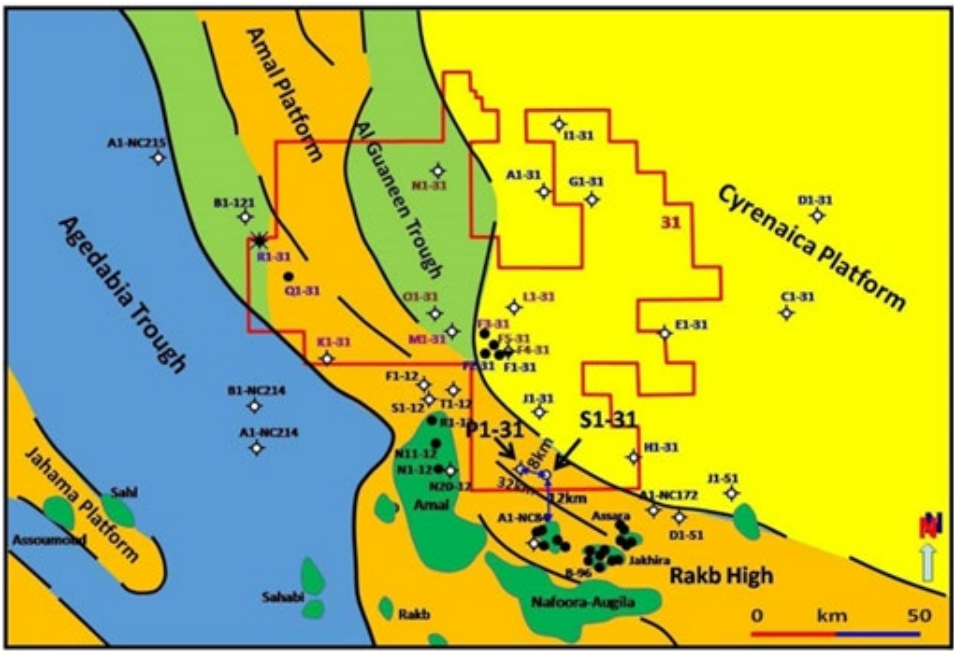

Figure 1: Location map of Con31 showing main tectonic provinces, wells and major oil fields.

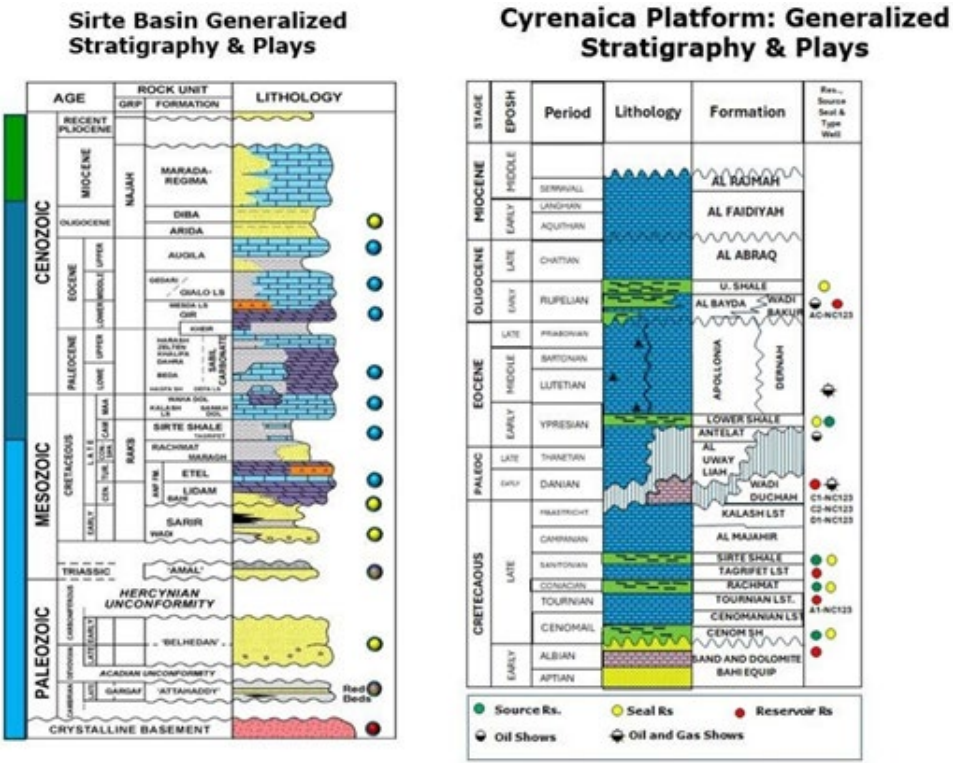

Figure 2: Illustrates the generalized stratigraphic plays of Xon31 and Cyrenaica Platform

Biography

Aiyda Ibrahim Fourgani is a Petroleum Geochemist and Exploration Geologist with over 10 years of experience in upstream oil and gas exploration. Fourgani currently serves as Supervisor, Geological and Geophysical Studies Section in the Exploration Department at Waha Oil Company, Tripoli, Libya, leading multidisciplinary teams and contributing to basin-, play-, and prospect-scale evaluations. Professional expertise includes source rock evaluation, maturity and charge assessment, migration analysis, petroleum system modeling, reservoir geochemistry, and seismic well integration, with a strong focus on the Sirte Basin and Cyrenaica Platform. Fourgani holds an MSc in Geochemistry from Colorado State University, USA, and a BSc in Geology from the University of Tripoli, Libya. Earlier in the career, Fourgani also worked as an instructor and academic collaborator with the University of Western Mountains of Gharyan and the University of Tripoli.

Anurag Singh*,
Claudia Milena Torres*
Mansarovar Energy, Colombia

Revitalizing a complex heavy oil field: Subsurface reinterpretation and integrated execution at Velásquez (Middle Magdalena Basin)

In 2021, Velásquez became Mansarovar Energy Colombia Limited's (MECL) sole producing field after operational restructuring. Traditionally viewed as a mature, low-upside asset, Velásquez is located in a faulted monoclinal setting on the western flank of Colombia's Middle Magdalena Valley Basin. The fluvial reservoirs (Guaduas–Tuné sequence) are structurally segmented and exhibit strong lithological heterogeneity and elevated water cuts.

A full-field reinterpretation-based on reprocessed seismic and enhanced petrophysical models-revealed untapped oil potential and enabled a phased redevelopment strategy. From 2023 to 2024, MECL executed 13 infill wells and 13 workovers, increasing production by 30% (from 3,043 to 3,949 BOPD).

As of mid-2025, the field has surpassed 5,000 BOPD, and is on track to reach 6,000 BOPD by year-end, supported by the planned drilling of 5 additional infill wells and 8 workovers.

The campaign delivered six key technical lessons:

1. Zonal differentiation is critical: Guaduas and Tune—and even their internal sub-units—respond differently to development strategies. Treating them with tailored completion and intervention criteria improved well targeting, drainage efficiency, and recompletion success rates.

2. Operational agility accelerates learning: Short-cycle integration of field data enhanced campaign performance.

3. High BSW wells can still be productive: Targeted isolation and recompletion strategies recovered value from wells with>85% water cut.

4. Stratigraphy drives entrapment: Subtle stratigraphic variations control lateral seal integrity and remnant oil distribution.

5. Low-resistivity sands hold untapped potential: Saturation-driven diagnostics enabled successful targeting of low-resistivity, oil-bearing intervals.

6. Pilot injection validated pressure support and sweep: A focused water injection pilot in Guaduas delivered over 1 MMBBL of incremental oil, confirming effective sweep and pressure behavior for scale-up.

MECL's newly approved growth manifesto outlines ambitious production targets (measured in KBOEPD), to be realized through base production optimization, expanded infill drilling campaigns, Enhanced Oil Recovery (EOR) techniques, and potential inorganic growth opportunities. These efforts align with global imperatives to secure energy investments, foster international cooperation, and accelerate the global energy transition.

This case underscores that unlocking complex mature assets requires stratigraphic understanding, real-time adaptation, and a disciplined, data-driven redevelopment model. MECL's roadmap aims to reach 10,000 BOPD by 2027 and 15,000 BOPD by 2030, leveraging optimized infill drilling, waterflood expansion, and EOR implementation.

Biography

Mr. Anurag Singh, with qualifications as Master's in Physics and an MBA, has built a distinguished career across ONGC and ONGC Videsh Ltd. (OVL), progressing from well log interpretation and field operations to strategic leadership in international oil and gas projects. At ONGC Mehsana Asset, Singh transitioned from real-time well data monitoring to interpretation, contributing significantly to Cambay Basin operations and special projects aimed at optimizing oil recovery from mature fields. Singh later joined the Business Development Group at OVL in New Delhi, evaluating overseas investment opportunities, particularly in the Americas. As Project Coordinator for Project Shahkdag, Singh managed complex international acquisitions in Azerbaijan, including equity in the ACG field and the BTC pipeline, and this performance in high-value transactions earned recognition from OVL leadership. Since 2024, Singh has served as Project Manager for Imperial Energy under ONGC Videsh's Russia Business Unit. Initially joining as Project Coordinator, Singh was quickly promoted for strategic insight and organizational capabilities, applying expertise in project management, technical operations, and cross-functional coordination to align with ONGC Videsh's global strategic goals. Since February 2025, Singh has taken responsibility as Chief Technical Officer (CTO) in Mansarovar Energy Colombia Limited.

Claudia Milena Torres is the Exploration & Development Deputy Manager at Mansarovar Energy Colombia, with over 20 years of experience in the oil and gas industry. Torres holds a Master's degree in Geophysics and specialized studies in Petroleum Geology. Expertise includes integrated subsurface evaluation, seismic interpretation, reservoir characterization, geological and geophysical modeling, petrophysical evaluation, reserves estimation, reservoir management, and field development planning. Torres has successfully led multidisciplinary teams in developing exploration and producing assets across Colombia's major sedimentary basins, and is recognized for collaborative leadership, technical excellence, and commitment to innovation, data-driven decision-making, and sustainable energy resource development.

Aodai I. Murad

YASREF, Saudi Arabia

Building YASREF's future capability

JASARA – 3D & Reverse Engineering Center is a strategic initiative established to strengthen maintenance reliability and accelerate digital transformation within YASREF through the application of advanced engineering technologies. By integrating 3D scanning, reverse engineering, CAD modeling, additive manufacturing, and digital engineering workflows, the center provides practical solutions to maintenance challenges while building sustainable in-house capabilities.

The initiative was created in response to persistent industry issues, including extended procurement lead times, obsolete or discontinued spare parts, limited OEM support, and dependency on external suppliers. Instead of relying solely on conventional procurement, JASARA adopts a structured engineering process that converts physical components into validated digital assets. These assets can be reused for local manufacturing, rapid reproduction of critical parts, engineering verification, and long-term preservation of technical knowledge.

The presentation will demonstrate how this digital spare parts ecosystem improves maintenance responsiveness, minimizes equipment downtime, reduces inventory requirements, and enhances supply chain resilience. Real industrial examples will illustrate how reverse engineering and additive manufacturing have successfully reduced costs, shortened delivery times, and enabled faster restoration of critical equipment. In addition, the presentation will highlight governance practices, quality assurance, engineering validation, and documentation processes that ensure manufactured components meet operational requirements.

Beyond technology, JASARA represents a people-development platform. Through specialized technical training, international certifications, and knowledge transfer, engineers and

technicians are equipped with modern digital manufacturing skills that support continuous innovation and operational excellence.

Finally, the presentation outlines the future roadmap of JASARA, including expanding its services across Yanbu industrial facilities, strengthening collaboration with local manufacturers and technology partners, and supporting localization objectives aligned with Saudi Vision 2030. By combining engineering innovation, digitalization, and workforce development, JASARA aims to become a regional center of excellence that delivers measurable business value through improved reliability, optimized maintenance performance, and sustainable engineering capability.

Biography

Aodai I. Murad is a maintenance professional with over 15 years of experience in refinery operations, specializing in Mechanical Workshops, maintenance engineering, and reliability improvement. Throughout a career spanning these areas, Murad has led and contributed to numerous initiatives that enhanced maintenance performance, optimized workshop capabilities, reduced costs, and improved operational efficiency. Murad currently leads the JASARA – 3D & Reverse Engineering Center, driving the development of digital spare parts, reverse engineering, 3D scanning, and advanced manufacturing capabilities. Under this leadership, JASARA has delivered innovative engineering solutions that support localization, reduce procurement lead times, preserve engineering knowledge, and create measurable business value. Murad holds a Bachelor of Science in Human Resources Management and is passionate about combining engineering, innovation, and people development to build sustainable capabilities that support operational excellence and align with Saudi Vision 2030.

Assad Ghazwani*,
Mosaab Alsunaidi and Zyiad Hilal
Saudi Aramco, Saudi Arabia

Organic geochemical characteristics of permian hybrid lacustrine-marine source rocks and their implications for unconventional shale oil potential

Carboniferous sedimentary basins contain extensive organic-rich shale successions deposited under alternating lacustrine and marine conditions, forming hybrid petroleum systems with considerable potential for unconventional shale oil exploration. Recurrent marine incursions into lacustrine environments generated mixed organic facies composed of terrestrial, lacustrine algal, and marine-derived organic matter. These hybrid depositional systems significantly influenced organic matter preservation, kerogen composition, retained hydrocarbons, and shale oil generation potential within fine-grained sedimentary sequences.

This study investigates the organic geochemical characteristics, depositional environment, and hydrocarbon extraction potential of Carboniferous lacustrine–marine hybrid source rocks using integrated sedimentological observations, solvent extraction analysis, Rock-Eval pyrolysis, and biomarker geochemistry. The research focuses on evaluating how mixed depositional conditions control retained hydrocarbons and unconventional shale oil prospectivity.

Geochemical analyses indicate the presence of predominantly mixed Type II–III kerogen with intervals enriched in oil-prone organic matter associated with lacustrine algal productivity and intermittent marine influence. Solvent extraction results reveal appreciable quantities of Extractable Organic Matter (EOM), indicating effective hydrocarbon retention within low-permeability shale matrices. Saturated and aromatic hydrocarbon fractions obtained from extraction further demonstrate a combination of terrestrial and marine organic inputs.

Biomarker distributions, including sterane and hopane assemblages, indicate fluctuating depositional conditions influenced by episodic marine transgressions into lacustrine settings. Elevated C29 steranes reflect substantial terrestrial organic contribution, whereas increased C27 steranes and marine-associated biomarkers suggest periodic marine influence during deposition. Pristane/phytane ratios, gammacerane occurrence, and hopane distributions indicate deposition under variable redox conditions ranging from suboxic to anoxic environments, with episodes of water-column stratification and salinity fluctuation favoring organic matter preservation.

The integration of extraction data with biomarker geochemistry demonstrates that retained hydrocarbons are concentrated within organic-rich laminated shale intervals, highlighting the significance of hybrid depositional environments in shale oil accumulation. Marine influence appears to enhance preservation conditions and contribute to improved hydrocarbon generation characteristics relative to purely terrestrial Carboniferous source rocks.

The results suggest that Carboniferous lacustrine–marine hybrid shales represent promising yet underexplored unconventional shale oil targets in mature petroleum basins. Integrated geochemical and extraction-based evaluation provides an effective framework for identifying prospective shale oil intervals and improving unconventional resource assessment in mixed depositional systems.

Biography

Dr. Assad Ghazwani is the Supervisor of the Geochemistry Unit at Saudi Aramco, with over 20 years of experience in organic geochemistry, petroleum systems analysis, reservoir characterization, and unconventional resource evaluation. He earned his PhD from RWTH Aachen University and has contributed extensively to technical studies and innovation initiatives supporting exploration, reservoir development, and applied geoscience workflows. Dr. Ghazwani is also an inventor and co-inventor of several patented and disclosed technologies, including the Interactive Core Description Assistant Using Virtual Reality, Interactive Correlation and Prediction of Source Rock Organofacies, Oil Families and Reservoir Alteration Using Machine Learning, and Water Washing Estimation and Prediction from Statistical Relationships of Gas Compositions. His work primarily focuses on integrating geochemistry, digital technologies, and advanced analytical workflows to improve subsurface characterization and unconventional resource assessment.

Ayesha M. Shamsi[1]*, Hiba K. Aoudi[2], Saeed M. Al Marzooqi[3]*

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Pipeline integrity under challenged operations: Restoring reliability in a 20 main oil line through root cause driven mitigation

Background and Integrity Challenge: This paper presents a comprehensive pipeline integrity investigation and recovery strategy for a 20 Main Oil Line that experienced severe internal corrosion following prolonged operation in by-pass mode. The objective is to identify the root causes of accelerated metal loss, evaluate gaps in operational and corrosion management practices, and demonstrate how a multidisciplinary, integrity led intervention successfully restored pipeline reliability and fitness-for-service.

Investigation and Systematic Approach: A structured Root Cause Analysis (RCA) was executed through a Joint Task Force, integrating In-Line Inspection (ILI/IP) data, operating history, Corrosion Risk Assessment (CRA) limits, chemical performance reviews, and well operation practices. The analysis focused on flow regime deviations, water chemistry (pH), solids and debris deposition, inhibitor delivery effectiveness, and deferred mechanical pigging. Mitigation strategies were then developed and implemented across corrosion management, well operations, and integrity assurance, supported by enhanced pigging technologies, high-resolution inspections, and verification techniques such as AUT on critical features.

Performance Outcomes and Key Findings: The integrated mitigation program resulted in a dramatic reduction of internal corrosion rates from approximately 3.5 mm/year to 0.1 mm/year, confirming the effectiveness of restoring operation within the defined integrity operating window. Key conclusions highlight that prolonged low-flow operation, under-deposit corrosion, acidic produced water following well stimulation, and ineffective inhibitor distribution were the dominant contributors to the observed damage. Recommendations emphasize strict adherence to CRA-defined operating envelopes, proactive debris management, aggressive

cleaning pigging, controlled well fluid diversion, and continuous integrity monitoring to prevent recurrence.

Engineering Significance and Industrial Application: This case study provides a rare, data driven demonstration of how temporary operational modes when extended beyond their original intent can rapidly compromise pipeline integrity if not governed by robust monitoring and multidisciplinary oversight. The work highlights the critical role of advanced pigging configurations (dual-module brush pigs with magnets), batch inhibition strategies post-pigging, and cross-functional MOC governance. Lessons learned have been formally captured and disseminated across ADNOC group assets, offering a transferable integrity framework applicable to similar brownfield and early-production pipeline systems.

Biography

Within Abu Dhabi National Oil Company (ADNOC Offshore), **Ayesha Alshamsi** has excelled as a Pipeline Integrity Engineer within the Technical Services Business Unit. Alshamsi's expertise lies in handling integrity in project deliverables, ensuring that all aspects meet the highest standards of quality and safety. In addition to this professional role, Alshamsi contributes significantly to the Youth Committee, serving as secretary. This commitment to making a meaningful difference is evident in proactive efforts to illuminate pathways for others and to continually uplift and support those around. Saeed Almarzooqi is a professional with over 10 years of experience in the oil and gas industry, specializing in asset integrity and engineering excellence. Currently serving as an integrity projects team leader at ADNOC Offshore, Almarzooqi plays a key role in safeguarding the reliability and longevity of offshore assets through advanced integrity management strategies.

Saeed Almarzooqi is a professional with over 10 years of experience in the oil and gas industry, specializing in asset integrity and engineering excellence. Currently serving as an integrity projects team leader at ADNOC Offshore, Almarzooqi plays a key role in safeguarding the reliability and longevity of offshore assets through advanced integrity management strategies.

Bakul Mathur*, Javad Karimi, Eric Salomon, Daniel Koehn

GeoZentrum Nordbayern, Friedrich-Alexander University of Erlangen–Nuremberg, Germany

Grain-scale modelling of deformation bands formation in porous reservoir rocks

Deformation bands in porous reservoir rocks can significantly reduce porosity and permeability, influencing fluid flow and reservoir performance. Understanding the grain-scale mechanisms responsible for their formation remains an important challenge. We present a new intergranular bonding model for polyhedral particles in the open-source Discrete Element Method (DEM) application Yade, and investigate its ability to reproduce deformation-band development under compactional-shear conditions. The model incorporates a mixed-mode tensile–shear bond failure formulation, allowing grain-scale cohesion loss to develop during deformation.

Cohesion between neighboring polyhedral grains is introduced through bonded contacts that apply equal and opposite forces between interacting particles. The bonds can fail in tension, shear, or a combination of both according to an elliptical failure criterion. Polyhedral particles were chosen to better represent the geometry of natural grains. Each grain is represented by a single numerical body. This avoids the need to construct grains from multiple bonded spheres and eliminates the additional internal contacts and bonds required by such approaches.

Simulations are performed in a 2D compactional shear setup. Samples with different initial porosities and sorting characteristics are considered. During deformation, bond failure localizes into narrow shear zones that resemble natural deformation bands. Strain and cohesion loss become concentrated within these localized regions, while the surrounding material experiences less deformation.

The results suggest that intergranular bonding is an important component of DEM models aimed at reproducing strain localization in porous rocks. The polyhedral model also allows future implementation of grain fracturing without discretizing grains into smaller elements. The

proposed model provides a basis for investigating how grain-scale cohesion loss influences the macroscopic mechanical response of porous reservoir rocks.

Biography

Bakul Mathur is a PhD researcher at Friedrich-Alexander University Erlangen-Nürnberg (FAU), Germany, specializing in computational geomechanics and the Discrete Element Method (DEM). Mathur's research focuses on grain-scale modeling of deformation bands, grain breakage, and strain localization in porous rocks. Mathur holds master's degrees in Computational Science in Engineering from TU Braunschweig, Germany, and Petroleum Engineering from the University of Alaska Fairbanks, USA, following a B.Tech. in Petroleum Engineering from PDPU, India. After completing the bachelor's degree, Mathur gained field experience in coal-bed methane operations in Durgapur, India.

Ahmed D. Al Remeithi[1], Fadheela N. Almemari[2]*, Hiba K. Aoudi[3], Saeed M. AlMarzooqi[4]*

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Pipeline integrity challenges across offshore fields: The 6 gas lift pipeline case study

This paper presents a detailed pipeline integrity investigation of a 6 subsea gas lift pipeline that experienced premature leakage shortly after commissioning. The objective is to identify the underlying damage mechanism, establish the immediate, direct, and root causes of failure, and derive integrity focused recommendations to prevent recurrence in similar pipeline systems. The scope covers design, material selection, installation, commissioning, preservation, and early operational phases, with particular emphasis on integrity risks associated with residual stresses, environmental exposure, and material susceptibility.

A structured Root Cause Analysis (RCA) was conducted using a Barrier-Based Systematic Cause Analysis Technique (BSCAT), integrating engineering review, inspection data, laboratory testing, and operational history. The investigation included subsea surveys, pipeline retrieval, non-destructive testing (MPI, PAUT), destructive examination, metallography, SEM/EDS, XRD, hardness profiling, and mechanical testing. Design documentation, installation records, hydrotesting and drying procedures, and operating data were reviewed to assess barrier effectiveness across the pipeline lifecycle.

The investigation concluded that the pipeline failure was caused by Sulfide Stress Cracking (SSC), driven by the simultaneous presence of material susceptibility, a corrosive internal environment, and longitudinal tensile stresses. Although the pipeline steel complied with API 5L and NACE requirements, laboratory findings revealed localized hardness exceeding SSC thresholds and microstructural features that

increased hydrogen cracking susceptibility. Residual seawater following hydrotesting, combined with H_2S/CO_2 in the lift gas, created conditions favourable for hydrogen generation and absorption, while longitudinal stresses were most likely introduced during pipelaying or global buckling. Key recommendations include enhanced post-hydrotest drying practices, improved verification of SSC resistance testing, review of pipelaying and clamping procedures to minimize residual stresses and strengthened integrity barriers during commissioning and early operation.

This case study provides a rare and a focused integrity perspective on how latent construction- and commissioning related factors can rapidly compromise pipeline integrity despite short operational exposure. It highlights the limitations of conventional SSC qualification testing when not supported by detailed metallurgical validation and demonstrates the importance of viewing pipeline integrity as a lifecycle system rather than a design-only compliance exercise. The findings offer transferable lessons for gas lift and sour service pipelines, particularly in offshore developments where drying efficiency, stress management, and early-life integrity assurance are critical.

Biography

Fadheela Almemari is a Senior Project Integrity Engineer at ADNOC Offshore, UAE. Her expertise includes project integrity, risk-based inspection, corrosion management, inspection engineering, and quality management. She is responsible for integrating integrity, inspection, and quality requirements throughout the project lifecycle, supporting the safe, reliable, and sustainable delivery of offshore assets.

Saeed Almarzooqi is a professional with over 10 years of experience in the oil and gas industry, specializing in asset integrity and engineering excellence. Currently serving as an integrity projects team leader at ADNOC Offshore, Almarzooqi plays a key role in safeguarding the reliability and longevity of offshore assets through advanced integrity

Fahad Almehmadi
Saudi Aramco, Saudi Arabia

Enhancing LPG capacity at Rabigh Bulk Plant: A case study on flow optimization and operational efficiency

Rabigh Bulk Plant (RBP) is a critical node in Saudi Arabia's Liquefied Petroleum Gas (LPG) distribution network, linking upstream production at Petro Rabigh Company (PRC) to downstream domestic demand. Historically, the plant faced throughput constraints that limited sustainable loading capacity, despite PRC's daily production. This capacity gap translated into operational inefficiencies and significant economic impacts.

To address these challenges, a comprehensive capacity assessment was conducted focusing on hydraulic performance, control valve optimization, and truck loading operations. As part of the implemented modifications, a Pressure Control Valve (PCV) was installed at the pumps' discharge header to regulate loading pressure, in addition to the adjustment of Flow Control Valve (FCV) set points and system reconfiguration. These improvements successfully enhanced the LPG loading system, enabling the plant to achieve its target capacity while maintaining safe operating pressures and stable flow behavior.

Operational outcomes indicated that 31% reduction in truck loading times, with average durations improving from 41 minutes to 28 minutes. Balanced flow rates across loading system confirmed system reliability, operational stability, and scalability under the new configuration. Importantly, the improvements also translated into significant annual cost savings of $31 MM by minimizing delays, improving truck turnaround, and maximizing product lifting.

This study underscores the significance of system-level optimization in energy infrastructure. By integrating hydraulic simulations with real-time operational monitoring and pressure control, the project not only unlocked latent plant capacity but also delivered measurable improvements in efficiency, safety, and economic value. The findings provide a replicable

framework for other distribution terminals seeking to expand throughput without major capital investments.

Biography

Fahad Almehmadi is an Operations Engineer at Saudi Aramco with a Mechanical Engineering background and several international certifications, including PMP, Crisis Management, and Decision Making. Almehmadi has over three years of experience across downstream operations, contributing to diverse industrial projects, and currently serves as the Business Continuity Coordinator for the North Region Distribution Department while leading the commissioning of upgraded oily water systems at Yanbu and Rabigh Bulk Plants. Almehmadi was recognized in 2022 through the Saudi Aramco Talent Essentials Program for successfully resolving a complex operational challenge in the North Area Oil Operations Department.

Fatima Ibrahim Almarzooqi*,
Khalfan Aldhanhani*
ADNOC Offshore, United Arab Emirates

Enhancing integrity and safety: Flare tip inspection strategies in offshore environments

Flare systems are critical safety components in offshore oil and gas operations, designed to safely combust excess hydrocarbons during normal operations and emergency scenarios. In the harsh offshore environment, flare tips are subjected to extreme thermal and mechanical stresses, making their inspection and maintenance a vital aspect of asset integrity management. This paper presents a comprehensive overview of flare tip inspection strategies employed across ADNOC Offshore facilities, highlighting recent innovations, operational challenges, and lessons learned from field applications.

The inspection of flare tips in offshore settings poses unique challenges due to limited accessibility, high elevation, and continuous operation requirements. Traditional inspection methods, such as visual inspection and ultrasonic thickness measurements, have been the cornerstone of integrity evaluations.

To overcome accessibility constraints and enhance safety, ADNOC Offshore has increasingly adopted UAV drone inspection technologies which reduce inspection time by 80%. These unmanned aerial systems provide high-resolution imaging and thermal data without requiring shutdowns or scaffolding. Drone inspections have proven particularly effective in facilities like Zirku Island, where Flares exhibited signs of thermal degradation, pilot damage, and structural cracks. Despite operational constraints, drones enabled timely assessments and informed maintenance decisions. We shifted from days of inspections to only hours. However, challenges remain in ensuring consistent report quality and coordinating with service providers.

In conclusion, flare tip inspection in offshore facilities is a multidimensional challenge that requires a blend of traditional techniques, innovative technologies, and strategic planning. ADNOC Offshore's experience demonstrates the value of continuous improvement, cross-functional collaboration, and technology adoption in safeguarding critical infrastructure and ensuring operational excellence.

Biography

Fatima Almarzooqi is an Integrity Engineer (Inspection) at ADNOC Offshore, contributing to asset integrity, digital transformation, and operational excellence. Almarzooqi plays a key role in supporting site teams and ensuring compliance with AIMS and industry standards. As a Technology Champion, Almarzooqi leads the piloting and deployment of advanced inspection solutions, including drones, robotics, and AI-enabled systems, driving efficiency, cost optimisation, and risk reduction. Almarzooqi is also active in cross-company collaboration and knowledge sharing, representing ADNOC Offshore at international forums and contributing to technical initiatives, and is committed to continuous professional development and advancing innovative, reliable, and sustainable solutions across operations.

Khalfan Aldhanhani is an Asset Integrity professional with over 18 years of experience in the oil and gas industry at ADNOC Offshore. Throughout a career at the company, Aldhanhani has held a variety of technical and leadership roles across subsea and facility integrity, leading multidisciplinary teams and driving asset reliability, safety, and operational excellence. Aldhanhani holds internationally recognized certifications including API 510, API 570, API 580, PMP, and CSWIP 3.4 Underwater Inspection Controller, and is passionate about innovation, digital transformation, and developing high-performing teams, with a strong focus on enhancing integrity management and operational performance.

Gareev Adib Akhmetnabievich

Ufa University of Science and Technology, Russia

Solving the problem of centrifugal pump thermodynamics in oil production is the way to complete automation

Gareev was the first to set and solve the problem of the thermodynamics of a centrifugal pump when pumping multiphase mixtures (oil, water, and gas) under high pressure and temperature.

For the first time, an analytical solution to the problem was obtained, providing an analytical expression for calculating the temperature of a centrifugal pump based on the properties of the oil, the characteristics of the reservoir, and the characteristics of the centrifugal pump. The temperature of the pump was calculated based on the gas content in the mixture, the properties of the oil, and the characteristics of the centrifugal pump.

It has been proven that the formation of high temperature in the pump leads to failures in the cable line and to failures in the installation due to salt deposits. It has been shown that only protection of the cable line from the heat flow from the pump eliminates failures in the cable line. The test was conducted on 180 installations.

Based on the obtained solution of the pump's thermodynamics, a solution was obtained for the problem of periodic operation of an electric centrifugal pump. A theory for calculating the periodic mode of a centrifugal pump without failures or salt deposits was provided.

The obtained solution provides a theory for using the pump shaft speed control to regulate the operation of the installation without failure in the cable line and without salt deposits.

It has been proven that by regulating the temperature of the centrifugal pump, salt deposits can be eliminated without the use of any chemical reagents or technical devices.

Theoretical studies have proven and shown that genuine automation of the operation of an electric centrifugal pump is possible only on the basis of the obtained solution of the pump's thermodynamics problem during the pumping of multiphase mixtures under high pressure and temperature.

The obtained solutions are presented in the textbooks titled The Latest Technology for Oil Production, Oil Production - Salt Deposition, which are published in English by Kindle Direct Publishing, and the books Oil Production - Periodic Operation and Frequency Control of a Centrifugal Pump in Oil Production are currently being prepared for publication.

It has been shown that by introducing automatic control systems for electric centrifugal pumps, the cost of oil production can be reduced by approximately two times. The automation of centrifugal pump control will lead to the creation of a manless technology. From there, it is possible to develop a fully automated oil field. Automatic systems are indispensable for the operation of small oil fields and offshore oil fields. Automatic systems are the future of the oil industry and offer a solution to all the challenges associated with the operation of electric centrifugal pump systems.

On the existing well stock it is necessary to start implementing protection of the cable line (about 25% of all failures);

On the existing well stock to implement a program of prevention of deposits of salts (patenting is carried out);

To create an automatic installation (there are patents), to test and to implement on the market of oil equipment

To publish textbooks, to organize retraining courses for teachers of higher education institutions, technical specialists of the oil industry, to reform training programs of specialists – oilmen in higher education institutions.

Biography

Gareev Adib Akhmetnabievic graduated from the Faculty of Physics and Mathematics of the Bashkir State University (Russian Federation), is currently transformed into the Ufa University of Science and Technology. Works as a practicing engineer in oil production in an oil production enterprise. The author has published about 140 scientific articles on thermodynamic problems of gas-liquid mixtures. More than 15 papers on the problems of pumping multiphase mixtures by electric submersible pumps have been published in foreign scientific journals.

The author received patents for inventions in the Russian Federation, China, Singapore and the USA (at the stage of issuing a patent). The author has published two monographs on the problems of operation of electric centrifugal pumps in fields with low reservoir properties. Works on a monograph on the operation of oil wells in a periodic mode.

Hashem A Al Obaid
Saudi Aramco, Saudi Arabia

Extending the horizon of real time hybrid coiled tubing applications in fracturing: A comparative study of first stage perforations in deep horizonal well

The boom in hydraulic fracturing over recent decades has intensified the drive for enhanced operational efficiency in terms of both cost and time. Multi-Stage Fracturing (MSF) completions have been introduced as an alternative to the traditional plugandperf method especially in deep horizontal wells. The constrained internal diameters (IDs) inherent in MSF completions have necessitated the adoption of advanced completion technologies to eliminate flow restrictions; however, the activation of the first stage remains a persistent challenge. Initiating fracturing typically requires either hydraulic port activation or intervention, both of which can be hindered by drilling and completion debris in the horizontal section. This debris often impairs hydraulic port functionality, increasing dependence on intervention-based solutions, which are both time and resource-intensive. This paper evaluates and compares various first-stage perforation strategies to enhance operational reliability and efficiency.

Typically, a first-stage perforation requires up to five operational runs. The process begins with a Coiled Tubing (CT) cleanout, followed by a venturi-jet junk basket to remove residual solid debris for the ease of wireline tractor deployment. Subsequent runs include a wireline dummy pass and perforation. If necessary, a final CT run may be required for acid spearhead in cases of poor injectivity. Real-Time Hybrid Coiled Tubing (RTHCT) enabled a reduction in operational runs to two, without compromising technical objectives. In contrast, abrasive jetting proved to be less efficient due to its technical limitations and higher resource requirements.

The utilization of RTHCT resulted in a 57% reduction in downhole operating time, delivering superior depth precision and control via real-time downhole sensors. RT E-Coiled (RTCT) achieved a 40%time reduction, but had limitations in acidic environments when using wireline tools. Abrasive jetting is another method, which exhibits relatively higher efficiency compared to RTCT, although it demonstrates limited precision, lower control over downhole parameters, and extended operational time compared to RTHCT applications. A comparative performance matrix will be presented, evaluating these strategies in horizontal well applications based on seven key factors.

Biography

Hashem Al-Obaid is a lead Petroleum Engineer in Saudi Aramco. Hashem received his B. S. Degree from KFUPM in Petroleum Engineering. He joined Saudi Aramco in 2013. Since then, he has been involved in completing gas wells activities including sandstone and carbonate formation . Hashem is an active SPE member. He is a certified petroleum engineer by SPE. In addition, he published nine SPE papers and presented five presentations.

Hery Mada Indra Paska, MMT, M.Eng, CCP, PMP, CRP
Senior Cost Engineer, Aramco, Dhahran, Saudi Arabia

Cost intelligence in the digital oilfield: An AI-enabled framework integrating estimate classification, probabilistic risk analytics, and earned value prediction for capital projects

Capital projects in oil and gas routinely exceed cost and schedule targets by 20 to 80 percent. A 2022 McKinsey analysis of over 500 capital projects found average cost overruns of 79 percent and schedule delays of 52 percent, while Independent Project Analysis (IPA), drawing on a database of over 20,000 projects studied over 35 years, places industrial megaproject failure rates at 65 percent globally. This study demonstrates that these outcomes are predictable and preventable through an integrated Cost Intelligence framework treating estimate governance, probabilistic risk analysis, and earned value management as one technologyenabled discipline.

The framework integrates three components. First, the AACE Cost Estimate Classification System (Class 1–5) operates as a stage-gate governance instrument, enhanced by digital tools mapped to each maturity tier, from big-data benchmarking at early stages to computer-vision-based quantity take-off and cost-loaded digital twins at sanction grade. Second, Cost and Schedule Risk Analysis using Monte Carlo simulation addresses the Narrow Bias problem, where decomposing risks into excessive sub-components produces false statistical precision; this logic extends to disruption and claims quantification through an unsupervised machine-learning Measured Mile technique that removes analyst subjectivity from Loss-of-Productivity calculations. Third, Earned Value Management functions as a prediction system, exploiting the statistical stabilisation of the Cost Performance Index after approximately 20 percent completion to forecast outcomes while corrective action remains affordable.

Applied to a large-scale national energy programme, the integrated framework reversed performance from a Cost Performance Index (CPI) of 0.70 and Schedule Performance Index (SPI) of 0.75 to a CPI of 0.90 and SPI of 0.95 – both unitless performance ratios rather than absolute cost or schedule figures. The recovery was achieved by re-establishing estimate-classification discipline at each stage gate, introducing probabilistic risk analysis where deterministic contingency had previously masked true uncertainty, and redeploying earned value as an early-warning system rather than a retrospective report. Beyond this case, five cost-control maturity heuristics emerged as the practitioner-level indicators that most reliably distinguish mature from immature cost-control environments: scope-led control, separation of the control baseline from approved funding, accrual-based reporting, defensibility of the Estimate at Completion, and disciplined contingency drawdown.

This work contributes a unified, technology-mapped Cost Intelligence framework connecting AI and digital-twin enablement to AACE estimate-maturity tiers, extending probabilistic risk methodology into machine-learning-based disruption and claims analysis, and operationalising earned value management as an early-warning system rather than a retrospective report. All data and methodologies referenced are drawn from public-domain sources, including AACE International Recommended Practices, PMI PMBOK, IPA, and McKinsey Capital Projects research, with no proprietary, confidential, or company-attributable project data disclosed.

Biography

Hery Mada Indra Paska, MMT, M.Eng, CCP, PMP, CRP is a Senior Cost Engineer with over 20 years of experience in cost engineering and project controls across upstream oil and gas in Indonesia and Saudi Arabia. He is a Certified Cost Professional (AACE International), Project Management Professional (PMI), Certified Risk Professional (LSPPM), and Aspen Capital Cost Estimator. He has supported capital portfolios exceeding USD 2.5 billion and led tender evaluations exceeding USD 500 million, and is a published author in PM World Journal and a member of the IATMI KSA Professional Development Committee.

Hossam Ahmed Aly Moustafa Teama
Abu Qir Fertilizers Company, Egypt

Proportional application technologies for urea removal in aqueous waste effluents, and recommended technologies for various industrial waste water

Introduction: There are many methods of urea removal, but most of them are still being developed or are very new. Urea can be removed from aqueous solutions by a variety of methods that differ in terms of their physicochemical nature and technological ingenuity. Many wastewater treatment methods include processes such as hydrolysis, enzymatic hydrolysis, decomposition in the biological bed, decomposition by strong oxidants, adsorption, catalytic decomposition, and electrochemical oxidation.

Considerations for Choosing a Method

- **Cost:** Methods like reverse osmosis and some advanced oxidation processes can be expensive.
- **Urea Concentration:** The specific method chosen will depend on how much urea needs to be removed.
- **Purpose:** The required purity of the water will determine the appropriate treatment level; for ultrapure water, additional steps are often needed after initial treatment.

Biography

Dr. Hossam Ahmed Tieama studied Chemistry at Alexandria University, Egypt, and graduated in 2000, then joined the research group of Polymer Chemistry. Tieama obtained a PhD degree in the field of water and wastewater treatment applications using modified membranes, and is currently employed as a utilities general manager at Abu Qir Fertilizers Company, with 23 years of experience in the field of water treatment. Tieama has participated in many international conferences and presented many researches in water purification applications using modified

membranes, has published in several international journals on membranes topics, and continues research activity at the City of Scientific Research and Technology Applications.

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Scientific and Production Laboratory Energy Modeling, Satbayev University, Almaty, Kazakhstan

Comparative analysis of core-flooding experiments and reservoir simulation results for chemical EOR methods in high-viscosity oil reservoirs

High-viscosity oil reservoirs are commonly characterized by an unfavorable mobility ratio, early water breakthrough, and a large amount of residual oil after conventional waterflooding. Under these conditions, chemical Enhanced Oil Recovery (EOR) methods require reliable laboratory validation and subsequent reservoir-scale assessment before field implementation. This study presents a comparative analysis of core-flooding experiments and reservoir simulation-based interpretation for chemical EOR methods aimed at improving oil recovery from high-viscosity oil reservoirs. The East Moldabek field in Kazakhstan is used as a representative case study.

The experimental part is based on core-flooding tests conducted on samples from Cretaceous and Jurassic productive horizons. The investigated chemical EOR methods include ASP flooding, polymer flooding, and surfactant solution injection, with conventional waterflooding used as the base case. The main evaluation indicators are displacement efficiency, incremental oil recovery after waterflooding, residual oil saturation, and changes in flow behavior associated with mobility control. The experimental results show that ASP flooding provides the strongest improvement among the tested chemical methods. In the Cretaceous core models, displacement efficiency increased from approximately 49% after waterflooding to more than 68% after ASP flooding, with an incremental increase of up to 19.2%. For the Jurassic core models, the increase was also significant, reaching up to 17.7%, depending on oil viscosity, permeability, and reagent formulation.

Reservoir simulation is considered as the necessary scaling stage for transferring laboratory-observed displacement mechanisms to field conditions. Core-scale results cannot be directly

extrapolated to the reservoir without accounting for heterogeneity, well interaction, injectivity limitations, and sweep efficiency. Therefore, combining laboratory filtration data with reservoir simulation improves the technical justification of chemical EOR selection and reduces uncertainty in pilot design. The results confirm that chemical EOR, particularly ASP and polymer-based systems, is promising for high-viscosity oil reservoirs when mobility control and residual oil mobilization are the dominant recovery mechanisms.

Biography

Karlygash Soltanbekova is Head of the Subsurface Hydrodynamics Department at the Scientific and Production Laboratory Energy Modeling, Satbayev University, Almaty, Kazakhstan. Soltanbekova graduated in Petroleum Engineering from Kazakh National Technical University named after K.I. Satbayev and completed a Master's degree with honors. Soltanbekova's research focuses on enhanced oil recovery, filtration experiments, reservoir simulation, and high-viscosity oil field development, with contributions to studies on chemical, thermal, and gas EOR methods for mature and heavy-oil reservoirs in Kazakhstan. Soltanbekova has participated in several research projects and authored more than 30 scientific publications, two monographs, and two copyright registration certificates.

Kyproula Georgiou[1,2]*, Nicolas Droushiotis[1], Pavlos Stephanou[2], Achilleas Konstantinou[2]

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Optimizing in silico sour gas processing for offshore deepwater gas technology applications in the Eastern Mediterranean Region

Growing global demand for Natural Gas (NG), together with the depletion of easily accessible hydrocarbon reserves, has pushed the industry toward technically challenging deepwater targets. Where these contain sour components, offshore sour gas management may constrain development flexibility and limit viable development options. A sour gas field is defined as a gas containing hydrogen sulfide (H_2S) levels above 4 parts per million of volume (ppmv), while a gas that includes significant concentrations of H_2S and/or CO_2 is referred to as acid gas and presents considerable challenges for extraction and processing. The process of removing H_2S, termed NG sweetening, is critical due to its toxicity, associated health risks, and strict environmental regulations governing both offshore and onshore processing. Offshore deepwater processing faces unique challenges compared to onshore operations, including space constraints, stringent Health, Safety, and Environmental (HSE) requirements, offshore operating conditions, reservoir location and hydrocarbon characteristics, and development plans requiring high Natural Gas flow rates.

This study contains a practical option for sour gas management based on Natural Gas desulfurization, simulated using Aspen Plus to evaluate the feasibility of an integrated process lineup for offshore application. The proposed configuration consists of an amine unit, a thermal oxidizer, a seawater scrubber column, and an aeration tank. The proposed line-up was optimized under a Natural Gas flow rate range of 200-600 MMscfd and an H_2S concentration range of 50-300 ppmv. A sensitivity analysis, performed using a tornado graph, identified key operational parameters that affect emissions, including seawater temperature, gas flow rate, seawater flow rate, and H_2S concentration.

COMSOL Multiphysics software was used to develop a comprehensive numerical model for effluent dispersion generated by the processing unit upon discharge to the marine environment. The numerical framework enabled the assessment of hydrodynamic transport, dilution behaviour, concentration distribution and pH evolution, providing valuable insight into the dispersion of the effluent and its compliance with regulatory pH discharge limits.

For the effluent dispersion modeling, the limited availability of a fully parametrized and validated MATLAB Gaussian plume model led to the adaption and full parametrization of a Gaussian Plume formulation using CFD dispersion model.

A systematic validation and verification process demonstrated that the MATLAB-based Gaussian plume model for marine environments accurately reproduces the CFD simulation results within accepted uncertainties.

Compared to CFD simulations, the Gaussian Plume model represents a computationally efficient and easy-to-use tool, enabling the rapid execution of a large number of simulations.

Finally, the integration of Aspen and MATLAB data facilitated the generation of extensive dataset, which was subsequently used to develop a machine-learning tool to support real-world, stakeholder-driven decision-making.

Biography

Kyproula Georgiou holds a First-Class Honors bachelor's degree in chemical engineering from Cyprus University of Technology and is currently pursuing a PhD at the same university in collaboration with Cyprus Hydrocarbons Company, funded by the Research Innovation Foundation. This current work focuses on optimizing in silico sour gas processing for offshore deepwater gas technology applications in the Eastern Mediterranean Region. Georgiou completed a bachelor's thesis in Computational Fluid Dynamics, and also worked as a lab technician and as a chemical engineering intern in the pharmaceutical industry, demonstrating skills and the ability to integrate theoretical knowledge with real-world industrial processes.

Maareb Alsubhi

Aramco, Saudi Arabia

Advancing net positive impact through biodiversity protection areas: Integrating ecosystem services into sustainable energy operations

The energy sector is increasingly challenged to balance operational growth with environmental stewardship and long-term ecosystem resilience. In response to global biodiversity commitments and rising expectations for sustainable development, this presentation demonstrates how Biodiversity Protection Areas (BPAs) can be integrated into energy operations to achieve measurable environmental outcomes while creating broader ecosystem and societal value.

This work presents a practical case study of biodiversity conservation and ecosystem service implementation within industrial landscapes through a structured biodiversity management approach. The initiative is guided by a net positive impact framework that prioritizes avoiding environmental degradation, minimizing residual impacts, restoring ecosystems, and generating measurable biodiversity gains beyond operational boundaries. Particular emphasis is placed on the designation and management of Biodiversity Protection Areas that safeguard ecologically important terrestrial and coastal habitats.

The presentation highlights how protected areas contribute to ecosystem services including habitat preservation, biodiversity enhancement, coastal resilience, and support for ecological connectivity. These services not only strengthen environmental performance but also contribute to long-term operational sustainability and alignment with international biodiversity frameworks.

Results indicate continued expansion of protected areas and increasing recognition of ecosystem value within industrial decision-making processes. Through systematic

biodiversity monitoring, restoration initiatives, and conservation planning, the program demonstrates how environmental commitments can be translated into measurable outcomes and incorporated into business strategy.

Additionally, the presentation discusses opportunities to enhance biodiversity performance through ecosystem valuation approaches, environmental monitoring technologies, and data-driven decision support. The proposed model illustrates how energy companies can move beyond compliance toward regenerative environmental practices that support both ecosystem health and operational resilience.

This presentation contributes to the broader discussion on the future of sustainable energy by demonstrating that biodiversity conservation and ecosystem service integration are not peripheral environmental activities, but strategic enablers of responsible energy development and long-term value creation.

Biography

Maareb Alsubhi is an Environmental Scientist at Saudi Aramco specializing in biodiversity conservation, environmental sustainability, and ecosystem management. Alsubhi has contributed to biodiversity protection initiatives, environmental compliance programs, and sustainability performance across industrial and natural environments, with experience including biodiversity monitoring, ecosystem restoration, environmental management systems, and integrating sustainability into operational decision-making. Alsubhi is actively engaged in advancing nature-based solutions and applying innovative approaches to strengthen environmental stewardship and support long-term sustainable development objectives.

Matteo Campanelli
Automa S.r.l, Italy

A solution for the quantification and active reduction of methane emissions from gas networks

Methane emissions from natural gas distribution networks represent a significant environmental and regulatory challenge due to methane's high global warming potential and the increasing stringency of European and international regulations. Traditional Leak Detection and Repair (LDAR) programs, based on periodic inspections and manual surveys, have long been the standard approach for managing fugitive emissions. However, these methodologies are inherently limited by their discontinuous nature and may fail to capture transient or intermittent leaks that occur between inspection cycles.

Gas distribution networks operate under variable demand and pressure conditions, which influence both the occurrence and magnitude of emission events. As a result, emission behavior can change dynamically over time, requiring more consistent monitoring and operational responsiveness than periodic surveys can provide.

To address these limitations, AUTOMA has developed an integrated framework for methane emission management that combines continuous monitoring, structured quantification, and adaptive mitigation within a unified operational architecture. The proposed approach enables asset-level methane detection and the generation of standardized emission indicators suitable for regulatory reporting and long-term performance evaluation. By relying on structured calculation methodologies rather than generic emission factors, the system enhances reproducibility and data transparency.

Mitigation is achieved through demand-driven pressure regulation, which dynamically aligns network operating pressure with actual consumption patterns. By reducing unnecessary overpressure during low-demand periods while maintaining service continuity and safety,

the system targets one of the primary operational drivers of fugitive emissions.

The integration of detection, quantification, and adaptive control establishes a closed operational loop in which measurement directly informs mitigation strategies. This shifts methane management from episodic inspection toward continuous operational governance, providing a scalable and regulation-ready pathway for improving environmental performance and compliance in gas distribution infrastructures.

Biography

Matteo Campanelli is Project Manager at AUTOMA S.r.l., with a background in Biomedical Engineering and previous experience in the Oil, Gas & Water sector. At AUTOMA, Campanelli has led the development of the MethanEye project, the solution for continuous monitoring and quantification of methane emissions in gas infrastructure. Campanelli is actively involved in promoting AUTOMA's technologies in the Italian and international markets, managing relationships with clients and partners and taking part in industry events and publications.

Muheddin Ibrahim Hamza
Petroleum Research Center, Tripoli, Libya

Ensuring consistency and quality assurance of PVT laboratory data for optimal reservoir management

Accurate analysis of the PVT data will enhance the effective management of reservoirs, determine the quantity and the quality of produced fluids and assure correct design of surface facilities. So, the PVT data from the laboratory must be checked for accuracy, consistency, and validity. High quality, accurate PVT data can reduce uncertainty in reservoir fluid properties, provide a sound foundation for reservoir engineering studies and improve investment efficiency. While acquiring sufficient volumes of representative reservoir fluid samples is the first step in obtaining reliable PVT data, understanding and identifying the quality of the PVT data is essential.

In this paper, preliminary and complementary consistency check of PVT laboratory methods was applied on PVT fluid data from an oil well located southeast Libya. The evaluation includes graphical method, recombination and material balance check for well stream composition test, Buckley, Hofman plot, Y- function of Constant Composition Expansion (CCE) test, compositional material balance of Differential Liberation (DL) test, overall mass balance for density, Bo and GOR of Differential Liberation (DL) test and density check for separator test. After implementing these procedures, results confirm that the sample is suitable as a representative for the entire reservoir.
What will audience learn from the presentation?

Reservoir fluid PVT properties are required as part of any field development stage such as accurate reserve estimation, reservoir modeling studies, material balance calculation, production engineering, surface facility design and optimization and reservoir management which are affected by applying valid PVT laboratory results.

PVT data and reports are essential for reservoir engineering, as they provide information on the fluid properties and behavior of oil and gas in the subsurface. It is essential to check the consistency of experimental information, comprehensively, before implementation of reported data in further studies.

Biography

Muheddin Hamza holds a B.Sc. in Petroleum Engineering from Tripoli University (1987) and a Master's from Libyan Academy (2015). Since 1988, he has worked at the Petroleum Research Center, specializing in PVT and EOR laboratories and fluid studies. With 37 years of oil field experience, his work covers reservoir fluid analysis and enhanced oil recovery, including experimental, analytical, and reporting roles. Mr. Hamza trained internationally in his field and PVT lab simulation software. He currently serves as a technical advisor and account manager, providing expertise, managing projects, and ensuring client satisfaction. He has co- authored three technical papers and attended various conferences and seminars locally and abroad

Prateek Upreti
University of Arkansas at Little Rock, United States

Circular economy: Financial analysis of the energy sector

This presentation examines the strategic importance of the circular economy in the energy industry, with a particular focus on its financial implications for the oil and gas sector. It provides a detailed financial analysis of how circular practices can create economic efficiencies across upstream, midstream, and downstream operations, and how these efficiencies can strengthen overall corporate financial performance.

The study explores circular energy systems that connect efficient energy mechanisms with existing fossil fuel infrastructure to improve economic performance indicators, resource efficiency metrics, and sustainability outcomes. It also investigates the relationship between circularity and key financial measures, including profitability, shareholder value, return on assets (ROA), return on equity (ROE), and EBITDA.

In addition, the presentation analyzes supply chain and operational procedures to demonstrate how incremental efficiencies throughout the system can generate substantial long-term financial impact. It includes a focused discussion on emerging technologies such as artificial intelligence, which can significantly improve operational efficiency and profit margins, while also increasing short-term capital expenditures and implementation costs. Influence of carbon taxes on circular project profitability and financial benefits of equipment remanufacturing and reuse are also explored.

The study further considers how adopting circular economy practices can improve access to sustainable finance and help mitigate short-term investment challenges. It evaluates the balance between upfront costs and long-term value creation, outlining potential financial solutions that can reduce uncertainty and support more informed investment decisions.

The presentation also positions the circular economy as a potential hedge against resource price volatility, operational risk, and financial risk. Specific attention is given to cost savings from recycling programs and financial models for resource recovery investments.

Overall, the purpose of the study is to demonstrate the financial implications of transitioning from linear to circular operations and to show how this transition can enhance long-term competitiveness, investor confidence, and financial resilience in the energy sector.

Biography

Prateek Upreti studied Biotechnology at G.B. Pant University in India, graduating with a Bachelor of Technology, and then pursued a Master of Business Administration at the University of Arkansas at Little Rock in the United States. Upreti then worked for GTL Americas as a financial analyst at an oil and gas company focused on producing liquid fuel from natural gas in the United States. Upreti has published various peer-reviewed papers and is currently employed at a multinational financial firm in the United States.

Rukiye Öztekin*, Delia Teresa Sponza
Dokuz Eylül University, Turkey

Hydrophobic cellulose nanocomposites for efficient removal of oil spills and organic solvents

Oil/chemical spill accidents and oily wastewater discharge from industry have been significant global environmental threats and have attracted a great deal of attention. Oil contaminants are commonly toxic, carcinogenic, teratogenic, and hazardous to human health and aquatic organisms. Therefore, the rapid adsorption of oil from water by an efficient adsorber has become a challenging issue. This paper report soil super adsorbent hydrophobic (Cellulose Maleate Derivatives (CMD)/Fe_3O_4@SiO_2) with cheap and accessible materials based on Cellulose Nanocrystals (CNC), whose hydrophobicity can be attributed to the cross-linker of Divinylbenzene (DVB), which is attached to it after the modification of cellulose by maleic anhydride. Additionally, to improve the recovery of the adsorbent from the environment, the substrate was magnetized using iron nanoparticles. Easy synthesis and ultrafast adsorption time (3 seconds), high adsorption capacity for oil and organic solvents (200–253 mg/g), and maintaining an adsorption efficiency of more than 80% in 8 consecutive cycles make it a stable, amazing, and efficient adsorbent. One of the major hurdles in deploying adsorbents is their dispersion and leakage into drinking water. This problem has been addressed by deploying a magnetized polymer that can be easily collected from water via an external magnet. As scientific progress depends on a healthy mind, which grows in a safe environment, preserving the environment and removing pollutants is the responsibility of every researcher. Finally, in this study, we attempted to prepare the simplest and least expensive adsorbent material (CMD/Fe_3O_4@SiO_2) in the shortest possible time with the highest efficiency to remove oil and oil slicks from water.

Biography

Post-Dr. Rukiye Öztekin is currently working as a researcher at Dokuz Eylül University,

Department of Environmental Engineering. Öztekin completed a master's education at Dokuz Eylül University, Department of Environmental Engineering, on Color removal from textile wastewater in sequencing batch reactor. Öztekin completed a doctorate education at Dokuz Eylül University, Department of Environmental Engineering, on Effect of sonication on the treatment of toxic and refractory industrial wastewaters. Öztekin completed a post-doctorate education at TÜBİTAK with a scholarship on The production of methane gas from carbon dioxide. Öztekin has many international publications.

Sowad Tebar[1*], Salah Alhengari[2*]

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Achieving zero routine flaring through membrane-based associated gas recovery and CO_2 reinjection: A life cycle assessment of the Bouri offshore oil field

Routine flaring of associated gas remains a major source of greenhouse gas emissions in the oil and gas industry. This study evaluates alternative process configurations for the separation and management of Carbon Dioxide (CO_2) from associated gas produced at the Bouri Offshore Oil Field, with the objective of identifying the most environmentally sustainable solution for CO_2 capture, utilization, and storage while contributing to routine flaring reduction.

A Life Cycle Assessment (LCA) methodology was employed as a decision-support framework to evaluate the environmental performance of several process alternatives for CO_2 removal from the associated gas stream. Four candidate process configurations were initially screened using the Best Practicable Environmental Option (BPEO) approach. The screening identified a membrane-based hydrocarbon recovery process integrated with CO_2 reinjection into the reservoir through a dedicated dry well as the most environmentally favorable configuration.

Based on this selected configuration, two CO_2 management scenarios were investigated: (i) CO_2 reinjection following gas liquefaction and (ii) CO_2 reinjection after gas compression. A detailed life cycle assessment was conducted for both scenarios, considering material and energy consumption together with the associated environmental emissions throughout the process life cycle.

The comparative assessment demonstrates that the liquefaction-based reinjection scenario achieves superior environmental performance owing to its lower overall greenhouse gas emissions and higher process efficiency. These findings demonstrate that integrating membrane-based hydrocarbon recovery with CO_2 capture and geological reinjection offers a viable pathway toward reducing routine flaring, lowering the carbon footprint of offshore oil production, and supporting sustainable development in the petroleum sector.

Keywords: Life Cycle Assessment (LCA); CO_2 Capture; Associated Gas; Membrane Separation; CO_2 Reinjection; Offshore Oil Fields; Routine Flaring Reduction; Environmental Sustainability.

Biography

Professor Salah Alhengari is associate professor at the Department of Chemical and Petroleum Engineering as the head of Chemical Engineering Division, Libyan Academy for Postgraduate Studies, Tripoli – Libya, since April 2019 up to now teaching M.Sc. courses in the area of Chemical, Environmental and Renewable engineering as well as supervising M.Sc. students for their thesis. Professor Alhengari was former Research Associate at the Libyan Petroleum Institute, Tripoli - Libya (Full Time - major of Chemical Engineering). Professor Salah Alhengari Has more than 25 years of experience in Oil and Gas Industry, 6 years in oil and gas production operations & maintenance (June 1985 – October 1990, Senior Oil and Gas Production Operations specialist with Veba Oil Operations Company, Ghani and Amal Oil Field - Libya) followed by 19 years with Libyan Petroleum institute, (LPI) as Research Associate carrying technical / research Studies for the benefit of Libyan oil and gas sector in the areas of water Desalination, industrial water / waste water treatment and improving economic of Oil refineries, petrochemical plants and oil and gas processes. In addition, Professor Alhengari has authored or co-authored over 30 refereed journal and conference publications in international journals and international conferences in the area of Desalination, Green Hydrogen, fuel cell and process intensification. Professor Salah Alhengari have a PhD in Chemical Engineering and Advanced Materials from the School of Chemical Engineering and Advanced Materials, Newcastle University - Newcastle upon Tyne, UK (June 2012). In addition, he had M.Sc. in Sustainable Chemical Engineering from the mentioned school (December 2004). In 1998 he received his B.Sc. In Chemical Engineering, Tripoli University, Faculty of Engineering. In 1984. Professor Alhengari Have received Industrial Petroleum Diploma (Dip.) majoring in Oil and Gas processing From Petroleum Training and Qualifying Institute, (PTQI), Tripoli – Libya. Prof. Salah Alhengari is a member of European Desalination Society (EDS), also a member of Society of chemical Industry, UK (SCI) and elected as Associate member of Institution of Chemical engineers, UK (AIChemE). Professor Salah Alhengari conducting many intensive training courses in the area of Oil / Gas Industry, Hydrogen and Green energy, water and environment and clean theology.

Saleh A. Alqahtani
Saudi Aramco – Dhahran, Saudi Arabia

Innovative flange localized leak testing using Reverse Integrity Specialized Gasket (RISG) technology: A safer and more efficient approach to flange integrity verification

This paper explores the innovative use of Reverse Integrity Specialized Gaskets (RISG) for flange leak testing, offering a more efficient and safer alternative to traditional methods. The conventional approach to leak testing, while effective for small systems, can be impractical and resource-intensive for large-scale piping and pipeline systems. RISG gaskets provide a localized testing solution that significantly reduces test medium usage, operational downtime, and safety risks. Environmental benefits are also realized through reduced emissions from lower test medium usage. This paper discusses the technology, its advantages, and a comparative analysis with traditional methods, highlighting the benefits of adopting RISG gasket technology for flange management.

Biography

Saleh Alqahtani is a Project Engineer at Saudi Aramco's Offshore Projects Department, specializing in offshore projects. With over a decade of experience in project management across Aramco and SABIC, Alqahtani has led major projects and handled localization initiatives. Alqahtani has contributed to multiple high-impact offshore projects and has played a key role in introducing innovative technologies that enhance safety and operational efficiency, with work focused on optimizing field execution, improving integrity practices, and implementing advanced testing methods in complex offshore environments.

Sharina Al Muhairi*, Richard Mohan, Mohamed A. Al Hashemi
ADNOC Upstream, Abu Dhabi, United Arab Emirates

Scaling AI-powered production optimization across ADNOC Upstream: Enterprise deployment, value realization, and operational transformation through AiPSO

The energy industry continues to seek innovative solutions that maximize production efficiency, reduce operational costs, and support sustainable field development. ADNOC Upstream has embarked on an ambitious digital transformation journey through the deployment of the Artificial Intelligence Production System Optimization (AiPSO) platform, an enterprise-wide AI solution designed to optimize hydrocarbon production while enhancing operational decision-making.

AiPSO integrates advanced machine learning models, production engineering expertise, and real-time operational data to identify production improvement opportunities, diagnose system constraints, and recommend optimal operating parameters. The platform enables engineers and operators to proactively manage production systems, improve asset performance, and accelerate value realization across diverse fields and operating companies.

This presentation highlights ADNOC Upstream's strategy for scaling AiPSO from pilot deployments to enterprise-wide adoption across multiple operating companies and assets. The deployment approach focused on establishing a standardized governance framework, ensuring data readiness, developing user engagement programs, and implementing robust value-tracking mechanisms. Particular emphasis is placed on the collaboration between technology, operations, production, and digital teams to drive sustainable adoption and business impact.

The presentation will discuss deployment lessons learned, key success factors, and methodologies used to measure value realization, including production gains, operational efficiency improvements, and enhanced decision-making capabilities. It will also showcase how AI-driven recommendations have supported field teams in identifying optimization opportunities that may not be readily visible through conventional approaches.

Results demonstrate that a structured enterprise deployment model, supported by strong governance, stakeholder engagement, and continuous value monitoring, can significantly accelerate AI adoption in upstream operations. The AiPSO journey provides a practical framework for organizations seeking to transition from isolated digital initiatives to scalable enterprise solutions that deliver measurable business outcomes.

The paper concludes with recommendations for future AI deployments in the energy sector and highlights ADNOC's vision for further expanding AI-enabled optimization capabilities across its upstream portfolio.

Biography

Sharina Al Muhairi is the Manager of Technology Deployment at ADNOC Upstream and has more than 14 years of experience in reservoir management, field development, and energy technology innovation. Al Muhairi leads the deployment and scale-up of advanced digital and AI technologies across ADNOC's upstream assets, focusing on value realization, operational excellence, and enterprise adoption. Al Muhairi has played a key role in advancing initiatives such as AiPSO, AR360, and other strategic digital transformation programs that support ADNOC's vision of becoming one of the world's most AI-enabled energy companies.

Yousef Alqaheem
Petroleum Research Center, Kuwait Institute for Scientific Research, Kuwait

Membrane system for hydrogen recovery in a hydrotreating unit

Hydrogen is the backbone of many processes in the refinery, such as hydrotreating. The Atmospheric Residue Desulfurization (ARDS) unit is one of the hydrotreating processes to remove sulfur compounds from the fuel. This step is essential because combusting high-sulfur fuel can produce sulfur dioxide, which contributes to acid rain. However, the ARDS unit requires excessive amounts of hydrogen, and its purge gas usually contains significant amounts of unreacted hydrogen. In this study, the stream will be recycled back to the ARDS unit rather than being wasted as boiler fuel. The membrane technology was selected for this purpose due to its lower capital investment and reduced energy input. The membrane works based on differences in solubility and diffusion among molecules. A commercial membrane made of polysulfone was integrated into one of the ARDS units at Kuwait refinery. The study was performed using the Honeywel® UniSIM® process simulator to estimate the quantity and quality of the recycled hydrogen. Unfortunately, the software does not have a membrane unit, so the module was built manually using a component splitter, adjust functions, and a spreadsheet. The system was solved by assuming the membrane area and guessing the permeate cut values. Results show that the single-stage membrane with an area of 2,050 m2can recover up to 92% of hydrogen with a product purity of 98 mol%. This recycled hydrogen reduced the requirement for fresh hydrogen by 24%. An economic assessment was also performed to compare the cost of recycling hydrogen via the membrane compared to producing fresh hydrogen by the Steam Methane Reforming (SMR) process. The estimated capital investment of the membrane system is $4.1m, with an operating fee of $620k to recycle 12,900 tons of hydrogen per year. It was predicted that the membrane unit would have a payback period of 4 to 6 months, which is very attractive to the refinery.

1. Introduction: Hydrogen is a key element for many processes in the refinery, such as hydrocracking and hydrotreating. In hydrocracking, hydrogen is used to convert large hydrocarbons into smaller ones in the presence of a catalyst, while in hydrotreating, hydrogen is used to remove sulfur compounds from fuels in the form of hydrogen sulfide. Furthermore, hydrogen is a feedstock for many industries like ammonia synthesis and methanol production. Hydrogen is produced in the refinery by Steam-Methane Reforming (SMR) where methane reacts with water to produce hydrogen and carbon monoxide. The product is called syngas, and hydrogen yield can be further increased by the reaction of carbon monoxide with water to form hydrogen and carbon dioxide.

Atmospheric Residue Desulfurization (ARDS) is a hydrotreatment process to produce fuel with low sulfur content. The presence of sulfur in the fuel can cause the formation of sulfur dioxide after combustion. This compound affects humans and is known to cause acid rain.

In the ARDS process, Atmospheric Residue (AR) from the crude distillation unit is sent as the feed stream. High-pressure hydrogen is also fed to the reactor, in which hundreds of reactions will take place. The main reactions are hydrodesulfurization, hydrodemetalation, hydro-denitrogenation, and hydrocracking. In hydrodesulfurization, sulfur is removed from sulfur compounds such as sulfides, mercaptans, and thiophenes. The process uses a catalyst, usually cobalt-molybdenum at a temperature of 370^{0}C. The reaction product is hydrogen sulfide, as given in the following equation:

$$R\text{-}S + 3/2\ H_2 \rightarrow R\text{-}H + H_2S \quad (1)$$

In addition to hydrotreatment, the catalyst can cause some hydrocracking of large molecules, leading to the formation of valuable products such as naphtha:

$$R\text{-}CH_2\text{-}R' + 2H_2 \rightarrow R\text{-}CH_3 + R'\text{-}CH_3 \quad (2)$$

In the ARDS process, hydrogen is fed with Atmospheric Residue (AR) normally with a 300 m^3/m^3(STP) gas to oil ratio. The stream is heated to 370^{0}C before entering the reactor. The product is then sent to a High-Pressure Separator (HPS) in which most of the gases will be separated. The gas enters a scrubber where hydrogen sulfide is removed by an amine. After that, part of the hydrogen will be recycled back to the reactor which will merge with a fresh hydrogen feed. The other stream (purge gas) cannot be recycled as it will affect hydrogen purity in the feed stream. Accordingly, the stream will be removed and used as a fuel for heating purposes. ARDS process flowsheet is given in Figure 1.

Typically, hydrogen is produced in the refinery by SMR, which relies on methane, but the increasing prices of natural gas affect the process cost. Therefore, it could be feasible to purify and recycle the purge stream back to the ARDS unit instead of producing a fresh stream. There are mainly three technologies for hydrogen separation, such as cryogenic distillation,

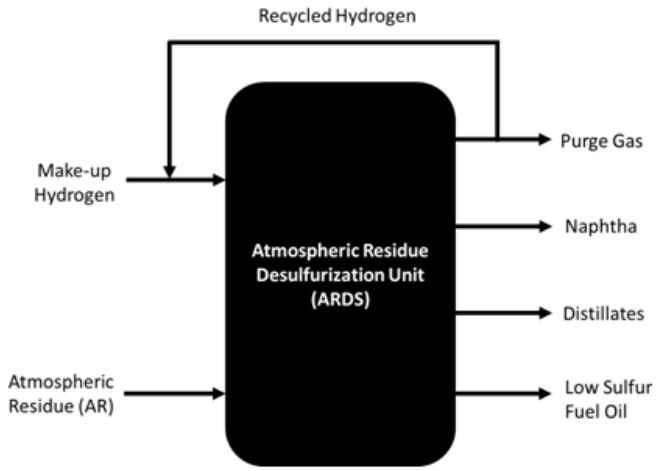

Figure 1. Process flowsheet of Atmospheric Residue Desulfurization Unit (ARDS).

Pressure Swing Adsorption (PSA), and membrane. The membrane has many advantages, such as lower capital investment, compact, easy integration, and a continuous operation life of five years. The membrane is made from a polymer in which the gases will dissolve and diffuse. The driving force is based on the pressure difference across the membrane. For hydrogen separation, polysulfone is widely used as the membrane material. The commercial membrane is reported to achieve hydrogen purity of 98 mol% with a recovery rate of more than 90%.

In this work, hydrogen was recovered from the purge gas of the ARDS process using a membrane unit. The membrane module was developed in Honeywell® UniSIM® manually using a component splitter and a spreadsheet. The membrane was evaluated for hydrogen recovery in one of the ARDS units at Kuwait refinery. The unit treats 50,000 barrels per day of atmospheric residue to produce Low Sulfur Oil (LSFO) with a sulfur content of 0.5 wt%. The membrane system was studied from a technical and economic perspective. The technical part was related to the quality and quantity of the produced hydrogen, while the economic part was based on the capital investment and annual operating cost.

2. Methodology: Honeywell® UniSIM® was utilized for the process simulation. The software includes a hydroprocessing bed that can represent the ARDS unit. Unfortunately, UniSIM® does not include a membrane module. Therefore, the system was developed and integrated into the software. The membrane module consisted of a component splitter, spreadsheet, and adjust functions. Mass balance was performed across the membrane using the following equation:

$$y_P n_P = x_F n_F - x_R n_R = QA(xP_F - yP_P) \quad (3)$$

where n is the number of moles (kmol/h), x is the mole fraction of component i. The subscripts F, R, and P refer to feed, retentate, and permeate, respectively. Q is the permeance in kmol/(m^{2}h kPa), A is the membrane area (m2), and the last term is the net driving pressure which can be simplified to:

$$(\overline{xP_F - yP_P}) \cong \left[\frac{x_F - x_R}{\ln\left(\frac{x_F}{x_R}\right)}\right] P_F - y_P P_P \qquad (4)$$

where P is the pressure (kPa). To solve the above equations, the stage cut (θ) was guessed using:

$$\theta_{Guess} = \frac{y_P n_P}{x_F n_F} \qquad (5)$$

Next, the following equations were solved simultaneously using adjust functions to calculate x_R and y_P:

$$y_P n_P = x_F n_F - x_R n_R \qquad (6)$$

$$\sum_{i=1}^{n} x_F = 1 \; ; \sum_{i=1}^{n} x_R = 1 \; ; \sum_{i=1}^{n} y_P = 1 \qquad (7)$$

Thereafter, the stage cut was recalculated and compared with the guessed values:

$$\theta_{Calc} = \frac{QA(\overline{xP_F - yP_P})}{x_F n_F} \qquad (8)$$

For the case to be converged, the difference between the guessed and the calculated value is no more than 0.01%.

Properties of Atmospheric Residue (AR) are given in Table 1. The operating conditions of the ARDS process are shown in Table 2. Atmospheric residue containing 4.5 wt% sulfur enters the reactor at 370^{0}C with a hydrogen-to-oil ratio of 300 m3/m (STP). The product is then sent to a High-Pressure Separator (HPS) where hydrogen will be separated and thereafter recycled and purified by a membrane system. The liquid product from HPS is sent to a Low-Pressure Separator (LPS) to further separate the gas and liquid. The liquid product enters a distillation column where fuel oil will be formed with a sulfur content of 0.5 wt%.

A commercial membrane made from polysulfone was considered in this study because the unit has been installed in many refineries worldwide. The operating conditions of the membrane system are given in Table 3. The simulation was performed in three steps. First, the ARDS process was built in UniSim® and make-up hydrogen was calculated for the production of Low-Sulfur Atmospheric Residue (LSAR) containing 0.5 wt% sulfur. Second, the membrane system was used to treat the ARDS purge gas to produce hydrogen with 98 mol% purity. This was achieved by changing the membrane area. Finally, the membrane system was integrated within the ARDS process and the reduction in make-up hydrogen was determined.

Table 1. Properties of Atmospheric Residue (AR) of Kuwait Export Crude (KEC).

Property	Condition
API Gravity	12.02
Sulfur Content	4.5 wt%
Nitrogen Content	3553 ppmw
Vanadium Content	90 ppmw
Distillation ASTM D1160	Temperature (˚C)
Initial Boiling Point (IBO)	381
10 vol%	400
30 vol%	470
50 vol%	550

Table 2. Proposed operating conditions for ARDS unit at Kuwait refinery.

Property	Condition
KEC-AR Feed Flow	50,000 barrels per day
Feed Temperature	370˚C
Feed Pressure	100 bar
H_2Oil-1 Ratio	300 m^3/m (STP)
Catalyst Loading	1,500,000 kg
Reactor Diameter	3 m
Product LSAR sulfur content	0.5 wt%

Table 3. Properties of Atmospheric Residue (AR) of Kuwait Export Crude (KEC).

Property	Condition
Feed Temperature	60˚C
Feed Pressure	91 bar
Retentate Pressure	89 bar
Retentate Temperature	58˚C
Permeate Pressure	22 bar
Permeance Data (Polysulfone Membrane)	Gas Permeation Unit (GPU)
Hydrogen (H_2)	100
Methane (CH_4)	4
Ethane (C_2H_6)	2
Propane (C_3H_8)	1

1 GPU = $3.3x10^{-10}$kmol/(m^2 s kPa)

3. Results and Discussion: The solved simulation case for using the membrane system for recovering hydrogen is given in Figure 2. Results show that before the introduction of the membrane system, make-up hydrogen flowrate was 3350 kmol/h. The membrane reduced the flow to 2544 kmol/h which gives a hydrogen saving of 24%. The membrane was capable of producing hydrogen with a purity of 98 mol% and a recovery rate of 92%.Before the ARDS purge gas entered the membrane, the stream was cooled down from 491^{0}C to 60^{0}C to avoid membrane degradation. Because the membrane operates on a pressure difference, the permeate pressure (produced hydrogen) decreased from 91 to 22 bar. Therefore, the permeate was sent to a compressor to increase the pressure back to 91 bar. After that, the permeate was merged with the make-up hydrogen.

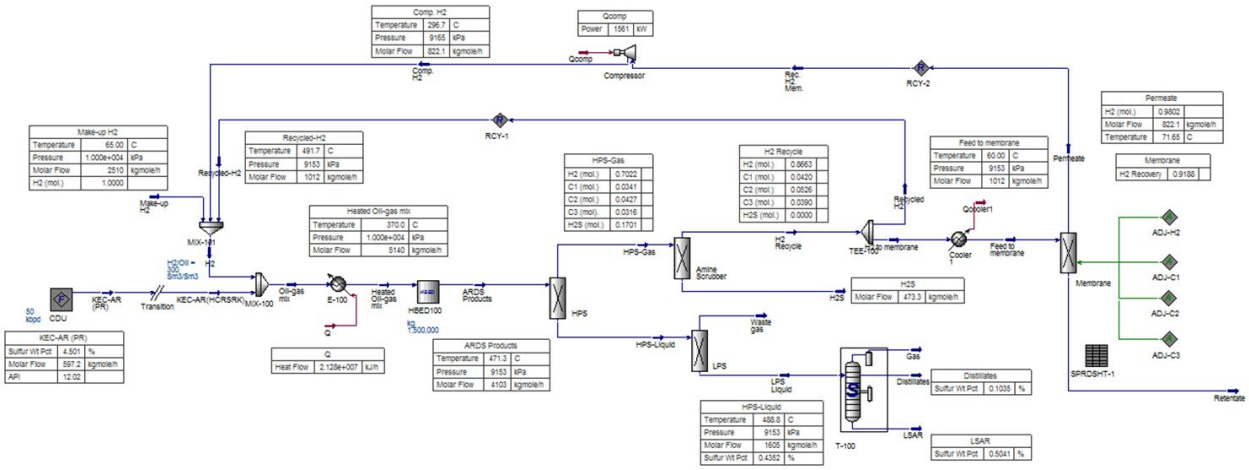

Figure 2. Solved simulation case of ARDS unit with hydrogen recovery by membranes using Honeywell® UniSIM®.

To do an economic assessment, the cost of the membrane skid, compressor, and cooler should be considered. The capital expenditure (CAPEX) was the sum of the equipment listed above. The required membrane area was calculated by the simulation, and it was 2,050 m^2 of polysulfone. Today, the membrane skid costs$100 per m^2. This gave a price of $205k for the membrane skid. The compressor price is generally $1,760 per kW and the simulation determined that 1,561 kW was needed for the compressor. This gave a compressor cost of $2.8m. A water cooling tower was selected due to its extended lifetime and lower operating cost. The tower consisted basically of a tank to store the liquid, fans to cool down the heated water, and pumps to transport the liquid. The capital cost of the tower is normally 200 $ per ton of cooling. The simulation found that 1,276 tons of cooling would be required to cool down the feed gas from 491^{0}C to 60^{0}C. Accordingly, the capital cost of the cooling tower was $255k. A heat exchanger was also needed for heat transfer between the cooling water and the hot gas. Based on the simulation results, the heat-exchanger area was 228 m^2, and assuming a fixed tube heat exchanger, the estimated cost was $235k. This gave CAPEX of $4.1m including a contingency fee of 18% to cover other costs such as auxiliary equipment and piping.

The annual operating cost depends on the maintenance fee and utility bills. The maintenance cost was assumed to be 5% of CAPEX, which gave 205k $. The membrane was assumed to work for 8000h per year, and the electricity tariff in Kuwait is $0.032 per kWh. The Utility

billswere estimated from the use of electricity for the compressor, and for fans/pumpsat the cooling tower. The required power input for the compressor was 1,561 kW, which resulted in a bill of $400k annually. Energy for fans/pumps of the cooling tower was estimated based on 0.05 kWh per ton of cooling. Therefore, the electricity bill for the cooling tower was around $16k per year. Adding all the fees up will gave an annual Operating Expenditure (OPEX) of $620k.

As mentioned before, using a membrane system reduces the makeup hydrogen by recycling 806 kmol/h of hydrogen, which is equivalent to 12,900 tons per year. Currently, the levelized hydrogen production cost is 1.16$ per kg for the SMR process. The following equation was used to estimate the Levelized Cost (LC) of hydrogen using the membrane process:

$$\text{Levelized Cost } (\$/\text{Kg.H}_2) = \frac{\frac{CAPEX}{Lifetime} + OPEX_{annual}}{M_{annual}} \quad (9)$$

where the plant lifetimeis 20 years and M is the annual mass of produced hydrogen (kg). The above equation gave LC of $0.063/kg.$H_2$, which is substantially cheaper than SMR. By subtracting the LC of SMR from the LC of the membrane, the annual net savings can be calculated. The estimated profits are$14.2m. Because membrane CAPEX was $4.1m, the payback duration is about 4 months. It should be noted that the economic assessment does not include the installation fee, salaries, insurance, etc., which may increase the payback duration to 6 months, as claimed by many manufacturers. Still, the payback duration is very attractive for the refinery. Detailed calculations of the economic assessment performed in this study are given in Table 5.

4. Conclusions: ARDS is a hydrotreatment process that excessively uses hydrogen to remove sulfur from atmospheric residue in the form of hydrogen sulfide. Conventionally, hydrogen is produced by SMR process but the increasing prices of natural gas necessitate hydrogen recovery. ARDS purge gas is known to have a significant amount of hydrogen, which is worth

Table 5. Economic assessment of hydrogen recovery in the ARDS unit by a membrane.
(1) Installation cost, labor salaries, and other fees are not covered. (2) Annual operation of 8000h.

(3) 6 months duration is expected if (1) fees were added.

Parameter	Value
CAPEX(1)	
Membrane Skid Base Cost	$100 per m^2
Membrane Area	2,050 m^2
Membrane Cost (M)	$205,000
Compressor Base Cost	$1,760 per kW
Compressor Power	1,561 kW
Compressor Cost (C)	$2,760,000
Cooling Tower Base Cost	$200 per ton of cooling
Heat Removal Rate	1,276 tons of cooling
Cooling Tower Cost (W)	$255,000
Cooler Heat Exchanger (X)	$235,000
Contingency Fee	18%
CAPEX = (M+C+W+HX) × 1.18	$4,100,000
OPEX(2)	
Maintenance Cost (MT)	5% CAPEX
Electricity Tariff (TF)	$0.032 per kWh
Compressor Bill (CB)	$400,000 per year
Cooling Tower Bill (CWB)	$16,000 per year
OPEX [MT+TF×(CB+CWB)]	$620,000 per year
Savings	
Levelized Cost of Hydrogen Production (SMR)	$1.160 per kg
Levelized Cost of Hydrogen (Membrane)	$0.063 per kg
Mass of Recycled Hydrogen	12,900 tons per year
Net Savings	14,134,000 $ per year
Membrane Payback Duration(3)	4 months

purification and recycling. There are many technologies for hydrogen purification, but membranes stand out for their lower CAPEX and OPEX due to their low energy requirements. In this study, one of the ARDS units at the Kuwait refinery was simulated in UniSIM® to evaluate the membrane performance from a technical and economic point of view. Results show that the membrane recovered 92% of hydrogen with a purity of 98 mol%. This recycled stream reduced the make-up hydrogen by 24%, which gives annual savings of $14.1m. The expected payback duration is four to six months, which is very attractive for the refinery.

Acknowledgement: This study was partially funded by the Kuwait Foundation for the Advancement of Sciences (KFAS) under project code PF093C.

Nomenclature:

θ	Stage cut
A	Membrane area (m^2)
n	Molar flowrate (kmol/h)
P	Pressure (kPa)
Q	Permeance ($kmol/m^2$ s kPa)
x	Mole fraction
y	Mole fraction in the product

Subscripts:

F	Feed
R	Retentate
P	Permeate

Keywords: ARDS, Hydrotreatment, Refinery, Gas-Separation Membrane, UniSIM®.

Biography

Dr. Yousef Alqaheem is a research scientist at the Petroleum Research Center of Kuwait Institute for Scientific Research. He received his PhD degree in 2015 from Newcastle University (United Kingdom). Alqaheem prepared and evaluated polymeric membranes for hydrogen separation, oxygen enrichment, and carbon dioxide capture. He also developed membrane units in process simulators such as UniSIM® and CAPE-OPEN. Currently, he has a project with the refinery to assess the membranes for propane/propylene separation from technical and economic points of view. Alqaheem published 23 papers in refereed journals and presented 5 conference papers.

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Evaluation of effective sealing length of cement sheath in gas storage well

The alternating internal pressure caused by the periodic injection and production significantly negatively impacts the sealing performance of cement sheaths in gas storage wells. Based on typical working conditions in the gas storage wells, a method and test device for evaluating the cement sheath's integrity and sealing performance are proposed to clarify the influence mechanism of cement sheath sealing performance under complex underground cementing conditions. Based on the test device, the sealing performance of the cement sheath under five curing temperatures, three pouring types, six bonding lengths, two alternating loads, and five cycles is evaluated. Cement sheath's integrity and sealing performance are characterized by interface micro gap, body crack, leakage position, leakage flow rate, gas breakthrough pressure, and residual sealing pressure. The sealing ability relationship between the cement's successive high-quality section and the cumulative high-quality section is clarified, the evolution characteristics of sealing performance of cement sheath with different bonding lengths before and after alternating loads, and the intrinsic damage mechanism of cement sheath under alternating loads are revealed. Based on experimental data, a method for evaluating the effective sealing length of the cement sheath is developed. An effective sealing length of cement sheath prediction model for cement sheath is established using the global optimization algorithm, by which the minimum length of successive high-quality sections and cumulative high-quality sections under different sealing years is calculated in a gas storage well. The results show that the evaluation method for the effective sealing length of cement sheath based on experimental data can more scientifically determine the minimum effective sealing length under different working conditions.

Biography

Yuanhua Lin, professor and doctoral supervisor, is the deputy director of the CNPC Key Laboratory of Petroleum Pipe Engineering, a researcher of the State Key Laboratory of Oil and Gas Reservoir Geology and Development Engineering, and the team leader of young scientific and technological innovation research in Sichuan Province. Lin mainly engages in research on oil and gas well construction engineering, oil well tubing mechanics and corrosion prevention, wellbore integrity management, and other related fields. Lin has published more than 120 research articles in SCI journals and obtained more than 60 national patents.

Zahrah Al Marhoon
King Abdullah University of Science and Technology,
Saudi Arabia

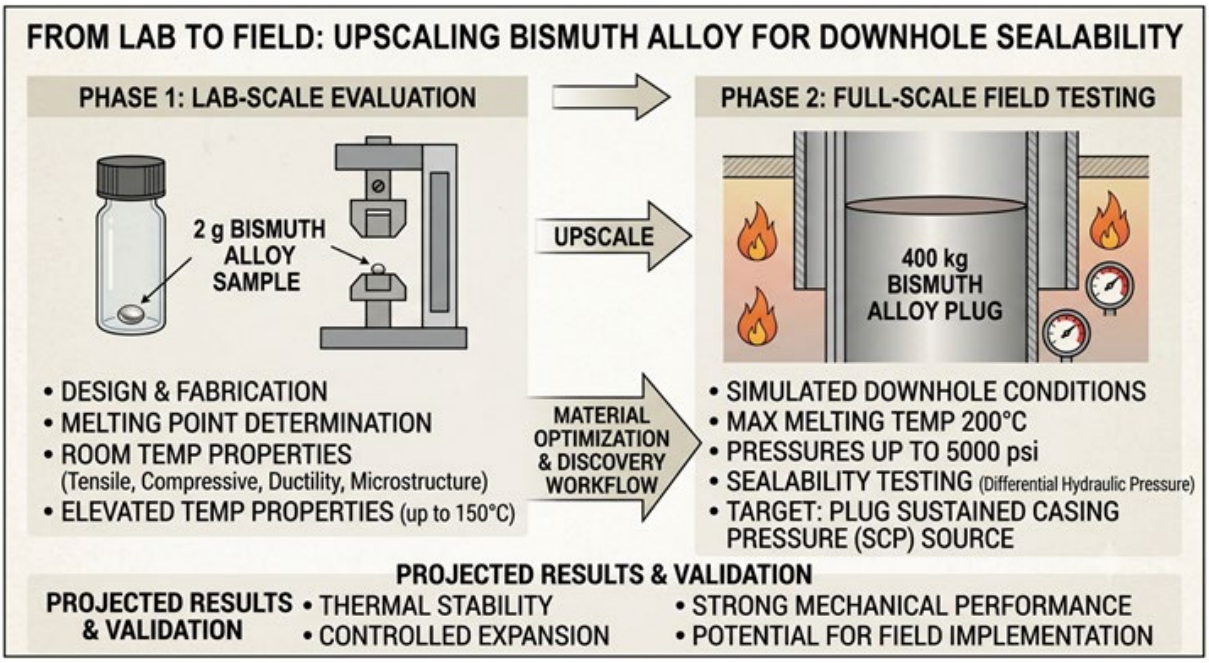
From lab to field: Designing high temperature metallic seal solutions for sustained casing pressure remediation

Objective: Sustained Casing Pressure (SCP) is a significant integrity challenge in oil and gas wells. A portion of these wells are in high-temperature environments. The industry continues to seek solutions that enhance long-term sealing performance under high pressure and high temperature downhole conditions. This study brings together materials science and field application to develop a high-temperature metallic sealing material engineered for casing pressure remediation.

Methodology: The development of the downhole metallic alloy involved two distinct phases. The first phase consisted of a lab-scale evaluation of the alloy's performance under simulated downhole conditions. The sealing alloy was designed and fabricated in the laboratory, with its melting point determined and key properties-such as tensile strength, compressive strength, ductility, microstructure, crystal structure, and thermal expansion-characterized at room temperature. These mechanical properties were further evaluated at elevated temperatures, reaching up to 150°C.

The second phase involved testing a full-scale setup that closely mimics actual downhole conditions, including realistic casing weights and grades, maximum melting temperatures of 200°C, and pressures up to 5000 psi. The sealability of the alloy was assessed using differential hydraulic pressure tests across the solidified alloy, aiming to plug the SCP source. The results of these tests established the foundation for direct field application, ensuring the alloy plug performs reliably in high-temperature gas environments while maintaining both structural integrity and sealing efficiency.

Results: By combining fundamental materials science with specific oil and gas applications, we established a robust workflow for material discovery and optimization. Transitioning from detailed material performance testing to upscaled testing under extreme downhole conditions enabled the progression from a 2-gram laboratory test to a 400-kilogram field-scale test. This comprehensive dataset guided the engineering of a next-generation sealing material optimized for high-temperature SCP remediation. Early results indicate acceptable thermal stability, controlled expansion properties, and strong mechanical performance, validating the material's potential for field implementation.



Biography

Zahrah Al Marhoon is a Senior Petroleum Engineer at the Upstream Advanced Research Center and a PhD candidate at King Abdullah University of Science and Technology (KAUST). She holds a degree in Petroleum Engineering from Texas A&M University and has over 15 years of experience in drilling research. For the past six years, Zahrah has focused on bismuth alloy technology as a remediation solution for sustained casing pressure in casing-casing annuli. Her work covers alloy development, thermal deployment system design, and full-scale testing. She has authored and co-authored over 20 papers and patents spanning well integrity and bismuth alloy technology.

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Abdurazag S. G. Ibrahim*, Mohamed A. A. Zbidat, Mahmoud K. S. Ben Mahmoud*, Abdulrauf M. A. Aldarhoubi*
Waha Oil Company, Libya

Improving water saturation estimation in carbonates through integrated formation factor porosity and capillary pressure analysis

Understanding the formation factor porosity relationship is critical for accurate water saturation estimation from well logs, particularly in carbonate reservoirs characterized by complex lithologies and heterogeneity. In this study, formation factor porosity relationship and capillary pressure functions were evaluated for the Defa Field in Libya to improve the reliability of key petrophysical parameters such as the cementation factor and saturation exponent, which are often affected by formation complexity and drilling induced effects.

This study utilized log data from three wells located in the Defa Field, each having different gross water zone thicknesses. Formation resistivity and porosity were interpreted from well logs, and cross plots were generated to derive the formation factor porosity relationships. The Archie parameters a and m were determined for each well individually. Additionally, capillary pressure data were evaluated using the Leverett J function method, allowing vertical water saturation profiles to be constructed based on average values for each core. Zonation analysis was also performed to distinguish porosity and permeability variations within each reservoir interval.

Results indicate minor variation in the Archie parameters across the three wells. The tortuosity factor a ranged from 1.1 to 1.4, with an average of 1.26, while the cementation factor m ranged from 2.39 to 2.6, averaging 2.49. The saturation exponent n variedbetween 1.7 and 2.4, with an average of 2.05. Cross plots between formation factor and porosity confirmed a good correlation across the wells. The Leverett J function analysis revealed smooth saturation profiles and consistent capillary pressure gradients, reinforcing the reliability of the log derived formation properties. Notably, the permeability and porosity trends were consistent with depositional facies and structural variations across the Defa Field. This

study presents a comprehensive integration of formation factor–porosity relationships and Leverett J function analysis for a carbonate reservoir. The combined use of zonation, Archie parameters, and capillary pressure data enhances confidence in log derived petrophysical properties, leading to improved water saturation modeling and more reliablereservoir performance predictions.

Biography

Abdurazag S G Ibrahim is a Reservoir Engineer at Waha Oil Company in Libya, where he has been working since 2015. He holds both a bachelor's and a master's degree in petroleum engineering from the University of Tripoli. His professional experience focuses on reservoir characterization, formation evaluation, and petrophysical analysis. He has been involved in field studies aimed at improving hydrocarbon recovery and enhancing the accuracy of reservoir property estimation through integrated log and core data analysis.

Abdulrauf Muhyeldin Abdulsalam Aldarhoubi holds a Bachelor's degree in Petroleum Engineering from the University of Tripoli (2012) and has over 10 years of experience in the oil and gas industry. Since 2015, he has been working as a Production Engineer at Al-Waha Oil Company, where his responsibilities include production optimization, well performance analysis, production surveillance, and troubleshooting operational challenges. He also holds a PET English certificate and has completed several technical training courses in petroleum engineering and oil and gas operations, further strengthening his technical and professional expertise.

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The tectonostratigraphic evolution of the Atshan-Gargaf Arch, and its influence upon flanking petroleum systems, Western Libya

The Gargaf-Atshan Arch, located in Western Libya, is a significant structural feature that separates the Ghadamis and Murzuq Basins. A Virtual Field Trip Guide is being developed to highlight key outcrop sections along this Arch and serve as a teaching tool, demonstrating the dynamic relationship between its tectonic history and entrapment of oil and gas in fields nearby.

The arch has undergone multiple exhumation events, which culminated in recent uplift and erosion, revealing a range of geological formations from the Lower Palaeozoic to Miocene epochs. Detailed tectono-stratigraphic studies based on well correlations and outcrop sections have identified the lateral extent of key unconformities and quantified the amount of erosional unroofing. These exhumation events have had a profound impact on petroleum systems around the arch, influencing the distribution of reservoirs, source maturation, expulsion, and charge. The petroleum reservoirs in the region, primarily located in Ordovician (Hawaz and Memouniat Formations) and Devonian (Tadrart Formation and F3 Unit) sandstones, are charged by the organic-rich radioactive shales of the Lower Silurian Rhuddanian age, known as the Tanezzuft 'hot' Shale. Maximum burial, peak expulsion and charge appears to have occurred immediately prior to mid-Cretaceous unroofing in most of the nearby fields with evidence locally of freshwater flushing during later Cenozoic exhumation of the Arch

Keywords: Gargaf-Atshan Arch, Exhumation Events, Virtual Field Trip Guide.

Biography

Dr. Abdussalam Dardour is Senior Petroleum Geoscience Advisor at the Petroleum Research Centre, Tripoli, Libya, with over 35 years' experience at the Petroleum Research Centre in leadership across basin evaluation, exploration strategy, and technical advisory roles, having held the positions of Geologist/Department Head, Project Manager (Libyan Basin Studies), Director and Senior Technical Advisor. Dardour received a Ph.D. from Kingston University, London, UK, in 2004 (thesis title: Tectono-Stratigraphic Evolution of the Palaeozoic Rocks and the Petroleum Systems of the Ghadamis Basin, Libya) and a BSc from University of Al-Fateh, Tripoli, Libya, in 1987. As Visiting Lecturer, Faculty of Engineering, Tripoli University, Dardour designed and taught a Basin Analysis course for postgraduate and undergraduate students. Dardour has published over 20 papers, articles and scientific research works in local and international conferences and scientific journals, and has transferred many international technologies in the field of digitizing geological, geophysical and engineering information by establishing, supervising, and localizing them at the Petroleum Research Centre, contributing to raising the scientific and service capabilities of the Centre and to the implementation of many important projects and studies.

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Aisha Kamel Mohamed Shalghum*
Libyan Petroleum Research Center, Libya

Integrated reservoir characterisation and production optimisation of the Bedum Gas Field

This project presents an integrated study of the Bedum Gas Field located in the northeastern Netherlands, aiming to evaluate past performance and identify opportunities for enhanced gas recovery. The field produces from the Permian Rotliegend Sandstone, deposited in a desert environment and trapped structurally by normal faulting, with effective sealing provided by Zechstein salt. Petrophysical evaluation of five wells indicates good to moderate porosity, adequate permeability for gas production, and generally low water saturation, confirming the presence of productive reservoir intervals. Interpretation of 3D seismic data delineated reservoir boundaries and identified approximately fourteen normal faults, forming the basis for a detailed structural model. A static reservoir model was constructed, incorporating structural frameworks and 3D gridding to distribute porosity, permeability, and water saturation. The gas–water contact was identified at approximately 3012 m, with the Gas Initially In Place estimated at about 25×10^9 m^3. The static model was subsequently converted into a dynamic simulation model, subjected to quality control and history matching, which demonstrated that gas expansion drive is the dominant production mechanism. Production analysis shows that nearly 95% of the reserves have been recovered, with peak production achieved in 2007 and continued production forecast until 2047. Development scenarios indicate that additional infill wells could further enhance recovery. Drilling engineering design, performed using Landmark software, emphasizes safe well placement while minimizing risks associated with fault uncertainty. Economic evaluation based on cash flow analysis confirms that new drilling options remain economically viable. Overall, the integrated geological, geophysical, reservoir, and economicmodeling approach provides reliable results and supports the potential for future optimization of the Bedum Gas Field.

Biography

Amel Abdurazag Alosta is an experienced Mining Engineer specializing in oil and gas exploration and geochemistry, with an MSc in Petroleum and Gas Engineering from the Polytechnic University of Madrid, Spain, and a BSc in Mining Engineering from the University of Tripoli, Libya. He has over 17 years of professional experience at the Libyan Petroleum Research Center, focusing on exploration studies, subsurface evaluation, and

applied research. His expertise includes geochemical and geological data interpretation, subsurface and reservoir analysis, integrated exploration and field evaluation, technical reporting, and contributing to scientific research projects.

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Modelling of effluent dispersion from offshore natural gas desulfurization facilities

A proposed line-up for sour gas desulphurization considered an amine unit, a thermal oxidizer, a water scrubber column and an aeration tank. The water scrubber technology, as such, cannot provide an environmental solution unless the emissions of vent gas and effluent streams and how they disperse in the atmosphere and sea are properly studied. Dispersion modelling is an efficient way to predict the contaminants' transport along with the concentration change occurring as they are leaving the source. Based on a straightforward formula that characterizes the three-dimensional concentration field produced by a point source under stationary meteorological emission conditions, the Gaussian Plume model is the most widely used. However, Computational Fluid Dynamics (CFD) has the benefit of fully capturing the system's transient behaviour, even though it can be difficult for non-experts to understand and time-consuming when modelling realistic scenarios. Although the Gaussian Plume model is much easier to use and can generate results in less than a minute, it is unable to represent the flow's temporal evolution and assumes steady-state conditions. Gaussian's Plume's simplicity has allowed it to be incorporated into industry-standard software packages that are used for monitoring and regulatory purposes. The use of such models is vital since the strict environmental regulations imposed on pollutants' emission should be met and therefore a realistic prediction of dispersion can benefit the design stage of the unit.

This study focuses on the effluent dispersion into the ocean coming from the water scrubber column, which was previously optimized using Aspen Plus software.

COMSOL Multiphysics software was used to develop a comprehensive numerical model of effluent dispersion generated by the processing unit upon discharge to the marine environment. The evaluation of hydrodynamic transport, dilution behaviour, concentration

distribution and pH evolution for effluent dispersion has been rendered by the numerical framework.

The main aim of the CFD analysis was to confirm whether the regulatory pH limit of 6.5 is satisfied at a 4 meters radius from the discharge point.

In recognition of the restricted availability of a completely parametrized and validated MATLAB Gaussian plume model, a CFD dispersion model was used to modify and fully parametrize a Gaussian Plume formulation for the effluent dispersion modelling.

The MATLAB-based Gaussian plume model for the marine environment has demonstrated the ability to reliably reproduce the CFD simulation results within acceptable uncertainty bounds through a methodical validation and verification approach. These models can now be confidently applied for further analyses for subsequent pH compliance assessments, thereby eliminating the need for parallel CFD simulations which are much more time-consuming.

Biography

Nicolas Droushiotis is a Senior Project Engineer at the National Cyprus Hydrocarbons Company (CHC), supporting offshore gas monetization in Cyprus, and also chairs the SUT Eastern Mediterranean Branch. Droushiotis holds an MEng in Chemical Engineering, an MSc in Biotechnology, and a PhD in Electrochemical Engineering from Imperial College London. Droushiotis has authored numerous publications in energy technologies, with experience spanning R&D, process engineering, petroleum technology, and project management across academia and industry projects.

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[2]PetroChina Southwest Oil &Gasfield Company, China

An evaluation method for effective perforation cluster opening efficiency using fracturing and production data

In multi-cluster hydraulic fracturing of shale oil horizontal wells, the number of effectively opened perforation clusters may differ substantially from the designed cluster number, directly affecting fracture stimulation efficiency and well productivity. Although diagnostic techniques such as fiber-optic monitoring and production logging can provide direct information on cluster activation, their relatively high cost limits widespread field application. To address this issue, this study develops a practical and field-scalable workflow for quantitatively evaluating the effective number of opened clusters and cluster opening efficiency using routinely acquired fracturing, flowback, and production data. Rate Transient Analysis and Pressure Transient Analysis (RTA/PTA) are first applied to production data to characterize the effective fracture–reservoir contact capacity after stimulation, which is subsequently converted into an equivalent effective fracture area by incorporating matrix permeability obtained from core measurements and dynamic analysis. Fracture half-length and effective fracture height are determined from hydraulic-fracturing simulations and calibrated using microseismic interpretations when available.

The effective number of opened clusters is then estimated by comparing the equivalent effective fracture area with the theoretical fracture area contributed by a single cluster, and the cluster opening efficiency is calculated relative to the designed cluster number. The workflow was applied to two shale oil horizontal wells with contrasting production performance. Well A contained 100 designed clusters, of which approximately 30 were evaluated as effectively opened, corresponding to an opening efficiency of 30%, whereas Well B contained 135 designed clusters and approximately 118 effectively opened clusters, yielding an opening efficiency of 87%. Consistent with these results, Well B exhibited significantly higher production per unit horizontal lateral length than

Well A. The agreement between the evaluated cluster opening efficiency and field production performance demonstrates that the proposed workflow can effectively quantify differences in actual hydraulic-fracturing stimulation effectiveness. By relying primarily on routine field data and using microseismic observations only as optional calibration information, the method provides a low-cost approach for post-fracturing diagnosis, identification of low-efficiency wells, refracturing candidate screening, and optimization of subsequent fracturing designs.

Biography

Qi Xu, born in 1998, is currently a Ph.D. candidate at China University of Petroleum (Beijing). His research interests focus on geology–engineering integration for unconventional oil and gas development.

Rasha Alosta *,
Aya Souf, and Muftah Abuzgaya
Zueitina Oil Company, Tripoli, Libya

Micro gas turbines as an alternative for diesel generators driving Electrical Submersible Pumps (ESP) on oil wells in Libya

This study examines the technical and economic feasibility of replacing diesel This study examines the technical and economic feasibility of replacing diesel generators with micro-gas turbines as the primary power source for Electrical Submersible Pumps(ESP) on a set of crude oil production well sata Zueitina Oil Company field in Libya. Diesel generators, while widely use dacross Libya's oil fields to power ESP systems in remote locations far from electricity grids, carry significant operational and economic disadvantages, including high fuel costs, substantial maintenance requirements, extensive spare parts inventories, and considerable environmental impact. With natural gas abundantly available on production sites and often partially flared, micro-gas turbines fuelled by natural gas present an alternative worthy of serious consideration.

The study adopts a techno-economic analysis approach using operational data obtained from Zueitina Oil Company. Fuel costs for both configurations were evaluate don a common energy basis, using diesel consumption and production cost data from the site's topping plant together with the manufacturer-specified performance characteristics of the micro-gas turbine, including its electrical conversion efficiency. Results are presented as aggregated statistics across the targeted wells to preserve the confidentiality of per-well operational data

The results in dicate a cost advantage in favour of micro-gas turbines. Operating ESP systems on natural gas – fuelled micro-turbines costs less per day than running the equivalent diesel generators. Beyondfuel savings, micro-gas turbines offer lower maintenance requirements, fewer spare parts, reduced emissions, and facilitate easier installation and removal. Adopted at scale across NOC-affiliated fields, this technology

could generate cost savings, support zero gas flaring targets, and meaningfully reduce the environmental footprint of oil production operations in Libya.

Biography

Rasha Alosta is a Junior Mechanical Engineer in the Projects and Technical Service Department at Zueitina Oil Company, Tripoli, Libya. I hold a Bachelor of Science in Mechanical and Industrial Engineering from the University of Tripoli and have completed international project management training through the NOC-OMV Exchange Program in Vienna, Austria and Bucharest, Romania. My engineering work focuses on oil and gas production systems, including technical evaluations, scope of work preparation, and data analysis for mechanical projects. I am committed to applying international best practices to advance Libya's upstream energy sector

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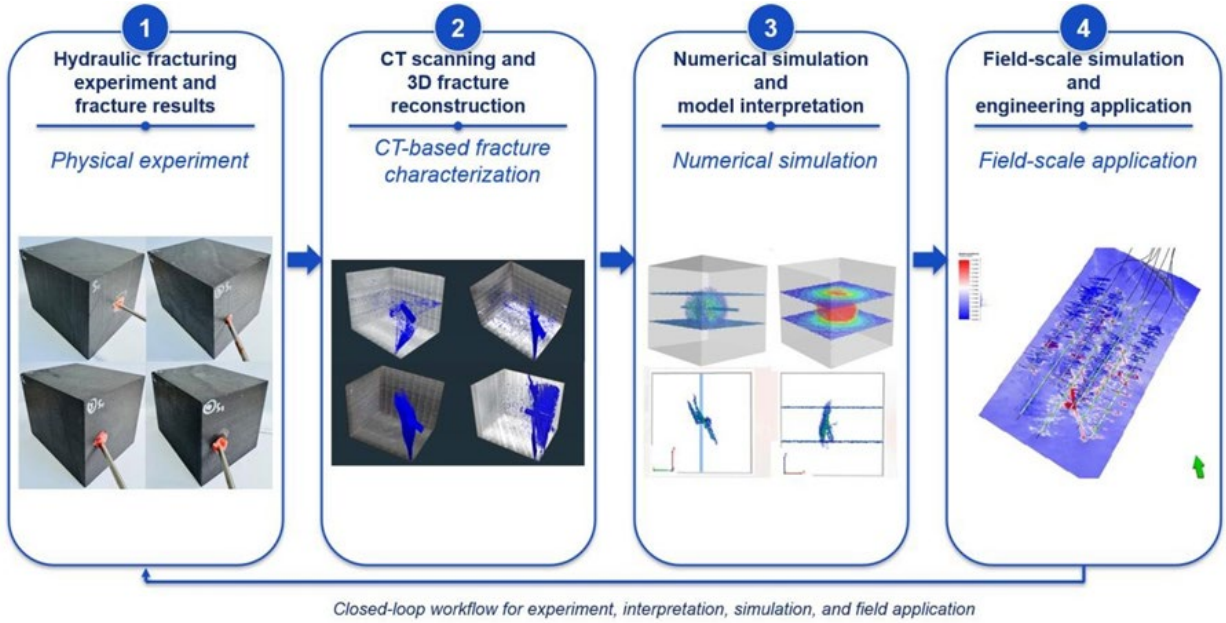
Experimental investigation and multiscale interpretation of shale hydraulic fracture propagation under non-principal-stress wellbore conditions



Closed-loop workflow for experiment, interpretation, simulation, and field application

Hydraulic fracture propagation in shale reservoirs is controlled by in-situ stress anisotropy, wellbore orientation, and pre-existing bedding fractures. In deep shale gas development, wellbores may deviate from the principals tress direction due to geological constraints, well-pattern deployment, or stimulation design requirements. This non-principal-stress wellbore placement changes the near-wellbore stress concentration and controls fracture initiation pressure, fracture trajectory, and fracture-network complexity. This study presents an experiment-centered workflow that combines true-triaxial hydraulic fracturing tests with CT-based fracture reconstruction, numerical interpretation, and field-scale upscaling.

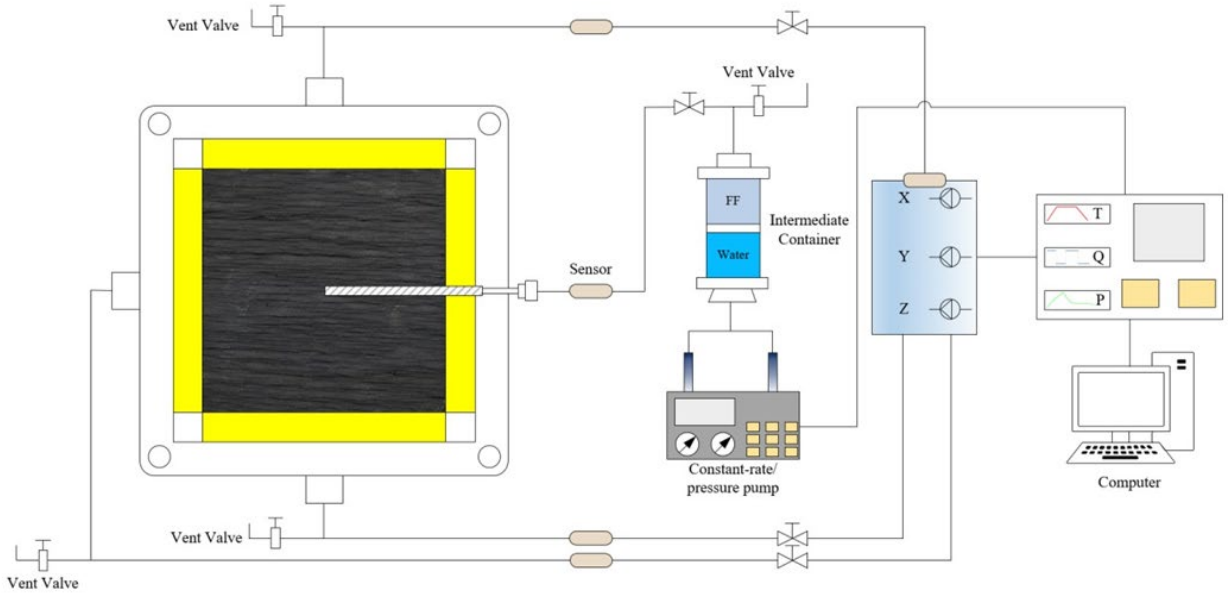
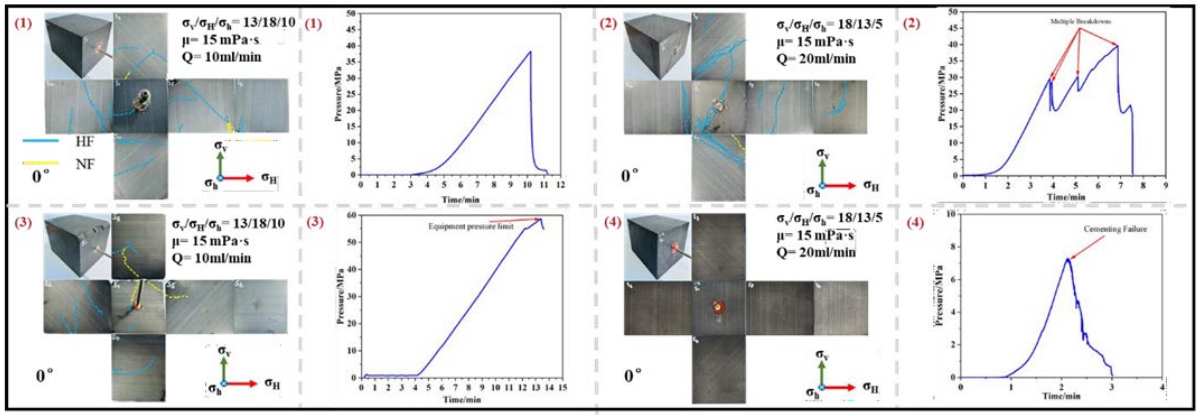


Figure 1. Schematic of the true-triaxial hydraulic fracturing experimental setup.

Cubic shale specimens with visible natural bedding fractures were drilled with small-diameter well boresto reduce borehole-size effects and to retain the mechanical control of bedding plane sand stress an isotropy on fracture growth. The well bores were arranged with different orientations, including 30° to the principal stress direction.During the experiments, the specimens were loaded under controlled three-dimension alstress conditions. Fracturing fluid was injected at a constant rate, and pressure-time curves were recorded to identify breakdown pressure, multiple breakdowns, and tests constrained by the equipment pressure capacity. After fracturing, surface observations and CT reconstruction were used to identify hydraulic fractures and natural fractures.

Experimental observations show that hydraulic fractures initiated near the wellbore and propagated toward the external surfaces of the shale specimens. Under non-principal-stress wellbore conditions, fracture traces showed as ymmetric propagation, indicating that in clined wellbo replacement produced un even near-wellbore stress concentration. Pressure responses differed among specimens: some tests exhibited a single rapid pressure drop after breakdown, whereas others showed multiple breakdowns, reflecting progressive fracture extension and repeated activation of weak planes.

Surface fracture mapping and CT-based reconstructions further indicate that hydraulic fractures frequently inter sected natural bedding fractures. At the einter sections, fracture deflection, branching, local bedding opening, and bedding-parallel propagation were observed. When bedding fractures were effectively activated, induced hydraulic fractures connected with natural fractures on multiple specimen surfaces and formed a composite fracture system. Representative numerical simulations were used to reproduce the observed fracture geometry and examine the consistency between wellbore orientation, bedding activation, and fracture trajectory.



Field-scale simulation was further introduced as an upscaling step to translate thelaboratory-scale mechanism into engineering implications for well placement and fracturing-parameter design. The results indicate that non-principal-stress wellbore placement modifies near-wellbore fracture initiation and promotes direction-dependent fracture propagation in shale. Natural bedding fractures control the final fracture path and determine the complexity of the stimulated fracture network. This study provides physical experimental evidence, supported by multiscale simulation interpretation, for optimizing hydraulic fracturing design in deep shale reservoirs

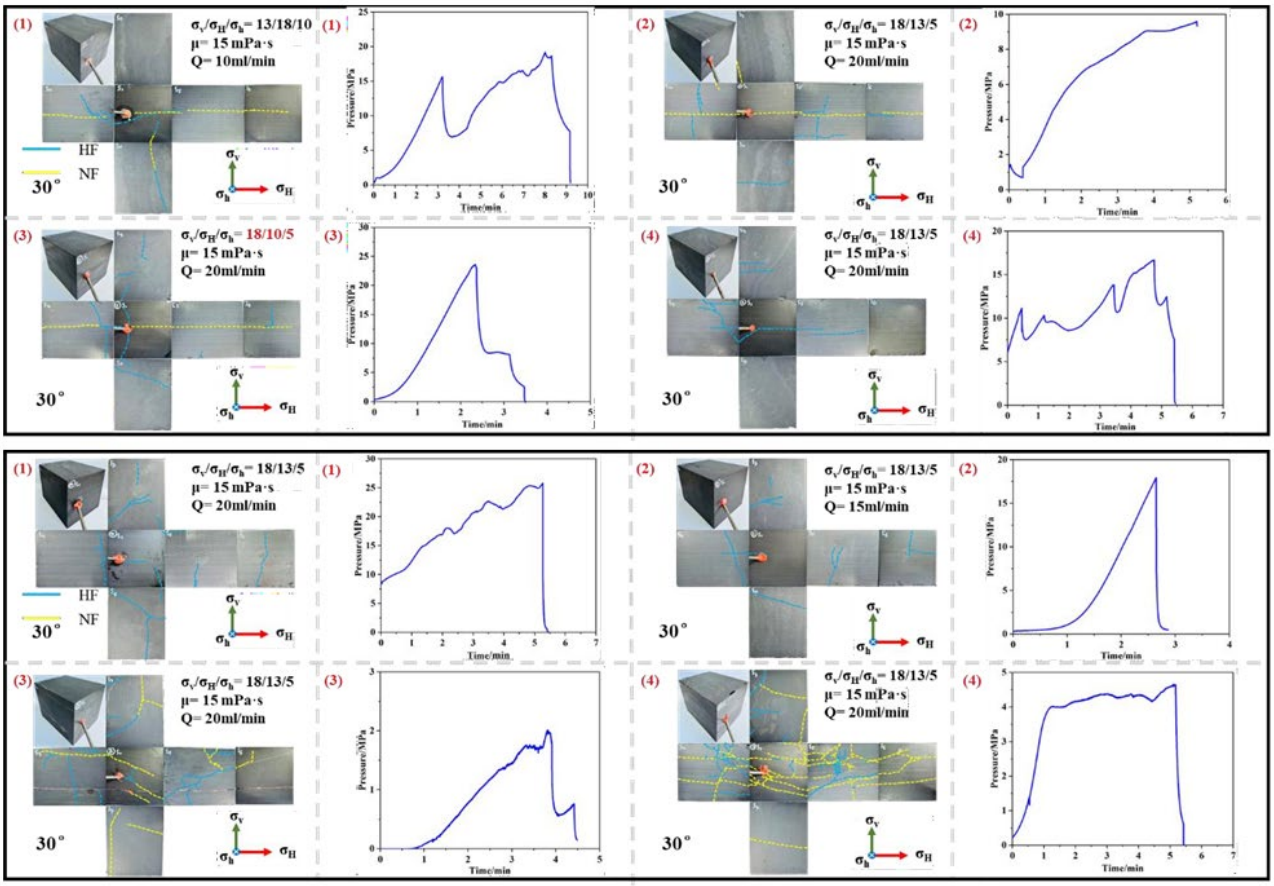


Figure 2. Surface fracture patterns and pressure-time curves of shale specimens under different wellbore orientation sand injection conditions. HF represents hydraulicfracture, and NF represents natural fracture.

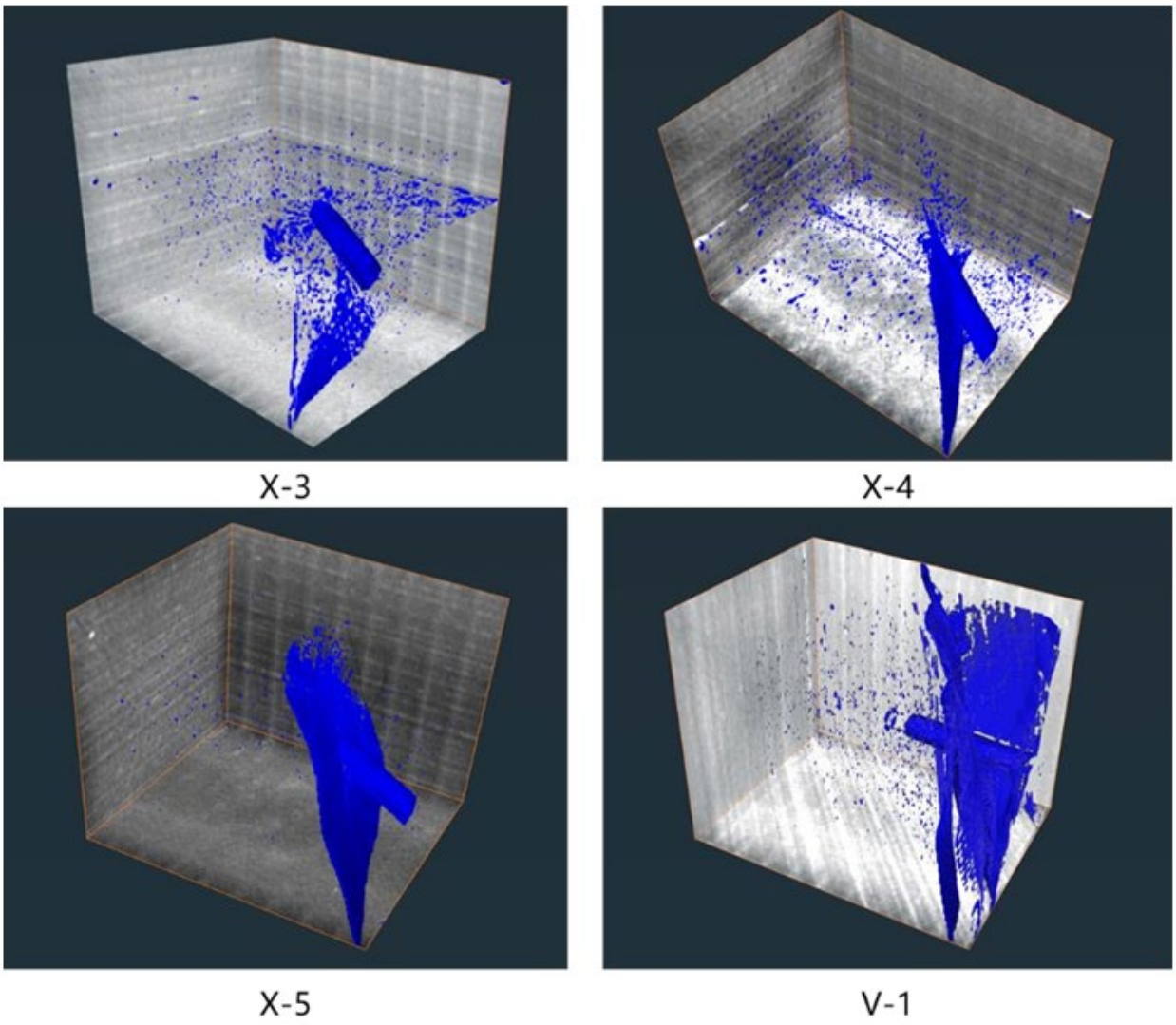
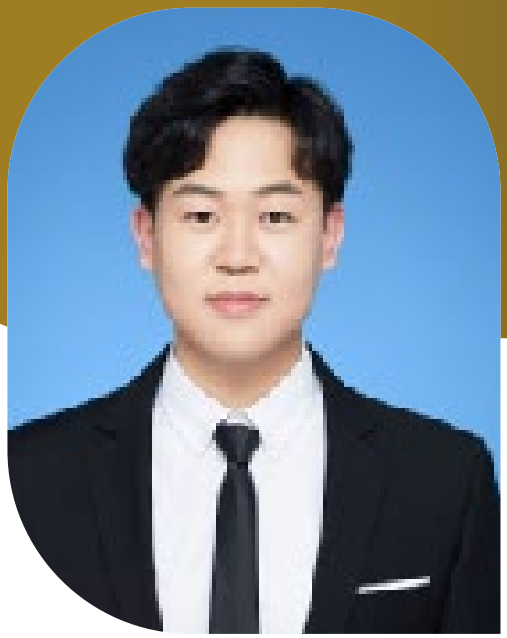


Figure 3. Three-dimensional reconstruction of representative hydraulic fracture networks in shale specimens after fracturing.

Biography

Shushuai Wang is affiliated with China University of Petroleum (Beijing), China. His research focuses on hydraulic fracturing, shale reservoir stimulation, true-triaxial physical modeling, and fracture propagation under complex in-situ stress conditions. He has conducted experimental studies on non-principal-stress wellbore placement, bedding-controlled fracture evolution, and breakdown pressure responses in shale. His current work aims to clarify the mechanisms of hydraulic fracture initiation and propagation in deep shale reservoirs and to support optimized well placement and fracturing design.



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Field diagnosis and operational mitigation of casing deformation during hydraulic fracturing: A case study of a multi-layer deep shale-gas development pad in the Daan Block, Sichuan Basin

Casing deformation is a recurring well-integrity challenge during multistage hydraulic fracturing of deep shale-gas horizontal wells, particularly on multi-layer development pads where wells targeting vertically stacked reservoirs are stimulated within a limited area. This paper presents a field-based diagnosis of casing deformation on the Daan 1H21 Pad, a representative multi-layer development pad targeting the deep Wufeng-Longmaxi shale succession in the Daan Block, southern Sichuan Basin, China. The analysis integrates multi-finger caliper surveys, well trajectories, cement-bond logs, fracturing-pressure records, interwell pressure responses, microseismic monitoring, and seismic discontinuity interpretation.

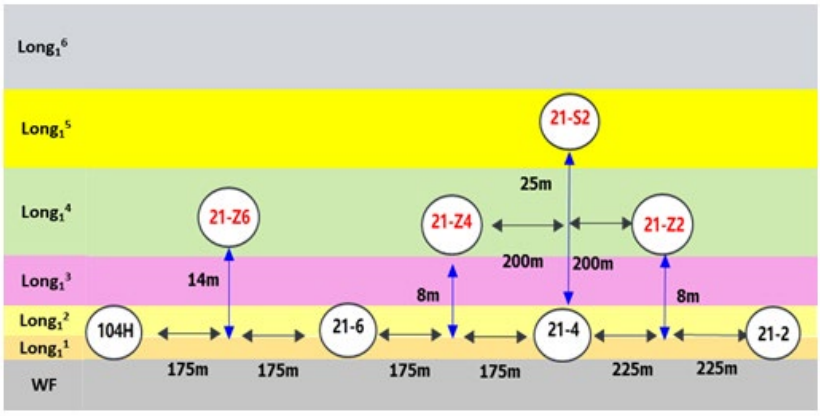

Figure 1: Schematic of the vertically stacked multi-layer development pattern and well spacing on the Daan 1H21 Pad targeting the Wufeng–Longmaxi shale succession

Seventeen deformation points were identified across the pad, nine of which displayed distinct step-like shear signatures. The deformation points were mainly located near interpreted fracture corridors or mechanically contrasting stratigraphic interfaces. Comparison with dogleg severity and cement-bond quality showed no systematic relationship, indicating that trajectory curvature and cement quality were not the dominant causes. In contrast, several deformation intervals coincided with anomalous microseismic energy release and rapid pressure responses in offset wells, including responses over relatively long interwelldistances. Pressure communication was also observed between wells targeting different vertical intervals. These observations suggest that injected fluid entered connected natural fractures, increased fracture pressure, and induced localized slip that transferred shear loading to the casing. The vertically stacked well arrangement and closely spaced fracturing sequence further increased interwell stress interference.

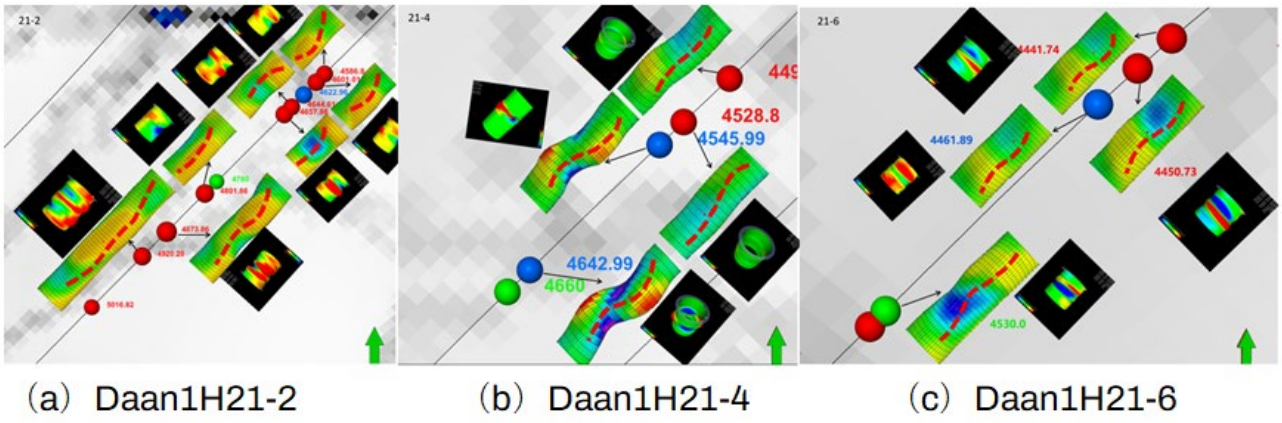

Figure 2. Casing deformation characteristics of selected wells on the Daan 1H21 Pad: (a) Well Daan 1H21-2, (b) Well Daan 1H21-4 and (c) Well Daan 1H21-6.

Following the deformation events, the stimulation sequence and operating parameters were adjusted. Continuous adjacent-well zipper fracturing was replaced by a more separated sequence, and pumping intensity was reduced near suspected risk zones. The remaining stages were subsequently completed successfully. The case study demonstrates that integrating casing diagnostics with pressure and microseismic surveillance provides an efficient means of identifying fracture-reactivation-related deformation and supporting timely operational decisions. The results offer a practical workflow for reducing casing-deformation risk on multi-layer shale-gas development pads.

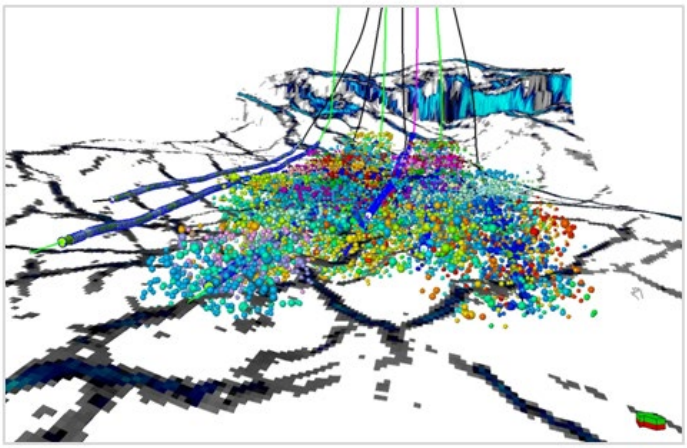

Figure 3. Three-dimensional spatial distribution of microseismic events and horizontal well trajectories during hydraulic fracturing on the Daan 1H21 Pad.

Keywords: Casing Deformation, Multi-Layer Development Pad, Deep Shale Gas; Hydraulic Fracturing; Fracture Reactivation; Wellbore Integrity.

Biography

Wang Hao is currently pursuing a Ph.D. in Petroleum and Natural Gas Engineering at China University of Petroleum (Beijing), specializing in petroleum geomechanics and wellbore integrity. He has conducted industry-oriented research at the Exploration and Development Research Institute of PetroChina Zhejiang Oilfield Company. His research focuses on casing deformation mechanisms, hydraulic-fracturing-induced interwell interference, natural-fracture reactivation, and stimulation optimization in deep shale-gas reservoirs.

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Numerical modelling of polymer drag reduction for efficient transportation of high-viscosity crude oil in pipelines

The transportation of high-viscosity crude oil through long-distance pipelines is often associated with significant pressure losses, high hydraulic resistance, and increased energy consumption. One of the effective approaches to improving pipeline transportation efficiency is the use of drag-reducing polymer additives, which can suppress turbulent structures and reduce friction losses in the near-wall region of the flow. This study presents a numerical approach to modelling non-isothermal turbulent flow and heat transfer of high-viscosity oil with a polymer drag-reducing additive in a pipe.

The research is based on the formulation of a mathematical model describing turbulent momentum and heat transfer in a high-viscosity fluid flow with a polymer additive. The rheological behaviour of the polymer-containing fluid is represented using the FENE-P model, which allows the viscoelastic effect of stretched polymer macromolecules in turbulent flow to be considered. The numerical methodology includes the development of a computational algorithm and software for solving the governing equations of motion, heat transfer, and turbulence characteristics. The model was verified through comparative calculations with available numerical and experimental data for turbulent viscoelastic flows.

The results of the study demonstrate that the addition of a small amount of polymer additive can significantly affect the structure of turbulent flow by reducing Reynolds stresses, suppressing near-wall turbulent fluctuations, and decreasing hydraulic resistance. Comparative calculations for non-isothermal turbulent oil flow in trunk pipelines show that the proposed model can be used to estimate the influence of flow regime parameters on velocity, temperature, friction coefficient, and heat transfer characteristics. The developed software framework also provides a basis for determining optimal additive dosage under pipeline operating conditions.

The practical significance of the study lies in improving the energy efficiency of crude oil transportation in main pipelines. The proposed modelling approach can support the selection of drag-reducing additive concentrations and operating conditions aimed at reducing hydraulic resistance, increasing pipeline throughput, and lowering energy costs during the transportation of high-viscosity oil.

Biography

Dr. Zhibek Akasheva is the Head of the Alternative Energy Department at the Modeling in Energy Sector Laboratory, Satbayev University (Kazakhstan). Akasheva holds a Ph.D. in Petroleum Engineering and specializes in reservoir engineering, pore-scale modelling, CO2 geological storage, and digital technologies for the energy sector. Akasheva's research focuses on fluid flow in porous media, enhanced oil recovery, wax deposition, and carbon sequestration. Akasheva has authored more than 20 scientific publications and leads nationally funded research projects, with work that bridges fundamental research with practical engineering solutions for sustainable energy and decarbonization.

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