Copenhagen Section

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SOCIETY OF PETROLEUM ENGINEERS

SPE NEWS

COPENHAGEN SECTION

FROM THE SECTION CHAIRMAN

DEAR SPE MEMBERS,

We opened the new season with Distinguished Lecturer Samba Ba from SLB, who gave an inspiring presentation on autonomous drilling technology. Samba described five levels of autonomy, from Level 0, with no autonomy, through assisted and partly remote operations, to Level 5, with full autonomy. The main drivers for autonomous directional drilling include lower operating costs, greater efficiency and consistency, reduced risk and uncertainty, fewer opportunities for human error, and fewer personnel offshore. Ultimately, the technology aims to improve drilling performance while reducing cost and operational risk. An important objective is also for the technology to remain field- and rig-agnostic.

Lifetime Achievement Award

I would also like to congratulate Hans-Henrik Kogsbøll on receiving our Lifetime Achievement Award in recognition of his outstanding and long-standing contributions to SPE and our local Section. In recent years, we have presented this local award to an SPE member who has made a remarkable contribution. This newsletter also includes an interview with Hans-Henrik.

We celebrated the start of the season with a reception featuring sparkling wine, refreshments, and canapés.

Following our first board meetings of the season, I am pleased to welcome Isabel Cristina Correa, Senior Drilling Engineer at INEOS Energy, as our new Program Chair. We are also pleased to welcome our new Secretary, Irina Andreeva, Global Solutions Manager at Welltec.

ISABEL CRISTINA CORREA

Senior Drilling Engineer at INEOS Energy, as our new Program Chair. Isabel brings more than 20 years of international experience across drilling, completions, workovers, well intervention, and well abandonment. Her career includes senior roles with INEOS Energy, Ross, Maersk Oil, Hess, and NOV, with responsibility for planning and executing North Sea drilling and intervention campaigns. She has delivered new wells, more than ten workovers and abandonments, and complex P&A programmes, and has introduced technologies such as MPD and specialised P&A tools. Earlier in her career, she worked with more than 150 horizontal heavy-oil wells and with artificial-lift and completion systems. We are delighted to benefit from her strong technical background, project leadership, and extensive network in the Danish and international energy industry.

IRINA ANDREEVA

Global Solutions Manager at Welltec. Irina brings more than 20 years of experience spanning geoscience, well delivery, reservoir management, completions, and commercial collaboration. At Welltec, she serves as a global subsurface and reservoir subject-matter expert, conducting inflow-control feasibility studies and developing advanced completion solutions. During her time with TotalEnergies, she identified optimisation opportunities that supported a rig-based intervention campaign covering more than 40 wells, developed 3D models for major offshore investments, and later supported collaboration with joint-venture partners during the Tyra Gas Hub restart. Her earlier roles with Maersk Oil and Shell included operational geology, 3D and 4D seismic interpretation, geosteering, and real-time support for complex North Sea and Sakhalin well-delivery programmes. We look forward to the technical breadth, energy, and collaborative perspective she will bring to the Board.

I was also pleased to see many of our members at the INNO-CCUS meeting in Copenhagen on Tuesday, 8 September. It is impressive to see how far many of the projects have progressed in only a few years. A search for CCS and geological storage on the INNO-CCUS website shows that three projects have already been completed and twelve are ongoing.



Figure 1. Fifteen CCS projects related to geological storage. Source: INNO-CCUS.dk.1

In addition, Denmark's CCS sector is moving rapidly from planning to field operations. Equinor, together with Ørsted and Nordsøfonden, has completed the Havnsø exploration well, with Ross Energy responsible for executing the drilling operations. Harbour Energy, INEOS, and Nordsøfonden are progressing the Purhus-1 well, while CarbonCuts is advancing the Rødbyhavn project. Ross Energy is also the preferred technical partner for the Norne Carbon Storage Hub. Together, these activities demonstrate the growing momentum and broad industry involvement in developing Denmark's CO_2-storage potential. I hope we will hear more about these projects at SPE meetings during the season.

Geothermal activity is also gaining momentum in Denmark. Innargi and Kredsløb's first geothermal plant in Aarhus is now delivering heat, with further expansion planned towards a total capacity of 110 MW. Green Therma is preparing its innovative Heat4Ever™ demonstration project near Aalborg, where H&P Rig T203 is scheduled to drill Denmark's deepest and longest geothermal well, with spud planned for January 2027. Together with continued operations in Thisted and new developments in North Zealand, these projects underline the growing role of subsurface expertise in Denmark's energy transition. We are working to arrange a meeting at which we can hear more about Green Therma's project.

Politically, the previous Danish government considered extending the North Sea licences to support the Danish economy and European energy security during the transition towards 2050. The new government's position on licence extensions remains unclear, while geopolitical conflicts and energy-price volatility continue to influence the debate. SPE Copenhagen remains politically neutral and does not advocate specific policies. Instead, we connect energy professionals and share technical knowledge that can support safe, efficient, and lower-carbon oil and gas production alongside the development of CCS, geothermal energy, and other related energy resources.

Warm regards,

Peter Tybjerg
SPE Copenhagen Section Chair

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DRILLING FOR DATA ON ZEALAND: NOTES FROM HAVNSØ-1

By Patryk Bijak, Ross Energy

Peter's letter in this issue lists the CCS wells now being drilled in Denmark, and Hans-Henrik Kogsbøll's interview tells younger engineers to get ready for carbon storage work. I can add a view from the wellsite. I worked on Havnsø-1 near Kalundborg as wellsite drilling engineer, left the location in July, and have spent part of the months since on the end of well report. That is a good point to look back.



Patryk Bijak

Havnsø-1 was Denmark's first onshore CCS exploration well. It was drilled for CO_2 Storage Kalundborg, the partnership of Equinor as operator, Ørsted and Nordsøfonden, to find out whether the subsurface under north-west Zealand can hold CO_2 safely and permanently. Ross Energy planned and managed the well, and MND drilled it with their Bentec B-250 land rig. We reached planned depth at around 2,000 metres, and the well was completed at the start of July.

I have worked on onshore and offshore wells before, and much of the drilling was familiar. The differences were in why the well was drilled, and in how long it has to last after we left.

A WELL WHERE THE PRODUCT IS DATA

The point of Havnsø-1 was information. The partners needed two answers: will the Fjerritslev Formation mudstones work as a cap rock, and how good are the Gassum Formation sandstones as a reservoir. Everything in the design followed from those two questions.

The well was kept deliberately simple: vertical, with a 30" conductor driven before the rig arrived. The top-hole sections were drilled with a bentonite/polymer mud, much like the mud used for water wells, to protect the shallow groundwater. Through the reactive Fjerritslev shale we changed to a KCl/glycol water-based system, and the last section went through the Gassum and far enough below it to log the whole reservoir.

Then came the data. Cores in both the seal and the reservoir, a wireline logging programme, pressurised fluid samples, and water injection tests in two zones of the Gassum using treated water from a nearby water well. No CO_2 went into the ground. The test only had to show how the reservoir takes fluid.

Anyone who has drilled production wells will recognise the shift. On a development well the conversation is about metres per day and days per well. On Havnsø-1, a fast section that left a poor hole for logging, or a core barrel that came up half empty, would have been a bad trade. Coring days are slow, and the whole crew understood why. Every operational decision was judged against one question: does this give us a clean hole and good data?

PLUGGED FOR THE LONG TERM

This is what I point to first when someone asks what makes a CCS well different. An oil or gas well is usually abandoned when the reservoir is depleted and the pressure is low. A well inside a storage licence is abandoned before the reservoir has done its job. If injection goes ahead, pressure in the Gassum will rise above anything the well saw while we drilled it, and the

formation water around the plugs may carry dissolved CO_2.

So the end of the well was designed in from the start. The two deepest casing strings were cemented with a CO_2-resistant blend and checked with cement bond logs. The Danish Energy Agency reviewed the abandonment plan specifically against a future rise in reservoir pressure. Hans-Henrik names corrosion around legacy wells as one of his main concerns for CCS, and he is right to.

If the Havnsø structure becomes a storage site, Havnsø-1 will be its first legacy well. The barriers we set this summer have to perform for far longer than any of us will be working. That is a different way to think about a cement job, and I expect it to become a standard question for every well drilled near a future store.

LAND DRILLING IS CLOSE UP

Offshore, your nearest neighbor is the standby vessel. At Havnsø the rig stood in a field near Særslev, between a country road and a row of wind turbines, with farms and villages all around. That changes the job in small ways every day.



The pad was built on an impermeable membrane, and rainwater from the inner area was collected in basins and reused for drilling where we could. Traffic, noise and lighting matter to people who live a few hundred metres away. Long before the rig arrived, the project had held information meetings at the inn in Snertinge, and several hundred landowners had agreed to let the seismic crews onto their land. During drilling, a local association asked to come and see the work, and some of its members climbed up the derrick to see the operation close up.

Public acceptance is not somebody else's department. The people around a land site judge the whole technology by what they see at the fence, and on a land well the drilling team is part of what they see. A tidy site, a quiet night shift and traffic that respects the neighbors probably do more for CCS in Denmark than any brochure. It is no accident that the INNO-CCUS projects in Peter's letter include one on public acceptance alone.

Onshore storage will need many more wells like this one, near many more villages. The industry's licence to drill them is earned one site at a time.

The B-250 came straight from a well in France with its regular crew, and on a land location the office container is a two-minute walk from the drill floor. This guys knew every piece of their job.

PLANNING WITH MANY HANDS

Before spud, more than 70 people from Equinor, Ørsted, Nordsøfonden, CO_2 Storage Kalundborg and Ross Energy spent a day in Copenhagen drilling the well on paper. We went through geology, well objectives, data acquisition, the injection test, risks and interfaces. The Danish Energy Agency met the team on the drilling programme, and in January it joined Equinor and Ross to see the rig at work in France. GEUS reviewed the data acquisition programme and asked for the fluid samples to be analysed for gases such as hydrogen and helium.

Working this closely with the authority and the geological survey before spud is not something you see on every project. It showed that the rules for onshore CO_2 storage in Denmark are being worked out in practice right now, one well at a time, with everyone learning together. It also explains why a good share of the job is documentation. A daily drilling report went to the authority every day, and the final well report is a deliverable in its own right.

ADVICE FOR THE YOUNGER ENGINEERS IN THE SECTION

The skills carry over almost one to one

Casing design, cementing, mud, well control and well integrity come from the same textbook. What changes is the objective, the people around the well and how long it has to last.

Get to the wellsite early, and spend time on the rig floor

A week of tripping, coring and cementing teaches more than a month of reading the programme.

Write things down

The after-action reviews and the end of well report are slower than drilling, but they are where you find out why decisions were really taken. Hans-Henrik makes the same point in his interview: knowledge survives when people document it.

Look at onshore Denmark

As Peter's letter shows, there are CCS wells at Havnsø and Purhus, geothermal heat flowing in Aarhus, and Green Therma spudding near Aalborg in January 2027. For a country many people thought had finished with drilling, there is a fair amount of it going on.

WHAT HAPPENS NEXT

The rig has left Havnsø and the site is being returned to farmland. The cores and test data are now with the specialists, and the partners are aiming for an investment decision around 2027–28, with start-up around 2032. Whether CO_2 ever goes into the Gassum under Havnsø is now a question for the data. My part was helping to get that data out of the ground in good shape.

I have since moved on to Purhus-1 in Jutland, the second onshore CCS well Ross Energy is drilling this year. If you want to know what this work looks like day to day, come to one of our YP events or get in touch. I am always happy to talk about it.

Patryk Bijak, Drilling Engineer and NDSV, Ross Energy, and Young Professionals Chair, SPE Copenhagen Section



DTU-Offshore Lab capabilities: Uses in Energy research, environmental research and crime forensics



KAREN FEILBERG

Karen Feilberg is a senior Research Scientist at DTU Offshore and in charge of the experimental capabilities of its research lab. Prior to this she worked at COWI, Copenhagen University, The University of California Berkeley and Universität Göttingen. Karen holds a PhD and MSc in (Atmospheric) Chemistry from the University of Copenhagen (KU) and a BSc in Natural Sciences from the University of Cambridge.

ABSTRACT:

DTU Offshore's laboratory facilities provide advanced experimental capabilities that support both fundamental and applied research in offshore energy production. Researchers use these facilities to develop, test, and validate methods that enhance the efficiency and sustainability of offshore operations across the oil, gas, wind power and CCS industries. The experiments conducted in the labs help industrial partners improve production processes while mitigating environmental impacts, such as harmful discharges to the sea and emissions to the atmosphere.

The laboratories are equipped to simulate and analyze complex interactions between industrial activities and the marine environment and the subsurface. Through controlled experiments, researchers investigate the degradation and behavior of pollutants in seawater, the dispersion of subsea emissions, and the interactions between sediments, biofilms, and other marine components. This work provides critical insights into the fate and transport of materials such as water additives, drilling fluids and lubricants, helping to develop environmentally sound offshore technologies and informing assessments and mitigation strategies that support sustainable ocean use.

While designed for offshore energy applications, the laboratories' advanced experimental capabilities are valuable for a wide range of disciplines. The same analytical and detection techniques used to trace marine contaminants can, for example, be applied in forensic science to uncover underlying environmental phenomena or criminal activity. This range of applications of advanced analytical equipment will be demonstrated during the presentation and highlighted further on the subsequent lab tour.

Following the presentation and sandwich dinner there will be a 'Halloween Mystery Lab Tour'.

"The dead body of a young Gremlin is found in the basement of DTU, just two days before Halloween. Academia is in shock, where did this furry individual come from, and how did it die?"

Visitors will be introduced to the full range of investigative capabilities present in the DTU-Offshore laboratory, and scientific test results will be used to solve the mystery.

For more info, click here:
https://issuu.com/dtuoffshore/docs/dtu_offshore_ccs_lab_facilities_2025

Or here:
https://www.linkedin.com/posts/dtuoffshore_ccs-carbonstorage-activity-7293248321119293440-kAIV?utm_source=share&utm_medium=member_desktop



SPE Meeting

DTU-Offshore Lab capabilities: Uses in Energy research, environmental research and crime forensics

What happened to the Gremlin?
That is what everyone will be asking when they tour the three floors of DTU Offshore's laboratories where an unfortunate Gremlin is found dead. Where did this Gremlin come from, and what killed him? Out of pure curiosity and with the scientific rigour of academia all of DTU Offshore's lab capabilities will this time be turned towards a major forensics investigation, rather than its traditional objectives of resolving energy transition related questions.

Samples will be taken of the deceased Gremlin, still in its furry Mogwai stage, and through a process of observation, deduction and elimination its cause of death will eventually be determined.

Everyone who is familiar with Gremlin movies knows what can kill adult Gremlins, but what on earth put down this young and unfortunate individual? If you're keen to find out then join us at the Halloween SPE mystery event on October 29th at DTU Offshore!

17:00 - 18:00 Social Hour: drinks
18:00 - 18:50 Presentation by Karen Feilberg
DTU-Offshore Lab capabilities:
Uses in Energy research, environmental research and crime forensics
19:00 - 19:30 Sandwich dinner
19:30 - 20:30 Halloween Mystery Lab Tour

Thursday, 29 October



Please sign-up no later than 27 October 2026

Register HERE

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PORT ESBJERG: A CENTRAL NODE IN EUROPE'S CCS VALUE CHAIN

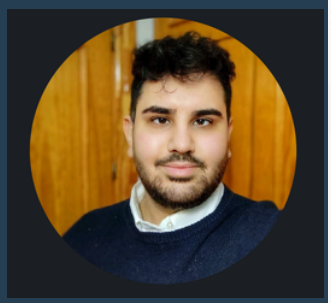
By Jaime Martín Gálvez, Port Esbjerg

Port Esbjerg is taking on a growing role as a logistics hub for CO_2 transport and storage in the North Sea. Since the Greensand CO_2 terminal was inaugurated by HM King Frederik X last September, liquefied CO_2 has been arriving at the port by truck before being shipped offshore for permanent storage in the Nini West reservoir. The terminal currently has six 1,000-tonne storage tanks and an initial capacity of 400,000 tonnes of CO_2 per year, with plans for capacity expansion are already underway.

At the same time, Port Esbjerg is exploring how its infrastructure can support a wider range of CO_2 sources and transport solutions. Through the EUDP-funded Small Scale CCS project led by Welltec, the port contributes infrastructure, logistics and operational expertise, helping connect decentralized point sources with the wider CO_2 value chain. Captured and liquefied CO_2 from a biogas plant in Gråsten will be transported to Esbjerg by truck for reception and temporary storage.

The ambition goes beyond this individual project. Port Esbjerg is also involved in a project exploring containerized transport of CO_2 in solid form (dry ice), adding another potential logistics concept for moving captured CO_2 between emitters and storage infrastructure. The port is furthermore promoting a rail extension to the area where the Greensand terminal is located, which could enable CO_2 from German emitters to reach Esbjerg by rail, while opportunities for future CO_2 flows from Sweden, Norway and Poland are also being explored.

Speaker



Jaime Martín Gálvez is a Research & ESG Specialist at Port Esbjerg, working across sustainability, ESG, innovation and EU-funded projects. His work covers areas including decarbonization, carbon capture and storage, renewable energy, circularity, biodiversity and nature-based solutions, with a focus on how ports can support the green transition. He holds an MSc in Environmental and Resource Management and a bachelor's degree in Biochemistry.

OPERATIONAL PREPARATION AND DEPLOYMENT OF AN AUTONOMOUS DENSITY ACTIVATED DUAL-PHASE INFLOW CONTROL SOLUTION IN A PROLIFIC NORWEGIAN SUBSEA PRODUCER

By Irina Andreeva, Welltec.com

The paper follows the complete journey from reservoir modeling and completion design through qualification, installation, and early production performance. The technology was specifically developed to address one of the industry's most persistent production challenges: uncontrolled water and gas breakthrough in heterogeneous reservoirs, particularly in light-oil applications where conventional inflow control solutions often have limitations.

By autonomously restricting water and gas while maintaining high oil-flow capacity, the system has the potential to optimize inflow distribution, accelerate oil production, improve recovery, and reduce the need for future interventions.



Speaker

Irina Andreeva *is a Global Solutions Advisor at Welltec with more than 20 years of international experience in subsurface and reservoir management, well delivery, production optimization, and advanced completion technologies. She earned an MSc in Geological and Earth Sciences from Ufa State Petroleum Technical University in 2006.*

Prior to joining Welltec, she held technical roles with Rosneft, Shell, Maersk Oil, and TotalEnergies, supporting field development and drilling operations in Sakhalin and the North Sea. She later expanded into commercial responsibilities at TotalEnergies before joining Welltec, where she now advises operators worldwide on advanced completion and inflow control solutions aimed at maximizing hydrocarbon recovery and asset value.

INTERVIEW WITH HANS-HENRIK KOGSBØLL BY BARTOSZ BULA



Hans-Henrik Kogsbøll

40 Years in Oil & Gas: Career Advice and Tech Trends

Looking back at your career, what advice would you give to yourself at the age of 25? Is there anything you would do differently?

I would still say that your education should be viewed as a foundation for continuous development. Keep educating yourself through a combination of self-study and company-supported learning opportunities.

One of the reasons I stayed with the same company for so many years was that they kept developing and challenging me. I would also advise young engineers to read the relevant SPE papers and technical publications within their area of expertise. By doing so, you become knowledgeable enough to be considered an expert, or at least to know as much as most people working in the field.

Which career decision had the greatest positive impact on your professional development?

The most significant decision was moving into petroleum engineering. I was originally hired as a systems engineer with an IT background, but that role was very office-oriented.

When I moved into petroleum engineering, the work combined technical, operational, managerial, and contractual responsibilities. It exposed me to many different aspects of the business. The transition into the operational and theoretical side of the industry was probably the biggest step in my career. That is where I found my place.

What advice would you give young engineers entering the oil and gas industry today?

I would advise them to develop skills that are transferable to industries related to oil and gas. They should not expect the oil and gas industry to continue growing indefinitely. The industry is gradually declining, and engineers need to prepare themselves for adjacent sectors such as carbon storage, injection technologies, and alternative energy solutions.

When I started 40 years ago, it was a growing industry. Today it is a declining industry. There will always be oil and gas, but the focus is changing. We see less development drilling and more abandonment and decommissioning work.

My advice is to understand the current state of the

industry and decide whether it matches your interests and personality. If your dream is to work on abandonment projects, then there will be opportunities.

If your focus is on drilling new wells, you may need to look for regions where expansion is still taking place.

What were the key findings and lessons from the early chalk stimulation campaigns, and how did they influence later designs?

One of the early assumptions was that horizontal wells could not be hydraulically fractured. Understanding the stress environment around the wellbore and learning how to prevent screen-outs became very important.

The research and development carried out in this area led to improved stimulation treatments, reduced costs, and advancements in completion systems. Those lessons significantly influenced later stimulation and completion designs.

Which stimulation and completion technologies delivered the greatest value, and why did some technologies succeed while others disappeared?

For chalk reservoirs, success depends on using the right technology for the right reservoir conditions.

In thinner reservoirs, acid stimulation often delivered excellent results and was significantly cheaper than hydraulic fracturing. In thicker reservoirs, proppant fracturing could be more effective because it could extend stimulation further into the formation.

Reservoir thickness, porosity, permeability, and rock stability all play important roles. Technologies did not necessarily disappear because they failed. In many cases, reservoir characteristics changed over time as operators moved into thinner zones, making acid stimulation more attractive and cost-effective than other methods.

For very high-porosity formations that are prone to collapse, proppant-fracturing can provide better long-term support than acid treatments.

How do you determine whether a production optimization project has been successful?

The simplest method is to compare production decline trends before and after the intervention. Ideally, you would see an improvement in the decline curve.

The challenge is that field data are often limited. In many cases, you only get one or two well tests after the intervention, making it difficult to draw firm conclusions.

Some modern technologies allow engineers to evaluate production using pressure, choke size, and surface data to create performance models. However, assessing optimization results often remains subjective because data availability is limited.

What are the most common failure mechanisms in aging chalk wells?

It depends on the reservoir conditions. Some chalk wells continue producing successfully for 20 to 25 years.

One failure mechanism occurs in very high-porosity chalk formations, typically above 39 to 40 percent porosity.

Under significant drawdown, the rock can collapse and begin producing as a soft material that resembles toothpaste.

When this happens, the formation continuously

produces solids, which are difficult to handle at surface facilities. Unless the affected zone can be isolated, it may effectively mark the end of the well's productive life.

Operators must be careful not to increase production too aggressively. A well may perform well initially, but excessive drawdown can eventually trigger formation collapse. There are models available that help predict this behavior.

Is there a role for traditional well stimulation expertise in geothermal wells?

It may be cost-prohibitive in many geothermal applications. The economic benefits are often different from those in oil and gas production.

The answer also depends heavily on reservoir properties such as pressure and permeability. In highly permeable formations, stimulation may provide limited additional value because the reservoir already accepts and delivers fluids efficiently.

What concerns you most about legacy wells in future CCS projects?

Corrosion is one of the primary concerns, especially when water is present in the system.

The specific risks depend heavily on reservoir pressure conditions. In depleted gas reservoirs, gas can accumulate in the wellbore and create cooling effects during injection because of the Joule-Thomson effect. This may result in ice formation or operational issues.

In systems where water has been removed, corrosion risks are reduced. However, if water mixes with the injected CO_2 in the reservoir, corrosion can become a concern again.

There is no single answer because the risks depend on the specific reservoir and operating conditions.

Which technologies in the oil and gas industry do you believe are currently overhyped?

I would not say that any particular technology is overhyped. The bigger challenge is that it is often too expensive to properly test new technologies.

Many promising concepts suffer from insufficient field trials and limited datasets, making it difficult to assess their true value. In my view, the issue is not excessive hype but rather a lack of opportunities to generate enough evidence to prove whether a technology works or not.

What knowledge or skills are most often lost when experienced engineers retire?

I would actually challenge the assumption behind the question. The industry has continued to develop for more than a century despite people retiring.

Knowledge should not reside only in individuals. As long as engineers document their work, publish reports, maintain databases, and record lessons learned, future generations can build on that knowledge.

For example, reviewing final well reports can provide tremendous insight into what worked and what failed. As long as companies and individuals preserve knowledge properly, relatively little is truly lost when people leave.

What matters is teaching younger engineers how to gather information, evaluate data, and learn from past experience.

What industry challenge remains unsolved despite decades of experience and technological progress?

One of the major challenges is predicting when a well will become stuck during drilling.

I do not believe this problem will be fully solved until we have enough data and understanding to drill thousands of wells without experiencing stuck-pipe incidents.

The challenge is that we are effectively trying to understand an enormous formation using very limited information. We are still working with only a small amount of data compared with the complexity of the subsurface.

What do you hope the next generation will do better than your generation did?

I hope the next generation finds smarter ways to gather reliable data and use that data to make better decisions.

Artificial intelligence may help, but it still requires large amounts of high-quality, formation-specific data. General datasets are often not enough.

One thing the industry has lost is extensive testing capability. In the 1980s and 1990s, major companies such as Shell operated dedicated laboratories and test rigs where new technologies could be evaluated before field implementation. Most of those facilities have disappeared.

Today, many technologies are effectively tested during live operations. Having dedicated test wells or test facilities would allow companies to evaluate new concepts more safely and cost-effectively before deployment.

Another improvement would be greater collaboration. Companies could partner with organizations operating lower-cost land rigs to test new technologies. We successfully did this in the United States when evaluating fracturing technologies, and it proved highly valuable.

Better cooperation, more testing, and improved use of data would significantly benefit future generations of engineers.



From Chalk Reservoirs to Carbon Storage: Lessons Learned and Future Challenges in Well Engineering

AUTONOMOUS DRILLING TAKES CENTRE STAGE AT DTU

By Jedrzej Bryla, Ineos Energy

A high turnout at the SPE Copenhagen Section meeting at the Technical University of Denmark (DTU) reflected strong interest in a timely subject: how artificial intelligence can improve the way wells are planned and drilled. SPE Distinguished Lecturer Samba Ba presented 'Building an Industry 4.0 Agentic AI for Autonomous Directional Drilling', bringing more than 20 years of experience spanning field operations, research and autonomous drilling development.

Ba's presentation addressed a familiar difficulty: directional drilling demands good decisions while formations, steering response and downhole conditions continually change. Measurements carry uncertainty, and shock and vibration complicate interpretation. His proposed system connects surface and downhole controllers through continuous feedback, combining sensor information to estimate the drilling state and selecting a suitable trajectory at each decision point. Moving from advice to control requires resilience when MWD telemetry or downlinks are disrupted. The controller must correct deviations without overreacting to unreliable data. These engineering details determine whether autonomy can earn operational trust.

Recent JPT coverage shows how far this work has progressed. In April 2025, Trent Jacobs described SLB's AI directional-drilling application in a 12-well campaign involving high dogleg severity. The reported autonomous performance delivered a 25% increase in rate of penetration compared with advisory mode and 48% compared with average manual operations. [1] These are results from a particular campaign, rather than universal performance expectations, but they provide encouraging field evidence. JPT's May 2026 deepwater case study extends the picture, describing an AI-driven system integrated with rig controls, downhole tools and two other onboard automation systems. [2] Coordinating these interfaces is a substantial step towards wider deployment offshore.

The February 2026 JPT drilling-automation feature illustrates the emerging architecture. One selected paper integrates autonomous directional drilling with



geosteering for maximum reservoir contact; another combines physics models and machine learning to improve motor sliding. A third places trajectory control within the rotary steerable tool itself. [3] Together, they show why intelligence belongs at several locations: remote systems can integrate geological interpretation and planning, rig-side computers can manage immediate operations, and downhole tools can respond locally within defined limits. JPT's February 2025 coverage of machine learning combined with physics for stick/slip mitigation provides another example of AI being applied to a specific drilling problem. [4]

The case for further adoption starts before the bit reaches bottom. AI-assisted planning could help engineers compare more trajectory options, interrogate offset-well experience and test alternatives against engineering constraints. The opportunity is to shorten repetitive analysis while making assumptions and trade-offs easier to review. Linking planning tools to verified engineering calculations would let teams explore a broader range of scenarios and carry the reasoning behind the selected design into execution. This offers particular value where engineering resources are stretched across several projects.

Geosteering makes the opportunity especially

compelling. As new LWD information changes the subsurface interpretation, integrated systems could evaluate alternative paths against reservoir objectives and drilling constraints. Autonomous downhole tools could then execute approved steering objectives with fewer surface interactions. The potential reward extends beyond faster drilling: more consistent placement in productive rock, smoother trajectories and improved conditions for running completions could strengthen the economics of the whole well. Human oversight remains central to setting objectives and resolving geological uncertainty.

AI can also make drilling trends investigation more systematic. JPT's February 2024 article on automated classification of daily drilling reports describes a foundation for extracting useful information from free text. [5] Combining such records with time-series data could help engineers investigate recurring dysfunctions, compare practices across wells and identify where performance deteriorates. Engineers would still need to test whether apparent relationships are causal. The longer-term prize is an evidence base that carries validated lessons from one campaign into the planning and execution of the next.

Automation and AI can also ease the industry's workforce pressures. As experienced specialists retire, decades of practical knowledge risk being lost. Capturing their expertise in validated models and workflows can help preserve it and support smaller teams. Attracting scarce talent becomes harder when graduates favour technology companies for their perceived growth potential. Autonomous drilling offers an opportunity to change that perception: graduates can pursue careers in AI, robotics and data science while working in oil and gas, developing technologies with direct operational impact.

Implementation will demand disciplined engineering. Models trained on one field or BHA may perform poorly in unfamiliar conditions; incomplete or inconsistent measurements can undermine decisions. JPT's February 2025 editorial argues that useful progress depends on combining AI with domain knowledge and physics. [6] Operators will need defined operating envelopes, validation against representative conditions and dependable handover when uncertainty exceeds those limits. Cybersecurity, traceable decisions and clear responsibility for control actions will also matter as more equipment becomes connected. Training must equip people to supervise automation and intervene effectively.

Commercial arrangements can be equally restrictive. JPT's April 2025 review highlights service contracts, day-rate agreements and integration between suppliers as barriers to obtaining the full benefit of automation. [1] Operators, contractors and service companies need workable agreements on data access, interfaces, responsibilities and the distribution of gains. Investment cases should assess total well-delivery performance, including reliability and reservoir placement. A faster drilling interval has limited value if integration problems create delays elsewhere. Successful adoption therefore requires changes to procurement and operating practices alongside the software.

Looking five years ahead to 2031, my expectation is that supervised autonomy will become a routine option on suitably equipped rigs within validated operating envelopes. AI planning assistants should become a normal part of well-delivery workflows as they connect to trusted engineering tools and historical records. Downhole controllers are likely to handle more local trajectory corrections, while geosteering and drilling systems exchange objectives more closely. This outlook builds on the distributed control architecture and field deployments described in JPT. Engineers will retain authority over objectives, operating limits and exceptions as the systems take on more routine decisions.

These advances can reinforce one another, improving consistency while reducing avoidable rig time, fuel use and emissions. The strong turnout at DTU reflected their relevance to our members. Ba's presentation offered a practical starting point for putting autonomous drilling to work.

References and further reading

1. Trent Jacobs, "New Papers Show Automated, Autonomous Drilling Systems Headed in Right Direction", April 2025. SPE/IADC 223649, 223824 and 223800.
2. "Global Deepwater Drilling Project Derives Drilling Parameters With AI Application", May 2026. SPE 227955.
3. Marc Willerth, "Drilling Automation and Innovation", February 2026. SPE 224743, 227896 and 225656.
4. "Combined ML- and Physics-Based Techniques Achieve Real-Time Stick/Slip Mitigation", February 2025. IPTC 24509.
5. "AI-Based System Automates Textual Classification of Daily Drilling Reports", February 2024. OTC 32978.
6. Marc Willerth, "Drilling Automation and Innovation", February 2025.

SELECTED UPCOMING SPE EVENTS

09 - 11 March 2027
Stavanger, Norway

IADC/SPE International Drilling Conference & Exhibition



20 - 21 April 2027
Aberdeen, SCT, GBR

SPE European Well Integrity Symposium



12 - 13 May 2027
The Hague, Netherlands

ISPE International CCUS Conference



EVENT CALENDAR

29 October | 17:00 - 23:30 | Face to Face

TOPIC	DTU-Offshore Lab capabilities: Uses in Energy research, environmental research and crime forensics
Speaker	Karen Feilberg
HOST	DTU Offshore, B375 Elektrovej, Kgs. Lyngby

25 November | 17:00 - 20:00 | Face to Face

TOPIC	Presentation 1: “Port Esbjerg: a central node in Europe's CCS value chain”
Speaker	Jaime Martín Gálvez, Port Esbjerg
TOPIC	Presentation 2: “Operational Preparation and Deployment of an Autonomous Density Activated Dual-Phase Inflow Control Solution in a Prolific Norwegian Subsea Producer”
Speaker	By Irina Andreeva, Welltec
HOST	Welltec A/S Gydevang 25, Allerød, DK-3450



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