



SOCIETY OF PETROLEUM ENGINEERS

# SPE NEWS

COPENHAGEN SECTION

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# WELCOME BACK

Firstly, I would like to welcome you all back after the summer break and into the SPE Copenhagen season 2015/2016. I think you would all agree that last season was a great success, with a great variety of topics. Topics ranging from Facilities to HSE with some drilling, petroleum, geology, geophysics and seismic operations thrown in to boot.

The board has been working throughout the summer to help ensure we replicate this success. We aim to continue growing our membership while making the SPE more convenient, user friendly and relevant than ever. As part of this we can proudly announce the creation of the SPE Esbjerg branch which will support our present members in Esbjerg as well as open up our services to the wider oil and gas community in Esbjerg.

Sadly, the board will be losing two very active members this season. Bill Ginty who has been active on the board

since 1997 and Jędrzej Bryła who has looked after the young professionals for the last few years. Many thanks to you both for your time and commitment and we look forward to seeing you at this seasons events.

We will be welcoming two new members to the board in their place. So it is my pleasure to welcome Lars Gammelgaard from DONG and Claus Myllerup from the Centre for Oil and Gas at the DTU.

The season will kick off on the 16th September with a distinguished lecturer at Maersk Oil. We look forward to welcoming you to a new and exciting SPE Copenhagen season.

**Anders Krag Norman,  
SPE Copenhagen  
Section Chairman**

## FUTURE MEETINGS

FOR MORE INFORMATION REGARDING  
THE PROGRAMME SEE PAGE 6



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# DELIVERING THROUGH TEAMWORK: Boosting barrels on GPIII

**The Global Producer III (GPIII) FPSO sits above the Balloch, Dumbar-ton and Lochranza fields in the Quad 15 area of the UK Central North Sea. It's a mature installation, but last month GPIII showed experience counts, producing more than 33,000 bopd.**

It's a strong performance from a production facility that has faced a number of operational challenges in recent years, with production efficiency as low as 43% in 2013. So what's driven the change? "We've focused on fixing the key issues that held us back operationally and enhanced our wells, reservoir and facilities management, and we've done this while maintaining an incident free mentality," says Brian Welinder, Quad 15 Asset Manager. "The biggest change has been in mind-set. First, we are now truly working as a team across the asset and functions to create enduring incident

free solutions. Second, we have pivoted in our performance culture from reactive to proactive. We've always had great people, but now we say 'why not?' instead of 'here's why we can't'. That's what's driven the positive challenge to taking us from 18,000 bopd to 33,000 bopd and pushing our production efficiency to 85%."

These adjustments have allowed us to balance GPIII's compressors, something we hadn't achieved before. This has helped to significantly reduce vibration, at its source, positively impacting the whole structure.

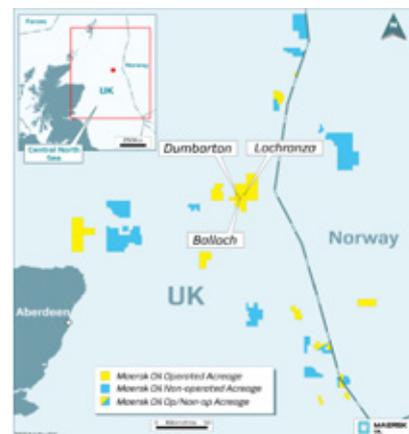
## VIEW ENDORSED BY ASSET TEAM

"It's nearly three years since we last saw these production levels," says Chris Petrovski, Operations Manager, and GPIII. "Since then, we've had a number of operational challenges, not least with gas compression – and that had affected the team's confidence in the installation. Over the last year, we've developed a plan that we all trust and that's meant we're more confident in pushing for improvement and results. But we're not complacent – this is still an installation that needs a lot of care and attention, so we recognise we're only as good as our previous day's production."

## SECURING FUTURE BARRELS

The willingness to push for results also applies to sustaining GPIII, as Development Manager, Tim Heijn, explains. "Achieving predictability in current production has meant we've had the space to focus on creating the future of GPIII. Short term, we've just brought on the Balloch-2 well, with the drilling of further Lochranza and Balloch wells later this year. Longer term, we've created a potential development roadmap with our exploration, development and commercial teams, which can ensure the success of the asset for many years ahead."

At the sharp end, a dedicated gas compression team and control loop and optimisation specialists have ensured the offshore mechanical stability to underpin solid production improvement. This positive development has been supported by close collaboration between the asset team and the onshore functions, with effective stakeholder engagement enabling the asset to challenge its maximum production potential (MPP). "The important first step in terms of production was to improve single compressor operation and sustainability, as GPIII has often only had one compressor available," says Mark Fotheringham, Director, Facilities and Projects and acting Operations Director. "After that, the next step was delivering the asset plan to shift the MPP from 18,000 up to 24,000 bopd and now, with dual compression coming on,





up to 35,000 bopd. Working alongside the asset team, our job as a function is to ensure that it is sustainable and to seek to support and engage in the right – and sometimes creative - solutions.”

## STEP CHANGE

The theme of collaboration has been critical, according to Andy Maddrick, GPIII Offshore Installation Manager (OIM). “We’ve really gone after the issues that have made our production performance so unpredictable in the last 18 to 24 months. To a large extent, that has been down to asking for and receiving the right support from functions like facilities and projects. I think you can also see the benefits of collaboration in areas such as shutdown planning. For this year, we’ve locked down early and managed to reduce by half the planned shutdown days through good communication and challenging ourselves to do better.”

The Quad 15 team aims to build on its improvement journey, balancing production from a mature asset alongside maximizing the potential from its near-field opportunities. “Just because you operate a mature asset, it doesn’t mean to say you can’t deliver a step change in performance and realise more potential,” says Brian Welinder. “We’ve made the first strides on a journey that the team is keen to continue. There will be challenges along the way, but I’m confident we have the mind-set and support to make the achievements sustainable and look for further opportunities to safely boost our MPP.”

Altering the way Maersk Oil operates the compressors on GPIII has paid dividends improving the uptime and operational performance. Paul Evans, Rotating Equipment Engineer explains more: “Understanding the role of the equipment in the production chain is critical to grasping how each affects the other, allowing us to adjust our maintenance regimes.” “These adjustments have allowed us to balance GPIII’s compressors, something we hadn’t achieved before. This has helped to significantly reduce vibration, at its source, positively impacting the whole structure.” “Key to this improvement has been ‘area ownership’; instead of having many people responsible for many areas we now have ‘area owners’ who are responsible for one zone. We’ve been able to con-



centrate our efforts better and ensure our equipment receives the care it needs. Using the gas compressors as an example, we can see that this approach works as we’re now running dual compression.” “Morale has definitely been boosted as our equipment runs more smoothly. We’re seeing that the incremental changes we undertake are working and this has given us more faith in our procedures and our equipment.”

## FACTS

- GPIII stands for Global Producer III, a Floating Production Storage and Offloading vessel (FPSO) that houses both processing equipment and storage for produced hydrocarbons.
- Maersk Oil has been operating GPIII since 2007
- 57.64 million barrels have been produced since Maersk Oil assumed operatorship
- 105 people can be accommodated on GPIII
- It is located 140 miles north east offshore Aberdeen in Quad 15
- There are three producing fields in the area: Dumbarton, Lochranza and Balloch
- Maersk Oil owns 100% of all three fields

## MILESTONES ON GPIII:



### 6 MILLION BARRELS

The Balloch Field, which first came on stream in 2013, has produced over 6.4 million barrels.

### TICK-OFFS

Balloch-2 well completed in summer 2014 and on stream in Q1 2015

### 100 EXTRA PEOPLE

Successful shutdown: completed ahead of schedule and incident free. 728 tasks were completed and over 100 extra personnel joined the GPIII’s core team as part of the Island Pride Walk to Work vessel.

### WORKING TOGETHER AWARD

Dumbarton Drill Centre Central (DCC) replacement flow line and riser successfully tied into GPIII, adding 3,600 boepd. The project won the Working Together award at the SPE Offshore Achievement Awards.

### 28TH STAR

Two of the licences Maersk Oil UK was awarded in the 28th Licensing Round were in Quad 15 – Tap O’Noth and Yeoman

### 576 DAYS

By end of 2014 GPIII achieved 576 days since their last reportable hydrocarbon release and 0 HiPo PSI



# ●● ABSTRACT.....

## CEMENT TESTING: ARE WE LOOKING AT THE RIGHT THINGS THE WRONG WAY?

We have come a long way in technology since the early days of oil well cementing. Today's complex chemical additives allow us to custom design cement slurries capable of meeting the challenges of the high pressure, high temperature and complex down-hole environments. Sophisticated laboratory testing apparatus is used to aid in the design of these complex slurries. Unfortunately, the core technology behind the key cement tests performed

today is based on testing methods developed over 50 years ago for simple slurries. The results of these tests tell us very little concerning how complex cement slurries will behave during placement and over time.

This presentation explores the current tests being performed, what these tests tell us and what they do not.



# ●● BIOGRAPHY.....



**Donald Purvis, Independent Consultant**

Don Purvis is an independent technical consultant. Mr. Purvis has done extensive research on cement flow dynamics and testing methodology. He has held research, engineering, and management positions with major service companies and operators. He holds two process patents and has authored multiple technical papers and journal articles. He has given technical presentations on good cementing practices both in and outside of the oilfield community. Mr. Purvis holds an engineering degree from Oklahoma State University. ◀



# THE CULZEAN PROJECT

The Culzean field was discovered in 2008 and established as a significant HPHT lean gas accumulation. This presentation will give a brief overview of the proposed Culzean development from a subsurface perspective, including some of the technical challenges and evaluations undertaken. After an appreciable appraisal programme with successful data acquisition, the project has progressed through the concept selection phase into the define phase, and is currently approaching FID approval. A description will be given of the discovered field, the subsurface challenges that have been met and how this has led to an optimised development plan as an integrated project. ◀

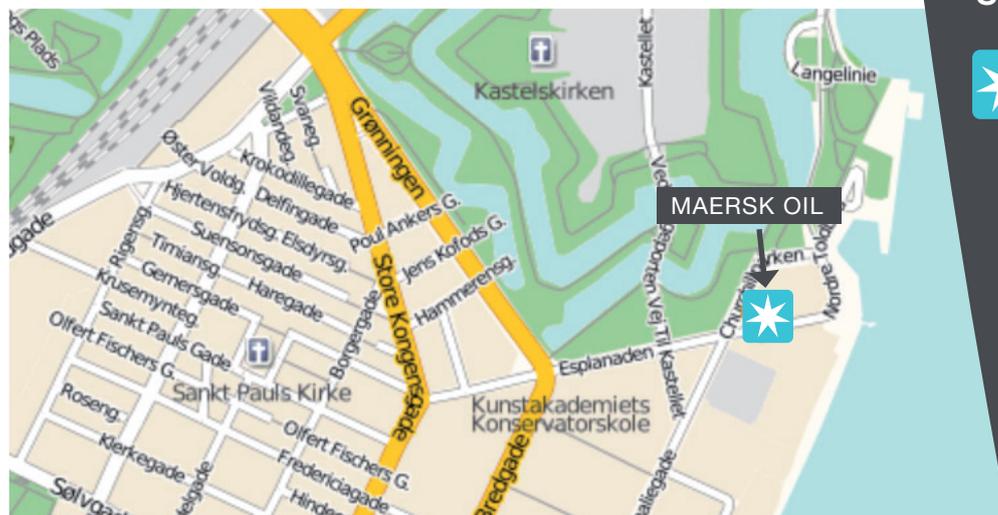


# ●● BIOGRAPHY.....



**Morten Stage, Maersk Oil**

Morten G Stage is a Development Director for Maersk Oil in the Global Production Development in Copenhagen. Morten has worked on Maersk Assets in Algeria, Brazil, Norway, Denmark and UK. Before joining Maersk, Morten was with Denmark based DONG Energy and GEO, where he focused on geomechanics and establishing a Technology and Innovation function. Morten has a background in Physics where received his PhD in 2001 from Chalmers Technical University in Sweden. ◀



### PROGRAMME

17:00 - 18:00

Drinks

18:00 - 19:00

Presentation and SPE News

19:00 - 21:00

Dinner

### LOCATION

Maersk Oil  
Esplanaden 50  
1263 København K

### SPEAKER

Donald Purvis, Consultant,  
SPE DL

### TOPIC

Cement Testing: Are we  
Looking at the Right Things  
the Wrong Way?

### DINNER SPEAKER

Morten Stage,  
Maersk Oil

### TOPIC

Culzean Project

### ENTRANCE FEE

None

### REGISTRATION

Please indicate your attendance  
by Friday 11 September 2015  
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<b>September 16</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC	<b>Cement Testing: Are we Looking at the Right Things the Wrong Way?</b>	Culzean Project
SPEAKER	Donald Purvis, Consultant, SPE DL	Morten Stage, Maersk Oil
LOCATION	Maersk	
SPONSOR	Maersk	
<b>October 6</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC	<b>DTU Research Projects</b>	Cross-Institutional Effort on the Oil and Gas Educations
SPEAKER	Farhad Varzandeh, Alay Arya and Amalia Halim	Martin P. Bendsøe, DTU
LOCATION	DTU	
SPONSOR	DTU	
<b>November 19</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC		
SPEAKER		
LOCATION	Shell	
SPONSOR	Shell	
<b>January 19</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC	<b>Bridging the Gap between Drilling and Completions: Challenges and Solutions in Horizontal Wells</b>	
SPEAKER	Mary Van Domelen, Continental Resources	
LOCATION	GEUS	
SPONSOR	GEUS	
<b>February 18</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC	<b>The Value of Assessing Uncertainty (What you Don't Know Can Hurt You)</b>	
SPEAKER	Duane McVay, Texas A&M	
LOCATION		
SPONSOR	Chevron	
<b>March 16</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC		
SPEAKER		
LOCATION	DONG, Gentofte	
SPONSOR	DONG	
<b>April</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC		
SPEAKER		
LOCATION		
SPONSOR		
<b>May</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC	<b>Chemical Water Conformance Treatment on South Arne</b>	Annual General Meeting
SPEAKER	Agustin Riccio Rodriguez	
LOCATION	Moltke's Palæ	
SPONSOR	Hess	
<b>June</b>	<b>MAIN SPEAKER</b>	<b>AFTER DINNER</b>
TOPIC	<b>SPE Summer party</b>	
SPEAKER		
LOCATION		
SPONSOR	Schlumberger	



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# MICROBIOLOGY HELPS

They are tiny and nasty. We struggle with them all our life. We kill them by antibiotics and biocides. This is difficult: some of these creatures manage to have nice lives under nearly boiling temperatures, at very high pressures and without oxygen. Moreover, they may form spores that survive almost everywhere and keep their individuality eventually forever; then, under favorable conditions, they wake up and start a new colony. A little bit of “junk food” and just a few molecules causing activation are enough for waking up. And if these are not available, bacteria are also capable of surviving by eating oil and “breathing” brine. Yes, some of them live underground in petroleum reservoirs.

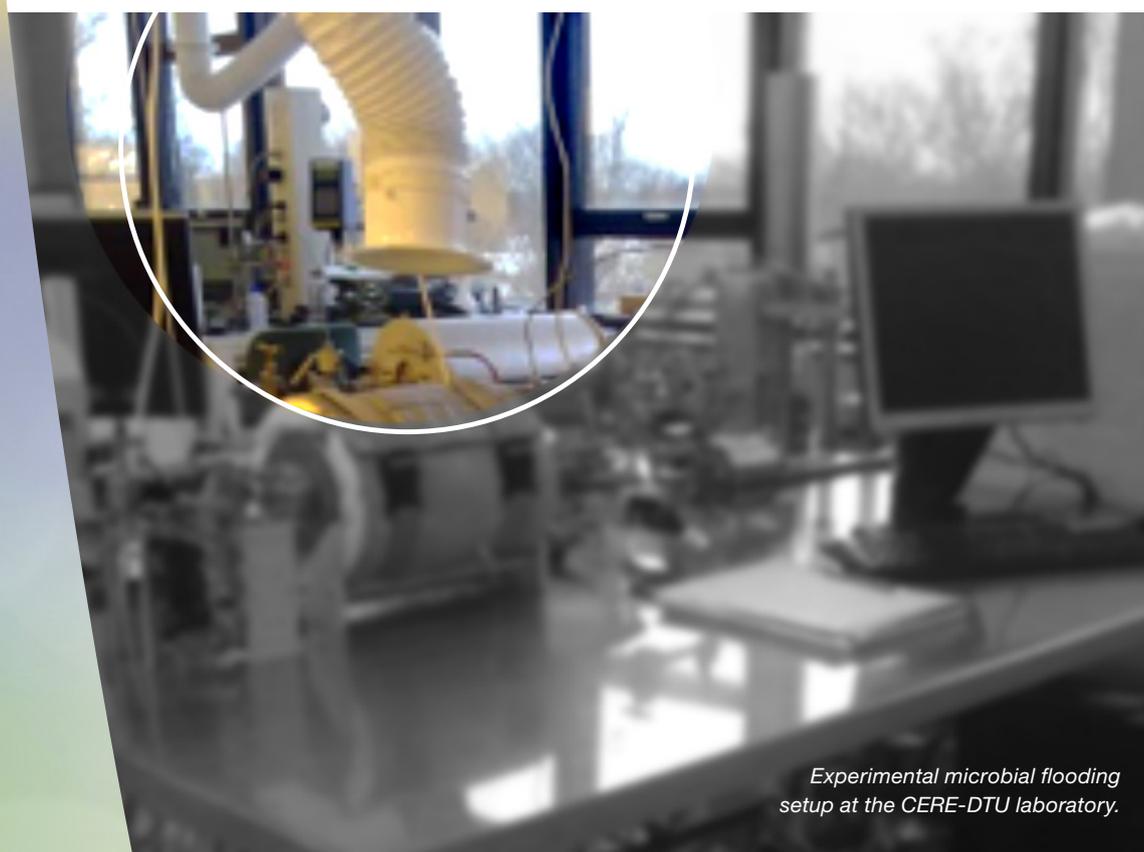
Around sixty years ago several people around the world asked the same question: if bacteria are already there, and if we cannot get rid of them, can we use them actively for oil production instead?

At Center for Energy Resources Engineering (CERE – DTU), Ph.D. student Amalia Halim is trying to answer this question, with regard to the petroleum reservoirs of the Danish sector of the North Sea. She is working with bacteria extracted by Russian scientists from a Chinese petroleum reservoir. This kind of bacteria is the most popular among petroleum microbiologists trying to enhance the oil recovery. The bacteria are inject-

ed into the chalk core plugs of a North Sea petroleum reservoir which has been flooded to such an extent that conventional waterflooding cannot produce any more oil.

It has turned out that the bacteria are able to penetrate deeply into the chalk rock, although their sizes are comparable to the sizes of the pores in chalk. The bacteria change their shapes, so that they can squeeze through the pores. And if this becomes impossible, they turn into spores, which are much smaller and can travel even further.

Smart injection of bacteria usually results in a few percent of additional oil recovery. The effect is considerably stronger in heterogeneous rock samples. This confirms that the main benefit of bacteria is plugging of the paths where it is easier for water to penetrate and go through the rock without additional oil production. Instead, water is redirected into the remaining oil bearing zones and displaces more oil. There are also additional positive effects of bacteria, like production of biosurfactants and gases, as well as formation of the water-oil emulsions. All these effects are studied in the thesis of A. Halim, where the problems of selecting the right nutrient and of competition between the injected and the reservoir bacteria are also discussed.



*Experimental microbial flooding setup at the CERE-DTU laboratory.*

# PRODUCE MORE OIL

If the bacteria cannot be injected directly, it might be possible to use proteins and enzymes extracted from them. Enzymes possess strong surface properties – that is why they are applied as a component in washing powders. There is a possibility that they may help in un-sticking oil from the internal rock surface and thus facilitate oil production. As follows from experiments of another Ph.D. student, Alsu Khusainova, it presently looks as if enzymes cannot do it alone, without other chemicals or particles.

The work of A. Halim and A. Khusainova has been carried out within the framework of the BioRec project, under supervision of A. Shapiro, S.M. Nielsen, A. Eliasson Lantz and J. Woodley. The project is sponsored by the Danish Advanced Technology Foundation and by the petroleum companies Maersk Oil and DONG E&P. Another partner is the biotechnological company Novozymes A/S, whose representatives actively participate in the problem formulation and all the ongoing discussions within the projects.



*Bacterias and spores.*

## SPE YP NEWS

### IS THERE A FUTURE FOR OIL AND GAS? 20TH OCTOBER, 17.00

The Young Professionals Section of SPE will be hosting an event on the 20th of October, 17.00 at a location to be decided. The meeting, which will be held in informal settings, will have Chresten Meulengracht speaking with the title: Is there a future for oil and gas?

Chresten Meulengracht has more than 25 years of experience with downstream and upstream facilities engineering and management of offshore projects, and economic evaluation of exploration opportunities. He has an MSc in chemical engineering and an MBA. He worked as a process engineer for Haldor Topsoe with pilot plant testing of new catalysts for synthetic fuels from natural gas and with redesigns of ammonia factories. Following this he joined Maersk Contractors where he participated in design and commissioning of FPSOs and finally became Operations Manager for FPSO activities. He then joined Maersk Oil as a Senior Facilities Engineer for development of exploration investment proposals based on stochastic economics. Finally he joined GeoKnowledge as a Technical Director specializing in probabilistic economics and fiscal modeling for exploration decisions. GeoKnowledge was acquired by Schlumberger Software Integrated Solutions in 2012 and today Chresten Meulengracht is a Principal Economic Consultant with SIS.

If you would like to participate in the event, please sign up by mail to [Mhansen4@slb.com](mailto:Mhansen4@slb.com) or go to the SPE Copenhagen website at [spe-cph.dk](http://spe-cph.dk).

**WE LOOK FORWARD TO SEEING YOU.**



## MODELING HPHT RESERVOIR FLUIDS WITH NON-CUBIC EQUATIONS OF STATE

High pressure, high temperature (HPHT) reservoirs are at the frontier of current oil and gas production. Development of these reservoirs requires accurate knowledge about rock and fluid properties at the extreme pressure and temperature conditions. Cubic equations of state are the classical models for properties of reservoir fluids but they are not suitable for fluid description over a wide temperature and pressure range. Non-cubic equations of state can in principle overcome such a limitation. We have performed a comprehensive comparison between two selected non-cubic and two classical cubic models in terms of pure component densities, vapor liquid equilibria, phase envelope calculation and PVT of reservoir fluids. For PVT calculation, a new fluid characterization method has been developed. For HPHT fluids, a peculiar phenomenon is the reserve Joule-Thomson effects, i.e. increase of temperature with depressurization of reservoir fluids. In this connection, the four models are also compared for calculation of Joule-Thomson coefficients. ◀



## ASPHALTENE PRECIPITATION ONSET CONDITIONS MODELLED BY THE CUBIC PLUS ASSOCIATION EQUATION OF STATE

Precipitation of high molecular weight asphaltenes is an important problem for oil production, flow assurance and refinery, for example, for miscible and immiscible gas flooding of a petroleum reservoir, or asphaltene deposition at oil refinery, when several crudes are mixed at the inlet facility. It is important to have a model capable of predicting the asphaltene precipitation onset conditions (pressure, temperature and composition); however such a prediction has been a challenge in the thermodynamic community. In the past few years researchers have started to apply association models, like Cubic Plus Association (CPA) equation of state, which has shown a potential to model asphaltene precipitation. In this work, we propose a simple modeling approach based on the CPA EoS, and provide a conceptual base for it. Different reservoir fluids have been studied in order to find out whether the model is capable of calculating the effect of (a) reservoir oil depressurization, (b) effect of the different injected gases, and (c) blending of different crude oils. A simple procedure to predict the asphaltene phase envelope for the reservoir oil based on relatively simple and few experimental data is proposed. ◀



## SPORE-FORMING BACTERIA FLOODING FOR ENHANCED OIL RECOVERY IN A CHALK RESERVOIR

The Microbial Enhanced Oil Recovery (MEOR) is studied as applied to chalk reservoirs. The present study focuses on core flooding experiments to see microbial plugging and its effect on oil recovery. A pressure-tapped core holder with three different pressure port reading along the core was used for this purpose. A spore-forming bacterium, *Bacillus licheniformis* 421, was used as it was shown to be a good MEOR candidate in a previous study. The bacterial spore can penetrate deeper into the chalk rock, squeezing through the pore throats. In our experiments, *B. licheniformis* 421, when injected in homogenous chalk cores as a tertiary oil recovery method, after synthetic seawater flooding, recovered additionally 1.0-2.3% original oil in place (OOIP). Additional recovery was much higher in heterogeneous chalk cores, as 6.9-8.8% OOIP was recovered. The pressure data confirmed that bacterial selective plugging played an important role in increasing the oil production from the heterogeneous chalk cores. Our findings showed potential application of bacteria as plugging agent in heterogeneous chalk cores to improve oil production. ◀



## CROSS-INSTITUTIONAL EFFORT ON THE OIL AND GAS EDUCATIONS

To secure qualified employees for the oil and gas industry in the decades to come Centre for Oil and Gas - DTU has initiated a major national initiative on the educational area. The initiative will focus on ongoing educational programmes outside the Centre, how they can be developed and how the Centre can contribute. The Centre's partner institutions (AAU, AU, GEUS, KU and other DTU departments) will be the primary focus, but other relevant educational institutions could also be included. The work is overlooked by a steering committee consisting of high level representatives from all partner institutions and carried out by a working committee, which has been given the task to deliver ideas for "quick-win" initiatives in November 2015 and later in the spring 2016 to deliver ideas on how to develop existing educational programmes according to industry needs and with increased contribution from the industry. New initiatives can include, but are not limited to, scholarships, talent programmes (e.g. tuition waivers), social events, guest lectures, summer schools, internships, student jobs, cases/data, joint degrees, and updated and recommended educational programmes. ◀

## Farhad Varzandeh, PhD student

Farhad Varzandeh graduated in 2011 with a M.Sc. in Chemical Engineering from Shiraz University, one of the leading universities in Iran. After graduation, he started working as a research assistant at the Enhanced Oil Recovery Research Center at Shiraz University where he worked on underground gas storage in an anticline in the south part of Iran. On August 2012, he joined National Iranian South Oil Company (NISOC) and worked as commissioning engineer of gas injection units for 1 year. Since December 2013, Farhad is a PhD student on Petroleum Engineering at CERE (DTU) working in the NextOil project on the modeling and phase behavior study of high pressure-high temperature (HP/HT) reservoir fluids using Non-cubic EoS. In this project, a combined effort of experimental studies and modeling work is carried out, with a focus on the uniqueness of the HP/HT reservoir fluids in the Danish part of the North Sea. ◀

## Alay Arya, PhD student

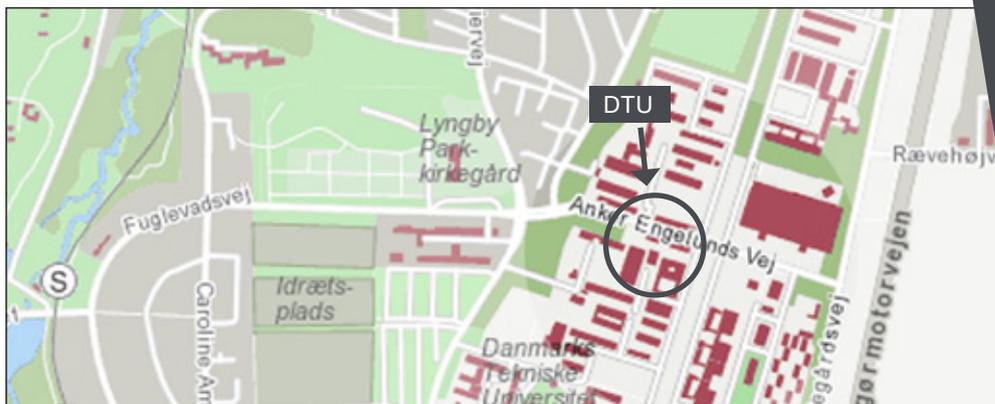
Alay Arya is doing his PhD on the subject of "Modeling of Asphaltene Systems using Association Models" at the Center for Energy Resources Engineering (CERE), Chemical and Biochemical Engineering Department, DTU. He has graduated with the Master of Technology degree in Chemical Engineering from the Indian Institute of Technology at Mumbai and started his career working as a process engineer on the Integrated Gasification Combined Cycle (IGCC) technology at General Electric in India (4 years) and on Liquefied Natural Gas (LNG) projects at Chiyoda Corporation in Japan (2 years). He is married to Niti Arya and they have one son. ◀

## Amalia Halim, Postdoc

Amalia Halim received a B.Sc. in Biology from Bandung Institute of Technology, Indonesia and an M.Phil in Chemistry from Curtin University, Australia. The M.Phil study was conducted at Curtin Corrosion Engineering Industry Centre and was fully funded by the Australian Development Scholarship. On June 2015, she finished her PhD at Center for Energy Resources Engineering (CERE), Department of Chemical and Biochemical Engineering, DTU. The topic of PhD was Application of Microorganisms for Enhanced Oil Recovery. She is currently working as a postdoc at Danish Hydrocarbon Research and Technology Center, DTU. ◀

## Martin P. Bendsøe, DTU

Professor Dr.techn, Dr.h.c. Martin P. Bendsøe. Senior Vice President and Dean, Graduate Studies and International at DTU. Chairman of the steering committee for the educational initiative at Centre for Oil and Gas – DTU. ◀



C O P E N H A G E N  
M E E T I N G  
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11

OCTOBER

## PROGRAMME

17:00 - 18:00

Drinks

18:00 - 19:00

Presentation and  
SPE News

19:00 - 21:00

Dinner

## LOCATION

DTU

Auditorium 101 B and  
DTU Faculty Club (dinner)  
Anker Engelundsvej 1  
2800 Kgs. Lyngby

## SPEAKERS

Farhad Varzandeh, Alay Arya  
and Amalia Halim,  
DTU

## TOPIC

DTU Research projects

## DINNER SPEAKER

Martin P. Bendsøe  
DTU

## TOPIC

Cross-Institutional Effort on the Oil and  
Gas Educations

## ENTRANCE FEE

None

## REGISTRATION

Please indicate your attendance  
by Thursday 1 October by signing up  
on the internet [www.spe-cph.dk](http://www.spe-cph.dk)

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