Volume 55
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November 2013

SOCIETY OF PETROLEUM ENGINEERS

SPE NEWS

COPENHAGEN SECTION

CONTENT

ENERGY SCENARIOS AND A CARBON FREE ECONOMY

The 2013-14 SPE season kicked off in style last month with two thought provoking lectures hosted by Shell, who are building quite a reputation for setting the scene by their choice of topics. Where last year's inaugural presentations were 'Putting the Energy Industry in Perspective' from a fossil fuel and HSE angle, this year's presentations focussed on broad future energy scenarios and a carbon free economy.

Shell's Wim Thomas entertained the crowd by walking through two 'what-if' new lens scenarios: a government orchestrated 'Mountain view' and a market driven 'Oceans view'. Fossil fuels feature prominently in both scenarios, and both assume growth in varying combinations of oil, gas, coal, nuclear and renewable energy sources for the benefit of the developed and developing world.

University of Copenhagen professor Katherine Richardson gave an absorbing speech about Denmark's road map for fossil fuel independence, a national goal of removing fossil fuels from its energy and transport sectors by 2050. This should allow similar rates of economic growth as a 'business as usual' scenario under the assumption that future fossil fuel costs will be the same as those of renewables. Implicitly the relatively low growth rates projected are expected to occur in combination with reduced demand thanks to greater energy efficiency.

Perhaps surprisingly neither addressed an alternative scenario combining the best elements of the two opposed views, which would be to reduce consumption through improved energy efficiency and benefit from (comparatively) low energy prices of fossil fuels. This wouldn't eliminate carbon emissions but it would help lift living standards of the poor as well as the affluent through economic growth. As responsible citizens we can all make a difference in this area by simple things such as improving our home's insulation, using public transport, thoughtful use of power appliances and reducing waste. Whatever one's view on sustainability is, these types of energy savings always make sense.

Hans Horikx,
SPE Copenhagen
Section Chairman

FUTURE MEETINGS

FOR MORE INFORMATION REGARDING THE PROGRAMME SEE PAGE 6

A program we still ADO

FORMALLY COMPLETED, THE SPIRIT OF CERE'S SUCCESSFUL PROGRAM ON ADVANCED METHODS FOR ENHANCED OIL RECOVERY LIVES ON IN SEVERAL APPLIED PROJECTS.

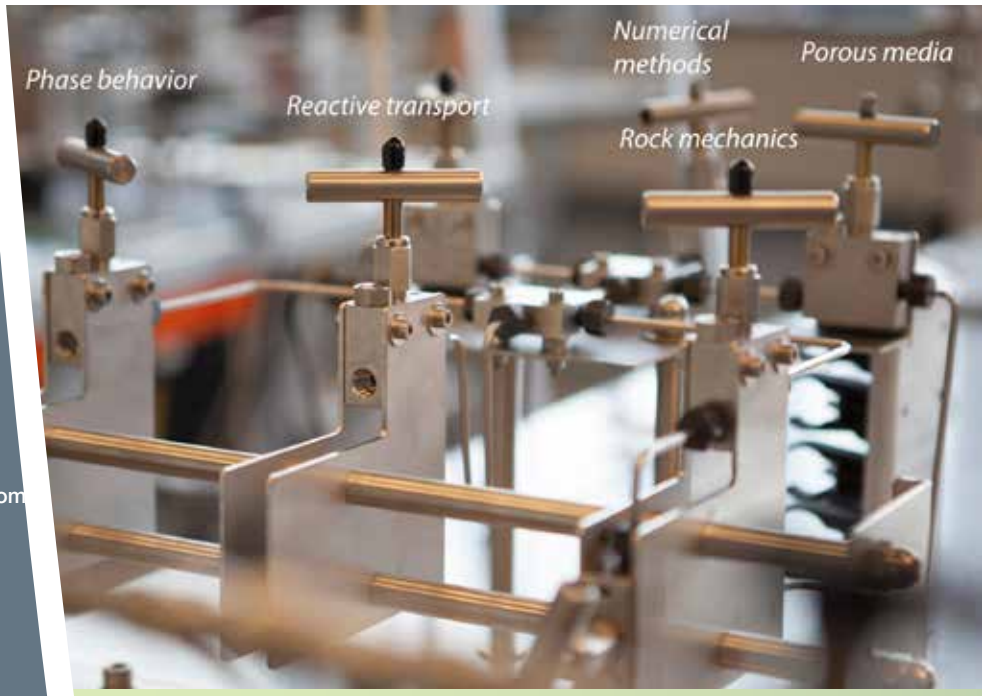
With an increasing global demand for oil and difficulties in finding new major oil fields the research in enhanced oil recovery is more needed today than ever. At Center for Energy Resources Engineering (DTU CERE) we are presently engaged in a number of joint industry projects in the field. Several of these have sprung from our Advanced Oil Recovery Methods (ADORE) program.

"While the program has just ended officially, it continues to be the cornerstone of our efforts in the field," says CERE Chairman Erling H. Stenby.

The ADORE program began in 2007 backed by a grant from the Danish Research Council for Technology and Production (FTP). Maersk Oil, and later DONG Energy, joined as partners and sponsors.

"We are grateful for the opportunity we were given by the FTP and the two industry participants in lifting the level of fundamental insight in this field. We will see the benefits in several academic and applied respects over the coming years," Erling H. Stenby comments pointing to the current BioRec and SmartWater programs.

Funded by the Danish Advanced Technology Foundation and industry partners Maersk Oil, DONG Energy, and Novozymes, BioRec addresses Biotechnology in Oil Recovery. The focus of SmartWater is novel techniques in water flooding – financing come from the Danish EUDP program (a program for development and demonstration of energy technology) and industry partners Maersk Oil and DONG Energy.



RE

"On top of these two high profile programs come several new projects in our pipeline. All these activities can largely be attributed to ADORE," says the CERE Chairman.

As the world's oil fields have an expected average recovery rate of less than 50 % the relevance of the efforts is easy to understand. Further, the challenge is even larger in respect to Danish chalk reservoirs where the expected average recovery is less than 30 %.

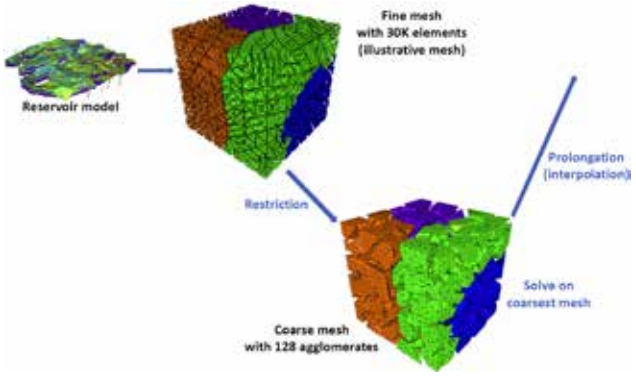
ADORE differed from many other EOR research programs as it was not focussed on one or even a few possible methods, but rather on a comprehensive approach to raising our fundamental understanding of EOR processes. The program encompasses five generic focus areas – Reactive Transport, Phase Behavior, Flow in Porous Media, Rock Mechanics and Numerical Methods – with the common objective of producing research that will ultimately help adding to recoverable hydrocarbon reserves via novel or improved EOR methodologies.

Beside the many academic results obtained in ADORE, the program has educated six PhD's: Sara Sandersen, Sidsel Marie Nielsen, Xuan Zhang, Adeel Zahid, Carsten Völcker, and Andrea Capolei. "All these talented young scientists are now engaged either here at DTU or in the industry," Erling H. Stenby notes. "I am confident that both they, our PostDoc's, and Master Students who have been active in ADORE will continue to be visible to the SPE community, just as will the academic results from this significant program." ◄

ABSTRACT

Algebraic Multilevel solvers for Reservoir Simulation

The presentation will focus on novel algebraic multilevel solvers applied to reservoir simulation. The purpose of the work is to enable fast time-to-solution and large-scale simulation on modern massively parallel computers. These developments are fundamental to improve engineering analysis in next-generation reservoir simulation tools. The objective is to design a scalable parallel solver with mesh-independent convergence for unstructured grids. The numerical challenges in reservoir simulation include highly discontinuous coefficients, strong anisotropies, high nonlinearity, bad cell aspect ratios and mixed near-hyperbolic/elliptic characteristics. In a first step, we have implemented a novel multilevel solver, which is based on information given by a Mixed Finite Element discretization. This approach provides a flexible framework for higher-order discretizations. Furthermore, as a comparison, we have implemented a solver based on the Auxiliary Space Algebraic Multigrid method. Numerical tests demonstrate mesh-independent convergence for both solvers, meaning time-to-solution will scale linearly with problem size. We will discuss prospects of further developing the algorithms for parallel execution on modern hardware. ◄



BIOGRAPHY

Max La Cour Christensen, Ph.D. Student, DTU Compute

Max has a background from DTU with a Master's degree in Mathematical Modelling and Computation. His Master's thesis, for which he won the DANSIS Graduate Prize of 2013, was carried out together with Schlumberger in the UK and DTU Compute.

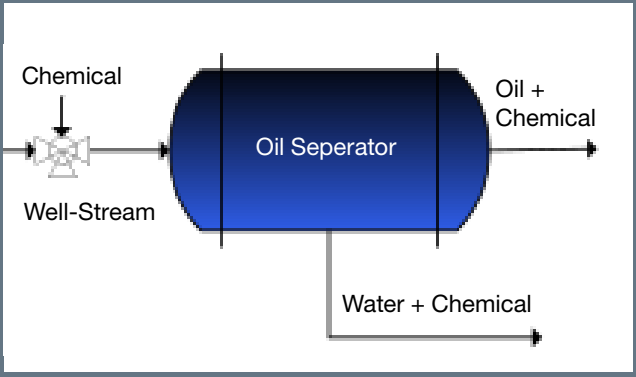
He is currently enrolled at DTU as an Industrial PhD student with Lloyd's Register Consulting, where his research focuses on solvers for the partial differential equations governing flow of fluids in the subsurface. His research is carried out in close collaboration with Center for Applied Scientific Computing at Lawrence Livermore National Laboratory in California, where he spent this summer. ◄

ABSTRACT

Measurement and Modeling of phase equilibrium of oil systems with polar chemicals

As the exploitable oil resources decrease, more advanced recovery methods are employed in the oil industry. This has led to an increase in used chemicals, in order to ensure a constant and safe production. These chemicals have many applications, and are part of different families like alcohols, glycols, alkanolamines etc.

Due to rising demands from environmental agencies and a wish for a more refined product, it is becoming increasingly important for downstream processing to know/predict the solubility of oil and gas with different complex chemicals. The objective of this work is to further develop the CPA equation of state for use in calculation of solubility between oil and polar chemicals. ◄



BIOGRAPHY

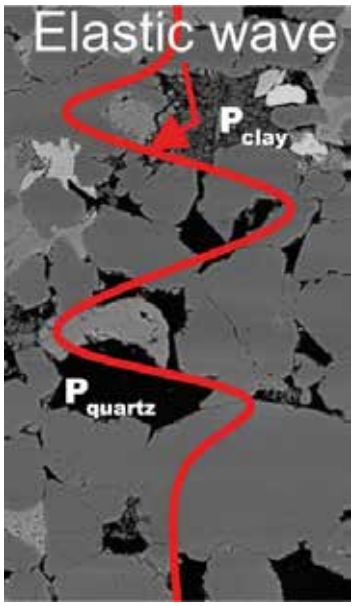
Michael Frost, Ph.D. Student, Center for Energy Resources Engineering (CERE), DTU Chemical and Biochemical Engineering

Michael Frost is doing a Ph.D. at the Center for Energy and Resources Engineering (CERE), Technical University of Denmark. The study finishes at summer 2014. He has obtained a Master degree in Chemical Engineering, and has worked closely with St atoil during both Master and Ph.D. studies. The work is focused on development of an equation of state, to be used for modeling of reservoir fluids with production chemicals. ◄

ABSTRACT

CORRECTING SONIC LOGS FOR INVASION

Sonic logs measure the travel time of elastic waves in a region close to the borehole. In this region the original fluid have typically been replaced by mud-filtrate causing the measured travel times to differ from those of the undisturbed formation. In order to get the travel times in the undisturbed formation, the measured log needs to be corrected. The fluid contribution to the travel times can be routinely quantified when the fluids are allowed to move freely in the entire porosity. Data measured in our laboratory shows, however, that pore-filling clays may conspire to complicate matters. The question addressed is just how difficult clays are and what can be done about it.a solver based on the Auxiliary Space Algebraic Multigrid method. Numerical tests demonstrate mesh-independent convergence for both solvers, meaning time-to-solution will scale linearly with problem size. We will discuss prospects of further developing the algorithms for parallel execution on modern hardware. ◄



BIOGRAPHY

Morten Kanne Sørensen, Ph.D. Student, Center for Energy Resources Engineering (CERE), DTU Civil Engineering

Morten Kanne received a B.Sc. in physics from Aarhus University and a M.Sc in geophysics from Copenhagen University. He is currently a Ph.D student with Ida Fabricius at the Department of Civil Engineering at DTU and Center for Energy Resources Engineering - CERE. The topic of his Ph.D is the effects of mud-filtrate invasion on acoustic velocities measured by down-hole sonic logging. ◄

ABSTRACT

CERE – A Succes Story of University–Industry Collaboration

For more than 30 years a successful center at DTU has carried out state-of-the-art research in close collaboration with the international petroleum industry. This activity has grown in size and scope over the years. Starting from a narrow focus on phase behavior at one DTU department to the current situation where activities at five departments cover PVT, reservoir engineering, EOR, process engineering, flow assurance, rock physics, rock mechanics, geophysics, uncertainty quantification, optimization, control and more. This talk will give you an insight or update of the current activities and future plans. ◄

ABSTRACT

Professor Erling H. Stenby, Chairman of Center for Energy Resources Engineering (CERE) & Head of Department DTU Chemistry

Erling H. Stenby holds a MSc and a PhD in Chemical Engineering from DTU. Since 1996 he has been a Professor of Applied Thermodynamics at DTU, and his research has mainly focused on various aspects of petroleum technology, in particular EOR. He has supervised 50 PhD students and co-authored more than 150 peer reviewed scientific papers. Besides being the Head of Department at DTU Chemistry he is leading the Center for Energy Resources Engineering that involves several departments at DTU. ◄

COPENHAGEN
MEETING
TUESDAY 26 NOVEMBER 2013

NOVEMBER

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
Max La Cour Christensen,
Michael Frost and Morten Kanne Sørensen PhD students, DTU

TOPIC
Algebraic Multilevel solvers for Reservoir Simulation, Measurement and Modeling of phase equilibrium of oil systems with polar chemicals and Correcting sonic logs for invasion

DINNER SPEAKER
Erling H. Stenby, Professor, DTU

TOPIC
CERE – A Succes Story of University–Industry Collaboration

ENTRANCE FEE
None

REGISTRATION
Please indicate your attendance by Wednesday 20 November by signing up on the internet www.spe-cph.cere.dk

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SPE MEETING SCHEDULE 2013-2014

September 16	MAIN SPEAKER	AFTER DINNER
TOPIC	**New Lens Scenarios**	Denmark; Fossil free in 2050? Prof. Katherine Richardson, Univ. of Copenhagen
SPEAKER	Wim Thomas, Chief Energy Advisor, Shell	
LOCATION	Shell Mikado House	
SPONSOR	SHELL	
October 28	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Fluid Profiling - A Modern Technique for Reservoir Characterization**	
SPEAKER	Michael O'Keefe - SPE DL (Schlumberger)	
LOCATION	GEUS	
SPONSOR	GEUS	
November 26	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**DTU Research Projects**	CERE – A Succes Story of University–Industry Collaboration Professor Erling H. Stenby
SPEAKER	PhD students, DTU	
LOCATION	DTU	
SPONSOR	DTU	
January 27	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Hydraulic Fracturing Myths, Reality and Environmental Stewardship through Better Chemistry**	Unconventional Resources Gavin Lewis, Geoscience Team Leader - Chevron Onshore Europe
SPEAKER	Daniel J. Daulton - SPE DL (Baker Hughes)	
LOCATION	Charlottehaven	
SPONSOR	Chevron	
February 19	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Development of Mature Oil Fields: Enhanced Oil Recovery Option**	
SPEAKER	Tayfun Babadagli - SPE DL (University of Alberta)	
LOCATION	Admiral Hotel	
SPONSOR	Welltec	
March	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Halfdan 4-D Seismic**	
SPEAKER		
LOCATION	Maersk	
SPONSOR	Maersk	
April	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**South Arne Development - Hess**	
SPEAKER		
LOCATION		
SPONSOR	Hess	
May 20	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Optimization of water injection and gas lift on the South Arne field using streamline simulation**	Annual General Meeting
SPEAKER	Kent Johansen. DONG E&P	
LOCATION	DONG	
SPONSOR	DONG	
June	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**SPE Summerparty**	
SPEAKER		
LOCATION		
SPONSOR	Schlumberger	

CHANGES WITHIN THE COPENHAGEN SPE BOARD

As an appropriate reflection of the dynamism within our industry several board members have nominated replacements for their roles on the board, as they are moving on to different positions or have other commitments.

Kjell Mundheim (Shell) is taking up a new role, and has nominated Ken Wesnaes (Shell) as the new Secretary of the Board. Alsu Khusainova (DTU) is starting maternity leave and has nominated Amalia Halim (DTU) as interim SPE Student representative. Carsten Moller Nielsen (GEUS) is being replaced by John Zuta (GEUS) as SPE Membership chairman. Also recently joining the board are Anthony Hughes (Chevron) and Bill Ginty (DONG).

Thanks go to all who served on the board, in particular Kjell who tirelessly produced minutes of every board meeting and Carsten who ensured all (paying) members received newsletters and invitations to events organised by the SPE Copenhagen chapter. The new board members are warmly welcomed to start their service as volunteers.

GORGON PR

Overview

The Chevron-operated Gorgon Project is one of the world's largest natural gas projects and the largest single resource development in Australia's history.

The Project is being constructed on Barrow Island, around 60 kilometres off the northwest coast of Western Australia. It includes a three-train, 15.6 million tonnes per annum (MTPA) liquefied natural gas (LNG) facility and a domestic gas plant with the capacity to provide 300 terajoules of gas per day to Western Australia.

The first LNG cargo is due to be loaded in the first quarter 2015. Domestic gas is due to be delivered to the market in 2015.

The Gorgon Joint Venture Participants are progressing with plans for an expansion of the Project with a fourth LNG train.

Project Participants

The Gorgon Project is operated by an Australian subsidiary of Chevron (47.3 percent interest), in joint venture with the Australian subsidiaries of ExxonMobil (25 percent), Shell (25 percent), Osaka Gas (1.25 percent), Tokyo Gas (1 percent) and Chubu Electric Power (0.417 percent).

Upstream – Offshore Wells & Facilities

The Upstream scope of the Project includes:

- Drilling eight high-rate, big-bore development wells at the Gorgon field, and ten at the Janszlo field.
- A subsea gas gathering system and subsea pipelines that will deliver gas from the Gorgon and Jansz-lo fields, located between 65 and 130 kilometres respectively off the west coast of Barrow Island.
- Pipelines that run from the shore crossing on the west coast of Barrow Island across to the east coast, where they tie into the gas treatment plant.
- A domestic gas pipeline that runs more than 90 kilometres from Barrow Island to the Western Australian mainland where it will tie-in to the existing Dampier to Bunbury Natural Gas Pipeline.

Downstream – Onshore Facilities

- A three-train, 15.6 MTPA LNG processing plant.
- Domestic gas processing plant.
- LNG and condensate storage.
- Marine facilities including a 2.1 kilometre Materials Offloading Facility (MOF) and 2.1 kilometre long LNG jetty.
- Operations and maintenance buildings.
- Workforce accommodation village and associated infrastructure.

Carbon Dioxide Injection Program

The Gorgon Joint Venture Participants are investing approximately $2 billion in the design and construction of the world's largest commercial-scale CO_2 injection facility to reduce the Project's overall greenhouse gas emissions by between 3.4 and 4.1 million tonnes per year.

The Australian Government has committed $60 million to the Gorgon Carbon Dioxide Injection Project as part of the Low Emissions Technology Demonstration Fund.

LNG Sales and Marketing

The Gorgon Joint Venture Participants have signed a number of sales agreements to market LNG in key customer countries and have adopted a flexible and innovative marketing approach where each participant secures markets for its share of gas.

Domestic Gas Sales

In November 2011, long term contracts were announced with Western Australia's largest energy retailer, Synergy and the State's leading energy generator, Verve Energy for a combined 125 terajoules per day for 20 years commencing in 2015.

OJECT

Gorgon Project Snapshot

- Annual production of 15.6 million tonnes of LNG and 300 terajoules of domestic gas per day
- On track to spend $30 billion on Australian goods and services during the construction phase of the Project
- About $40 billion to the Australian Government's revenue*
- About $64 billion to Australia's Gross Domestic Product*

**According to independent research group ACIL Tasman (based on 30 years of operations and an annual production of 15 million tonnes of LNG).*

Local Benefits

The Gorgon Project will be an important pillar of the Australian economy for decades to come. Already the Project has:

- Committed more than $20 billion to Australian goods and services, with approximately 90 percent of this flowing to Western Australia.
- Generated more than 10,000 jobs in Australia through the Gorgon Project and its contractors, this includes around 6,000 people working on and around Barrow Island.

Environmental Stewardship

Barrow Island has been a Class A Nature Reserve since 1910. The Gorgon Project is being undertaken in accordance with strict environmental standards to preserve the island's ecology.

Central to the Gorgon Project's commitment to protect the conservation values of Barrow Island is the Quarantine Management System (QMS), which directs the Project's quarantine operations. The QMS is the largest non-government quarantine initiative in the world and was considered to be "likely world's best practice" by the Western Australian Environmental Protection Authority.

The Project's gas processing facilities are being constructed within a 300 hectare ground disturbance limit, which represents 1.3 percent of Barrow Island's uncleared land area.

Where does the name Gorgon come from?

The origin of the Gorgon Project's name can be traced back to a ship named the SS Gorgon.

The SS Gorgon (and its 1933 replacement the MV Gorgon) carried passengers, general cargo, sheep, wool and cattle from Perth to Singapore from 1918 through to the 1960s.

During one of the SS Gorgon's voyages, a navigation hazard was located between Onslow and Thevenard Island. The hazard, a gravel patch, came to be known as the "Gorgon Patch". The nearby Gorgon field was subsequently named after this geological feature.

Gorgon Project Plant Site (February 2013)

For more information on the Gorgon Project:

Visit our website
www.chevronaustralia.com/ourbusiness/gorgon

Email
gorgon.info@chevron.com

ABSTRACT

Hydraulic Fracturing Myths, Reality, and Environmental Stewardship through BETTER CHEMISTRY

Education is the secret to overcoming preconceived notions, prejudice, and a general lack of knowledge. Oil and gas companies must demonstrate their commitment to responsibly developing and supplying energy by sharing their technical accomplishments, concerns for environmental stewardship, and processes for continuous improvement. This lecture will address common concerns encountered during routine completion and stimulation operations of oil and gas wells, focusing primarily on hydraulic fracturing fluid chemistries. Key topics are (1) responsible oil and gas development beginning with proper well construction and zonal isolation, (2) continued chemical development with a focus on reducing environmental, human, and physical hazards, and (3) the importance of education and openness to the oil and gas industry and public perception. ◄

BIOGRAPHY

Dan Daulton, Baker Hughes SPE DL

Dan Daulton is the director of environmental conformity for the production enhancement and pressure pumping product line at Baker Hughes. He earned a BS in earth sciences from Northwest Missouri State University and has 34 years of experience in the energy industry. ◄

ABSTRACT

A TALK
by Gavin Lewis on Unconventional Resources

BIOGRAPHY

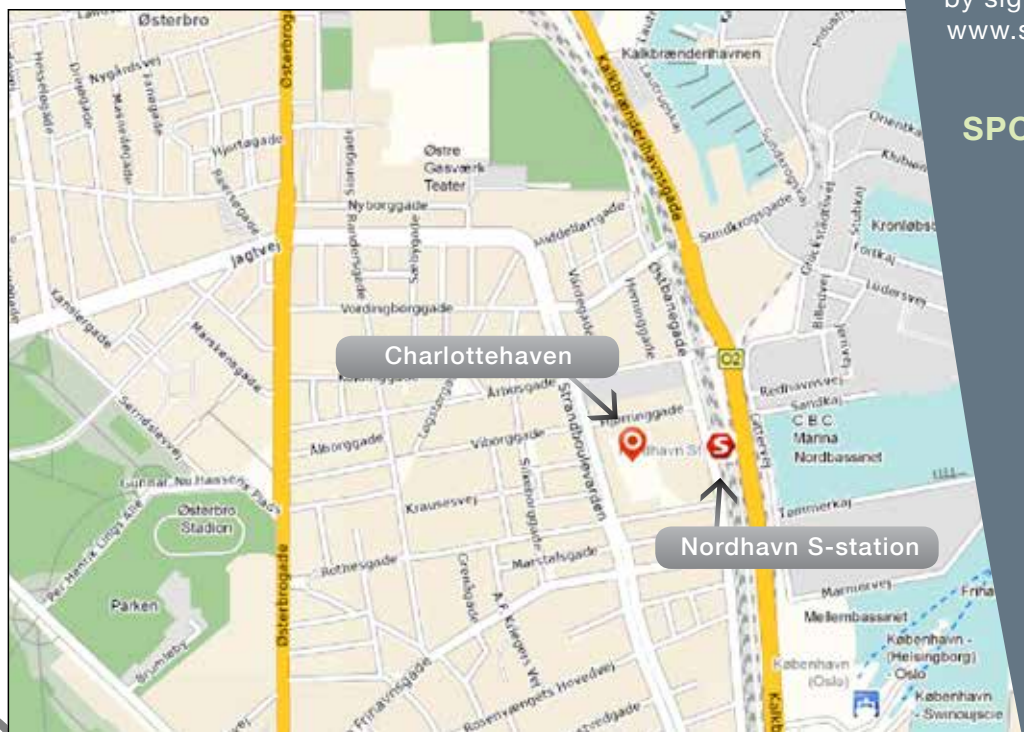
Gavin Lewis, Chevron Onshore Europe

Brief Career history:
BSc Geology at Imperial College, London 1993,

PhD University of London 1997

Joined Chevron in 1998 in London, license management West of Shetland

2001 - 2003	Exploration projects in Norwegian Sea
2003 – 2005	Regional team leader Norway
2005 – 2007	Structural Specialist Gulf of Mexico
2007 – 2009	Portfolio Team Leader Deepwater Gulf of Mexico
2009 – 2011	Global Exploration New Ventures Manager Europe, responsible for building European unconventional portfolio
2011 – 2013	Romania Subsurface Team Leader
2013 – present	Gas Play Geoscience Team Leader, Chevron Upstream Europe, Aberdeeen ◄



COPENHAGEN MEETING
MONDAY 27 JANUARY 2014

JANUARY

PROGRAMME
17:00 - 18:00
Drinks

18:00 - 19:00
Presentation and SPE News

19:00 - 21:00
Dinner

LOCATION
Charlottehaven
Hjørringgade 12C
2100 Copenhagen

SPEAKER
Daniel J. Daulton,
Baker Hughes SPE DL

TOPIC
Hydraulic Fracturing Myths, Reality and Environmental Stewardship through Better Chemistry

DINNER SPEAKER
Gavin Lewis
Chevron Onshore Europe

TOPIC
Unconventional ressources

ENTRANCE FEE
None

REGISTRATION
Please indicate your attendance by Thursday 23 January by signing up on the internet www.spe-cph.cere.dk

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