Volume 56
Number 28
February 2014

SOCIETY OF PETROLEUM ENGINEERS

SPE NEWS

COPENHAGEN SECTION

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FUTURE MEETINGS

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A HAPPY NEW YEAR TO ALL!

What are your New Year's resolutions for 2014? Give up smoking, read more perhaps, do more exercise or eat less? Many years ago I resolved not to bother with New Year's resolutions, and I've stuck with it ever since. But this year is different as gradually a worthwhile cause has appeared. No, it isn't about becoming a blood or organ donor, or improving safety awareness – that has already become a norm. No, my New Year's resolution is about developing more effective and efficient energy habits. It'll be a reconsideration of personal transport, heating, food and electricity choices on a path to lower energy use at home and while on travel in 2014. Incidentally, this is expected to not just be environmentally friendly but also to lead to lower costs, which is a great incentive!

Despite our industry's best efforts fossil energy is a finite and increasingly scarce commodity, so energy efficiency makes good sense. There have been phenomenal advances in energy efficiency across the board, for instance in transportation, with airplanes being twice as efficient as in the 80s and even three times more efficient than in the 70s, which now makes air travel more ecologically responsible than long-distance travel by car (although trains easily beat both). Also, continuous improvement of building insulation standards is reducing heating costs, and energy-efficient shipping allows food to be imported at low cost from the most prolific production areas.

We all are able to make personal choices to reduce our energy footprint in these areas, but an area that is even easier to get a grip on, and one that is subject to more tax incentives than anything else in order to diminish consumption, is electricity. This might not be top of your list of concerns for 2014 but a true revolution of lighting technology with highly efficient LED bulbs in all shapes and colours is taking place, making it quite attractive to finally replace those hot halogen and incandescent lamps that riddle our houses by lamps that consume a cool factor eight less power. It is just a small step in the bigger energy consumption picture, but it illustrates how ongoing technological progress can impact our daily life right into our house... why, even into our bedroom! Before moving on to the more Petroleum Engineering oriented topics in this newsletter, why not give this modest New Year's resolution a thought?

Hans Horikx,
SPE Copenhagen
Section Chairman

Challenging the conv
SAFER, EFFICIE
to downhole mechan

By Christian Krüger, Welltec

Starting out as the disruptive newcomer to the O&G industry in the mid-90s, Welltec® has continuously challenged conventional intervention methods through introduction of new tools and methodologies. The driving philosophy has always been a dedication to solving the operators' challenges through simplicity and responsiveness and through breaking down the barriers of conventional thinking.

By designing intervention solutions based on e-line technologies, the company has diminished the need for explosives, chemicals and heavy equipment. E-line technology offers lightweight alternatives with subsequent HSE improvements and lower risks of deferred production as a result of accidents and wellbore damages.

Today, a wide range of mechanical interventions can be performed, including setting and pulling plugs and packers, opening and closing valves, shifting sleeves, and deploying and retrieving gas lift valves. Lately, drill pipe and casing recovery operations have been added to the repertoire.

In addition, it is a piece of the puzzle to solving one of the North Sea industry's biggest up-coming challenges – well maturation – as it offers a cost-efficient solution to P&A activities.

Case story – Pipe Cutting Operations and Removal of Packer in Russia

In late 2012, the first job with a pioneering, mechanical cutting tool was performed offshore Russia on 4-1/2 in. 12.6 #/ft tubing in a 57° deviated well at a depth in excess of +2,100 m. Such cut can be accomplished with the pipe in tension or compression; however, in this case it was neutral. Total operating time was ca. six hours with actual cutting time significantly less. As the tool uses a self-centralizing rotating head that removes the pipe incrementally preventing the creation of shavings, it leaves a smooth, beveled cut ready for fishing. Hence, the operator saved substantial rig time by not having to polish the cut prior to fishing it out of the well and quoted the e-line cutting tool as providing the 'perfect cut' because there was no flaring or irregularities in the cut.

Case story – Pipe Cutting in ERD Wells Under Compression

Recently the cutting tool was chosen to reduce rig time during workover operations in four ERD wells in the Middle East. Prior to a tubing change-out campaign, the 4-1/2 in. tubing of these highly deviated wells needed to be cut and pulled. A system integration test proved that the grinding face of the cutter could cut the pipe in compression; in the test it took just 36 minutes.

entional to create NT APPROACHES ical manipulation

On location six successful, rigless cuts were made in the four wells without needing to put the pipe in neutral weight or tension. The amount of compression at the cutting depth was unknown, but at least 10,000 lbs, as per the packer setting procedures.

Case story – Removal and Replacement of Three GLVs Using a Kick-Over Tool

When a tubing-to-A-annulus leak was discovered in a producer well, a North Sea operator needed to stop the leak by displacing the A-annulus to brine and install three GLV's in the three side pocket mandrels. Using an e-line tractor for conveyance, a hydraulic stroking tool for pulling force and a KOT the three GLVs were successfully replaced in six runs.

Case story – World's First Thru-tubing ESP Swap on E-line

An operator needed to retrieve a number of electric submersible pumps (ESP's) from highly deviated wells. The remote location made mobilization of large equipment logistically challenging and thus ideal for lightweight technologies. For the operation an e-line clean-out tool removed potential debris. Then an e-line tractor, hydraulic stroking tool, release device and a GS pulling tool retrieved the tubing stop and pump. Swapping the pulling tool for a fishing tool overshot, the same toolstring recovered the pump eye insert. The replacement ESP was installed using the same tools and technique in reverse order.

Case story – RLWI Crown Plug Pulling

Today, crown plug pulling can also be done on e-line as a RLWI. The world's first operation was performed in the Gulf of Mexico where the upper crown plug had gotten stuck. After two days of slickline jarring the operator changed to a stroking tool run on e-line due to its ability to apply up to 60,000 lbs axial force downhole. This proofed enough to pull the plug and retrieve it to surface, allowing the planned well intervention to continue without further non-productive time. ◄

FOTOS: Welltec®

ABSTRACT

Development of Mature Oil Fields: Enhanced Oil Recovery Option

With the decrease in the possibility of discovering new giant oil fields, mature fields become critically important for meeting future oil demands. Special attention is required for identifying the proper diagnostic techniques to determine the reason for and the location of the unrecovered oil and prudential reservoir management techniques for economically viable redevelopment applications. In this lecture, after discussing the methods to estimate the amount and location of the residual oil, attention will be given to the most widely applied enhanced oil recovery methods to develop mature fields—primarily chemical and immiscible/miscible gas injection. After reviewing mid- and late-stage development options using these methods, proper reservoir management strategies for different size companies will be discussed. ◄

BIOGRAPHY

Tayfun Babadagli, Professor of Petroleum Engineering, University of Alberta

Tayfun Babadagli is a professor of petroleum engineering at the University of Alberta where he is a senior chair holder of Unconventional Oil Recovery in the Natural Sciences and Engineering Research Council of Canada. He earned BS and MS degrees from Istanbul Technical University and MS and PhD degrees from the University of Southern California. Babadagli is the executive editor of SPE Reservoir Evaluation & Engineering. ◄

Celebrating 30 years

SPE International

ABSTRACT

A New, Safer Development in Pipe Recovery

Time and cost savings are always of the essence and the industry is constantly searching for optimized processes and innovative technologies to accomplish this goal. Welltec has invented a tool to improve safety, efficiency as well as costs on pipe cutting operations. With this new technology run on e-line for accurate depth control it is possible to perform drill pipe and casing recovery operations without explosives or chemicals. This represents a significant improvement in HSE as well as operational efficiency, logistics and on-site storage. The tool uses a self-centralizing rotating head to remove pipe incrementally, which prevents the creation of shavings and leaves only a smooth, beveled cut ready for fishing.

The after dinner presentation will present the advantages of this new and safer way of performing pipe recovery operations through several case stories from around the world. ◄

FOTO: Welltec®

BIOGRAPHY

Christian Krüger, VP for Well Intervention, Welltec

Christian Krüger is the VP for Well Intervention Solutions at Welltec®. Based in Denmark, he has responsibility for optimizing Welltec® intervention solutions offerings. He has been with Welltec® since 1999. Prior to that, he was 11 years with Schlumberger with the last position being Drilling Services Manager for West Venezuela where he was responsible for the Anadrill service line. Previous to that he was LWD Business Development manager for Latin America for three years after seven years of different field and sales positions with wireline. ◄

COPENHAGEN MEETING

WEDNESDAY 19 FEBRUARY 2014

FEBRUARY

PROGRAMME

17:00 - 18:00
Drinks

18:00 - 19:00
Presentation and SPE News

19:00 - 21:00
Dinner

LOCATION

Admiral Hotel
Toldbodgade 24 – 28
1253 København

SPEAKER

Tayfun Babadagli
Professor of Petroleum Engineering,
University of Alberta

TOPIC

Development of Mature Oil Fields:
Enhanced Oil Recovery Option

DINNER SPEAKER

Christian Krüger
VP for Well Intervention, Welltec

TOPIC

A New, Safer Development in Pipe Recovery

ENTRANCE FEE

None

REGISTRATION

Please indicate your attendance by Monday 17 February 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**	A New, Safer Development in Pipe Recovery Christian Krüger - Welltec
SPEAKER	Tayfun Babadagli - SPE DL (University of Alberta)	
LOCATION	Admiral Hotel	
SPONSOR	Welltec	
April 3	**MAIN SPEAKER** SPE PRESIDENT VISIT	**AFTER DINNER**
TOPIC	**Using 4D Seismic in the Halfdan Field to Close the Loop and Define New Opportunities**	Memories of 30 years of SPE Copenhagen Former Section Chairpersons
SPEAKER	Monica Calvert - Maersk Oil	
LOCATION	Maersk - Esplanaden	
SPONSOR	Maersk Oil	
April 23	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**South Arne Development - Hess**	
SPEAKER	Toby Wood & Andreas Høie - Hess	
LOCATION	TBC	
SPONSOR	Hess	
May 19	**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 - Gentofte	
SPONSOR	DONG	
June	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**SPE Summerparty**	
SPEAKER		
LOCATION		
SPONSOR	Schlumberger	

SPE MEMBERSHIP DUES

As of today, only 278 of 450 registered members have renewed their membership dues for 2014. **PLEASE REMEMBER TO PAY FOR THE SPE MEMBERSHIP FOR 2014, AND ALSO REMEMBER TO UP-DATE MEMBERSHIP DETAILS AT SPE.ORG**, so as to receive the Copenhagen Section Newsletter and corresponding e-mails if based in Copenhagen/Denmark or otherwise interested in the section activities.

FOOT ON THE

Maersk Oil's important and technically challenging Culzean gas project on the UK continental shelf is successfully navigating the project maturation process and is on track to potentially deliver first gas within its target envelope. Culzean is one of Maersk Oil's most significant projects and the field will be its first operated High Pressure, High Temperature (HPHT) gas development.

At a spot beneath the North Sea, almost equidistant between Denmark and the UK, a major gas field, capable of producing up to around five per cent of the UK's domestic needs, awaits development.

For the team at Maersk Oil UK's Aberdeen headquarters this is a particularly exciting opportunity.

"As well as being an important energy and revenue provider to the UK, there is no doubt that Culzean is a key component of Maersk Oil UK's contribution towards the 2020 ambition of 400,000 barrels of oil equivalent each day entitlement production. With first gas expected before the turn of the decade, there's no shortage of focus on moving Culzean forward" commented Martin Rune Pedersen, Managing Director of Maersk Oil UK.

"To take the development forward we are actively recruiting to grow the team. The fact that Culzean has a high probability of maturation success is proving very attractive to both internal and external industry professionals."

Martin Urquhart, Culzean Project Director, Maersk Oil UK

As operator of the field, and in conjunction with its stakeholder partners, the team in Aberdeen is eager to see this technically challenging high-pressure and high temperature gas field live up to high expectations.

In Culzean, the subsurface conditions are complex, the pressure is around three times as great as an ordinary reservoir, and the temperature will be around 170 degrees Celsius. This combination of factors impacts the design and evaluation of the subsurface, the wells, creates significant drilling challenges and ultimately tests the design of the surface production facilities.

"The main challenge for the team is that all the solutions typically employed to mitigate the various development risks at normal pressures and temperatures are being pushed to the limit of what the supply chain can provide in order to cope with the high pressure and high temperature environment," he says.

"It is at a very exciting point in the development cycle where we are weighing up the options and are taking a major decision with regards to whether the infrastructure we produce Culzean from will be a tie back to existing North Sea infrastructure, or a stand-alone option, both of which have pros and cons as well as risks and opportunities," he adds. "For such a large project with long lead times, we need to ensure that robust commercial and economic incentives exist to support our journey from concept selection to first production."

People power

The Culzean team's transition to its new permanent home at Maersk House in Aberdeen continues to build overall project momentum, explains Urquhart. "We know we have the full support of our Global Corporate functions which is truly reassuring and we see that bringing the team together in Aberdeen has certainly helped to integrate and allow the project to establish its identity more firmly here in the UK."

"We have made a significant number of Maersk Oil colleagues' members of the Culzean team and recruited new professionals to Maersk. The additional team members are just the start of a phased ramp up from about 40 now, to around 50 in the next stage, and depending on the contracting situation, around 100 people in the coming years, provided the project moves ahead as expected." he remarks.

Making such headway in the current marketplace is encouraging, he adds. "There is a lot of competition for good people. We can't be complacent and we must make the most of the fact we have an exciting HPHT development to offer. We must look to build as much internal experience as possible within Maersk Oil and look to retain it."

"It's a flagship project, we are potentially adding an entire Asset stream to the UK business, which in itself is a significant thing to be part of. This and other projects have led us to invest in the new office facilities here in

"As well as being an important energy and revenue provider to the UK, there is no doubt that Culzean is a key component of the UK's contribution towards the company's 2020 ambition of 400,000 barrels of oil equivalent per day entitlement production. With first gas expected before the turn of the decade, there's no shortage of focus on moving Culzean forward"

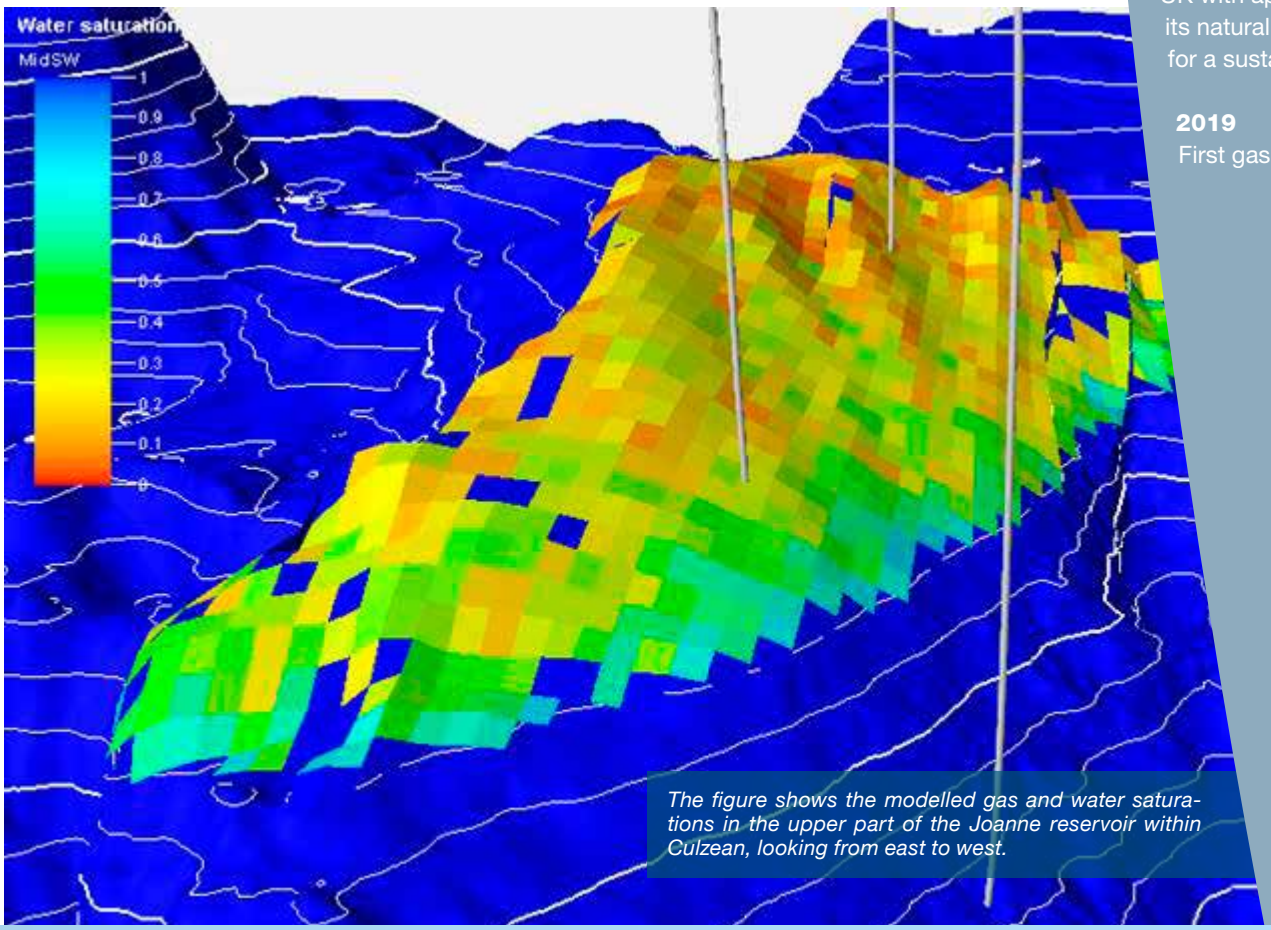
Martin Rune Pedersen, Managing Director Maersk Oil UK

GAS

The drilling rig (Ensco 101) first discovered gas in commercial quantities in 2008, confirmed in size and scope by a subsequent successful testing phase in 2010

Aberdeen to accommodate our current and future needs. In terms of our commitment to the UK it's a major signal of our intent going forward," Martin Rune concludes.

With the potential to produce between 200 million and 500 million cubic feet of gas per day, interest in the Culzean project will intensify as each step on its journey to commercial first gas is cleared. ◄



The figure shows the modelled gas and water saturations in the upper part of the Joanne reservoir within Culzean, looking from east to west.

Fact Box – Culzean in Brief

2008
Culzean Field discovered

242 km
Distance from Aberdeen

49.99 %
Maersk Oil's share of the Culzean project

280
The new building nearing completion at Maersk House in Aberdeen will have seating for an additional 250 - 280 people, depending on seating configuration

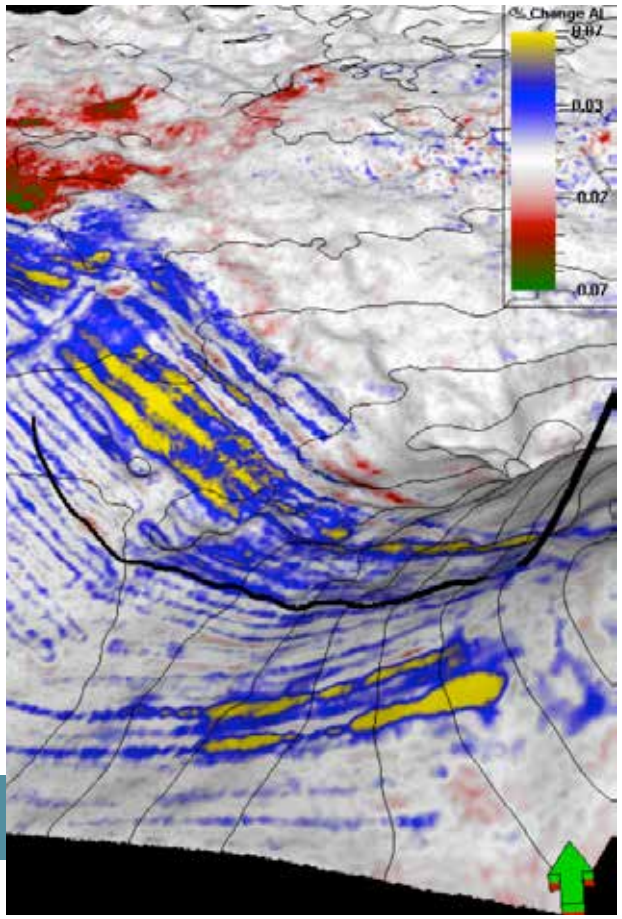
5 %
Once fully operational the Culzean field could supply the UK with approximately 5 % of its natural gas requirements for a sustained plateau period

2019
First gas is expected

ABSTRACT

Using 4D Seismic in the Halfdan Field to Close the Loop and DEFINE NEW OPPORTUNITES

A repeat 4D seismic survey was acquired in 2012 over the Halfdan oil field, located in the Danish North Sea Central Graben. The main objectives of the survey were to understand the lateral and vertical sweep within the reservoir, identify unswept areas, guide future well interventions and to improve the reservoir model. The main oil reservoir is the Cretaceous chalk Tor Formation and the field is developed via a line drive waterflood. The reservoir saturation changes due to the water injection lead to large changes in acoustic impedance which can be imaged with 4D seismic. The rock physics model was used to model 4D acoustic impedance changes based on the pressure and saturation changes within the reservoir. An integrated 'close the loop' approach combining the 4D seismic response, 4D model response, production data and geologic data was critical to achieving the project objectives. Examples from this repeat 4D, as well as the first 4D acquired in 2005 will be shown. ◄



4D Acoustic Impedance change in the Tor reservoir from 2005 to 2012.

BIOGRAPHY

Monica Calvert, Maersk Oil

Monica Calvert joined Maersk Oil in 2010 and is currently the lead geophysicist working on the Halfdan field 4D seismic program. She started working in the industry with Amoco in Houston and London focusing on rock physics, forward modelling, and seismic attributes/inversion. She continued to work for BP focusing on seismic inversion and interpretation before moving to Denver to work for Ion Geophysical concentrating on azimuthal anisotropy for fracture characterisation in unconventional plays. During her career she has worked both onshore and offshore exploration and development in many basins around the world including: Onshore North America, Gulf of Mexico, Trinidad, Egypt, Algeria, Angola, South China Sea, North Sea & Qatar. Now working with 4D seismic, she is combining her various skills from 20 years of industry experience linking rock physics and 4D seismic with the reservoir model. Monica earned her MSc in Geophysics from Cornell University and a BSc in Engineering Geology from Purdue University. ◄

SPE PRESIDENT VISIT AND SPE *Anniversary*

WE HAVE THE HONOUR TO HOST TWO MEMORABLE EVENTS ON THE 3RD OF APRIL:

The 30 year anniversary of our Copenhagen SPE section and a related visit by the global SPE President for 2015 Helge Haldorsen.

The Copenhagen SPE Section was officially established on the 26th of March 1984 by a number of employees of the Danish Energy Agency, Maersk Oil and Shell, among them Peter Helmer Steen, the first Chairman of the Board, Nils Lange Jacobsen and Mike Newman.

In order to commemorate this event the dinner of the April 3rd SPE meeting in the Maersk Office will be dedicated to the 30 year jubilee, and will include dinner speeches by previous chairmen of the board reflecting on the various facets of past SPE happenings, and a special appearance by the global SPE President Helge Haldorsen.

Helge will also address students at the DTU earlier in the day and Young Professionals in the Maersk auditorium prior to the start of the regular SPE meeting, and all members are welcome to attend. A schedule for the entire day, of the SPE President's visit and Anniversary celebrations, will be made available on the SPE Copenhagen website in due time. ◄

COPENHAGEN MEETING

THURSDAY 3 APRIL 2014

ANNIVERSARY

PROGRAMME

17:00 - 18:00
Drinks

18:00 - 19:00
Presentation and SPE News

19:00 - 21:00
Dinner

LOCATION

Mærsk Oil
Esplanaden 50
1263 København K

SPEAKER

Monica Calvert, Maersk Oil

TOPIC

Using 4D Seismic in the Halfdan Field to Close the Loop and Define New Opportunities

DINNER SPEAKER

Former Section Chairpersons

TOPIC

Memories of 30 years of SPE Copenhagen

ENTRANCE FEE

None

REGISTRATION

Please indicate your attendance by Monday 31 March 2014 by signing up on the internet www.spe-cph.cere.dk

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Making the most of natural resources

600,000

4,200

Opportunities are turned into commercial reality by the continuous improvement of our technical capabilities and the creation and application of new innovative solutions.

We build and foster strong partnerships to maximise value for all parties. There is plenty of oil and gas to be explored and produced, and as the operational environment gets more challenging, partnering is key to success.

Maersk Oil is a fully-owned subsidiary of the global conglomerate, the A.P. Moller - Maersk Group.

Maersk Oil, the natural upstream oil and gas partner; Navigating complexity, unlocking potential.

Explore more: www.maerskoil.com

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