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September 2021

SOCIETY OF PETROLEUM ENGINEERS
SPE NEWS
COPENHAGEN SECTION

FROM THE NEW SECTION CHAIR

Dear SPE Copenhagen Members,

After an eventful 2020/21 season I hope you have all had the chance to unwind and take a break during the summer holidays. Covid-19 had a massive effect on our collective ways of life, and it is a huge relief to see that the vaccination drive in a number of countries is allowing life to slowly return to normal, albeit, a 'New Normal'. There is still a long way to go though, as vaccination coverage has not been uniformly distributed globally and some countries are experiencing 3rd and 4th waves of infection. I am confident that humanity will eventually defeat the pandemic.

Last season, SPE CPH hosted 9 events, all of which were organized as virtual events. A wide variety of interesting and thought-provoking topics ranging from Carbon capture and storage to Machine learning in Reservoir Analysis were presented and discussed. Of these, 2 were Distinguished Lecturer events which took place in November 2020 and May 2021. Additionally, we saw a move towards joint events with sister SPE sections across Europe Region. On 8th March, we joined SPE Netherlands section in a presentation titled "In Relentless Pursuit of Offshore Safety: A Privileged Perspective"

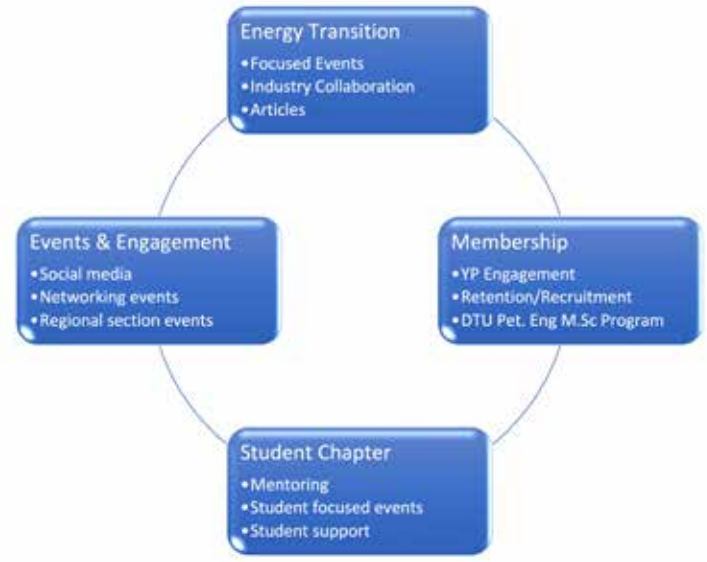
In all, 2 regional external virtual events were attended by our members. I believe this development has come to stay and it can only be beneficial – wider reach and larger engagement is always good! We maintained the student scholarship which was won by Abdelrahman Ali (congratulations to him!) and at the end of the season, the Section AGM was held, where a new Board was announced.

Another positive note from last season - I am pleased to announce the good news that SPE CPH has been recognized for membership retention by SPEi. Our membership committee shall receive the award before year end. This recognition is something to be proud of as there has been significant attrition in membership over the last few years especially since the downturn of 2014/15 and the "double whammy" of the Covid pandemic in 2020. However, amongst other sections, we have managed to minimize the reduction. I would like to enjoin all of you to play your part in attracting members to join SPE. The benefits are numerous even for non-petroleum engineering related disciplines. Membership is subsidized for students, and many professionals have their fees covered by their companies. For our members who are currently not employed, there is an opportunity to maintain membership for free via the "Members in Transition" toolkit.

With the pleasantries out of the way, I am pleased to welcome you to the new season and excited to embark on this journey.

The new SPE Copenhagen section board has resumed planning for 2021/22 season in earnest. We intend to build on the achievements of last season. To do this, we have set out our strategic focus areas going forward. They are:

SPE CPH Focus 2021/22
1. The Energy Transition and the place of Oil & Gas
2. Events & Engagement
3. Membership
4. Student chapter



To deliver on these goals and enhance our efficiency, the new board has been constituted into working committees as follows:

- **Daily Operations Committee,** headed by the section Chairperson
- **Events Committee,** headed by the Program Chairperson
- **Communications Committee,** headed by the Communications Chairperson
- **Membership Committee,** headed by the Membership Chairperson

There have also been some personnel changes within the Board. The aim is to bring in some much-needed energy and renewal to help us into the future.

We would be saying goodbye to one of our longest serving Board Members Carsten Møller Nielsen.

Carsten Møller Nielsen works as a Senior Reservoir Engineer at GEUS. His work involves research and consulting in O&G, geothermal energy production and CCS.

He has participated in the SPE CPH board since 2010 with a short pause in 2013-14. He held the position of Membership chair until 2018 and has remained in an advisory role since.

The Board will be saying a big welcome to its new members:

Jedrzej Bryla
Student Liaison Officer

Jedrzej Bryla, P&A Well Engineer for Maersk Decom, joins the SPE Copenhagen Section Board. Jedrzej has received an MSc. in Drilling Engineering from the University of AGH in Cracow, Poland. He has worked as a Drilling Engineer in Maersk Oil in Denmark and Qatar, before joining Ross Offshore where he worked both on oil and gas, as well as geothermal projects across Europe. His current role as P&A Well Engineer in Maersk Decom focuses on delivering innovative well abandonment solutions for a global client base. Jedrzej has served as Webmaster and YP Chairman of the SPE Copenhagen Section from 2012 to 2015 and is happy to rejoin the board, where he will take the role of the Student Liaison.

Nikolai Adrianov
Social Media Officer

Nikolai has a background in applied mathematics with expertise in numerical modelling of multiphase flows in porous media and in pipes. After obtaining his PhD from the University of Magdeburg (Germany) he has worked at Université Bordeaux and Institut Français du Pétrole in France before joining Schlumberger Moscow Research Center in Russia. There, Nikolai led a group of researchers working on adding new functionalities to Schlumberger's simulator FrontSim and developing codes for modelling of wellbore flows. Following the shale oil boom in the early 2010s, Nikolai was tasked to develop rock mechanics business in Russia, which led to the establishment of a dedicated laboratory in Tyumen in Western Siberia. After the sharp oil price drop in 2015 Nikolai returned to academia, having worked at two Universities in Moscow before joining the Danish Hydrocarbon Research and Technology Centre at DTU. Currently he is a researcher at GEUS working on numerical modelling of subsurface flows related to a number of CO_2 storage and oil recovery projects.

Nikolai has been a member of SPE since 2006 and has participated in numerous SPE conferences and workshops. He is a co-author of 5 SPE papers.

Nikolai's motivation for joining the board is the opportunity to contribute to the sustainable development of our society by representing the SPE expertise on subsurface engineering. Nikolai will be on the Communications committee as our Section Social Media officer.

2021/22 season

SPE-CPH has lined up a number of events and activities for this new season aimed at achieving our goals. The current update of the season events calendar can be found on page 5.

Finally, I welcome you back and I want you to join me in looking forward to an engaging 2021/22 season!
Here we go!

Yours Sincerely,
Adebowale Solarin
SPE Copenhagen Section Chairman

Please remember to pay your SPE dues. If you are in work transit, please check the link https://www.spe.org/en/members/transition/

Please follow us on LinkedIn to be up to date on SPE Cph events and other great stories:

https://www.linkedin.com/company/spe-copenhagen-section

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SPE

COPENHAGEN SECTION

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2021-2022 SEASON

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Digitalizing workflow across partners in drilling operations – a step change for the industry

Abstract

It is well known that the oil and gas industry fall behind others when it comes to digitalisation and is under increasing pressure to transform. One topic urgently in need of modernization is the process of handling well construction information between the Operators drilling program and all parties involved in the drilling operations. Today this remains a manual paper-based process driving many pain points and inefficiencies.

With the Drilling Process Platform (DPP) Maersk Drilling (MD) has developed and deployed a first-of-a-kind digital offering, that provides the drilling program information across to involved teams from both Drilling Contractor, Operator and Service Companies – offshore and onshore – directly connecting front-line rig crew with the required instructions to drive efficient rig operations. Doing so provides real-time information across all parties in the drilling operations significantly improving situational awareness, coordination, preparedness, communication, and transparency both on- and offshore, and thereby providing more efficient and consistent rig operations. Furthermore, this creates an unbroken real-time data flow spanning the drilling program, the actual execution and subsequent reporting significantly improving the foundation for lessons learned and performance information as-well as connecting onshore operational centers as an integral part of the workflows and operations.

Looking ahead, this will act as a steppingstone for further digitalization and efficiency gains in drilling operations. The DPP scope will move towards integration of predictive 3rd party models into well construction process optimizing the drilling instructions on real-time basis based on down-hole and rig operational data, as-well as integrating directly with drilling automation systems. All of which will support MD gradually moving towards the industry vision of autonomous drilling.

Biography

Esben Thorup, Maersk Drilling

Esben is Head of Digital Innovation situated in Maersk Drilling's Innovation function and has been leading the development of the Drilling Process Platform solution since 2019. Esben has been with Maersk 2011 in various positions with-in digital, Innovation, IT and Procurement. Before this, Esben worked for Ramboll Group in Denmark and India after obtaining a MSc degree from Technical University of Denmark (DTU) in 2008.

Meeting SEPTEMBER 22

PROGRAMME
17:00 - 18:00
Networking and drinks
18:00 - 19:00
Presentation (45 min + Q&A)
19:00 - 21:00 Drinks and Snacks
- Second presentation (TBC)

LOCATION
Maersk Drilling
Lyngby Hovedgade 85,
2800 Kgs. Lyngby

TOPIC
Digitalizing workflow across partners in drilling operations
- a step change for the industry

SPEAKER
Esben Thorup, Maersk Drilling

REGISTRATION
Registration will be through SPE-I; sign-up e-mails with details will be distributed to Copenhagen & Esbjerg section members in advance of the meeting.

SPONSOR

MAERSK DRILLING

Register HERE

Self-Healing Cement

Biography

Christian Husum Frederiksen is a Production Technology advisor at DHRTC with more than 25 years of experience in the oil and gas industry having worked for Maersk Oil in Denmark and Qatar. He holds degrees from Aalborg University and Syddansk Universitet.

Christian will present one of the projects in the Well Production Technology research program, on self-healing cement. Self-healing cement has the ability to repair its cracks at ambient temperature. This research is to verify self healing ability at well condition and typical offshore pumping operations.

The goal of the program is to reduce costs and enhance sustainability of wells through technology solutions for new wells and abandonment wells.

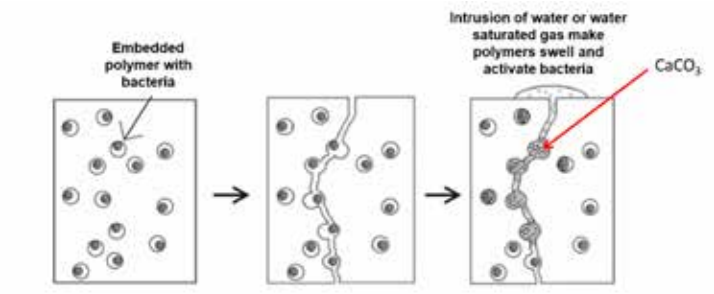


Fig.1 Self healing cement mechanism

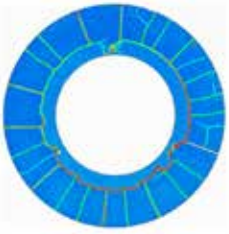


Fig.2 Typical configuration of fractures in a well with poor integrity

Produced Water Management Program at the DHRTC – DTU

Biography

Jørgen R. Næumann is a petroleum engineer with more than 25 years of experience in the oil and gas industry working for Shell, Dong E&P, Total and several contractors. He started as Program Manager at DHRTC in 2019, where he is currently responsible for two research programs.

At the October meeting, Jørgen will present the Produced Water Management research program that started at DHRTC in 2020. This is the first program at DHRTC that focuses on reducing the environmental impact of oil and gas operations offshore. The goal of the program is to eliminate harmful discharges to the marine environment associated with produced water.

Biography

Georgios M. Kontogeorgis is a professor of applied thermodynamics at the Technical University of Denmark, Department of Chemical and Biochemical Engineering.

His research covers a wide range of aspects of theoretical and experimental physical chemistry (molecular thermodynamics, colloids & interfaces, spectroscopy) of complex systems with emphasis on hydrogen bonding and related ones. He has published over 300 peer reviewed WoS papers which have received over 12000 citations (H=59, google scholar). He is also the co-author of 4 books. He has supervised over 60 PhD students and post-doctoral researchers. He is the editor or editor-in-chief of journals in thermodynamics (Fluid Phase Equilibria, Chemical Thermodynamics and Thermal Analysis). He has given numerous keynote/invited lectures in both scientific conferences and industries all over the world and has served/is serving as evaluator in many foundations and councils in Denmark (FTP, 2012-2017, DFF Green Transition 2020, 2021) and abroad (incl. Petromaks, Norway). He has been awarded in 2019 from the European Research Council (ERC) an ERC Advanced Grant with title “New Paradigm in Electrolyte Thermodynamics”. Among other distinctions: EFCE Excellence Award in Applied Thermodynamics (June 2018) and Member of Danish Academy of Technical Sciences, ATV (2021). He has been the Chairman of Center of Energy Resources Engineering, CERE-DTU (1.7.2014.31.10.2020) and he is currently the leader of KT-Consortium.

Water Thermodynamics – New Developments in Science and Engineering

Georgios M. Kontogeorgis – *Center for Energy Resources Engineering (CERE), Department of Chemical and Biochemical Engineering, Technical University of Denmark.*

Water is a very important molecule, of immense significance in petroleum, chemical, environmental engineering and numerous other fields. It is of course vital for life and life itself (if indeed existed) might have been very different without water.

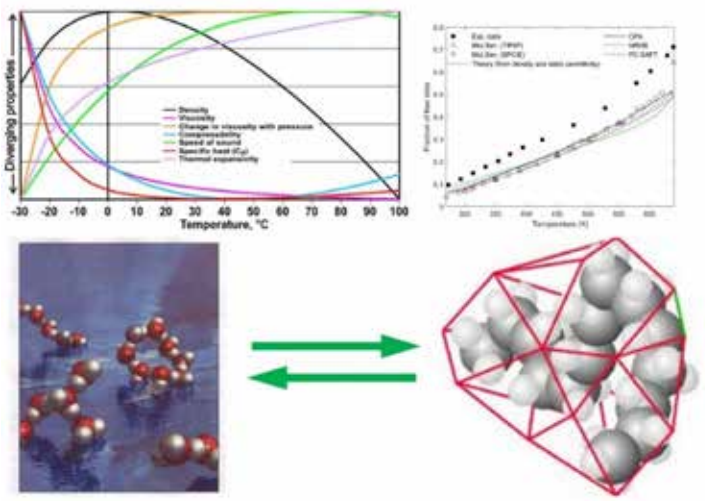
On the other hand, water is a very strange molecule and its simple chemical formula is deceiving. It took several millenia before we established water’s chemical formula, H2O, sometime in the mid of the 19th century, whereas basic info such as geometry of the water molecule should wait until early 20th century before they were finally established.

No surprise then that just about 100 years later we are still struggling to understand water’s many anomalous properties and how they are linked to or can be predicted from its structure and how all is connected to many applications where water plays or may have a role. The figure above illustrates some of the anomalous properties and theories proposed for water’s structure. ▸▸

⏩ In this lecture, first of all, the impressive thermodynamic theories which appeared over the last 35 years will be summarized and applications in the energy field (oil & gas and beyond) will be presented.

During the 21st century, the quest for understanding water's structure has intensified and the same can be said for the claims that water can, in some cases, assume special structures. Modern theories for water structure will be presented in the second part of the talk.

A broader perspective will be attempted throughout the talk, which will be concluded with some reflections on still unanswered questions about water structure and its link to properties and applications. Questions we hope can be addressed in the years to come.



Peculiarities of water. Maxima and minima of many thermodynamic properties as functions of temperature, monomer fractions of water and theories proposed for liquid water structure.

Virtual Meeting OCTOBER 27

PROGRAMME

17:45 – 17:50
Introduction

17:50 – 18:10
Christian Husum Frederiksen.
Self-Healing Cement

18:10 – 18:30
Jørgen Rentler Næumann.
Produced Water Management Program at the DHRTC – DTU

18:30 – 19:00
Georgios Kontogeorgis.
Water Thermodynamics – New Developments in Science and Engineering

LOCATION

The meeting will be held online

TOPIC

Self-Healing Cement. Produced Water Management Program at the DHRTC-DTU. New Developments in Science and Engineering.

SPEAKER

Christian Husum Frederiksen, DHRTC
Jørgen R. Næumann, DHRTC
Georgios M. Kontogeorgis, DTU

REGISTRATION

Registration will be through SPE-I; sign-up e-mails with details will be distributed to Copenhagen & Esbjerg section members in advance of the meeting.

SPONSOR

DTU

Register HERE

SPE Meeting schedule

2021-2022

September 3	MAIN SPEAKER
TOPIC	**SPE Students barbecue event**
SPEAKER	Jedrzej Bryla
LOCATION	DTU
SPONSOR	SPE-CPH
September 7-10	**MAIN SPEAKER**
TOPIC	**SPE Offshore Europe Virtual Conference**
SPEAKER	Various
LOCATION	Virtual
SPONSOR	SPE International + various
September 22	**MAIN SPEAKER**
TOPIC	**Digitalizing workflow across partners in drilling operations – a step change for the industry**
SPEAKER	Esben Thorup, Maersk Drilling
LOCATION	Maersk Drilling
SPONSOR	Maersk Drilling
October 5-7	**MAIN SPEAKER**
TOPIC	**SPE Virtual Annual Caspian Technical Conference**
SPEAKER	Various
LOCATION	Virtual Event
SPONSOR	SPE international + various
October 27	**MAIN SPEAKER**
TOPIC	**Self-Healing Cement. Produced Water Management Program at the DHRTC. New Developments in Science and Engineering.**
SPEAKER	Christian Husum Frederiksen, DHRTC - Jørgen R. Næumann, DHRTC Georgios M. Kontogeorgis, DTU
LOCATION	VIRTUAL MEETING
SPONSOR	DHRTC-DTU
November 8-12	**MAIN SPEAKER**
TOPIC	
SPEAKER	Fabio / Mette
LOCATION	VIRTUAL MEETING
SPONSOR	Welltec
December 2	**MAIN SPEAKER**
TOPIC	
SPEAKER	Ian Philips
LOCATION	VIRTUAL MEETING
SPONSOR	SPE DL
January TBD	**MAIN SPEAKER**
TOPIC	
SPEAKER	Susanne Poulsen / Lars Petersen
LOCATION	VIRTUAL MEETING
SPONSOR	Maersk Holding
January TBD	**MAIN SPEAKER**
TOPIC	
SPEAKER	
LOCATION	VIRTUAL MEETING
SPONSOR	Calsep

Innovation at Maersk Drilling

The purpose of Innovation in Maersk Drilling is to drive growth to the company in the mid-term through new services and digital transformation, as well as in the long-term through new step-out opportunities

How we work

We engage closely with our customers and partners as we believe true success can only be achieved through collaboration and partnerships

We also utilise start-up communities to innovate and develop new technologies

Our entrepreneurial attitude allows us to embrace challenges and turn them into opportunities to deliver awesome solutions

How our department is structured

In Maersk Drilling we want to take an active part in transforming the future and remaining competitive. Our portfolio is divided into 3 strategic areas

SWIM LANES	Superior delivery systems	Energy transition	Ocean Economy
DESCRIPTION	• Growing need for delivery systems combining people and digital across complex high-risk and hazardous industries • These systems support challenges related to efficiency, reliability and safety performance	• New opportunities within the broader energy transition sector materialising in the coming decade • From climate change to changing energy infrastructure and new technologies	• Climate change, energy transition and growing population create a range of new business opportunities • Ocean will become increasingly important as resource constraints grow
WHY MD	• Extensive experience within complex high-risk and hazardous industry • Ability to leverage domain knowledge and create scalable solutions for industries outside O&G by combining core people skills with digital	• Strong customer relations enabling us to follow our customers' transition • Ability to identify new customer segments to expand our services beyond current offerings	• Valuable experience and competences from operating on the ocean • Existing capabilities can be transferred into many of the new emerging opportunities

MAERSK DRILLING

The Case for Carbon Capture and Storage

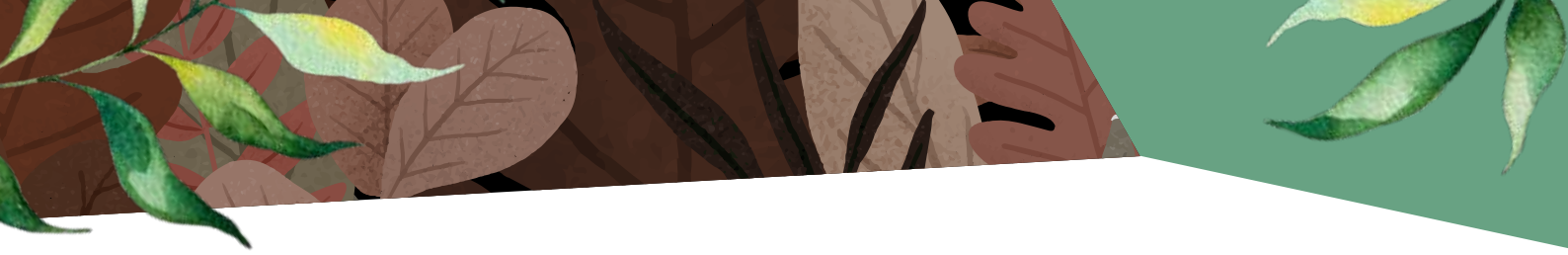
In May this year the International Energy Agency (IEA), a Paris-based energy watchdog, issued a landmark report that sets out what it believes to be a realistic roadmap for reducing CO_2 emissions to zero by 2050. It proposes a concept of comprehensive electrification of the global economy while replacing fossil fuels as energy sources by renewable methods such as wind and solar. In contrast, an alternative lower cost scenario where Carbon Capture and underground Storage (CCS) would play a larger role than that proposed by the IEA could allow continued use of fossil fuels while still achieving the goal of net-zero-emissions.

In their own words the IEA said about its roadmap: "The world has a viable pathway to building a global energy sector with net-zero emissions in 2050, but it is narrow and requires an unprecedented transformation of how energy is produced, transported and used globally" and "The pathway on which we focus is – in our analysis – the most technically feasible, cost-effective and socially acceptable".

According to the IEA study the energy world would look completely different by 2050. Global energy demand would be around 8% lower than today, but it would support an economy more than twice as big and a population of almost 10 billion people. Nearly 90% of electricity generation would come from renewable sources, with wind and solar together accounting for almost 70%. Most of the remainder would come from nuclear power. Solar would be the world's single largest source of total energy supply. Fossil fuels would fall from almost 80% of total energy supply today to circa 20%. Fossil fuels that remain would be used in goods where the carbon is embodied in the product such as plastics, in facilities fitted with carbon capture, and in other sectors where low-emissions technology options are limited. Hydrogen would play a surprisingly small role, carrying less energy than for instance oil by 2050, and with synthetic and biofuels projected to be the major energy carriers for shipping and aviation.

It remains a question whether this Net Zero Emissions (NZE) scenario will indeed be realized, as there is strong opposition to it from countries in the developing world, but regardless of its feasibility the study is a reliable source of information, numbers and cost estimates that may be used for building alternative scenarios to reduce CO_2 emissions to zero. An important reason to investigate alternative scenarios would be to determine if there are other pathways that are more technically feasible, more cost-effective or more socially acceptable than the one proposed by the IEA.

The IEA's NZE scenario assumes that the road towards zero emission must go through electrification of society and that electrical power must be generated predominantly through renewable means such as wind and solar, distributed via global networks. These assumptions are however merely choices ⏩



⏩ rather than requirements for achieving the goal of net zero carbon emissions. There may be lower cost choices that could be made to achieve that goal.

Using capacity and cost estimate numbers provided by the IEA report an alternative scenario could for instance be one where CO_2 would continue to be produced but no longer emitted into the atmosphere. The energy required by industry, power generation and (centralized) heating of buildings would continue to be provided by fossil fuels, mainly natural gas which generates less CO_2 than oil or coal, while capturing all generated CO_2 for storage in subsurface reservoirs. The total investment cost of such Carbon Capture and Storage (CCS) arrangements would be an additional 0.6 trillion US$ per year globally, and would double global CAPEX on fossil fuel investments to circa 1.2 trillion US$ per year, raising ALL energy related CAPEX to ca. 2.9 trillion US$ per year (including distribution, industry, transport, power generation, infrastructure etc.). This would be considerably cheaper than the CAPEX of IEA's zero emissions scenario that would globally cost ca. 5 trillion US$ per year, a difference of over 2 trillion US$ per year!

Looking at this alternative scenario of CCS in another way, by estimating the cost consumers would pay for their energy needs, a similar picture emerges. While it's true that the OPEX cost of producing electricity through solar and wind from existing installations is currently similar to that by existing gas or coal powered installations, that is only the case when the sun shines brightly or the wind blows. A huge expansion of global electricity networks is required to transfer green power from its generation sites to the consumers. The total price charged to the consumer is much higher than the spot electricity production cost as it must include all additional costs being made to guarantee reliable supply across continents 24 hours per day, 7 days a week. A rough estimate of cost implications, based on real world data, is that consumer prices of electricity generated by wind or solar will be circa three times higher than when generated locally by coal or natural gas. Electricity prices charged to industry and business would be two times higher. In countries such as Germany and Denmark consumers are already being charged similarly elevated electricity prices, but for the rest of the world following that example would have enormous consequences. Based on IEA electricity consumption forecasts, the world would be paying some 5 trillion US$ per year more for their energy needs in the IEA's maximum electrification and global distribution scenario than in a Net Zero Emission scenario for maximum Carbon Capture and Storage that allows fossil fuels to be used in industry and for power generation. Considering that total global GDP is currently some 90 trillion US$, such an extra energy cost would cause considerable hardship on those living in low-income countries.

Increased consumer costs are not the only downside of the IEA scenario, there is also the aspect of required 'behavioural change', a widely held goal of environmentalists and politicians.

According to the IEA, this includes measures to limit global energy consumption to levels that are lower than current levels, such as:

- No growth in air travel.
- No car ownership for 70% of households; two cars for just 5% of households.
- Regulation to limit heating and cooling temperatures in buildings, mandatory insulation and heat pump requirements.
- Taxes on transport: i.e. on pollution, parking, distance travelled and emissions.

This may sound like music in the ears of many environmentalists but for most people aspiring to a life of comparative freedom and individual happiness this may not necessarily sound like an attractive proposition. The alternative scenario that Carbon Capture and Storage enables would however not only help reach the objectives of Net Zero Emissions of CO_2 to the atmosphere, it would also allow a more liberal growth of energy consumption and well-being across the world at lower overall cost to the consumer. It would even help reduce global poverty faster than via the IEA scenario thanks to more efficient allocation of capital, reduce pollution caused by mining of rare minerals and production of energy storage devices, and avoid dependency on countries producing such minerals and devices.
Ladies and gentlemen, the case for Carbon Capture and Storage is strong. Recently started projects and studies indicate that Denmark has the know-how and natural resources to achieve a net-zero-emissions national economy based on a mix of green energy and CCS of fossil fuels within our lifetime.

These are just two of many possible scenarios. A third scenario would for instance be to use nuclear energy instead of wind and solar. That scenario would also be cheaper than the pathway proposed by the IEA, but arguably less socially acceptable. It remains to be seen what choices individual countries will make, and whether a global solution will prevail.

Hans Horikx.

Note 1, and this may be trivial to many, but descriptions of the terms OPEX and CAPEX are as follows:

- *OPEX = Operating Expenses, day-to-day spending to keep activities operational (e.g. fuel, salaries, taxes).*
- *CAPEX = Capital Expenditures, investments required to start or extend operations over the long term (e.g. infrastructure, buildings, equipment, vehicles).*

Note 2, link to the IEA report "Net Zero by 2050. A Roadmap for the Global Energy Sector":

- *https://www.iea.org/reports/net-zero-by-2050*

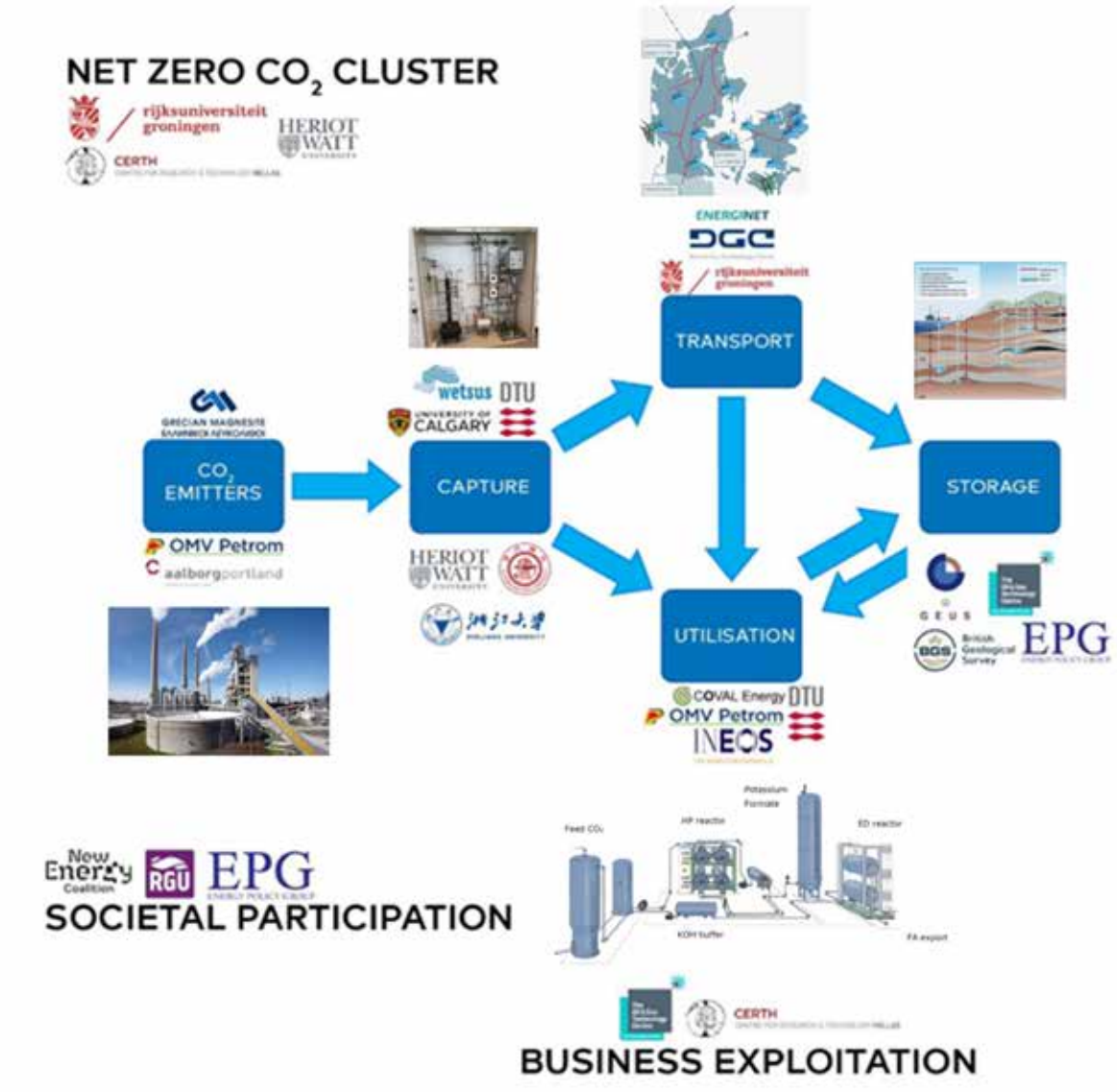
Note 3, the cost of the full CCS chain is circa 100 US$/tonne CO_2

ConsenCUS – a new EU-funded project addressing the problem of CO_2 emissions of industrial sectors

Partners from Denmark, the Netherlands, the UK, Romania, Greece, China and Canada have joined forces to address the problem of CO_2 emissions from industrial sectors through development and demonstration of novel carbon capture, conversion, and storage technologies.

The EU ambition towards the net-zero greenhouse gas emissions in 2050 puts high pressure on energy-intensive and large emitting industries such as cement, steel and waste processing, which are of strategic importance to the EU economy. Since in many technological processes the CO_2 emissions are unavoidable, the EU climate targets cannot realistically be met without the utilizing the carbon capture, utilization and storage (CCUS) technologies.

The ConsenCUS (CarbOn Neutral cluSters by Electricity-based iNnovations in Capture, Utilisation and Storage) consortium aims to directly address the problem of CO_2 emissions from selected industrial sectors through the development and demonstration of novel versatile carbon capture and conversion technologies and coupling these innovations to CO_2 storage. In addition to permanent storage, the temporary CO_2 storage in the geological units such as salt caverns and saline aquifers will add to the flexibility of such clusters by introducing seasonal buffering capacity for delayed permanent storage or Power-to-X applications. An optimization framework will be developed for the optimal CCUS chain design and planning for captured CO_2 to reach end users as well as for permanent and/or temporary storage. Finally, ConsenCUS will engage with the ▸▸



⏩ people in the communities surrounding the selected demonstration sites in order to assess the societal acceptance of the planned undertakings, notably the storage part.

Denmark plays an active role in ConsenCUS with four consortium partners:

- DTU is leading the design and construction of mobile capture and utilization units.
- Aalborg Portland – demonstration of the proposed CCU technology.
- Danish Gas Technology Centre – design of a CO_2 compatible gas grid.
- GEUS – laboratory experiments and computational modelling of different storage strategies, probing the outcome of critical geochemical and flow processes, identifying risks, and selecting the most promising strategy.

Speaking of CO_2 storage, GEUS will focus on saline aquifers while the British Geological Survey will study the use of salt caverns. A particular emphasis will be made on the temporary storage, which can be useful for minimizing the flow rate variations or for ensuring the flexibility when dealing with constraints such as minimum or maximum pipeline pressures. If shipping is used to deliver CO_2 to an offshore site for permanent geological storage, an intermediate buffer storage is required to accommodate for the continuous CO_2 flow from an industrial emitter. Looking down the road, there might be an interest in recovering the temporarily stored CO_2 to produce commodity chemicals and materials.

One particular geological site which can be used as a testbed for CO_2 storage modelling is Stenlille, a saline aquifer located in the middle of Sjælland approx. 90 km west from Copenhagen. Current work at GEUS includes creating a detailed geological model for the site, which will provide accurate estimates for the structural elements and the distribution of rock properties. Linking the refined geological modelling with the results of the laboratory core flooding and geochemical experiments will reduce the uncertainties in storage capacity for Stenlille and for analogous geological structures. This will eventually open up a wide range of opportunities because Denmark has a significant potential to store CO_2 in saline aquifers.

About ConsenCUS
ConsenCUS is a 4-year international Innovation Action under the Horizon 2020 framework of the EU. It investigates how electrochemically driven carbon capture and conversion innovations can combine with safe transport and/or storage through economically viable networks and clusters, with specific attention for the interaction of local communities with the technological developments.

The consortium consists of University of Groningen, New Energy Coalition, Wetsus, Coval Energy (NL), Danish Technological University, Geological Survey of Denmark and Greenland, Danish Gas Technology Centre, Aalborg Portland(DK), Heriot-Watt University, Robert Gordon University, OGTC Ltd, British Geological Survey (UK), Center for Research and Technology Hellas, Grecian Magnesite (GR), OMV Petrom, Energy Policy Group (RO), Zhejiang University, Shanghai Jiao Tong University (CN) and University of Calgary (CA).

For more information, see the project site: https://consencus.eu

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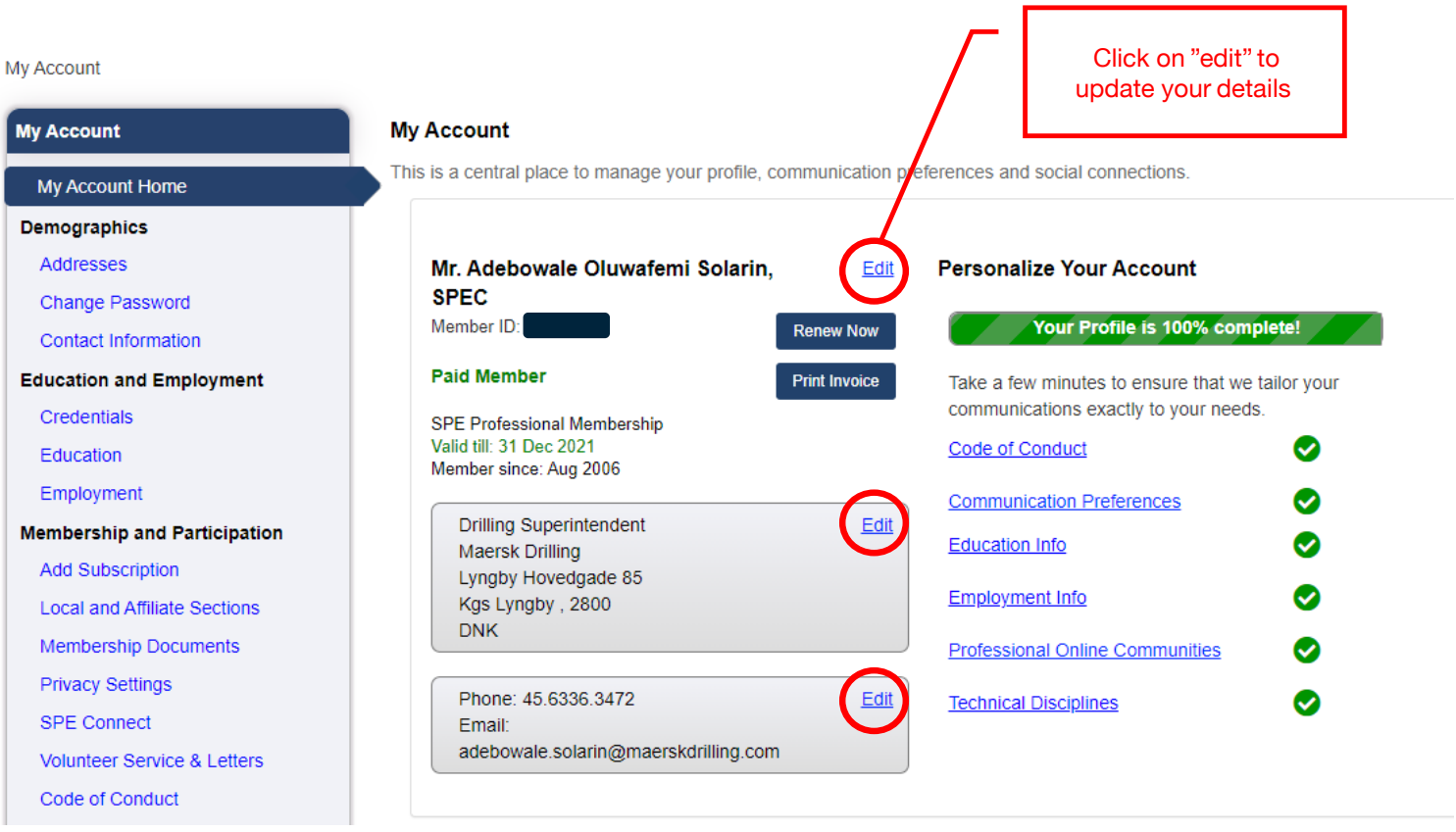

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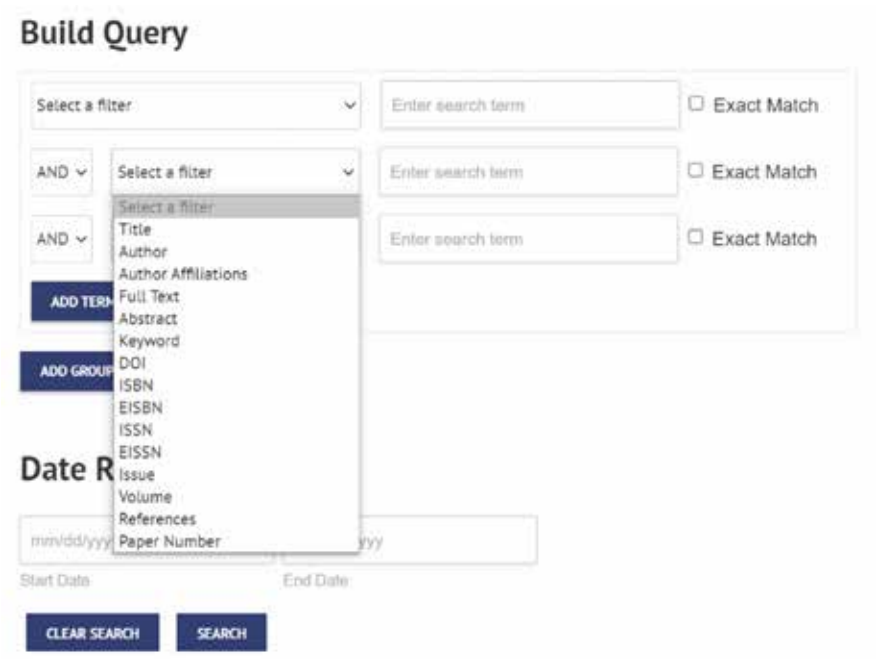

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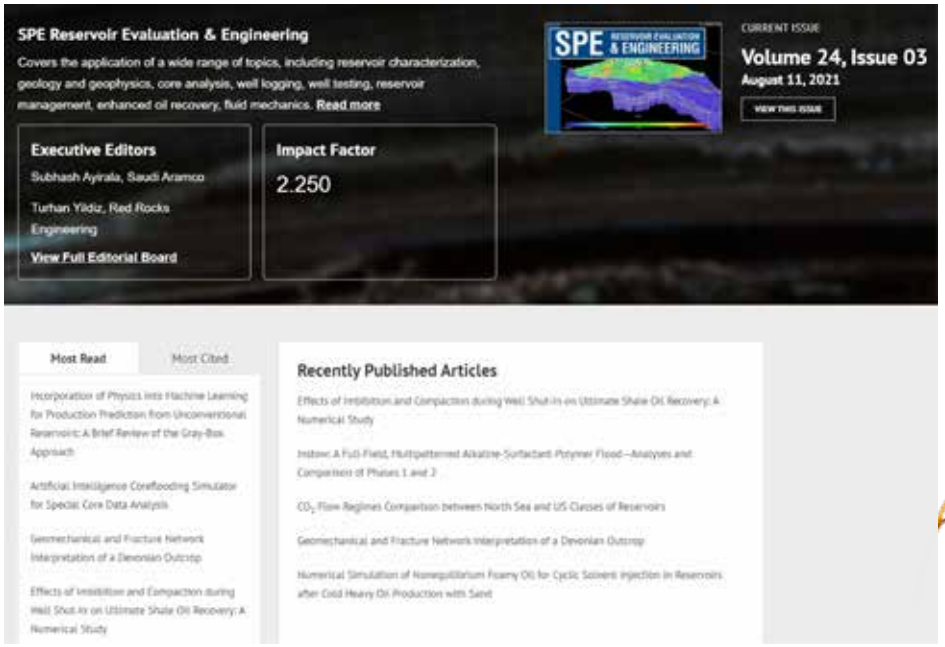

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