

Norwegian Energy Symposium

H₂ & CCS Solutions and Technologies

ABSTRACTS

DAY 1: 9 NOVEMBER – GREEN HYDROGEN	1
AKER CLEAN HYDROGEN - AN EFFICIENT HYDROGEN VALUE CHAIN INTEGRATOR	1
HYDROGENPRO - LARGE SCALE ELECTROLYSER PLANTS	1
WILHELMSSEN - INVOLVEMENT IN THE HYDROGEN VALUE CHAIN	1
MOSS MARITIME - DESIGN FOR SHIP TRANSPORT OF LIQUEFIED HYDROGEN	2
UMOE ADVANCED COMPOSITES - SOLUTIONS FOR DISTRIBUTION AND STORAGE OF HYDROGEN	2
GEXCON - HYDROGEN SAFETY	2
ROLLS ROYCE BERGEN ENGINES - HYDROGEN READY RECIPROCATING INTERNAL COMBUSTION ENGINE	2
TECO2030 - ZERO EMISSION ALTERNATIVE TO DIESEL GENERATORS	2
DAY 2: 10 NOVEMBER – BLUE HYDROGEN / CARBON CAPTURE & STORAGE	3
EQUINOR - NORTHERN LIGHTS PROJECT	3
GASSNOVA (TCM) - TEST CENTER FOR DEVELOPING CO ₂ CAPTURE TECHNOLOGIES	3
REINERTSEN NEW ENERGY - EMISSION-FREE PRODUCTION OF BLUE HYDROGEN AND AMMONIA	3
ZEG POWER - CLEAN HYDROGEN PRODUCTION FROM GAS	3
AKER SOLUTIONS	3
BAKER HUGHES - COMPACT CARBON CAPTURE	3
NOV COPS - ENGINEER, DESIGN, AND FULLY EXECUTE CARBON CAPTURE SYSTEMS	3
DNV - RE-USING AND CONVERTING OFFSHORE ASSETS INTO CO ₂ INJECTION FACILITIES	4
HOEGH LNG / ALTERA INFRASTRUCTURE - LARGE SCALE CCS VALUE CHAIN	4
LARVIK SHIPPING - TRANSPORT OF LCO ₂ BY SHIP	4
ALLTON - 4D CSEM TECHNOLOGY TO MONITORING OF CO ₂ STORAGE	4
OCTIO - A COST-EFFICIENT HOLISTIC APPROACH TO MONITORING OF CO ₂ STORAGE	4

Day 1: 9 November – GREEN HYDROGEN

[Aker Clean Hydrogen - an efficient hydrogen value chain integrator](#)

The hydrogen production facilities are based on a modularized, plug & play architecture. This presentation will give project examples of how the renewable energy production, and the distribution to end-users, are integrated into overall system design to achieve the most efficient hydrogen value chain.

[HydrogenPro - large scale electrolyser plants](#)

HydrogenPro is a Norwegian based supplier of high quality hydrogen plants based on high-pressure alkaline electrolysers. During the last years HydrogenPro has developed the world largest single cell stack and a new advanced electrodes technology enabling large scale green hydrogen plants to be competitive with fossil based hydrogen sources.

[Wilhelmsen - involvement in the Hydrogen value chain](#)

Founded in Norway in 1861, Wilhelmsen is now a comprehensive global maritime group. In addition, the newly formed Wilhelmsen New Energy division aims to develop new opportunities

and collaborations across renewables, zero-emission shipping, and marine digitalization and specifically in offshore wind and the hydrogen value chain.

Wilhelmsen have established Topeka, a zero-emission shipping company. This company's aim is to demonstrate that new zero emission fuels and technologies works and scale this up further.

Along with Topeka we are involved in the earlier stages of the hydrogen value chain, from infrastructure investments supporting the production of hydrogen and carbon capture to the distribution and bunkering for ships. Our business model in Topeka is built on partnerships, with various shipping stakeholders wanting to decarbonize their fleets and supply chain ranging from ship owners, tonnage providers, operators, charterers and cargo owners

[Moss Maritime - design for ship transport of liquefied hydrogen](#)

Moss Maritime pioneered the LNG market with the Moss LNG carrier, much used for LNG export from Australia to Japan. The presentation will focus on how that experience can be utilized to prepare a design for ship transport of liquefied hydrogen from Australia to the world market.

[Umoe Advanced Composites - solutions for distribution and storage of Hydrogen](#)

Innovative solutions for distribution and storage of Hydrogen in containerized plug and play modules. The solutions offer a very cost-effective balance between Capex and Opex, optimizing Cost of Ownership. The solutions are in daily use in some of Europe's most developed Eco-systems for Hydrogen, in order to e.g. transport Hydrogen from electrolysers to Hydrogen Refueling Stations, as well from source to industrial users of Hydrogen.

[Gexcon - hydrogen safety](#)

While Hydrogen is new as an energy carrier, it has been around as an industrial gas for more than a century. In some respects, though, Hydrogen differs from other gases, and hence the risks and appropriate mitigation measures are different. Gexcon will share some key findings from their work within Hydrogen safety and provide their view on how Hydrogen can be implemented in a safe manner.

[Rolls Royce Bergen Engines - hydrogen ready reciprocating internal combustion engine](#)

The reciprocating internal combustion engine is a well proven and robust machine. It can be further developed and become a part of the solution for a carbon neutral future. Bergen Engines has started this development and we will be ready for the future.

[TECO2030 - zero emission alternative to diesel generators](#)

TECO 2030 tackles one of the biggest environmental challenges of our time: How to reduce emissions from growing industries dependent on fossil fuels. The company works together with the world's largest developer of power trains, AVL, in order to give the industry a plausible zero emission alternative to diesel generators with their hydrogen Fuel Cell solutions.

Day 2: 10 November – BLUE HYDROGEN / CARBON CAPTURE & STORAGE

Equinor - Northern Lights Project

Northern Lights is developing an open and flexible ship-based infrastructure for transport of CO₂ from capture sites across Europe for safe and permanent storage offshore Norway. The development is enabling decarbonisation of industrial hubs and exploring the realisation of full-chain CO₂ removal projects.

Gassnova (TCM) - test center for developing CO₂ capture technologies

Technology Centre Mongstad (TCM) is the world's largest and most advanced test center for developing CO₂ capture technologies and a leading competence center for carbon capture. TCM is an open access test center which tests, verifies and demonstrates different post-combustion technologies related to cost-efficient and industrial scale CO₂ capture. www.tcmda.com

Reinertsen New Energy - emission-free production of Blue Hydrogen and Ammonia

- The colours of hydrogen; pros and cons
- New methods for production of emission-free, blue hydrogen and ammonia
- Hydrogen production by HyPro-Zero™ and hydrogen separation by Palladium membranes
- Efficient transportation and distribution of hydrogen and ammonia in the market
- The most interesting end-user technology being developed for various market sectors

ZEG Power - clean hydrogen production from gas

ZEG delivers solutions for **clean hydrogen** production from gas, using our ZEG ICC™ Technology. ZEG has recently secured its first commercial sale of a ZEG H1 plant, and the roadmap to industrial scale H600 plants is established at CCB Energy Park at Kollsnes, next to Northern Lights CO₂ storage facility in Norway.

Aker Solutions

- Enabling Large Scale CO₂ Capture by solving the Transport & Storage Challenge
- Large scale capture of industrial CO₂ emissions will require that we cost effectively store the entire captured volume, predictably & permanently. The optimal way to achieve this is inherently unique and challenging for each project. Aker Solutions helps our partners safely transport & store the world's CO₂ deep underground.

Baker Hughes - Compact Carbon Capture

Compact Carbon Capture – A Baker Hughes Venture (CCC) is a novel CO₂ capture technology under development. By applying centrifugal forces CCC will be able to significantly reduce the size of the equipment without compromising on the capture capacity. The Norwegian company was acquired by Baker Hughes late 2020 and is now a part of a larger portfolio of CCUS technologies offered by Baker Hughes.

NOV COPS - engineer, design, and fully execute carbon capture systems

NOV will present our flexible technology base for carbon capture, utilization, and storage highlighting the correlation with our existing gas processing portfolio. With more than three decades of global process engineering and gas treatment expertise coupled with established

execution models, NOV can engineer, design, and fully execute built-for-purpose carbon capture systems for many industry applications.

[DNV - re-using and converting offshore assets into CO₂ injection facilities](#)

CCS and offshore asset decommissioning are sharing the newsfeed and one can see the appeal of re-using the offshore assets designed to extract resources and convert them into CO₂ injection facilities. In this scenario, the trunkline exporting gas to the shore would reverse its flow direction and fluid to transport the CO₂ from shore to offshore.

[Hoegh LNG / Altera Infrastructure - large scale CCS value chain](#)

Stella Maris is a large scale full delivery chain for CCS. Designed to keep costs down, it can handle 10 million tons per year, and consists of multiple floating collection and treatment hubs, CO₂ carriers with capacity of 50,000 cubic meters and an offshore injection unit.

[Larvik Shipping - transport of LCO₂ by ship](#)

Larvik Shipping and MOL are currently the only company that offers transport of LCO₂ by ship. In this symposium, I will talk about how LS/MOL can support the CCUS value chain from emission to subsea, CO₂ characteristics for sea transport, key challenges, Tank specification for LCO₂ and our view on Low-pressure transport.

[Allton - 4D CSEM technology to monitoring of CO₂ storage](#)

The resistivity of a CO₂ reservoir can be highly dependent on gas saturation, and saturated volumes have a high resistivity contrast to non-saturated volumes. Under such conditions CSEM provides high sensitivity and accurate imaging of the CO₂ subsurface distribution. We present the latest CSEM developments for a safe monitoring solution.

[Octio - a cost-efficient holistic approach to monitoring of CO₂ storage](#)

Gravimetry and subsidence surveys have been used to monitor hydrocarbon producing reservoirs and CO₂ storage in the Norwegian continental shelf for over two decades (Alnes et al., 2010). This technology provides insight into reservoir dynamics with short turnaround time and cost-efficiency when compared with 4D seismic.

As opposed to time-lapse seismic, 4D gravity is sensitive to density changes alone, thus its interpretation is not subject to ambiguities from competing signals from e. g. pressure-induced changes in the elastic properties of the reservoir. The technology can confirm location of injected volumes in the subsurface as well as monitoring the physical state (insitu density) of the injected volumes. The technology has the sensitivity to detect vertical movements of the injections and map lateral pressure in the geological storage reservoir.

gWatch monitoring is conducted using remotely operated vehicles and a survey usually lasts from one to five weeks depending on the field size.