



# Clean Energy Ministerial CCUS Initiative Webinar

## Approaching Final Investment Decision: CCUS Developments in Norway

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*Thursday 14 November 2019*  
*08:00 EST | 14:00 CET*



## SOME HOUSEKEEPING ITEMS

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## SOME HOUSEKEEPING ITEMS (CONTINUED)

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# AGENDA

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Welcome &  
Introductory  
Remarks

- Juho Lipponen  
Co-ordinator  
CEM CCUS Initiative

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Presentation

- Kristin Myskja  
Assistant Director-General  
Ministry of Petroleum and  
Energy, Norway
- Ole Martin Moe  
Project Manager  
Fortum Oslo Varme
- Per Brevik  
Director, Alternative Fuels  
HeidelbergCement Northern  
Europe
- Sverre Johannesen  
Overå  
Project Director, Northern  
Lights  
Equinor

3

Question and Answer  
Session



Juho Lipponen  
*Co-ordinator*  
CEM CCUS Initiative

Mr. Juho Lipponen is the Co-ordinator of the Clean Energy Ministerial (CEM) Carbon Capture, Utilization, and Storage (CCUS) Initiative, working with the eleven member governments, observers and other partner organisations to ensure the day-to-day functioning of the Initiative.

Juho is based in Paris, France.



Kristin Myskja  
*Assistant Director-General*  
Ministry of Petroleum and Energy, Norway

Kristin has worked in the Norwegian Ministry of Petroleum and Energy since 2006. She worked four years in the Oil and Gas department in the Ministry where her responsibilities included a portfolio of oil and gas fields on the Norwegian Continental Shelf, infrastructure development on the Norwegian Continental Shelf and ownership in the Norwegian gas transport system.

She has worked in the CCS-section since 2011 with the Norwegian government's CCS-strategy and the Norwegian CCS demonstration project. She holds a Master's degree in Economics from the University of Oslo, obtained in 2006.



Ole Martin Moe  
*Project Manager*  
Fortum Oslo Varme

Ole graduated as a civil engineer in marine engineering from NTH (now NTNU). He has enjoyed a long career in the shipping and offshore industries and has been fortunate to be involved in many interesting projects, both as project engineer and project manager.

“The most exciting projects are those that can take us a step further and provide good solutions to small and large challenges for our customers and society.

How to solve our climate problems is an interesting and huge task. Therefore, it is immensely inspiring to be part of the Fortum Oslo Varme's carbon capture project, which is one of the areas that I believe should be invested in in order to fulfil the climate goals, which we said we would.”



Per Brevik  
*Director, Alternative Fuels*  
HeidelbergCement Northern Europe

Per Brevik has a Master's degree in Business Administration from the Norwegian School of Business Administration (NHH).

Since 1993, he has worked with alternative fuels development in the cement industry. From 2007 onwards, he has been responsible for alternative fuels, climate and sustainability at HeidelbergCement Northern Europe.

He has been responsible for the carbon capture project at Norcem Brevik since the launching of the project in 2011.





Sverre Johannesen Overå  
*Project Director, Northern Lights*  
Equinor

Sverre Overå has been managing large investment projects for Equinor for the last 20 years. He was project manager for TCM (Technology Centre Mongstad) in the design and construction phases from 2006 to 2012, before moving to Brasil and heading up Equinor's portfolio of modification projects there.

After returning to Norway, he spent two years as deputy project director at the Nyhamna Expansion project for Ormen Lange – one of the largest oil & gas modification projects in the world at that time. In 2016 he returned to CCS when he became project director for the Northern Lights project, a key element of the Norwegian State's full scale demonstration project.



Olje- og  
energidepartementet

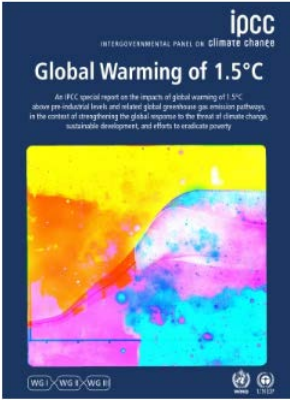
# Approaching Final Investment Decision CCUS developments in Norway

Assistant Director General, Kristin Myskja

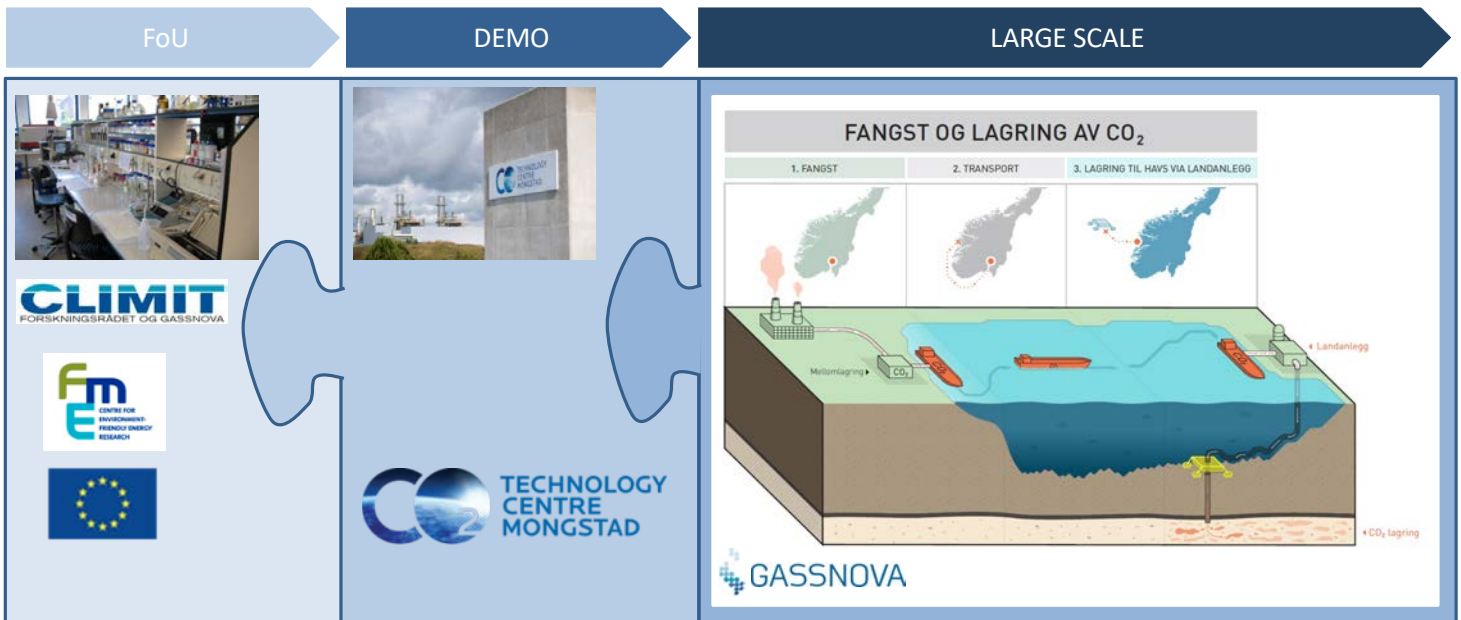
14 November 2019



# CCS is a necessary part of the solution



# Norwegian CCS-strategy – a broad approach



## Large scale CCS in Norway

"...realise a **cost-effective** solution for full-scale CCS in Norway, provided that this incite **technology development in an international perspective**".

**Solberg Government's Political Platform**

Our aim for a CCS project in Norway:

- Demonstrate a full chain of capture, transport and storage of CO<sub>2</sub>
- Demonstrate CO<sub>2</sub> capture in existing industry
- Establish a flexible storage solution with excess capacity
- Provide cost and risk reductions for subsequent CCS projects



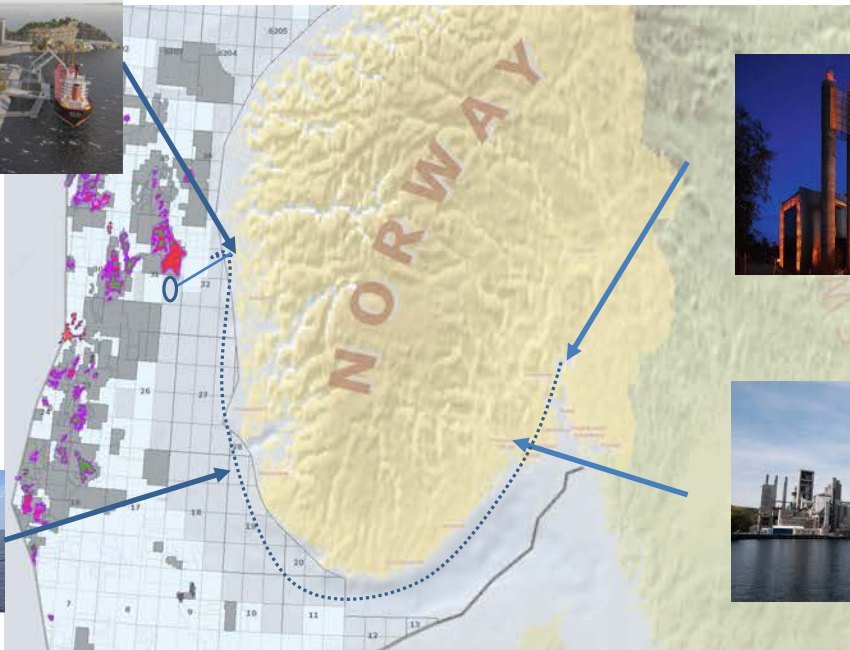
# The Norwegian CCS demonstration project



Ship transport from capture to storage terminal – pipeline to offshore storage complex



Olje- og energidepartementet



Waste-to-energy  
400 000 tonnes CO<sub>2</sub> per annum



Cement production  
400 000 tonnes CO<sub>2</sub> per annum

## The way forward



QA - prepare  
investment decision –  
2019/2020

Development  
2020/2021→






# ccsnorway.com







Fortum Oslo Varme AS

# CCS from waste incineration

part of tomorrow's climate solution









Ole Martin Moe  
14 November 2019

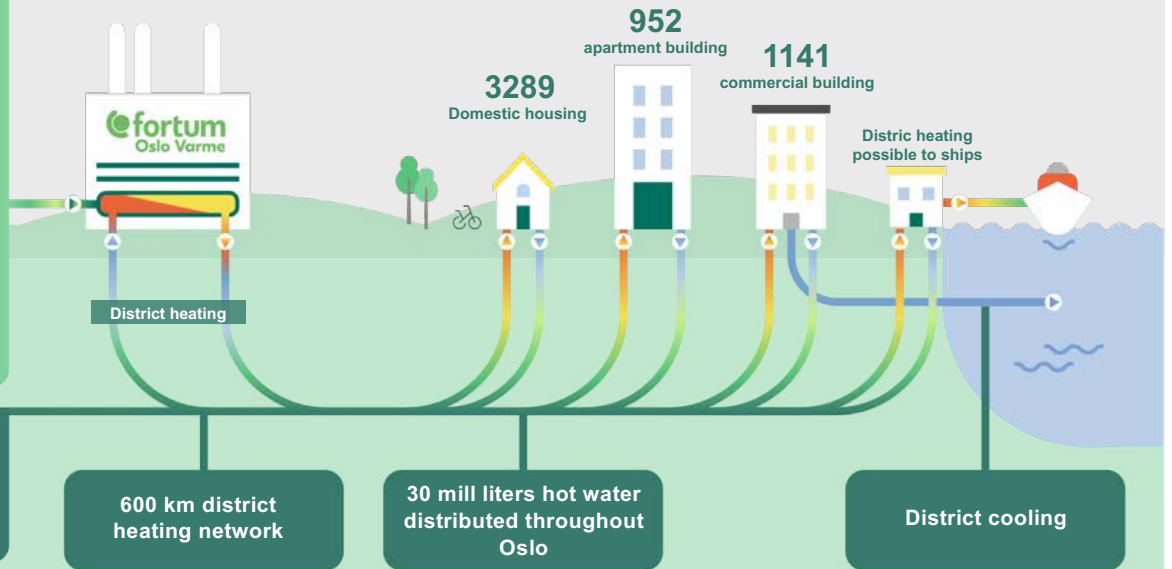


fortum

# Fortum Oslo Varme AS

## Energy sources:

-  WASTE HEAT
-  ELECTRICITY
-  HEATPUMP/  
SEWER
-  DATACENTER
-  WOOD PELLET
-  BIOFUEL
-  FOSSIL OIL
-  LNG



Production approx  
**150 GWh**  
electricity (est. 2017)



## Carbon Capture in Oslo

- Goal to capture about **400 000 tons CO<sub>2</sub>** per year
- CCS at Waste-to-Energy plants will capture both fossil and biological CO<sub>2</sub> (appr. **50 % BIO-CCS**)
- CO<sub>2</sub> transport to port via **emission free cars**
- Pilot testing on **real flue gas**
- **90% cleaning** of CO<sub>2</sub>, technology supplier with full scale experience (Shell), EPC contractor TechnipFMC



A photograph of a worker in an orange safety suit, yellow hard hat, and white respirator mask standing next to a large, towering pile of garbage. The worker is looking towards the camera. The background is a hazy, overcast sky.

## Waste is one of the world's biggest climate challenges;

- ➔ **2.2 billion tons** of waste produced yearly and **5% of global emissions** is from household waste alone
  - ➔ Landfilling has to reduce and **waste-to-energy** is the best solution for waste that cannot be recycled
  - ➔ Significant **BIO-CCS** potential; **waste-to-energy** with **CCS** can contribute to achieve negative emissions
  - ➔ **EU's targets** for recycling and reduced landfills; **40 mill. tons** missing capacity of **waste-to-energy**
- 1 ton waste is equivalent to 1 ton CO<sub>2</sub>**



# Integration of a CO<sub>2</sub> Capture Plant in Brevik

Per Brevik

14 November 2019



## Cement and concrete

- Hard to imagine a future without it
- Lasts for hundreds of years (even thousands)
- The main elements: Limestone, Iron, Aluminium and Silica are the four most dominant elements in the earth's crust. Practically unlimited resources





■ **Cement industry is very well suited for CO<sub>2</sub>-capture**

■ **Large, stationary units**

- Typically emitting 500.000 – 2.000.000 tons CO<sub>2</sub> per year
- Often clusters of cement plants close to large limestone deposits
- Long lifetime (>100 years)

■ **Often located close to sea**

■ **Process emissions represents 2/3 of CO<sub>2</sub> emissions**

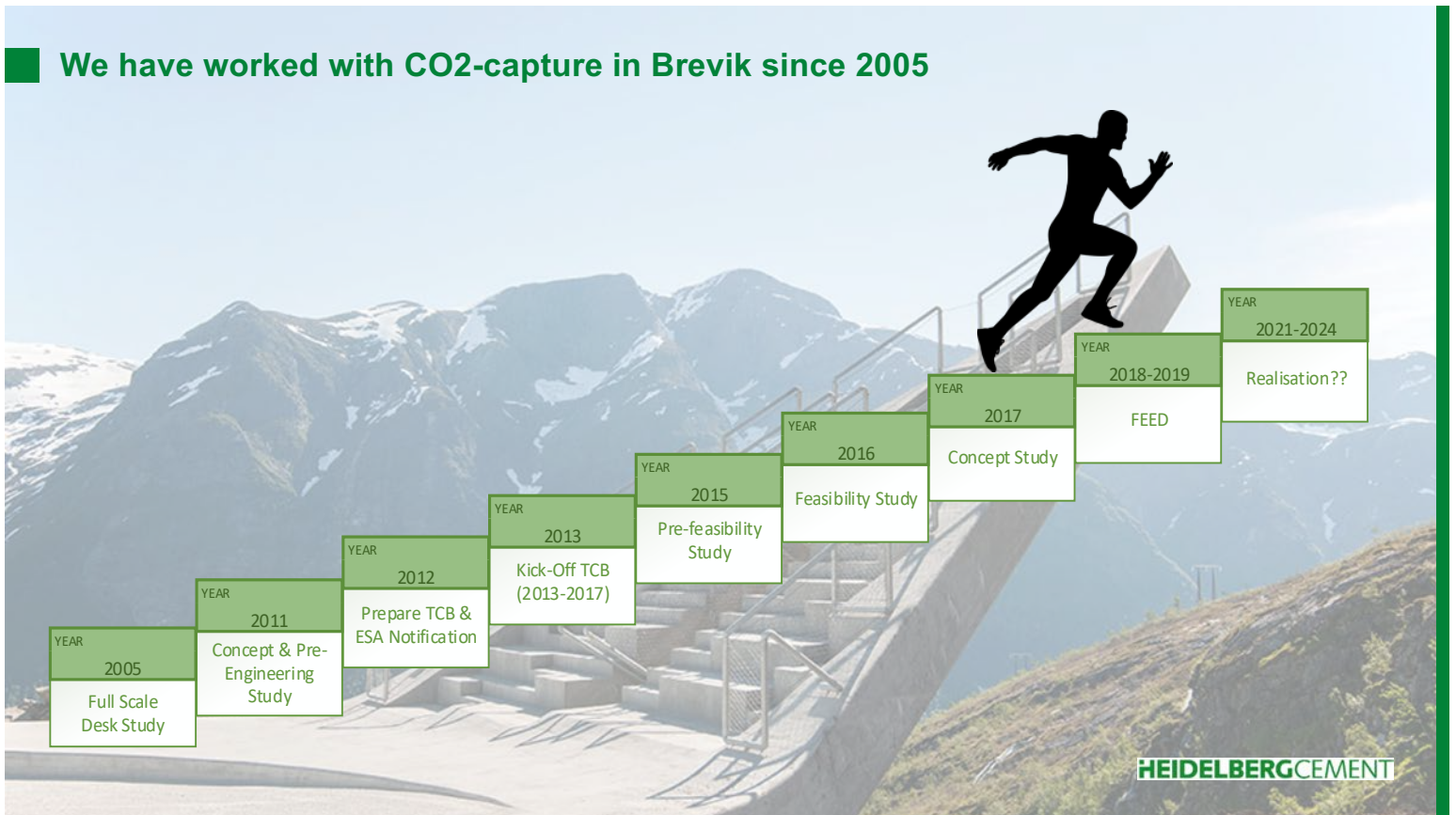
- Fuels only 1/3

■ **A lot of waste heat available**

■ **High concentration of CO<sub>2</sub> in flue gas (22-24% CO<sub>2</sub>)**

■ **Huge total potential (5-8 % of the entire CO<sub>2</sub> emissions from cement)**

## We have worked with CO2-capture in Brevik since 2005

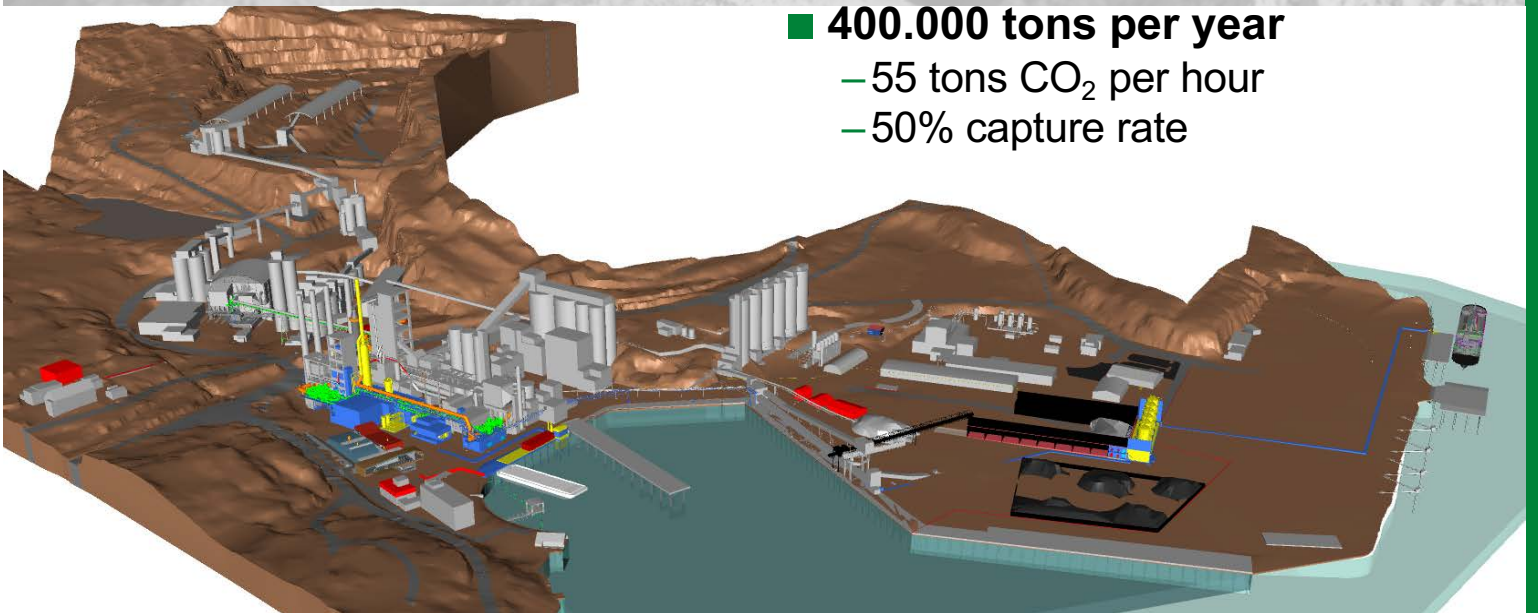




## Integration of a new CO<sub>2</sub> capture plant in Brevik

### Demonstration plant

- **400.000 tons per year**
  - 55 tons CO<sub>2</sub> per hour
  - 50% capture rate



HEIDELBERGCEMENT

# Northern Lights

A European CO<sub>2</sub> transport and storage network

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Oslo, 2019-11-14  
Sverre Overå, Project director

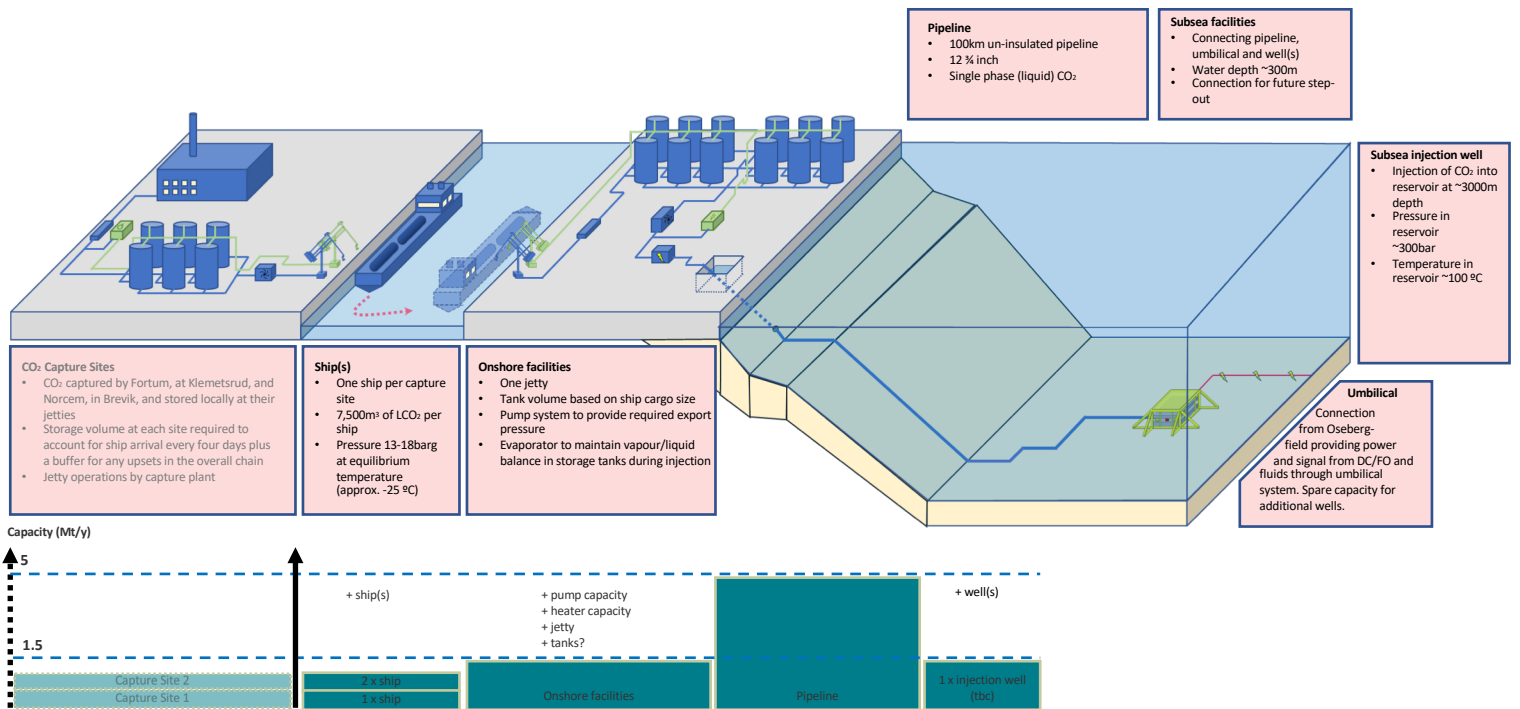


equinor



**TOTAL**

# Northern Lights – Concept

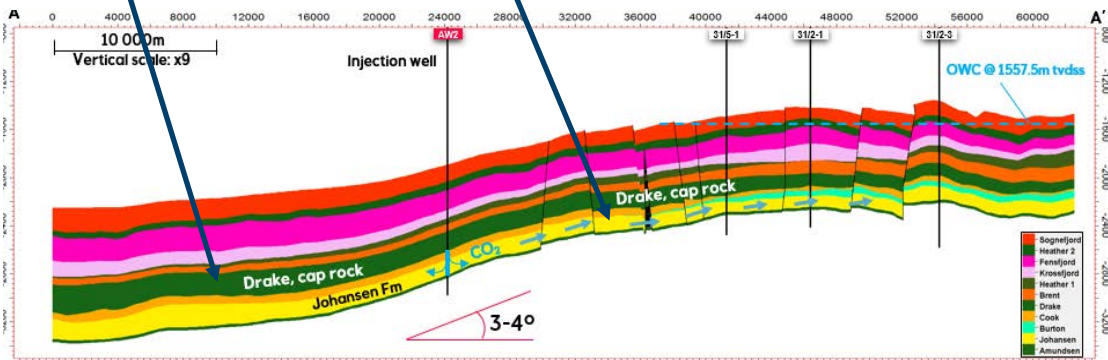


# Subsea equipment installed



# Why drill ?

1. Confirm we have suitable sandstone
  - Capacity
  - Injectivity
2. Confirm strength and presence of seal
3. Confirm ability to monitor injected CO<sub>2</sub>



## QUESTION AND ANSWER SESSION



Kristin Myskja  
Assistant Director-  
General  
Ministry of Petroleum  
and Energy, Norway



Ole Martin Moe  
Project Manager  
Fortum Oslo Varme



Per Brevik  
Director, Alternative  
Fuels  
HeidelbergCement  
Northern Europe



Sverre Johannesen  
Overå  
Project Director,  
Northern Lights  
Equinor

Webinar recordings provided on  
YouTube

<https://www.youtube.com/user/cleanenergypolicy>

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## Interested? Want to get involved?

If you want to learn more about the initiative, please reach out to Mr. Juho Lipponen, CEM CCUS Initiative Coordinator: [juho.k.lipponen@outlook.com](mailto:juho.k.lipponen@outlook.com)

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<https://www.linkedin.com/company/clean-energy-ministerial-ccus-initiative/>



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**CARBON CAPTURE,  
UTILIZATION & STORAGE**  
ACCELERATING CCUS TOGETHER

AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL