Shaping the future of CCS value chains

European Refining Technology Conference, 18th November 2020

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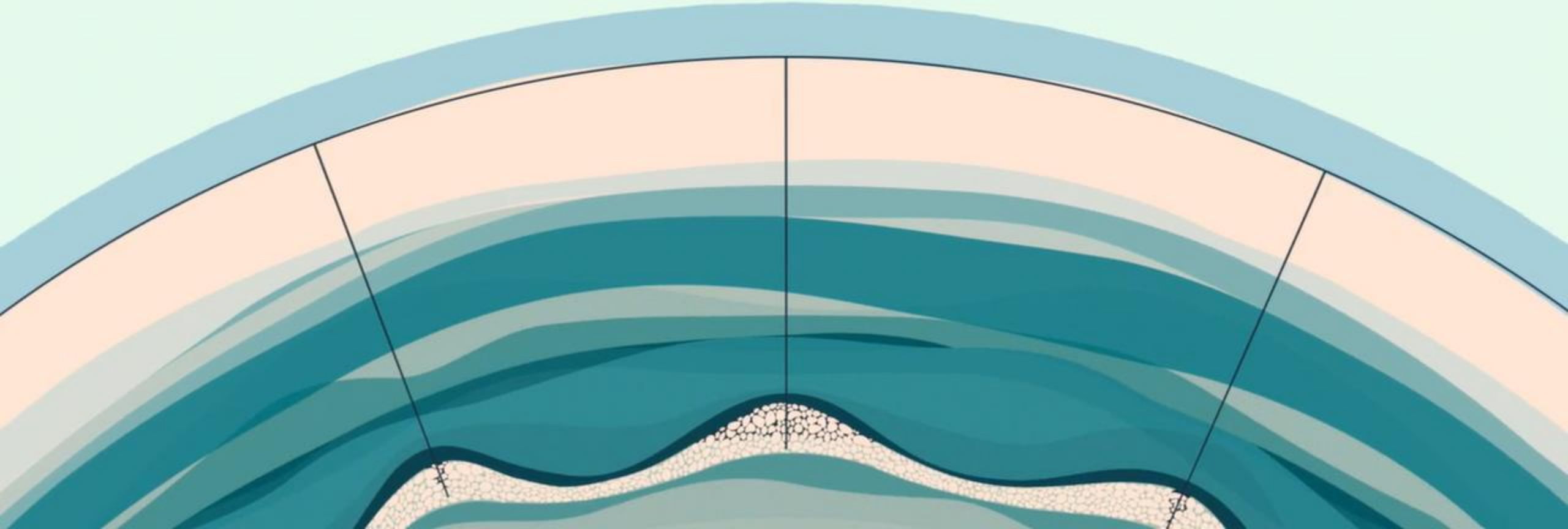
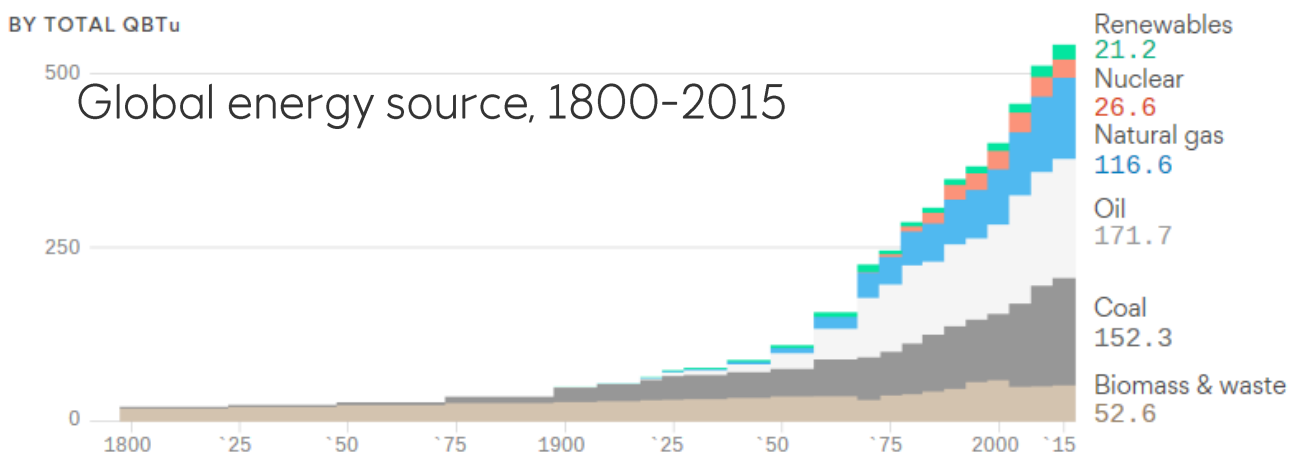
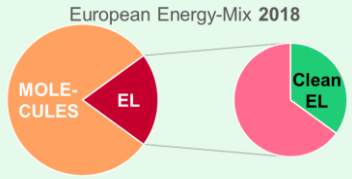


Energy transition and the scale of the challenge



Note: 1800–1900 data shown at 25-year intervals, 1900–1920 & 1930–1970 data shown at 10-year intervals, and 1920–1930 & 1970–2015 data shown at 5-year intervals. Data: Arnulf Grubler (2008), International Energy Agency (2017). Reproduced from charts by Richard Newell and Daniel Raimi. Chart: Axios Visuals



- Historic view on energy transition
- Shifts in primary energy supply has taken decades in the past
- The low carbon energy transition can not be solved by phasing in renewable only – we need the entire toolbox
- Carbon capture and storage can provide clean molecules

Molecules vs elecrons

Example

Snøhvit - Melkøya
Every cargo **~1 Twh**

70 ship loads/cargos of LNG per year

Sheringham shoal
Yearly generation **~1,1 TWh**

(317 MW, 88 wind turbines, power to 220.000 UK homes)

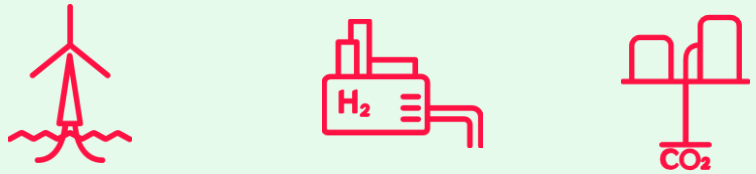
Shaping the future of energy

Equinor

Becoming a broad energy company

Growing renewable energy capacity tenfold by 2026, developing as a global offshore wind major

Pursuing Carbon Capture and Storage (CCS) and low carbon fuel (hydrogen) for energy intensive segments



- Climate ambitions are clear!
- Policy shaping happens now - governments moving from ambitions to actions
- Opportunity window to demonstrate sustainable solutions that can deliver at scale

Low Carbon Solutions portfolio

Building markets for CCS and clean hydrogen

CO_2 T&S

2023

Northern Lights

- CCS for industry
- Transport of CO2 by ship
- Open

2026

NEP*

- Pipeline transport
- Storage for Humber and Teesside

Hydrogen

2025

Hydrogen Norway

- Liquid hydrogen for maritime
- Distribution of H2
- Integration with existing onshore plants

2026

Zero Carbon Humber

- Hydrogen for industry
- Chemicals
- Synthetic fuels
- BECCS
- Hydrogen to power
- Blue Ammonia

2027/28

Clean Steel

- Hydrogen for industry (steel)

2027/28

H2 Magnum

- Hydrogen to power
- Hydrogen for industry
- Flexible back-up for intermittent renewable

Post-combustion

2026

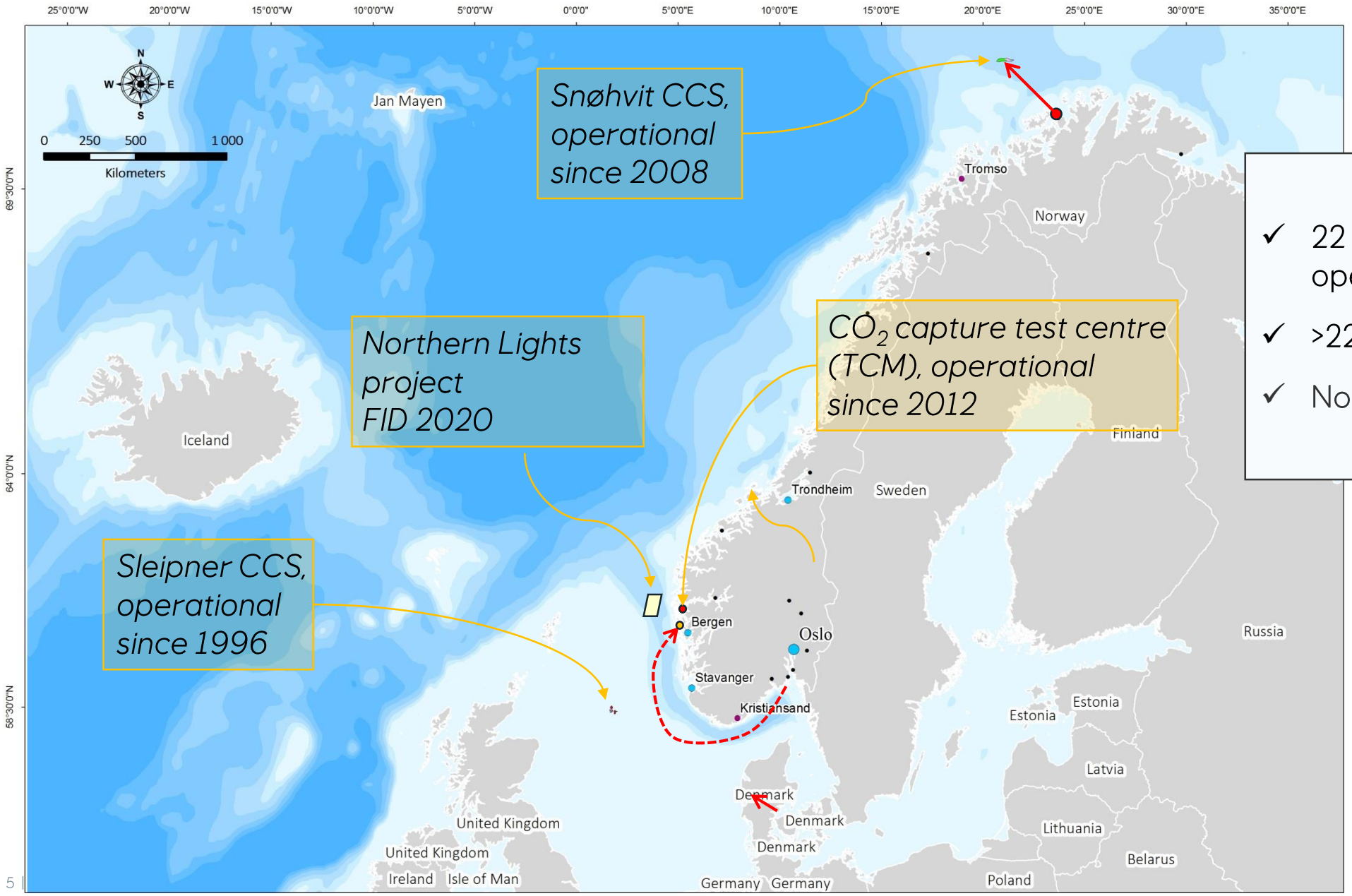
Net Zero Teesside

- Post-combustion CCS power generation
- CCS for industry
- BECCS
- Hydrogen production

Progressing projects in nations with advanced CCS/H2 policies – "first mover nations".

**Northern Endurance Partnership*

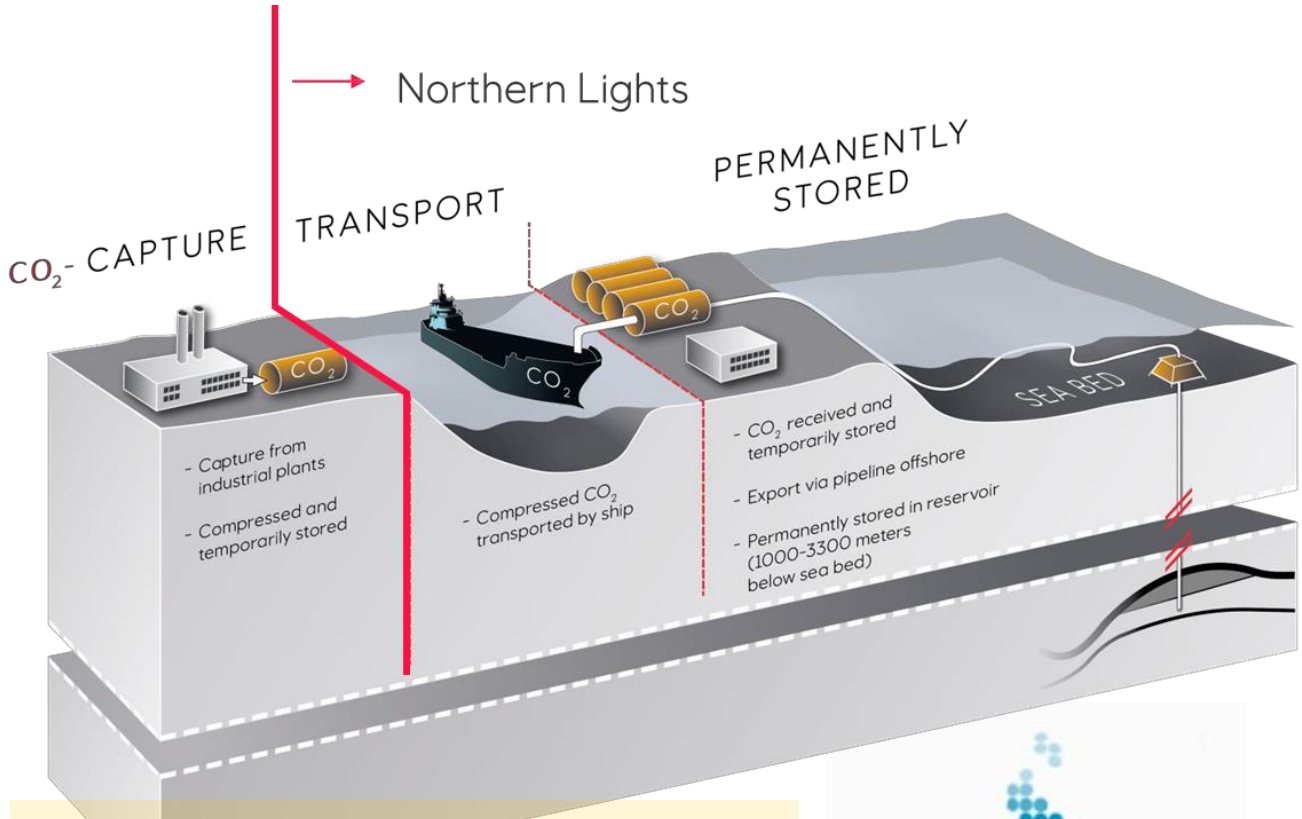
CCS and hydrogen: Building on our experience



- ✓ 22 years of CCS operations
- ✓ >22 Mt CO_2 stored
- ✓ Northern Lights FID 2020

A European "open source" network for CO_2 removal

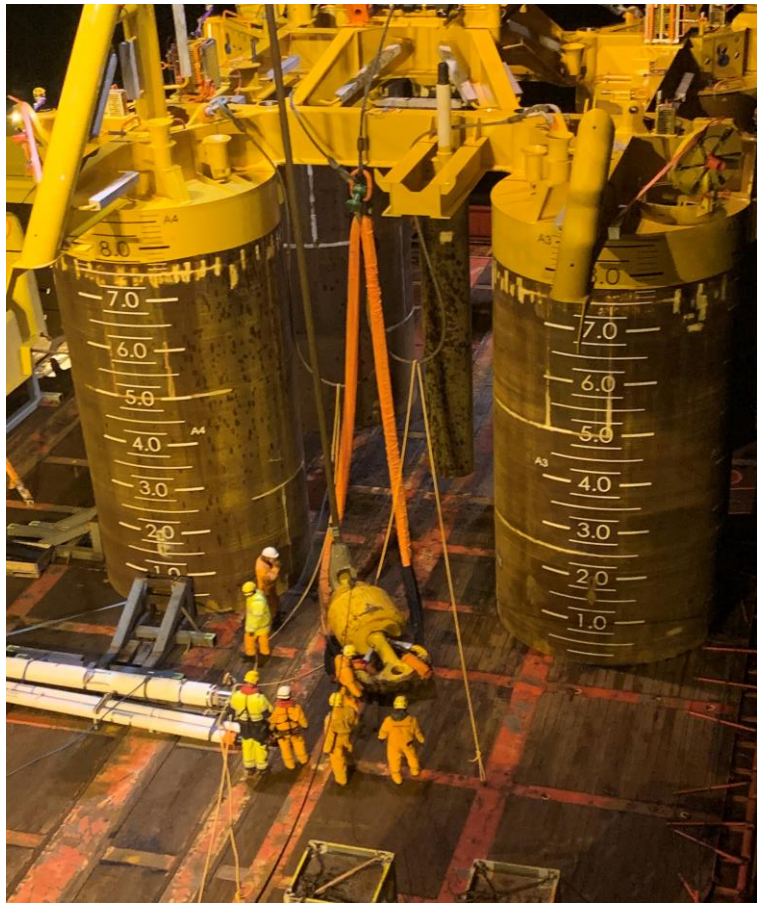
Source: Bellona Europe

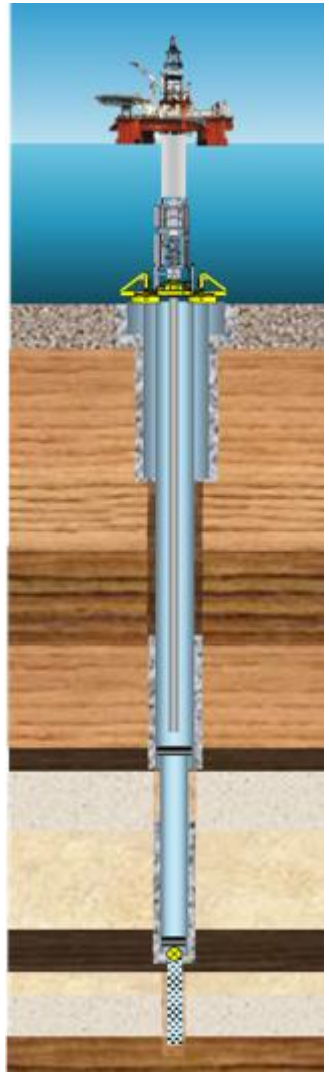


Innovative business model:
CO_2 Transport and storage as a service for industry that wants to decarbonise

GASSNOVA

2020 – Northern Lights making history for CCS



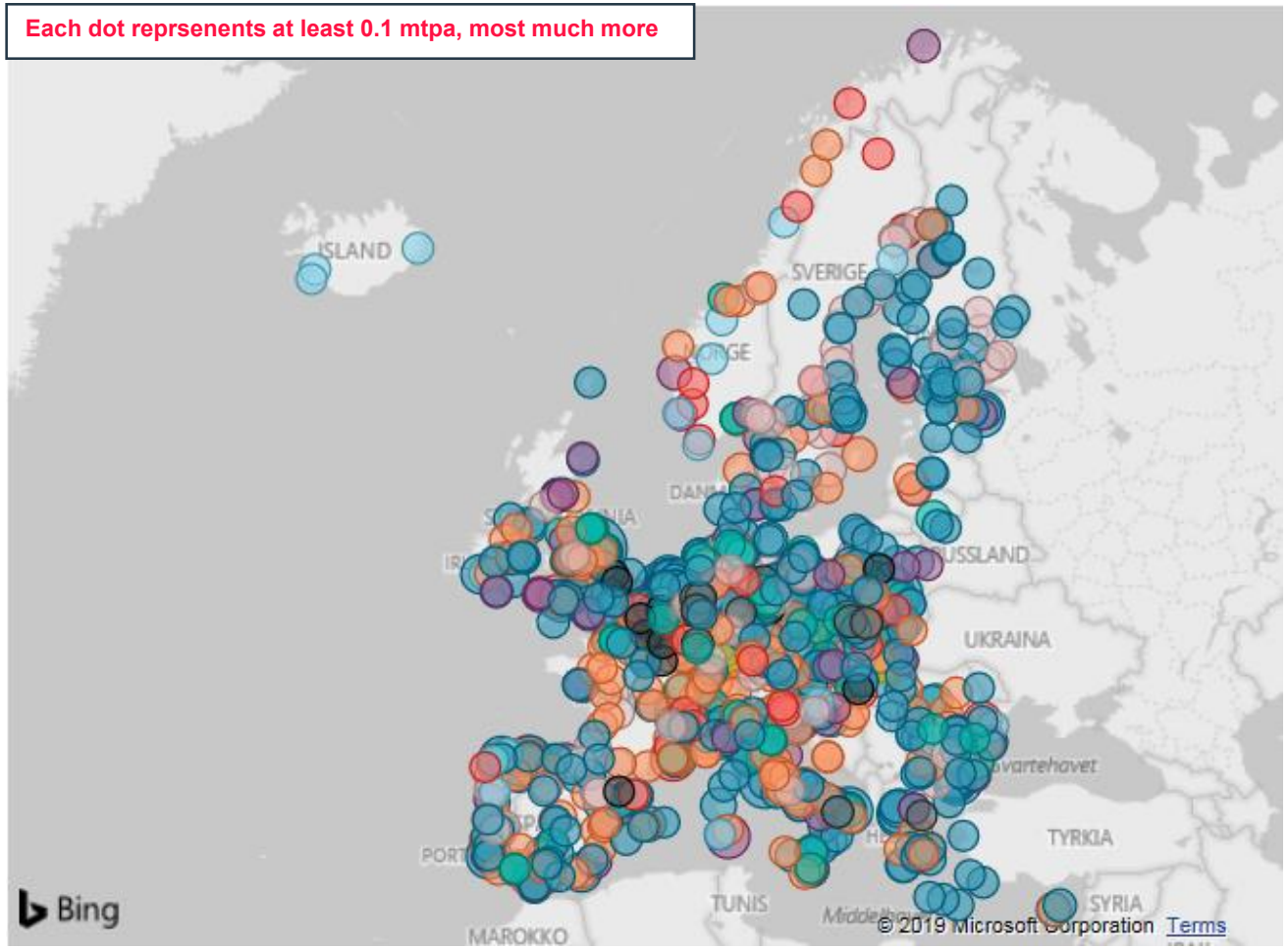


Historic investment decision for transport and storage of CO2

May 15, 2020 16:01 CEST | Last modified May 15, 2020 17:28 CEST

Equinor, Shell and Total have decided to invest in the Northern Lights project in Norway's first exploitation licence for CO_2 storage on the Norwegian Continental Shelf. Plans for development and operation have been handed over to the Ministry of Petroleum and Energy.

The ship based solution means access for CO_2 emitters across Europe

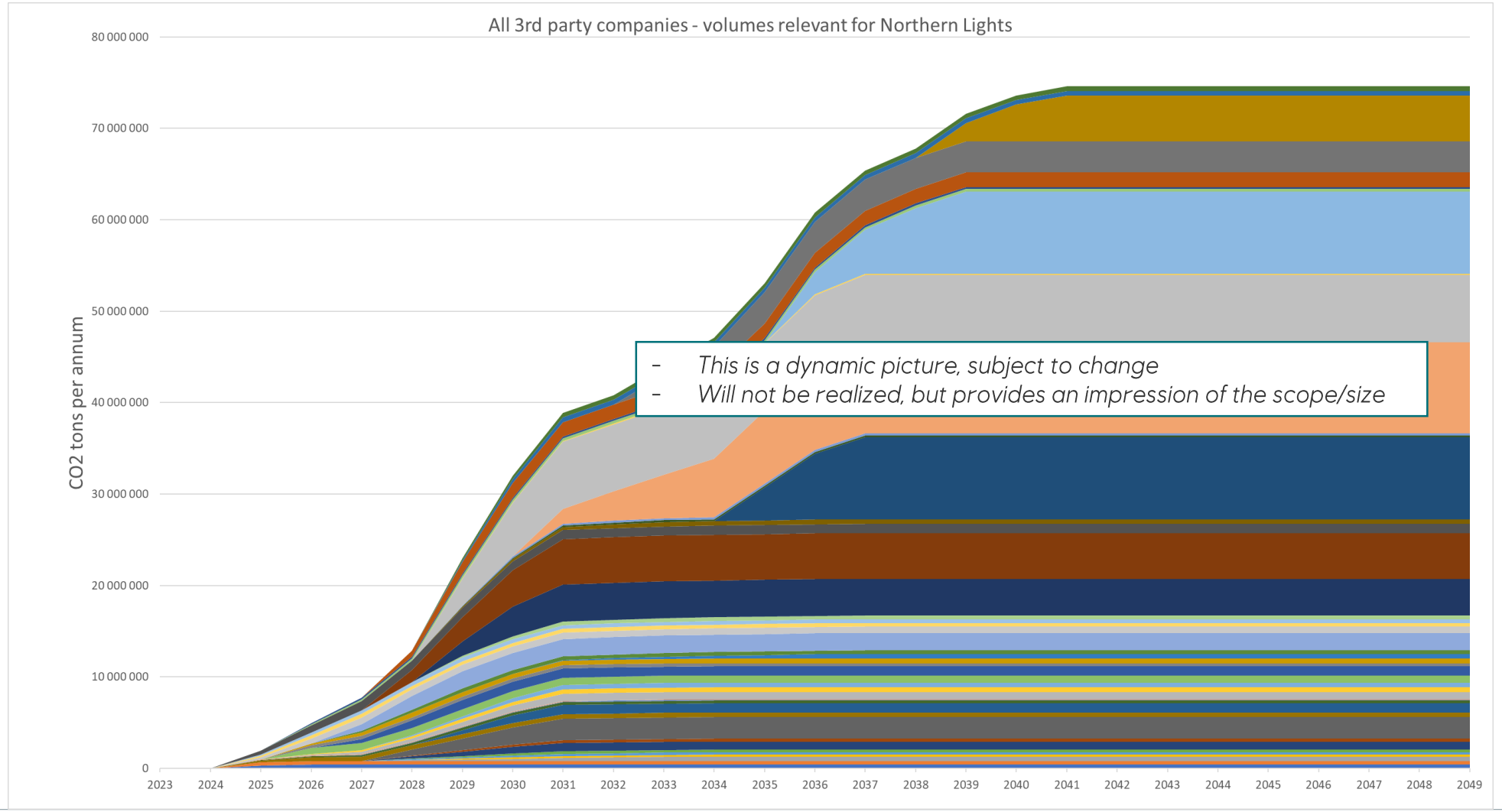


endrava CARBON LIMITS

Sectors with the largest potential

- Waste incineration / WtE
- Cement
- Biomass and biofuel
- Refineries
- Steel
- Natural gas
  - Hydrogen (pre combustion)
  - Electricity (post combustion)

Volume profile based on companies Northerh Light are in dialogue with



From exploratory discussions to formalisation

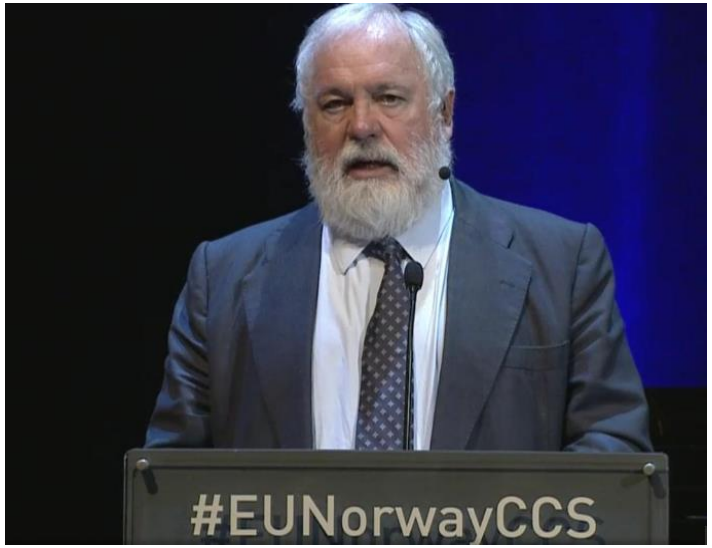
Northern Lights entering into MoUs with European industries @ #EUNorwayCCS event September 2019

European CCS pioneers.....

- Fortum Group (WtE); **Finland**
- Ervia (natural gas supply), **Ireland**
- Air Liquide (chemicals, hydrogen), **Belgium**
- Stockholm Exergi (WtE), **Sweden**
- ArcelorMittal (steel and iron), **Luxembourg**
- Preem (refineries and fuels, hydrogen), **Sweden**
- Heidelberg Group (cement), **Germany**

To collaborate on

- Logistics studies
- CO_2 specifications optimized across value chain
- Roadmap towards potential start of operations
- Joint advocacy for CCS and its importance for decarbonization of European industry
- Dialogue with National and Norwegian Governments and exploring funding schemes



Summary

- Northern Lights enable low carbon transitions of refineries
- Opportunity window to influence policy actions -> Low carbon project must happen now!
  - build confidence and public acceptance
  - stimulate governments to establish policy framework
  - develop the market