The Norwegian Full-scale CCS project
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- Advise the Ministry of Petroleum and Energy
- Manage the State’s full-scale CCS project
- Contribute to technology development and knowledge-sharing
A European CCS value chain to drive CCS development and industrial success

The Northern Lights Project of Common Interest (PCI) is a CO2 cross-border transport connection project where CO2 captured from industrial sites in Europe will be collected by ship and transported to the Norwegian Continental Shelf for permanent storage subsea, resulting in a full-scale CCS value chain. Equinor, Shell and Total announced on 15 May 2020 that they have decided to invest in the Northern Lights transport and storage solution. The investment decision is subject to final investment decision by Norwegian authorities and approval from EFTA Surveillance Authority (ESA).

The development of a European CCS ecosystem can be a powerful driver for carbon capture in Europe and globally.
Equinor, Total and Shell (‘Northern Lights’) are planning the transportation and storage of CO₂ in the North Sea.

- **Norcem AS, Brevik** Cement factory
- **Fortum Oslo Varme AS** Energy recovery plant
- **Reception Terminal for CO₂ at Øygarden, Hordaland**

- Onshore terminal with storage buffer, pump and heating of CO₂
- 110 km pipeline, 12 inches
- One injection well

- **Transport**: 2 ships
- **Distance**: 700 km
- **Level**: Liquid (15 barg, -26°C)

- Capture 400 kt CO₂/year from Norcem and Fortum Oslo Varme respectively.
- Amino technology
- Includes CO₂ cleaning, condensation and storage buffer (4 days)
Pipeline and umbilical routes

Oseberg platform

Eos well drilled 2020

CO2 pipeline

Receiving terminal
3D view of onshore terminal on west coast of Norway
CCS value chain in operation 2023/2024

- **Idea study**
- **Concept studies (Capture and transport)**
- **Feasibility study**
- **Pre-engineering studies**
- **Political decision**
- **Results from verification well**
- **External quality assurance (KS2)**
- **Construction phase**
- **Operation**
External quality assurance

In Norway, public projects above USD 100 millions are required to pass external quality assurance:

- Independent consultant company appointed by the government (in this case Atkins in collaboration with Oslo Economics).
- Quality assurance performed in several stages along the project development, with a concluding review before final investment decision (called KS2).
- The review is based on examination of project documentation and interviews/workshops with project owners, the relevant industrial companies, chosen engineering contractors, etc.
- The KS2-report was published on June 24th, with main focus on costs & uncertainties, as well as the planned project governance.
Cost of the CCS-chain

- Total CAPEX of 1860 USD Million (both capture plants included)
- Annual OPEX is around 4-5% of CAPEX for each part of the chain.
- Biggest contributions to OPEX are cost of electricity and manning, for the capture plants and transport/storage facilities, respectively.
- Uncertainty in the «market development» (suppliers and materials) is the major contribution to overall cost uncertainty of +/-20% at the end of FEED
State support – CAPEX sharing

**Capture**

- **Agreed max limit (P85 estimate)**
  - 75% (State)
  - 25% (Company)

- **Investment threshold**

- **Basic scope**

- **Potential upside for company:**
  - Green product (higher price?)
  - Income from sale of CO₂ quotas for avoided emissions

**Transport & Storage**

- **Agreed max limit (P85 estimate)**
  - 80% (State)
  - 20% (Company)

- **Basic scope**

- **Potential upside for company:**
  - Strategic fit
  - Income from sale of transport & storage service to paying customers

- **Similar sharing mechanism for OPEX (state support for 10 years of operation)**
Net present cost per ton stored

- 25 years of operations
- Discount rate 4%
- The future net present cost per ton is estimated based on:
  - Larger storage terminal & injection pipeline
  - Larger capture plants (at least 1 Mtpa)
  - Replace ships with pipelines
  - Further cost reduction in line with experience from similar industries