Greensand CO2 Transport and Storage Project
Status and CO2 footprint of CCS value chain
INEOS Energy and Wintershall Dea

June 14th, 2022, Copenhagen
By Søren Reinhold Poulsen, Greensand Project Director
Greensand in the European CCUS landscape (Current!)

Turning Siri Oil and Gas hub into a CO2 storage hub

[Map and images of Siri Oil and Gas hub and CO2 storage facilities]

INEOS Energy
Greensand Project – Transport and Storage of CO2

Overview

- Use of Siri Area for CO₂ storage
  INEOS has experience and huge data set from exploration and production activities in Siri Area over more than 20 years
- Initial Greensand work focused on CO₂ storage in Nini West
- Nini Full scale project includes Nini Main & West
- Expansion project includes remaining Siri area suitable reservoirs
Greensand Project
Phase 2 – Pilot CO2 injection trial, monitoring testing and further maturation

Key activities:
- Pilot injection
  - Logistical set-up
  - CO2 Transfer solution
  - 12,000 MT CO2 (food grade quality) injected in Nini West test well
- Full scale maturation
  - Further reservoir modelling and lab testing
  - Well design
  - CO2 carrier ship design
  - Monitoring tools deployed and tested
  - DnVGL Site Endorsement CoC

Pilot Injection Sequence

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<tr>
<th>Phase 1</th>
<th>2020</th>
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Strong Phase 2 Consortium of 23 Companies
Greensand Project
Phase 2 injection pilot – securing the equipment and planning

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<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Liquid CO₂ conditions</td>
<td>-31°C @ 14 bar to -40°C @ 10 bar (initial vs empty conditions)</td>
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<td>Payload</td>
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<td>Holding time</td>
<td>30 to 50 days</td>
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Liquid CO₂ storage tanks in Antwerp. 2500 MT @ 16 barg and -20 deg C
Greensand Full Scale Project
Starting with a 1.5 MTPA capacity

Full Scale (Nini West/Main) Conceptual Set-up

Key activities:
- Mature Nini Main reservoirs
- Mature Development concept
  - Ship design
  - Offloading/Transfer system
  - CO2 injection wells
  - Monitoring set-up
- Establish logistical & commercial model
- Authority approvals
- DnV Storage Site & Site Development CoC’s

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Greensand Full Scale Project
CCS value chain CO2 footprint considerations

Capture and purification
Onshore Infrastructure
Temp. Storage and Jetty
Liquefaction

Offloading system
Nini

Energy Consumption

Capture
Transportation
Storage

Capture

Transportation

Storage

Cumulative Energy Consumption

CCS life cycle cost vs. CO2 footprint

Pre-FID activities
FID
Operational
Termination

CAPEX
OPEX
ABEX

This is the effective CO2 footprint reduction - will become a competition parameter in the CCS game going forward
Greensand Project – CO2 footprint of Full scale project
Emission assessment study (Industrial PhD project 2021-2024)

- Emission assessment done from a Life Cycle perspective (applying LCA methodology ISO14040/44)
- PhD project (Maersk Drilling, INEOS/WDEA and DTU Environment)...
- Collaborate with relevant Greensand partners and relevant stakeholders to gain necessary insight into processes and data gathering

PhD study timeline:

- Q4 2021: Study beginning
- Q4 2022: LCA results: well prep and injection from platform
- Q4 2023: LCA results: transport and storage
- Q2 2024: Assessment model implemented and recommendation for industry
- Q4 2024: Dissimination ends
Optimisation of the full CCS value chain
Collaboration across the entire value chain is a pre-requisite for success

- Lack of common understanding across sections today.
  - Intersections and linkage between processes need to be outlined and assessed (emission quantification and optimization).
  - Large number of stakeholders included today in developing this new industry value chain.

- Few studies assessing the emission footprint of the entire CCS value chain
  - Infrastructure depends on CO2 requirements – e.g. CO2 Pressure, Temp, Specs throughout
  - CCS value chain uniqueness vs. areas of standardization

- Greensand full scale project working as a case study. Feed results into network of partners and academia
Greensand Project

Thank you for your attention