

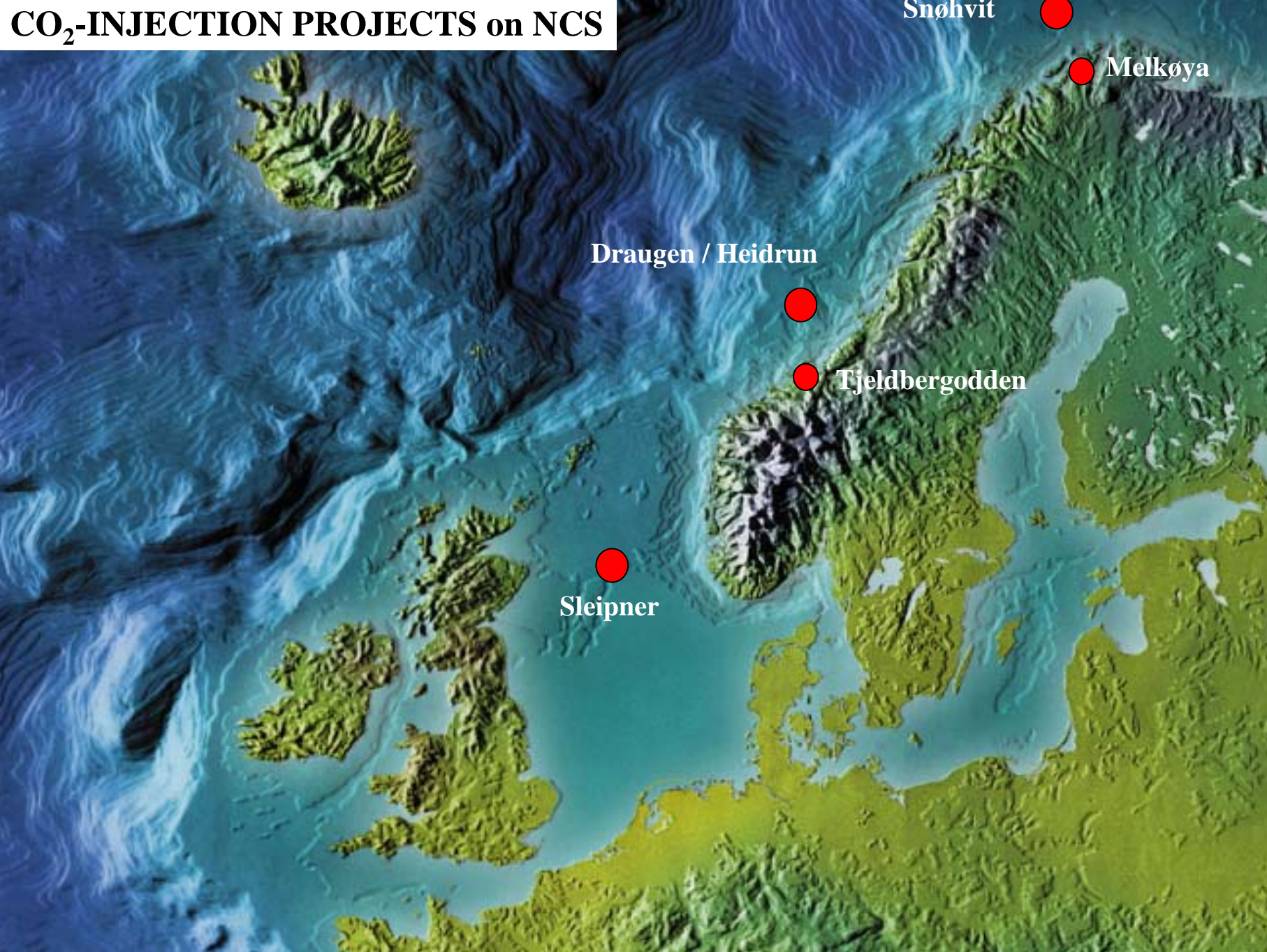
CO₂ Capture and storage on NCS



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Statoil New Energy**



CO₂-INJECTION PROJECTS on NCS



Decision in 1992. Gas production and CO₂ injection started in 1996



Challenge

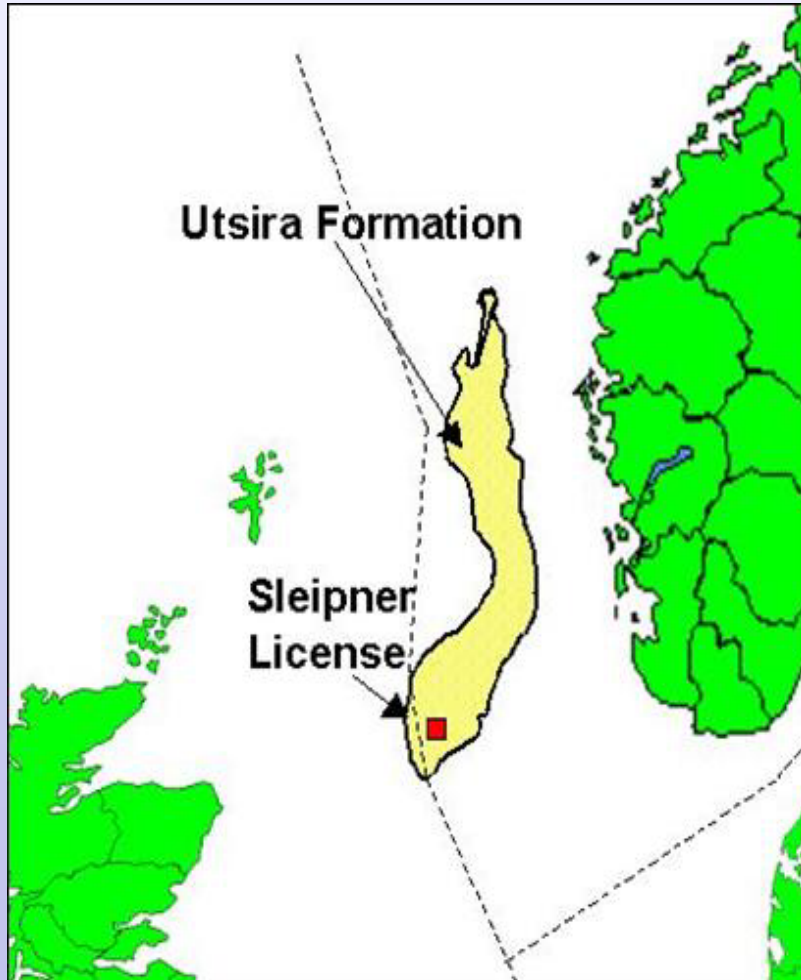
- First large scale offshore CO₂-removal
- Natural gas contains 4 to 9.5% CO₂
- Sales gas must contain less than 2.5%

Solution

- Large-scale offshore CO₂ capture (Sleipner T platform)
- One million tonnes per year injected into the Utsira Formation



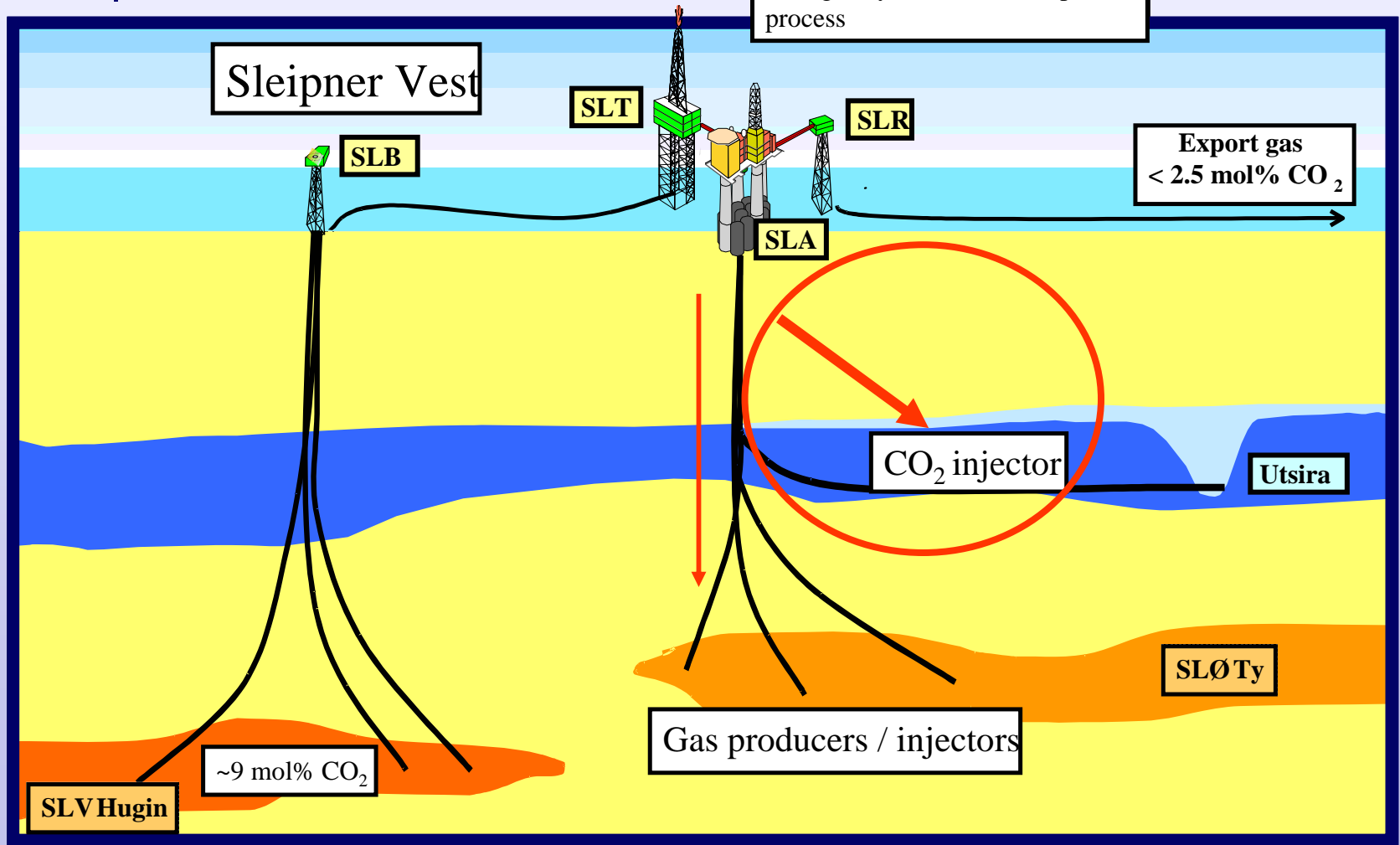
The Utsira Formation



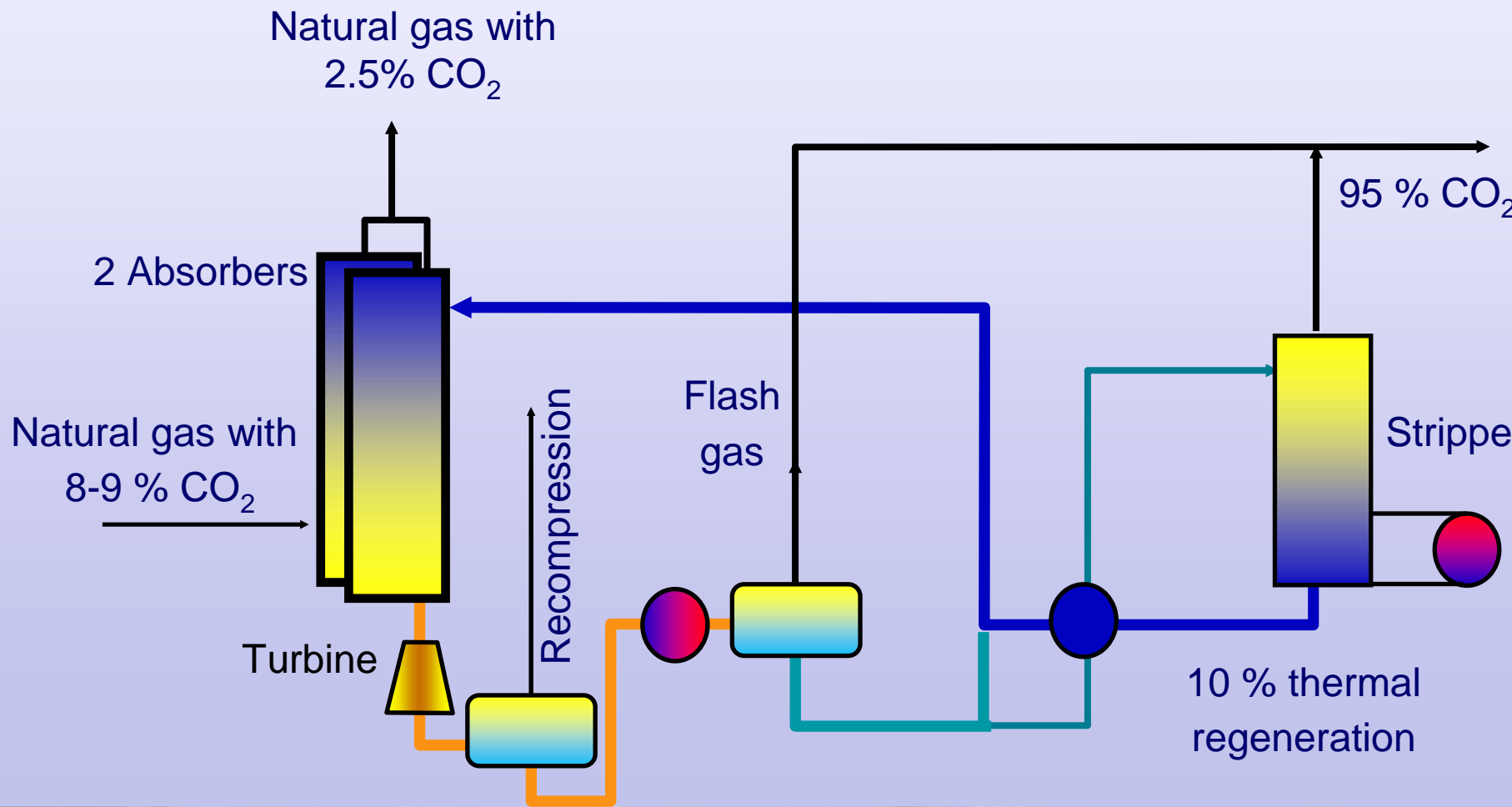
**Storage capacity
is theoretically
hundred times
larger than
average annual
European
emissions**



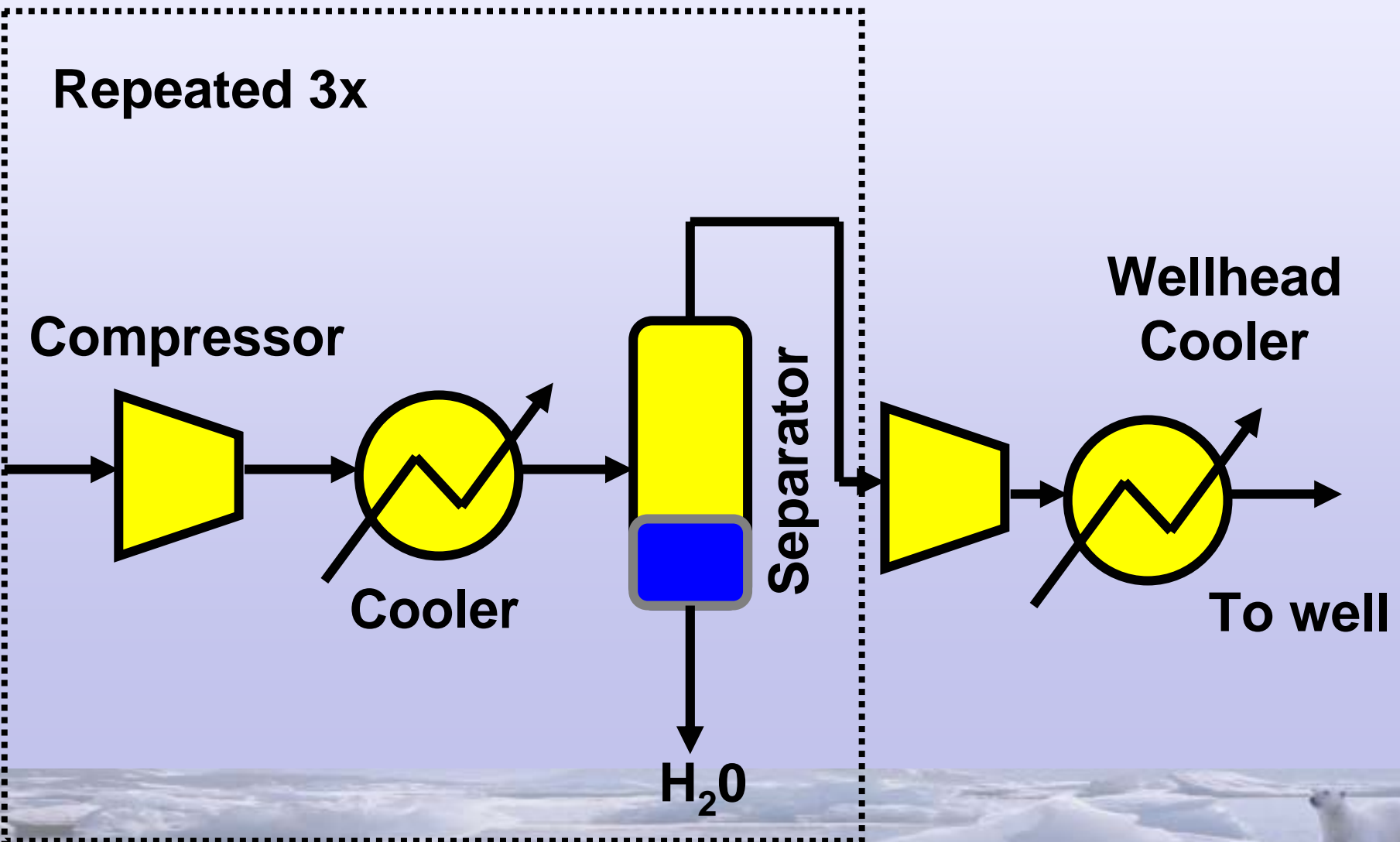
Sleipner Field Centre



Process Flow Diagram of CO₂ Capture



Process Flow Diagram of CO₂ Injection



Main cost of CO₂ injection at Sleipner

- Investments for injection only
- Investments: 750 MNOK in 1996
 - Drilling and completion of well
 - 4 Compressors
 - 4 Knock-out drums
 - 4 Coolers
- Operational costs: 54 MNOK/year
 - Fuel for compressors
 - CO₂ tax on compressor fuel exhaust
 - Maintenance

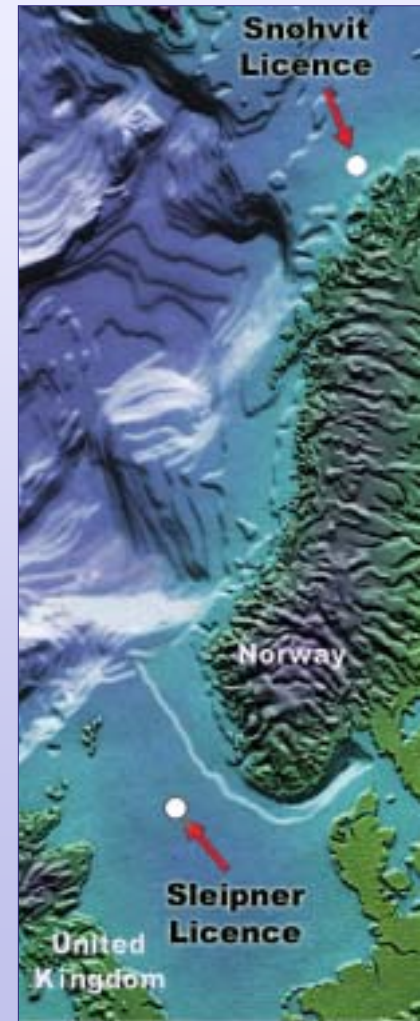
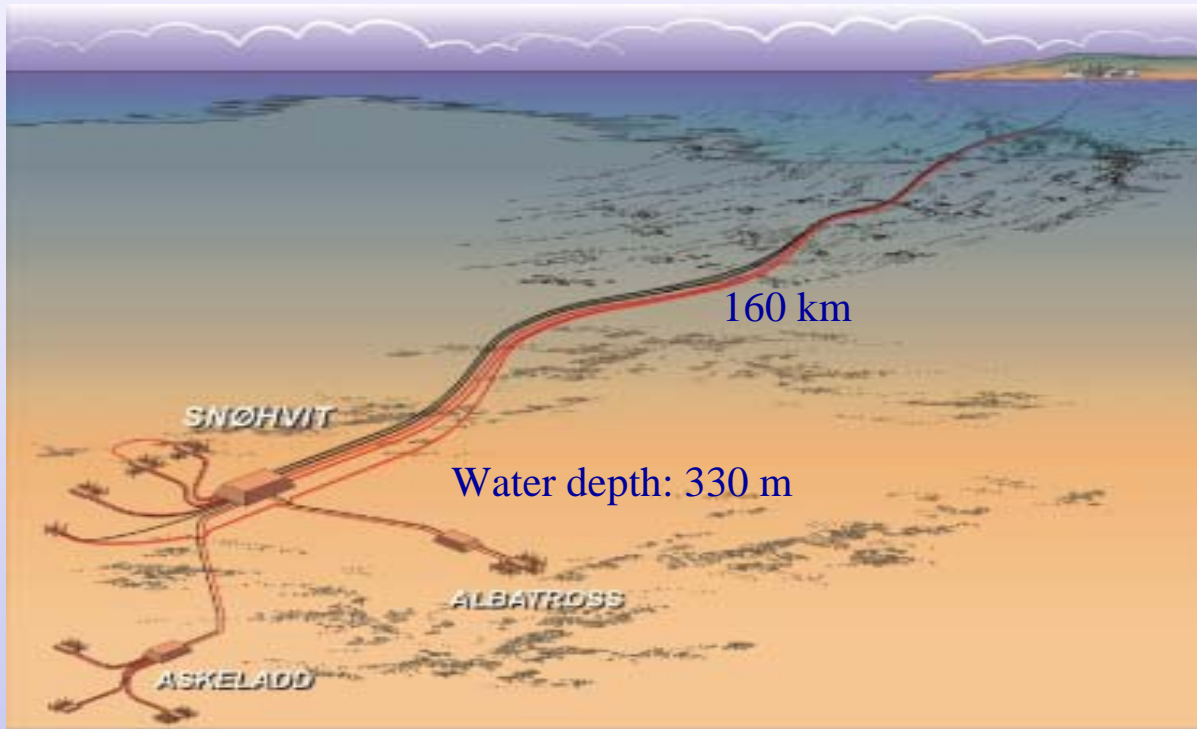


Summary Sleipner

- CO₂ injection at Sleipner is well established and proven technology
- Minor challenges, but in operation for 10 years
- Offshore CO₂ tax made storage the most economic option
- Research from SACS programme confirms that geological CO₂ storage can be done safely



SNØHVIT LNG PROJECT W/CO₂-INJECTION



Challenge

- A fully sub-sea offshore development (no platform)
- Natural gas contains 5 to 8% CO₂
- Must be lowered to 50 ppm prior to liquefaction

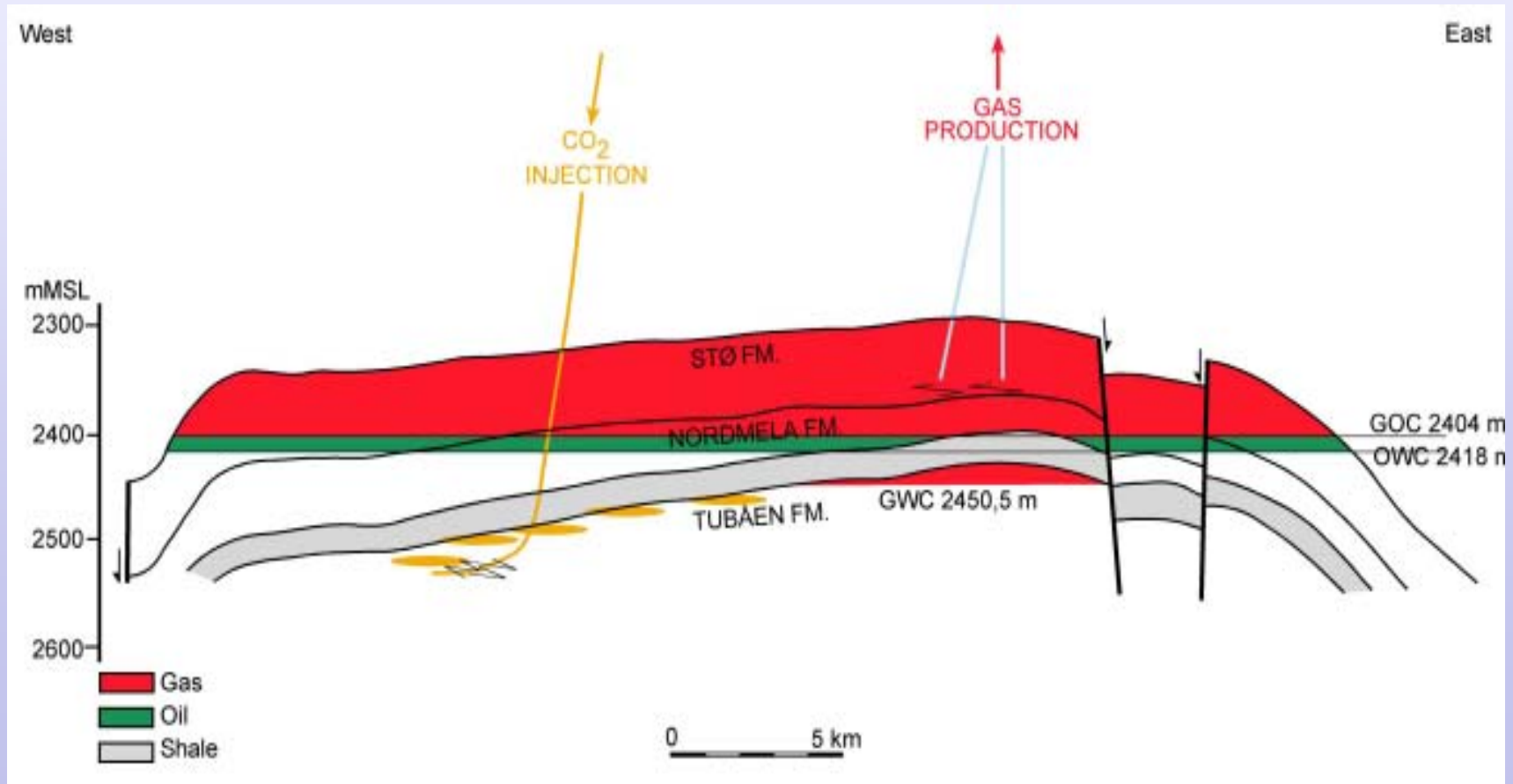
Solution

- Onshore (Melkøya) CO₂ capture, 700 000 tonnes per year

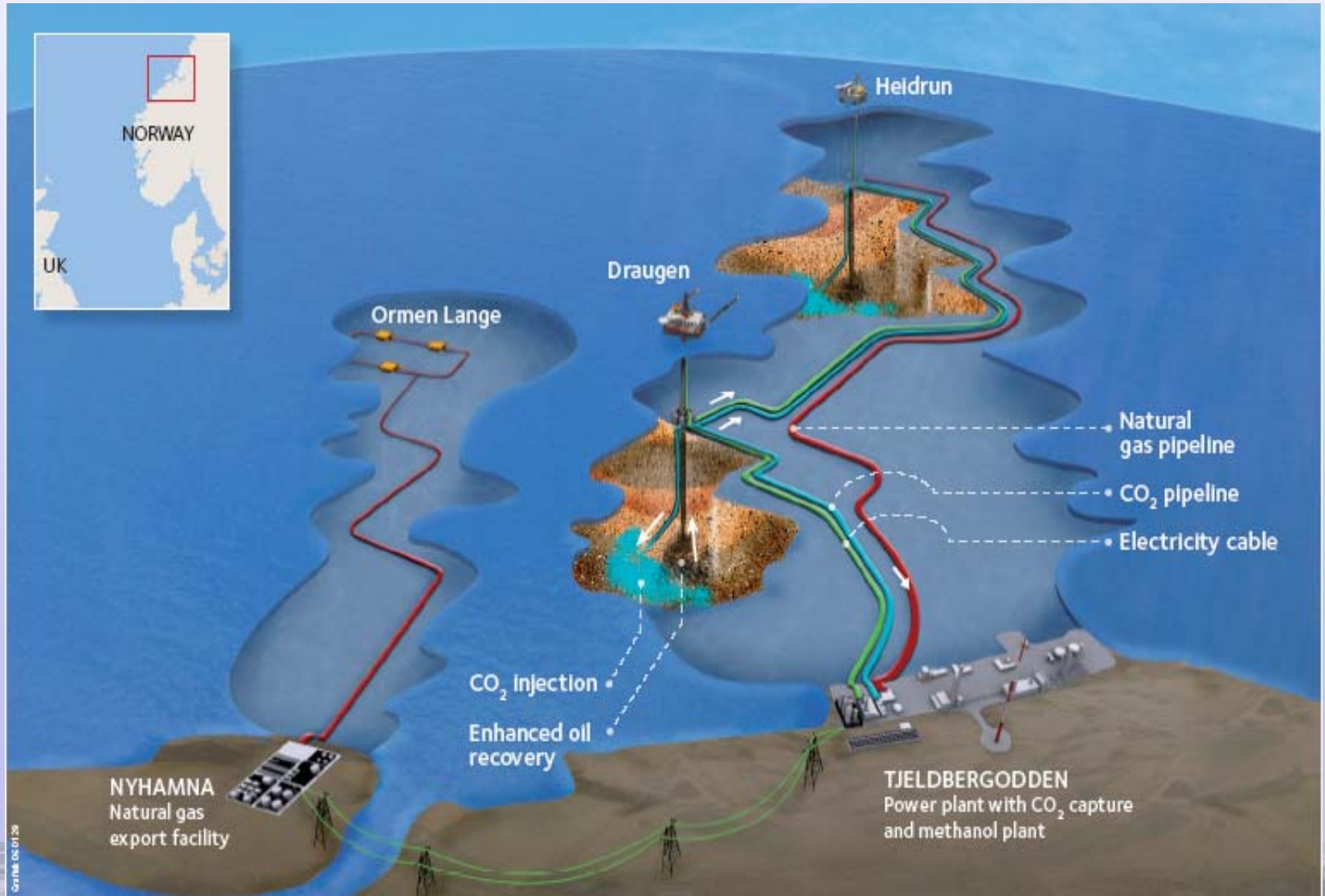
1.6 million tonnes of CO₂ is injected into the Uthmaniyah field



CO₂ storage in the Snøhvit Field



Offshore Mid Norway



Power plant at Tjeldbergodden



- 860 MW gas power plant:
 - Offshore electricity demand
 - Regional power supply

CO₂ capture and transport



- Offshore CO₂ injection
 - Up to 2,5 million tonnes CO₂ injected annually

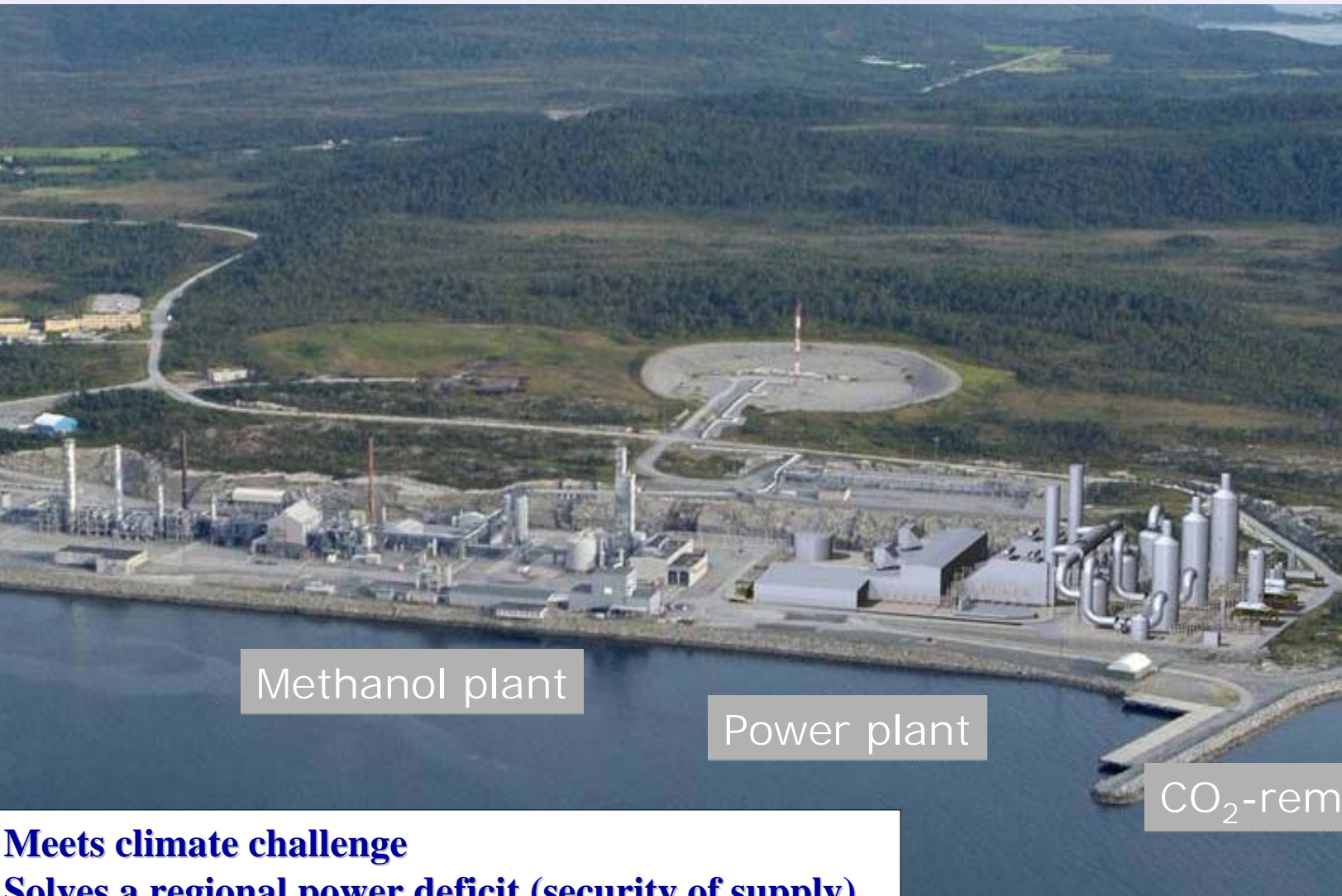
CO₂ for enhanced oil recovery/storage



- Enhanced oil recovery:
 - Draugen
 - Heidrun
 - Other fields



Gas power plant with carbon capture



Methanol plant

Power plant

CO₂-removal

- Meets climate challenge**
- Solves a regional power deficit (security of supply)**
- Enhanced oil recovery**
- Value creation and industrial development**



• Environment

- Reduction of CO₂ and NO_x emission through offshore electrification
- Industrial utilisation of greener fossil fuels technologies with a global market potential

• Industry

- Large scale CO₂ for EOR
- Improved security of supply

• Society

- Prolonged field life and increased oil recovery
- National electricity grid benefits

• Joint Statoil and Shell team:

- Feasibility study: end 2006
- Concept select: end 2007
- Value chain investment decision: 2008

• Provided a satisfactory commercial outcome:

- Start-up power plant and electrification of Draugen: 2010/11
- First CO₂ supply for Draugen EOR: 2011/12

• Successful development requires:

- A substantial economic contribution by Norwegian authorities
- Contribution by industrial players onshore and offshore



- Lowest CO₂ emissions per unit produced
- CCS accepted as baseline
- Commercial CO₂ solutions

- Research continues with CO2STORE and other programmes
- Discussion on legal aspects of geological CO₂ storage is ongoing....and moving towards acceptance?

