

CCS in Northern Netherlands



Off-shore transport and storage

International cooperation

On-shore transport and storage

CCS in Northern Netherlands



The Northern Netherlands has a unique position
for making CCS work



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Capture

- North-Netherlands hosts several power plants (existing and under construction): Nuon/ Vattenfall, RWE, Advanced Power, SEQ and Electrabel
- About 1/3 of the Dutch electricity (fossil & renewable) will be produced in Northern Netherlands
- Pre-combustion, post-combustion and oxyfuel are all part of the CCS-portfolio

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Transport

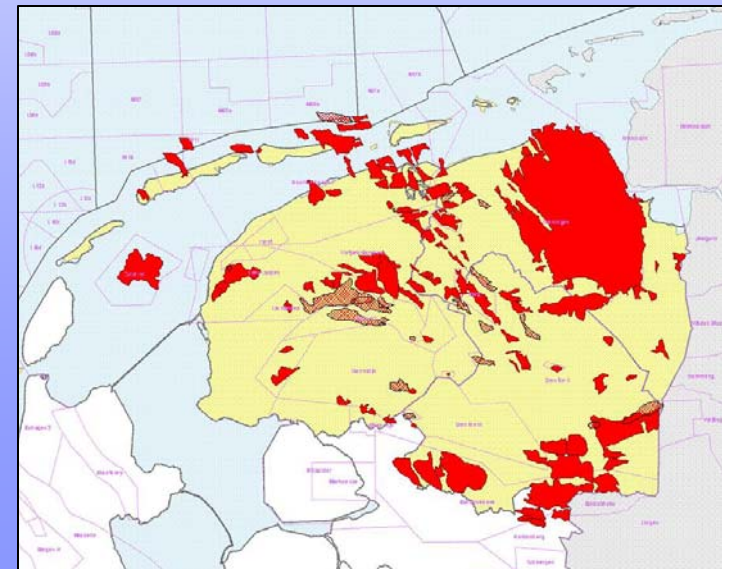
- North-Netherlands has a high level of knowledge on transport of (natural) gas: Gasunie and many other companies
- Gasunie already announced participation in the Northern CCS projects

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Storage

- Largest on-shore gas fields of Western Europe
 - About 1200 Mton storage capacity onshore (excluding the Groningen field)
- Part of these fields are well suited for CCS
- Significant off-shore storage potential as well



CCS in Northern Netherlands



The main plans for CCS at the moment are from Nuon/
Vattenfall and RWE, combined with Gasunie and a
storage company



Nuon, pre-combustion, 1200 MW



- Nuon is building a 1200 MW multifuel plant
- IGCC
- Pre-combustion
- About 2,5 MT capture (EEPR)
- Tests are being executed at the existing plant in Buggenum, the Netherlands



RWE, post-combustion, 1600 MW



- RWE is building a 1600 MW multifuel plant
- Powder coal and biomass plant (2015)
- 0,2 Mton PCC demo is announced in 2015 together with Gasunie and a storage company
- A larger demo can be part of NER proposal
- After 2015 the demo will gradually be build up to app. 7,2 MT in 2023
(4 trains of 1,8 Mton)





Other initiatives & plans

- Advanced Power
 - 1200 MW Natural gas plant (capture ready)
- SEQ
 - Several 50 to 200 MW EGR (oxyfuel) projects
- Akzo-Nobel
 - Existing facility: testing CO₂-capture (PCC, app. 0,2 Mton CO₂)
- Plans for a LNG terminal in Eemsdelta harbour (Gasunie, Essent, Vopak): possibilities for Cryogene capture
- Electrabel has an already existing Power station in the Eemsdelta harbour

Roadmap



- 2010 – 2015: RWE, Akzo-Nobel: demo and pilot
Nuon: large-scale capture
- 2015 – 2020: Building up to 10 Mt storage in 2020
(Nuon and RWE)
SEQ builds a 200 MW EGR (oxyfuel) plant
- >2020: Storage connections from other regions
Other plants and industries join in
(Electrabel)



Costs estimate



CCS costs, including transport & onshore storage:
€ 40-60 /ton CO₂ (2008 price level)

External economic validation in 2010



CCS NNL Foundation



- **CCS NNL Foundation**
 - Joint plan by all CCS chain partners
 - Subsidy €5 million in progress
 - CCS preparation activities program €8 million
- **Activities focus on**
 - Transport
 - Storage
 - Communication



USP of Northern Netherlands



- Existing and new power stations in the region
- Pre-combustion, Post-combustion and Oxyfuel
- High level knowledge of transport
- Very large on-shore storage capacity (fields >200 Mton)
- Partners as RWE, Nuon, NAM, Gasunie, the University of Groningen and public bodies all co-operate
- Eemsdelta: Chemical industry with possibilities for re-using CO₂ (Brunnermond, AKZO and BioMCN)

Next steps



- Joint approach for demonstration projects under NER
- Collaboration with other regions; RCI and cross-border
- NNL wants to be frontrunner in Dutch and European CCS developments