



Status of the ROAD Demo Project in Rotterdam

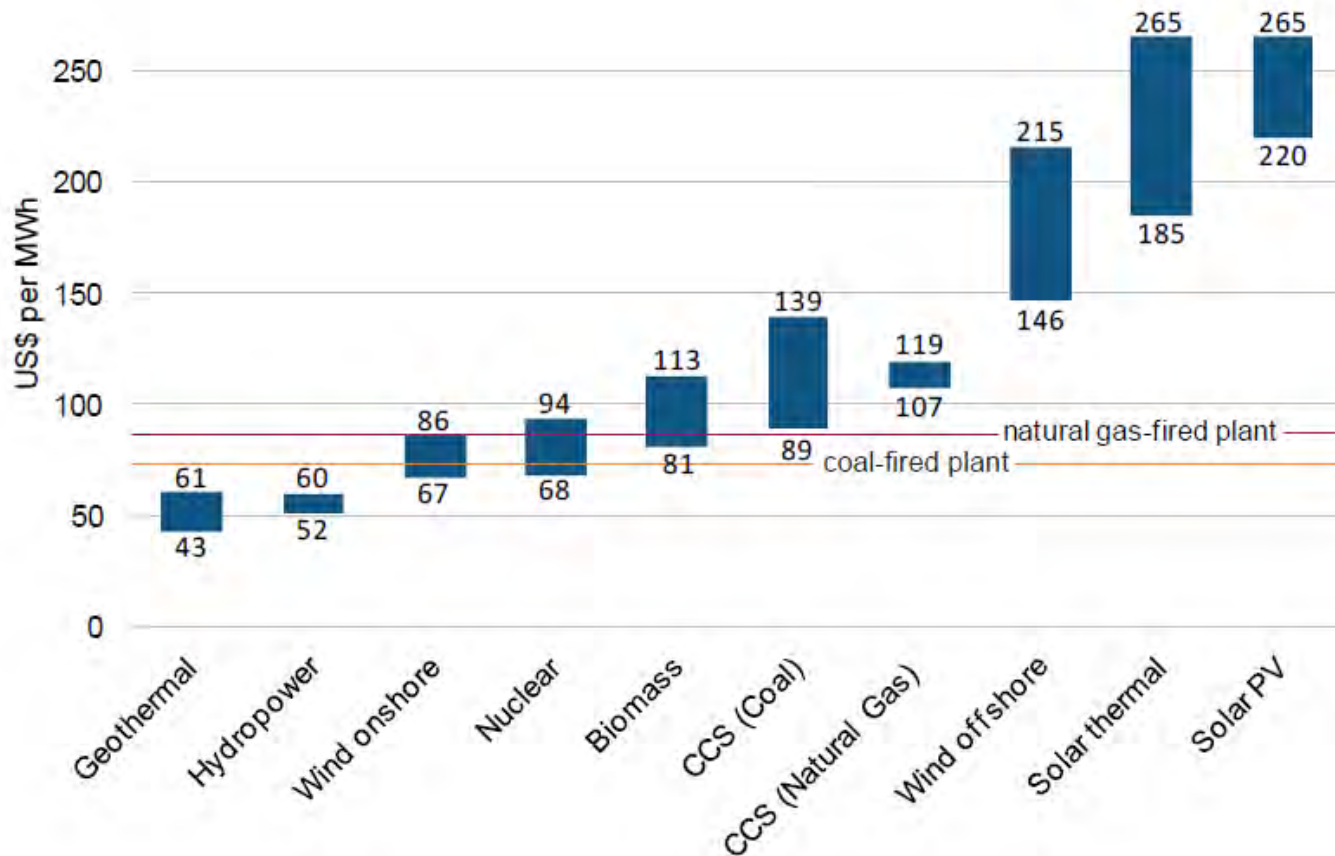
The challenge of CCS investment

CSLF CO₂ Capture Interactive Workshop
14 June 2012, Bergen, Norway

Hans Schoenmakers

Why do CCS? (just to remind ourselves)

Figure 4 Levelised cost of electricity of low-carbon technologies and conventional power generation



Quotes

- IEA - CCS delivers about 20% of carbon abatement in their “blue scenario”. Achieving global carbon abatement targets without CCS would be 70 % more expensive
- EU Roadmap 2050 - “Carbon capture and storage has to play a pivotal role in system transformation” with 19-24% of power generation in most scenarios

ROAD means...

Rotterdam

Opslag

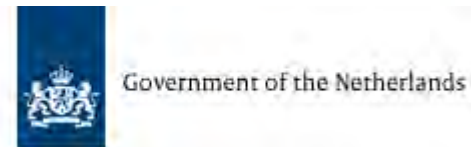
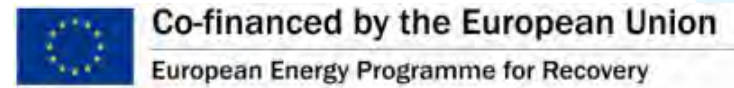
Afvang

Demonstratieproject

“ROAD aims to show that the overall CCS chain of CO₂ capture, transport and storage can be put into operation on an industrial scale in 5 - 10 years”.

Co-operating Partners ROAD

- Maasvlakte CCS Project C.V. is a joint venture of:
 - E.ON Benelux
 - GDF SUEZ Energie Nederland (GDF SUEZ Group)
- In co-operation with intended partners:
 - TAQA Energy
 - GDF SUEZ E&P
- With financial support of:
 - European Commission (EU)
 - Government of the Netherlands
 - Global CCS Institute

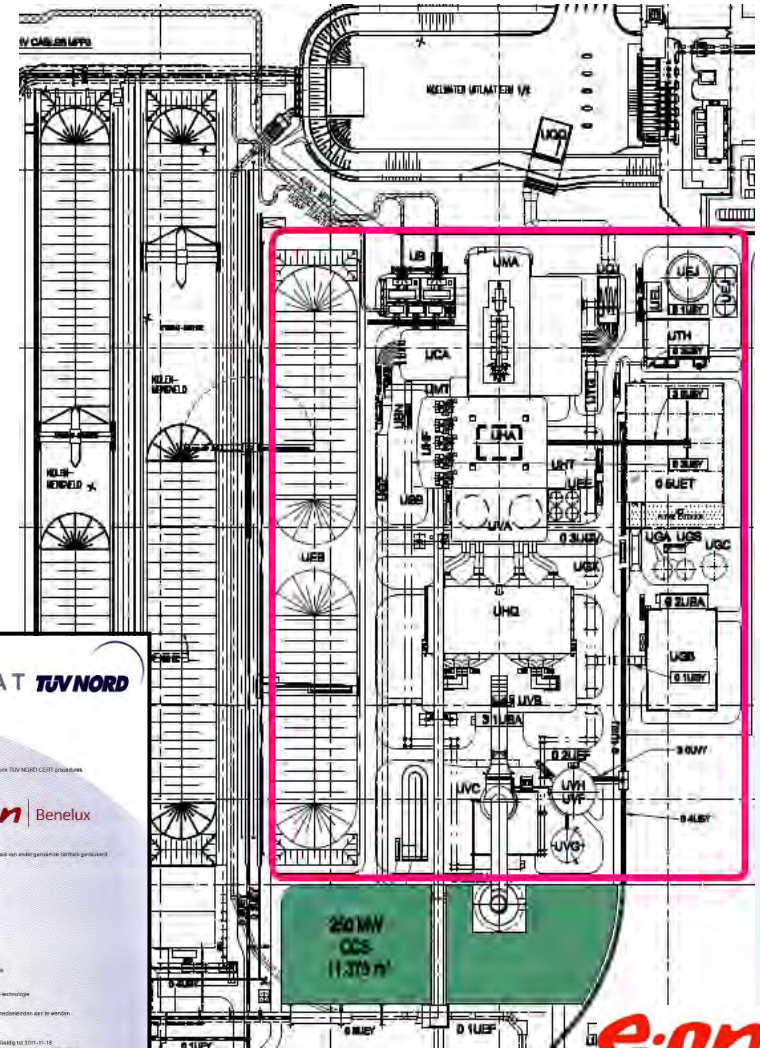
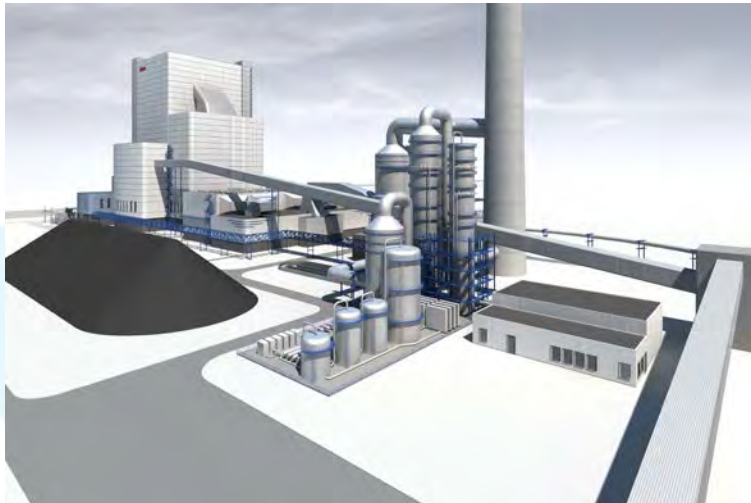


Location: Maasvlakte Power Plant 3



Capture

- Post combustion capture
- 250 MW equivalent
- 90% capture efficiency
- CO₂ captured: 1.1 Mt/year
- Operational 2015

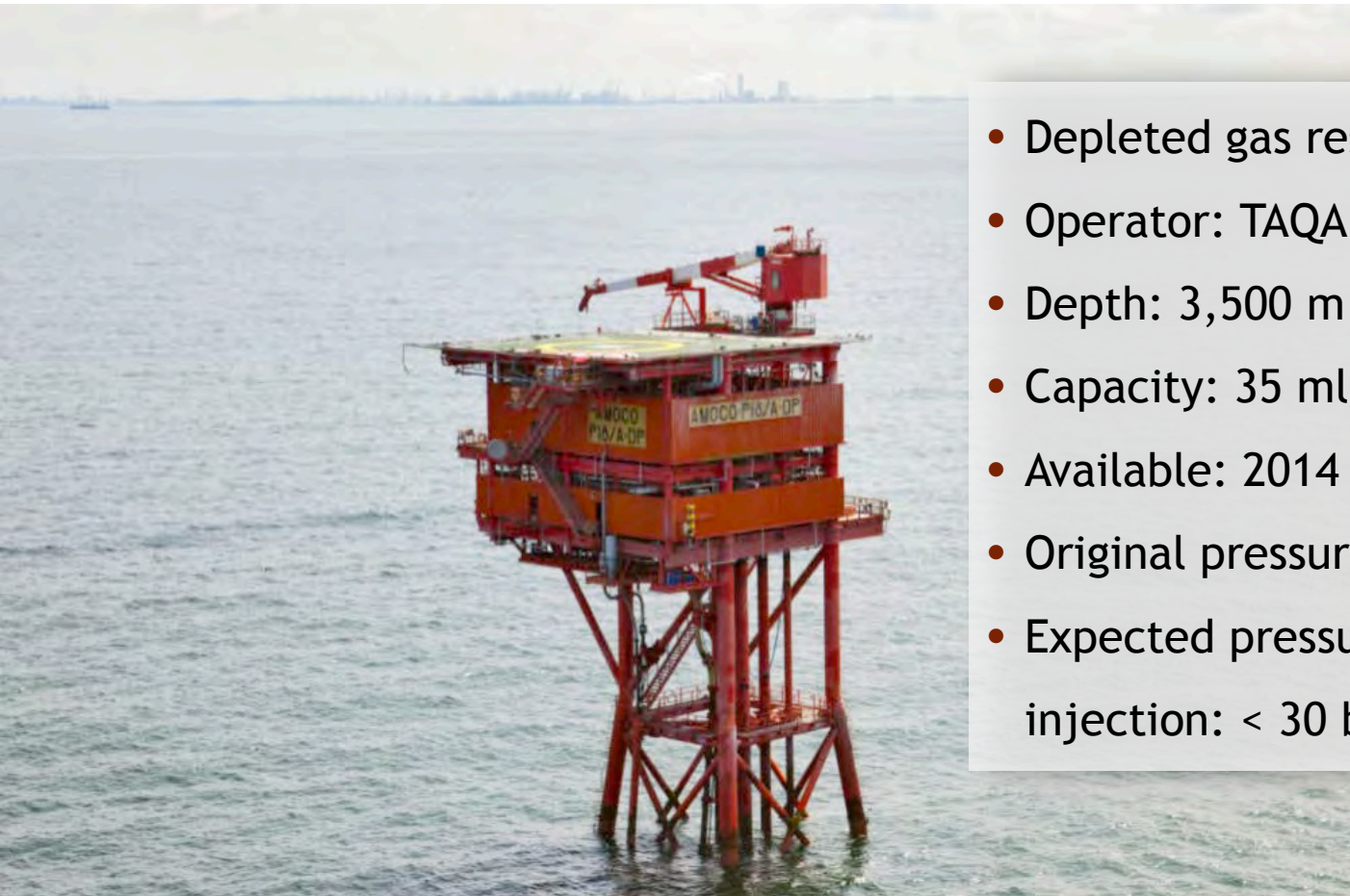


CO₂ Transport



- Pipeline length:
 - 5km onshore, 20km offshore
- Diameter: 16"
- Capacity:
 - 1.5 mln tonne / year (gaseous)
 - 5 mln tonne / year (dense)
- Design specs: 175 bar, 80 °C
- Pipeline insulated

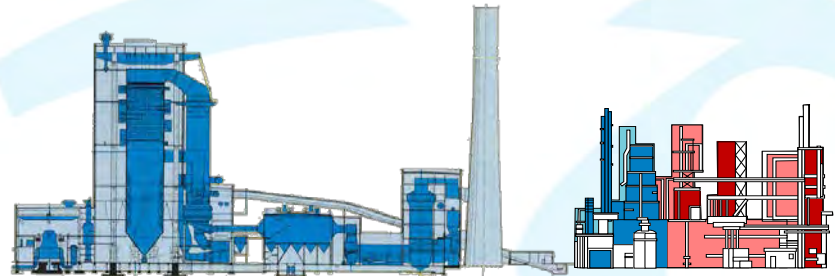
CO₂ Storage Location



- Depleted gas reservoir P18
- Operator: TAQA
- Depth: 3,500 m
- Capacity: 35 mln tonne
- Available: 2014
- Original pressure: 350 bar
- Expected pressure at start of CO₂ injection: < 30 bar

Timepath and milestones

- 14 July 2009 : EU project proposal submission
- September 2009 : Project selection by EU
- May 2010 : Dutch government support
- Q2 2011 : EIA (MER) and permit application
- Q1/2 2012 : Permits Acquired
- Q2 2012 (?) : Final Investment Decision
- 2013 : Commercial operation E.ON MPP3
- 2015 : Full CCS-chain operational
- 2015 - 2020 : Demonstration phase CCS chain



Status - Engineering

- Capture FEED complete
- Supplier selected (Fluor)
- Detail engineering underway and some major components selected
- Pipeline route engineered and surveys completed
- Tie-ins to power plant ready for installation

Conclusion - Engineering is ready

Status - Permits

- Positive advice on Environmental Impact Assessment
 - Capture permits:
 - Environmental
 - Water
 - Building
 - Nature Protection
 - Positive advice EC on Storage permit
 - Transport & Storage permits:
 - Updated zoning plan
 - Water
 - Environment
 - Endangered Species (“Nature 2000”)
 - Storage
- “Definitive” permit just published**
- Consultation complete, publication of “definitive” permits awaited**

Conclusion - nearly there!

Commercialisation of CCS

- CCS-intrinsic factors
- External drivers

Market vs. Regulation - Capture

Market

EOR
EGR

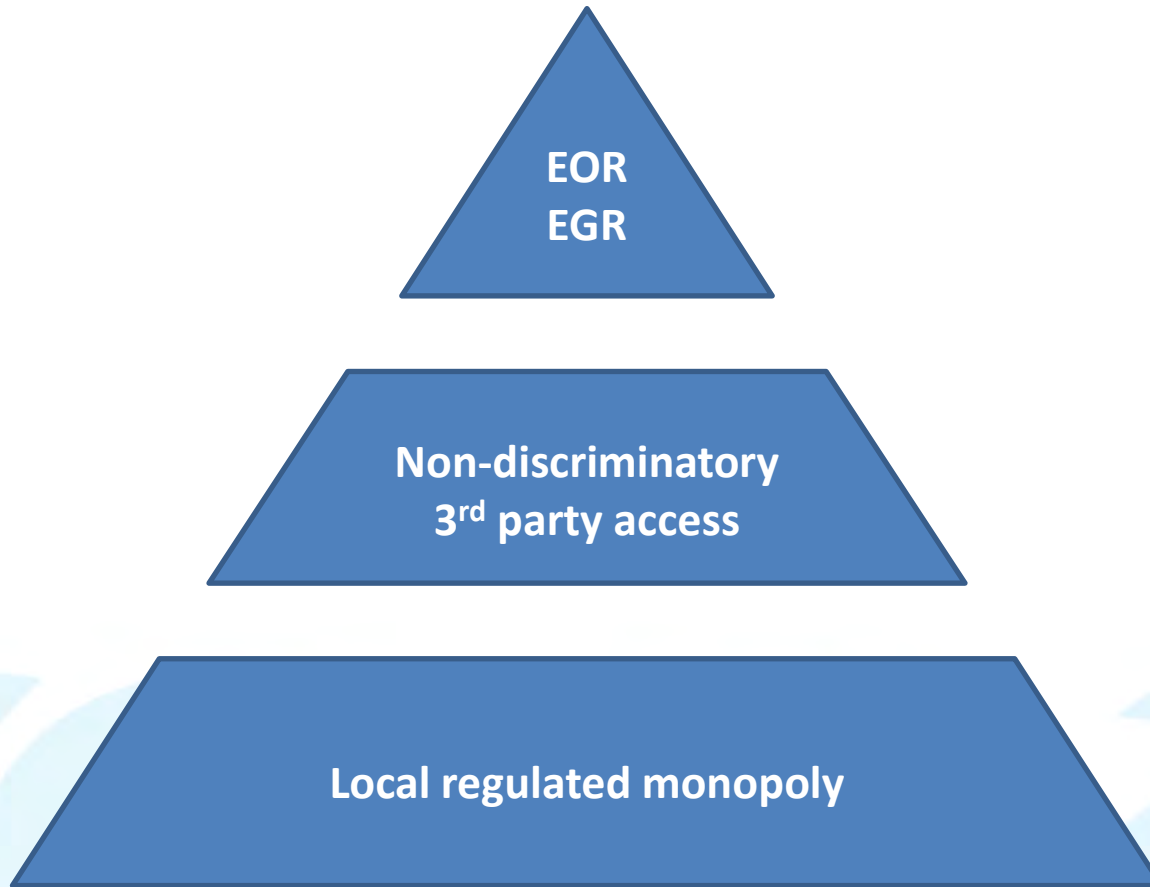
ETS price
Carbon tax

Competitive subsidy (e.g. capital grant)
Mandatory capture / Emission standard
State planned

Regulation

Market vs. Regulation - Transport/Storage

Market



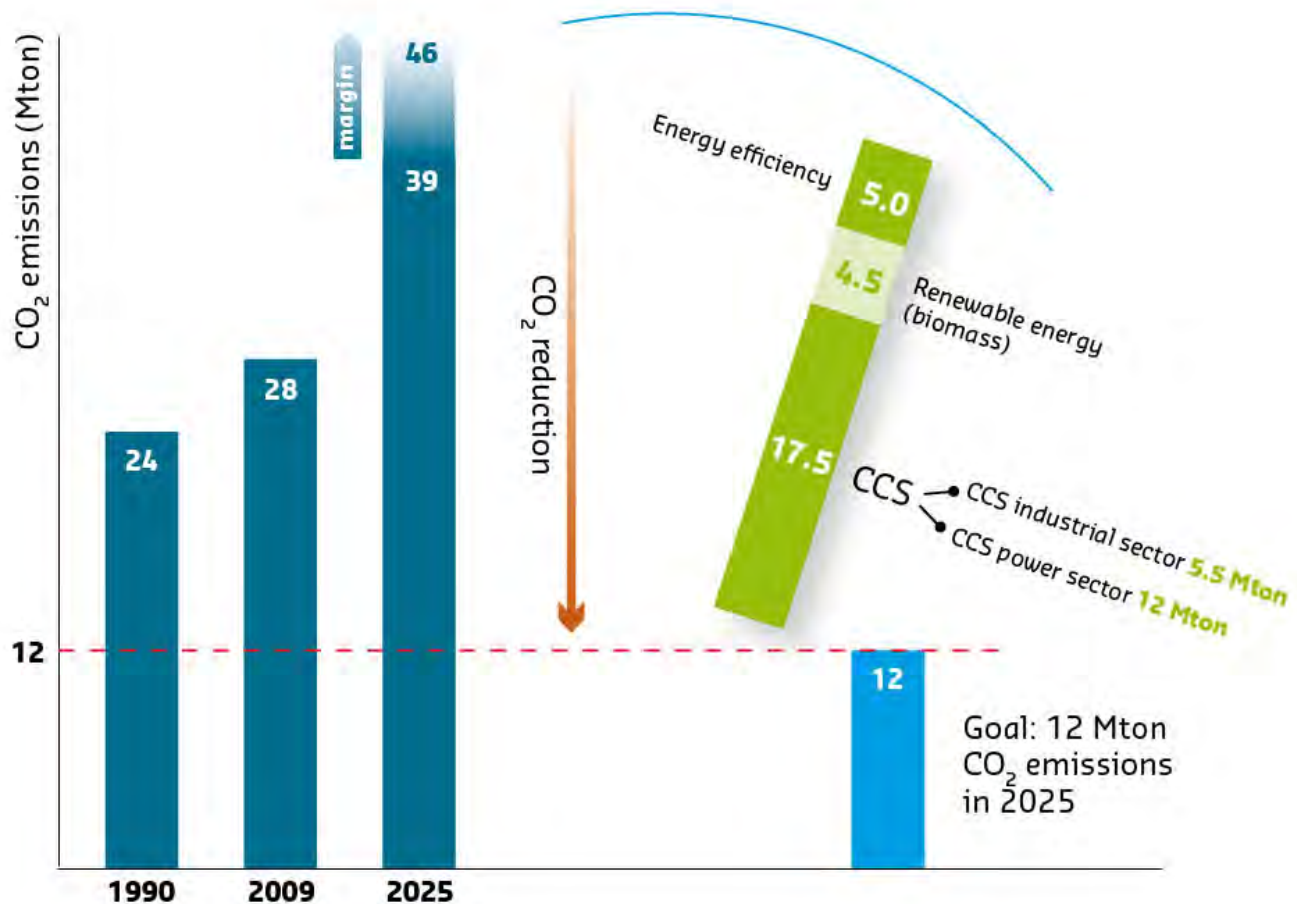
Regulation

Success factors

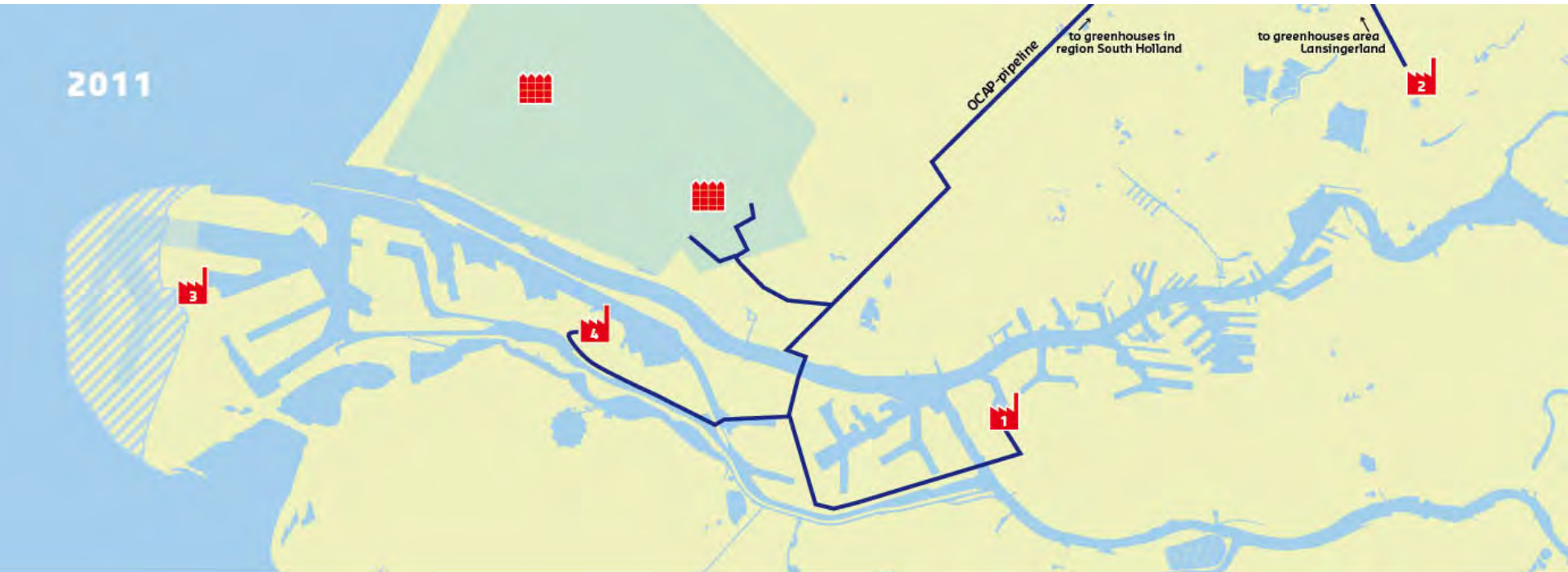
- Offshore storage
- Industrial Area
- Local political RCI



Rotterdam CCS Objectives



Rotterdam CCS Network 2011



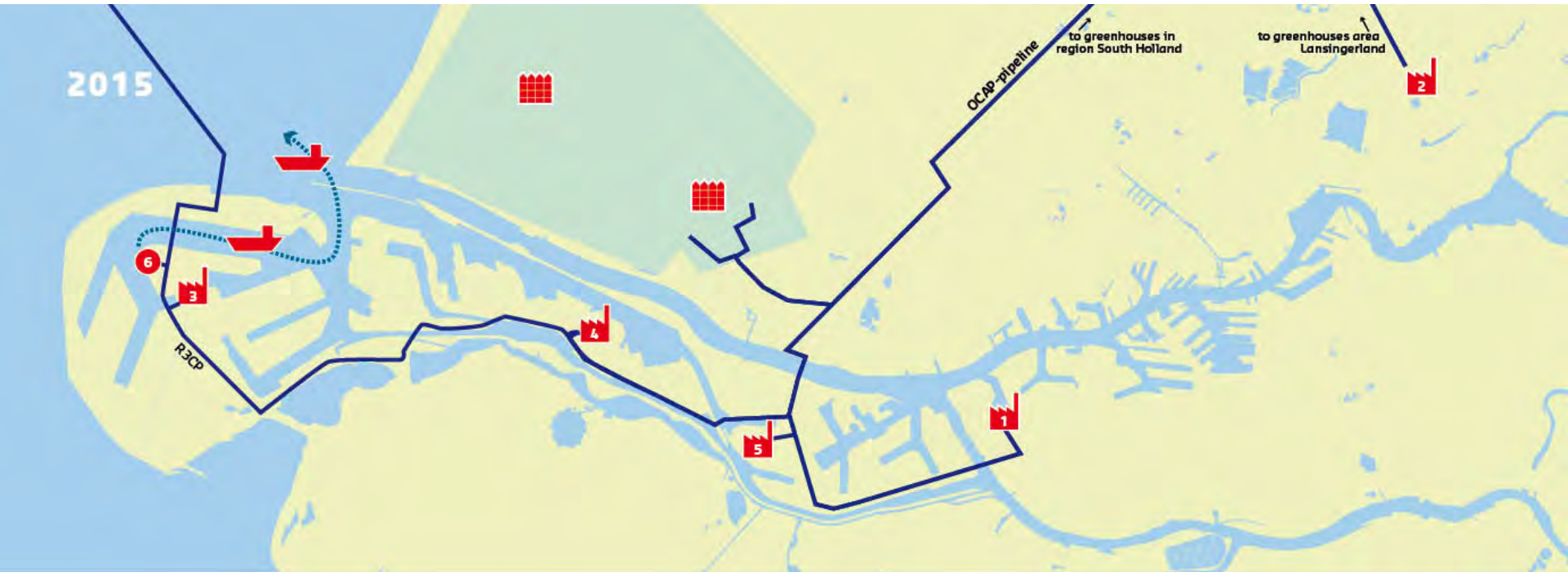
- 1 Shell Pernis
- 2 E.ON-ROCA

- 3 E.ON CO₂-Catcher (CATO-2 pilot project)
- 4 Abengoa

- Maasvlakte II, under construction
- Transport by pipeline
- Transport by ship

- CO₂ capture
- Green houses
- Energy intensive industry
- CO₂ Hub

Rotterdam CCS Network 2015



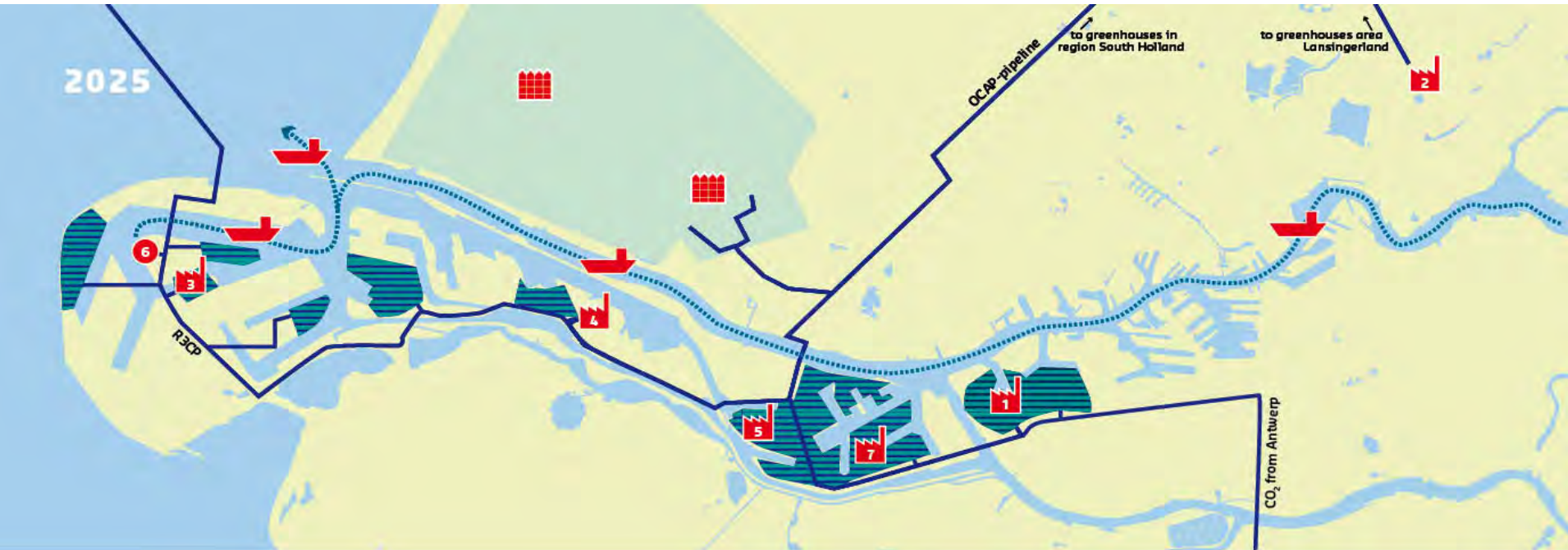
- 1 Shell Pernis
- 2 E.ON-ROCA
- 3 ROAD
- 4 Abengoa

- 5 Air Liquide
 - 6 CO₂ Hub CINTRA
- Pegasus: location not yet determined

- Maasvlakte II, under construction
- Transport by pipeline
- Transport by ship

- CO₂ capture
- Green houses
- Energy intensive industry
- CO₂ Hub

Rotterdam CCS Network 2025



- 1 Shell Pernis
- 2 E.ON-ROCA
- 3 ROAD
- 4 Abengoa
- 5 Air Liquide

- 6 CO₂ Hub CINTRA
- 7 Air Products
- Connecting industry to CCS network (not just large scale demo's)

Pegasus: location not yet determined

- Maasvlakte II, under construction
- Transport by pipeline
- Transport by ship

- CO₂ capture
- Green houses
- Energy intensive industry
- CO₂ Hub

Rotterdam Climate Initiative (RCI)

RCI has presented a vision on why:

- CCS in Rotterdam is good for the climate
- CCS in Rotterdam will protect jobs
- CCS in Rotterdam will protect the future economy

⇒ **Win for the local population**

⇒ **Strong political backing**

ROAD - current status

- Project is ready for FID
 - Engineering ✓
 - Permitting ✓
 - Political / Public support ✓
 - Commercial structure ✓
- But parent companies haven't decided
- Decision is awaited

Veel rook, weinig prikkels

Europese emissierechten in € per ton CO₂-equivalent



Het financiële Dagblad, 10th April 2012

Conclusions

- CCS can make a very important and *affordable* contribution to global carbon abatement
- The ROAD project has succeeded
 - technically
 - permitting
 - public acceptance
- ROAD is ready for the Final Investment Decision
- The market framework to make CCS commercial is not there, yet.

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