



Rotterdam Opslag en Afvang Demonstratieproject (ROAD)

Introduction to the Carbon Sequestration Leadership Forum

Harry Schreurs (The Netherlands)
Beijing, September 2011

ROAD means...

Rotterdam

Opslag (storage)

Afvang (capture)

Demonstration project

Co-operating Partners ROAD

- Maasvlakte CCS Project C.V. is a joint venture of:

- E.ON Benelux
- Electrabel 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



Co-financed by the European Union
European Energy Programme for Recovery

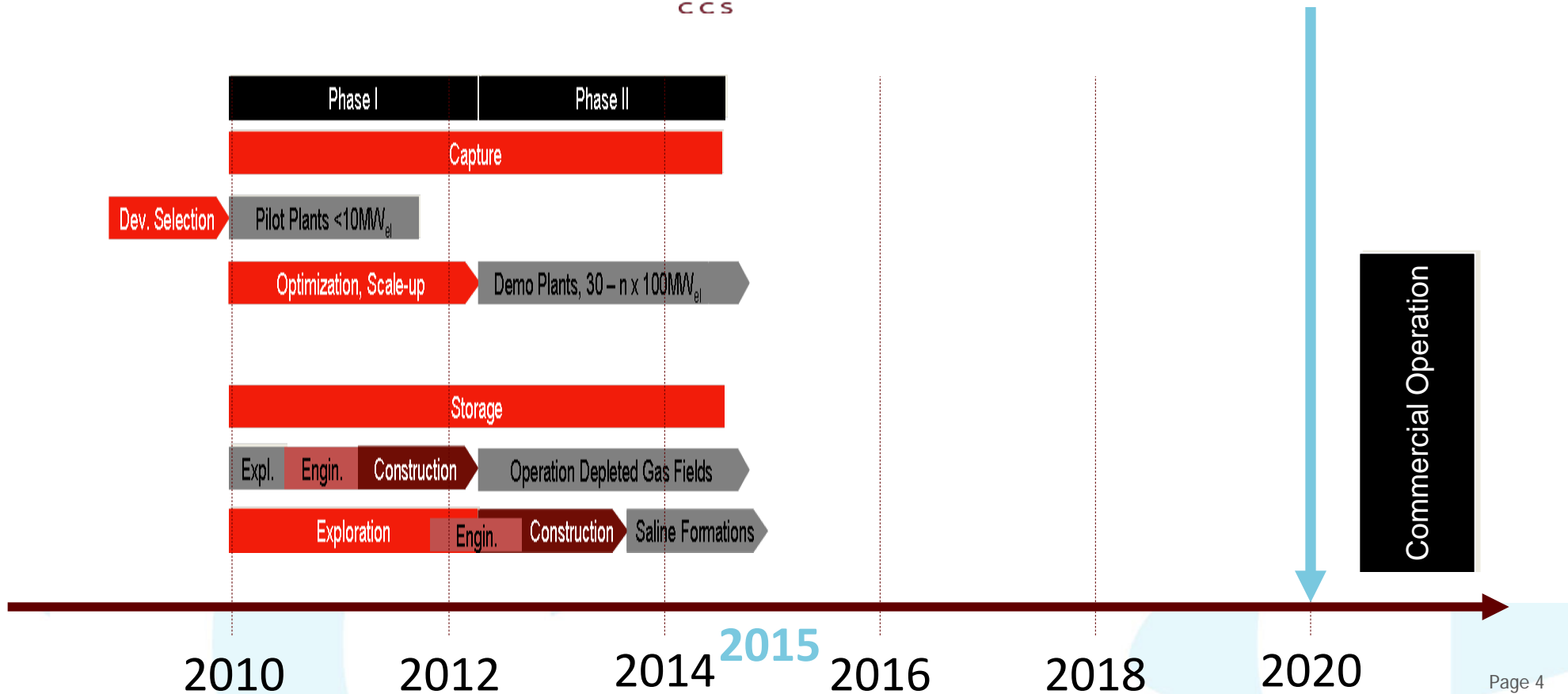


Government of the Netherlands

SUPPORTED BY



Acceleration commercial deployment CCS



Project Goal

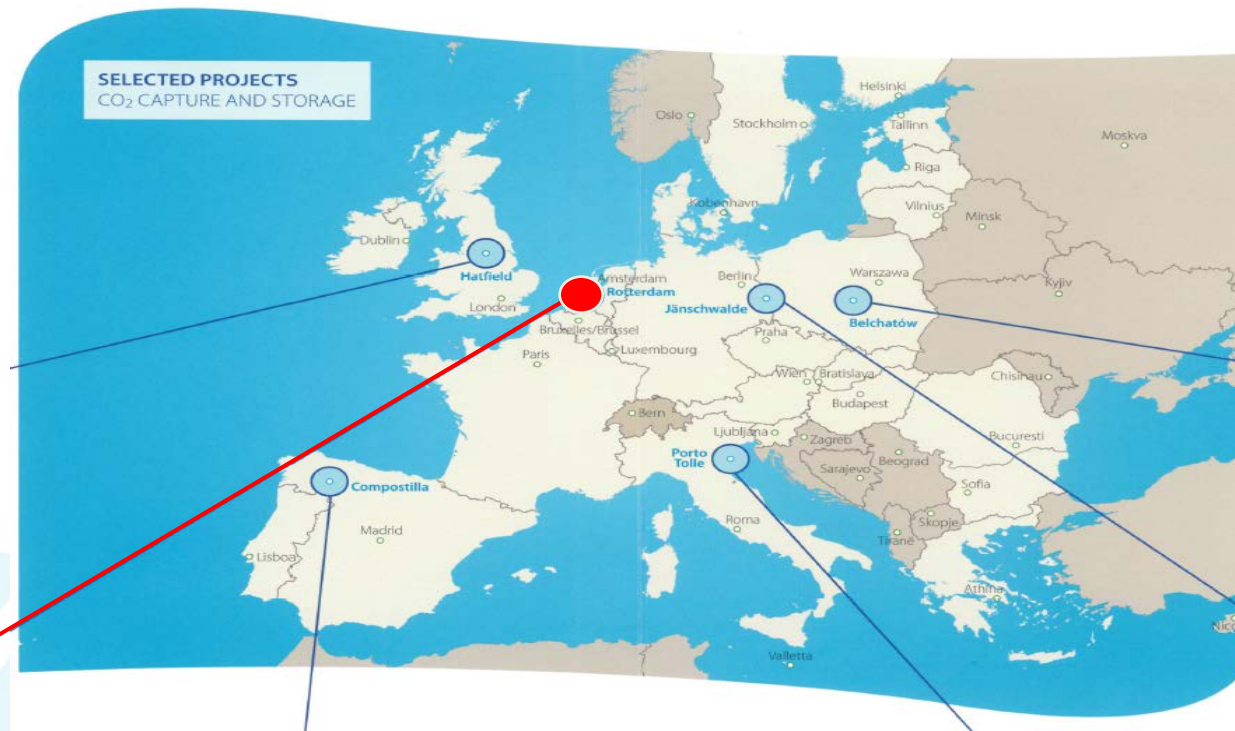
- Demonstrate feasibility (technical, economic) of large-scale, integrated CCS chain
- Capture and storage of ca. 1.1 mln tonne CO₂ per year in (nearly) depleted gas reservoirs in period of 2015 - 2020
- Acquire knowledge of and experience with deployment of large-scale, integrated CCS chain:
 - Technical
 - Legal
 - Economic
 - Organizational
 - Social

Project Objectives & Anticipated Outcomes

- Concept development full CCS chain
- Engineering: capture plant, integration with base power plant, pipeline, platform modifications and well workover
- Permitting
- Construction
- Demonstrating full chain operation for 5 years
- Subsequent commercial operation
- Continuous knowledge sharing

European Energy Programme For Recovery (EPR)

ROAD selected by European Commission as one of six EPR projects



Don Valley (UK)
Pre combustion
Offshore
Gas reservoir

road (Rotterdam)
CCS
Post combustion
Offshore
Gas reservoir

Compostilla (Spain)
Oxfuel + CFB
Onshore
Saline aquifers

Porto Tolle (Italy)
Post-combustion
Offshore
Saline aquifers

Bełchatów (Poland)
Post combustion
Onshore
Saline aquifers

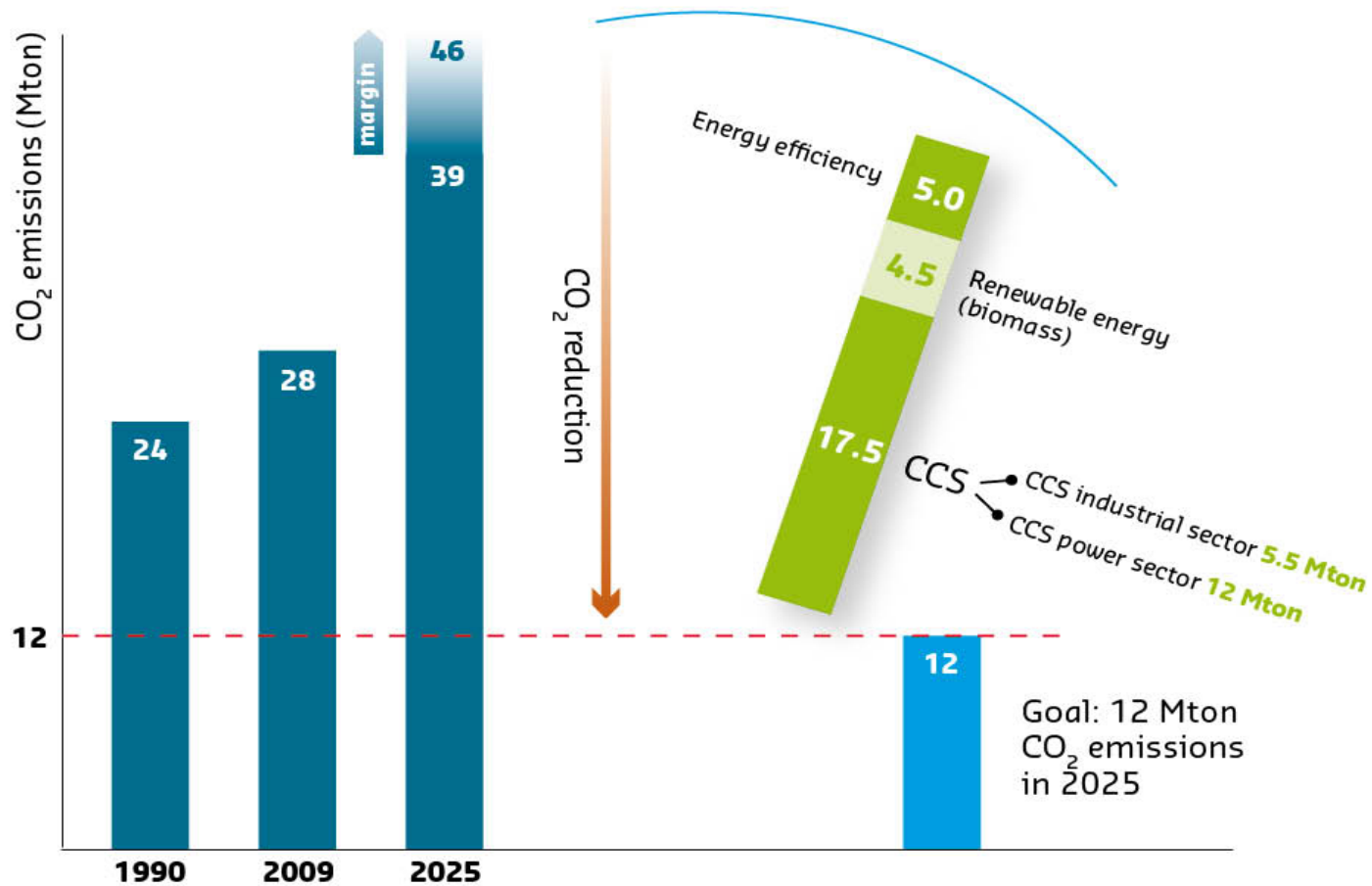
Jämschwalde (Germany)
Oxy fuel / post combustion
Onshore

Why CCS Demonstration Projects in The Netherlands?

- Industrial areas with many point sources (large CO₂ emitters)
- New power stations under construction with potential deployment of CCS
- Onshore and offshore gas reservoirs which will deplete in years to come
- Depleted gas reservoirs have appropriate structure for permanent CO₂ storage
- Indepth knowledge of gas transport because of dense natural gas grid
- Vast experience with exploration and production of oil and gas, and gas storage in aquifers and gas reservoirs

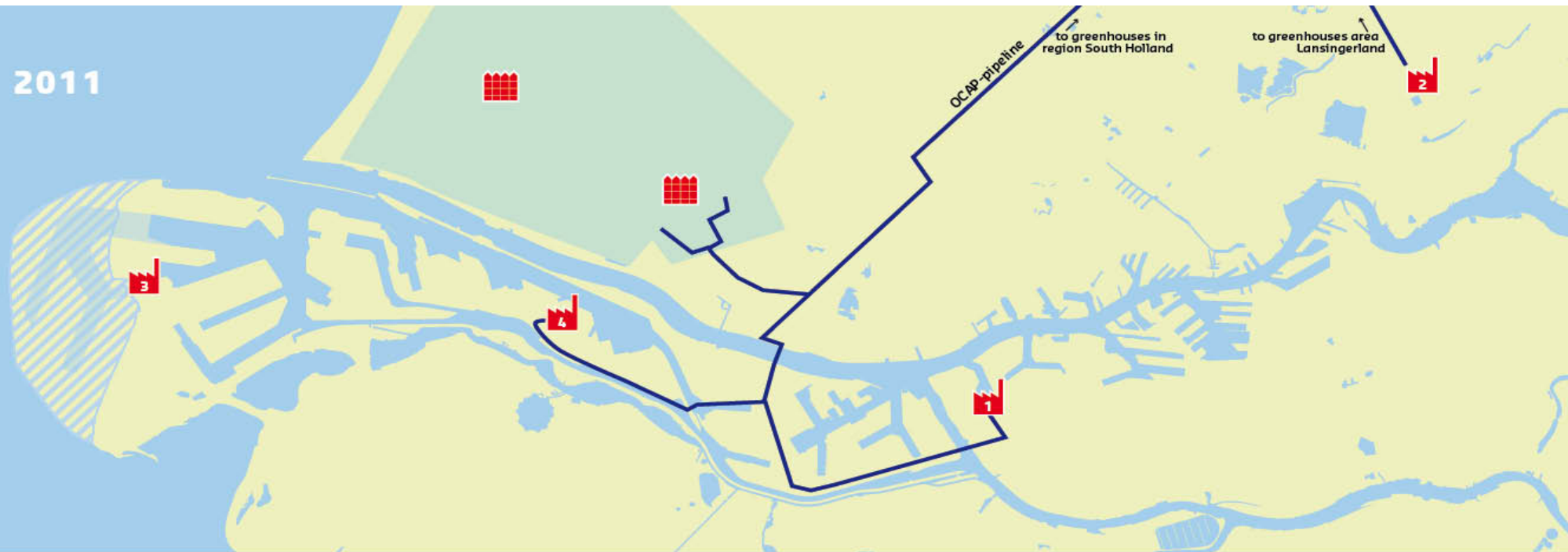
“God’s greatest gift to Rotterdam is its location”

Rotterdam Climate Initiative CCS objectives






Rotterdam CCS Network 2011





2011



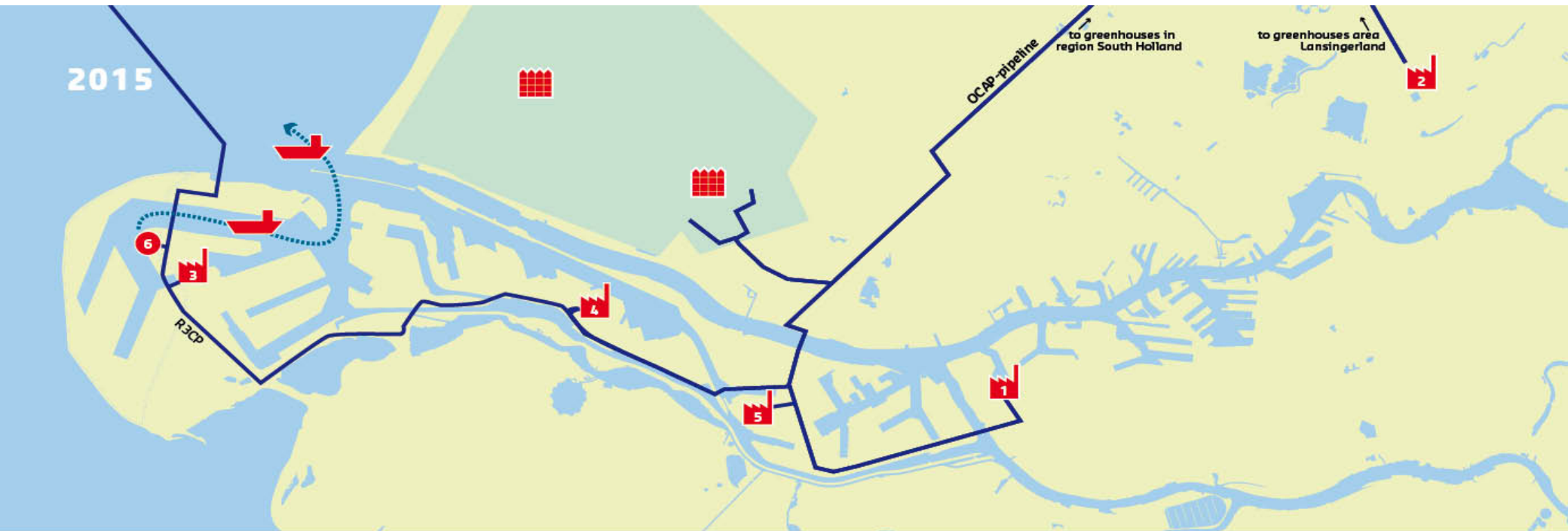
1 Shell Pernis
2 E.ON-ROCA

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

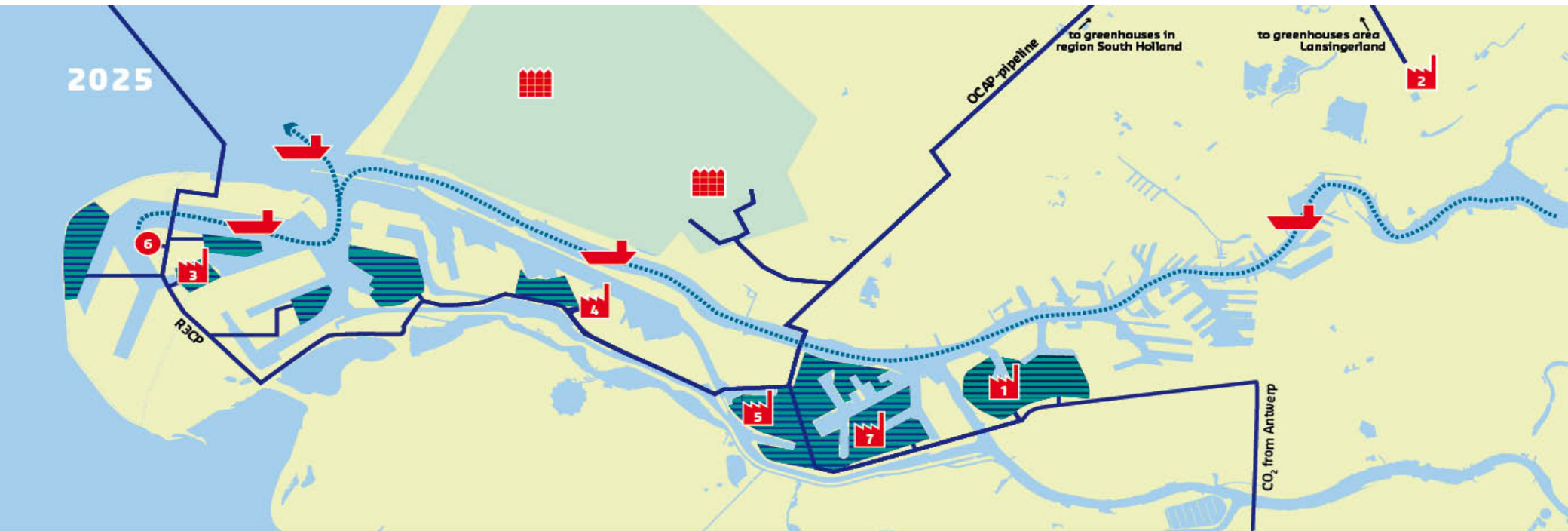
- 5 Air Liquide
- 6 CO₂ Hub CINTRA

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)

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

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

Pegasus: location not yet determined

CO₂ Capture, Transport and Storage Chain

CAPTURE



Power plants



Chemical industry

TRANSPORT

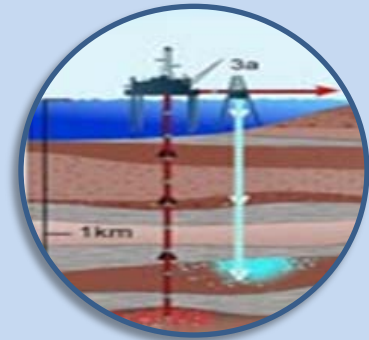


Pipelines



Shipping

STORAGE



Depleted gas reservoirs



Enhanced Oil Recovery

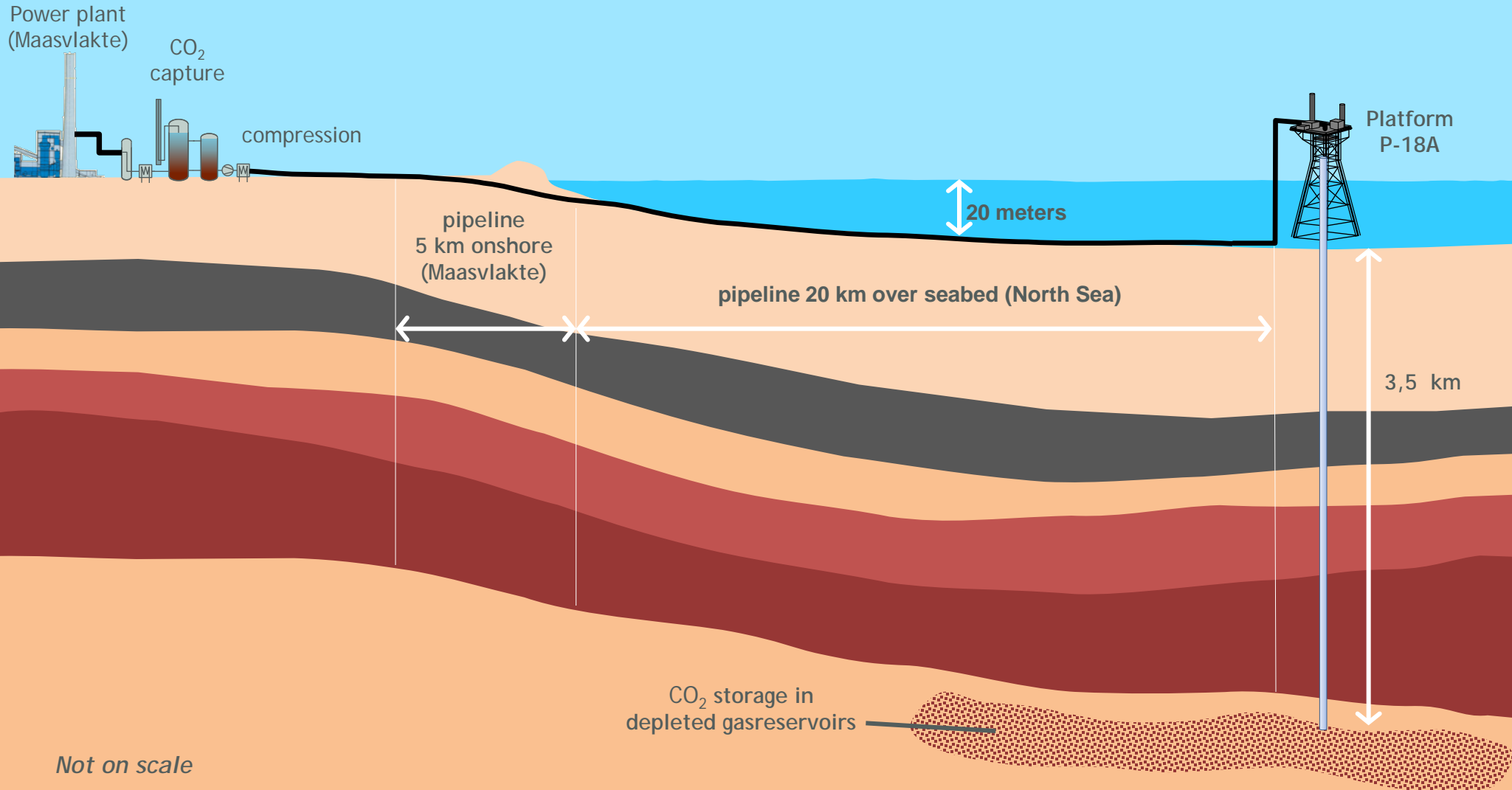
Regional Vision and Co-operation



ROTTERDAM.CLIMATE.INITIATIVE



ROAD CO₂ Capture, Transport and Storage Chain



Location: Maasvlakte Power Plant 3

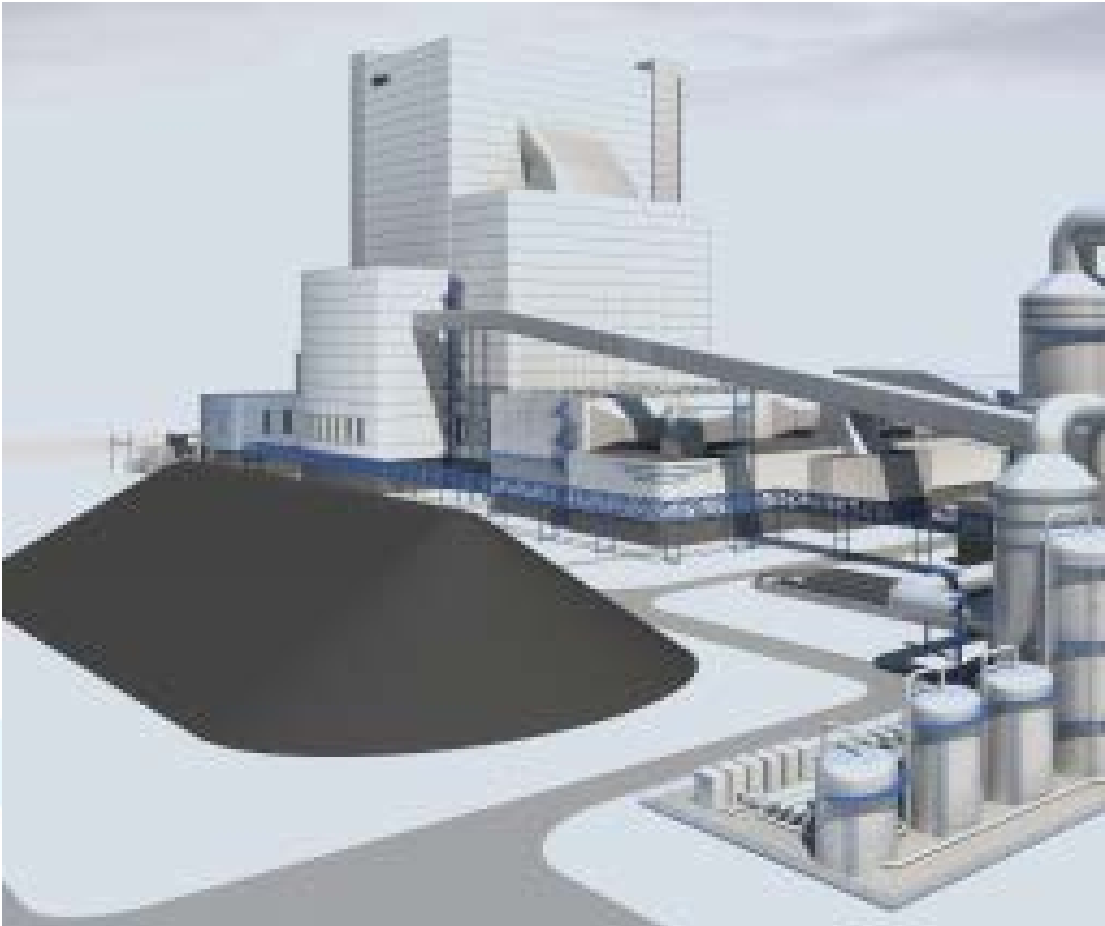


Capture Location: Maasvlakte Power Plant 3



- Output: 1070 MWe
- Efficiency: 46%
- Operational: end 2012
- Capture ready

CO₂ Capture Unit



- Technology: post-combustion
- Size: 250 MW equivalent
- Capture rate: 90%
- CO₂ capture:
1.1 mln tonne/yr
- Operational: 2015

CO₂ Storage Location



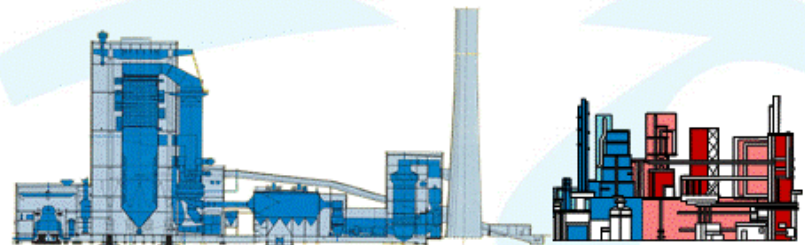
- Depleted gas reservoir P18
- Operator: TAQA
- Depth: 3,500 m
- Capacity: 35 mln tonne
- Available: 2014
- Alternatives / future expansion options are being investigated (EOR)

Knowledge Sharing

- Participation in European CCS Demonstration Project Network
Technical setup and performance, cost levels, project management, environmental impact, health and safety
- Reports for the Global CCS Institute
Capture supplier selection, capture FEED study, permitting, public engagement, risk management, execution strategy, general lessons learned
- Discussions with other parties involved in CCS
(e.g. research programs CATO-2, ECN/NEARCO2, CO2Europipe)
- Conferences, presentations, documentation, website, Regional CCS Advisory Committee, E.ON visitor's centre

Time Path and Milestones

- 14 July 2009 : EU project proposal submission
- September 2009 : Project selection by EU
- May 2010 : Grant decision by Government of the Netherlands
- September 2010 : Publication starting note Environmental Impact Assessment
- Q2 2011 : EIA and permit procedures
- Q4 2011 : Final Investment Decision
- 2014 : CCS chain mechanically complete
- 2015 : Integrated CCS chain operational
- 2015-2019 : Demonstration phase CCS chain
- 2020 : Start commercial operation



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