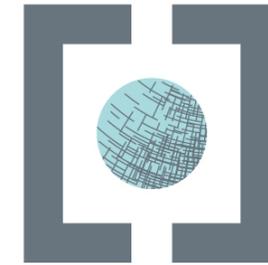


ROTTERDAM.**CLIMATE**.INITIATIVE

SUPPORTED BY



GLOBAL  
**CCS**  
INSTITUTE

## Rotterdam CCS Network project Case Study – interim slide report

August 2011



DCMR Environmental Protection Agency  
Centre of Environmental Expertise

Lead author: Barend van Engelenburg

Contributing authors: Paul Noothout, Stefan Mackaaij,  
Reinier van der Wees and Willem de Neve.



Gemeente Rotterdam



The Rotterdam Climate Initiative is the climate programme of the City of Rotterdam,  
the Port of Rotterdam, Deltalinqs, and DCMR Environmental Protection Agency Rijnmond



ROTTERDAM.**CLIMATE**.INITIATIVE

## Disclaimer

This document is published on the Global CCS Institute's website in the interest of information exchange. The Global CCS Institute does not give any representation or warranty as to the reliability, accuracy or completeness of the information, nor does it accept any responsibility arising in any way (including by negligence) for errors in, or omissions from, the information.

©Global Carbon Capture and Storage Institute Limited 2011 Canberra. Use of this document is permitted in accordance with Creative Commons Attribution 3.0 Australia License.



ROTTERDAM.**CLIMATE**.INITIATIVE

1

## Introduction to the Case Study

2

Research approach

3

Rotterdam Climate Initiative

4

Drivers and Risks for CCS in Rotterdam

5

Storyline of the CCS Approach in Rotterdam

6

Interim Lessons Learnt

7

Annex: further reading



## Context and reason for the case study

A CCS Network Project (CNP or a Hub) is a connection of multiple sources of CO<sub>2</sub> to multiple sinks or users of CO<sub>2</sub> via a collection network of pipes and other means of transport (like ships, barges and trucks). In some instances there could be only one sink connected to the collection network. A Hub has benefits and challenges. The main benefit is the integration of transport, storage and use and thus a better cost perspective. The challenges are diverse, ranging from technical (e.g. CO<sub>2</sub> quality), to financial (e.g. how to get revenues for overcapacity) to political issues (e.g. public support for the large upfront investments).

Rotterdam is developing a Hub. The aim is to realize full-scale CCS application by 2025 with an amount of more than 17 Mton captured and stored annually. CCS activities in Rotterdam commenced in 2006 and until now, more than 15 major companies cooperated to provide feasibility level engineering studies for CO<sub>2</sub> capture projects and a CCS infrastructure network. The Rotterdam Hub can be characterised by:

- a broad cooperation between parties, with active commitment of industrial actors;
- a vision that transcends single-source-single-sink projects and aims at a network, and focuses on the whole chain of CCS (from capture to storage; encompassing technology and organisational, legal and financial issues);
- a local (also political) commitment to a long term approach which also transcends the region of Rotterdam;

The Rotterdam approach appears to be effective. Domestically and internationally, people have expressed interest in the Rotterdam approach and why the RCI is so successful in promoting the development and deployment of CCS. The main reasons for doing a case study are:

- Context and results of the Rotterdam project seem positive
- Time is right: a lot of experience already exist (but is not explicitly disclosed) and similar projects seem to be ready to share and learn
- Broad support from different stakeholders to do this kind of case study
- A good combination of initiators and researchers could be found to carry out the study.

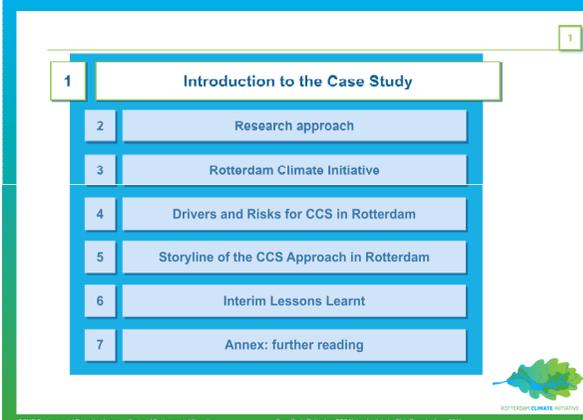
In other places on the globe one can also observe the developments of Hub approaches (like the Collie SW Hub in Australia). This case study is meant to disclose the lessons learnt from the Rotterdam project, with the main aim to help others in developing their Hub approach.



## Structure of the slide report and follow-up

### This report has the following chapters:

1. **Introduction** – current chapter.
2. **Research approach** – describes the research method that we used for the case study.
3. **Rotterdam Climate Initiative** – describes the Rotterdam approach towards tackling the climate change issue and focuses on explaining the present situation of the Rotterdam CCS Network approach.
4. **Drivers and Risks for CCS in Rotterdam** – describes the interactions between technology development and stakeholders.
5. **Storyline of the CCS Approach in Rotterdam** – describes the history and development of the Rotterdam Project.
6. **Interim Lessons Learnt** - describes the first order results of the research, the direct answers to most of the analytical questions.
7. **Annex: further reading** – this contains some suggestions for further reading.



1	Introduction to the Case Study
2	Research approach
3	Rotterdam Climate Initiative
4	Drivers and Risks for CCS in Rotterdam
5	Storyline of the CCS Approach in Rotterdam
6	Interim Lessons Learnt
7	Annex: further reading

DCMR Environmental Protection Agency – Centre of Environmental Expertise Case Study Rotterdam CCS Network – Interim Slide Report – June 2011 ROTTERDAM CLIMATE INITIATIVE

### Reading guidelines:

as shown in the figure on this page, every page has a green rectangle with the chapter number in it. Every chapter starts with a page similar to the figure above.

### Follow-up

- This report is an interim report, finalised after we completed the greater part of the primary analyses.
- After the publication of this report, we will exchange our lessons and experiences with other CCS projects around the globe in local workshops. The output of these workshops, the reactions on this interim report and some additional research will be the ingredients for the final report (expected in October 2011).



1

**Introduction to the Case Study****2****Research Approach**

3

**Rotterdam Climate Initiative**

4

**Drivers and Risks for CCS in Rotterdam**

5

**Storyline of the CCS Approach in Rotterdam**

6

**Interim Lessons Learnt**

7

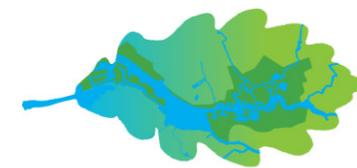
**Annex: further reading**

### The challenge: research question and approach

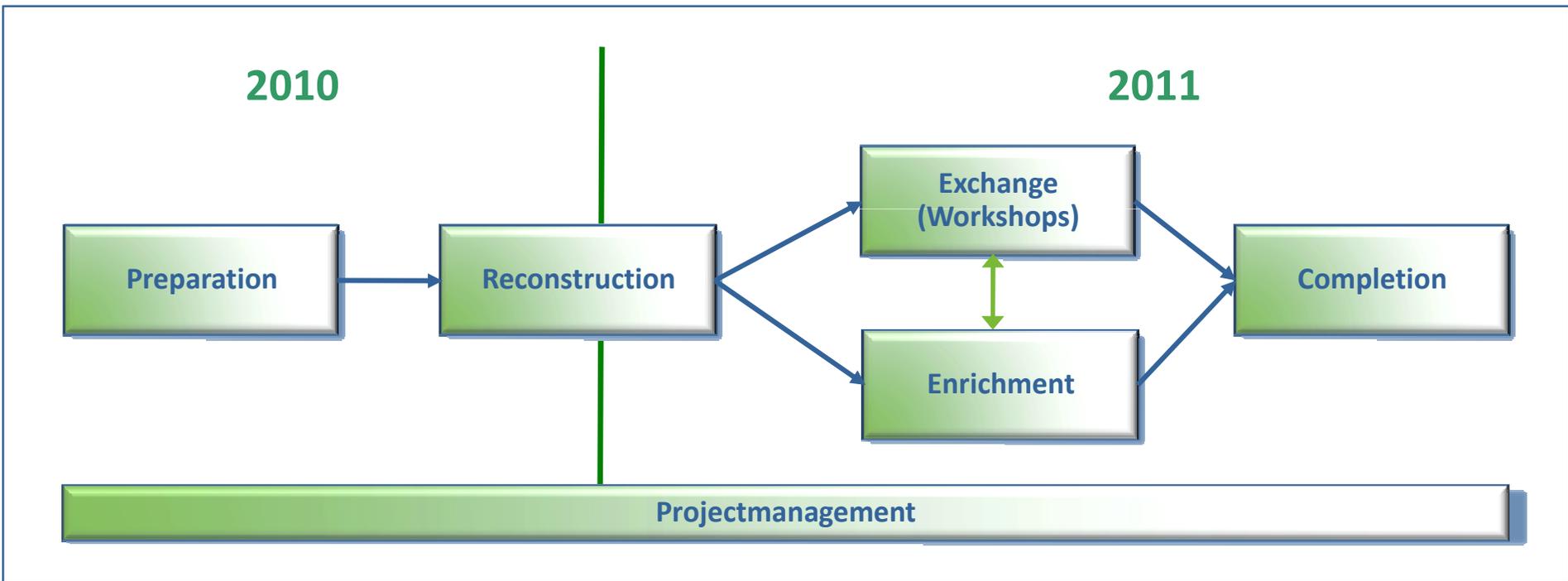
- The main research question of the case study is:
  - **What can we learn from the Rotterdam CCS Network project (RCNP)?** The objective is to make available the lessons learnt from RCNP and translate them into general guidelines or best practices, which can help other Network projects to build on and improve their projects.
- The deducted sub questions are:
  - **The how-question:** what has happened in the development of the RCNP? How could you describe the project and the history and development of the project?
  - **The value-question:** what does one see as the successes of the RCNP? What do they see as the strengths of the RCNP? What do other CCS stakeholders think they can learn from the RCNP?
  - **The why-question:** which relations can be found between elements of the RCNP approach and success? Why is the RCNP successful?
  - **The reflection-question:** what are the strengths and weaknesses of the project? What can others learn from our strengths? What could have been done better?
  - **The learning-question:** what could others learn from the RCNP with the aim to improve their activities, businesses or practices? How can we generalise the strengths of the RCNP?
- The approach:

There are two main evaluative approaches that are suitable for the purpose of learning: (i) the Innovation Management Approach and (ii) Learning History. We have chosen a combination of both approaches.

**For a more comprehensive description of the ins and outs of the research approach: see the reference to our research plan in the annex.**



The research plan



The research is divided into four main activities:

1. reconstruction
2. exchange
3. enrichment
4. completion

The first step is called ‘reconstruction’. It will deliver an interim report on the outcomes of the analysis described in the previous chapter. The idea is that the 80/20 rule will be followed, so in the reconstruction phase the project team will deliver a result that is about 80% relevant and correct. These interim results are the starting point of the second phase, i.e. an interactive and iterative phase, in which the project team will test the outcomes with similar projects in other regions. These ‘exchange’ and ‘enrichment’ phases consist of two key activities: hands-on workshops with CCS project proponents and additional research to cover iteratively what we have learnt in those workshops. For the explicit purpose of planning and organising, this scheme is supplemented by the phase of *Preparation* and an activity called Project Management.



1

**Introduction to the Case Study**

2

**Research approach****3****Rotterdam Climate Initiative - RCI**

4

**Drivers and Risks for CCS in Rotterdam**

5

**Storyline of the CCS Approach in Rotterdam**

6

**Interim Lessons Learnt**

7

**Annex: further reading**

## Rotterdam Climate Initiative – RCI

### Rationale of the RCI and goals

The Rotterdam area is responsible for 16% of national CO<sub>2</sub> emissions in the Netherlands. As an international port with a large CO<sub>2</sub>-intensive industrial sector, which is set to grow over the coming years, Rotterdam is aware of its responsibility to take action. This is why an ambitious program called the Rotterdam Climate Initiative (RCI) was set up in 2007, designed to:

- achieve a 50% reduction of CO<sub>2</sub> emissions in the Rotterdam region by 2025 compared to 1990;
- climate-proof and adapt the city to the consequences of climate change;
- strengthen the Rotterdam economy.

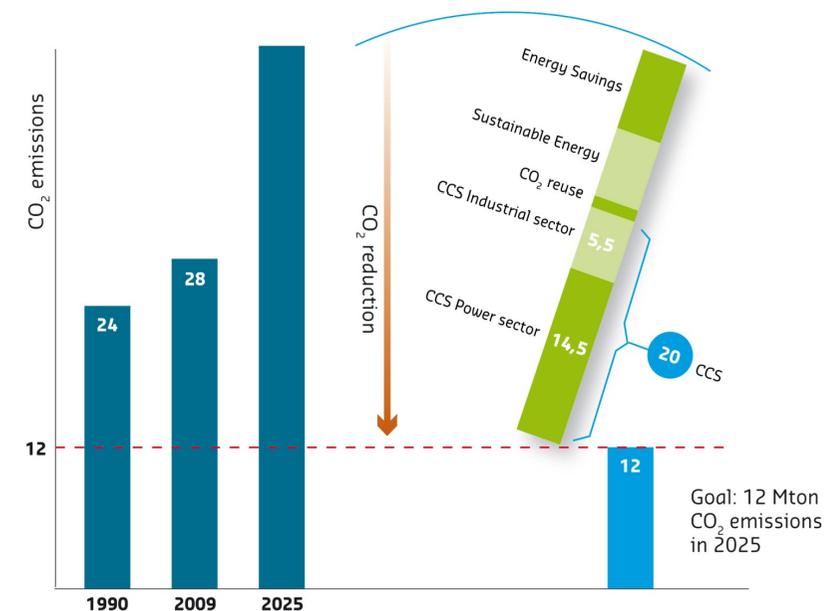
RCI is a collaboration of the Port of Rotterdam, the City of Rotterdam, port and industries' association Deltalinqs, and DCMR Environmental Protection Agency Rijnmond.

The ambition of RCI to reduce CO<sub>2</sub> emissions will be realized through energy efficiency in industry (2% reduction annually), buildings and transportation, sustainable energy – predominantly biomass, use of residual heat and wind energy – and through carbon capture and storage (CCS).

Given the large presence of the industrial and power sector in the port, CCS is a logical and crucial solution to achieve CO<sub>2</sub> emission reduction. Twenty million tonnes annually, more than half of the projected reduction, has to be covered by CCS. One fourth of the CCS objective comes from industrial installations. The aim is to realize full-scale CCS application by 2025.

Within RCI, the Board is responsible for decision making. The executives of the RCI partners are member of the Board and the Mayor of Rotterdam is the chairman of the Board. The Board has mandated the Steering Committee on CCS to prepare decisions and carry out the day-to-day work. The Steering Committee is chaired by DCMR.

The budget of the RCI was supplied by the Municipality of Rotterdam and amounted 50 million Euro for the first 4 years (2007-2010). From that amount about 10 million Euro was spent on CCS.



## Rotterdam Climate Initiative – RCI

RCI = Working together between the public sector and industry



The RCI itself is an example of working together in a public private partnership, see the figure above where the partners of the RCI are listed (see also previous slide).

A large number of Rotterdam-based companies show great commitment to join forces in order to realise CCS in Rotterdam and to contribute to the Rotterdam CCS network. The following projects are currently in progress: ROAD, Air Products, Air Liquide, Shell Pernis, OCAP, Liquid Logistics Concept, Maersk and TAQA. Some of these initiatives involve setting up pilot projects, while others focus on full-scale implementation in the longer run. Combined, they cover the entire chain of capture, transport, use and storage.

RCI has signed Letters of Co-operation with eleven companies and these letters confirm the intention of parties to develop CCS and enhance the cooperation between signatories (see photographs). Other stakeholders include local communities, the Dutch and EU governments and other companies in the port of Rotterdam who are interested in implementing CCS at a later stage support their efforts. A CCS Business Platform was created to provide a platform for information exchange and learning in a public-private setting.

Over the past few years, RCI and its partners have gained thorough knowledge on CCS and today they are at the forefront of global CCS development. The most tangible results include the preparation of the ROAD-project, the first large-scale offshore storage demonstration project, the preparation of a business case for a liquid logistics CO2 terminal and two applications for the national NER300 call. RCI will continue to build on this momentum to help address key challenges in developing the Rotterdam CCS network.

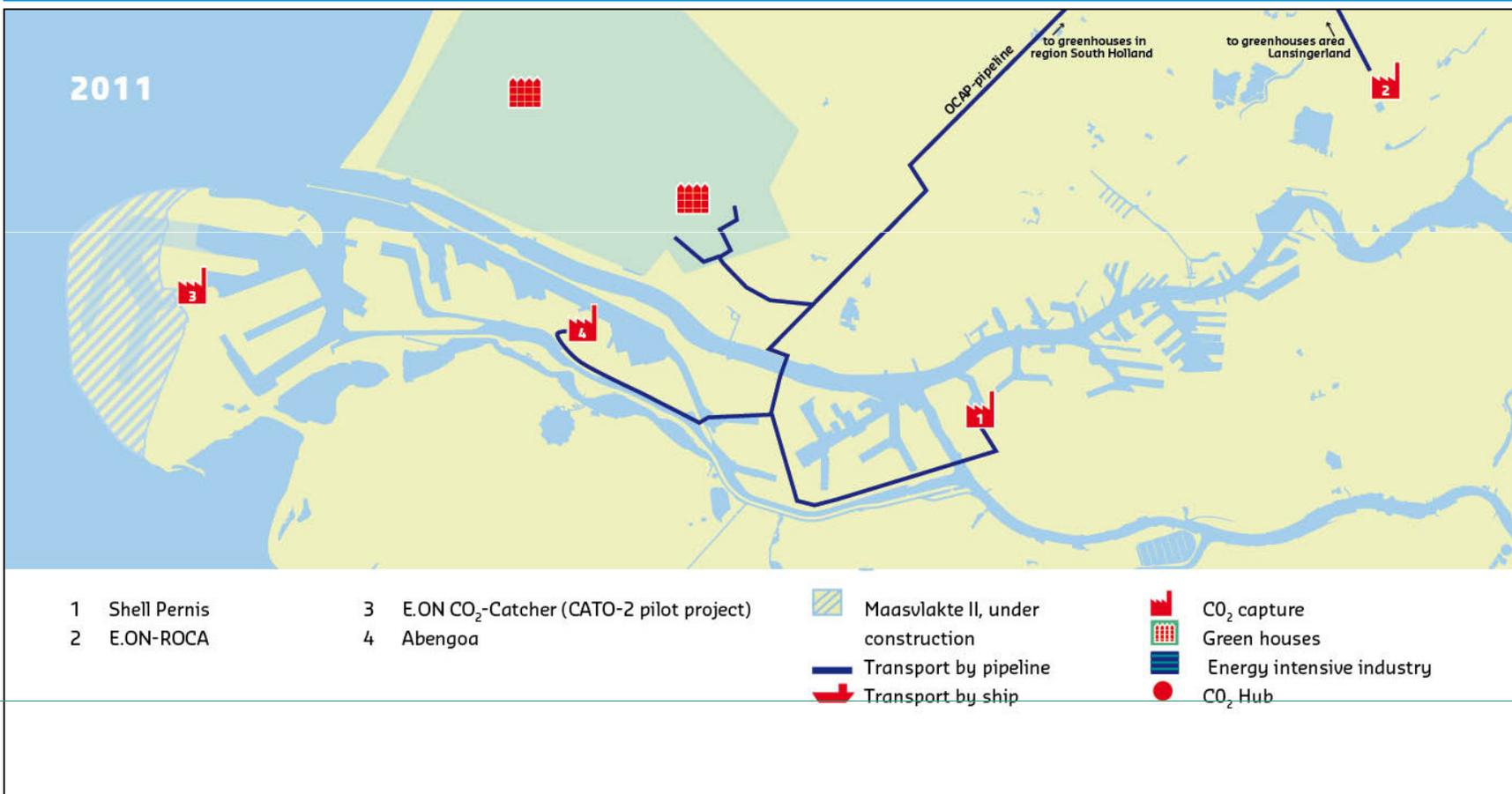


Signing of letters of co-operation:  
Liquid Logistics Shipping Concept (above) and Maersk (below).

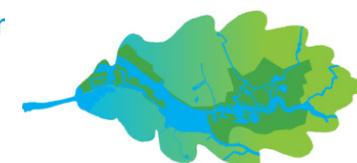


ROTTERDAM.CLIMATE.INITIATIVE

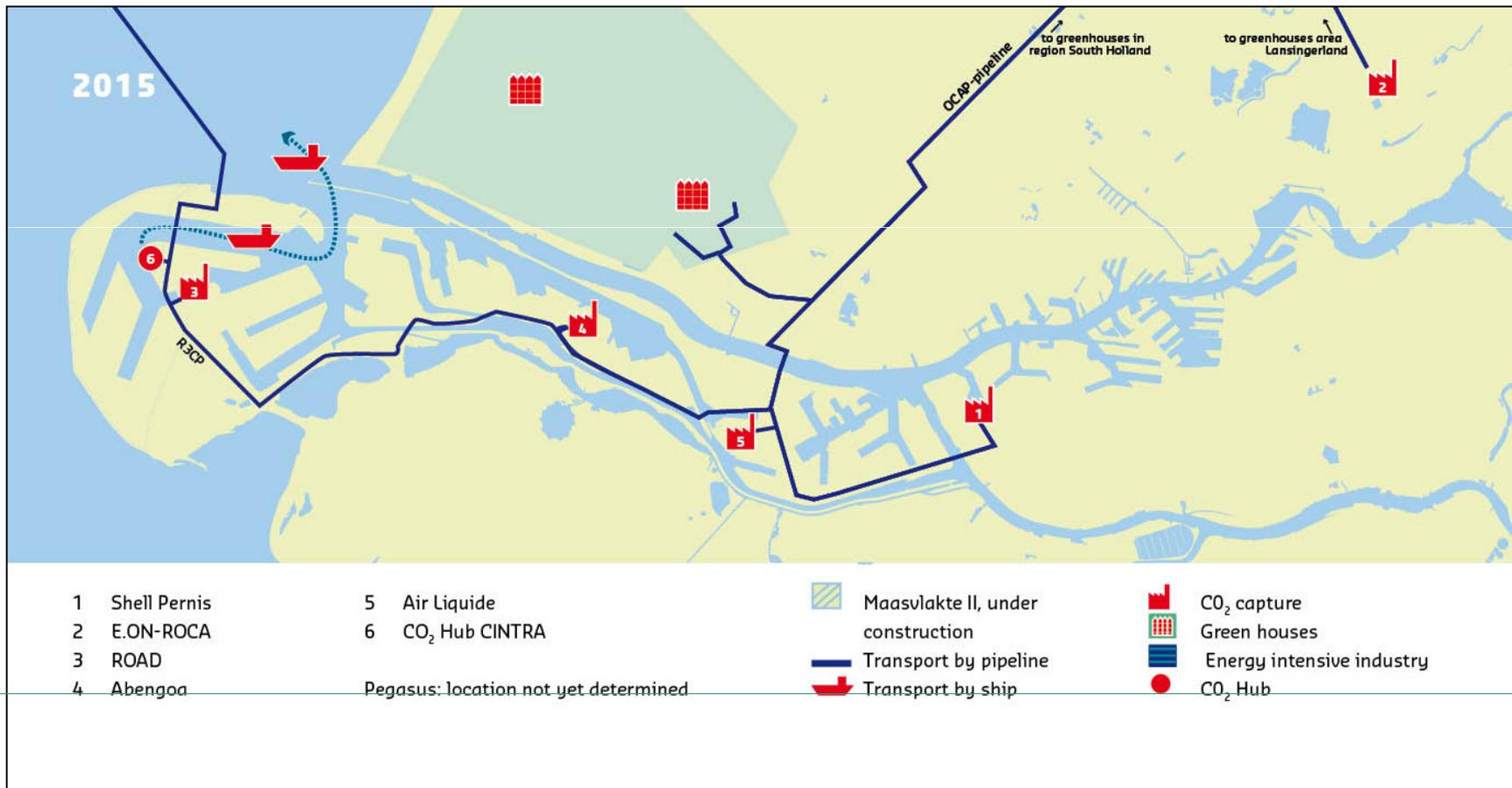
The Rotterdam CCS approach – phase 1: current situation (focus on pure sources)



The map shows the present situation (2011): Several companies, active in RCI, already operate CCS projects. OCAP delivers CO<sub>2</sub> from the Shell refinery to greenhouses. With the addition in 2011 of Abengoa as a source of CO<sub>2</sub>, OCAP continues to expand these deliveries. E.ON’s CHP plant, RoCa, also delivers CO<sub>2</sub> to greenhouses. Other examples include Gaz de France SUEZ, who has operated a small-scale CO<sub>2</sub> injection project in an offshore gas field (K12B) since 2004, and the pilot capture plant called CO<sub>2</sub> catcher at the E.ON Maasvlakte coal-fired power plant. This pilot is part of the CATO R&D program.



The Rotterdam CCS approach – phase 2: focus on demonstrations



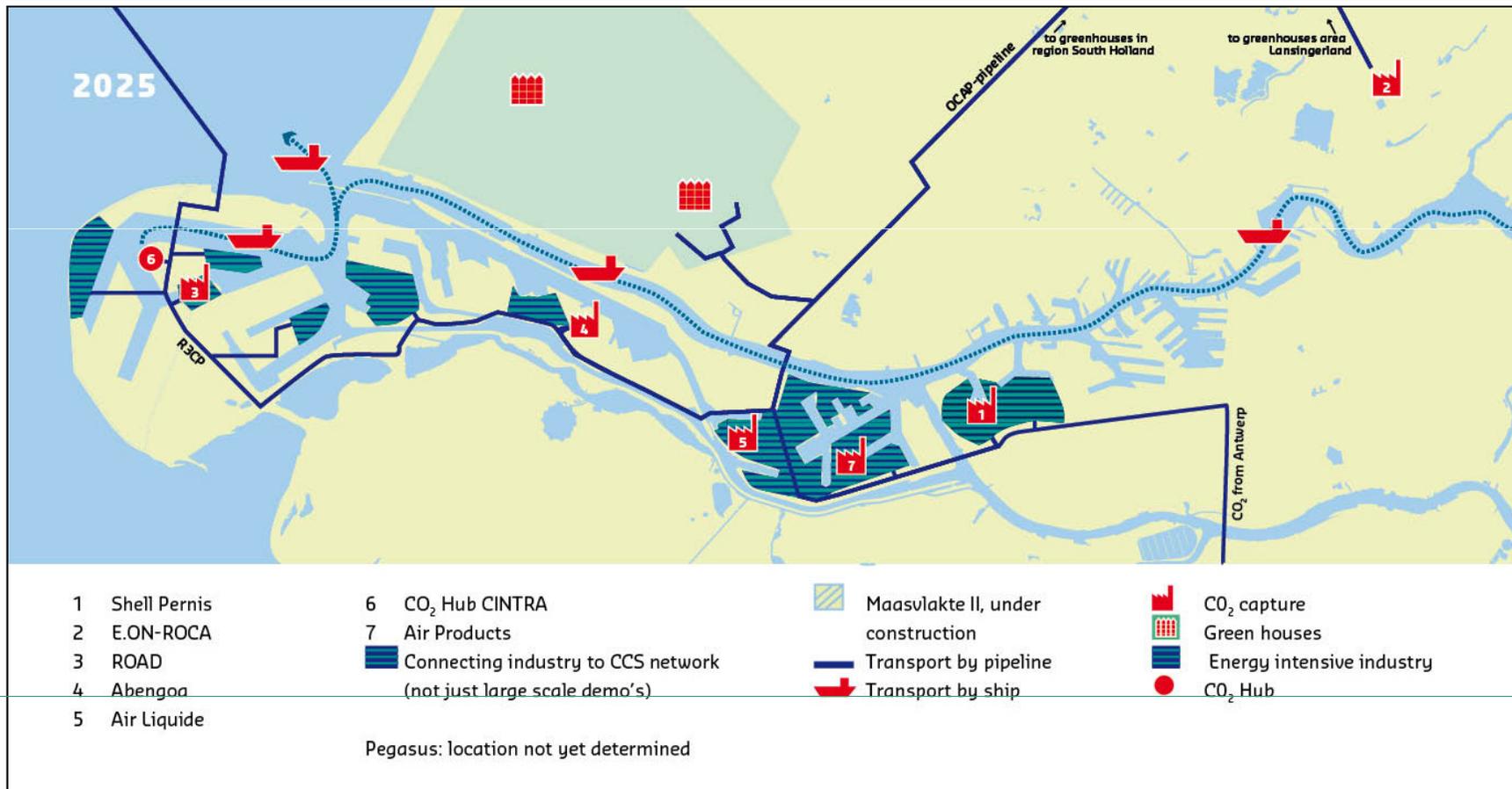
The second map shows the developments projected for the period between 2015 and 2020, when the CCS network will evolve into its demonstration phase. Large-scale demonstrations are required as stepping-stones towards full-scale implementation:

- These demonstrations will lead to the development and improvement of capture technologies.
- They will enable cost reduction for CCS.
- They are the start of the CCS network.

Currently the most prominent demonstration project is the ROAD project, which has been granted funding from both the EU and the Dutch government. RCI also expects at least one hydrogen production facility to apply CCS by 2015. By then, the CO<sub>2</sub> hub will have started its first operations and initial offshore storage will take place at the TAQA and other fields.



The Rotterdam CCS approach – phase 3: transition towards commercialisation



As indicated this map, the demonstration projects form the stepping-stones towards full-scale deployment of CCS by 2025 in the Rotterdam area, enabled by the establishment of the Rotterdam CCS network. RCI anticipates that the pilots will capture and store CO<sub>2</sub> on a full scale and that an increasing part of the Rotterdam industry will apply CCS by 2025. The three maps also indicate the connections that RCI expects the CO<sub>2</sub> network to make outside the Rotterdam-Rijnmond region. The next slide contains a map of North-western Europe, showing the locations of those connections.



The Rotterdam CCS approach – phase 3: expanding the network



Rotterdam (D) itself is already a highly industrialised area with lots of large and medium-scale CO<sub>2</sub> emitters. The current aim is to capture and store 17,5 Mton per annum from 2025 onwards. Rotterdam is also located in the vicinity of other highly industrialised areas with large CO<sub>2</sub> emissions, several in the Netherlands but also some abroad like the Ruhr area (K) and the Antwerp area (I). Rotterdam is a port that already has a connection to these areas (supply of goods by ships, pipeline or lorries). Furthermore, Rotterdam is well situated to transport CO<sub>2</sub> to the main set of storage reservoirs in Europe: the hydrocarbon fields and aquifers under the North Sea. On the map the offshore location that the RCI partners intend to use are marked, but there are many more opportunities. On the Dutch continental shelf alone there is potential for 900 Mton of storage in depleted gas fields.

Rotterdam is thus in a good position for the development of a CCS hub: it can collect the CO<sub>2</sub> from the other industrialised areas and become the central point for delivery to the storage sites. The companies in the port and the port itself have a good track record to realise such ambitions, and they are eager to develop this kind of business cases. So, RCI expects this hub to benefit both climate change policies and the investment climate in the port.



1

**Introduction to the Case Study**

2

**Research approach**

3

**Rotterdam Climate Initiative**

4

**Drivers and Risks for CCS in Rotterdam**

5

**Storyline of the CCS Approach in Rotterdam**

6

**Interim Lessons Learnt**

7

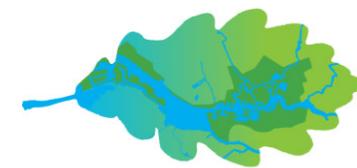
**Annex: further reading**

### The Unique Selling Points of Rotterdam

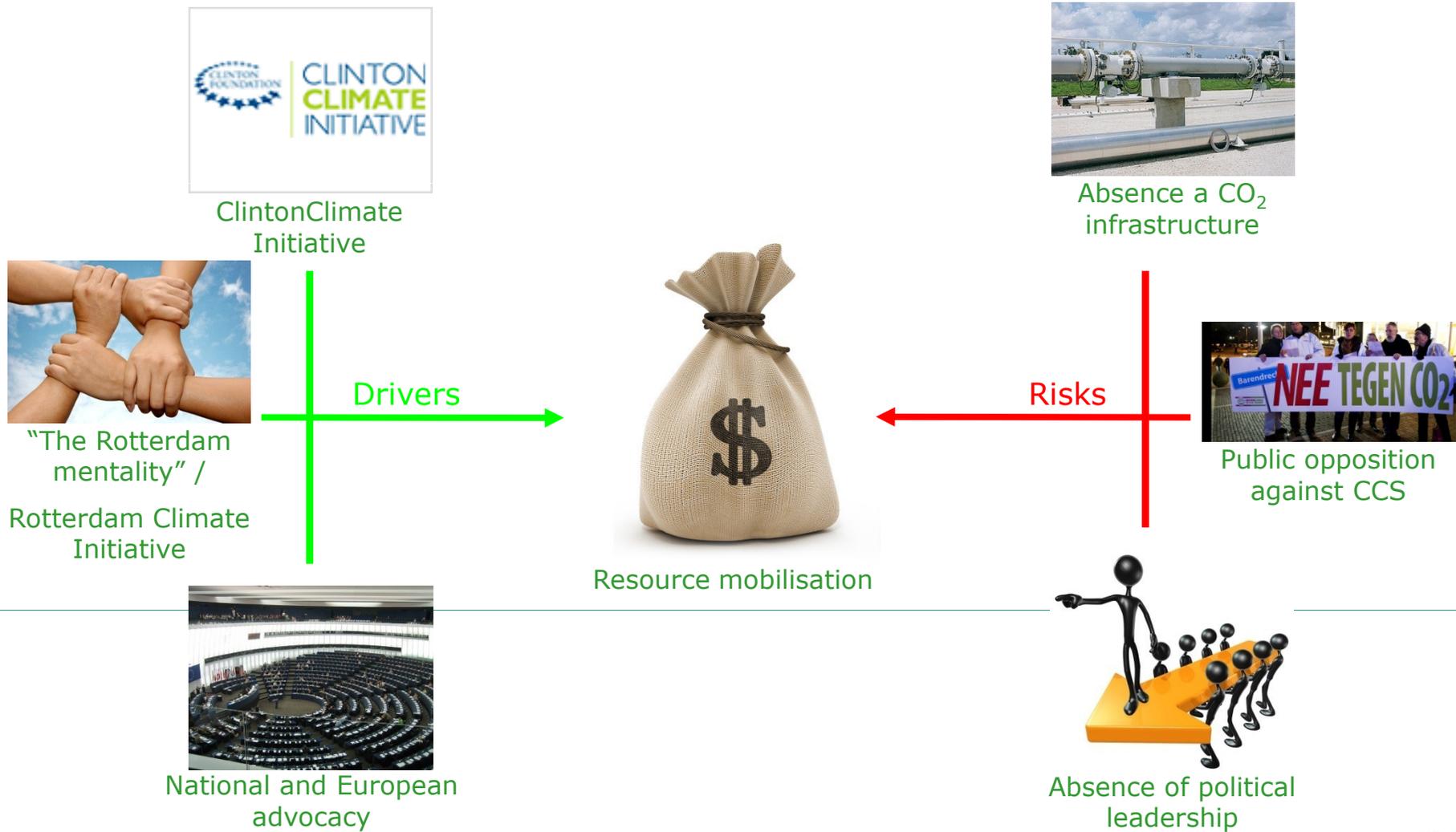
- Rotterdam has a **high density** of medium and large scale **CO<sub>2</sub> emitters** in a relatively small area. CO<sub>2</sub> emission in 2025 of those sources is more than 30 Mton per annum.
- Depleted oil and gas fields and other suitable **geological formations are available and situated nearby** in the North Sea basin. Estimated capacity is 800-1000 Mton for depleted gas fields.
- Rotterdam has **extensive experience in infrastructure** development and shipment of gases. A dedicated CO<sub>2</sub> pipeline is already available, so the extension towards a shared CCS transport network is a logical next step.
- Rotterdam has **an ambitious goal** to tackle climate change and to strengthen the Rotterdam economy at the same time. This goal is **broadly supported** by industrial and political executives. CCS is essential to reach the targets.

**Thus:**

**Rotterdam offers excellent opportunities for a CCS Network project or a CO<sub>2</sub> Hub.**



Drivers and Risks (scheme)



### Drivers

The results of the research point at the following factors that have had a positive effects (drivers) on the development and implementation of CCS activities in Rotterdam:

- **Rotterdam Climate Initiative (RCI)** – CCS was not a single issue in Rotterdam, all CCS activities are part of the broader RCI. It also was instrumental that there was a joint commitment and approach of all regional actors (industry, network organisations and political forces).
- **The Rotterdam mentality** – In Rotterdam the motto is “Actions speak louder than words” (“Geen woorden maar daden” in Dutch) and the practice is that there are “short distances” between organisations. For CCS this also meant that it is seen as an opportunity: “Rotterdam wants to stay an energy port and thus it needs to be sustainable”. “CO<sub>2</sub> will be priced, so we can better take action now.” Part of the Rotterdam mentality is also that the future has to be prepared well: a shared vision has been developed and the RCI has been set up as a well organised network organisation with the four partners covering all stakeholders in the port.
- **National and European advocacy** – Rotterdam is fortunate to have Dutch political “celebrities” who wanted to support the goals of the RCI: like Ruud Lubbers (former prime-minister of the Netherlands) and Ivo Opstelten (former mayor of Rotterdam, now Minister of the National Justice Department). Together with these celebrities the contacts between Rotterdam and National government (Ministers of Dutch ministries) and EU commissioners Piebalgs (Energy) and Dimas (Environment) could be established in a positive way.
- **Connection to Clinton Climate Initiative (CCI)** – In the first phase this connection helped in getting commitment in Rotterdam. Later on it helped in achieving international publicity and enlarging the international network connection of the RCI. The expertise of the CCI in financial assessment and their relations with financial institutions were very helpful in fundraising and improving business cases.



### Risks

The results of the research point at the following factors that can have negative effects (risks) on the development and implementation of CCS activities in Rotterdam:

- **Political leadership** – Although the European authorities and local politicians and authorities are pretty reliable in supporting CCS, the attitude of national governments and politicians shows less consistency in commitment. Next to that there are a lot of policy issues that need consistent political direction: inclusion of CCS in the European emission trading scheme; liability of storage; harmonisation of regulations at different levels (EU and national); safety regulation; management of the availability of storage location and a common policy on transport.
- **CO<sub>2</sub> Transportation Infrastructure** – The challenges for the mid term for infrastructure are large. For the current demonstration phase pipelines will be chosen and the question now is: how to choose them in a way that they can be a stepping stone towards the commercial phase. Questions that need to be resolved are:
  - What will the future infrastructure look like (e.g. main transport routes on the North Sea; what amount are foreseen to be transported) and how will cross-border transport be regulated (open access? Quality demands for CO<sub>2</sub>? Etc.)?
  - What is the most efficient way to organise the transport for the first projects (in relation to the expected future capacity; ship and/or pipelines? What size of the pipelines? Etc.)?
  - How to finance over capacity in a proper way?
- **Public support** – The current status on the engagement of the public with CCS does not give a positive picture. There has been a rather strong local opposition against onshore storage and the common attitude towards CCS is not very positive (not very negative either): it scores on popularity between biomass and nuclear. Opposition against CCS will have a negative effect on the willingness to invest and will not stimulate politicians to show leadership.



1

**Introduction to the Case Study**

2

**Research approach**

3

**Rotterdam Climate Initiative**

4

**Drivers and Risks for CCS in Rotterdam****5****Storyline of the CCS Approach in Rotterdam – RCNP**

6

**Interim Lessons Learnt**

7

**Annex: further reading**

## Storyline of the CCS Approach in Rotterdam

### The Rotterdam CCS Hub Approach has had different periods with different focus

The first part of the research was the reconstruction (see [the research plan](#)). The reconstruction consisted of the following parts:

- Media analysis – Analysis of nearly 100 articles in national newspapers.
- Document analysis – Analysis of more than 2000 internal documents.
- Interviews – Interviews with internal and external stakeholders: 5 executives from the RCI partners, 3 Rotterdam based industrial executives and 5 external stakeholders.

These activities form the core of the research. The first result was the construction of the storyline of the Rotterdam CCS activities. CCS has some history in Rotterdam. Already in the period 1995-1998 there was discussion at national and local level on CCS in Rotterdam, related to plans of Shell to capture its “pure” source of CO<sub>2</sub> from the refinery and store it somewhere. The Rotterdam think-tank R3 released in 2003 a vision document with the name “To C or not to C” which covers the long term approach towards energy in the port of Rotterdam. The focus was on turning the “weakness” of the port of Rotterdam (lots of fossil fuels) into an advantage. In that document CCS also has a (small) position. And in 2005 the company OCAP starts with delivery of CO<sub>2</sub> captured at the Shell Refinery in Rotterdam to the hot houses or greenhouses in the Northern vicinity of Rotterdam. We start the reconstruction at the beginning of 2006. In the storyline we have discerned four distinct periods. Below you will find the names and time frames of these periods:

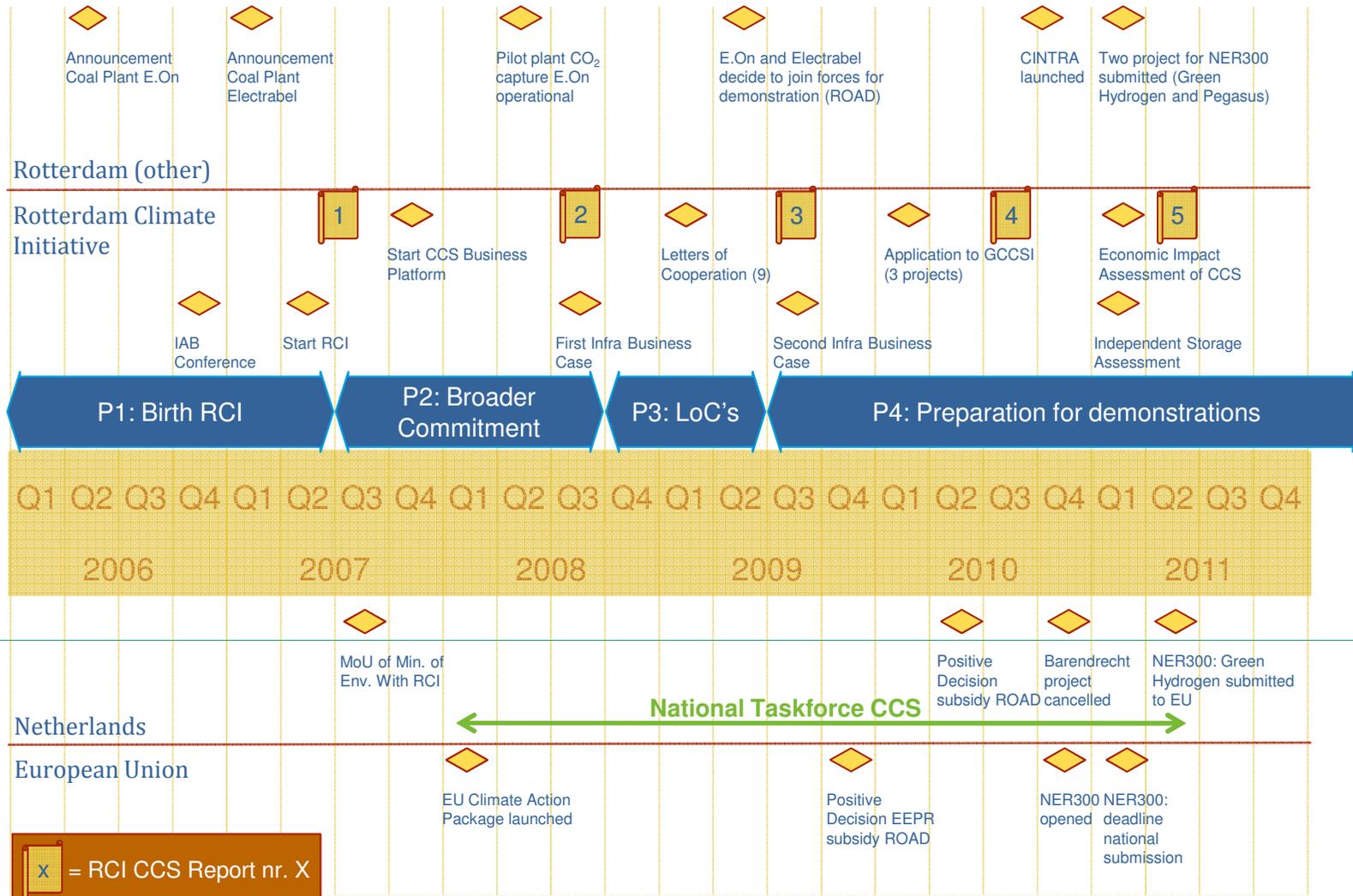
PERIOD NAME	PERIOD TIME FRAME
➤ Birth of the Rotterdam Climate Initiative (RCI)	2006 (Q1) – 2007 (Q2)
➤ Achieving broader commitment (outside Rotterdam)	2007 (Q3) – 2008 (Q3)
➤ Getting industry prepared for concrete projects (LoC's)	2008 (Q4) – 2009 (Q2)
➤ Preparing for demonstration decisions	2009 (Q3) – still ongoing

Each period will be briefly described in the following slides. But we start with a graphical overview of the timeline.



# Storyline of the CCS Approach in Rotterdam

## Timeline



In this figure the four periods of the Rotterdam CCS storyline are given (P1 till P4). Next to that some highlights in these years are given for RCI, Rotterdam (other than RCI), the Netherlands and the European Union.

Reference to the different RCI CCS reports are found in chapter 7.



## Storyline of the CCS Approach in Rotterdam – 2006 and 2007 (Q2)

### Period 1 – Birth of the Rotterdam Climate Initiative (RCI)

In this period a couple of companies announce plans to build a power plant in the Rotterdam region, among them are E.On and Electrabel who plan to build new coal fired power plants. These plans spark the debate on need and necessity of new generation capacity in the Netherlands but also on coal itself. The DCMR Environmental Protection Agency is developing an assessment framework for new power plants. This framework already includes demands on capture readiness. Early in 2006, DCMR started a cost/benefit and opportunity survey study for CCS activities in the Rotterdam area.

At the end of 2006 the conference “New Energy for Rotterdam” is held. This leads to an advice of the International Advisory Board (IAB) of Rotterdam that Rotterdam should be the “world capital of CO<sub>2</sub>-free energy” in 2025, which included an emission reduction of 50% in CO<sub>2</sub> emissions in 2025. CCS is also mentioned as an important opportunity for Rotterdam. In that same month the mayor of Rotterdam meets Mr. Bill Clinton during his visit to the Netherlands and Mr. Clinton invites Rotterdam to the Clinton Climate Conference in May 2007 in New York. Since the meeting with Mr. Clinton, the advice of the IAB has been embraced by the mayor of Rotterdam and has become a kind of commitment of the Municipality of Rotterdam.

Together with DCMR, Deltalinqs and the Port Authority, the Municipality develops a plan to realise the IAB advice. This plan is completed in May 2007 and has ambitious goals on all three domains of climate change mitigation: energy efficiency improvement, renewable energy and CCS. For CCS the plan contains a summary of an ambitious business case for CCS. The plan is used to start the Rotterdam Climate Initiative (RCI). The **birth of the RCI** in May 2007 is celebrated with Mr. Clinton at his conference in New York. First meetings with delegates from the Clinton Climate Initiative follow shortly afterwards.

Meanwhile the parties involved in the business case for CCS are working hard to get support from industry. Cooperation is formalised at that stage by the signature of Letters of Intent (8 companies at the start, see box) in which the signatories state to support the RCI goals. In July 2007 the CCS business case is presented to local stakeholders and the first RCI CCS report is published. This report contains an assessment of the cost and benefits for CCS in Rotterdam and a roadmap in three phases for the realisation: 1,5 Mton in phase 1, 10 Mton in phase 2 and 20 Mton in phase 3. The report is based on the assessment of public available data, like the IPCC Special Report on CCS of 2005. The conclusion of the report is that CCS in Rotterdam is feasible and an attractive opportunity for the Port of Rotterdam.

#### The eight companies at the start:

1. Abengoa
2. Electrabel
3. Eneco
4. E.On
5. Gaz de France
6. Linde
7. NAM
8. Shell

In summary this period is characterised by:

- Focus on **agenda setting** for climate change mitigation and economic development at the same time and on achieving fundamental commitment of all parties in Rotterdam (authorities and industry).
- Cost/benefit and opportunity survey was carried out based on literature.



### Period 2 – Achieving broader commitment (outside Rotterdam)

The **most important event** of the second period is a European one: the European Commission published the Climate Action package in January 2008. In this package the EU energy policy for the period 2008-2020 is presented with matching financial support. CCS is an important part of this package. This EU package is used afterwards as the roadmap for national CCS policy in the Netherlands. The promise for matching financial support is seen to be the main driver for CCS activities in Europe, Netherlands and Rotterdam.

On the **national level** in the Netherlands the following events are significant in this period:

- The Dutch Ministry of Environment and the Rotterdam Climate Initiative (RCI) sign of a cooperation agreement (MoU, July 2007). The aim of the MoU is to accelerate realisation of large-scale CCS in the port of Rotterdam.
- The National Taskforce CCS is established. The Taskforce aims to support Dutch CCS activities and to remove possible obstacles in the implementation of CCS in the Netherlands. The Taskforce has high level members from public and private entities (March 2008).
- The pilot plant for CO<sub>2</sub> capture, the CO<sub>2</sub>-catcher, is opened at the E.On site in Rotterdam (April 2008).
- The Ministry of Economy publishes its Energy Report (the main biennial policy document on this issue). Setting up a CO<sub>2</sub> infrastructure is one of the three infrastructure areas that are detailed in the report (September 2008).

The partners of the RCI have the following main activities:

- Achieving visibility by a well-organised advocacy.
- Enhancing cooperation with industry.
- Developing a business case for CO<sub>2</sub> transport and storage.
- Developing a strategy for (long-term) deployment of CCS.

**Advocacy** – In the summer of 2007 the CCS report was published and the main executives of the RCI determined the need for improving the visibility of the CCS activities of RCI and the need for advocacy to solve the bottlenecks mentioned in the report. RCI defined an advocacy strategy for CCS direct after that summer. It consisted of a stakeholder analysis and a decision to work together with the other region in the Netherlands that is focussing on CCS (Northern Netherlands, a cooperation of the three Northern Dutch provinces) and it defined a sequence of advocacy activities. For the activities in the Netherlands this resulted in the following three main events:

- RCI and Northern Netherlands send a joint letter to the Ministers of Economic Affairs and Environment (October 2008).
- RCI and Northern Netherlands have a meeting with the Ministers of Economic Affairs and Environment (April 2008)
- RCI and Northern Netherlands become members of the Dutch CCS Taskforce (see before).

On the European level, the advocacy achieved a real boost after the announcement of the European Climate Action package (January 2008). Mr. Lubbers and Mr. Opstelten contact the European commissioners of Energy (Piebalgs) and Environment (Dimas). A visit by European Commissioner Piebalgs to Rotterdam takes place in January 2008.



### Period 2 – Achieving broader commitment (outside Rotterdam) – cont.

**Advocacy cont.** – Content of the advocacy is twofold: first to show that Rotterdam is well-suited to start CCS deployment and, second, that the European and national authorities have to provide more clarity on the financing of demonstration projects, that they should propagate a clear and consistent message on CCS and that they need to speed up to fix the legislation in such a way that it support the application of CCS.

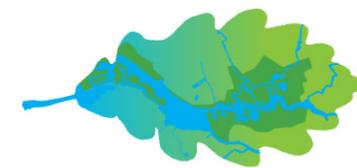
**Cooperation with industry** – In the summer of 2008 the CCS Business Platform is founded (in 2011 about 20 companies participate). The participating companies declare to endorse the RCI objectives and are willing to cooperate in accelerating the introduction of CCS. The main function of the platform is to share knowledge and experience between industry and RCI partners.

**Business case infrastructure** – RCI partners, led by the Port Authority, started exploring and defining a business case for the infrastructure for CO<sub>2</sub> transport. The existing pipelines of OCAP were seen as the backbone or the starting point. A couple of growth scenarios were developed and at the beginning of 2008 a real study was started to define a business case for the first phase (see RCI CCS Report 2): which financial model could work for the exploitation of this transport network and under what condition could that network function with a positive turn-over. Wintershall came to the RCI with the message that they an offer or an idea: their nearly depleted gas reservoir in the Q8a field could be possibly be used for CO<sub>2</sub> storage. The result was that Wintershall also became involved in the business case. The Q8a field could fit neatly into one of the growth scenarios. In 2007 the Port authority, OCAP, Wintershall and Rotterdam signed a cooperation agreement to develop the business case. In this period Linde and TNO conducted a feasibility study for storage of CO<sub>2</sub> in the reservoir Q8a. The consortium delivered a confidential report on the business case, the main results were fit in the RCI CCS report 2.

**Strategy** – After the summer of 2007, the RCI elaborates a strategy for accelerating the deployment of CCS. In that strategy the organisation of the CCS Network plays a large role as does the long-term incentives for CCS deployment. Especially on these issues, the cooperation with the Clinton Climate Initiative (CCI) becomes more intense. Mr. Magaziner (director of CCI) visits Rotterdam twice to have extensive discussions with RCI partners. The formal collaboration between the RCI and CCI is signed in August 2008. CCI and RCI together have increased their understanding, especially on the ins and out of organising a hub approach. The RCI team uses this experience in the development of the 2008 report. This report combines the RCI analysis with an external assessment by Dutch experts. The report contains an assessment of local data on industry and an own infrastructure business case. This second CCS report is published in July 2008 and presented by Mr. Lubbers to the national ministers. The message of the report is that Rotterdam is ready for applying CCS. This requires, however, a long-term and stable policy that will offer the necessary confidence to companies to make such large investment decisions.

In summary this period is characterised by:

- Broad advocacy and communication activities, mainly directed to the Dutch national government and the European Union
- An (own) infrastructure business case was developed
- A consultation and review of the data for second report was organised. The report was partly based on local data from industry and new data from capture technology providers.



### Period 3 - Getting industry prepared and committed

This (short) period is characterised by (i) very intense cooperation with industry, (ii) achieving more confidence on the infrastructure business case and (iii) advocacy for European funding and national co funding of CCS projects.

**Cooperation with industry** – At the end of 2008 RCI started to work on an integrated approach for cooperation with the emitters. RCI developed the possibility of a Letter of Cooperation (LoC). In such a LoC companies or consortia promise to do a prefeasibility study and RCI promises to supply an independent expert to validate the studies. Early in 2009 RCI signed a LoC with nine companies including E. ON and Electrabel. E. ON and Electrabel explicitly decided in this period to look at a joint demonstration project. A few months later they submit a joint proposal for the European EEPF subsidy scheme: the ROAD project. All nine companies carried out the pre-feasibility study in Q1 of 2009. Foster Wheeler validated these business cases for CO<sub>2</sub> capture, whereas Climate Change Capital has analyzed the plans from the role of financial advisor and made a full chain analysis for the Rotterdam CCS network.

**Infrastructure** - RCI led by the Port Authority developed an improved version of the transport business case with Gasunie, OCAP, EBN, Wintershall, Taqa, Stedin and Gaz de France. In May 2009 the second report on the business case for the infrastructure appears. This is again a confidential report of which the summary is enclosed in the 2009 CCS report. In January 2009 a parallel transport initiative started: Anthony Veder, Gaz de France, Gasunie and Vopak come with a joint proposal for a "CO<sub>2</sub> Liquid Logistics Shipping Concept". In this proposal CO<sub>2</sub> is liquefied (using the 'cold' of the LNG facility in the port) and is then transported by ship to depleted gas fields in the North Sea. The summary of the business case for this proposal is also enclosed in the 2009 CCS report.

**Advocacy** – RCI supports the European Commission's NER proposal, the new subsidy scheme that was in development in that period. Another message that RCI starts advocating towards the European Commission is the need for additional policy and a change of focus: i.e. That the focus should be on networks and cooperation instead of stand-alone projects. RCI also campaigns for financial support from the national government for the Rotterdam CCS plans. RCI also continued the advocate that the large-scale deployment of CCS is can't rely on industry finance for the transport and storage infrastructure, given the current and expected CO<sub>2</sub> prices. The RCI puts the aforementioned need for additional policy in the memorandum "Ensuring implementation of CCS – How can the use of CCS be guaranteed?" In this period the RCI also made the first contacts with the Global CCS Institute in Australia.

**The 2009 CCS Report** – With the publication of the 2009 CCS report, the RCI explains in a press release that international experts confirm that CCS is feasible in Rotterdam. The total cost of CCS vary between € 50 to € 80 per ton of CO<sub>2</sub>. The studies by Foster Wheeler and Climate Change Capital are an important part of the 2009 report.

In summary this period is characterised by:

- The infrastructure business case was improved and a shipping option was added.
- Getting industry really committed: 9 letters of co-operation (LoC) were signed and pre feasibility studies were carried out.
- A third party evaluation of the industry studies was carried out by Foster Wheeler and Climate Change Capital.



### Period 4 – Preparing for demonstration decisions

The main events of this period are:

- The EU subsidy for ROAD (EEPR) has been acknowledged, as is the co funding from the Dutch government.
- The other and larger EU subsidy scheme (NER300) was prepared and started (see below).
- The Dutch government officially cancelled the Barendrecht CO<sub>2</sub> storage project in Q4 of 2010 and also decided for indefinite suspension for onshore storage of CO<sub>2</sub> in Q1 of 2011.
- RCI and GCCSI started a closer cooperation (see below).

**NER300 and developments in industry** – The companies Gasunie and Vopak conducted a feasibility study for developing a distribution hub for handling and temporary storage of CO<sub>2</sub>. Part of that work was co financed by Global CCS Institute. The result was a new report on the business case of the Hub and the launch of a new service company with the name CINTRA in the second half of 2010. The partners of the ROAD project prepared for the FID (including execution of the FEED study and negotiations on storage), now scheduled at the end of 2011.

The time between conception of the NER300 and the final decision for the NER300 is relatively long. RCI was involved in this preparation process as focal point for the Rotterdam industry. The national government organizes a briefing for stakeholders who wish to submit applications for NER300 in July 2010. In this meeting the criteria for the pre-selection by national governments are discussed (criteria that do not seem positive for Rotterdam based companies because they directly or indirectly lead to a preference of projects from other locations). Finally the European Commission decided in November 2010 to go ahead and publish the subsidy regulation. Due to the advocacy of RCI and Rotterdam based companies the Dutch criteria were more neutral to location. Late 2010 and early 2011 RCI was completely dedicated to supporting companies who wish to apply for a grant in the NER300 procedure. RCI also tried to achieve one joint proposal from Rotterdam based companies. At the end on 9 February 2011, four proposals were submitted to the national government of which two in Rotterdam area: (i) the Green Hydrogen project led by Air Liquide and (ii) the Pegasus project led by SEQ International. National government assessed these four projects and decided to only pass one project to the European assessment part: the Green Hydrogen project.

**RCI strategy and reports** – In the beginning of this period, the RCI CCS Plan 2010-2011 is drawn up. In this plan the Port Authority states that it has the ambition to develop the port area to become the CO<sub>2</sub> hub of North-West Europe. The cooperation between RCI and Global CCS Institute started early 2010 and results in three research projects being co financed by the Global CCS Institute: (i) an Independent Storage Assessment (ISA), (ii) the Liquid Logistics Shipping Concept (see above on Hub and CINTRA) and (iii) the Case Study on Lessons Learnt (current report is one of the deliverables of this project). The ISA is a detailed analysis of the storage locations. ISA is meant to reduce uncertainties by determining for each potential storage site whether CO<sub>2</sub> can be stored and what the storage capacity and injectivity could be. In September 2010 RCI publishes the 2010 CCS report, this time focused on politicians, administrators and senior officials. The report identifies the strengths of the Rotterdam CCS activities: the network approach, the commitment of the companies and the involvement of industry in addition to the electricity sector.



PLEASE TURN OVER

### Period 4 – Preparing for demonstration decisions – cont.

**RCI strategy and reports cont.** – Other studies of the RCI in this period are:

- The Economic Impact Assessment, a study on the likely additional economic benefits of the investments in CCS projects in Rotterdam
- The Strategic Environment Management study (SOM, acronym in Dutch), an assessment of the position of relevant parties in and around the port area with regard to CCS projects and the related infrastructure
- A safety study on CO<sub>2</sub> infrastructure by DNV.

The main results of these studies are incorporated in the fifth CCS report that was published in May 2011.

**Policy and advocacy** – McKinsey advises in November 2009 the national CCS Taskforce on securing the development of CCS after the demonstration phase. McKinsey states that additional policy instruments are deemed necessary because the CO<sub>2</sub> price on the short term will be too low. As a matter of fact, this advice strengthens the position that RCI already defended from 2008 onwards. In that respect, RCI started cooperation with *Nature and Environment* (a Dutch environmental NGO) as part of the goal to secure the application of CCS after the demonstration phase. One possible route that is studied is the development of a national covenant for CCS. This agreement must ensure that CCS is developed sufficiently to 2020. The European Climate Foundation (ECF) supports this initiative financially. It is still ongoing.

On the visibility level of advocacy there are some national events. The new national CCS project director (Mr. Van Slobbe) is introduced in Rotterdam in March 2010. At this meeting RCI partners and industry emphasize that Rotterdam has unique capabilities to become a CO<sub>2</sub> hub and that companies are the driving force behind the development of CCS in Rotterdam.

Another discussion at national level is the shift of focus of national politics to northern Netherlands. Dutch policy documents stated since 2007 that the Netherlands needs two large-scale demonstrations: one in Rotterdam and one in the North of the Netherlands. In 2010 during the preparation of the NER300 RCI has worries on this shift of focus: does that mean that projects from Rotterdam are not amenable for NER300? This also makes companies from Rotterdam uncertain. A lot of effort was spend on neutralising this issue. The end result in February 2011 was that the political decision on onshore storage (see above) ended this uncertainty in an unexpected way.

In summary this period is characterised by:

- Support for decision making (independent storage assessment; advice and advocacy)
- Support for resource mobilization (especially for NER300 applications)



1

**Introduction to the Case Study**

2

**Research approach**

3

**Rotterdam Climate Initiative**

4

**Drivers and Risks for CCS in Rotterdam**

5

**Storyline of the CCS Approach in Rotterdam****6****Interim Lessons Learnt**

7

**Annex: further reading**

### Status and overview

#### This is an interim version

The case study is not completed yet. Parts of the reconstruction need some extra attention before we can be more confident on the results, especially where the interpretation of the facts takes place. In this part we share those lessons with you that we are convinced they will “survive” the current assessment activities.

#### Content in the next slides:

A lot of lessons can be learnt from the Rotterdam approach and our case study. For this interim report we have chosen to focus on a few of them. They will be described in more detail in the following slides:

- A. **Factors of Success** – What are the main factors that cause that the Rotterdam approach is or will be a success?
- B. **Hub approach** – What did Rotterdam do to organise the Hub? What is assessed to be positive?
- C. **Storage** – Why and how did Rotterdam assess storage? Why did this become urgent?
- D. **Public awareness and communication** – How did Rotterdam communicate and what was the result? What can we learn from the Rotterdam experience with regards to the Barendrecht CO2 storage project?
- E. **Content of the final report** – The previous subjects are the *Selected Topics* of the results of the case study. On this slide you will find an overview of what you can expect in the final report (which will appear on the website in Q4 of 2011).



**A**

## **Factors of Success**

**B**

**Organising a CCS Hub Approach**

**C**

**Getting Storage Available**

**D**

**Public Awareness and Communication**

**E**

**Overview of the Contents of the Final Report**



## Interim Lessons Learnt

### Factors of Success

What most helped Rotterdam to arrive at the current and positive situation? Based on our research we derived the following top six for the factors of success (the order of the factors is random):

- **The starting position** – The USPs of Rotterdam (see ch. 4) are exceptional: no region in the world has the same positive circumstances for CCS. This is especially true for the commitment of all parties involved: CCS is generally seen to be necessary for the continued existence of the port. CCS is seen as an OPPORTUNITY.
- **Image and Public Relations** – The external communication has been very good: good and credible reports, good website, CCS is connected to RCI as a broad climate change program, good spokespersons and a well directed advocacy (Lubbers, Opstelten, Smits, aldermen, Van Sluis). Rotterdam is well informed, well prepared and using its channels of influence.
- **The Rotterdam approach** – The Rotterdam approach is effective. It consists of a solid goal for 2025 and a softer approach for the short term (listening to parties; being flexible to changing conditions etc.). The approach thus sometimes has a strong temporary character: could be seen by external parties as somewhat “aimless” or hesitant.
- **Working together** – In Rotterdam cooperation is archetypal (it is in our genes). In the case of CCS the broad cooperation between industry, administration, port authority and environmental experts. This cooperation not only resulted in a common approach but also more progress than elsewhere. Internal and external parties are impressed by our cooperation. Cooperation could be improved by involving social organisations, like environmental NGOs.
- **The future is an opportunity** – Rotterdam is focused on the future and its opportunities, an attitude coupled to the vision on the existence of the port and the role of CCS. Rotterdam thus also concentrates on the period after demonstration: there is a need for real (commercial or regulatory) incentives for CO<sub>2</sub> emission reductions; there is a need for a superintendent for infrastructure and storage locations. By combining short term and long term Rotterdam has proven to be a reliable and above all a credible partner, especially for NGOs.
- **Companies take responsibility** – Rotterdam has real companies who are committed to invest in CCS. They spot opportunities and work towards realisation. The seed money of the Rotterdam Municipality of about 10 million Euro is already enlarged with a factor of at least 10 by company investments and will very likely be enlarged even more by the coming investments by the industry in demonstration projects and by the Port Authority and its partners in infrastructure.



**A**

**Factors of Success**

**B**

**Organising a CCS Hub Approach**

**C**

**Getting Storage Available**

**D**

**Public Awareness and Communication**

**E**

**Overview of the Contents of the Final Report**



## Interim Lessons Learnt

### Organising a CCS Hub Approach

One of the main activities of the Rotterdam Climate Initiative (RCI) with respect to CCS was to develop an approach that could pave the way to the grand scheme of capturing and storing more than 15 Mton per annum in our region. RCI recognised from the start that the end goal needed an approach that integrated capture, transport and storage, and that Rotterdam at least needed a shared infrastructure. All these aspects form ingredients for a Hub.

#### What activities were carried out?

- A shared and widely supported vision has been developed. The long-term goals are fixed and the short term goals are flexible: the phases are targeted annually to the best insights of that moment.
- A lot of knowledge has been shared through the CCS Business platform and through exchange inside RCI. RCI also became an active member of the Dutch national CCS research program CATO.
- Formal partnerships with Letters of Cooperation (LoC) or Memorandums of Understanding (MoU) have been established with industry and national and foreign entities.
- Business cases for transport (and storage) have been developed.
- There has been an extensive advocacy towards national government and European authorities and executives.

#### Lessons learnt

- The vision has worked in a unifying way. It was good that all components of the CCS chain have been stakeholders of the process.
- The involvement of the "celebrities" had and has a unifying and activating effect.
- The formal partnerships have a positive effect: in terms of commitment but also in terms of credibility and reliability.
- The advocacy was based on visibility on the one hand and credibility on the other. Visibility through the "celebrities" and credibility by the reports. This combination has worked well.
- In the development of the transport business cases, the challenge is to mix the goal of the "grand scheme" and to be as flexible as possible to connect to the factual realisation of single projects. RCI has learned that it is not easy to cope with that challenge (nobody likes to change plans or schemes), but when you succeed to deal with it, the reward is trust and better insight.
- RCI learned that it is effective to make and assess transport business cases as early as possible: these cases give the best insights in the real bottlenecks in the region.
- The participation of RCI in CATO had two positive effects for Rotterdam: (i) it led to a demand driven program that is really focused on supporting the demonstration projects and (ii) Rotterdam got an easy entrance to academic knowledge and expertise.



**A**

**Factors of Success**

**B**

**Organising a CCS Hub Approach**

**C**

**Getting Storage Available**

**D**

**Public Awareness and Communication**

**E**

**Overview of the Contents of the Final Report**



## Interim Lessons Learnt

### The global context of CO<sub>2</sub> storage

Observing the worldwide developments with regards to the availability of storage reservoirs, we conclude the following:

- **Capacity estimates are becoming better** – There is more experience in carrying out global and regional screening assessments. Standards (e.g. classification system) are being developed. There is a high degree of convergence in estimating the capacity of hydrocarbon fields, and some improvement in estimating saline aquifers capacity.
- **More storages locations are being used or developed** – In North America: mostly EOR; Europe: depleted gas field, saline aquifers and maybe EOR; Australia: mostly saline aquifers and some hydrocarbon fields.  
**BUT: a growing percentage gets cancelled for various reasons.**
- **Finding and developing suitable storage location has become a major bottleneck for a lot of large CCS projects** - Long development time (especially for saline aquifers). Lack of available expertise (human resources) and integrated tools. No harmonised or standardised data acquisition and assessment. Uncertainty on financial liability leads to increasing sales prices for storage.

If we look at the somewhat broader context of storage we can observe that the following should be high on the agenda:

- **The public appreciation of (onshore) storage has become very low** - Multiplier effect of the positive impact of opposition in certain cases (Barendrecht, Ketzin, ...). Decreasing sense of urgency in the public arena of climate change problem. Poor performance in communication with lay public of many relevant parties dealing with the underground.
- **Integration and parallel timing of capture and storage is essential** – When you start you need a portfolio of storage “prospects” (plural!!). Integration of decision and investment points (like FID) for capture and storage has to be taken care of.
- **Cost of storage** – Screening of storage locations is affordable (about 100-500k\$ per region). The characterisation and development of a single reservoir is pretty expensive (>10M\$ onshore; >50M\$ offshore; depends strongly on the quality of the reservoir). The data on the O&M costs during operation are not yet conclusive enough.
- **Skills and experience** – Tools for the characterisation and development of reservoirs need to be invented or adapted. Human capacity needs to be expanded in all directions like finance, legislation and technical occupation (extra education; new curricula; new university disciplines or vocational training schools).

In general this shows that the development of storage is in its early stage and that a lot of challenges need to be tackled in the coming years.



## Getting storage available in the Rotterdam case

In Rotterdam several activities have been carried out to stimulate the availability of storage reservoirs. In the last year some of these activities were negotiations between private parties, mainly between instigators of capture or transport projects and storage operators. We are not in a position (yet) to assess these more private activities, but below we give an overview of the more public activities within the domain of the RCI.

### What activities were carried out?

- RCI commissioned a first reservoir study in the context of the transport business case (in 2008 the Q8a field of Wintershall was assessed).
- Rotterdam brought together parties from both sides: emitters and storage operators. This resulted in 2010 in carrying out the ISA (Independent Storage Assessment) study. This study was carried out with financial support from the Global CCS Institute and personal support from the Clinton Climate Initiative (CCI). This study is still ongoing.
- Rotterdam played a crucial role in the discussion on national level with regards to a storage strategy. Rotterdam, and especially Mr. Lubbers, put the development of such a strategy on the national agenda inside the national Taskforce CCS. Rotterdam participated in all parts of the following discussion and advocated their case accordingly.
- Rotterdam offered practical support for regulatory challenges (like cross-border transport, the liability issue around storage and the implementation of the European CO<sub>2</sub> Storage Directive).

### Lessons learnt

- Storage is perhaps the main barrier for the current investment decisions.
- Storage screening is a necessary activity to achieve confidence for all stakeholders. Relatively easy to do (public data and some private data are sufficient) with limited costs (200-300 k€).
- The ISA study has been very helpful. Initial assessment of single reservoirs is possible, not too expensive, and the research method is highly appreciated internationally. The method can be instructive for other projects.
- Getting nearly empty gas fields available for storage can be a complex and lengthy process. There is a strong need for a common approach and strategy and may need a European 'superintendent' to manage storage availability on the North Sea.
- Knowledge and experience in storage is sparsely available, as is the number of CO<sub>2</sub> storage experts. We have observed that this is already a cause for delay (on the regulator side but also on the operator side). This shortage of expertise can be a large barrier to widespread application of CCS.
- The costs are still uncertain, but we are more confident that they will converge to the 5-10 € per ton of CO<sub>2</sub> stored. One of the main challenges for the costs is to decrease the risky dependence on liability (financial security).



**A**

**Factors of Success**

**B**

**Organising a CCS Hub Approach**

**C**

**Getting Storage Available**

**D**

**Public Awareness and Communication**

**E**

**Overview of the Contents of the Final Report**



## Interim Lessons Learnt

### Public awareness: the current context (1)

Public awareness has received a lot of attention the last year, mainly caused by the “sudden appearance” of evident public opposition against CO<sub>2</sub> storage projects onshore. On this slide we summarise the main issues with relation to public awareness, perception and support from literature and Rotterdam experience.

**General public and attitude towards CCS** – From experience and scientific research we know that uninformed opinions are contingent: they are easily influenced and not stable. The general public has very little knowledge of climate change and energy problems and even less on the technical aspects of energy technologies. So their opinion about these issues is, nearly by definition, contingent; a simple opinion poll on CCS is thus useless. From communication theory we also know that the “recipients” of messages mostly do not process information unless they are very motivated. When they are not motivated they assess information by using simple schemes (cues): Do I like or trust the sender? Is the information brief? How much arguments do they use (the more the better)? Is a celebrity involved? Does he or she look like an expert? Etc. But there is more knowledge: CCS is very unknown in most part of the world. And when a person learns from it he or she does not rank it high. So (lay) persons in general are not very motivated to process information on CCS and they will use cues to assess the information. This attitude can change when they are faced with a CCS activity in their vicinity.

**Lessons from the Barendrecht CO<sub>2</sub> storage project** – The main thing we learned is that not only the public (the residents) are not ready to discuss and receive a CCS project, but the CCS community itself is also not ready to start a dialogue on a project. For the residents this was and is a project that is new, unknown, never done before. They were also not aware of what CCS is and what it signifies and they do not have a clue on why CCS could benefit them or the Netherlands or Europe. This combination of unfamiliarity and lack of benefits can trigger any audience into opposition, not much is needed for that trigger. A couple of “mishaps” in the process combined with the unpreparedness of the proponents were more than enough to indeed trigger the opposition.

Why do we say the CCS community was not ready to start a dialogue? In the first place, they did not really appreciate and assess the fact that the general public is unfamiliar with all aspects of CCS; and they did not really contemplate and reflect on the fact that this project was a demonstration project and THUS had to fit into a “technology roll out strategy” with corresponding risk assessments. Both national government (the initiator of onshore projects via a tender procedure) and Shell (the operator of the project) were totally focused on the techno-economic aspects of onshore projects and a little bit on getting support from local authorities. No local risk assessment was made: What is the local situation and what problems do residents and authorities face at this moment? Is there a value proposition possible? How do the residents perceive the credibility of the national government or Shell? Etc.



PLEASE TURN OVER

## Interim Lessons Learnt

### Public awareness: the current context (2)

**Lessons from the Barendrecht CO<sub>2</sub> storage project (cont.)** – These local risk assessment questions were only asked after the escalation into opposition had happened. Also no risks assessment was made by the national government to fit the desired plans for onshore storage into the broad development needs for CCS as a whole. The simple question “What is the risk that this project does trigger such a large opposition that we need to cancel the project?” was never asked. The common view in the CCS community was that onshore storage was the logic next step and worries of residents were perceived to be futile.

On the communication side the process was also not prepared well enough. The question you need to pose is: What do we need to be prepared to communicate and have a dialogue with local residents and authorities? We know that this question was asked at the national level. The level of the first assessment inside the national government was fair enough but there was no follow up due to “other priorities”. We also know that this question was posed by Shell and that they invited external expert for advice. The end result was that they started communicating with the residents “because that was necessary for the timing of the permitting scheme and the Environmental Impact Assessment and thus for the timing of the project itself”. History shows that they were not prepared to tackle the communication with the residents.

What could we learn for this project? That it is necessary to make proper risk assessments: (i) of the intended policy option and the intended projects, (ii) of the local situation and (iii) of the communication or dialogue context. And that is necessary to act accordingly, also when that results in postponing the project to a later date or cancel it. We like to draw your attention to some obvious aspects from Barendrecht that have to be addressed in any risk assessment. First, it is hard to communicate on CCS when there is not a broad public knowledge on or familiarity with (not to mention: support for) the social issues it relates to (energy availability and security; climate change). CCS can not be understood if you do not have a clue on solving the energy and climate change problems. Second, if the sense of necessity can be made clear, you have to take into consideration that local persons perceive a balance of cost and benefits. In the Barendrecht case, they only perceived costs. Achieving a more balanced outcome is essential. And last, the role of (lack of) confidence and trust towards the different stakeholders, especially public entities, should not be underestimated.

**Present situation on public support** – In many countries there is no public consensus on the need and necessity of CCS. The knowledge situation on CCS is very diverse: peer reviewed analyses can be found but are not written in common language; lots of internet sites (blogs) exist with biased or partially wrong information. Furthermore, cooperation between knowledge institutes, academia, politics, industry and NGOs can be improved to develop a shared information supply (consistent message) towards the public. What we do observe that there is a flavour of success for opposition: in Barendrecht, in Germany, in the USA and the Northern part of the Netherlands (all onshore). This gives hope for opposing parties. What also can be observed is an increase in the distrust in certain parties (industry and public authorities). And since these two parties are the most likely ones that start, initiate or support a CCS project, this certainly does not ease the challenge. At this moment in time people confronted with a local storage project will be triggered to look for and find information that helps them to oppose.

## Interim Lessons Learnt

### Communication about the Rotterdam CCS activities

In Rotterdam several activities have been carried out around communication, all of them coordinated by the office of the Rotterdam Climate Initiative (RCI).

#### What activities were carried out?

- RCI has made a communication and advocacy plan right from the start in 2007 and updated this plan nearly every semester, based on external developments and media analysis. The visibility and the credibility of CCS in the Rotterdam region was part of that plan.
- RCI made a CCS status report every year, with varying forms of peer review and external auditing. The last issue was aimed at a more general audience.
- RCI assessed all its activities with regards to suitability for media attention; it composed app. 4 press releases per year on CCS and several press inquiries.
- RCI supported high level officials and regional “celebrities” in their contacts with the press and other media and they were also part of the advocacy activities.
- RCI has co-operated with other (media) influential parties like NGOs.
- RCI delivered lots of speeches and presentation at meetings, national and international.
- CCS is part of all general RCI means of communication (website, presentations, annual reports), along with energy efficiency and renewable energy. CCS is communicated along with more ‘audience friendly’ subjects like wind energy and electric vehicles.

#### Lessons learnt

- RCI has succeeded in sending the message in such a way that the media presented the Rotterdam CCS activities with a positive attitude. The communication strategy of the RCI has had the intended positive effects.
- Political ‘celebrities’ (like the former Prime Minister Ruud Lubbers and the mayor of Rotterdam Ivo Opstelten) did really increase the effect of the advocacy towards the national government and the European Commission.
- The annual status reports have been instrumental in achieving good relation with the media with a positive image. The credibility of the report and of the RCI has been highly increased by a consultation of Dutch CCS experts (2008) and the external verification of Foster Wheeler and Climate Change Capital (2009).
- The communication strategy with relation to Barendrecht (deliberately detached) did prevent negative impact on the perception of the Rotterdam CCS activities. There was hardly any negative ‘spill over’ in the media appreciation from Barendrecht to RCI (but also no positive one the other way around).
- The broad coalition of parties in Rotterdam did not prevent some negative media attention (mainly caused by actions of Greenpeace and political parties against coal fired power stations)
- The broader message (sustainability) and the broader approach (not only coal but the whole industry) was not really captured by the media, since media are more focused on single issues than on the broader backgrounds.



## Interim Lessons Learnt

### Communication and awareness – What is next? Confidence building measures!

Based on our experience we have to conclude that there is a need to improve the trust in the stakeholders involved in CCS, actually in all stakeholders involved in energy production: industry, government, regulators, politicians and scientists. And next to that, and especially for CCS, we have to pay more attention on how to obtain confidence in the technology itself in such a way that it can be easily explained to lay persons. We would like to phrase it this way: **we need “confidence building measures”**.

What could help? A **real public debate** on the way to deal with the energy and climate change problems is not only useful but necessary. This discussion on energy policy and the desirability of climate mitigation options (like renewable energy and CCS) is a prerequisite for any sound public communication strategy. The politicians, the executives and the scientists have to initiate the discussion and debate on the possible solutions, via face to face contacts and via the media. That's the only way to get public awareness of the complexity of the problems around the energy sector. What could help for public support: broad agreement among diverse public and private parties about need and necessity of the technology and its implementation; and formalise agreement in e.g. regional covenants.

This does not mean there has to be a standstill for CCS or biomass or wind or whatever. In the case of CCS, positive examples can function as **best practice** for others: the RCI example on communication can help to define effective communication approaches. We also observed that there are plenty of lessons learnt from risk communication (and other relevant experiences) available to be used to characterise of the outreach and project approach. And in those approaches one has to address the worries of the citizens. Especially with regards to the credibility of the messages, the CCS community has to find ways to organise a **credible consortium** of information providers.

And, like all innovation communities, the CCS community has to build confidence in practice. This means that you have to make broad **risk assessment of the demonstration phase that is emerging right now**. Policymakers should carry out (outreach) **risks assessment of demonstration plans** and analyse the risks in relation with overall technology development goals. Issues in the assessment:

- consistency of decision making and political commitment;
- the balance of cost and benefits;
- the role of confidence and trust towards the different stakeholders, especially the public entities.

This could mean that you need to focus on offshore storage locations. Onshore storage might be skipped to later dates (until storage is more proven and shown in practice).



**A**

**Factors of Success**

**B**

**Organising a CCS Hub Approach**

**C**

**Getting Storage Available**

**D**

**Public Awareness and Communication**

**E**

**Overview of the Contents of the Final Report**



### Overview of the Contents of the Final Report

This slide report is an interim account on the results of our Case Study in which we try to define the lessons learnt from the Rotterdam CCS approach. There is certainly more to be learned than we have described in this report and in the coming period we will work on improving and finalising our analysis. The accounting of the whole research will take place in the final report. This report will be published in the fourth quarter of 2011. On this page you see the intended table of content of that report.

For any comments or suggestion:

Lead Author

Barend van Engelenburg

DCMR Environmental Protection Agency

Email: [barend.vanengelenburg@dcmr.nl](mailto:barend.vanengelenburg@dcmr.nl)

#### Table of Content

##### Executive Summary

1. Introduction
2. Project approach
3. Storyline of the Rotterdam CCS Network project  
Extended and updated description of the four phases described in this report.
4. Analysis  
The main analytical results will be described by using four perspectives: the entrepreneur, the network organiser, the policy-maker and the politician.
5. Lessons learnt  
Extended and updated description of the lessons learnt as described in this report.
6. Conclusions and recommendations
  1. On the results and lessons learnt
  2. On the method
  3. On knowledge sharing

##### References



1

**Introduction to the Case Study**

2

**Research approach**

3

**Rotterdam Climate Initiative**

4

**Drivers and Risks for CCS in Rotterdam**

5

**Storyline of the CCS Approach in Rotterdam**

6

**Interim Lessons Learnt**

7

**Annex: further reading**

## References for further reading

### Rotterdam Climate Initiative (RCI):

- RCI CCS Report no. 1, 2007, *CO<sub>2</sub> capture and storage in Rotterdam (in Dutch only)*. An executive summary in English is available under the name *The route to large scale CO<sub>2</sub> Capture and Transport in the Rotterdam Harbour Industrial Complex*.
- RCI CCS Report no. 2, 2008, *CO<sub>2</sub> capture, transport and storage in Rotterdam, Report 2008*.
- RCI CCS Report no. 3, 2009, *CO<sub>2</sub> capture, transport and storage in Rotterdam, Report 2009*.
- RCI CCS Report no. 4, 2010, *CO<sub>2</sub> capture and storage in Rotterdam – A Network Approach*.
- RCI CCS Report no. 5, 2011, *CO<sub>2</sub> capture and storage in Rotterdam – A Network Approach, 2<sup>nd</sup> updated edition*.

To be found on the website: [www.rotterdamclimateinitiative.nl](http://www.rotterdamclimateinitiative.nl) or contact the author.

### Recent reports related to Rotterdam CCS activities:

- DCMR, 2011, *Rotterdam CCS Network Project, Case Study On 'Lessons Learnt' – The Methodology And Plan Of The Research*.
- VOPAK et al, 2011, *Business Case on the Liquid Logistics Shipping Concept (in progress)*.
- TNO, 2011, *Independent storage assessment of offshore CO<sub>2</sub> storage options for Rotterdam - Summary report*.
- TNO et al, 2011, *CO<sub>2</sub> storage capacity assessment methodology*.

To be found on the website: [www.globalccsinstitute.com](http://www.globalccsinstitute.com).

### Other publications:

- Van Alphen, 2011, *Accelerating the Development and Deployment of Carbon Capture and Storage Technologies – an Innovation System Perspective*, PhD thesis, Utrecht University, March 2011 (for an overview of the Innovation Management Approach applied to the CCS Case).
- GCCSI, 2011, *The Global Status of CCS: 2010* (for an overview of the development of CCS at this moment).

For more references, especially on the Barendrecht CO<sub>2</sub> storage case, contact the lead author.

