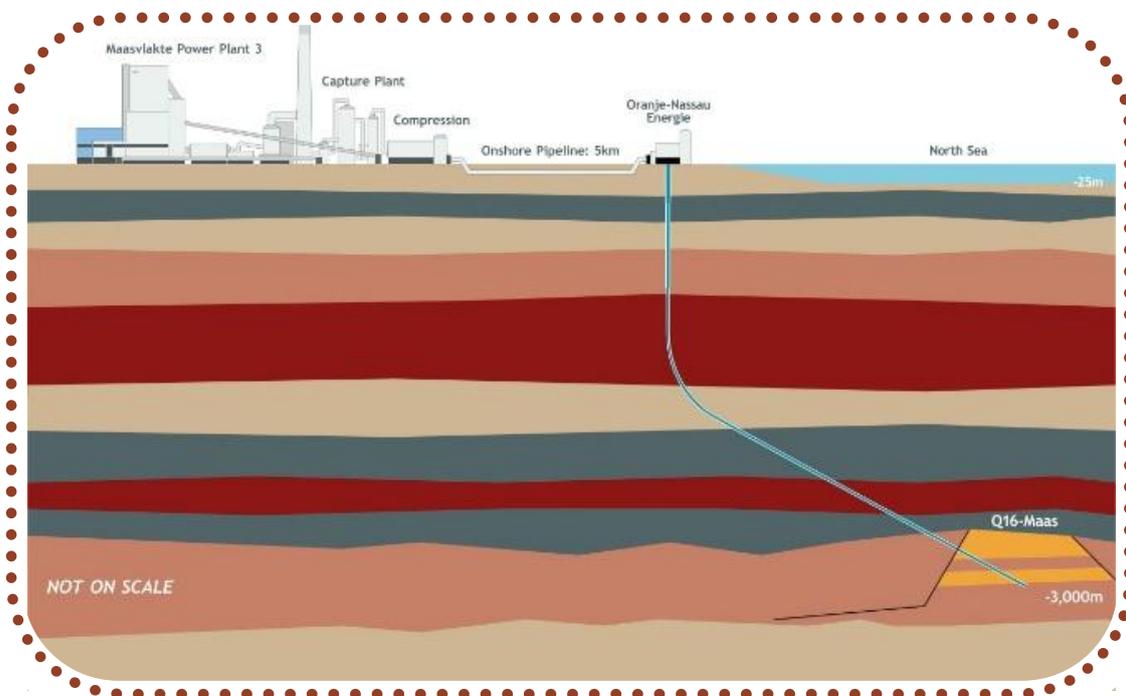


## Close-Out Report Knowledge Sharing

### Rotterdam Opslag en Afvang Demonstratieproject



#### Maasvlakte CCS Project C.V.

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## Close-Out Report 10 of 11: Knowledge Sharing

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### Index of ROAD Public Close-out Reports

No	Title	Scope
1	Overview	Introduce and summarise the public close-out reports.
2	Capture and Compression	Technical report covering capture, compression and power plant integration.
3	Transport	Technical report covering CO <sub>2</sub> pipeline transport.
4	CO <sub>2</sub> Storage	Both technical and commercial aspects of CO <sub>2</sub> storage for ROAD. Subsurface work required to demonstrate permanent storage is described.
5	Risk Management	The risk management approach used by ROAD.
6	Permitting and Regulation	Description of the regulatory and permitting framework and process for the ROAD project, including required changes to regulations.
7	Governance and Compliance	Company structure and governance for Maasvlakte CCS Project C.V., the joint venture undertaking the ROAD Project
8	Project Costs and Funding	A presentation of the projected economics of the project, with both projected income and costs.
9	Finance and Control	Description of the financial and control systems, including the costs incurred and grants claimed.
10	<b>Knowledge Sharing</b>	<b>Outline of the Knowledge Sharing &amp; Dissemination plan as developed by the ROAD project and completed KS deliverables and actions</b>
11	Public Engagement	Description of how ROAD organized and managed the Public Engagement process.

**Table of Contents**

**1. Management Summary ..... 1**

**2. Introduction ..... 2**

2.1 Introduction ..... 2

2.2 General Project Description ..... 2

2.3 Scope and Structure of this Report ..... 5

**3. Knowledge Sharing & Dissemination Approach ..... 6**

3.1 Knowledge Sharing Strategy ..... 6

3.2 Co-operation with EU Bodies ..... 7

3.3 International Knowledge Sharing ..... 7

3.3.1 Participation and contributions to international conferences and publications on the CCS ..... 8

3.3.2 Co-operation with the Global CCS Institute ..... 8

3.3.3 Bilateral contacts ..... 8

3.4 Collaboration with Spearhead Research Initiatives ..... 9

3.5 Dutch Authorities and Local Stakeholders ..... 10

3.6 Internal (Uniper and Engie) Knowledge Sharing and Dissemination ..... 11

**4. Schedule of Actions ..... 12**

4.1 Co-operation with EU bodies ..... 12

4.2 International Knowledge Sharing ..... 13

4.3 Collaboration with Spearhead Research Initiatives ..... 14

4.4 Dutch Authorities and Local Stakeholders ..... 16

4.5 Internal Knowledge Sharing ..... 17

**5. Knowledge Dissemination Resources and Management Plan ..... 19**

5.1 Knowledge Sharing Structure ..... 19

5.2 Resources Management ..... 20

5.3 Dissemination and Knowledge Sharing Plan Management ..... 20

**6. Annex: Completed Deliverables and Actions ..... 22**

## 1. Management Summary

### Project Summary

This public close-out report describes how Knowledge Sharing & Dissemination of the CCS demonstration project “ROAD” was managed. The ROAD Project (Rotterdam Opslag en Afvang Demonstratieproject) was one of the largest integrated carbon capture and storage (CCS) projects in the world, aiming to install carbon capture on a coal-fired power station in Rotterdam and store the CO<sub>2</sub> in an empty off-shore gas-field.

The project ran from 2009 to 2017. The developer was Maasvlakte CCS Project, a joint venture between Uniper (formerly E.ON) and Engie (formerly Electrabel and GDF SUEZ), with financial support from the EU EEPR program, the Dutch Government, the Port of Rotterdam and the Global CCS Institute.

In the first phase of the project, 2009-2012, the project was developed to Final Investment Decision (FID) based on using the TAQA P18-4 gas-field as the CO<sub>2</sub> storage location. This required a pipeline of approximately 25km from the capture location (Uniper’s coal-fired Maasvlakte Power Plant – MPP3), about 5km onshore and 20km off-shore.

Unfortunately, the collapse in the carbon price undermined the original business case, and in 2012 a positive FID was not economically possible. The project then entered a “slow-mode” in which activities focused on reducing the funding gap, either by reducing costs or by securing new funding. In late 2014, a possible new funding structure was identified, and explored in 2015 and 2016. This included additional grants for operation and cost reductions. The cost reduction that could be successfully applied was to change storage sink to Q16-Maas, operated by Oranje-Nassau Energie (ONE). This smaller field was much closer, with only a 6 km pipeline required. This resulted in a remobilization of the project late in 2016, and development of the new scheme. However, in mid 2017 work was again halted, and formally stopped in November 2017.

### Scope of this report

After an introduction and project description, this report outlines the Knowledge Sharing & Dissemination plan as developed by the ROAD project. It describes the Knowledge Sharing & Dissemination approach, strategy, partners and action plan. Finally, a list of completed Knowledge Sharing & Dissemination deliverables and actions is provided.

## 2. Introduction

### 2.1 Introduction

The ROAD project was one of the leading European CCS Projects from 2010 to 2017. During that time, a great deal of project development and engineering work was completed, including full design and procurement to allow a possible FID at end 2011 or early 2012.

This report is one of a set of “Close-out” reports written after the formal decision to terminate the project was made in September 2017. The report aims to summarise describe the risk management system used by the project. The objective is to give future CCS project developers, and knowledge institutes, the maximum opportunity to use the knowledge gained and lessons learnt by the ROAD project team. Unlike the other close-out reports, which cover the whole project development from 2010 to 2017, this report describes the risk management approach applied in 2011 and 2012 only. This is because work during and after the “slow mode” that began in 2012 was not done to a sufficient level of detail to justify a systematic update of the risk database. This was planned prior to a new FID decision in 2017, however, it was not completed before the project was stopped.

This brief introduction to the “Close-out Report Risk Management” gives a general description of the overall project, including the history of its development, and describes the scope and structure of the rest of this risk management report. This should enable readers to quickly locate information of relevance to them in this report.

### 2.2 General Project Description

The ROAD Project is the Rotterdam Opslag and Afvang Demonstratieproject (Rotterdam Capture and Storage Demonstration Project) which ran from 2009 to 2017, and was one of the leading integrated Carbon Capture and Storage (CCS) demonstration projects in the world.

The main objective of ROAD was to demonstrate the technical and economic feasibility of a large-scale, integrated CCS chain deployed on power generation. Previously, CCS had primarily been applied in small-scale test facilities in the power industry. Large-scale demonstration projects were needed to show that CCS could be an efficient and effective CO<sub>2</sub> abatement technology. With the knowledge, experience and innovations gained by projects like ROAD, CCS could be deployed on a larger and broader scale: not only on power plants, but also within the energy intensive industries. CCS is one of the transition technologies expected to make a substantial contribution to achieving European and global climate objectives.

ROAD is a joint project initiated in 2009 by E.ON Benelux and Electrabel Nederland (now Uniper Benelux and Engie Nederland). Together they formed the joint venture Maasvlakte CCS Project C.V. which was the project developer. The ROAD Project is co-financed by the European Commission (EC) within the framework of the European Energy Programme for Recovery (EEPR) and the Government of the Netherlands. The grants amount to € 180 million from the EC and € 150 million from the government of the Netherlands. In addition, the Global CCS Institute is knowledge sharing partner of ROAD and has given a financial support of € 4,3 million to the project. The Port of Rotterdam also agreed to support the project through investment in the CO<sub>2</sub> pipeline.

In the first phase of the project, 2009-2012, the project was developed to final investment decision (FID) based on using the P18-4 gas-field operated by TAQA as the CO<sub>2</sub> storage location. This required a pipeline of approximately 25km from the capture location (Uniper’s coal-fired Maasvlakte Power Plant – MPP3), about 5km onshore and 20km off-shore.

Unfortunately, the collapse in the carbon price undermined the original business case, and in 2012 a positive FID was not economically possible. The project then entered a “slow-mode” in which activities focused on reducing the funding gap, either by reducing costs or by securing new funding. In late 2014 a possible new funding structure was identified, and explored in 2015 and 2016. This included additional grants for operation and cost reductions. The cost reduction that could be successfully applied was to change storage sink to a

newly developed field, Q16-Maas, operated by Oranje Nassau Energie (ONE). This smaller field was much closer, with only a 6 km pipeline required. This resulted in a remobilization of the project late in 2016, and development of the new scheme. However, in mid 2017 work was again halted, and the grant formally terminated in November 2017.

The ROAD project design applied post combustion technology to capture the CO<sub>2</sub> from the flue gases of a new 1,069 MWe coal-fired power plant (Maasvlakte Power Plant 3, "MPP3") in the port and industrial area of Rotterdam.

The capture unit has a design capacity of 250 MWe equivalent. During the operational phase of the project, approximately 1.1 megatons of CO<sub>2</sub> per year would be capture and stored, with a full-load flow of 47kg/s (169 t/h) of CO<sub>2</sub>. For transport and storage two alternatives were developed as described above: storage in the P18-4 reservoir operated by TAQA; and storage in the Q16-Maas reservoir operated by Oranje-Nassau Energie.

After a competitive FEED process, Fluor was selected as the supplier for the capture technology in early 2011. The plant was fully engineered, and long lead items contracted for, ready for an FID in early 2012. All the necessary permitting was completed, with a permit for the capture plant being granted in 2012. Following the delay to the project, an updated design was developed with Fluor in 2017 incorporating lessons learnt from research and development in the intervening years, changes to the MPP3 site, and the impact of the changes to the transport and storage system. A revision to the permit was under development when the project was halted.

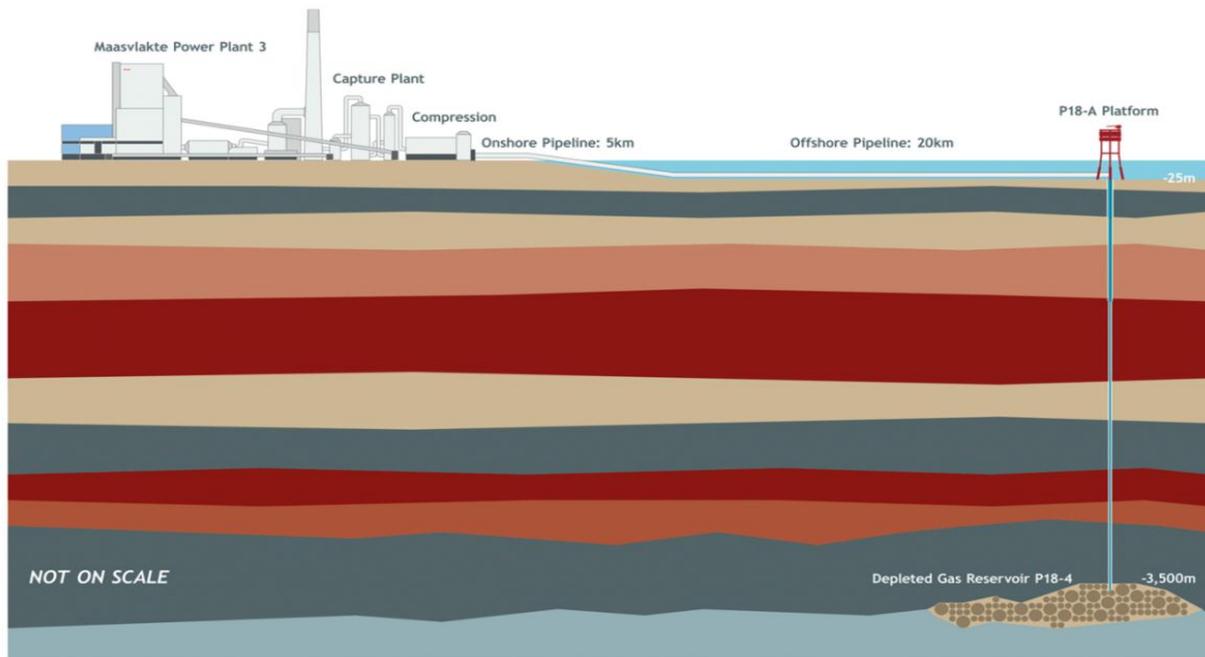
### **For storage in P18-4**

From the capture unit the CO<sub>2</sub> would be compressed and transported through a pipeline: 5 kilometers over land and about 20 kilometers across the seabed to the P18-A platform in the North Sea. The pipeline has a transport capacity of around 5 million tonnes per year. It is designed for a maximum pressure of 140 bar and a maximum temperature of 80 °C. The CO<sub>2</sub> would be injected from the platform P18-A into depleted gas reservoir P18-4. The estimated storage capacity of reservoir P18-4 is approximately 8 million tonnes. Figure 2.1 shows the schematic illustration of this.

P18-4 is part of the P18 block which also includes the larger P18-2 and also a small field, P18-6. These depleted gas reservoirs are about 3.5 km below the seabed under the North Sea about 20km from the Dutch coastline, and have a combined CO<sub>2</sub> storage capacity of around 35 Mt.

The ROAD Project with storage in P18-4 was fully developed for FID at the end of 2011, including all engineering, regulatory and permit requirements. A CO<sub>2</sub> storage permit was granted in 2013, the first such permit in Europe. Unfortunately, a positive FID was not possible due to funding problems, and in 2012 technical project development on P18-4 was halted.

Figure 2.1 Schematic overview of the ROAD Project using storage in P18-4



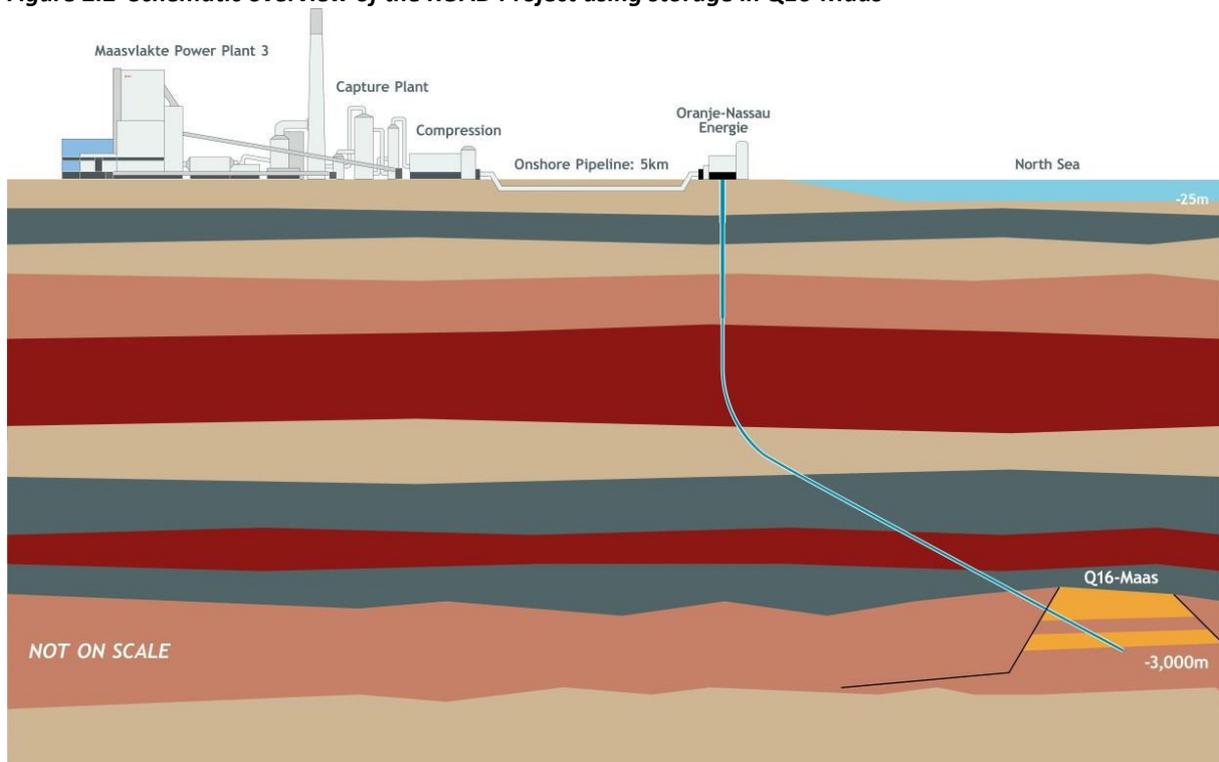
#### For storage in Q16-Maas

From the capture unit the CO<sub>2</sub> would be compressed and transported through a pipeline over land to the current ONE-production site Q16-Maas (Figure 2.2). The selected pipeline design would have a transport capacity in excess of 6Mt/year. It was designed for a maximum pressure of 40 bar although in the first phase operation at 20 bar was planned. Final compression to injection pressure (around 80 bar) would be at the injection site.

The Q16-Maas reservoir is located just off-shore from the Maasvlakte, and is reached by a long-reach well, drilled from on-shore. The well is about 5km long, and travels approximately 3km down to reach the reservoir depth, and 3 km horizontally (off-shore) to reach the reservoir location. The reservoir is relatively new (production started in 2014) and was not due to finish production until 2022. Therefore this scheme involved the drilling of a second well to accelerate gas production and so allow CO<sub>2</sub> injection to start in 2020. This second well would also allow co-production of modest amounts of condensate (and possibly natural gas) during CO<sub>2</sub> injection. The estimated storage capacity of reservoir Q16-Maas is between 2 and 4 million tonnes.

This reservoir was identified as a possible storage location only at the end of 2014, with project development running through 2015-2017. Due to funding uncertainties, the work focused on feasibility, cost estimation and concept design to the level required for permitting. Therefore a lower level of detail is available for this storage location, compared to P18-4. It should also be noted that unexpected water production was experienced from Q16-Maas in 2016, leading Oranje-Nassau Energie to issue a revised reservoir model and production plan in May 2017. Since this was only shortly before the ROAD work was halted, the ROAD plans for Q16-Maas were not fully amended to reflect this new production data.

**Figure 2.2 Schematic overview of the ROAD Project using storage in Q16-Maas**



### 2.3 Scope and Structure of this Report

This report outlines the Knowledge Sharing & Dissemination plan as developed by the ROAD project. It describes the Knowledge Sharing & Dissemination approach, strategy, partners and action plan. Section 3 presents the Knowledge Sharing and Dissemination objectives of ROAD as well as the approach to meet these objectives. Section 4 summarizes the result of the translation of the knowledge sharing objectives in a practical action list. In Section 5 the internal and external organization of the knowledge sharing process is described in terms of structure, resources and management. Finally, in the Annex a list of completed Knowledge Sharing & Dissemination deliverables and action is provided.

## 3. Knowledge Sharing & Dissemination Approach

This chapter presents the objectives of ROAD in terms of Knowledge Sharing and Dissemination as well as the developed approach to meet these objectives.

### 3.1 Knowledge Sharing Strategy

The strategy of ROAD was to disseminate and share knowledge with a broad range of parties in order to meet four different main objectives:

1. Increase the know-how of ROAD in order to facilitate the scaling of CCS up to a demonstration and finally (and especially) a commercial size.
2. Accelerate the general development of the CCS technologies, especially for the power industry.
3. Increase the knowledge and confidence of the main stakeholders of ROAD, i.e. the European Commission (EC), the national and regional authorities, the regional industrial partners, the scientific community and the wider public.
4. Optimize the amount of knowledge shared while respecting Intellectual Property rights in order not to hamper innovation, and consequently prevent the slowdown of the development of commercial CCS applications

Therefore, the ROAD project set its priorities in disseminating and sharing knowledge with the following parties:

- The EU bodies and especially via the EU CCS Network to meet all the above objectives.
- The important international parties, as it allowed ROAD to broaden its information source and its influence on objectives 2 and 3. As the parent companies of the ROAD project were present on the international scene, this represented a necessary and complementary approach to the EU CCS Network.
- The scientific CCS community and in particular the European and Dutch spearhead projects.
- The Dutch authorities and local stakeholders (industry and citizens).
- The parent companies. The ROAD project being a joint venture between Uniper and Engie, it was of prime importance that both parent companies got the maximum of the knowledge and experience generated by the demonstration project. This condition was necessary to accelerate the CCS deployment of those two major European utilities

Besides the above mentioned parties, ROAD was inclined to disseminate/share knowledge with any other parties if the ROAD objectives were met.

The type of knowledge that ROAD wanted to disseminate/share was in line with the expectations of the EU CCS Project Network:

- Identification of new knowledge generated by the project.
- Technical set-up and performance.
- Cost levels.
- Environmental impact.
- Health and safety.
- Identification of good practices, lessons learned (positive or negative) and recommendations for implementing large-scale CCS projects in the above areas and also in the project management:
  - Planning.
  - Application of legislative procedures.

- Public communication and engagement strategies.
- Selecting, characterizing, modeling and monitoring of storage sites.
- Risk management (including financial risks).

Finally, the ROAD project had a proactive approach of identifying the needs of its stakeholders, ensuring that information reaches stakeholders in a format that could be utilized for their needs.

Also the use of different channels of dissemination would improve the efficiency of knowledge dissemination/sharing activities:

- Lessons learnt reports.
- Reports.
- Conferences.
- Workshops, seminars.
- Publications.
- Work groups.
- Personal relationships.
- ROAD general documentation – CD, poster, etc.
- Visits to the Maasvlakte site and the visitor center.

### 3.2 Co-operation with EU Bodies

Because of the European nature of the ROAD project and of the parent companies (Uniper and Engie), the first priority of ROAD was to disseminate and share knowledge with the EU institutions. In particular, as the ROAD project was one of the six large-scale CCS demonstration projects within the European Energy Programme for Recovery (EEPR), ROAD had a firm commitment to participate actively to the EU CCS Project Network activities. More specifically, the commitment of ROAD regarding the EU CCS Project Network was the following:

- Participation of ROAD to the Annual Network Event.
- Participation to all information knowledge sharing events of various formats.
- Reporting and presentations on relevant domains.
- Participation to the Advisory Forum.
- Provision of contents to the knowledge sharing website of Network members and actualization of this web content. In particular:
  - Regular provision of standardized project database information in relevant categories by completion of an electronic knowledge sharing form .
  - Regular completion of the ROAD project’s fact sheet.
- Support the Network, e.g. at conferences and events.

Besides the active participation to the EU CCS Project Network, ROAD also had a commitment to answer any inquiries of i.a. the EU Parliament or EU Commission.

### 3.3 International Knowledge Sharing

Because all knowledge was considered as valuable and each region was testing a limited number of technical configurations, exchanging best practices on the international level would help the ROAD project identifying a broader source of knowledge and increasing the size of its network, as well as accelerating the commercial deployment of CCS. Finally, identifying regional specific lessons learned was important for the parent

companies of the ROAD project, both present on the international energy scene. Specific areas of interest for the ROAD project were:

- Public Engagement.
- Technology choices along the full value chain, including norms and standards.
- R&D results sharing.

Even if ROAD would intend to share knowledge with international bodies and CCS projects outside of the EU CCS Project Network, ROAD had the firm commitment to follow the procedures and support the objectives of the EU in order to demonstrate the EU leadership in the CCS field.

### 3.3.1 Participation and contributions to international conferences and publications on the CCS

As a way to efficiently target the international CCS scene, the ROAD project had a firm commitment to increase its participation and contribution to international CCS conferences and to take the opportunity, whenever possible, to publish/present articles about non-proprietary knowledge developed by the ROAD project. On one hand, this would allow ROAD to reach a broad international CCS community and on the other hand, to feed the scientific community of on-hands return of experiences from the ROAD project.

### 3.3.2 Co-operation with the Global CCS Institute

Besides the fact that ROAD was funded by the GCCSI, there was a willingness of ROAD to enter in a long-term cooperation with the GCCSI because the Institute offered the ideal platform to connect the different regional CCS initiatives. In that sense, ROAD was willing to develop its international dissemination and knowledge sharing activities thanks to the broad CCS knowledge network of the GCCSI.

The knowledge dissemination activities undertaken by the ROAD project would support international knowledge sharing in several ways and initially comprised the following key activities:

- The FEED study for the ROAD project which included the CO<sub>2</sub> capture plant at the Maasvlakte Power Plant Unit 3. The FEED work completed such items as technology selection, flue gas analysis, process design, process flow diagrams, heat and mass balances, layout designs, reagents studies, cooling studies, capital and O&M cost estimates and Project schedules.
- The development work to put in place the commercial and funding arrangements of the ROAD project plus a risk analysis, a business case and economic model to enable ROAD and its parent companies to make a final decision on advancing to the next phase of the ROAD project.
- Addressing implementation issues associated with the ROAD project, i.e. environmental impact assessment, permitting under Dutch and European institutional environments, stakeholder consultation, etc.
- Participation to knowledge sharing activities like digital knowledge platform, conferences, technical panels, workshops, thematic group discussions, interviews, close-out meetings, case studies and others.

### 3.3.3 Bilateral contacts

The priority of ROAD was to use the EU CCS Project Network and the platform of the GCCSI to develop its knowledge network internationally. Because the ROAD project was getting closer to the construction and operation phase, a major interest in the near future would be to develop knowledge cooperation with CCS projects in operation. Therefore the ROAD project intended to take demand-driven bilateral contacts with operating CCS projects in order to de-risk the future operational phase. In particular, projects in the USA, Canada or the Lacq project in France were of prime interest for the ROAD project. In that case, the ROAD project was open to participate to knowledge sharing initiatives like the US-EU Energy Council or the North American Knowledge Sharing Initiative (NAKSI).

## 3.4 Collaboration with Spearhead Research Initiatives

Because the ROAD project was the first of its kind, lots of technical and non-technical areas still needed to be researched and developed. The ROAD project anticipated that the scientific knowledge in the field of CCS would increase significantly during project development, and certainly during the duration of the demonstration phase of the ROAD project (2015-2020). Therefore, it was a major priority for ROAD to be involved in the major spearhead research initiatives in the CCS field. On one hand, the presence of ROAD as one of the few candidates for full-scale and integrated CCS chain was crucial to feed the research activities and on the other hand, the outcome from the research programs was of prime importance to optimize the performance and understanding of the ROAD project and to improve the transition between demonstration and commercial CCS applications.

In particular, the ROAD project was committed to be engaged in the following main research programs/networks:

- CATO2<sup>1</sup> (2009-2014): Main Dutch research program on CCS with focus on research enabling demonstration projects in the Netherlands. The focus for ROAD was on the work package 1.1 (post combustion capture), subproject 3 (underground storage, monitoring and verification), work package 4.2 (permitting and best practice). CO<sub>2</sub> capture pilot plant @ Maasvlakte: 250 kg CO<sub>2</sub> /h pilot, operational since 2008. It was important to note that ROAD had the willingness to support and participate to any interesting continuation of CATO<sub>2</sub> after 2014, as it was of prime importance for ROAD to feed Dutch CCS research projects and to be supported by those projects.
- NEARCO<sub>2</sub><sup>2</sup>: NEARCO<sub>2</sub> was the NEw pARTicipation and communication strategies for neighbours of CO<sub>2</sub> capture and storage operations. It was a FP7 European project running from April 2009 and ending in 2011. The purpose of this project was to develop effective strategies for:
  - Objective communication to stakeholders and the public at large about risks and advantages of CO<sub>2</sub> capture and storage
  - Involving stakeholders and the public in local decision-making on CCS projects
- NERP (2011)<sup>4</sup>: NERP stood for Nitrosamines Emissions Reduction Program and was a Dutch research program with priorities on HSE, standardization of measurements, and reduction of nitrosamines emissions.
- Renicuv (2011)<sup>3</sup>: Norwegian program with focus on reduction of nitrosamines emissions by use of UV light. Laboratory experiments and pilot scale testing were foreseen.
- Cesar/Octavius (2008): FP7 European project that aimed for a breakthrough in the development of low-cost post-combustion CO<sub>2</sub> capture technology.
- ZEP research network<sup>4</sup>: Founded in 2005, the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP) was a unique coalition of stakeholders united in their support for CO<sub>2</sub> Capture and Storage (CCS) as a key technology for combating climate change. The mission of ZEP was to identify and remove the barriers to creating highly efficient power plants – with near-zero emissions.

In addition of the research projects where ROAD or its members were directly involved, knowledge from much other research activities was accessible to the ROAD project via the participation of the parent companies. This knowledge, if non-proprietary, could hence feed the knowledge network of the ROAD project. Some examples of participation of the parent companies to major research activities in the CCS field are given below:

<sup>1</sup> Formally, the ROAD project as a legal entity was not member, but ROAD members were actively involved via the participation of Uniper and Engie in the given research program

<sup>2</sup> The ROAD project was an active contributor of the NEARCO<sub>2</sub> as it represents a case study

<sup>3</sup> For this project, ROAD as entity was formally member

- DONG capture pilot at Esbjerg: 1000kg CO<sub>2</sub>/h. Project only financed by industrials (DONG, Vattenfall, Statoil, EDF, Uniper, EnBw, Doosan, ACC, Hitachi and Engie). Its objective was to generate data that could be used for permit application for future pilot and demonstration projects with the main focus on liquid and gaseous emissions.
- Hitachi Power Europe capture pilot @ Gelderland: 1000 kg CO<sub>2</sub>/h. The target of the project was to design, build and operate a test facility to investigate the behaviour of different solvents in the process for CO<sub>2</sub> capture from flue gases. The main objectives were acquiring operational experience, lowering the energy consumption of the process, and assessing the environmental impact of such installations. Project partners were Engie, Hitachi Power Europe (HPE) and Uniper.
- FLUOR Uniper capture pilot @ Wilhelmshaven: 3000 kg CO<sub>2</sub>/h. Uniper project developed with the capture technology supplier Fluor to assess the capture performance in different operation modes.
- K-12B CO<sub>2</sub> Injection project: K12-B was the first site in the world where CO<sub>2</sub> is being injected into the same reservoir from which it was, together with methane, produced. Investigated is the feasibility of CO<sub>2</sub> injection and storage in depleted natural gas fields and the corresponding monitoring and verification. The K12-B gas field is located in the Dutch sector of the North Sea, approximately 150 km northwest of Amsterdam. At January 2009 the CO<sub>2</sub> injection is still ongoing and since 2004 a total of 60 kT of CO<sub>2</sub> has been injected in the nearly depleted gasfield K12-B. The monitoring activities are funded by the CO2REMOVE project. The participants were Engie and TNO.
- CO<sub>2</sub> Europipe: CO2EuroPipe is a FP7 research program that would provide guidance to elements of an EU 'Master Plan' for the development of large-scale European CO<sub>2</sub> infrastructure. This project would geographically focus on the North West and Central parts of the EU, with major industrial players from Norway, Sweden, UK, Germany, Poland, Czech Republic and the Benelux, but the major organizational conclusions of the project would be applicable throughout Europe.

### 3.5 Dutch Authorities and Local Stakeholders

Besides the priority of ROAD to collaborate with Dutch spearhead research projects in the CCS field like CATO2, the ROAD project also followed the firm commitment to feed the Dutch authorities with all the necessary knowledge that would enable them to better understand the CCS field and the ROAD project in particular. The knowledge dissemination towards authorities was done on several levels, answering the specific needs of each specific body:

- Ministry of Economic Affairs, Agriculture and Innovation.
- Ministry of Infrastructure and Environment.
- Members from the Second Chamber.
- Energie Beheer Nederland (EBN).
- Rotterdam Municipality and surrounding municipalities.
- Province Zuid-Holland.
- DCMR Environmental Protection Agency.

As an answer to the need of increasing the understanding of, and confidence in, CCS by the local communities and industries, ROAD exchanged extensively knowledge with its local stakeholders. The focus of this section was on the type of knowledge and the identification of the main stakeholders and not on the manner this knowledge was fed to the different stakeholders, the latter being a part of the public engagement approach. In particular, the following stakeholders constituted the priority target of knowledge dissemination/sharing:

- Co-operation with the local industry like with the Rotterdam Climate Initiative (RCI).
- Knowledge dissemination towards citizens. This was a clear priority for the ROAD project, which was engaged in this field via its Public Engagement Plan.

### 3.6 Internal (Uniper and Engie) Knowledge Sharing and Dissemination

The ROAD project being a joint venture between the groups Uniper and Engie, with a normally equal representation of Uniper and Engie delegates in the ROAD team, there was a need to ensure a knowledge sharing process within the ROAD team and between ROAD and the parent companies. The objective of the ROAD project was to significantly increase the knowledge sharing with the parent companies, while reinforcing the internal procedure regarding the protection of confidential information from the parent companies used within the ROAD project.

A special focus of ROAD was to give more insight into the ROAD project to the centralized CCS groups of both Uniper and Engie, in order to ensure that all the knowledge developed by the ROAD project was acquired by both groups. This was a necessary condition to accelerate the deployment of commercial CCS applications within Uniper and Engie

Finally, a ROAD priority was to give sufficient access to Uniper in the following subjects:

- Transport & Storage, including operation data.
- Project Office & Governance.

ROAD would also give sufficient access to Engie in the following subjects:

- Capture including operation of the capture part (located on MPP3 site) and integration of the capture plant to the MPP3 site.
- Stakeholder Management.

## 4. Schedule of Actions

This chapter summarizes the result of the translation of the knowledge sharing objectives in a practical action list. Not all the points are described in details and the action plan is linked with a high level schedule. This action plan was subject to change as it would be regularly reviewed and updated. Because the intention of ROAD was to be engaged in multiple small, simple and focused initiatives that met the major objectives of the dissemination and knowledge sharing plan, the action plan below was not seen as exhaustive, especially concerning outlook activities.

The action plan given below was defined for each category of parties (EU bodies, international knowledge sharing, CCS research initiatives, Dutch authorities & local stakeholders and internal knowledge sharing) and for different time periods, including non-exhaustive examples of what had already been performed.

In the period 2011-2012, the content of the knowledge sharing focused on project management, i.e. project experiences and lessons learned during the project and planning phase. The period 2013-2014 would focus on project planning and specific information on the construction phase. Finally, in the period 2015-2020, the knowledge sharing would focus on project data and specific information on project progress and operational results in the 5 categories below:

- Technical set-up and performance.
- Cost levels.
- Project management.
- Environmental impact.
- Health & safety.

### 4.1 Co-operation with EU bodies

The action plan given below corresponds to the description given in 3.2.

Stakeholder	Theme	Initial status (non-exhaustive)	Outlook 2011-2014	Outlook 2015-2020
<b>EU CCS Project Network</b>	CO <sub>2</sub> composition, transport standards and infrastructure strategies	Contribution about the CO <sub>2</sub> composition	Contribution on transport standards and infrastructure strategies	n.a
	ROAD project website	Launch in September 2010 ( <a href="http://www.road2020.nl">http://www.road2020.nl</a> )	Yearly update and significant extension of its content, including link to main ROAD-related publications	Update twice a year with communication of high level operational results
	Annual Network Event	Systematic participation	Systematic participation	Systematic participation
	Reporting and presentations on three specific domains	Systematic participation	Systematic participation	Systematic participation
	Advisory Forum	Systematic participation	Systematic participation	Systematic participation
	All information	Systematic participation	Systematic	Systematic

	knowledge sharing events of various formats		participation	participation
	Provision of contents to the knowledge sharing website of Network members	Fact sheet and general presentation of the ROAD project. ROAD presentations on the three specific themes	Update once a year	Update twice a year
	Support the Network, e.g. at conferences and events	Systematic participation	On-request	On-request
<b>EU Parliament</b>	Answer to queries	ROAD presentation to the Members of the European Parliament. Topic: current state of the CCS technology, foreseen next steps, societal context	On-request	On-request
<b>EU Commission</b>	Answer to queries	Workshop on nitrosamines	Dissemination and knowledge sharing plan and updates On-request	On-request

Table 1: Specific knowledge sharing action plan with regards to EU bodies

### 4.2 International Knowledge Sharing

The action plan given below corresponds to the description given in 3.3.

Stakeholder or Event	Theme	Initial status (non-exhaustive)	Outlook 2011-2014	Outlook 2015-2020
<b>CCS Conferences and publications</b>		VGB Congress (Essen); September 2010; "ROAD: Rotterdam Storage and Capture Demonstration"; G.Boon, J.Kruhl, H.Schoenmakers RCI Shanghai, October 2010, "Acceleration of CCS at commercial scale"; H.Schoenmakers Etc.	Participation and/or contribution to at least 3 major CCS conferences per year	Participation and/or contribution to at least 3 major CCS conferences per year
<b>GCCSI</b>	Project database	Contribution in 2010	Yearly update	Yearly update
	GCCSI knowledge sharing activities	Participation to the GCCSI meeting in Rotterdam – May 2011	On-request activities + participation to 4 GCCSI knowledge sharing technical panels (2011-2012)	On-request
	Special lessons learnt report		Special report on CO2 capture technology selection methodology – July 2011 Special report on	To be defined but interest of ROAD to extend its collaboration with the GCCSI

			<p>public engagement – July 2011</p> <p>Non-confidential FEED study report – August 2011</p> <p>Special report on mitigating project risks – August 2011</p> <p>Special report on the permitting process for implementing the Project – December 2011</p> <p>Special report on handling of business risks for the Project - December 2011</p> <p>Special report on the execution strategy for the Project – December 2011</p> <p>Final lessons learnt report – June 2012</p>	
<b>Bilateral contacts</b>			Contact with operating CCS projects for knowledge sharing co-operation	Contact with operating CCS projects for knowledge sharing co-operation

Table 2: Specific knowledge sharing action plan with regards to international knowledge sharing

### 4.3 Collaboration with Spearhead Research Initiatives

The action plan given below corresponds to the description given in 3.4.

Stakeholder	Theme	Initial status (non-exhaustive)	Outlook 2011-2014	Outlook 2015-2020
<b>CATO2</b>		<p>Participation in several work packages</p> <p>Presentations by ROAD and knowledge sharing workshop between ROAD and CATO2 (sometimes covered by a Non-Disclosure Agreement):</p> <ul style="list-style-type: none"> <li>Information on the new MPP3 coal-fired plant</li> </ul>	<p>Participation to monthly progress meeting per working group.</p> <p>Focus for ROAD on work package 1.1 (post combustion capture), subproject 3</p>	<p>Support continuation of the CATO-2 project or engage into any other interesting major Dutch CCS research program</p>

		<p>and on the capture plant interface</p> <ul style="list-style-type: none"> <li>• Demo preliminary design report</li> <li>• User requirements Specification for Uniper case and User requirements Specification for Other Cases</li> <li>• Feasibility study P18</li> <li>• Best practices in CCS demonstrations</li> </ul>	<p>(underground storage, monitoring and verification), work package 4.2 (permitting and best practice)</p> <p>Participation to meetings on project or subproject level</p> <p>Participation to Executive Board meetings each trimester</p>	
<b>NEARCO<sub>2</sub></b>		Active contribution of the ROAD project, taken as a case study in the research program	Active contribution of the ROAD project Willingness to participate to any continuation of the project	n.a
<b>NERP</b>		Active involvement of the ROAD project, especially regarding research results on capture emissions	Active follow-up by the ROAD project Willingness to participate to any continuation of the project	n.a
<b>Renicuv</b>		ROAD as formal member	Active involvement of the ROAD project  Results taken into account for the capture design	n.a
<b>Cesar/Octavius</b>		Active involvement of the ROAD project in Cesar	Willingness to participate to the continuation of the Cesar project, i.e. the Octavius project	n.a
<b>ZEP</b>		Regular participation of a ROAD member	Regular participation of a ROAD member	n.a
<b>Other projects via the parent companies<sup>4</sup></b>		Informal contacts with the parent companies about projects results	Launch of a formal approach of the ROAD project to regularly identify and exchange valuable	Launch of a formal approach of the ROAD project to regularly identify and exchange valuable knowledge

<sup>4</sup> Without direct participation of ROAD members

			knowledge with/from the parent companies and to disseminate non-proprietary acquired knowledge	with/from the parent companies and to disseminate non-proprietary acquired knowledge
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Table 3: Specific knowledge sharing action plan with regards to spearhead research initiatives

## 4.4 Dutch Authorities and Local Stakeholders

The action plan given below corresponds to the description given in 3.5.

Stakeholder	Theme	Initial status (non-exhaustive)	Outlook 2011-2014	Outlook 2015-2020
<b>ROAD Presentations to Dutch industry, authority, citizens</b>		CATO dag; June 2010; "Development of ROAD project" H.Bak  Nationaal CCS Platform; August 2010; "Development of ROAD project"  Rotterdam CO2 Transportation Summit (Rotterdam), November 2010, "CCS Project ROAD: A view", A.Read	At least two contributions per year of the ROAD project to Dutch seminars or workshops	At least two contributions per year of the ROAD project to Dutch seminars or workshops
<b>Citizens</b> (For further details, see the Public Engagement plan)	Dedicated platforms	ROAD initiated a Regional CCS Platform and a Community Advisory Panel (CAP) in order to structurally inform and involve regional stakeholders on developments regarding the ROAD project specifically and CCS in general	Further establishing the Regional CCS Platform and a Community Advisory Panel	Engagement to maintain and feed the CAP and the regional CCS platform on project progress and high level operational results
	Town hall meetings	2 town hall meetings for local citizens, politics, NGO's interested in the project (2010)	1 town hall meeting or equivalent per year	1 town hall meeting or equivalent per year
	ROAD website	On this website the general public is provided with basic, easily understandable information on the project, as well as CCS in general.	Extension and yearly review of the knowledge shared on the website	Yearly update of the website, including major operational results
	Site visits	Several visits to the Maasvlakte site and the visitor center	Access to the visitor center	Access to the visitor center
	Dissemination contact database	Uncentralized list of stakeholders	Development of a Dissemination contact database	Regular use and update of the dissemination contact database

<b>Local authorities</b>		Intensive knowledge dissemination to the local authorities, notably for the permitting process	On-request – The ROAD approach is too keep a close and regular contact with local authorities	On-request – The ROAD approach is too keep a close and regular contact with local authorities
<b>Local industry</b>	RCI	Active collaboration of the ROAD project	Firm engagement to continue the collaboration	Firm engagement to continue the collaboration
	CCS Hub in Rotterdam	Various presentations to / discussions with specific interested parties, e.g. with the Port of Antwerp (topic: how to initiate a regional CCS Network)	Commitment to support the development of a CCS hub in Rotterdam	Commitment to support the development of a CCS hub in Rotterdam

Table 4: specific knowledge sharing plan with regards to local stakeholders

### 4.5 Internal Knowledge Sharing

The action plan below corresponds to the description given in 3.6.

Stakeholder	Theme	Initial status (non-exhaustive)	Outlook 2011-2014	Outlook 2015-2020
<b>Uniper and Engie</b>	Workshops to identify lessons learned/return of experiences		Organization of at least one thematic workshop/year with members of parent companies supporting the project to identify lessons learned/best practices to be shared	Organization of at least two workshops/year with members of parent companies supporting the project to identify returns of experience on the operational behavior of the CCS chain
	ROAD Knowledge sharing event		Organization of one event each two years where ROAD presents the situation of the project and the lessons learned to the parent companies, based on the needs of the parent companies	Organization of one event each two years where ROAD presents the situation of the project and the lessons learned to the parent companies, based on the needs of the parent companies
	Implication of parent companies in knowledge sharing activities of the EU CCS Project Network	Broader access of E Uniper and Engie to the EU CCS intranet platform	When relevant, involvement of member of parent companies to EU CCS Project Network events in order to increase	When relevant, involvement of member of parent companies to EU CCS Project Network events in order to increase

			the level of knowledge present	the level of knowledge present
	Information flow from ROAD to the parent companies		Development of a new, transparent, and structured approach to share project documentation with the parent companies	Use and follow-up of the documentation sharing approach
	Advisory meeting		Yearly advisory meeting with representative of the parent companies to guide the knowledge sharing activities	Yearly advisory meeting with representative of the parent companies to guide the knowledge sharing activities

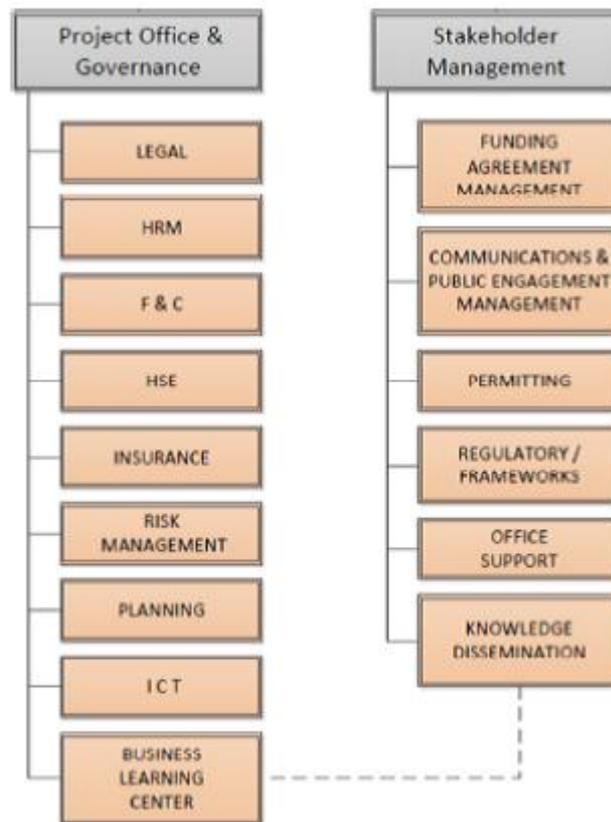
*Table 5: Specific knowledge sharing action plan with regards to internal knowledge sharing*

## 5. Knowledge Dissemination Resources and Management Plan

This chapter describes how the ROAD project was organized to meet the objectives of the dissemination and knowledge sharing plan. Three particular aspects are described: the internal knowledge sharing structure of the ROAD project, the resources engaged in the knowledge sharing aspects and the management of the knowledge sharing plan.

### 5.1 Knowledge Sharing Structure

Usually demonstration project organizations are more focused on the project success rather than on the global optimization of the project results, which means that dissemination and knowledge sharing is not often clearly part of the organogram. Because the ROAD project had the ambition to prove that an industrial, integrated CCS chain could be applied in a reliable and efficient way without being yet economically viable, it was clear that knowledge build-up was the first priority of the project. A complementary objective of ROAD was to accelerate the deployment of commercial CCS applications, so the dissemination and sharing of non-proprietary knowledge was fundamental. Therefore the ROAD project decided in 2011 to appoint a Knowledge Dissemination Manager, whose responsibility was to coordinate all the knowledge dissemination/sharing activities in order to reach the knowledge sharing objectives of the ROAD project.



*Figure 1: Part of the ROAD organogram showing the position of the knowledge dissemination function and the link with the business learning center*

As indicated in the figure above, the new knowledge dissemination function was part of the Stakeholder Management department, increasing the links between the two complementary approaches: Communication/Public Engagement and Knowledge Dissemination. As suggested by the same figure, the Knowledge Dissemination manager was also responsible for the Business Learning Center of the Project Office

& Governance department. This learning center had the objective to give the possibility to the parent companies to appoint one or several of their employees in the ROAD organization, with the objective to contribute to the knowledge sharing activities of the ROAD project, resulting in a double interest of ROAD and the parent companies.

### 5.2 Resources Management

As time was a key constraint for knowledge dissemination/sharing, initially one person was dedicated to knowledge sharing only (= the knowledge dissemination manager). Therefore a knowledge sharing workgroup within ROAD was established, permanently represented by one representative from each ROAD department and with the regular presence of the communication/public engagement manager. The missions of this workgroup, led by the knowledge dissemination manager, was the following:

- Centralization of all knowledge sharing activities.
- Coordination role:
  - Identification of knowledge needs.
  - Defining, organizing and following-up ROAD contributions to knowledge sharing.
    - What, Who and When planning.
    - Follow-up of the Dissemination and knowledge sharing plan.
- Internal platform of exchange within ROAD – link between experts and knowledge dissemination manager.
- Execution of the knowledge sharing tasks by either:
  - The experts of the ROAD departments (Capture, Transport&Storage, Project Office&Governance, Stakeholder Management).
  - The knowledge dissemination manager.
  - The Business Learning Center.

The ROAD project intended to increase the knowledge sharing staff after the Final Investment Decision date (FID) in order to meet the objectives of the dissemination and knowledge sharing plan.

### 5.3 Dissemination and Knowledge Sharing Plan Management

The dissemination and knowledge sharing approach of ROAD consisted of multiple, relatively simple, and focused initiatives to meet the objectives of the dissemination and knowledge sharing plan. In order to efficiently follow-up this plan, monthly knowledge sharing workgroup meetings were organized and the plan was regularly updated.

On an internal organization point of view, the links between Public Engagement, Funding Agreement and Knowledge Dissemination would be optimized, looking for synergies. Also the internal procedures covering the Intellectual Property aspects would be developed in order to increase the knowledge sharing content while respecting the technological innovation of the suppliers.

After FID, the resources related to knowledge dissemination/sharing would be increased.

The table below summarizes the actions of the knowledge disseminations resources and management plan.

Theme	Initial situation	2011-2012	2013-2014	2015-2020
<b>Knowledge Sharing Working group</b>	Established in March 2011	One Working Group Meeting per month After FID, official knowledge sharing contact points in each ROAD department	Regular Working Group Meeting – frequency to be determined	One Working Group Meeting per month, including operational staff
<b>Intellectual Property</b>	Internal procedure describing collaboration between ROAD and parent companies	Further development of internal procedures to manage the knowledge sharing of information coming from the suppliers	Review of internal procedures to allow: -Engie having sufficient access to the capture plant integration, construction and operation -Uniper having sufficient access to the pipeline construction and operation	
<b>Public Engagement / Funding</b>	Parallel approaches with knowledge dissemination	Develop a common action plan between public engagement, funding and knowledge dissemination	Synergetic approach with knowledge dissemination	Synergetic approach with knowledge dissemination
<b>Dissemination and knowledge sharing plan</b>	Launch in June 2011	Annual review and formal approval by the Board of ROAD	Annual review and formal approval by the Board of ROAD	Annual review and formal approval by the Board of ROAD
<b>Resources</b>	1 person	After FID, increase of the knowledge sharing staff	To be reviewed according to workload	At least 2 FTE in the knowledge sharing team
<b>Business Learning Center</b>	0 person	To be increased	According to workload	At least 1 person

*Table 6: Knowledge dissemination resources and management plan*

## 6. Annex: Completed Deliverables and Actions

This Annex provides a list of completed deliverables and action by ROAD during the Action (from 2010 to 2017). These deliverables and actions are described for each period.

### Period #1: 01-01-2010 – 31-12-2010

In this period the Knowledge Sharing activities included the following activities:

- Participation in all activities of the European CCS Project Network.
- Contribution (Huizeling et al., 2010) to the International Conference on Green House Gas Technologies (Amsterdam, September 2010).
- Activities related to permitting:
  - Publication of “Startnotitie” for the Environmental Impact Assessment.
  - 2 town hall meetings for local citizens, politics, NGO’s interested in the project.
- Various presentations to / discussions with specific interested parties, e.g.:
  - Port of Antwerp (topic: how to initiate a regional CCS network).
  - Members of the European Parliament (topic: CCS: current state of technology, foreseen next steps, societal context).
- Contribution to project database of the Global CCS Institute.

ROAD explored opportunities to expand the co-operation on knowledge sharing with the Global CCS Institute (GCCSI). In case of co-operation, a limited amount of funding will be provided by the GCCSI and knowledge generated by ROAD, amongst which the results of one of the FEED studies (as far as acceptable to the technology supplier), would be shared with the GCCSI.

In September 2010, the new project website was launched. The website provided the general public basic, easily understandable information on the project, as well as CCS in general. The website address was <http://www.road2020.nl>

ROAD initiated a Regional CCS Platform and explored possibilities for a so-called Community Advisory Panel (CAP) in order to structurally inform and involve regional stakeholders on developments regarding the ROAD project specifically and CCS in general. Furthermore, (internal) dissemination and communication committees were currently being established.

### Period #2: 01-01-2011 – 30-06-2011

During this period significant steps were made in organizing ROADs knowledge sharing activities:

- A knowledge dissemination manager was appointed.
- A knowledge dissemination working group, consisting of project team members from different departments within the ROAD project team, was set up.
- The dissemination and knowledge sharing plan (D6.2) was finalized.

Knowledge sharing with the partners in ROAD was also further structured and intensified:

- Knowledge needs and potential knowledge transfer processes were identified.
- Knowledge sharing workshops (of which the results will be also incorporated in public reports) on the capture technology selection process and stakeholder management were held, facilitated by Delft University of Technology.
- A knowledge sharing meeting for the partners in ROAD was organized.

ROAD participated in all activities of the European CCS Project Network (network meetings in Brindisi, Lacq, Rotterdam and Ponferrada; advisory forum meeting in Brussels). The Director Stakeholder Management of ROAD, Hans Schoenmakers, was elected as chair of the Steering Committee. ROAD also participated in and contributed to the European Commission workshop on nitrosamines in Brussels, in May 2011. Furthermore, presentations were held to various national and international groups, both on conferences and during site visits to the Maasvlakte.

An article on ROAD in Energy Procedia that written during the previous reporting period was published, in April 2011. An introduction of ROAD was published in the European Regional Review Magazine, in June 2011.

Contributions to the CATO2 research program were focused on work packages 1.1 (post combustion capture, 3 (underground storage, monitoring and verification) and 4.2 (permitting and best practice). Concrete activities during the reporting period were related to WP1.1A6 Process Development and WP1.1A7 Environmental Aspects. ROAD also contributed to the NEARCO2, NERP and RENICUV programs. ROAD was invited to become member of the Carbon Sequestration Leadership Forum (“CSLF”) and was expected to be formalized during the CSLF meeting in Beijing, September 2011.

ROAD initiated a Regional Advisory Committee on CCS (RAC CCS) in close co-operation with regional authorities and other CCS projects in the Rotterdam port and industrial area. This regional CCS platform had the objective to structurally engage stakeholders with the demonstration CCS projects on the long term. The RAC CCS also planned to initiate a Community Advisory Panel (CAP) to structurally and closely involve local and regional communities in CCS projects in the region. In addition, ROAD shared knowledge with various governmental bodies and the local public through the Environmental Impact Assessment.

In July 2011, ROAD launched an update of the project website ([www.road2020.nl](http://www.road2020.nl)) in English and including various animations and visuals of deployed CCS technologies.

### **Period #3: 01-07-2011 – 31-12-2011**

In this period ROAD completed the following Knowledge Sharing deliverables and activities:

#### ***Knowledge Sharing with the GCCSI***

For the GCCSI, the following reports were published:

- Report on CO<sub>2</sub> Capture and Technology selection methodology.
- Special report on stakeholder management and public engagement.
- Non-confidential FEED study report.
- Special report on mitigating project risks.
- Special report on the permitting process for implementing the project.

In addition, a webinar on the results of the CO<sub>2</sub> Capture Plant FEED took place, on 22 November 2011.

#### ***Websites***

The project website and the ROAD page on the EU website were updated, with links to the published GCCSI reports.

#### ***Participation in and contribution to multiple conferences***

ROAD participated in and contributed to multiple conferences including:

- The EU CCS Project Network Meeting in Poland (public engagement and risk management). The 6th Annual EXPERTS 2011.
- The European Fossil Fuels Forum, Berlin 2011.
- Workshop on clean coal for Hebei (China) and Zuid-Holland Provinces.
- Platts 6th Annual European CCS Conference.

- GCCSI / CSLF meeting on project integration.

### **Standard Knowledge Sharing Activities**

Standard knowledge sharing activities included but were not limited to:

- Completing the EU knowledge sharing form.
- Collaboration with spearhead research projects CATO2, NEARCO<sub>2</sub>, NERP and RENICUV.
- Knowledge sharing with the parent companies of the ROAD project, ENGIE and Uniper.
- Various presentations to / discussions with specific interested parties.

### **Period #4: 01-01-2012 – 30-06-2012**

In this period the Knowledge Sharing activities included the following activities:

#### **Knowledge Sharing EU CCS network**

ROAD participated in the EU CCS Project Network Meeting in Cottbus, Germany, where topics on storage, public engagement and regulatory affairs were discussed. Since ROAD was the first EU CCS project to apply for a storage permit, it shared the legal, technical and financial lessons learnt from the application procedure with the other network members.

#### **Knowledge Sharing with the GCCSI**

For the GCCSI, the following reports were published during the first half of 2012:

- Special report on project execution strategy.
- Special report on handling and allocation of business risks.
- Special report on lessons learnt.

#### **Websites**

The ROAD website was regularly updated and the GCCSI special reports were published.

### **Standard Knowledge Sharing Activities**

Standard knowledge sharing activities including but not limited to:

- Completing the EU knowledge sharing form for the first half of 2012.
- Collaboration with spearhead research projects CATO2, NEARCO<sub>2</sub>, NERP and RENICUV.
- Knowledge sharing with the parent companies of the ROAD project, ENGIE and Uniper.
- Participation in and contribution to multiple conferences.
- Various presentations to / discussions with specific interested parties.

### **Period #5: 01-07-2012 – 31-12-2012**

In this period the Knowledge Sharing activities included the following activities:

#### **Knowledge Sharing EU CCS network**

ROAD participated in the EU CCS Project Network Meeting in Rotterdam, the Netherlands, where topics on storage, public engagement and regulatory affairs were discussed. Since ROAD was the first EU CCS project to apply for a storage permit, it shared the legal, technical and financial lessons learned from the application procedure with the other network members.

#### **Knowledge Sharing with the GCCSI**

A variation agreement on the existing funding agreement with the GCCSI, for the publication of an additional set of special reports was signed during the second half of 2012. One special report on “getting a CCS project permitted” and a first “construction progress report” was prepared for publication in Q1 2013.

### **Websites**

The ROAD website was regularly updated and ROAD special reports written during the first half of 2012 were published on the GCCSI website, in the second part of 2012.

### **Standard Knowledge Sharing Activities**

Standard knowledge sharing activities included, but were not limited to:

- Completing the EU knowledge sharing form for the second half of 2012.
- Collaboration with spearhead research projects CATO2, NEARCO<sub>2</sub>, NERP and RENICUV.
- Knowledge sharing with the parent companies of the ROAD project, ENGIE and Uniper.
- Organisation of an internal knowledge sharing event on 29<sup>th</sup> November 2012.
- Editing of an internal transport and storage summary document, making reference to all major documents and references for each part of the transport and storage chain.
- Participation in and contribution to multiple conferences.
- Multiple presentations were given by ROAD employees during the GHGT-11 in Kyoto, Japan.
- Various presentations to / discussions with specific interested parties.
- Regarding the flow assurance works, ROAD exchanged experiences with multiple parties working on CCS. It was found and confirmed that ROAD is a very unique project. The pressure of the empty gasfield is very low and therefore ROAD will not install a heater nor compressor on the platform, an insulated pipeline will be used.

### **Period #6: 01-01-2013 – 31-12-2013**

In this period the Knowledge Sharing activities included the following activities:

#### **Knowledge Sharing EU CCS network**

ROAD participated in the EU CCS Project Network Meetings in Doncaster (United Kingdom) and Stavanger (Norway) where topics on storage, transport, public engagement and regulatory affairs were discussed. Furthermore, ROAD wrote an expert report “Case study of the ROAD storage permit” (June 2013) for the EU CCS Project Network on the lessons learnt regarding the storage permit.

#### **Knowledge Sharing with the GCCSI**

Based on the variation agreement on the existing funding agreement with the GCCSI, ROAD wrote two special reports for the GCCSI:

- Special report on “Flow Assurance & Control Philosophy” (July 2013).
- Special report on “Capture Integration and Power Plant” (December 2013).

### **Websites**

The ROAD website was regularly updated and ROAD special reports written for GCCSI were published on the GCCSI website, in July and December 2013.

### **Standard Knowledge Sharing Activities**

Standard knowledge sharing activities included, but were not limited to:

- Completing the EU knowledge sharing form for the first half of 2013.
- Contribution to the Situation Report 2012 of the EU CCS Project Network.
- Collaboration with spearhead research projects CATO2, NEARCO<sub>2</sub>, NERP and RENICUV.
- Knowledge sharing with the parent companies of the ROAD project, ENGIE and Uniper.
- Participation in and contribution to multiple conferences.

- Various presentations to / discussions with specific interested parties.

### **Period #7: 01-01-2014 – 31-12-2016**

In this period the Knowledge sharing activities included the following activities:

#### ***EU CCS Demonstration Project Network Knowledge Sharing Events***

ROAD participated in the following EU CCS Demonstration Project Network Knowledge Sharing Event:

- Ponferrada (Spain), 7-9 May 2014. At this knowledge sharing event ROAD participated in the sessions on transport, storage and regulatory affairs.
- Sugar Land, Texas (U.S.A.), 16-17 November 2015. At this knowledge sharing event ROAD participated in the sessions on capture public perception, capture and transport.
- Lausanne (Switzerland), 14 November 2016. At this knowledge sharing event ROAD participated in the session on media management.

#### ***Knowledge Sharing with GCCSI***

Based on the variation agreement on the funding agreement with the GCCSI, ROAD wrote two special reports for the GCCSI in 2013. In 2014, ROAD presented these reports in two webinars.

- 4 Februari 2014: Opportunities for integration of carbon capture process with coal-fired power plants.
- 15 April 2014: From compressor to reservoir – Flow assurance and control philosophy for CCS CO<sub>2</sub> operation.

#### ***Knowledge Sharing at GHGT-12 and GHGT-13***

Within the framework of the GHGT-12 conference from 6<sup>th</sup> till 9<sup>th</sup> October 2014, ROAD submitted four papers and contributed to two papers by the EU CCS Demonstration Project Network (cover pages of submitted papers are included in the Annex). The following papers were submitted:

- Update on the ROAD Project and Lessons Learnt (ROAD)
- Reduction of freshwater usage of a coal fired power plant with CCS by applying a high level of integration of all water streams (ROAD)
- Start of a CO<sub>2</sub> hub in Rotterdam: connecting CCS and CCU (ROAD)
- Drafting a monitoring plan for the ROAD project under the EU CCS Directive (ROAD)
- CO<sub>2</sub> storage development: status of the large European CCS projects with EEPR funding (EU CCS Demonstration Project Network)
- CO<sub>2</sub> transport systems development: status of three large European CCS demonstration projects with EEPR funding (EU CCS Demonstration Project Network)

ROAD presented two of its papers at the GHGT-12 conference in a technical session and one was presented during on of the poster sessions.

At the GHGT-13 (14-18 November 2016) in Lausanne (Switzerland), ROAD gave a presentation in the session on permitting and participated in various other sessions of the conference.

#### ***Websites***

The ROAD website was regularly updated. Furthermore, the presentations and recorded sessions of the webinars on the mentioned special reports for GCCSI were published on the GCCSI website:

- Opportunities for integration of carbon capture process with coal-fired power plants: <http://decarboni.se/insights/opportunities-integration-carbon-capture-process-coal-fired-power-plants>.
- From compressor to reservoir – Flow assurance and control philosophy for CCS CO<sub>2</sub> operation: <http://decarboni.se/insights/compressor-reservoir—flow-assurance-and-control-philosophy-ccs-co2-operation>.

### **Various Knowledge Sharing Activities**

Standard knowledge sharing activities including, but not limited to, have been:

- Completing the yearly Information and Experience Gathering (IEG) questionnaire for the Network internal survey.
- Contribution to the Situation Reports of the EU CCS Project Network.
- Collaboration with spearhead research projects like CATO2, TKI-Toeslag-2013: CCUS, NEARCO<sub>2</sub> and OCTAVIUS, Align project, Aerosolve, Gateway and CO<sub>2</sub>-Smartgrid.
- Knowledge sharing with the parent companies of the ROAD project, ENGIE and Uniper.
- Participation in and contribution to various meetings and conferences:
  - GCCSI Members' Meeting (18 June 2014).
  - 7<sup>th</sup> Dutch CCS Symposium (19 June 2014)
  - CCS meeting with Members of European Parliament (1 October 2014).
  - CCS meeting with Members of European Parliament (28 April 2015).
  - EU Sustainable Energy Week (17 June 2015).
  - 8<sup>th</sup> Dutch CCS Symposium (16 October 2015)
  - ZEP NWPE meeting (9 February 2016).
  - ZEP NWT3 meeting (17 February 2016).
  - Milestone Mongstadt 4 (10 May 2016).
  - CO<sub>2</sub> GeoNet Open Forum (11 May 2016).
  - CSLF-CCSA workshop (29 June 2016).
  - ZEP Government Group Meeting (6 July 2016).
  - CCS Knowledge Transfer workshop (8 September 2016).
  - European CCS Forum and EMEA's Members' Meeting (13 October 2016).
- Development of a Question & Answer Tree summarising the CO<sub>2</sub> storage elements (e.g. P18-4) of the CATO2 research programme (2015).
- Various presentations to / discussions with specific interested parties.

### **Revision of ROAD brochure**

In 2014, ROAD developed a revised project brochure (A5 format) also focussing on the Rotterdam CO<sub>2</sub> hub and opportunities for CCUS and Bio-Energy & CCS (BECCS). The booklet was updated in 2016 based on the new project set-up.

### **Period #8: 01-01-2017 – 26-11-2017**

In this period the Knowledge Sharing activities included attendance and/ or presentations at the following meetings:

- "CO<sub>2</sub> Smart Grid" meeting, 30 January 2017.
- H2020 Gateway Stakeholder workshop , 27 February 2017.
- "6<sup>th</sup> CCUS Advisory Group" at the port of Antwerp, 17 March 2017.
- ZEP Advisory Council meeting in Brussels, 22 March 2017.
- European Parliament hearing, 23 March 2017.

- H2020 Gateway meeting, 24 March 2017.
- “CO<sub>2</sub> Smart Grid on CCS” kickoff meeting, 30 March 2017.
- Conference “Reducing the carbon footprint of the steel industry (CATO & ECN)” in Petten, 20 April 2017.
- CATO General Assembly, 20 April 2017.
- Hosting and attendance of the final meeting of the Horizon 2020 Gateway Project, 24 April 2017.
- CO<sub>2</sub>GeoNet Open Forum "Growing CCS for a sustainable future" in Venice, 8 - 10 May 2017 .
- 8<sup>th</sup> International Conference on Clear Coal Technologies (CCT 2017) by IEA Coal in Sardinia, 10 - 11 May 2017.
- EU workshop on EU funds for industrial CCS clusters in Brussels, 19 May 2017.
- EU (DG Clima) Consultation roundtable on CCS, 29 May 2017.
- 9<sup>th</sup> Trondheim conference on CO<sub>2</sub> Capture, Transport and Storage, 13 & 14 June 2017.
- ZEP Advisory Council, 5 July 2017.
- ZEP Advisory Council meeting, 13 September 2017.
- “CO<sub>2</sub> Smart Grid” expert meeting, 5 October 2017.
- 2017 CSLF Regional European Event, 6 October 2017.
- EU CCS Network Advisory Forum in Rotterdam, 25 October 2017.
- GCCSI European Forum on CCS in Rotterdam 26 October 2017.
- ROAD Lessons Learnt workshop on Public Engagement, 9 November 2017.
- ROAD Lessons learnt workshop on Commercial Business Case, 14 November 2017.
- Conference “CATO meets the Projects” in Utrecht, 15 November 2017.
- ROAD Lessons learnt workshop on Transport & Storage Technical, 23 November 2017.
- ROAD Lessons learnt workshop on Permitting and Regulation, 30 November 2017.