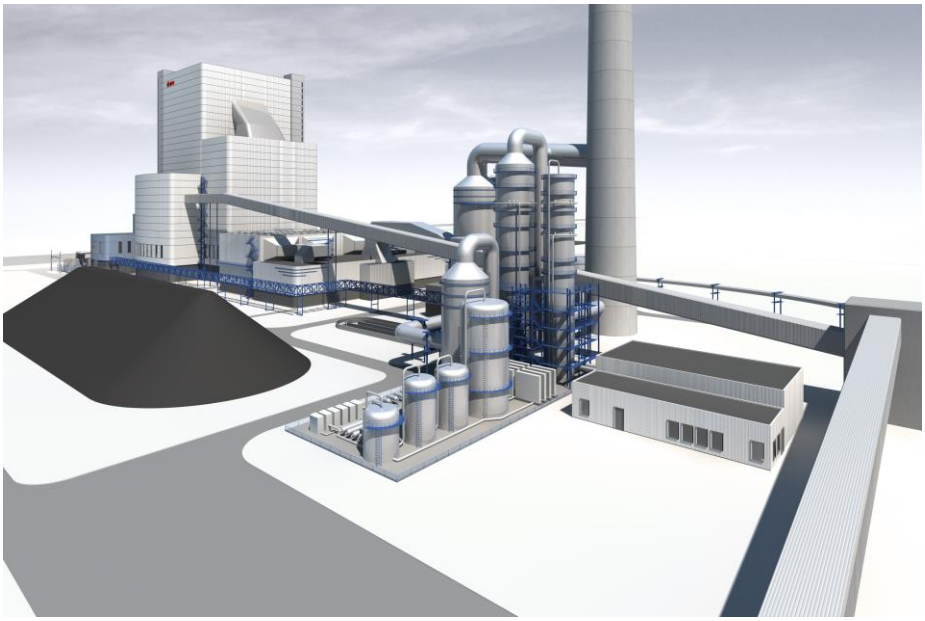


Case study of the ROAD storage permit

A report by the ROAD project - part of the European CCS Demonstration Project Network

June 2013

Contents

1. Summary

Getting a CCS project permitted is a long and difficult process, especially because of the storage permitting obligations. The regulations on a storage permit (the CCS Directive, Guidance Documents) are new and some key details can be interpreted in a variety of ways. In total the storage permitting process took almost two years for the ROAD project. ROAD was fortunate to have Dutch competent authorities fully support the demonstration project. While this may not be the case for other projects, hopefully this report gives some lessons learnt and concrete examples on how to approach some of the key issues arising from the CCS Directive.

The outcome of the storage permitting process seems to be one of the most important factors for CCS projects. In particular, the requirements regarding the financial security and financial mechanism, for example, could be a key reason why an organisation would stop its involvement in a project.

Based on the European CCS Demonstration Project Network meeting in Cottbus in May 2012, it was agreed by the regulatory development network members that a case study of the storage permitting process of the ROAD project would be informative for other projects. The most important CCS legislation regarding the storage of CO_2 comes from the Directive 2009/31/EC on the geological storage of CO_2. There are several important requirements of this legislation, which leave room for interpretation by Member States. This case study by the ROAD project only assesses key issues relating to the storage permit.

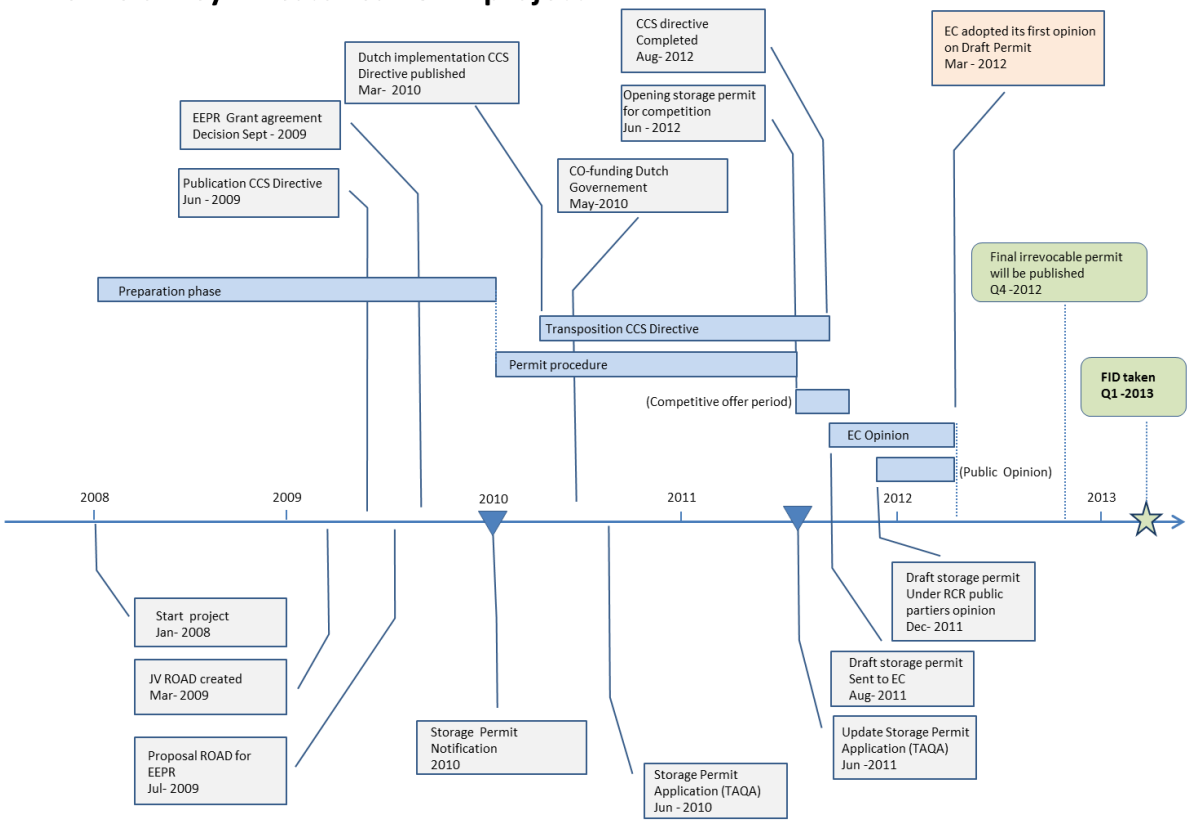
Internal organization and stakeholder management

In ROAD's experience, several different sets of expertise need to be brought together with a view to successfully obtaining the storage permitting. These include: technical, legal, communication, regulatory, and commercial negotiations. Organising a project should take into account the interactions and relations between all of these different experts. Structured weekly meetings during the permitting process (especially to line up with the external advisors) have been crucial, these included: technical experts meetings, monthly meetings with the competent authorities. Communication to stakeholders or other third parties was centralised. Only a key team would undertake communications. This was highly appreciated by the competent authorities. ROAD experienced the same with the competent authorities, as they also appointed one general CCS manager. It was very effective to discuss every topic of the storage permitting process with the same person.

Storage permit

The storage permitting process has taken almost two years, as characterised in the timeline below.

Timeline of key milestones ROAD project



The CCS Directive gives a general regulatory framework to ensure permanent containment of CO_2 and where this is not possible, eliminate possible negative effects and any risk to the environment and human health.[1] The Directive also introduces several key elements such as a monitoring plan, financial security provisions, provisions for the handover of responsibility and the financial mechanism. However, it only gives a high-level description of these elements. The interpretation of these elements is up to the Member States.

The Dutch Minister of Agriculture, Economic Affairs and Innovation decided to implement the Directive in its entirety, with no additional national provisions or any further interpretation of the key elements (monitoring plan etc.). ROAD fully endorsed this approach since each CCS project has its own specific characteristics and in order to have a proper assessment of a project proposal, a tailor-made approach is essential. Most other stakeholders agreed with this open and flexible legislation. The requirements for the storage of CO_2, set by the Government, are based upon the specific characteristics of each storage site. This means that the key elements of the CCS Directive are addressed in the storage permit. Four key elements have been identified:

1. **Storage complex and storage site.** Following the information given in the CCS Directive, definitions are made regarding the storage site and for the storage complex. These definitions are not that easy to apply to a reservoir or aquifer. These definitions are also relevant regarding surrender of EUAs. No EUAs need to be purchased in case where the CO_2 leaks out of the storage complex, but remains trapped under the ground.

[1] Article 1(2) CCS Directive.

2. **Financial Security(FS).** The CCS Directive requires that the storage operator must present proof that adequate Financial Security will be valid and effective before commencement of the injection. However, the CCS Directive does not require that the Financial Security be valid and effective at the time the permit application is submitted, only that it must be valid and effective before commencement of injection. The question which then was posed by ROAD was to what extent the applicant needs to provide proof in the permit application that the financial security will be "valid and effective" in time. ROAD faced the incongruity between the requirements of the CCS Directive and the “normal” practice for a demonstration project. Other essential questions included: (1) what are the obligations of the FS and which activities must be included in the financial security? And (2) What is an adequate calculation method for the amount of security which results in a good estimated amount of Financial Security? And (3) which instrument(s) would be acceptable for the Competent Authority?
3. **Financial Mechanism. The CCs Directive states that** Member States shall ensure that the operator makes a financial contribution available to the competent authority before the transfer of responsibilities to the competent authority takes place. The contribution should cover at least the anticipated cost of monitoring for a period of 30 years, but it also “may be used to cover the costs borne by the competent authority after the transfer of responsibility to ensure that the CO_2 is completely and permanently contained in geological storage sites after the transfer of responsibility”. In theory, this means that the competent authority can demand a financial contribution that is almost unlimited, while the competent authority will be forever responsible after the handover.
4. **Transfer of responsibilities.** After the storage site has been closed, the responsibility for all legal obligations can be transferred to the competent authority of the Member State, subject to several conditions. In ROAD’s opinion, clarity on the transfer of the responsibilities to the competent authority is one of the crucial issues that at this moment still has not solved. The main concern of the ROAD project is in which way and under which conditions the minimum period of 20 years can be reduced. The key questions that ROAD still has, include: (1) Which evidence is taken into account? (2) What if the competent authority is not convinced, although all available evidence indicates that the stored CO_2 will be completely and permanently contained? And (3) Who is going to assess this evidence?

Legal liabilities

There are four different legal regimes under which liability may arise for storing CO_2:

1. EU-ETS; operator is liable for damage to the climate in case of the release of CO_2;
2. Environmental Liability Directive; operator is liable for damage to the environment;
3. Civil liability; operator is liable for damage to third parties (damage to persons and/or goods);
4. CCS Directive; operator is liable to the competent authority in case it does not undertake sufficient monitoring and corrective measures in case of leakage.

The first three regimes are also applicable on capture and transport, but this case study only addresses the storage permit, therefore only the liabilities for storing CO_2 are addressed in this case study. ROAD concludes that the liabilities arising from the EU ETS Directive are of the main concern.

2. Introduction

This chapter provides a brief overview of the ROAD project and explains why this report has been drafted.

2.1 Cottbus meeting European CCS Demonstration Network

Based on the CCS Network meeting in Cottbus it was agreed by the regulatory network members that a case study of the storage permitting process of the ROAD project would be informative for other projects. The network members identified several key issues of the storage permitting process which will be addressed in this case study report.

This case study was presented at the October 2012 meeting as a knowledge product in Rotterdam, the Netherlands. The authors hope that this case study can assist other European CCS demonstration projects with their storage permitting processes. In addition, the authors from the ROAD project are available to answer any questions that may arise after reading this case study.

2.2 Outline case study

The most important CCS legislation regarding the storage of CO_2 comes from the Directive 2009/31/EC on the geological storage of CO_2. There are several important requirements of this legislation, which leave room for interpretation by Member States. This case study by the ROAD project only assesses key issues relating to the storage permit.

Firstly, it gives an overview of the internal ROAD organization. The way in which ROAD was organized was very relevant for the storage permitting application. The report gives an overview of the key stakeholders and describes how the project kept in touch with them.

Secondly, the report goes into a brief description of the process, including detailed timelines. It gives insights into how long the storage permitting process took in the Netherlands, what the important milestones are and which occurrences can cause delays or time advantages.

Thirdly, in the chapter covering the details of the storage permit, several key aspects of the directive are discussed in detail. These aspects are crucial for developing any CCS project in Europe. The case study describes how the ROAD project interpreted the outstanding issues and was able to agree solutions with the competent authorities.

Finally, it must be noted that the storage permit application is filed by TAQA. TAQA already holds the current gas production permit and submitted the application and will be the storage permit holder and the storage operator. As this case study is drafted to inform the other projects, ROAD uses it to describe their view of the process from a full chain project view. This case study is drafted by the ROAD project; it only represents the views and opinions of the ROAD joint-venture parties.

2.3 Introduction ROAD project

ROAD is the Rotterdam Opslag and Afvang Demonstratieproject (Rotterdam Capture and Storage Demonstration Project) and is one of the largest integrated Carbon Capture and Storage (CCS) demonstration projects in the world.

The main objective of ROAD is to demonstrate the technical and economic feasibility of a large-scale, integrated CCS-chain. Large-scale demonstration projects are needed to show that CCS is an efficient and effective CO_2 abatement technology within the next 5 to 10 years.

ROAD applies post combustion technology to capture a portion of the CO2 from the flue gases of a new 1,100 MWe coal-fired power plant (Maasvlakte Power Plant 3) in the Rotterdam port and industrial area. The capture unit has a capacity of 250 MWe equivalent and aims to capture 1.1 million tonnes of CO_2 per year. The capture installation is planned to be operational in 2015.

From the capture unit the CO_2 will be compressed and transported through a pipeline: 5 kilometres over land and 20 kilometres across the seabed to the P18-A platform, operated by TAQA, in the North Sea. The pipeline has a planned transport capacity of 5 million tonnes per year. ROAD plans to store the captured CO_2 in a depleted gas reservoir under the North Sea. This gas reservoir is located 20 kilometres off the coast and is at a depth of 3,500 meters under the seabed of the North Sea.

ROAD is being developed by a joint-venture of E.ON and GDF SUEZ. The project has received funding from the EU as one of six selected projects within the EEPR funding scheme, the Dutch Government, and the Global CCS Institute. The intended partners of ROAD are GDF SUEZ E&P Nederland B.V. for the CO_2 transport and TAQA Energy B.V. for the CO_2 injection and permanent storage. TAQA has filed the storage permit application and will become the permit holder and storage operator.

3. Internal organization ROAD

In order to understand the storage permit processes, it is important to understand the internal organization of ROAD. Relevant aspects that need to be taken into account include:

- several different expertises (legal, technical, communication, finance, etc.) are needed to be deployed;
- structured meetings need to be organized (weekly internal meetings, weekly meetings with partners, monthly meetings with competent authorities);
- stakeholders (mainly the competent authorities) prefer one contact for all their questions.

This chapter will set out the internal ROAD organization and give a brief overview of all relevant stakeholders. This will demonstrate the breadth and depth of these relationships.

In paragraph 3.2, a more detailed description of the Stakeholder Management organization is given since Stakeholder Management was crucial for the permitting process.

3.1 Organization chart

E.ON Benelux and Electrabel Nederland (GDF SUEZ Group) created the joint venture Maasvlakte CCS Project C.V., a limited partnership with a 50-50 division of shares. This project organization provides the technical, operational and economic management of the activities. The Maasvlakte CCS Project C.V. has the following organizational departments:

- Project Office & Government
- Stakeholder Management
- Capture
- Transport & Storage

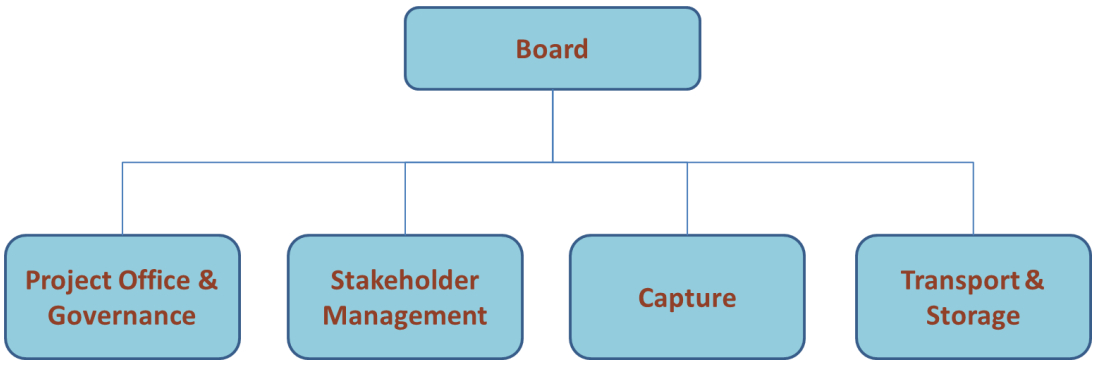


Figure 1: Project Organization of the ROAD project.

The Stakeholder Management Group is responsible for all permitting, however, it is important to note that close interaction and cooperation with the Transport & Storage (T&S) Group and Project Office & Governance and the Capture group was necessary throughout the application process. For

example: all the technical experts regarding storage belong to the T&S Group and the capture team provided details on the CO_2 composition, the Project Office calculated the total costs of the permit requirements, and a project team of TAQA and a contracted technical consultancy firm completed the storage permit team.

To keep this case study as specific and practical as possible, only the Stakeholder Management Group will be discussed.

3.2 Stakeholder Management

The Stakeholder Management team of ROAD comprises professionals in the fields of: permitting, funding (EEPR funding scheme, the Dutch Government, and the Global CCS Institute), public & regulatory affairs, communications, public engagement and knowledge dissemination. They are responsible for managing the relations with the most important stakeholders of the project. The Director Stakeholder Management is part of the Board of Directors of ROAD. The Stakeholder Management team co-ordinates all stakeholder relations.

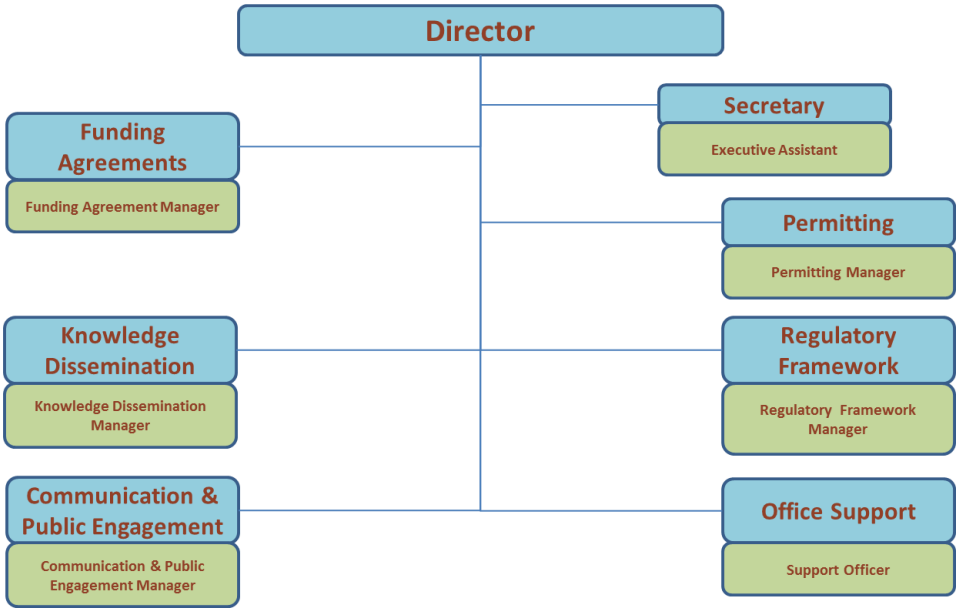


Figure 2: Stakeholder Management within the ROAD project.

Within the broader team, the permitting experts are responsible for managing the Environmental Impact Assessment (EIA) procedure and the permitting application process of the ROAD project. The permitting team coordinates all dealings with the relevant authorities, which include:

- the Ministry of Economic Affairs, Agriculture and Innovation;
- the Ministry of Infrastructure and Environment;
- the Bureau for the Rijkscoordinatieregeling;
- the Netherlands Emissions Authority (Nea);
- the DCMR Rijnmond Environmental Agency;

- the Department of Construction and Transport of the City of Rotterdam;
- the Province of Zuid-Holland;
- the State Water Authority of Zuid-Holland;
- the State Water Authority of the North Sea; and
- the Netherlands Commission for Environmental Assessment.

The members of the permitting team come from the parent companies E.ON Benelux and SUEZ GDF, supplemented by external advisors and have external support and advice by an independent technical consultancy firm. As mentioned in the introduction, TAQA Energy applied for the storage permit, meaning that it was crucial for the permitting team to work with TAQA's CCS project manager and supporting technical experts.

In drafting the storage permit, it is important to note the role that the regulatory affairs team played. While regulatory affairs is defined within the Stakeholder Management Group as a separate section, it cannot operate without close collaboration with other members of the ROAD-project. In addition, the storage permit application was submitted when the Dutch transposition of the CCS Directive[2] had still not been completed, meaning that throughout the entire permitting process the transposition process was also on-going. During the process it was unclear which detailed requirements would be demanded by the competent authorities, which meant that the transposition was of great interest to the ROAD permitting team.

Another important reason why regulatory affairs was included in the storage permit team, was due to the relatively new nature of the CCS Directive (i.e. there are no precedents, no jurisprudence etc.). The interpretation and practical application of the Directive requirements had to be assessed on basis of typical regulatory tools. These tools included: Guidance documents, Parliamentary discussions, announcements of the European Commission (EC), announcements of national Ministers, etc. The regulatory affairs team provided all these relevant documentations and tools to help interpret the implementation of the CCS Directive. A similar organisations setup may benefit projects in other Member States where the transposition of the Directive has not yet been fully completed. Furthermore, most of the Member States that have transposed the Directive have decided to take an almost literal translation of the Directive, which means that there is room for interpretation since the Directive is unclear on several topics.

There was some degree of overlap with both the permitting as well as the Communication & Public Engagement team as they are responsible for the communication objectives, strategy, key messages, activities and materials. Responsibilities, roles and procedures on internal and external communication of ROAD have been defined in a communication protocol. External communication activities and materials with (possible) high exposure for stakeholders are reviewed by technical specialists on accuracy of facts and figures. External (formal) documents (Environmental Impact Assessment) are checked by communication specialists on potential reputation issues for the

[2] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006.

project. When the permitting process was coming to an end, the Communication & Public Engagement team became much more involved.

With the precedent and experiences of Barendrecht[3], ROAD decided to be 'over prepared' on all communication activities. ROAD adopted a cautious but open communication strategy. All communications on the storage permit were discussed first with the competent authorities and other key stakeholders. ROAD organized information events for local communities in cooperation with the competent authorities, informed the public via ads in newspapers, drafted leaflets and installed a website, drafted hundreds of Q&A's and discussed these with the key stakeholders and provided technical experts training. ROAD tried to inform the public actively, while still making the information as objective as possible.

The two main concerns of the public that ROAD experienced included: (1) why do we need CCS? And (2) is it safe? In the end, the ROAD approach seemed to have worked well since almost no official objections were filed by the public, which is a great achievement since similar sized infrastructure projects usually receive more than 1000 official objections.

As described above, in ROAD's experience, several different sets of expertise need to be brought together with a view to successfully obtaining the storage permitting. These include: technical, legal, communication, regulatory, and commercial negotiations. Organizing a project should take into account the interactions and relations between all of these different experts. Structured weekly meetings during the permitting process (especially to line up with the external advisors) have been crucial, these included: technical experts meetings, monthly meetings with the competent authorities. Communication to stakeholders or other third parties was centralized. Only a key team with members of TAQA, ROAD and a technical consultancy firm would undertake communications. This was highly appreciated by the competent authorities. ROAD experienced the same with the competent authorities, as they also appointed one general CCS manager. It was very effective to discuss every topic of the storage permitting process with the same person.

Summarized, approximately 10 - 15 people worked on the storage permit:

- 1 overall general manager (ROAD)
- 2 storage permit managers (TAQA and ROAD)
- 5 technical experts (TAQA and ROAD)
- 1 lawyer (TAQA)
- 2 regulatory affairs experts (TAQA and ROAD)
- 2 communication experts (TAQA and ROAD)
- 2 advisors of a technical consultancy firm

[3] In 2006, Shell started preparations for a CCS demonstration project in two depleted gas fields under the town of Barendrecht in the South-West of the Netherlands, near the Rotterdam Harbor area. It soon became apparent that local politicians were strongly opposed and that residents had many questions about the procedure, safety, and risks for public health. Although the EIA committee stated that the EIA was complete and that the safety risks were properly assessed and complying with Dutch legislation, the Dutch government cancelled the project in 2010 due to the public opposition.

3.3 Storage permitting stakeholders

The teams of regulatory affairs and communications teams started their analysis by mapping the subjects that would be relevant for CCS in the Dutch and European Parliaments. In addition, after consulting several key stakeholders (politics, government and industry), the list of subjects was complemented with topics that were not (yet) on the Parliamentary agenda, but could have a significant impact on the storage permitting process in the near future. For example, ROAD decided that a number of topics that may appeared to have no immediate relation to CCS can have an important indirect effect on the storage permitting process, such as gas storage, a coal-fired power plant tax, electricity prices, emission trading system, etc. This resulted in a stakeholder list that contained a lot of different subjects, and prioritizing was essential.

The next step, after the mapping and prioritizing of the subjects, was to map the stakeholders. It was remarkable that a lot of stakeholders, local, regional, national and international, were identified with very different interests. However, not all the stakeholders were closely involved in the transposition process of the CCS Directive itself (in particular the NGOs did not actively participate in the process).

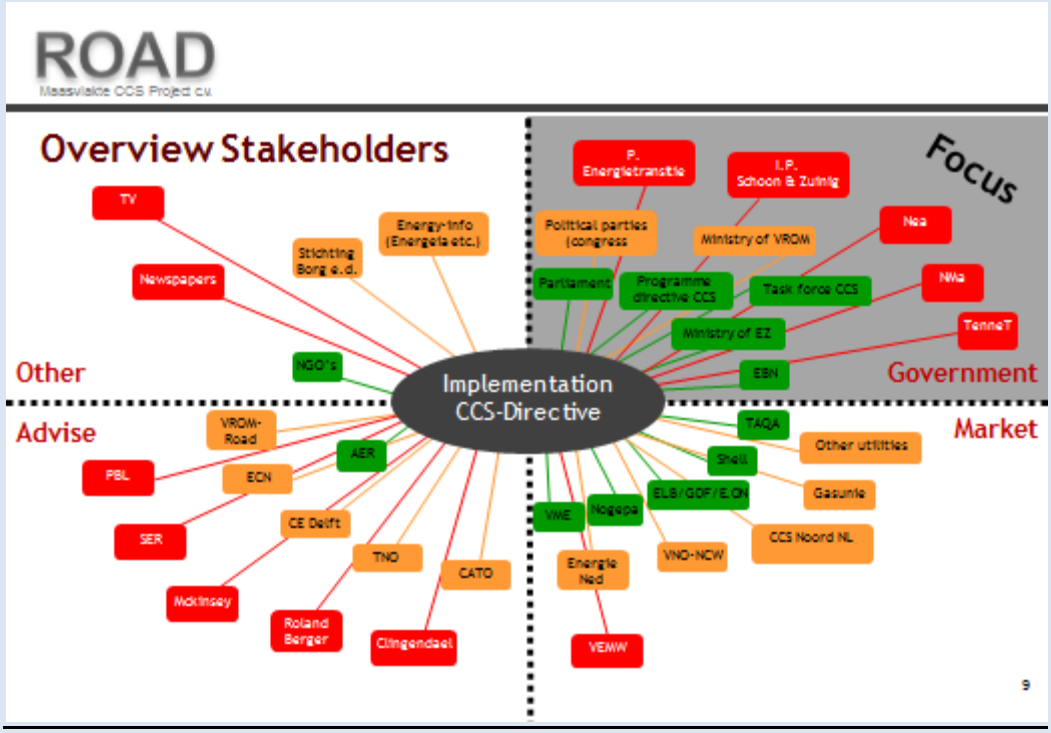


Figure 3: Overview of the ROAD stakeholders with a view to the storage permitting process.

On the basis of table 3 (above), ROAD prioritized the stakeholders since it would take up too many resources to manage all stakeholders. ROAD decided to focus on the governmental stakeholders because they would be the ultimate decision makers regarding the CCS Directive transposition and the permitting processes. Within this focus area, the following stakeholders were approached:

- the Ministry of Economic Affairs, Agriculture and Innovation;
- the CCS Direction (interdepartmental Direction of the Ministry of Economic Affairs, Agriculture and Innovation and the Ministry of Infrastructure and Environment);
- regional authorities;
- mining authorities; and
- several political parties.

CCS was already a relative important topic for politics when ROAD started in 2010, making the Members of Parliament, their assistants and the involved ministries important stakeholders for the ROAD project.

Regarding the storage permitting process, the civil servants of the competent authorities were the key stakeholders. As mentioned before, within the ministries, a lot of different sections were involved. Therefore, structured regular meetings and having just one contact within the ministry was found to be very effective. In ROAD's experience, the Dutch civil servants were approachable and willing to discuss the development of CCS at any time.

Other important stakeholders included regional authorities and CCS projects in the Rotterdam port and industrial area, such as: the Port of Rotterdam Authority, the City of Rotterdam, regional industry organization Deltalinqs, DCMR Rijnmond Environmental Agency and other CCS projects. These organizations work together in a regional CCS platform, which engages stakeholders of CCS projects in a structured, long term way. The members of this platform meet regularly to develop necessary conditions (i.e. the regulatory, permitting, public engagement) for CCS in the Rotterdam port and the industrial area. One of the shared objectives of the members is to focus on developing public outreach and build public acceptance within the Rotterdam region.

Once ROAD had a pretty good overview of all the relevant topics, stakeholders and interests, ROAD was able to set out positions for these subjects using position papers, internal discussions and did some external research. ROAD was then was able to contact stakeholders, to work together with them, and form coalitions.

4. Storage permit

This case study sets out to address the questions that the ROAD project faced in interpreting the CCS Directive and the solutions that they devised. It is envisaged that CCS projects can use these interpretations and solutions in their discussions with their own competent authorities.

This chapter outlines the storage permitting process, gives insight in the periods that need to be taken into account in order to establish a storage permit, and addresses the key issues created by the CCS Directive.

4.1 CCS Directive

The EC published the CCS Directive on 25 June 2009[4], with the implementation deadline of 25 June 2011. The legislative proposal for transposing the Directive into Dutch legislation was published in March 2010 and after the Parliamentary discussions, the proposal came into force in August 2011. In the Netherlands the CCS Directive has been implemented in both the:

- Dutch Mining Act[5]; and the
- Mining Decree and Mining Regulation.

Both of these frameworks give general rules for the process of the storage permit application[6].

The Directive gives a general regulatory framework to ensure permanent containment of CO_2 and where this is not possible, eliminate possible negative effects and any risk to the environment and human health.[7] The Directive also introduces several key elements such as a monitoring plan, financial security provisions, provisions for the handover of responsibility and the financial mechanism, but only gives a high-level description of these elements. The interpretation of these elements is up to the Member States.

With a view to the transposition of the CCS Directive, the key question was whether the Directive would be implemented 'as-is' (In its original format/without amendment) or whether the Dutch Government would add additional national CCS provisions to the legislative proposal. In ROAD's opinion, the EC Guidance Documents for the implementation of the CCS Directive did not give sufficient clarity and are primarily applicable for storage in aquifers. More importantly, the final

[4] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006.

[5] Wet van 6 juni 2011 tot wijziging van de Mijnbouwwet in verband met implementatie van richtlijn nr. 2009/31/EG van het Europees Parlement en de Raad van 23 april 2009 betreffende de geologische opslag van kooldioxide en tot wijziging van richtlijn 85/337/EEG van de Raad, de richtlijnen 2000/60/EG, 2001/80/EG, 2004/35/EG, 2006/12/EG en 2008/1/EG en verordening (EG) nr. 1013/2006 van het Europees Parlement en de Raad (PbEG L 140) en van Ospar Decision 2007/2 on the storage of carbon dioxide streams in geological formations.

[6] Besluit van 29 augustus 2011, houdende wijziging van het Mijnbouwbesluit en twee andere besluiten in verband met bepalingen voor het permanent opslaan van CO_2.

[7] Article 1(2) CCS Directive.

versions of the Guidance Documents were not published when the Dutch legislative proposal was drafted and discussed in Parliament.

The Dutch Minister of Agriculture, Economic Affairs and Innovation decided to implement the Directive in its entirety with no additional national provisions or any further interpretation of the key elements (monitoring plan etc.). The result was that the legislative proposal was almost a literal translation of the English-language Directive. Most stakeholders agreed with this open and flexible legislation.

ROAD fully endorsed this approach since each CCS project has its own specific characteristics, and in order to have a proper assessment of a project proposal, a tailor-made approach is essential. Most other stakeholders agreed with this open and flexible legislation. The requirements for the storage of CO_2, set by the Government, should be based upon the specific characteristics of each storage site.

This means that the key elements of the CCS Directive are addressed in the storage permit, which is described in detail in the sections below.

4.2 Permitting timeline and process

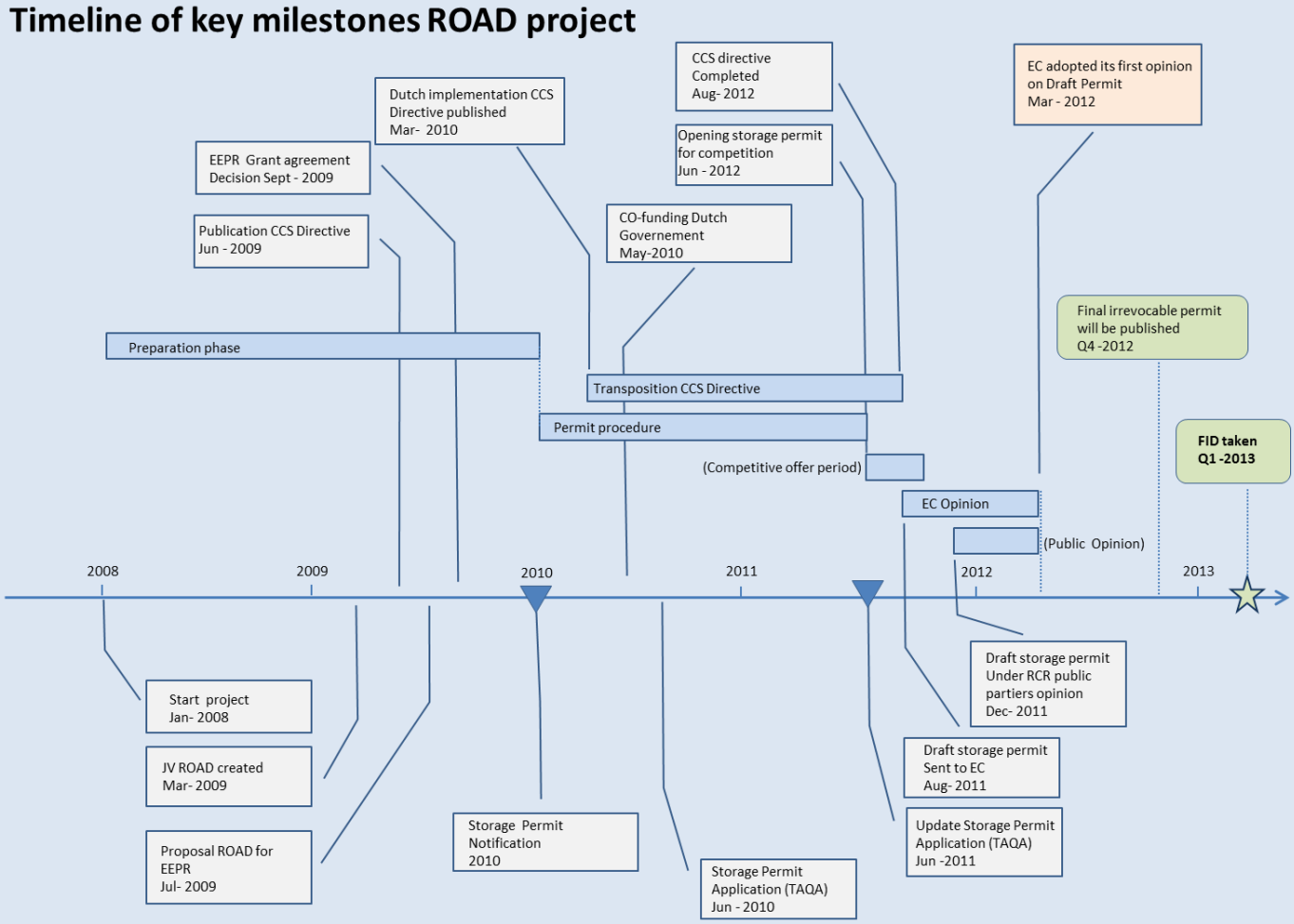


Figure 4: Timeline of the key storage permit milestones of the ROAD project

As characterised in the timeline above, the storage permitting process has taken almost two years; however, ROAD still does not have the final storage permit, because some minor issues in the spatial planning will need to be handled before the final storage permit may be granted.

Within the two years process, several different developments caused delays:

- The permitting process had one year delay due to the fact that the original permit application was filed in June 2010. At that time, the CCS Directive was already published by the EC, but still needed to be implemented in Dutch legislation. The competent authority understandably wanted to assess the application with a view to the Directive framework and therefore demanded an application that was complying with all requirements of the Directive (although the transposition was not completed yet).
- It was not until June 2011 an update of the application with all necessary information regarding the CCS Directive was submitted. Almost immediately after the application was submitted, the competent authority granted the draft storage permit.

- The EC drafted its opinion on the permit in 6 months, although the Directive states that the EC has a maximum term of 4 months to do so. The rationale for the delay can be explained as follows. When the draft permit was submitted to the EC, the EC required additional documents and asked approximately 50 questions on the content of the permit and all associated documents (approximately 1000 pages). According to the EC, the 4 month term only actually starts once any additional documents have been submitted, and the EC has all the required information. If you exclude the communication period from the process, the EC actually drafted its opinion within the 4 months period. Furthermore, it was the first storage permit in its kind that was sent to the EC, and is a good precedent for the timeliness of the process.

On the other hand, there are a number of other lessons learnt regarding the permitting process, where time was gained due to the fact that:

- TAQA and ROAD have had several informative meetings with the civil servants and their advisors that were preparing the draft permit. In this way, TAQA/ROAD could already explain the approach or adjust the application. This resulted in a very short period between the application being submitted and the date on which the draft permit was granted. The civil servants and their advisors knew the content of the application and their questions were answered before the application was submitted.
- As soon as the permit application was filed by TAQA, the competent authority published the application. In the Netherlands the CCS Directive requirement of "*Member States shall ensure that the procedures for the granting of storage permits are open to all entities possessing*"[8] is elaborated in the requirement that the government must publish the permit application in order to enable possible other interested party to apply also for the same storage permit. Competitors have a 91-days term in which they can file an application. The competent authority immediately published the permit application of TAQA and did not wait before the draft permit was ready. This led to a time advantage.
- The public consultation period and the EC opinion period started at the same time. Although the EC made several remarks on this aspect, the EC preferred to give its opinion after all national procedures were finished. This resulted in the public consultation period and the EC opinion period coinciding, leading to a time advantage of approximately 5 months.

This permit may assist other projects to understand the way in which the ROAD project agreed the process with the Dutch competent authority and the EC. In ROAD's opinion, the permitting process in the CCS Directive is not that realistic for a project, because the Directive requires that all the required plans (i.e. monitoring, corrective measures, etc.) are fully ready at the moment a project submits its application. In reality, developing all the studies, collecting all necessary information, and issuing reports will only be completed after a FID is taken, and in order to take an FID, a granted storage permit is necessary.

To overcome this issue, TAQA and ROAD came up with the following solution: lower the level of details of all plans (i.e. monitoring, corrective measures, financial security etc.) in the application and update these plans prior to injections. The plans (not operational yet) in the permit application

[8] Article 6 sub 2 Directive 2009/31/EC.

provide sufficient information and prove that CO_2 can safely be stored, complying with the CCS Directive requirements, but do not include operational parameters, choices for specific monitoring instruments, etc. These will be elaborated in the final plans.

At this time, the competent authorities and the EC have stated that they are content with the current levels of detail and granted the permit. The EC concluded in its opinion that the application "*..confirms the suitability of the chosen storage location for the permanent storage of CO2 as was demonstrated by a detailed characterization and assessment of the storage site and complex*".[9]

It has been agreed that the final plans will be submitted to the competent authority and the EC a year before the injection of CO_2 starts. The competent authorities must give their approval on the final plans and before adjusting the permit Sodm and TNO (state advisors) will give their expert advice. Also the EC will be enabled in 2014 to give another non-legally binding opinion on the update of the storage permit, when all of the plans have been elaborated.

4.3 Storage complex and storage site

Following the information given in the CCS Directive, definitions are made for the storage site and for the storage complex. The storage site is a specified volume within a geological formation that is used for the geological storage of CO_2 and includes wells penetrating such volume. The storage complex includes the storage site and all the surrounding geological volumes that act as barriers to migration (out of the storage site) or leakage (out of the storage complex).[10]

These definitions are not that easy to apply on a concrete reservoir or aquifer. However, defining the site and complex are very relevant because it has important consequences. According to the CCS Directive, corrective measures must be taken in the occurrence of leakage and significant irregularities. 'Leakage' is defined as "*any release of CO2 from the storage complex*".[11]

After many discussions with the competent authorities, their advisors and also with the EC, the site and complex are defined as:

The storage site consists of:

- the geological formation, in this case the P18-4 reservoir which is made up of the Hardegsen, Upper Detfurth, Lower Detfurth, and Volpriehausen rock layers. The reservoir is bordered by faults on all sides;
- the injection well to the well head; and
- the injection facility (in this case the well head located on the P18-A platform) the control valve and the measurements on the well.

[9] Commission Opinion of 28.2.2012 relating to the draft permit for the permanent storage of carbon dioxide in block sectionP18-4 of block section P18a of the Dutch continental shelf, in accordance with Article 10(1) of Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide.
[10] Article 3(6) CCS Directive.
[11] Article 3(5) CCS Directive.

The storage complex consists of:

- the storage site;
- all geological layers above the storage reservoir up to the base of the Chalk Group, consisting of the Upper Germanic Triassic Group, Altena Group, Schieland Group, Rijnland Group, and aquifer intervals Rijn/Rijswijk sandstone, Holland Greensand, and Texel Greensand;
- the formations below the storage reservoir, consisting of Rogenstein and Main Claystone;
- the fault zones around reservoir P18-4; and
- the P15-9 reservoir, from which the P18-4 storage reservoir is separated by a fault zone.

However, it is clear that if CO_2 migrates out of the reservoir (out of the storage site) into the complex, ROAD would need to scale up its monitoring. The permit is granted for storing CO_2 in the site, not in the complex. Migration of CO_2 out of the storage site could also have important consequences for the public acceptance, while the public most likely would see this migration as leakage. But according to the law, only corrective measures need to be taken in case of leakage or significant irregularities, meaning CO_2 leaking out of the complex.

Therefore, a width definition of the storage complex is preferable, especially for projects storing CO_2 in aquifers.

Another interesting issue regarding the definitions of 'storage complex' and 'leakage' concerns the surrender of EUAs. According to the EU Emissions Trading System (ETS)Directive[12] in the occurrence of any CO_2 leakage the permit holder would need to purchase CO_2 allowances equivalent to the volume of escaped CO_2. However, this definition of 'leakage' is not the same as the definition for 'leakage' in the CCS Directive: where only EUAs must be purchased in case the CO_2 leaks to the atmosphere (to the surface). No EUAs need to be purchased in case where the CO_2 leaks out of the storage complex, but remains trapped under the ground. In P18-4, CO_2 will be stored at a depth of 3.5 kilometers and it is very unlikely that CO_2 would leak to the atmosphere in case CO_2 leaks out of the reservoir.

This does not mean that there are no other issues regarding the definitions of 'storage complex' and 'leakage'. It is especially difficult to monitor the amount of leaked CO_2 and how it can be proved that the CO_2 remains under the surface (CO_2 that leaks out of the storage complex will most likely be trapped in other formations underground). The monitoring plan addresses these issues. Furthermore, the risk of large scale leakage of CO_2 has to be part of the Corrective Measure Plan.

4.4 Financial Security

Article 19 of the CCS Directive requires that the operator applying for a storage permit must present proof that adequate Financial Security will be valid and effective before commencement of the injection. In essence, it obliges the Member States to only award permits if the operator proves that it is able to finance the storage operation and in the future will be able to maintain it, pay for closure

and will be able to finance corrective measures. If there is an incident during operation, the competent authority might use the financial security to fulfil the necessary obligations and it will use the security in case of corrective measures and premature closure. Member States are to ensure that in the application for a storage permit the operator proves that he is able to fulfil all financial obligations, which actually have to be in place before injection starts.

However, the CCS Directive does not require that the Financial Security be valid and effective at the time the permit application is submitted, only that it must be valid and effective before commencement of injection. The question that ROAD had to ask was to what extent the applicant needs to provide proof in the permit application that the financial security will be "valid and effective" in time.

On this topic, ROAD faced the incongruity between the requirements of the CCS Directive and the “normal” practice for a demonstration project.

Another important question that ROAD faced was, how can one prove during the application process (which is in the case of the ROAD project 4 years prior to injection) that one (the permit holder) is able to surrender a valid and effective financial security in time?

TAQA and ROAD had almost ten meetings with the competent authorities and the EC, after which all involved parties agreed that when the financial security is given (in 2014), the competent authority needs to officially give its approval and that the EC will be given the opportunity to give their non-legally binding opinion.

Regarding the storage permit application, ROAD felt that three aspects need to be elaborated:

1. According to the requirements of Article 19 of the CCS Directive, the financial security must ensure that all obligations arising under the storage permit, including closure and post-closure requirements, can be met. The question is what are these obligations and which activities must be included in the financial security?
2. What is an adequate calculation method for the amount of security which results in a good estimated amount of Financial Security? For example, how do you estimate the costs for handover EUAs in case of leakage? What are the costs for the monitoring instruments in 2017?
3. The CCS Directive and Guidance Documents describe several financial instruments that can be used to provide the Financial Security. The CCS Directive only states that a “financial security or any other equivalent” will be established. The Guidance Documents give a (non-limiting) summary of financial instruments to cover the financial security, for example: balance sheet, parental guarantee, funds, insurance, or bank guarantee. But which instrument(s) would be acceptable for the Competent Authority?

To clarify these questions ROAD broke them down the three sections.

4.4.1 Activities in the financial security

According to the requirements of Article 19 of the CCS Directive, the financial security must ensure that all obligations arising under the storage permit, including closure and post-closure requirements, can be met. The question is what are these obligations and which activities must be included in the financial security?

ROAD mapped all of the activities and contingency activities they could think of. ROAD then assessed this list with key questions, which included:

- if the operator goes bankrupt, which activities are essential to complete the project under current conditions or abandon the project, and how much would it cost the competent authority if it would need to take over the project? ROAD concluded that the most important activities are:

- Monitoring
- Contingency monitoring
- Abandonment
- Financial contribution
- EUAs in case of leakage

(Please note that the corrective measure plan is included in this summary.)

For the ROAD project, the contingency monitoring will impose the highest costs for the corrective measures plan. Therefore, the costs for contingency monitoring are in fact the costs for the corrective measures plan.

After agreeing on which activities should be included in the financial security, ROAD assessed these activities further and thought about the costs for every activity.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10 - 29
Monitoring	12	10	9	8	7	6	5	4	3	0,1
Contingency monitoring	10	10	10	10	10	10	10	10	10	10
Abandonment	15,5	15,5	15,5	15,5	15,5	15,5	15,5	15,5	15,5	0
FC	2	2	2	2	2	2	2	2	2	2
EU-ETS	0	1	2	3	4	5	6	7	8	8
Sub Total	***47***	***46***	***46***	***46***	***46***	***46***	***46***	***46***	***46***	***39,5***
Contingency 20%	9,4	9,2	9,2	9,2	9,2	9,2	9,2	9,2	9,2	7,9
Total	**56,4**	**55,2**	**55,2**	**55,2**	**55,2**	**55,2**	**55,2**	**55,2**	**55,2**	**47,4**

Figure 4: Overview financial security ROAD project

4.4.2 Calculation of financial security

What is an adequate calculation method for the amount of security which results in a good estimated amount of Financial Security? For example, how do you estimate the costs for handover EUAs in case of leakage? What are the costs for the monitoring instruments in 2017?

4.4.2.1 Monitoring: Market quotes from Service Company Schlumberger were used as the basis of the monitoring costs.

4.4.2.2 Contingency monitoring: The most expensive identified potential monitoring activity (i.e. 3D time/lapse seismic survey) in case of irregularities has been included as contingency monitoring. The estimated cost is based on market quotes (Service Company Schlumberger) and historical values/experiences.

Corrective measures: The corrective measures plan include the most expensive corrective measure, being a well repair, which is estimated at its worst case on the cost level of a full well work over.

4.4.2.3 Well abandonment P18-4A2: The abandonment costs include abandonment of the well and not the platform. Well abandonment has been estimated based upon the well work over and abandonment study performed by the company Well Engineering Partners (WEP).

Removing injection facilities (i.e. P18A platform): The costs for the platform abandonment are based on market information.

Well abandonment / CO_2 proof work over of wells in P15-9: Incremental cost of CO_2 proof abandonment of the wells in P15-9 with respect to standard abandonment of the wells in P15-9 reservoir, costs were estimated by market quotes.

4.4.2.4 Financial contribution: The financial contribution allows for the Competent Authority to monitor the sea bed on a five yearly basis for CO_2 leaks for a period of 30 years. This will be done by multi- beam echo sounding to see if there are any pockmarks and if these pockmarks are there due to CO_2 leakage (in the next paragraph, the financial contribution is elaborated).

4.4.2.5 EUAs: ETS credit financial security is based on taking 3 months of leakage when the reservoir is full (year 9) at 63 kg/s. The 3 months was determined as worst case before the well can be killed. The total leakage in year 9 could be 0.50 Mton @ 16 €/ton this is the financial security of 8.0 M€ in year 9. The financial security for this item builds up linear towards this value.

The total amount of CO_2 stored in the period 2015-2020 is in the range of 4 Mton CO_2. This CO_2 will be permanently stored in the P18-4 reservoir. All the risks for potential leakage have been identified and all possible measures will be taken to prevent leakage. The injection of CO_2 will be constantly monitored and also after the abandonment of the well, monitoring will continue. A corrective measures plan is being developed to ensure that in case of a leakage sufficient measures can be taken to prevent further leakage. However, if CO_2 at any time would leak out of the reservoir and reach the atmosphere (for example due to a blowout) the emission permit holder (i.e. TAQA) must surrender EU-ETS allowances for the amount of CO_2 that has leaked.

With a view to the storage permit application, ROAD needed to prove that the reservoir is sealed and, but if CO_2 did happened to leak, what the most likely leakage pathways are. ROAD also needed to calculate the amount of CO_2 that could leak to the atmosphere in case of a leakage. Furthermore, the permit holder needs to handover a financial security that also covers the value of the EU-ETS allowances that is equivalent to the amount of CO_2 that could leak. ROAD has already taken the financial risks into account that ROAD is going to suffer in case of a leakage, and the risk is set out below:

Risk = (1) amount of CO_2 x (2) allowance price

The uncertainty for ROAD mainly lies in (2) the allowance price, while ROAD has a pretty good estimation of the maximum amount of CO2 that could leak to the atmosphere in case of a leakage. A sufficient and well thought corrective measure plan has been developed and ROAD is confident that in case of a leakage, ROAD can take sufficient corrective measures to stop the leakage.

ROAD considered one of the most serious risks to be the price of an EU-ETS allowance;

- Since the EU-ETS allowances must be handed over in the year that the leakage occurs, ROAD would need to pay the price at that time (this risk can to some extent be covered by banking). For example, if a leakage occurs in 2022, ROAD is obligated to pay the price in that year.
- At this time, almost everybody agrees that the price will increase, but nobody knows how high the price will rise. Estimations differ from 15 euro in 2020 to 140 euro in 2020. Furthermore, ROAD remains liable for leakage after the well and platform have been abandoned until the responsibilities are handed over to the competent authority. According to the CCS.
- Directive, this could even take 20 years after the stop of injection. Under certain conditions, ROAD could even be liable for leakage after the handover of responsibilities. The extended period of liability increases the risk of high costs in case of leakage.
- The biggest concern is that an accurate estimation of the development of the EU-ETS price is not possible, but the amount of CO_2 that could leak will remain the same over time. To further illustrate this point: the EU Commission writes in its Guidance Document 4 on the Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide regarding Article 19 Financial Security and Article 20 Financial Mechanism[13]: "There is unavoidable uncertainty about the future price of EU Allowances (EUA) at the time of any potential leakage. There is no cap on the EUA prices; the penalty for excess emission (100 Euros per tonne) does not relieve the operator of the need to provide allowances to cover the emissions, and is not therefore a cap on EUA prices."

[13] The purpose of the *Guidance Document nr 4* was to guide Member States to "strike the right balance between full coverage of obligations as required under Article 19 while at the same time not overpricing the risks in relation to these obligations for early movers." The 'unavoidable uncertainty' can be dealt with by competent authorities because article 19 requires that the Financial Security should be periodically adjusted. Competent authorities can therefore avoid making long-term estimates of future EUA prices. In fact, the first known official example of such Financial Security (the draft Taqa storage permit), states that "the permit award system is such that the security to be provided for the first five years following the start of injection is determined in the permit. The financial security will be revised and adjusted five years following the permit award and subsequently every five years thereafter." This however does not create more certainties for project initiators for the entire project.

- Finally, it must be noted that the financial security must be adjusted yearly. This means that raises or declines in the EU-ETS price have effect on the amount of financial security over time.

4.4.3 Instruments for financial security

The CCS Directive and Guidance Documents describe several financial instruments that can be used to provide the Financial Security. The CCS Directive only states that a "financial security or any other equivalent" will be established. The Guidance Documents give a (non-limited) summary of financial instruments to cover the financial security, for example: balance sheet, parental guarantee, funds, insurance, or bank guarantee. But which instrument(s) would be acceptable for the Competent Authority?

Regarding the financial instrument, ROAD described in the storage permit application several financial instruments that could be used to provide the financial security. ROAD elaborated one specific instrument that proves that a valid and effective financial security can be given before injection. The balance sheet of the operator is strong and can easily cover the financial security as assessed in the storage permit application. The permit conditions secure that injection can only start if the Competent Authority is satisfied with the financial security in 2014, (according to the draft storage permit):

- Operator sets financial security preferably by bank guarantee or escrow;
- Minister approves the financial security instrument selected by operator;
- Operator sets financial security 3 months before start of injection;
- At this moment the Dutch Government accepts a balance sheet, but prefers a bank or parental guarantee. This is also explicitly noted in the storage permit.

ROAD successfully argued that a bank guarantee (that will impose higher costs than for example a balance sheet or parental guarantee) must not be demanded by the competent authority. ROAD consulted several banks and they stated that under the current conditions (amount financial security, permit conditions, etc.) they all would be prepared to provide a bank guarantee in 2014. After discussions with the EC, ROAD provided a letter of intent of one Dutch bank. ROAD proved that it most likely would be able to handover a bank guarantee in 2014, if this was demanded by the competent authority.

With a view to a bank guarantee, ROAD argued that invoking the financial security in case the operator does not comply with the permit conditions, the costs always first needs to be paid by the operator itself (a bank guarantee can only be invoked after the company can't pay the bill). This means, given the financial security amount and the strong balance of the operator, that a bank guarantee will give no/minimal additional security for the competent authority. A bank guarantee is accompanied by a parental guarantee. Only in the case where the operator goes bankrupt would a bank guarantee provide extra security for the competent authority.

Therefore, a bank guarantee does not provided the needed extra security above a parental guarantee and only increases the costs of the project; however, if the balance of the operator

dramatically weakens in the coming years a bank guarantee could be demanded by the competent authority.

4.5 Financial Mechanism

According to Article 20 of the CCS Directive, Member States shall ensure that the operator makes a financial contribution available to the competent authority before the transfer of responsibilities to the competent authority takes place. The contribution should cover at least the anticipated cost of monitoring for a period of 30 years, but it also "may be used to cover the costs borne by the competent authority after the transfer of responsibility to ensure that the CO_2 is completely and permanently contained in geological storage sites after the transfer of responsibility".[14]

In theory, this means that the competent authority can demand a financial contribution that is almost unlimited, while the competent authority will be forever responsible after the handover. ROAD discussed this many times with the competent authority and concluded that if the Government would demand a high financial contribution, there is actually no handover. While the competent authority is technically responsible, the former operator will pay the bill. In the opinion of ROAD, the financial contribution should only include costs that the competent authority will certainly have after handover (so no contingency costs), i.e. monitoring.

There are several strict requirements for the handover, and only if these are fully met, then can the handover can take place. All available evidence must indicate that the stored CO_2 will be completely and permanently contained, the abandonment plan was fulfilled according strict regulation. The risk that after handover CO_2 would leak is by all these measures and requirement kept to an absolutely minimum.

Therefore, the Dutch competent authority also concluded that with regarding to the financial contribution:

- It only includes monitoring after the handover for a period limited to 30 years. Only the monitoring instruments will be used as described in the monitoring plan after the well has been abandoned.
- Also the frequency of monitoring is included in the monitoring plan. This means that once in the five years a subsea bed inspection will take place. ROAD requested several market orders for this 30 years of monitoring. On basis of these orders, a provisional amount of EUR 2M will be included in the financial security.
- No contribution will be charged for other possible costs after handover (for example in case of leakage).

[14] Article 20 CCS Directive.

4.6 Transfer of responsibilities

Article 18 of the CCS Directive states that when a storage site has been closed, the responsibility for all legal obligations can be transferred to the competent authority of the Member State, subject to several conditions:

a. all available evidence indicates that the stored CO_2 will be completely and permanently contained;
b. a minimum period after closure, to be determined by the competent authority has elapsed. This minimum period shall be no shorter than 20 years, unless the competent authority is convinced that the first condition above is fulfilled;
c. the financial obligations under the financial mechanism have been fulfilled; and
d. the site has been sealed and the injection facilities have been removed.[15]

In ROAD's opinion, clarity on the transfer of the responsibilities to the competent authority is one of the crucial issues that at this moment still has not solved. The main concern of the ROAD project is in which way and under which conditions the minimum period of 20 years can be reduced. There are no technical or safety arguments why a minimum period would have to lapse. The greatest risk of leakage is during injection (although this risk is less than negligible, particularly for a reservoir that is only partly repressurised), when the well is open. After the well has been abandoned and the CO-proof sealing has been successfully carried out, and during injection no leakages occurred, future leakages are as good as ruled out. The minimum period was a political compromise, not based on any scientific substantiation.

A period of 20 years after injection is very costly. Costs for monitoring, financial security, insurances for liabilities will continue while there is no additional income. Furthermore, a minimum period creates a great uncertainty for the ROAD project. The transfer could be postponed in theory infinitely.

The CCS Directive created a possibility to reduce the minimum period of 20 years, if all available evidence indicates that the stored CO_2 will be completely and permanently contained, this minimum period can be reduced. At this time, the key questions ROAD still haves include:

- Which evidence is taken into account?
- What if the competent authority is not convinced, although all available evidence indicates that the stored CO_2 will be completely and permanently contained, for example due to leakage in another CCS project (what if for example in Canada stored CO_2 would leak and the Dutch public/politics get worried?)?
- Who is going to assess this evidence?

The first two questions are to the main concerns of ROAD. The CCS Directive and Guidance Documents to support coherent implementation of the CCS Directive across the EU Member States,

[15] Article 18 CCS Directive.

give clarity to some extent on the first question[16]. At least the following three items noted must be taken into account as evidence that the stored CO_2 will be completely and permanently contained:

1. **The conformity of the actual behaviour of the injected CO_2 with the modelled behaviour;**
   It is important to recognise that assessing the conformity of models for geological storage for regulatory purposes is an emerging area of practice. Hence, learning by doing is a key part of this process, and it is difficult at this stage to provide detailed standards which will be possible only if there is operating history and experience to use as a benchmark.

2. **The absence of any detectable leakage;**
   A key aspect of containment is that there are no detectable leaks from the storage complex, including leakage through geological or man-made structure. There should be no observed leakages from any existing or abandoned wells. This may be assessed by the operator demonstrating that the there are no leakages for a continuous 10 year period immediately before the time of transfer. If a successful corrective measure has taken place (as result of leakage), the 'clock' for the ten year time period would start over from the point in time when the corrective measure has been proven successful. This would allow the competent authority to have sufficient confidence that the site would not leak again.
3. **That the storage site is evolving towards a situation of long-term stability.**
   Monitoring instruments that could be suitable to prove the evolvement towards a situation of long-term stability are:
   a. *Pressure within the storage complex;*
   b. *Movement of the plume;*
   c. *Geochemical changes in the storage complex and the wells; and*
   d. *Samples of cap rock for testing integrity should be done using side-core samples, where the characteristics of injected fluids pose unusually high risks for the cap rock integrity.*
   e. *Integrity of materials used to construct or abandon the wells.*

Due to the long term nature of CCS, it is expected that technologies and techniques will have changed by the time the transfer of responsibilities becomes relevant. As of now, the regulation on the transfer of responsibility is not detailed enough.

All of this is decided upon by the competent authority and ROAD is concerned that the decisions that are made will change over time and under political pressure. The CCS Directive only gives directions on the issues to include in permits and it was anticipated that national legislation would provide details. As Dutch legislation is not more specific there is a gap, which gives project initiatives the opportunity to use the freedom and come up with their own solutions, but the disadvantage is the uncertainty the project will face in the future. Taking into account good industry practices, careful monitoring and inspection, the transfer condition could be met relatively easily. However, in case of unforeseen circumstances, it could take a lot longer than 20 years before this condition could be

[16] GD 3 Criteria for Transfer of Responsibility to the Competent Authority, p.3.

met, which would leave an operator (and therefore the entire CCS project) with a large amount of 'unavoidable uncertainty' on the EUA price.

ROAD tried to reduce these risks in the storage permit, as the storage permit application included a plan for abandonment and post abandonment. ROAD described this process, including a timeline, which was accepted by the competent authority, meaning that ROAD will continue monitoring activities for a period of 1 to 2 years after the stop of injection and will close and seal the well. After the abandonment monitoring is almost impossible (only some sub seabed inspections are possible while no monitoring is possible in the well or reservoir after abandonment). If after abandonment no additional evidence comes up, an assessment of the known data and information of the injection process should be sufficient. The well can only be abandoned if the competent authority is confident that the stored CO_2 will be completely and permanently contained. This should lead to the conclusion that after abandonment (and the inspections of the abandonment are positive), all available evidence indicates that the stored CO_2 will be completely and permanently contained and therefore handover can be established. Otherwise, the competent authority would not be able to give approval for abandonment of the well.

However, this still does not lead to sufficient certainty. In ROAD´s opinion, the CCS Directive still leaves to much room for Member States to reject permits based on the handover criteria even if all evidence indicates that the stored CO_2 will be completely and permanently contained. Also the competent authority could simply reject the abandonment request in order to keep the well and the monitoring possibilities open. This creates unlimited liabilities and gives no certainty that the transfer of responsibilities will be established overtime. Therefore, discussions with the Dutch competent authority continue. But at this moment, no additional regulation or an agreement has been agreed upon.

4.7 Legal liabilities

There are four different legal regimes under which liability may arise for storing CO_2:

5. EU-ETS; operator is liable for damage to the climate in case of the release of CO_2;
6. Environmental Liability Directive; operator is liable for damage to the environment;
7. Civil liability; operator is liable for damage to third parties (damage to persons and/or goods);
8. CCS Directive; operator is liable to the competent authority in case it does not undertake sufficient monitoring and corrective measures in case of leakage.

Please note that the first three regimes are also applicable on capture and transport, but this case study only addresses the storage permit, therefore only the liabilities for storing CO_2 are addressed below.

4.7.1 EU-ETS

The operator is liable for damage to the climate in case of the release of CO_2 out of the storage complex into the atmosphere. In case of leakage, the operator must purchase EUAs on an equivalent

tons basis of the leakage and surrender these EUAs. As already discussed under '**4.4.2.5 EUAs'**, these EUAs are included in the financial security that the operator provides to the competent authority and the biggest risk for an operator is the unpredictability of the price of an EUA.

4.7.2 Environmental Liability Directive

Liability for environmental damage, or the imminent threat thereof, is regulated by the Environmental Liability Directive[17]. Regarding CO_2 storage (because it is listed in Annex III of the Directive) strict liability applies on (i) damage to protected species or natural habitats under the Birds and Habitats Directives, (ii) water damage in the wording of the Water Framework Directive, and (iii) soil. Strict liability means that liability immediately imminent when the damage occurs, irrespective of the question whose fault it was. This means that if there is a significant adverse change to protected species, natural habitats, water or soil as a result of CO_2 storage, the operator is liable for the costs of the repair.

For activities not listed in Annex III of the Directive, the liability of the operator is more limited. The operator is only liable for damage to protected species and natural habitats if the damage occurred due faults or negligence of the operator.

If there is environmental damage or an imminent threat thereof, the operator shall immediately take the necessary preventive or corrective measures. The operator shall bear the costs of these measures. If the operator takes no action, the competent authority shall take measures itself or entrust the implementation thereof to third parties, and recover the costs from the operator.[18]

In principle, the operator can only be held liable until the transfer of responsibilities to the competent authority. However, if damage is done after the transfer of responsibilities and this damage is caused by negligent of the operator, the operator is liable even after the transfer.

Although this environmental liability is pretty strict, this does not result in high additional risks for CCS projects in ROAD's opinion. But even more important, if there even would be environmental damage, the highest costs for an operator will probably be related to the corrective measures (and contingency monitoring). These requirements and relating costs are however already covered by the CCS Directive. For example, if CO_2 would leak through the cement of a well and causes damage to the environment, according to the environmental legislation the leakage must be stopped and a well makeover will probably be needed. In case of leakage the CCS-D is in compliance with the Dutch environmental legislation. ROAD does not assess the environmental liability as an additional liability above the liability under the CCS Directive.

4.7.3. Civil liability

The CCS Directive introduced a number of obligations for the storage holder and also amended the EU ETS Directive and the Environmental Liability Directive. The CCS Directive explicitly states that liabilities other than those covered by the EU ETS Directive and the Environmental Liability Directive,

[17] Directive 2004/35/EC.
[18] Article 16 CCS Directive.

in particular concerning the injection phase, the closure of the storage site and the period after transfer of legal obligations to the competent authority, should be dealt with at national level[19].

In ROAD's opinion, this statement in the Directive refers to civil liability. Therefore, the civil liability for CO_2 storage must be regulated by the Member State (Netherlands) itself. While this regulation can and probably will differ in every Member State, a brief summary of the Dutch regulation is given below.

Civil liability (in general, not specific for CCS) is regulated in the Dutch Civil Code ('Het Burgerlijk Wetboek' BW). The Civil Code applies in principle only on Dutch territory and not in the exclusive economic zone or on the Dutch continental shelf. However, the Civil Code does apply where the damage occurs. In the event of leakage, damage may occur almost exclusively on Dutch territory, the BW regime is applicable on the CO_2storage of the ROAD project.

The BW has a general basis for accepting liability in the form of 'tort' (Article 6:162 BW). This article is in principle applicable on any wrongful act or omission that causes damage to a person and/or its goods. The article gives the following five conditions that must be met:[20]

1. unlawful conduct (act or omission).
2. attribution of the act to the perpetrator;
3. there must be damage;
4. causal link between the act and the damage; and
5. relativity.

Whether, and to what extent, the operator can be held liable is highly dependent on the specific circumstances of each case. Questions around whether it was foreseeable that harm could occur, whether the operator has failed to take adequate safety measures, and whether sufficient warning against possible risks, all play an important role in the assessment of the operator's liability.

The Dutch Civil Act (BW) gives also several liability provisions specific for mining activities, with provisions for mining infrastructure, hazardous substances, landfill, gas storage operator, etc.

An extensive assessment of this Dutch regulations can be obtained from the ROAD project, but for now it is sufficient to conclude that the civil liability provisions in the form of 'tort' and the qualitative mining liabilities are almost all applicable on CO_2 storage. The Dutch government announced that it will assess whether these regulations are sufficient for CO_2 storage or that additional regulation is required, and the Dutch Ministry of Justice is currently working on an amendment to the Civil Code and the ROAD project is awaiting the outcome.

4.7.4 CCS Directive

The CCS Directive introduced several obligations for the storage operator - such as the monitoring, risk management and corrective action plan. The Directive states that if the operator fails to

[19] CCS Directive, preamble recital 34.
[20] Article 6:162 Burgerlijk Wetboek

undertake sufficient monitoring or, for example, does not take the required corrective measures in case of a leakage, then the competent authority must make sure that additional requirements or measures are taken[21]. The CCS Directive requires the competent authority in such cases to recover all of the costs from these actions from the storage operator, with the possibility of using the financial security.

Therefore, the operator can be held liable by the competent authority or non-fulfillment of the obligations under the storage permit.

5. Conclusions

Getting a CCS project permitted is a long and difficult process, especially because of the storage permitting obligations. The regulations on a storage permit (the CCS Directive, Guidance Documents) are new and these leave room for interpretations. In total the storage permitting process took almost two years for the ROAD project. ROAD was fortunate to have Dutch competent authorities that supported the demonstration project to the fullest. While this may not be the case for other projects, hopefully this report gives some lessons learnt and concrete examples on how to approach some of the key issues arising from the CCS Directive.

The outcome of the storage permitting process seems to be one of the most important factors for CCS projects. In particular, the requirements regarding the financial security and financial mechanism, for example, could be key reasons for an organization to stop its involvement in a project.

Several conclusive remarks form the ROAD project:

The way in which a project is organized is very relevant for the storage permitting application. Establish a separate storage permit team that combines all different disciplines and represents one contact for the competent authorities and other important stakeholders.

Obtaining a shared and workable definition of storage complex and storage site are of great relevance for process, as is the definition of leakage.

Undertaking detailed analyse of the key issues arising from legislation will be of the utmost importance. Most important aspects that should be covered in depth are:

- Financial Security
- Financial Mechanism
- Transfer of responsibilities

This case study is drafted by the ROAD-project and therefore it only represents the views and opinions of the ROAD joint-venture parties.

[21] CCS Directive Article 16, paragraph 3 and 4 CCS Directive.

The European CCS Demonstration Project Network was established in 2009 by the European Commission to accelerate the deployment of safe, large-scale and commercially viable CCS projects. To achieve this goal, this community of leading demonstration projects is committed to sharing knowledge and experiences. The successful deployment of this key technology will allow Europe to reach its environmental objectives, stimulate job creation, and generate a sustainable economic and industrial base.

Network support provided by: