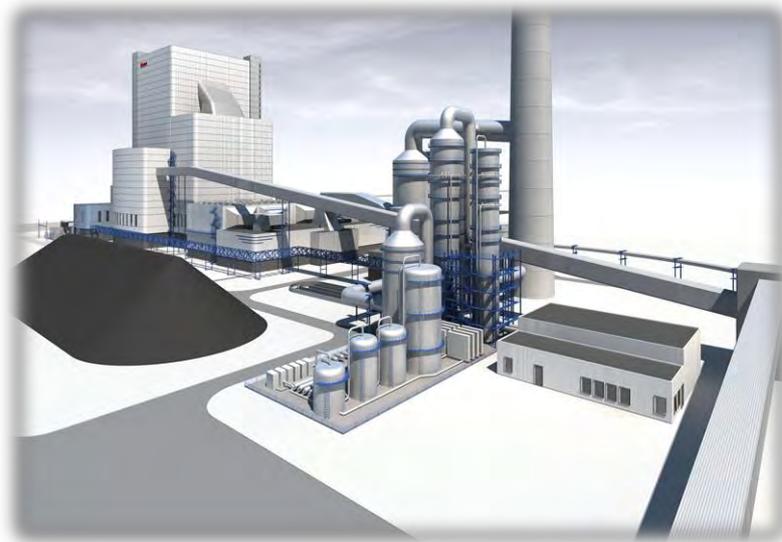


Project Execution Strategy

ROAD

Special Report for the Global Carbon Capture and Storage Institute



ROAD | Maasvlakte CCS Project C.V.

March 2012

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Project Execution Strategy ROAD
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Table of Contents

Executive Summary	1
1. Introduction	2
2. Project Factsheet	3
2.1 Project Overview	3
2.2 Maasvlakte CCS Project C.V.	6
2.3 Intended Partners	7
2.4 Financial contributors	7
3. Project Organisational Structure.....	8
4. Project Schedules.....	11
5. Key Implementation Issues	15
5.1 Environmental Impact Assessment	15
5.2 Permitting	16
5.3 Environmental management	19
5.4 Management of health and safety	20
5.5 Contracting	21
5.6 Finance	26
5.7 Stakeholder Consultation	29
6. Risk Mitigation.....	34
6.1 Risk Identification and Mitigation	34
6.2 Risk mitigation during construction phase	36
6.3 Financial impact of risk mitigation over time	37
7. Conclusions and lessons learnt	39
Abbreviations and references	41
Abbreviations	41
References	41

Executive Summary

As the project approaches the key milestone of a decision on investment from its parent companies, this report aims to outline the future path of the project. An overview of upcoming milestones and a discussion on relevant activities and the project execution strategy is provided.

Following the Final Investment Decisions (FID), two consecutive organisations will be formed, the first focusing on design and construction up until 2015, whilst the second will focus on operation of the project between 2015 and 2020. The project employs skills of specialists from across both parent companies and also strategic partners will play a role throughout the development and operational phases of the project.

The project schedule is driven by both the MPP3 construction schedule and cost optimisation. In order to avoid MPP3 outage penalties, the tie-in works have to be executed on-track. ROAD focuses on cost optimisation and controlling. Both drivers led to the specific construction plan and the clustering of heavy lift components. The heavy lifting activities of large vessels and main compressor are on the critical path. Thanks to the clustering of heavy lift components the cost and project schedule can be squeezed significantly. After the lifting and placement of these major components the capture plant can be assembled. In a second phase the transport and storage works will become the major point of attention.

From execution of the Front-end Engineering and Design (FEED) stage, a much more detailed state of engineering allowed ROAD to reduce uncertainties. The execution phase risks for construction, finance, scheduling, stakeholder engagement and permitting are addressed in this report. The risk mitigation actions progressively decreased the project contingencies. These contingencies represent the exposure due to volatile market prices, state of engineering detail, planning uncertainties and other issues. The FEED study reduced the total CAPEX contingency from 25% (pre-FEED) to 10% (post-FEED) of total CAPEX. The remaining key risks for the construction phase are the interfaces with MPP3, the timely signed EPC contract for the construction of the capture plant, and the CAPEX risk and commercial negotiations for the transport and storage chain. Furthermore, permitting and stakeholder management are points of attention. Objections or appeal on published permits from NGO's or local organisations could result in scheduling issues.

The project budget is governed by the company's organisational structure, with a budget split between Project Office and Governance, Stakeholder Management, Capture and, lastly, Transport and Storage. Budget is split over the life of the project into two phases; the design and construction phase (2010-2014) and the operational phase (2015-2019). Following the operational period, provisions have been made for plant decommissioning, and monitoring of the storage site.

In ROADs probabilistic models the scheduling risk of FID postponement can also be visualised taking into account the probability of risks and defined mitigation actions.

Please note that this report only highlights the key aspects of ROAD's execution strategy.

1. Introduction

In July 2009, Maasvlakte CCS Project C.V. ('MCP') submitted its project proposal to the European Commission, to apply for funding under the framework of the European Energy Programme for Recovery (EPR). This marked the start of the 'ROAD project' ('Rotterdam Opslag en Afvang Demonstratieproject'; Rotterdam Storage and Capture Demonstration project).

Due to its 'first of a kind' nature, the ROAD project poses an array of challenges that can be considered uncommon to other utilities projects. Issues that are both technical and regulatory have been thoroughly assessed and evaluated through the processes established within the project. A project strategy that is rigorous in addressing new and expected challenges is required to establish clear links between a wide range of aspects throughout the project.

This report aims to provide an overview of the project's execution strategy, exploring project fundamentals such as the project's organisational structure and project scheduling, to the project specific aspects that are unique to a 'first of a kind' Carbon Capture and Storage (CCS) demonstration. Areas including knowledge sharing, public engagement, contracting and permitting are covered. An overview of the risk mitigation strategy has also been provided; describing key project actions and decisions taken to remove or mitigate key risks. This report provides insight to the underlying philosophy and reasoning behind important decisions and actions taken by the project in these areas.

The report highlights the key aspects of ROAD's execution strategy. The actual execution plan of the project is more complex as details can be elaborated in much greater level of detail. The entire chain of Carbon, Capture and Storage on an industrial scale reaches the limits of the present-day proven technologies and therefore, the particular experts working on the ROAD project are key to its success.

As the project approaches the key milestone of a decision on investment from its parent companies, this report aims to outline the future path of the project. An overview of upcoming milestones and a discussion on relevant activities is provided, with a focus on how previous experience and project execution will be used to benefit future strategy.

The project's commitment to knowledge sharing and dissemination of important experiences aims to provide a comprehensive overview of the challenges faced by CCS demonstration projects, and how they can be overcome. Therefore, this report will outline key aspects of the project strategy with an explanation of key experiences and lessons learnt.

2. Project Factsheet

2.1 Project Overview

ROAD is the **R**otterdam **O**pslag and **A**fvang **D**emonstratieproject (Rotterdam Capture and Storage Demonstration Project) and is one of the largest integrated Carbon Capture and Storage (CCS) demonstration projects in the world.

2.1.1 Project objectives

The main objective of ROAD is to demonstrate the technical and economic feasibility of a large-scale, integrated CCS-chain. In the power industry, to date, CCS has primarily been applied in small-scale test facilities. Large-scale demonstration projects are needed to show that CCS is an efficient and effective CO₂ abatement technology within the next 5 to 10 years. With the knowledge, experience and innovations developed by projects like ROAD, CCS could be deployed on a larger and broader scale: not only on power plants, but also within energy intensive industries. CCS is one of the transition technologies expected to make a substantial contribution to achieving climate objectives.

2.1.2 Partners

ROAD is a joint project initiated by E.ON Benelux N.V. and Electrabel Nederland N.V. (GDF SUEZ Group). Together they constitute the limited partnership Maasvlakte CCS Project C.V. The intended partners of ROAD are GDF SUEZ E&P Nederland B.V. for the CO₂ transport and TAQA Energy B.V. for the CO₂ injection and permanent storage. The ROAD-project is co-financed by the Government of the Netherlands, the European Commission within the framework of the European Energy Programme for Recovery (EEPR) and the Global CCS Institute.

2.1.3 Project specifications

ROAD applies post combustion technology to capture the CO₂ from the flue gases of a new 1100 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 CO₂ per year. The capture installation is planned to be operational in 2015.

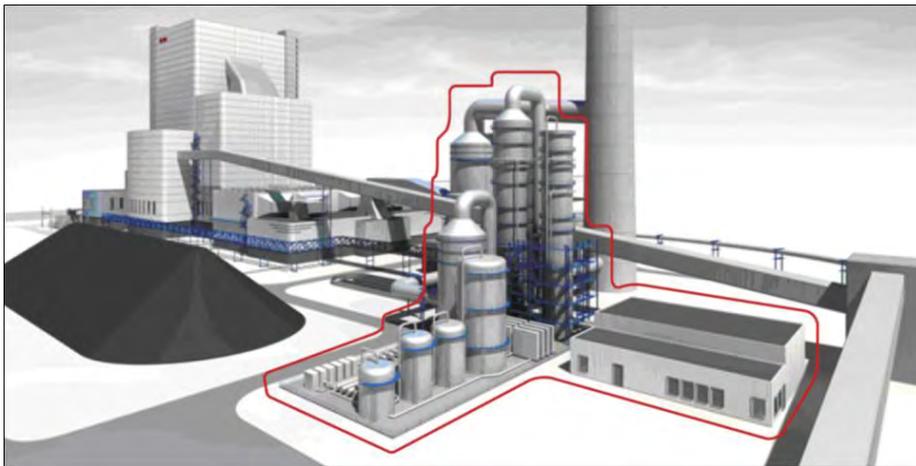


Location of ROAD CCS chain: Rotterdam port and industrial area and North Sea



Location of capture unit: Maasvlakte Power Plant 3 (photo: E.ON)

From the capture unit the CO₂ will be compressed and transported through a pipeline: 5 kilometres over land and 20 kilometres across the seabed to the P18-A platform in the North Sea. The pipeline has a planned transport capacity of 5 million tonnes per year. It is designed for a pressure of 175 bar and a maximum temperature of 80 °C.



250 MWe capture unit (post-combustion)

ROAD plans to store the captured CO₂ in depleted gas reservoirs under the North Sea. These gas reservoirs are located in block P18 (P18-6, P18-4 and P18-2) of the Dutch continental shelf, 20 kilometres off the coast. The depleted gas reservoirs are at a depth of 3500 meters under the seabed of the North Sea. The CO₂ will be injected from the platform into depleted gas reservoirs. The estimated storage capacity is 35 million tonnes.

2.1.4 Rationale for Rotterdam port and industrial area

The Rotterdam port and industrial area has a number of advantages creating favourable conditions to implement a CCS demonstration project like ROAD. The Rotterdam port and industrial area has many CO₂ point sources. Several new power stations prepared for the application of CCS (capture ready) are under construction. It is relatively close to a large number of (almost) depleted gas reservoirs on the continental shelf under the North Sea, allowing a small transport distance. These gas reservoirs meet the physical and geological properties for CO₂ storage and will become available in the next few years (from 2014 onwards). Furthermore, the Netherlands has a lot of knowledge and experience with both oil and gas extraction and storage of gas in aquifers and gas reservoirs. Finally, the complete CCS-chain (e.g. storage) is

remote from inhabited areas. Stakeholders in the direct vicinity of the capture site and the onshore pipeline are other industries. Municipalities neighbouring this part of the port and industrial area are e.g. Westvoorne and Hoek van Holland.



P18-A platform at the North Sea (photo: TAQA)

2.1.5 Facts & Figures

Base installation: E.ON Maasvlakte Power Plant 3 (Rotterdam, The Netherlands)

- Net electrical output : 1069 MWe
- Efficiency : 46.3 % (LHV)
- Operational : 2013
- Capture ready : Carbon Capture Ready Certificate from TUV Nord

Capture Plant

- Technology : Post-combustion
- Solvent : MEA formulation
- Capacity : 250 MWe equivalent
- Capture rate : 90%
- CO₂ captured : Ca. 1.1 megatonnes / year
- Operational : 2015

Transport

- Pipeline
- Diameter : 16 inch
- Distance : 5 km onshore, 20km offshore
- Capacity : Gas phase : 1.5 megatonnes / year
Dense phase : 5 megatonnes / year
- Design specifications : 175 bar, 80 °C

2.3 Intended Partners

Intended partners of Maasvlakte CCS Project C.V. are GDF SUEZ E&P Nederland for the CO₂ transport and TAQA Energy for the CO₂ injection and the permanent storage under the seabed of the North Sea.

TAQA Energy

TAQA Energy is part of the Abu Dhabi National Energy Company PJSC (TAQA), an energy company that has worldwide interests in power generation, combined heat and water, desalination, upstream oil & gas, pipelines, services and structured finance. TAQA has a workforce of 2800 employees and is located in Abu Dhabi, The Hague, Ann Arbor: Michigan, Aberdeen, Calgary and Amsterdam. In addition, TAQA has sustainable partnerships with companies in Africa, the Middle-East, Europe, North-America and India. TAQA is listed at the Abu Dhabi Securities Exchange (ADX).

In the Netherlands, TAQA Energy explores and produces gas and condensates from wells located onshore in the Alkmaar region and offshore in the Dutch North Sea. TAQA also operates a gas storage facility in Alkmaar and has interests in Dutch North Sea pipelines. 200 people work for TAQA directly and indirectly in the Netherlands both onshore and offshore.

GDF SUEZ E&P Nederland

GDF SUEZ E&P Nederland is one of the largest operators in the Dutch sector of the North Sea. With more than thirty production platforms and 300 employees, it is at the basis of the provision of energy to the Netherlands and several other countries.

Since its first successful drilling results in the Dutch North Sea, approximately forty years ago, GDF SUEZ E&P Nederland has grown into a leading operator. It has ample expertise and experience, always chooses the safest option and is continuously working towards the development of new techniques and improved methods. Continuity is ensured through exploration, takeovers and acquisition.

The company has also gained valuable experience through involvement in the K12-B CO₂ storage project. The project aims to investigate the possibilities of CO₂ storage and enhanced gas recovery at the K12-B gas field which is operated by GDF SUEZ E&P Nederland.

2.4 Financial contributors

The ROAD-project is co-financed by the European Commission within the framework of the European Energy Programme for Recovery (EEPR), the Government of the Netherlands and the Global CCS Institute.

In response to the economic crisis, the European Council and the European Parliament adopted the Commission proposal for an EEPR in July 2009. The EEPR funds projects in the field of gas and electricity infrastructure as well as offshore wind energy and CO₂ capture and storage (CCS). In total 12 CCS projects applied for assistance under the EEPR. In December 2009, the European Commission granted financial assistance to six projects that could make substantial progress with project development in 2010. These projects will receive overall funding of € 1 billion under the EEPR.

3. Project Organisational Structure

The Limited Partnership Company, Maasvlakte CCS Project C.V. (MCP) is a joint venture between E.ON Benelux Holding B.V. (EBX) and Electrabel Nederland Project B.V. (EBL), the holding companies of which are E.ON AG and GDF SUEZ, respectively. ROAD is the name of the project executed by MCP. The ownership of MCP shares is 50% by EBX and 50% EBL. The limited partnership company (Commanditaire Vennootschap (C.V.) in Dutch) is a very common form for joint venture structures in the Netherlands. This structure has been chosen because of legal and fiscal transparency.

Given the joint ownership of the project, the MCP board of management is represented by two directors from E.ON and two from GDF SUEZ. The company's four directors are each head of a Project Team which comprise of the project's key focus areas:

- Capture;
- Transport and Storage;
- Stakeholder Management;
- Project Office and Governance.

The current organizational structure is summarized in figure 1. The responsibilities for and within each of the four organizational pillars have been balanced on a 50/50 base between both parent companies. Furthermore the organization revolves around a work package breakdown, subdivided by sub-work packages that are then built up to a projects oriented structure. This work package breakdown has advantages for accounting and reporting purposes in place at MCP.

As an alternative to the current organisation a single project lead structure was analysed but was not selected because of the inherent risk to drift away from the 50/50 balance of the involved parent companies. Following the Final Investment Decision (FID), two organisations will be formed, with the first focusing on design and construction up until 2015, whilst the second will focus on operation of the project between 2015 and 2020. The design and construction organisation has already been established (figure 1). Furthermore a construction manager has been appointed in each of the organisational pillars. The organisation responsible for operation of the project will be established in 2015.

The project aims to employ the skills of specialists from across both parent companies. ROAD sees the employment of people of the parent companies as part of the learning lever. However, strategic partners will also play a role throughout the development and operational phases of the project. These third parties currently include GDF SUEZ E&P Nederland B.V. and TAQA Offshore B.V. for the CO₂ transport and CO₂ storage aspects, respectively. Also the capture plant supplier, Fluor, provides guidelines and has been selected, partly, because of their relevant former industrial scale experiences.

The fact that the project is carried out in a joint venture has a generally positive impact. By combining the knowledge and methodologies of two parent companies, assumptions are challenged more rigorously, group thinking was avoided and decisions were taken more objectively. However, working in a joint venture project also poses some obvious challenges as

it can lead to double reviewing procedures and more time-consuming decision-making processes. However, trust is key to reduce these inefficiencies. Even in a project organization under development, trust can be achieved through dedicated team work and face to face contact.

For ROAD, capture specialists and chemical experts are crucial to correctly assess the risks and to review the capture plant design. It is hard to obtain people who know about industrial scale CCS and the level of their experiences is therefore mainly research-, laboratory and pilot plant oriented. ROAD employs people with extensive knowledge of the CATO2 projects and the Kingsnorth CCS project. Besides this, theoretical knowledge and team working skills are the main selection criteria. The staff needed for pipeline-, platform- and well-engineering and those needed to perform flow assessment studies are more common. Most of ROAD's employees in this regard have extensive on-the-field project experience. The technical staff profile is mainly related to mechanical engineering, welding expertise, process engineering, compressor and rotating equipment expertise, control and instrumentation specialisms and civil engineering.

In addition to technical expertise ROAD employs experts on finance, risk, regulatory affairs and permitting issues, as well as lawyers. Most of these are external consultants and subcontractors.

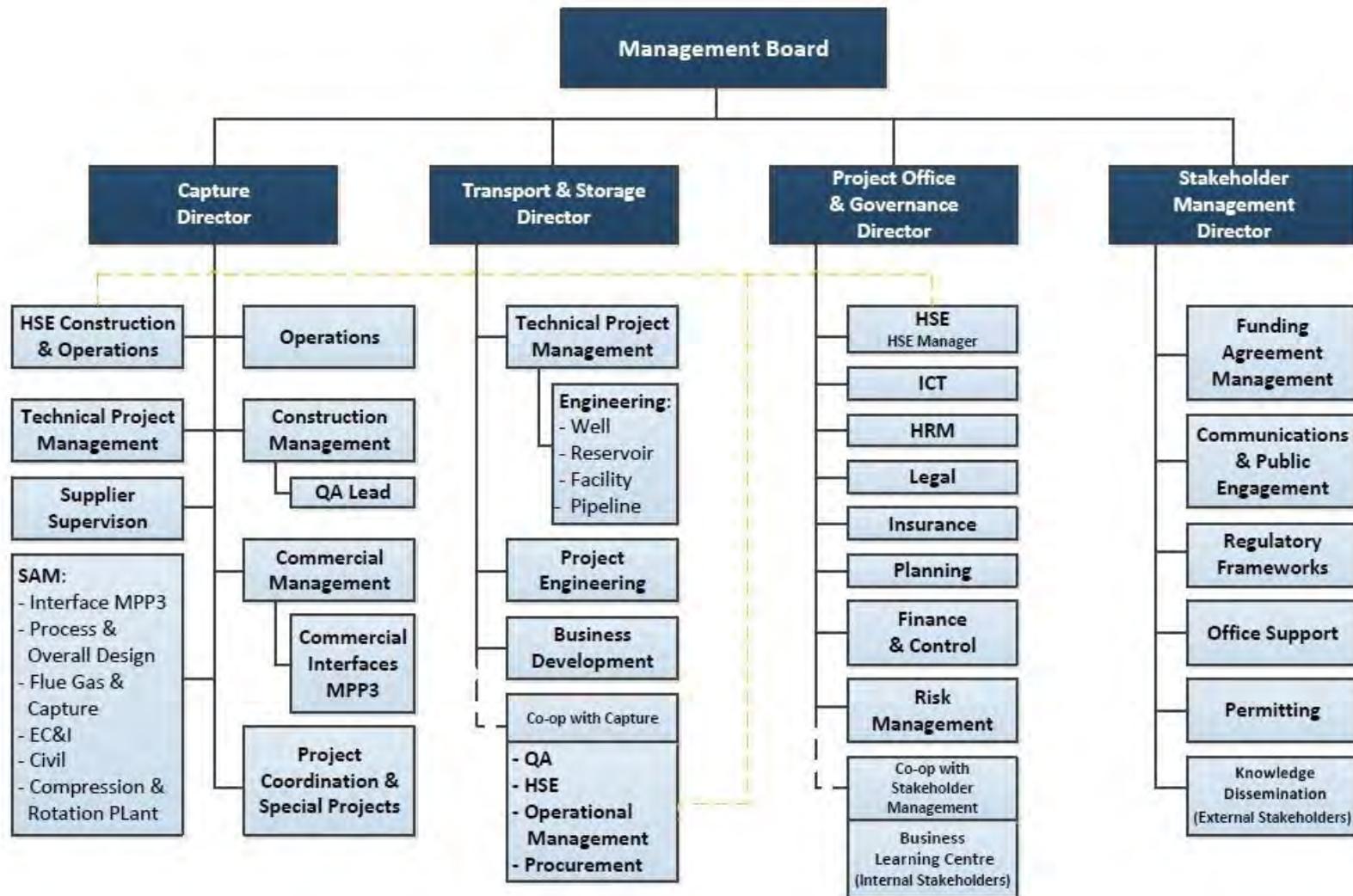


Figure 1: Project organisational structure for the FEED, FID and construction stage

4. Project Schedules

The key project milestones are outlined in this section, providing an overview of the scheduling for the base power plant construction and operation, capture plant construction and interfaces, transport, storage and permitting.

The current scheduling decisions and activities are aimed to have the full CCS chain operational in 2015. An operational CCS chain in the beginning of 2015 is required because of funding commitments:

- The grant from the EU and 50% of the grant from the Dutch government are foreseen for the construction phase (2010-2014). The capture, transport and storage facilities will need to be commissioned and delivered by the end of 2014.
- During the operational phase, 2015-2019, a minimum of 4MTe CO₂ will need to be stored as a condition of receiving 50% of the Dutch grant.

The key milestones and completion dates are presented in figure 2A. Two additional work packages not presented in this figure include knowledge dissemination activities and project management, of which activities are ongoing throughout the project life. After the FID, it will be possible to commit to the EPC-contract for the Capture Plant, to start the construction works of the tie-ins with MPP3 and to commit to laying the envisaged pipeline.

The FID currently is on the critical path of the ROAD project. The company currently foresees FID in the first quarter of 2012. Rescheduling of the FID can lead to extensive commercial renegotiations with subcontractors. The critical risk factors for FID are related to the following circumstances:

- Permitting: the definitive permits are required prior to FID;
- Commercial negotiations with the envisaged storage provider: negotiations about long term liabilities are still on-going;
- Finance: the ROAD cash deficit is assumed to be covered by the parent companies.

Better insights in the costs related to developing and operating the CCS chain and engineering details gained during the FEED study led the company to define a detailed work plan for the ROAD project. The general plan of approach for procurement and contracting is to outsource activities clustered in packages, to selected organisations within the GDF SUEZ and E.ON groups as well as to selected external business partners, creating responsibility sub-levels. Two different risk profiles for these outsourced packages have been identified:

- The capture plant is intended to be realized on a lump-sum basis after the Final Investment Decision (FID), including maximum risk (costs and timing) for the Engineering, Construction and Procurement (EPC) contractor.
- All other components are being contracted on a reimbursable basis, allocating the risk predominantly to ROAD, while, on the other hand, reducing costs due to a lower risk premium.

The remaining key risks for the construction phase are explicitly described in section 6.2.

The timing of sub-activities is inherently included in the sub-level responsibilities. The contractors are responsible and are closely monitored by the ROAD organisation. A detailed view on the long lead items can be found in figure 2B. The long lead items (requiring the longest engineering time) within the scope of the intended EPC capture contract are the main heat exchangers (direct contact cooler, wash water cooler, absorber intercooler, solvent cross heat exchanger and sea water coolers), the reboiler, the dehydration unit, the flue gas blower and the lean vapour compressor. A profound probability analysis of the scheduling risks on the project timing is added in paragraph 6.3.

The schedule presented in figure 2B is driven by both the MPP3 construction schedule and cost minimization. In order to avoid MPP3 outage penalties, the tie-in works have to be executed on-track. In order to remain within the foreseen budget ROAD focuses on cost optimisation and cost controlling. Both drivers led to the specific construction plan (figure 2B) and the clustering of heavy lift components. The heavy lifting activities of large vessels (direct contact cooler, absorber, stripper and lean vapor flash tank) and main compressor are on the critical path. Thanks to the clustering of heavy lift components the cost and project schedule can be squeezed significantly. After the lifting and placement of these major components the capture plant can be assembled. In a second phase the transport and storage works will become a point of attention.

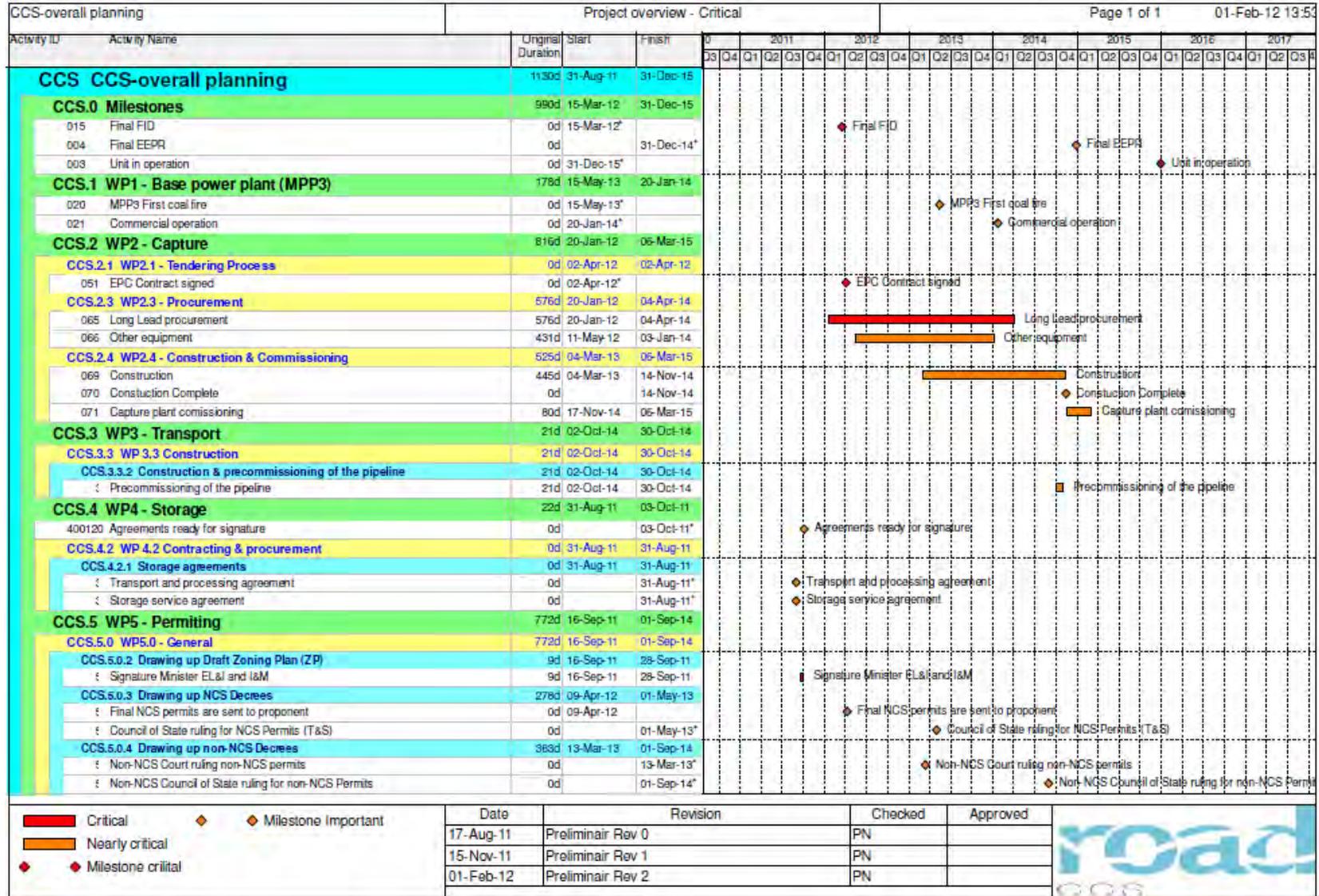


Figure 2A: Key project milestones for the work packages up until operation of the full CCS chain

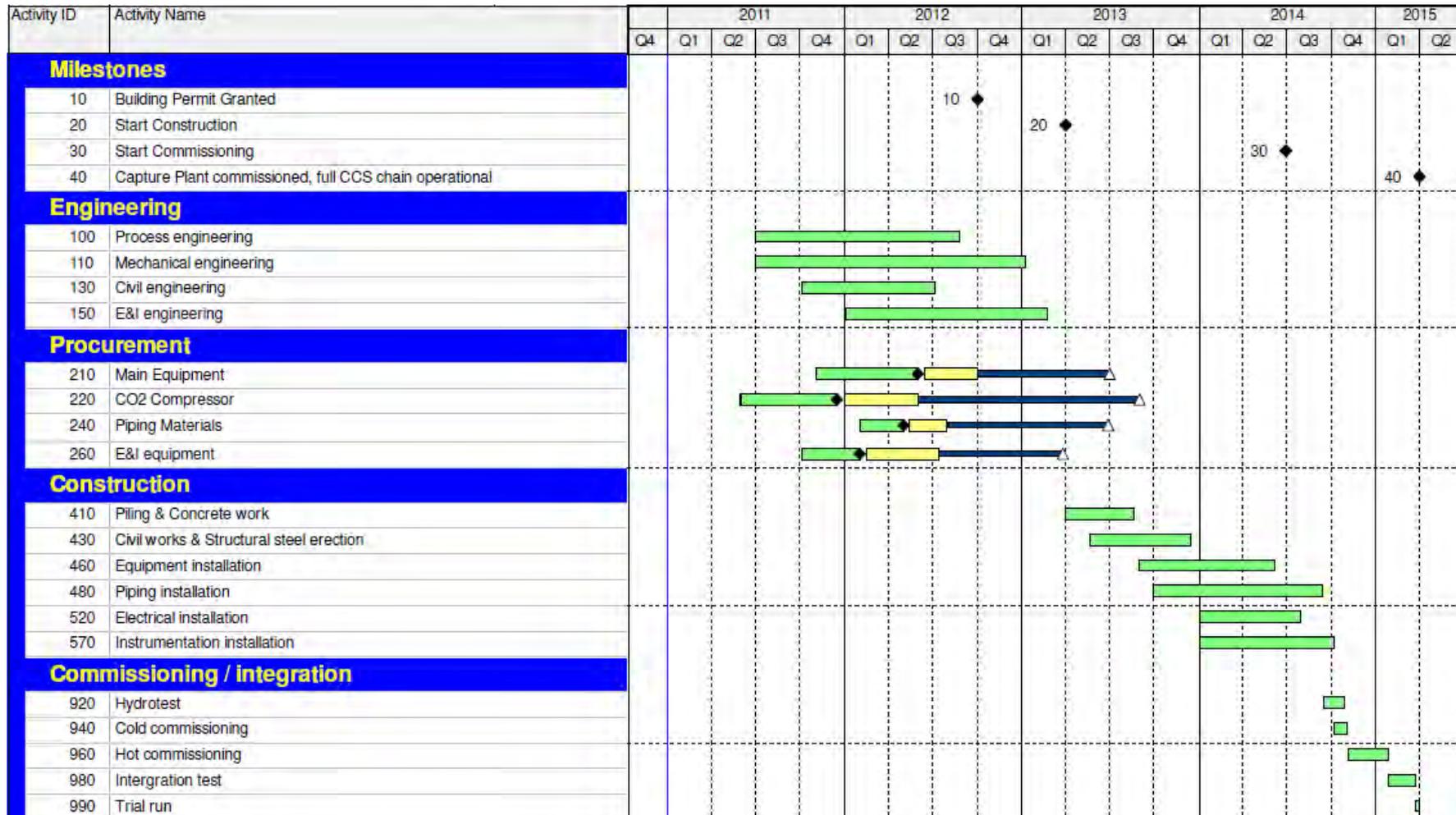


Figure 2B: Identification of long lead items

5. Key Implementation Issues

This section aims to provide a high level overview of the key implementation issues of the project with a specific focus on environmental impact assessment, permitting, health and safety, contracting, finance and stakeholder consultation.

5.1 Environmental Impact Assessment

Environmental Impact Assessments (EIAs) were applicable to both, the capture and storage aspects of the project, in order to fully address the impact of constructing and operating these phases of the project on the environment. Figure 3 provides an overview of these requirements. In addition to this, several permits, consenting documents, and assessments were completed across the full chain. These procedures are discussed further in section 5.2. The permitting team is responsible for managing the EIA procedure and the permitting application process of the ROAD-project.

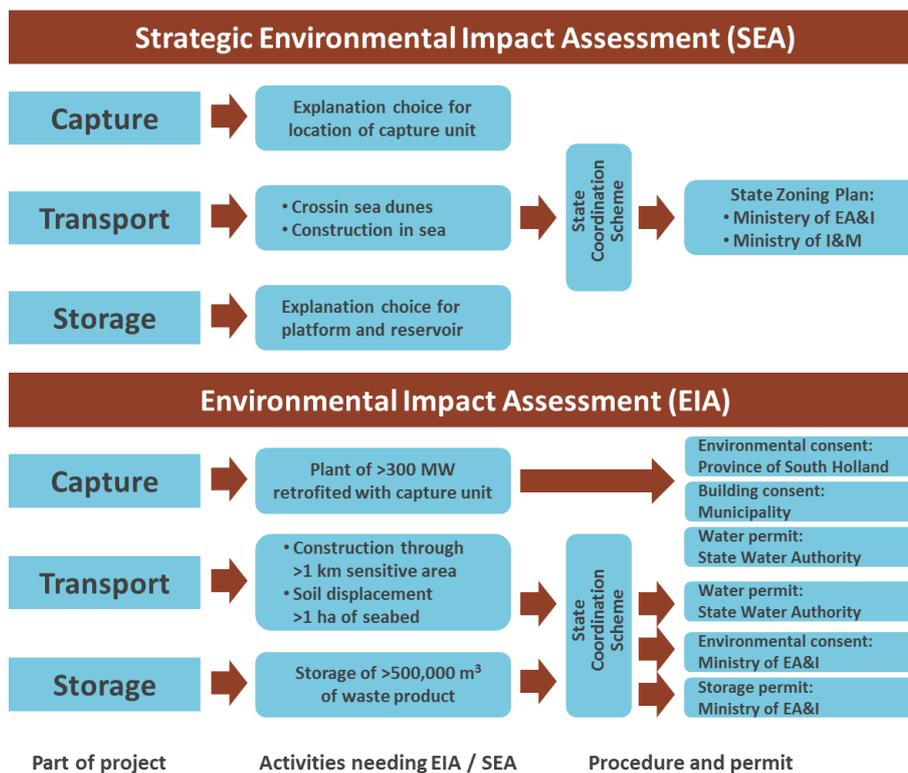


Figure 3: An overview of SEA and EIA mandatory activities

The ROAD project initiated the development of its EIA in November 2009 through a request to four environmental consultancy firms to produce proposals for the work. At this point a preliminary overview of the expected permits was provided to the consultancies in order to aid the proposal offers.

The proposals submitted by the consultancies outlined the required studies necessary to complete the EIA and aid the permit applications. The following studies were included in the proposal:

- Acoustics - on land and under water;
- Air - emissions, dispersion and deposition;
- Ecology - on both habitats and endangered species;
- Cooling Water Dispersion;
- Soil;
- Geology - for CO₂ storage;
- External Safety.

Following selection of the environmental consultancy and delivery of a final EIA, the following schedule was proposed:

- February 2010: Submission of the EIA Notification;
- April 2010: submission of the first, general EIA chapters and collection of the EIA guidelines as based on the EIA Notification;
- July 2010: submission of the chapters on considered alternatives;
- September 2010: submission of the underlying studies and draft EIA and permit applications;
- December 2010: submission of the final EIA and permit applications;
- April 2011: draft permits open to comments from ROAD and the public;
- June 2011: final permits submitted.

After submitting the starting note of the EIA, ROAD organized two town hall meetings in the communities closest to MPP3 in October 2010. These town hall meetings are mandatory in the EIA procedure and were organized in close cooperation with relevant authorities (e.g. Ministry of Economic Affairs, Province of South-Holland, DCMR and the City of Rotterdam).

During the EIA consultation period, the project was required to amend its approach in compliance with changes in regulation from the Dutch government. The *Act on Modernising the Environmental Impact Assessment* came into force on 1 July 2010, introducing two separate procedures for completing EIAs; one for regular projects, and one for complex projects. Given these changes and along with consultation from the Commission of Environmental Impact Assessments, the procedural route for complex projects was chosen.

Additional detail on this topic can be found in the Global CCS Institute Special Report on Stakeholder Management [1].

5.2 Permitting

As described in section 5.1 the EIA consultation work was successful in providing an initial overview of the required permits for the project. Consultancy firms also provided support and advice in drafting the permit applications, a procedure subjected to rigorous reviewing and assessment of the draft reports. This procedure proved useful in establishing a permitting timeline, as it was found that certain permits were not necessary, whereas others were only necessary at a later stage of the project. The necessary permits were identified and are listed in table 1.

Project Component	Permit	Competent Authority
Capture: Capture facility	Environmental Permit	Province of South Holland
	Water Permit	Ministry of Infrastructure and Environment
Transport: Pipeline (on land and at sea)	Water Permit	Ministry of Infrastructure and Environment
	State Zoning Plan	Ministry of Economic Affairs, Agriculture and Innovation, and Ministry of Infrastructure and Environment
Transport: Pipeline (at sea)	Water Permit	Ministry of Infrastructure and Environment
Storage: CO ₂ Storage	Environmental Permit	Ministry of Economic Affairs, Agriculture and Innovation
	Storage Permit, regulated by the Mining Act	Ministry of Economic Affairs, Agriculture and Innovation

Table 1: An overview of required permits and relevant permitting authorities

Having established the necessary procedure and relevant permitting activities, a permitting schedule was created, identifying key milestones and consultation periods during the project (figure 4).

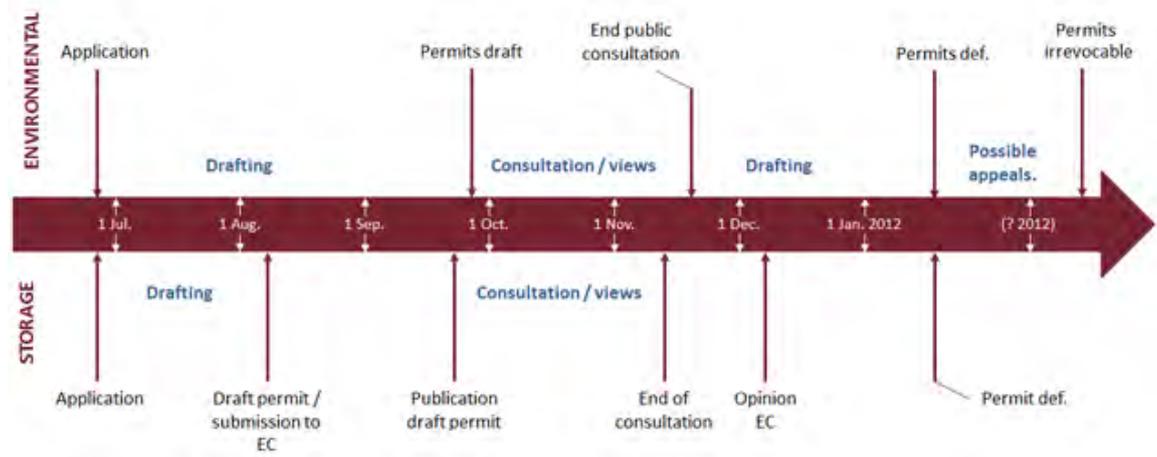


Figure 4: Permitting Schedule

In January 2010, an initial consultation with the Dutch environmental agency, DCMR, found that the project would likely qualify for the State Coordination Scheme, through which the Ministry of Economic Affairs, Agriculture and Innovation (EA&I) hold certain authority over the permitting process. This scheme would only be applicable for the transport and storage permits, as the project's storage permit will be the first offshore storage permit for CO₂ in the Netherlands. This process would allow the Ministry of EA&I to coordinate with regional governments and authorities throughout the permitting process, and also provide them with power to overrule and take over the permitting authority from the provincial and/or municipal authorities if necessary. The Ministry of EA&I sets the maximum lead times and the phase of appeals is also shortened.

Following this, in October 2010, the Ministry made the decision to take a coordinating role through the State Coordination Scheme and continued to support the permitting procedures. This has been done through the setup of two town hall meetings, inviting representatives from the DCMR, Province of South-Holland, and the State Water Authority of South Holland to present details of the ROAD project alongside representatives from ROAD to members of the public.

An overview of the permitting process and key interfaces between relevant authorities, ROAD, the Ministry of EA&I and project stakeholders has been provided (figure 5).

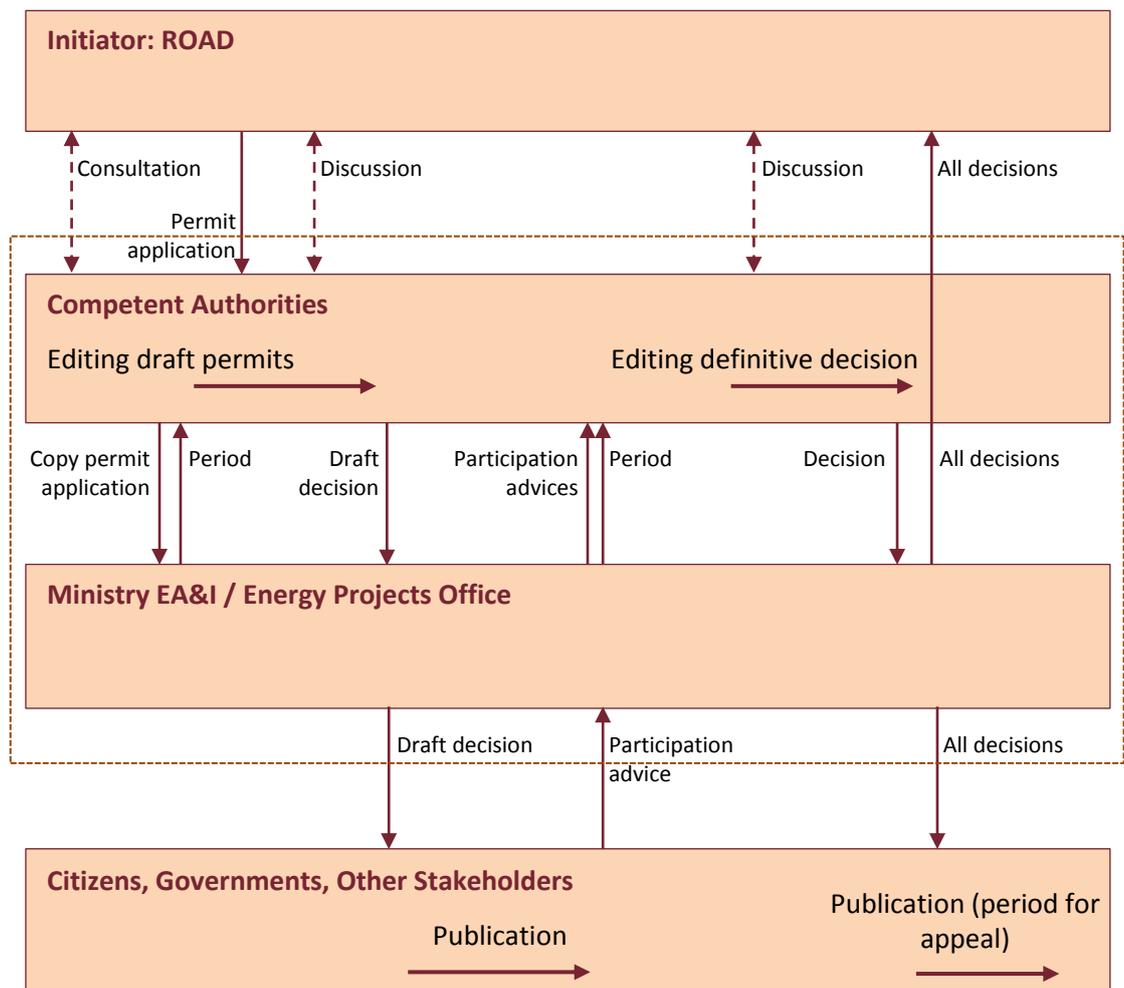


Figure 5: An overview of the interactions between interested parties in the permitting process

In June 2011, ROAD submitted its Environmental Impact Assessment (EIA), as well as all permit applications (except for the emission permit for the various parts of the chain, which will be applied for in 2014). In the table below, the status of the relevant permit applications is shown, together with the expected dates of upcoming key events.

	Draft Publication	Definitive Permit (and Publication)
Environmental permit	Done	Feb 2012
Nature Protection Act	Not applicable	Done
State Zoning Plan	Done	Mar 2012
Storage Permit	Done	Mar 2012

Table 2: Status of the relevant permit applications

The dates listed under the heading “Definitive Permit” are key milestones in the permitting process. Effectively, these permits can be considered to be final, having received approval of the appropriate permitting authorities. Following any legal proceedings resulting from consultation period or due to expiry of the appeal window, the permits will become ‘irrevocable’.

In addition to this, an insight into public response and stakeholder reaction will be acquired through the appeal period after publication of the definitive permits, providing a valuable understanding of the risks related to the subsequent phases of the permitting process. Therefore, the achievement of definitive permits and the outcomes of the public consultation are key factors that will aid the FID.

Further detail on the permitting process can be found in the Global CCS Institute Special Report on the Permitting Process [2].

To enable monitoring of the permit requirements during the execution phase, a close cooperation between ROAD and the MPP3 project team will be set up. In practice, 1 or 2 ROAD employees will physically join the MPP3 project team, including environmental aspects.

5.3 Environmental management

There are a number of activities ROAD has undertaken in addition to fulfilling the legal requirements to ensure sound environmental management.

Firstly, ROAD is partner in an agreement with the Port of Rotterdam, Province of South-Holland and other stakeholders that states that the undersigned (private) parties will financially contribute to nature management plans in case the authorities cannot do so. These nature management plans ensure that potential negative effects of enhanced nitrogen deposition will be taken away by grazing, mowing, excavation of the topsoil etc. These management plans take more nitrogen out of the natural system than ROAD and other parties contribute, thereby making sure no eutrophication and decrease of habitat quality takes place.

Secondly, ROAD has the intention to appoint an environmental compliance manager during the construction and operational phase of the capture plant. This person should monitor compliance with the permit requirements as set in the several permits for the capture plant, and the legal requirements as set by Dutch law. Such a manager is an extra assurance that ROAD will comply with all legal conditions.

Finally, ROAD is setting up a safety management system. By doing so, ROAD decreases the risk of incidents, which also lowers the probability of environmental incidents, such as spills or other unwanted emissions. This management system is an extra ‘lock on the door’ to avoid negative environmental effects.

5.4 Management of health and safety

5.4.1 General set-up

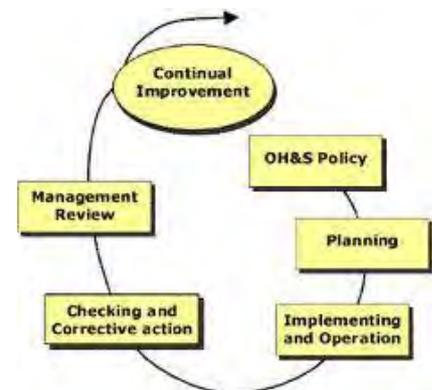
The design and construction organisation has been established (figure 1) with the appointments being made in-line with the 50/50 split between employees of the parent companies. A HSE manager has been appointed in each of the organisational pillars:

- On the level of the project office the HSE manager looks for “doing the right things”;
- In the technical branches the HSE manager focuses on “doing the things right”.

To establish good H&S practices during Design and Construction and to ensure that the design meets requirements (from ROAD, authorities and other stakeholders) the H&S execution must demonstrate full implementation and verification of the requirements (compliance).

The general plan of approach is to outsource activities, clustered in packages of which the contractor is responsible for compliance, ROAD MCP is accountable. Therefore ROAD MCP ensures by monitoring safety deliverables/milestones, attending meetings and reviewing specific safety activities and registrations of the contractors. H&S is not a separate item; it is integrated into regular project execution.

ROAD will, together with the contractors, create a safe and healthy working environment in order to promote the wellbeing, to prevent work related accidents, injuries and occupational diseases, as much as possible and to discourage unsafe behavior (which could lead to injuries and damage to property). ROAD will do so by a clear health and safety policy and by formulating it in the organization by embedding a safety & health management system. ROAD requires the contractors to comply with this policy.



The following ROAD H&S principles have been established:

- Source Approach: Eliminating causes by design review on safety and preventive stakeholder communication;
- As Low As Reasonably Practicable: risk-mitigating measures will be weighed against potential benefits by periodical review of residual risks and risk evaluation in case of changes;
- Responsibility for safety lies within each individual.

Currently specific safety topics are addressed frequently during team meetings to develop safety awareness.

5.4.2 State of affairs

During the FEED study, the Capture plant EPC contractor performed several risk assessments, e.g. a HAZID, HAZOP, reliability assessment, maximum credible accident study, ergonomics assessment etc. In August 2011, a detailed HAZOP and SIL assessment was performed by the EPC contractor, including the ROAD project team. The impact of the capture plant on the MPP3 installation was also taken into account. The assessment resulted in 134 recommendations to

improve the design of the capture plant. These recommendations will be taken into account during the further development of the project.

Foreseeable risks during construction are also being managed as good as possible. A heavy lifting plan has been elaborated, the construction schedule is being examined for interferences, etc. Discussions with MPP3 are ongoing concerning rules and agreements on site.

A coarse HAZOP has been performed by the ROAD team on the basic design of the pipeline and the platform, starting at the tie-in point with the capture plant, continuing until the reservoir. HAZOP (Hazard and Operability study) is a systematic, comprehensive analysis of a plant design, and is used to identify design faults leading to safety or operability issues. It is based on the supposition that most problems are missed because the system is complex, rather than because of a lack of knowledge on the part of the design team. The analysis led to 27 recommendations, concerning backflow issues, control system philosophy, etc. These recommendations are being followed up and will be taken into account during further design of the pipeline and the platform.

5.5 Contracting

Preparations and planning with regards to the setup of contracts for procurement, construction and operation of the CCS chain has been undertaken, with three key areas focusing on the following:

- Capture Agreements;
- Transportation Agreements;
- Storage Agreements.

The Capture Agreements comprises of a set of four contracts which outline the terms and conditions for the supply of electricity, steam, and cooling utility to the capture plant from MPP3 (including utility returned to MPP3 from the capture plant). Metering the consumption of these utilities aims to appropriately quantify the operational cost of the capture plant on the power plant through accurately determining the loss in electricity output of MPP3. In addition to this, these contracts outline the cost benefits that the capture plant would incur through integration with the power plant's boiler feed water pre-heat cycle as well as reduced spend on CO₂ credits. Some of these aspects are covered within an Efficiency Loss Agreement as well as a CO₂ Capture Agreement. The Utility Agreement also outlines utility requirement for the building and commissioning of the capture plant.

The main principles covered in the Utility Agreement are outlined as follows:

- E.ON is allowed to operate MPP3 without being limited by the capture plant;
- Title and risk of utilities shall pass to MCP at the designated points of delivery;
- Supply of all utilities is against market prices;
- Each party is responsible for its own permits.

In practice the utility agreement aims to compensate MPP3 for any lost electrical output as a result of capture plant operation, as well as to ensure that operation will not have further impact on power plant availability and operability.

Lost electrical output would be metered and compensated at market prices. For the ROAD organisation it is important to closely monitor the CO₂ price in proportion to the electricity

price, no specific hedging is in place for the market risks (the mother companies possibly apply specific hedging to face the market price risk).

With regards to the Transport Agreements, a set of contracts have been prepared establishing key agreements between MCP and GDF SUEZ E&P. These contracts aim to set out that the pipeline should be designed, constructed, owned and operated by a newly established organization, Maasvlakte CCS Pipeline C.V. However, GDF E&P will be sub-contracted for the design, construction, operation and maintenance of the pipeline.

Maasvlakte CCS Pipeline CV will be established after a positive investment decision by the parent companies. The required preparation for establishing this new limited partnership is complete, including completed drafts of the joint-venture agreement.

For the transportation activities, there are three main contracts outlined as follows:

- The Construction Agreement (COA) between the Pipeline CV and GDF SUEZ E&P;
- The Operating Services Agreement (OSA) between the Pipeline CV and GDF SUEZ E&P;
- The Transportation Agreement (TRA) with MCP and Pipeline CV.

The basic principles of the contracts include:

- CO₂ title and risk is held by MCP;
- Third party access to the pipeline is possible;
- Agreed accounting procedures and audit rights for MCP.

With regards to the storage agreements, an understanding of the offshore assets and their ownership is needed. The storage site is TAQA's P18-4 reservoir, which this is accessed through an existing single well from an existing unmanned platform P18-A. In order to establish contractual agreements for construction and operation of the storage site, a contractual structure is required that takes account of these various separate entities:

- The Platform Group, consisting of the platform owners being TAQA, EBN, DYAS and Dana, TAQA is the operator and represents the Platform Group;
- P18-4 Group, being the holder of the production license and also the applicant for the CO₂ storage license (TAQA), and the beneficiaries of the production, and owner of the P18-4 well (TAQA and EBN) and is represented by TAQA;
- The Offshore Group, which is the Platform Group and the P18-4 Group combined, also represented by TAQA.

For the storage activities, there is a set of contracts between the different groups, being:

- The Project Development Agreement (PDA) between the Offshore Group and MCP;
- The Transporting, Processing and Operating Services Agreement (TPOSA) between the Platform Group and MCP;
- The Storage Services Agreement (SSA) between the P18-4 Group and MCP;
- The Master Services Agreement (MSA) between the P18-4 Group and the Platform Group.

An overview of the agreements between all parties is shown in figure 6. This illustration highlights the key interfaces between the parties, and the associated contractual agreements.

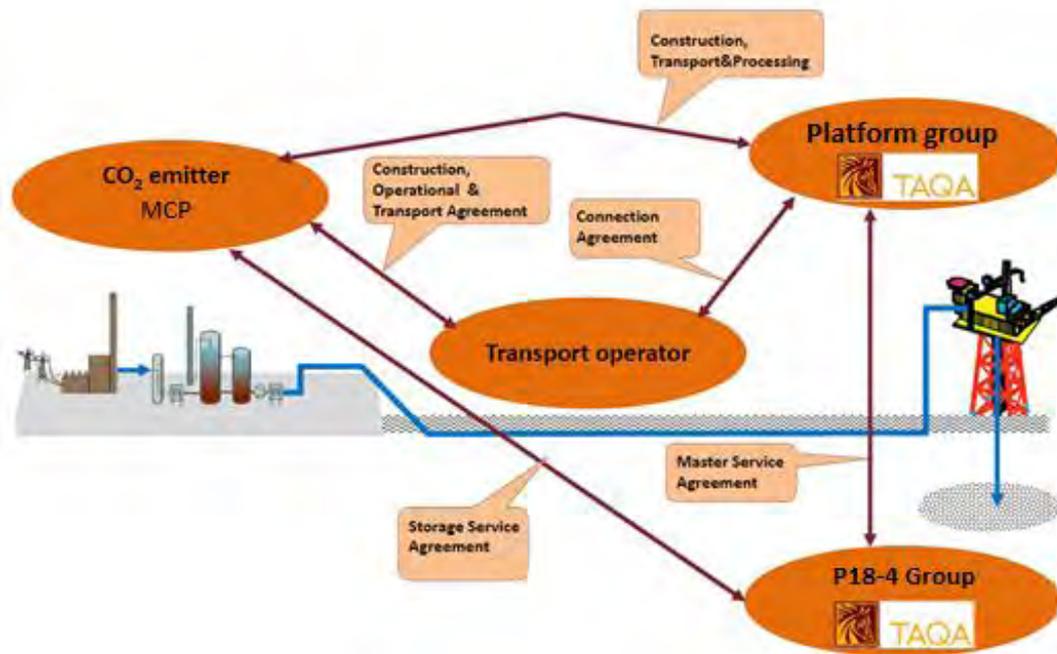


Figure 6: An overview of contractual interfaces across the CCS chain

Contract management and quality monitoring during construction and operation phases:

The general plan of approach for procurement and contracting is to outsource activities, clustered in packages, to selected organisations within the GDF SUEZ and E.ON groups, as well to selected external business partners, creating responsibility sub-levels. ROAD set-up specific guidelines and all contract processes are in line with the parent companies’ methodologies and general industry practices and are in compliance with the grant agreement regulations.

List of business partners and construction contracts:

MCP unit	Component	Business partner / contractor
Capture	Capture plant	Fluor (Netherlands/USA)
	MPP3/CCS interfaces construction	E.ON Benelux / MPP3
	Engineering and project management	MCP with combined team of experts from parent companies + externals
	Other costs (tendering process, etc.)	Various parties, mainly expensed in 2010
Transport & Storage	Transportation (pipeline)	GDF SUEZ E&P
	Storage (platform, well)	TAQA
Stakeholders, Project office & governance	Permitting	Royal Haskoning
	Other activities	Various parties

Table 3: List of business partners

These business partners (see table 3) in turn, source a significant part of the works from vendors and subcontractors. The MCP project owner team is working closely with each of them to optimise this sub-sourcing through, among other actions:

- Vendor/subcontractor selection/screening processes (bidding list and final selection);
- Initial cost estimation (before bidding process starts) and bid evaluation and selection; *(ROAD inputs to the selection of subcontractors in the field of transport and storage (through an operating committee with TAQA in particular) and MPP3 Interfaces. For the Fluor contract, ROAD is involved in the pre-selection phase but Fluor makes the final selection.)*
- Contracting, strategy, standard terms and conditions, good procurement practices including risk evaluation;
- Supervision of project execution through operating committees.

A set of specific procurement and construction contracts were established, as shown in table 4:

	Contract	Scope	Contracting parties
CAPTURE	CCS tie-in and interfacing development agreement	MPP3/CCS interfaces construction	E.ON Benelux / MPP3
	Aiming for EPC	The capture plant is intended to be managed on a lump-sum basis after the FID, including maximum risk for the EPC-contractor. However, the contract will not be on a turnkey contract basis because CCS isn't a fully mature technology and high risk premiums are counted for turnkey contracts.	Fluor (Netherlands/USA)
TRANSPORT	Construction Agreement (COA)	The design, procurement, construction, installation, certification and commissioning of the pipeline necessary for transportation of CO ₂ to platform	MCP or Pipeline CV and GDF SUEZ E&P
STORAGE	Project Development Agreement (PDA)	The development, construction and commissioning of all facilities (incl. well) needed for CO ₂ handling, injection and storage of CO ₂	MCP and the Offshore group

Table 4: List of construction contracts

List of contracts for operation stage of the CCS chain:

A set of contracts between MCP and E.ON Benelux sets the terms and conditions for the supply of electricity and utilities and for the compensation of the reduced need to buy emission rights for MPP3 (see table 5). A lean ROAD team will monitor these capture contracts during the operation period.

Contract	Scope	Contracting parties
Utility Agreement	Within the scope of the project E.ON will act on a cost neutral basis, specifically with regard to the operation of MPP3.	MCP and E.ON Benelux
Efficiency Loss Agreement (ELA)	E.ON is willing to provide utility products, the negative effect needs to be reimbursed by MCP. On the other hand, E.ON will require fewer EUAs (ETS credits) for the decreased CO ₂ emissions of MPP3, which results in less cost to MPP3.	
CO ₂ Capture Agreement (CCA)		

Table 5: List of contracts for operating the capture plant

For the transportation activities, there is another set of operational contracts (see table 6).

Contract	Scope	Contracting parties
Operating Service Agreement (OSA)	Pipeline maintenance, pipeline (commercial) management, metering and allocation services, information provision and communication	MCP or Pipeline CV and GDF SUEZ E&P
Transportation Agreement (TRA)	The acceptance, transport, process and delivering of CO ₂ from the entry point in the pipeline to the delivery point at the platform.	Users of the pipeline (MCP/third party) and owner of the pipeline (MCP/Pipeline CV.)

Table 6: List of contracts for transportation activities

And finally, also for the storage activities there is a set of operational contracts (see table 7).

Contract	Scope	Contracting parties
Transport Processing and Operation Services Agreement (TPOSA)	Transport, processing, metering and injection of CO ₂ into the well	MCP and platform group
Storage Services Agreement (SSA)	Storage and monitoring of CO ₂ injected in P18-4 reservoir (from well until sandstone)	MCP and P18-4 group
Master Services Agreement (MSA)	The MSA covers the services that need to be provided by the operator to comply with the obligations under the storage license and perform the services under the SSA. This includes, for example, well maintenance, monitoring and well abandonment.	P18-4 Group (CO ₂ storage license holder) and platform group

Table 7: List of contracts for storage activities

For transport and storage an operating committee is responsible for ensuring that the work is performed under the agreements according to specification, time and budget.

5.6 Finance

The ROAD project receives external funding in the form of EEPR funding from the European Union, a grant from the Dutch government as well as funding from the Global CCS Institute. In addition to this during the operational phase of the project, income will also be generated from the cost of CO₂ avoided as well as parent company contributions. An overview of the project funding arrangement received from external bodies is as follows:

- € 180 mln – European Commission (EEPR);
- € 150 mln – Government of the Netherlands;
- AUD 5 mln – Global CCS Institute.

Grants received from the EU are conditional on achieving CAPEX milestones; whereas the Dutch government funding is conditional on both CAPEX and OPEX phase milestones. Funding from the Global CCS Institute is dependent on knowledge dissemination deliverables. The budget has a start date of January 2010 and, as above, has been split up into construction, operation and residual phases. In the construction phase, 2010-2014, the grant from the EU and the grant from the Dutch government need to be spent. The capture, transport and storage facilities will need to be commissioned and delivered by the end of 2014. During the operational phase, 2015-2019, a minimum of 4MTe CO₂ will need to be stored as a condition of receiving 50% of the Dutch grant (the grant will have been received during the CAPEX phase).

A complete study into the financial requirements of the project has been completed, in which the total CAPEX, OPEX and project Net Present Value (NPV) have been estimated through detailed financial modeling activities. The work presents a breakdown of costs in both CAPEX and OPEX phases, the cost assumptions, contingency that has been included in the budget and risk attribution. Furthermore several scenarios and their sensitivities were investigated; finally the expected cash flows were then reviewed.

The projected income from grant authorities currently amounts to ca. €334m. The actual cash demand heavily depends on the payment schedule agreed upon with Fluor (capture plant supplier), which is currently under negotiation.

In nominal terms, the total CAPEX of completing the project is estimated at €417m. These costs include the total construction phase project costs, from project onset (2010) to the end of 2014, including sustained or sunk costs. For the determination of the project costs in the operational and abandonment phases ROAD assumes the following conditions:

- Construction of the capture plant under EPC contract;
- Physical interfaces with MPP3 are to be managed through MCP;
- Use of TAQA P18-4 reservoir for storage;
- TAQA remains the operator of the platform (also after 2014);
- Abandonment of capture plant and pipeline are cost neutral.

The cash deficit is assumed to be covered by an equal equity contribution from the parent companies. In the investment phase, the cash position is volatile due to the grant payment schedules determined by the European Commission and the Dutch Government.

The project budget is governed by the company's organisational structure, with a budget divided between Project Office and Governance, Stakeholder Management, Capture and Transport and Storage. Budget is split over the life of the project into two phases; the design and construction phase (2010-2014) and the operational phase (2015-2019). Following the operational period, provisions have been made for plant decommissioning, and monitoring of the storage site. A work package breakdown has been used in compliance with the existing accounting and reporting structure in place at MCP. This structure revolves around a work package (WP) breakdown, subdivided by sub-work packages (used for reporting purposes) that are then built up to a projects oriented structure. Cost estimating has been performed on project level. The WP breakdown is as follows:

- WP2: Capture;
- WP3: Transport;
- WP4: Storage;
- WP5: Permitting;
- WP6: Knowledge Dissemination;
- WP7: Project Management.

With regards to the capture, transport and storage costs a complete breakdown of costs has been developed in order to incorporate all individual engineered or estimate line item costs and rates. These costs have been based on a range of indicators, including historical equipment costs, current market prices, firm quotations from vendors, or other estimations. In order to

account for price variations a total cost contingency has been reported in the overall project budget.

Contingencies:

The total project contingency has been determined through a bottom-up approach indicating the maximum spread on each expense line item. The cost spread arbitrated on each expense line item represents the exposure due to:

- Market price exposure resulting in cost spread;
- Current state of engineering detail: concept design (40% contingency), basic design (pre-FEED, 25% contingency), detailed design (FEED, 10% contingency);
- Planning uncertainties (weather risk, mobilization of equipment);
- Other issues.

Individual line item cost uncertainties have been determined incorporating advice from the relevant discipline experts and external experts such as Tebodin, WEP and GDF SUEZ E&P. These numbers have been extensively reviewed and scrutinized and are currently considered to be the best judgment of possible cost spread on these items. The budgeted contingencies covering these cost uncertainties are now consolidated on a project and work package level.

More specifically, the contingency for the capture plant is the smallest and the contingency for the storage is the highest, mainly due to uncertainty in both the scope of work and market prices for the platform modifications and well work-over.

All risk-related cost items have been specifically excluded from the contingency buildup. Risk costs are all those costs from events and scenarios which deviate from the base case budget (deterministic approach, see paragraph 6.3).

Funding Agreement Management:

As described previously, the MCP ROAD project receives funding from three external contributors, the European Commission through the EEPR, the Dutch Government and the Global CCS Institute. In order to secure funding from these bodies it is necessary to ensure that all funding requirements are met by the project through delivery of reports, knowledge dissemination workshops and achieving specified project milestones. An overview of the EEPR and Dutch State funding requirements are outlined in figure 7.

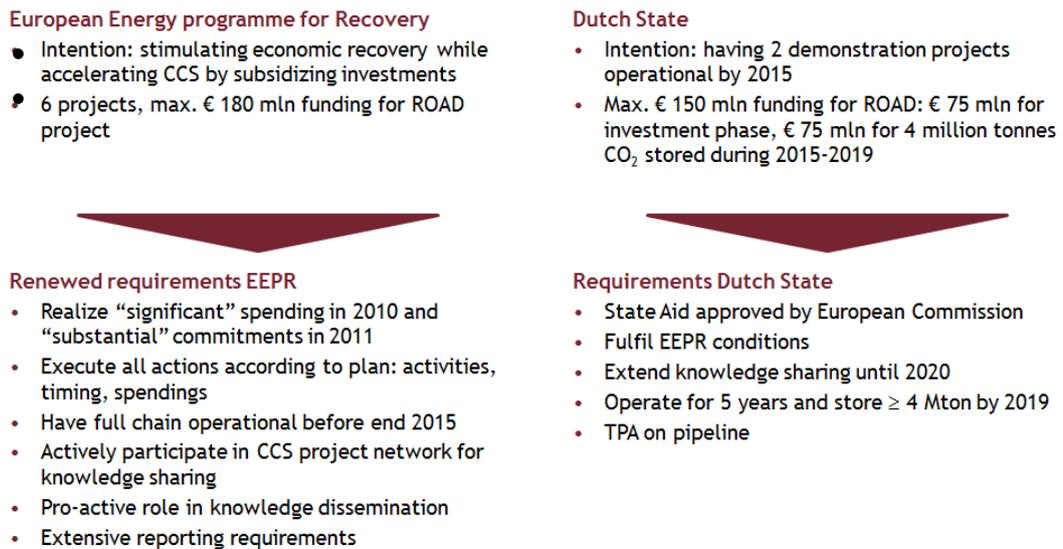


Figure 7: EEPR and Dutch State Funding Requirements

The requirements of the Global CCS Institute are currently mainly focused on knowledge sharing. All funding is allocated after the successful delivery of reports that will be published via the institute’s website. In addition to these deliverables, ROAD participates in a number of conferences and other knowledge sharing initiatives.

5.7 Stakeholder Consultation

Stakeholder management forms one of the four project teams within MCP that is headed by a member of the MCP board of directors. Therefore, engaging in stakeholder consultation has been and remains a key priority of the company throughout the whole project; during design, construction and operational phases. The key areas of focus within this team include:

- Communications and Public Engagement;
- Regulatory Affairs;
- Permitting;
- Funding Agreement Management;
- Knowledge Dissemination.

The strategy on stakeholder consultation was initially developed through identification of the key stakeholder groups by defining their interest and perceptions of the project. Experiences of the parent companies again proved valuable as a result of their new build power station developments in the Rotterdam Port area. In addition to this, the development of the new

Maasvlakte 2 (land reclamation project) has provided the parent companies with experience in working with the Port Authority of Rotterdam. These activities provided a strong starting point for identifying and mapping local and regional stakeholders.

With the aim of maintaining strong relationships with the key stakeholders, the ROAD project ensures that regular workshops are held with specialists from other organisations and projects. This allows the project to maintain an up-to-date outlook on stakeholder perception and interest, and is illustrated by means of a 'Force Field Map' (figure 8). This provides an overview of the main stakeholders and their relative positions and concerns on the project.

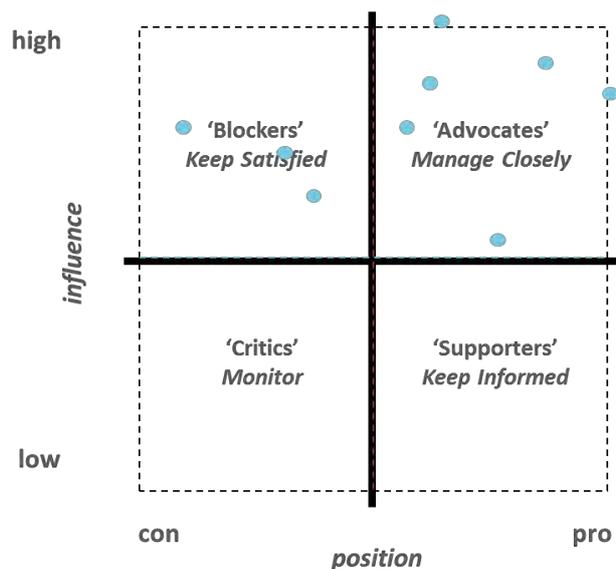


Figure 8: 'Force Field Map' of key stakeholders

Through this process a list of local, regional and national stakeholders was compiled and categorised into the following groups:

- Local communities and civic groups;
- Regional NGO's (e.g. environmental);
- Local and regional governments and authorities;
- Regional business platforms (port and industrial area);
- National government and parliament;
- Local and national media;
- National NGO's;
- Knowledge institutes.

In order to attain a set of representative perspectives from these stakeholders a review of available information was performed. This involved review of information sources including opinion surveys, focus group discussions, stakeholder consultations, involvement in the NEARCO2 research project (addressing public perception on CCS), as well as consultation with the Global CCS Institute on public engagement.

Communications and Public Engagement:

This aspect of stakeholder management has been a key focus of this project, given its 'first of a kind' status; a team was formed in order to establish procedures on internal and external

communication as well as coordination activities with the parent companies. These activities aimed to ensure an aligned and consistent approach when involved in external communication activities. An internal communication policy document has been produced to outline these procedures.

The company's external communication activities and products which may prove to be 'high exposure' for stakeholders are thoroughly reviewed by technical specialists. In addition to this, formal documents that are submitted externally are thoroughly reviewed by Communication and Public Affairs specialists in order to assess any potential political or reputational implications that may arise.

Views on communication objectives, strategy, key messages, on-going activities and materials of the project are regularly exchanged within a communications taskforce. This taskforce not only comprises of communications and public engagement specialists within ROAD, but also communication officers of the parent companies and the intended partners.

The company has also prioritised involvement in a range of public outreach activities, which include taking the time to deliver presentations to key stakeholders, producing a project brochure, drafting a 'frequently asked questions' document, and hosting a series of town hall meetings as part of the EIA procedure.

Regulatory Affairs;

Affairs relevant to the project have been dealt with through the setup of a dedicated team. Responsibilities include the identification and management of all applicable legislative dossiers. Further to this, the monitoring of regulatory risks and opportunities has also been a task undertaken by the regulatory affairs team. The team also plays a valuable role in the development of legislative and regulatory framework required for the deployment of large scale CCS projects in the Netherlands, the learnings of which are continually disseminated amongst project stakeholders.

Through the management and development of the required legislative and regulatory framework, it has also been essential to maintain close cooperation with the technical specialists within the ROAD project. Guidance from those working within the areas of Permitting, Communication and Public Engagement proved necessary for the development of a comprehensive strategy on managing and developing regulatory affairs. In addition to this, the Regulatory Affairs team maintained close links with the Regulatory and Public Affairs specialists from the parent companies. This allowed for an improved and coordinated approach when dealing with government officials and members of Parliament.

Knowledge Dissemination:

Maasvlakte CCS Project has, and continues to be committed to sharing the lessons learnt throughout the project through the delivery of public reports and participation in knowledge dissemination workshops and conferences. These commitments support the requests of the EC as well as the Global CCS Institute; consequently, the ROAD has prioritised the sharing of knowledge with the following parties:

- EU bodies, especially the EU CCS Network;
- Dutch authorities and local stakeholders (industry and citizens);

- Scientific CCS community, in particular the European and Dutch spearhead projects (including CATO2, NEARCO2, Renicuv);
- Global CCS Institute;
- Other CCS projects (on a mutual basis);
- E.ON and GDF SUEZ.

A prerequisite for the success of the project is that the authorities feel involved in the project. For example, the Dutch Ministry of EA&I was a big help in coordinating the permitting stakeholders and showing them that the project has national relevance. Sharing knowledge and having a clear project vision are a prerequisite in that regard. This builds up mutual commitment and trust. Also during the operational phase, 2015-2019, knowledge will be shared. Part of the Dutch government funding namely is conditional on the OPEX phase milestones.

Besides the above mentioned parties, ROAD is committed to disseminate/share knowledge with other parties via pro-active participation in international conferences. The project therefore aims to share knowledge gained on the following topics:

- Technical set-up and performance;
- Cost levels;
- Environmental impact;
- Health and safety;
- New knowledge generated by the project;
- Good practices, lessons learnt (positive or negative) and recommendations for implementing large-scale CCS projects;
- Planning;
- Application of legislative procedures;
- Public communication and engagement strategies;
- Selecting, characterizing, modeling and monitoring of storage sites;
- Risk management (including financial risks).

The project's commitment to share knowledge and learnings extends to address the requirements of its stakeholders. Consequently, the means in which information is delivered is tailored to the specific needs of the interested party, and so a number of different channels of dissemination are used, including:

- Reports and other publications;
- Conferences, workshops and seminars;
- Work groups;
- Personal correspondence;
- MCP documentation such as CDs, posters, brochures, etc.;
- Visits to the Maasvlakte site and the visitor center;
- Other public outreach activities.

Stakeholder management plans:

Support and involvement of local and regional governments throughout all project phases is a prerequisite for a successful implementation of a CCS project. The stakeholder engagement and communication strategy of ROAD is aimed at gradually involving local communities in the project. In the initial phase (e.g. design and permitting phase) of the project communication activities have been generally aimed at informing stakeholders on the project (i.a. brochure, website).

Throughout the different phases of the project ROAD will monitor relevant information sources (public, media, political, governmental, NGO's, scientific) in order to track evolving stakeholder perceptions and opinions and to early detect emerging issues. ROAD will maintain an issues management database and will develop a practical issues and crisis preparedness plan, including scenarios, procedures and responses. In accordance with changing information needs of each phase communication materials will be updated regularly.

On issues and stakeholders management ROAD also closely co-operates with other CCS-initiatives and authorities in the Rotterdam region. A structural coordination platform is the Regional Advisory Committee on CCS (RAC CCS). Members of the RAC CCS are the Port of Rotterdam Authority, the City of Rotterdam, regional industry organization Deltalinqs, DCMR Rijnmond Environmental Agency and a number of regional CCS projects and initiatives. These stakeholders closely co-operate in order to create necessary conditions (i.a. public engagement) for the development of CCS activities and a CCS network in the Rotterdam port and industrial area. Various experts of involved stakeholders meet on a regular basis and share relevant information and knowledge.

Furthermore, information about the MPP3 plant and ROAD project are available in the Maasvlakte visitor center. The visitor center will be accessible during all phases of the project; working visits and open days will be organized. This is another engagement in order to keep involved the local community during all project phases.

Additional detail on this topic can be found in the Global CCS Institute Special Report on Stakeholder Management [1].

6. Risk Mitigation

Throughout the execution of the project, there has been an emphasised focus on the risks that may be faced due to the nature of this ‘first of a kind’ project. Therefore, the risk mitigation strategy aimed to account for risks across all aspects of the project. These included the risks associated with the implementation of new technologies on a scale never before demonstrated. The capture, transport and storage aspects of the CCS chain were individually assessed, along with their interfaces with each other and the host-power plant. In addition, risks of operating the full CCS chain were investigated. Further to this, non-technical risks associated with the regulatory framework, public-acceptance, and environmental permitting were also addressed within the risk mitigation activities. An overview of the risk mitigation process has been reported in the Special Report to the Global CCS Institute on ‘Mitigating Project Risks’ [3]. Therefore, this section provides an overview of the risk identification and mitigation process (risk register) as well as an overview of the key risks facing the project.

6.1 Risk Identification and Mitigation

The methodology adopted by ROAD for identifying and mitigating risks is in line with relevant standards such as ISO 31000 “Risk management - Principles and guidelines” (ISO 31000:2009, IDT), and OSPAR Guidelines for Risk Assessment and Management of storage of CO₂ streams in geological formations. The processes for risk management outlined in these standards provided a basis for the project’s risk strategy. An overview of the adopted process is given in figure 9.

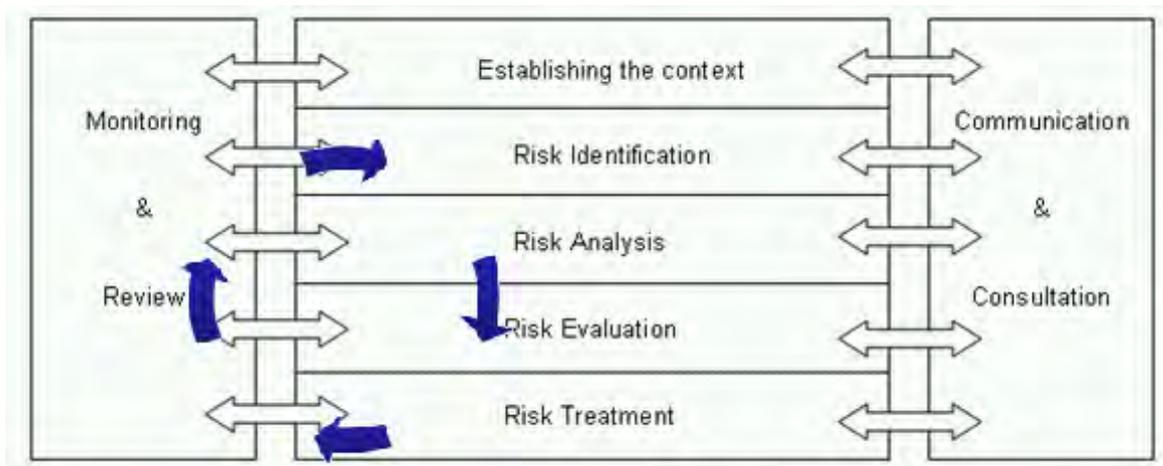


Figure 9: Risk Identification and Mitigation Procedure

This process provides the project with a dynamic cycle of risk identification, analysis, evaluation and treatment. Initial procedures involved establishing key sources of information that provide a basis for identifying relevant risks. This was implemented through assigning one member per work stream of the ROAD project (Capture, Transport and Storage, Stakeholder Management, Project Office and Governance) responsibility for collating information on potential risks. Further to this it was ensured that a clear and open dialogue between these work streams was maintained in order to identify risks over interface aspects, as well as financial and regulatory matters. This was implemented through organizing internal risk workshops.

In addition, external input on potential risks was encouraged as third party experts were invited to provide their views on the project. Some examples of this include:

- Safety Risks – Contributions from Tebodin, Marin and Royal Haskoning;
- Environmental Risk – Contributions from Royal Haskoning;
- Workshops with TNO (CATO2 framework).

Following the identification of relevant risks, each risk was evaluated based on its likelihood of occurrence as well as financial impact. Consideration of these two factors provides an assessment of risk exposure. The risk exposure is then assessed again through parent company methodologies to decide whether mitigating action is required. The responsibility of seeing out any mitigating action on a risk which has an unacceptable risk exposure is that of the 'risk owner'. Through this process, counter-measures and mitigating actions are considered through the following methodology:

- Is it possible to remove the risk?
- Determine and implement counter measures (technical, financial, process, policy);
- Determine and implement action plans;
- Evaluation and Identification of new risks.

A record of all risks identified is kept through a database referred to as the project risk register. The risk register is updated on a regular basis, and as of September 2011 a comprehensive review and update had taken place over all work streams, including:

- Capture;
- Transport;
- Storage;
- Permitting and Regulatory;
- Knowledge Dissemination;
- Project Management and Funding.

The outcome of this recent review has resulted in the delivery of an enhanced risk control and implementation methodology, along with an updated quantitative assessment of the achievable remaining exposure to added costs and delays over the project life-time.

Quantifying the impact of the relevant risks provided a basis for a series of modelling activities, which aimed to rank the risks in terms of their impact on the project. This was achieved through 'Monte Carlo Simulations', in which the execution of the ROAD project throughout its lifetime was simulated 10,000 times; providing a thorough understanding of the likelihood and impacts of risks faced by the project.

A key aspect of the project's risk mitigation strategy is the cyclical nature of the process through which possible risks are continuously monitored and evaluated. It has also been shown that the project risks are closely coupled with the project scheduling; therefore a process in which risks are assessed throughout the project is required. Practically a risk register is available in which the key risks are valued. Both the supervisory board and management board make use of this risk register.

Additional detail on this topic can be found in the Global CCS Institute Special Report on Mitigating Project Risks [3].

6.2 Risk mitigation during construction phase

6.2.1 Permitting

The risk related to permitting is that the permit under the environmental act and/or nature protection act can be delayed due to appeals by local communities and/or NGOs, with a risk that consequently the FID would be delayed as well as the start of the operational phase. Therefore, a risk exists that ROAD will not be able to store the first 1.1 Mton CO₂ in 2015. Hence, ROAD risks an overall reduced feasibility of the demonstration target of storing 5 Mtons CO₂ by the end of 2019.

Mitigating actions:

- Maintain regular communication with competent authorities in the Netherlands;
- Open dialogue with the public;
- Close monitoring of emissions during commissioning.

6.2.2 Capture plant and MPP3 interfaces

The risk during the construction phase is that the actual CAPEX outcome will not be the same as the previously forecasted CAPEX, the three main raisons being:

- EPC contract with the supplier of the capture plant, Fluor claims extra costs if the EPC is not timely signed;
- No timely installation of critical tie-ins with MPP3 and consequently an MPP3 outage penalty;
- Accuracy of the estimates on the number of construction workers during construction phase.

Mitigating actions:

- Continue to commit to ordering subcontracts as per Fluor schedule or sign the EPC contract and use cancellation clauses to allow a halt if the positive FID is not achieved;
- Formal interface meetings and interface decisions approved during the project board meetings and request for advance investment decision on critical tie-ins;
- A value engineering phase was added.

6.2.3 Transport & storage

The risks are the uncertainty to determine the actual costs. The main sub-raisons are:

- Environmental or engineering issues force an onshore pipeline rerouting;
- Uncertainty about order of magnitude of vibrations in the pipeline during start and stop of operation of the capture plant;
- Hidden defaults in platform design and risk of CAPEX increase for additional structural and stiffening and/or design changes.

Mitigating actions:

- Route survey for the route of the pipeline and review alternative transport and/or storage fallback options;
- Full FEED and detailed engineering study immediately after FID and optimizing start-up and shut-down procedures using flow simulations;

- Assess possibilities for weight reduction on the existing platform; Review of TAQA maintenance records; Detailed engineering and detailed structural survey to minimize the potential for hidden defects by ROAD / third party; Contractual agreement with TAQA on supply of latest information, arbitration process and cost allocation (following detailed engineering and survey activities).

6.3 Financial impact of risk mitigation over time

The risk mitigation actions progressively decreased the project contingencies. These contingencies represent the exposure due to:

- Volatile market prices, resulting in a cost spread;
- Current state of engineering detail;
- Planning uncertainties (weather risk, transport of equipment);
- Other issues.

Over the project phases the total CAPEX contingency decreased to 10% of total CAPEX:

- Contingencies during concept design phase (40% CAPEX contingency);
- Basic design (pre-FEED, 25% CAPEX contingency);
- Detailed design (FEED, 10% CAPEX contingency).

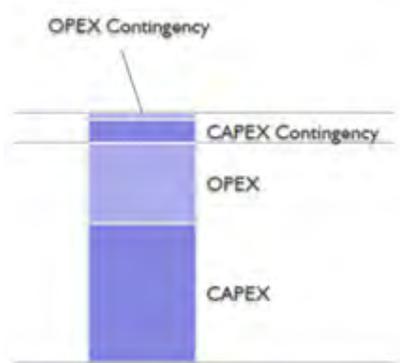


Figure 10: Deterministic project contingencies



Figure 11: Probabilistic project contingencies (Analysis November 2011)

In ROADS probabilistic models the scheduling risk of FID postponement can also be visualised taking into account the probability of risks and mitigation actions mentioned in paragraph 6.2:

- In the beginning of November a risk estimate has been made on the project schedule supposing a FID in Q4 2011. A mean risk value of 107 days was calculated.

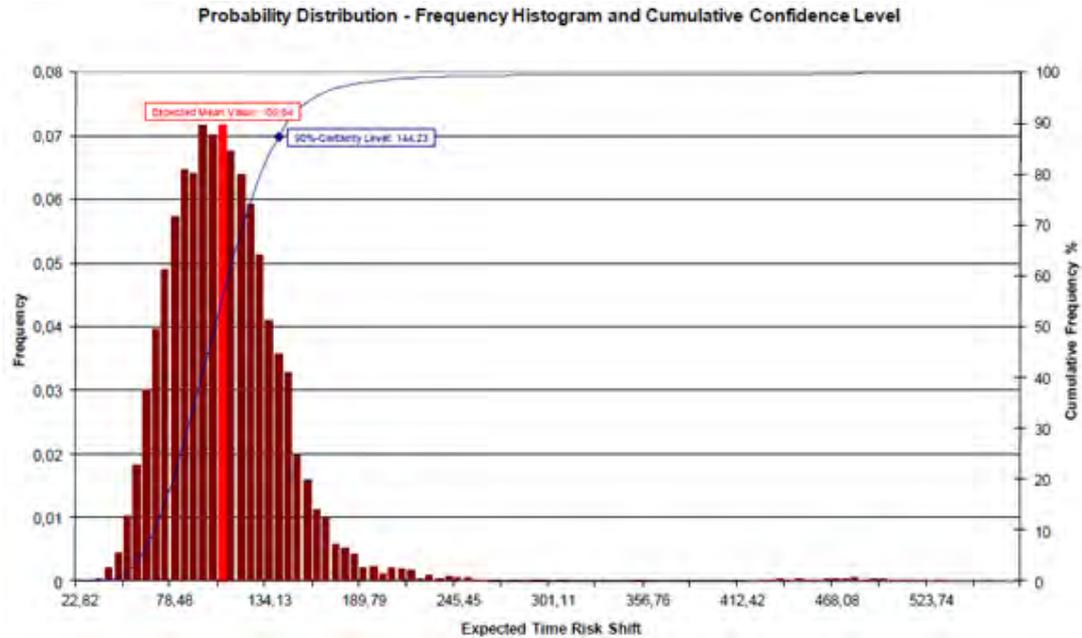


Figure 12A: Scheduling risk of FID in Q4 2011 (Analysis November 2011)

- In the beginning of November a risk estimate has been made on the project schedule supposing a FID in Q1 2012. A mean risk value of 204 days was calculated.

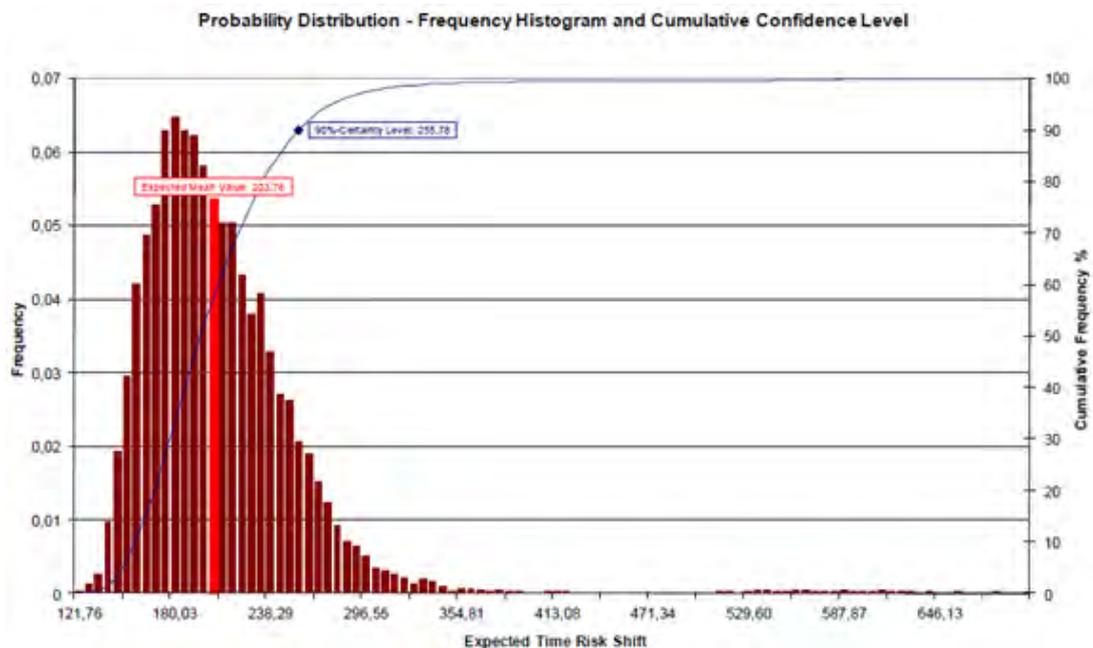


Figure 12B: Scheduling risk of FID in Q1 2012 (Analysis November 2011)

7. Conclusions and lessons learnt

Through execution of the aspects explored in this report, a wide-range of project activities have provided ROAD with a number of key learning points that will allow the project to continue successfully through future phases. These points focus on learnings from the permitting procedures and risk analysis, which provide an indication of the main factors that can influence project scheduling and expenses.

It was found that a solid understanding of permitting procedures and scheduling can have a significant impact on timing and funding constraints. Anticipating delays in agreeing draft permits for public consultation, and building these delays into the project schedule would help avoid any delays in agreed milestones; for example, a final investment decision. The nature of this project as a technical demonstration of a new technology must be noted as having a unique impact on the permitting procedure that is likely to result in challenges through various aspects of the procedure, from permit application to public consultation. In addition to this, the impact of any project delay could have further consequences on funding that may be conditional on achieving certain milestones.

ROAD has very favourable storage conditions, an offshore site only 25 km away from the plant. Furthermore, it enjoys financial and political support from the EU Commission, the Dutch Government and the Rotterdam region. The fact that all of these conditions are favourable at the same moment of time is remarkable. Despite these encouraging circumstances the project development phase last longer and therefore the FID decisions for the ROAD project are postponed by ca. 1.5 year with respect to the initial schedule. The bottlenecks are linked to permitting and the storage agreements. Nevertheless, the engineering and design works continue and the first operation date for the CCS chain remains unchanged. For future off-shore CCS projects in the Netherlands, ROAD recommends to incorporate a permitting delay in the planning of half a year. Specific for ROAD a set of new regulations were needed and Dutch laws have been adapted. For future off-shore CCS projects in the Netherlands the regulatory framework is now in place. Other countries may use ROAD's regulatory experience and the Dutch legislation as an example, but more delay should be incorporated for CCS projects in other countries, on-shore CCS projects and/or CCS projects for greenfield plants (mainly due to possible objections and appeals on construction of new power or industrial plants).

A key outcome of the work performed to date has been the impact of the transport and storage aspects on the overall risk of the project. Section 6 explores the main risks of the project in various scenarios, indicating that these demonstration projects must give particular attention to transport and storage. Commencement of the key engineering studies early in the project would prove beneficial in addressing and eliminating the risks observed. However, in addition to this, non-technical aspects of transport and storage such as permitting and regulatory issues must also be addressed early in the project.

The project has also been successful in cooperating productively with E.ON with regards to their MPP3 plant and the associated integration with the capture plant. It was found that a key learning point of the project is to consider the importance of the utilities agreement between MCP and MPP3. Providing a clear agreement on how the power plant and capture plant will interact is an important factor in ensuring a strong relationship between the power plant and capture plant owners and operators. In ensuring minimal impact on MPP3 operation, this agreement between the two parties has demonstrated that strong cooperation between power and capture plant can be achieved. The basic principles of the Utility Agreement as the main contract are:

- E.ON is allowed to operate MPP3 without being limited by the capture facility;
- Title and risk of utilities shall pass to MCP at the points of delivery;
- E.ON will use its best endeavors to install, own, maintain and operate a 10KV voltage line from E.ON's facility to the capture facility for the transportation of electricity. The consequences of MCP's choice not to have a direct connection to the public grid are entirely for MCP;
- Supply of all utilities is against market prices;
- Each party is responsible for its own permits and E.ON's permitting position must not be adversely effected by the capture facility.

Further detail on lessons learnt may be found through individual special reports to the Global CCS Institute, as well as in the Final Report on Lessons Learnt [4].

Abbreviations and references

Abbreviations

CAPEX	Capital Expenditure
EBX	E.ON Bennelux B.V.
EBL	Electrabel Nederland Project B.V.
EC	European Commission
EEPR	European Energy Programme for Recovery
EPC	Engineering, Procurement and Construction
EU	European Union
FEED	Front-end Engineering and Design
Global CCS Institute	Global Carbon Capture and Storage Institute
HAZID	Hazard Identification study
HAZOP	Hazard and Operability study
MCP	Maasvlakte CCS Project C.V.
MPP3	Maasvlakte Power Plant unit3 (E.ON)
OPEX	Operational Expenditure
ROAD	Rotterdam Opslag en Afvang Demonstratie

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[4] Final Report on Lessons Learnt – Report for the Global Carbon Capture and Storage Institute; Buysse, D.; Global CCS Institute website (2012)