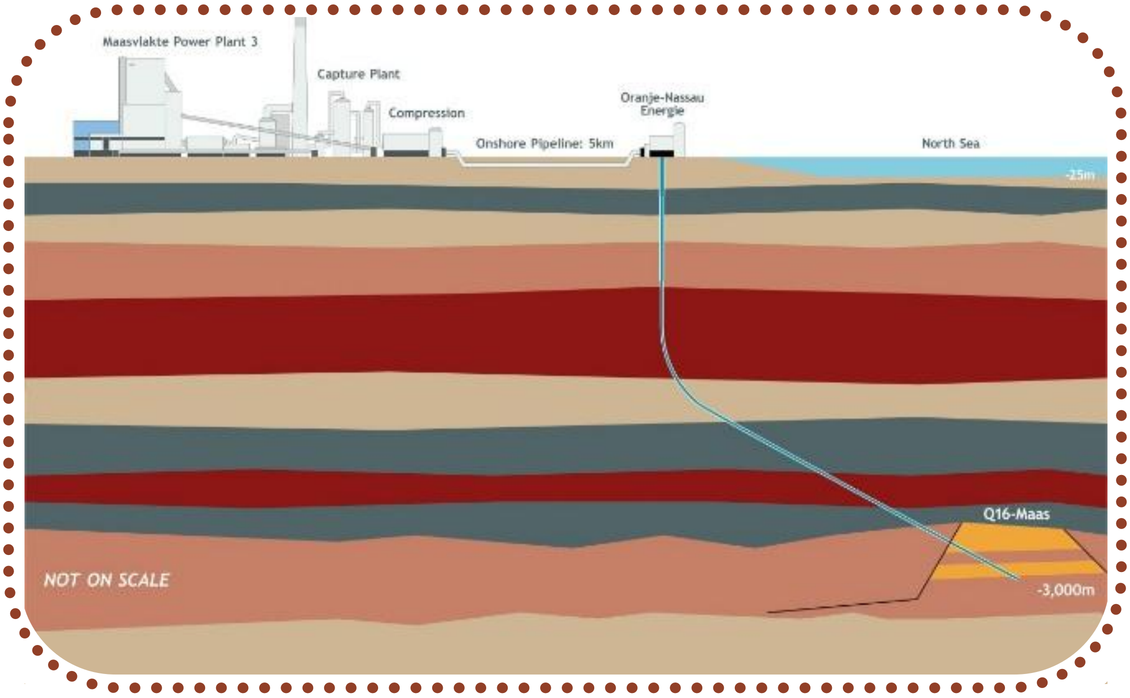
Public Close-Out Report Risk Management

Rotterdam Opslag en Afvang Demonstratieproject



Maasvlakte CCS Project C.V.

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Public Close-Out Report 5 of 11: Risk Management

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Index of ROAD Public Close-out Reports

No	Title	Scope
1	Overview	Introduce and summarise the public close-out reports.
2	Capture and Compression	Technical report covering capture, compression and power plant integration.
3	Transport	Technical report covering CO_2 pipeline transport.
4	CO_2 Storage	Both technical and commercial aspects of CO_2 storage for ROAD. Subsurface work required to demonstrate permanent storage is described.
5	***Risk Management***	***The risk management approach used by ROAD.***
6	Permitting and Regulation	Description of the regulatory and permitting framework and process for the ROAD project, including required changes to regulations.
7	Governance and Compliance	Company structure and governance for Maasvlakte CCS Project C.V., the joint venture undertaking the ROAD Project
8	Project Costs and Funding	A presentation of the projected economics of the project, with both projected income and costs.
9	Finance and Control	Description of the financial and control systems, including the costs incurred and grants claimed.
10	Knowledge Sharing	Outline of the Knowledge Sharing & Dissemination plan as developed by the ROAD project and completed KS deliverables and actions
11	Public Engagement	Description of how ROAD organized and managed the Public Engagement process.

Table of Contents

1. Management Summary

Project Summary

This report summarises the approach to risk management used by the CCS demonstration project "ROAD". The ROAD Project (Rotterdam Opslag en Afvang Demonstratieproject) was one of the largest integrated carbon capture and storage (CCS) projects in the world, aiming to install carbon capture on a coal-fired power station in Rotterdam and store the CO_2 in an empty off-shore gas-field.

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

In the first phase of the project, 2009-2012, the project was developed to final investment decision (FID) based on using the TAQA P18-4 gas-field as the CO_2 storage location. This required a pipeline of approximately 25km from the capture location (Uniper's coal-fired Maasvlakte Power Plant – MPP3), about 5km onshore and 20km off-shore.

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

Scope of this Report

This report describes the risk management framework in use by the project from 2011 to 2012.

Although the risk-based philosophy continued to be used throughout the remainder of the project, the risk database was not systematically updated after the project entered "slow mode" in 2012. The intention was to update the risk management database during the updated FEED so risks were well defined and assessed prior to FID. However, the work was halted in mid 2017 before this was completed.

Main Highlights / Lessons Learnt

Although the ROAD project was highly innovative, and therefore faced an unusual balance of risks, a fairly conventional risk management approach was effective as a management tool to identify and minimise risks. In addition, use of the quantified probability analysis on the risk database provided an insight into the likelihood of delays and overspends. This provided a cross-check for the contingencies in the business case.

The high-level commercial risks identified in 2012 were:

- National and EU developments in energy legislation and regulations
- Liabilities associated with CO_2 storage (leakage of CO_2)
- Co-firing of biomass (which does not qualify under the EU ETS carbon pricing scheme and therefore could result in a loss of revenue for the project)

There has been some refinement in understanding since 2012. For CO_2 storage liabilities, we are now at least as concerned with future costs of monitoring obligations and the financial mechanism, as we are with liabilities for an actual leak (which is very unlikely to happen). However, in updated form all these risks remain valid for CCS projects in Europe in 2018.

Technical and project risks were more conventional in nature:

- Capex and opex overruns

- Risk of delay
- Commercial arrangements with the storage provider
- Loss of grant funding
- Permitting risks

These are all described including a description of how the risk was managed through mitigating actions, as of 2012.

2. Introduction

2.1 Introduction

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

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

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

2.2 General Project Description

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

The main objective of ROAD was to demonstrate the technical and economic feasibility of a large-scale, integrated CCS chain deployed on power generation. Previously, CCS had primarily been applied in small-scale test facilities in the power industry. Large-scale demonstration projects were needed to show that CCS could be an efficient and effective CO_2 abatement technology. With the knowledge, experience and innovations gained by projects like ROAD, CCS could be deployed on a larger and broader scale: not only on power plants, but also within the energy intensive industries. CCS is one of the transition technologies expected to make a substantial contribution to achieving European and global climate objectives.

ROAD is a joint project initiated in 2009 by E.ON Benelux and Electrabel Nederland (now Uniper Benelux and Engie Nederland). Together they formed the joint venture Maasvlakte CCS Project C.V. which was the project developer. The ROAD Project is co-financed by the European Commission (EC) within the framework of the European Energy Programme for Recovery (EEPR) and the Government of the Netherlands. The grants amount to € 180 million from the EC and € 150 million from the government of the Netherlands. In addition, the Global CCS Institute is knowledge sharing partner of ROAD and has given a financial support of € 4,3 million to the project. The Port of Rotterdam also agreed to support the project through investment in the CO_2 pipeline.

In the first phase of the project, 2009-2012, the project was developed to final investment decision (FID) based on using the P18-4 gas-field operated by TAQA as the CO_2 storage location. This required a pipeline of approximately 25km from the capture location (Uniper's coal-fired Maasvlakte Power Plant – MPP3), about 5km onshore and 20km off-shore.

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

The ROAD project design applied post combustion technology to capture the CO_2 from the flue gases of a new 1,069 MWe coal-fired power plant (Maasvlakte Power Plant 3, “MPP3”) in the port and industrial area of Rotterdam.

The capture unit has a design capacity of 250 MWe equivalent. During the operational phase of the project, approximately 1.1 megatons of CO_2 per year would be capture and stored, with a full-load flow of 47kg/s (169 t/h) of CO_2. For transport and storage two alternatives were developed as described above: storage in the P18-4 reservoir operated by TAQA; and storage in the Q16-Maas reservoir operated by Oranje-Nassau Energie.

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

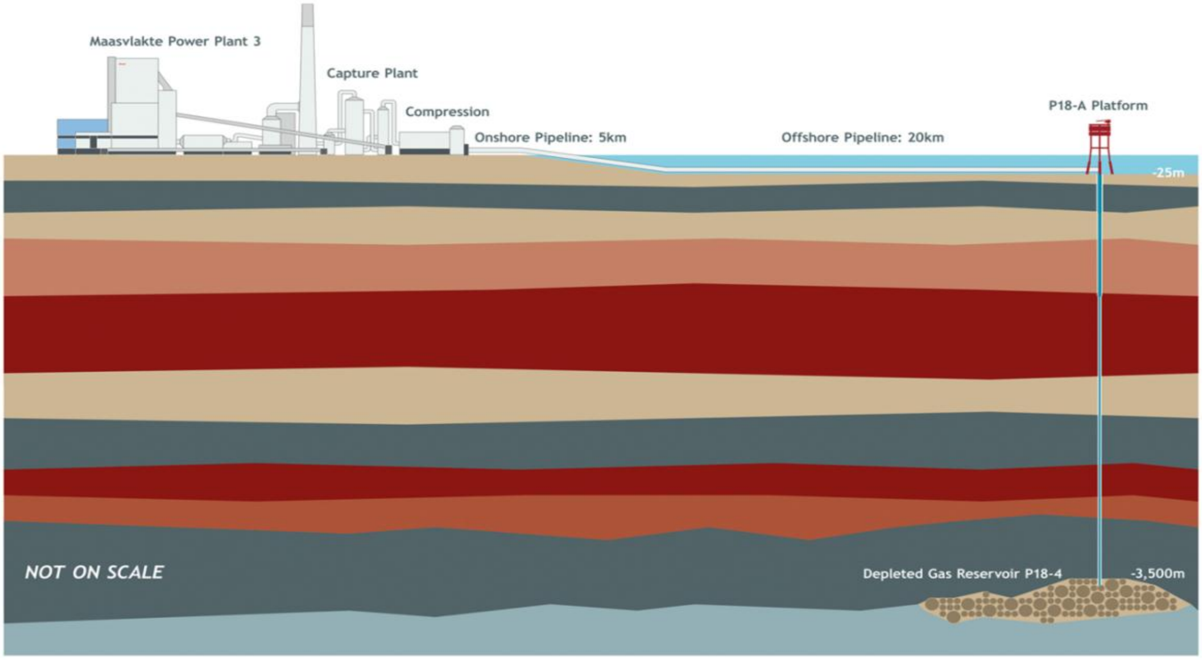
For storage in P18-4

From the capture unit the CO_2 would be compressed and transported through a pipeline: 5 kilometers over land and about 20 kilometers across the seabed to the P18-A platform in the North Sea. The pipeline has a transport capacity of around 5 million tonnes per year. It is designed for a maximum pressure of 140 bar and a maximum temperature of 80 °C. The CO_2 would be injected from the platform P18-A into depleted gas reservoir P18-4. The estimated storage capacity of reservoir P18-4 is approximately 8 million tonnes. Figure 2.1 shows the schematic illustration of this.

P18-4 is part of the P18 block which also includes the larger P18-2 and also a small field, P18-6. These depleted gas reservoirs are about 3.5 km below the seabed under the North Sea about 20km from the Dutch coastline, and have a combined CO_2 storage capacity of around 35 Mt.

The ROAD Project with storage in P18-4 was fully developed for FID at the end of 2011, including all engineering, regulatory and permit requirements. A CO_2 storage permit was granted in 2013, the first such permit in Europe. Unfortunately, a positive FID was not possible due to funding problems, and in 2012 technical project development on P18-4 was halted.

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



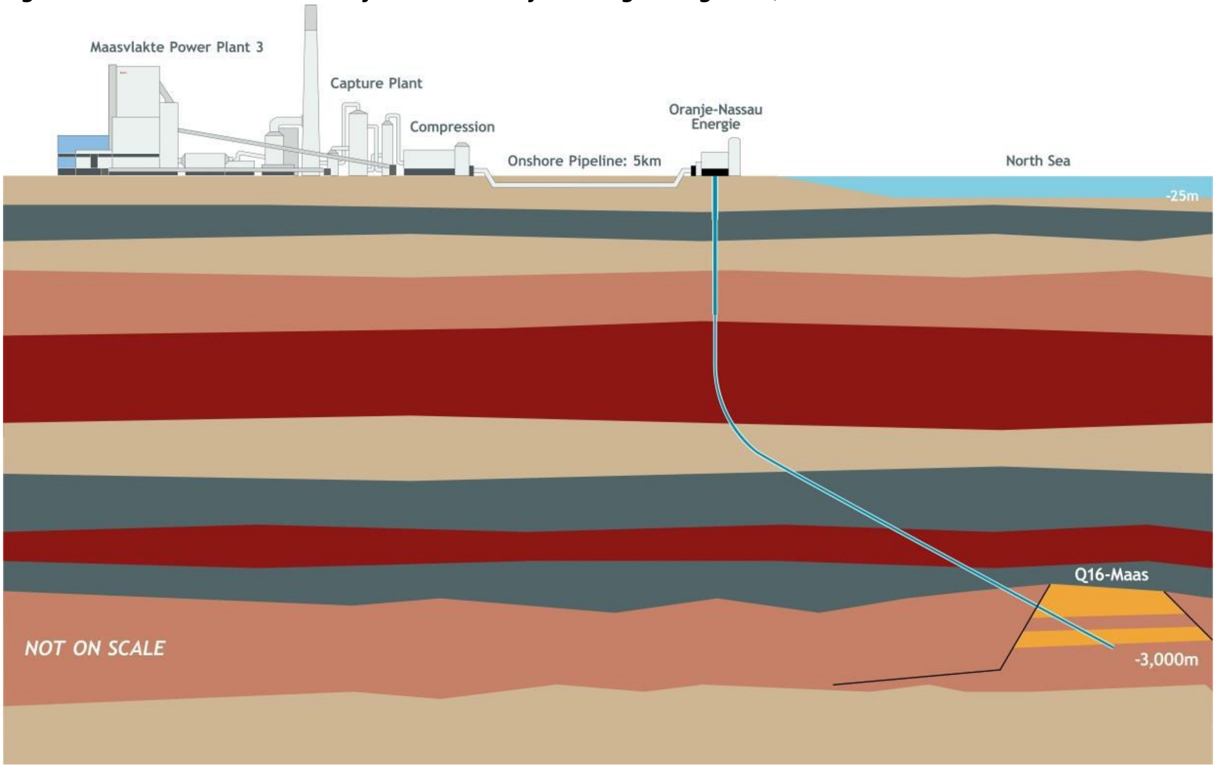
For storage in Q16-Maas

From the capture unit the CO_2 would be compressed and transported through a pipeline over land to the current ONE-production site Q16-Maas (Figure 2.2). The selected pipeline design would have a transport capacity in excess of 6Mt/year. It was designed for a maximum pressure of 40 bar although in the first phase operation at 20 bar was planned. Final compression to injection pressure (around 80 bar) would be at the injection site.

The Q16-Maas reservoir is located just off-shore from the Maasvlakte, and is reached by a long-reach well, drilled from on-shore. The well is about 5km long, and travels approximately 3km down to reach the reservoir depth, and 3 km horizontally (off-shore) to reach the reservoir location. The reservoir is relatively new (production started in 2014) and was not due to finish production until 2022. Therefore this scheme involved the drilling of a second well to accelerate gas production and so allow CO_2 injection to start in 2020. This second well would also allow co-production of modest amounts of condensate (and possibly natural gas) during CO_2 injection. The estimated storage capacity of reservoir Q16-Maas is between 2 and 4 million tonnes.

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

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



2.3 Scope and Structure of this Report

This report describes the risks management approach, and high-level risks of the ROAD Project, as developed for the proposed (unsuccessful) FID of 2012, this being the point in the project when the risk database was most well developed. Section 3 gives an introduction to the risk management approach and tools. The process by which it was applied in the project is described in Section 4, including assigning ownership of risks to individual members of staff, and ensuring regular review. Sections 5 and 6 cover high level commercial and high level project risks respectively.

3. Risk Management Approach

3.1 Risk Management Methods and Tools

The ROAD project decided to develop risk management methods and tools based on available general or specific standards like:

- **ISO 31000** "Risk management - Principles and guidelines" (ISO 31000:2009, IDT); and
- **OSPAR Guidelines for Risk Assessment and Management** of storage of CO_2 streams in geological formations.

The ISO 31000 defines risk management as:

- Coordinated activities to direct and control an organization with regard to risk; and
- Risk is the effect of uncertainty on achievement of objectives.

The OSPAR Guideline risk definition is as follows:

- Combination of the probability of occurrence of harm and the severity of that harm.

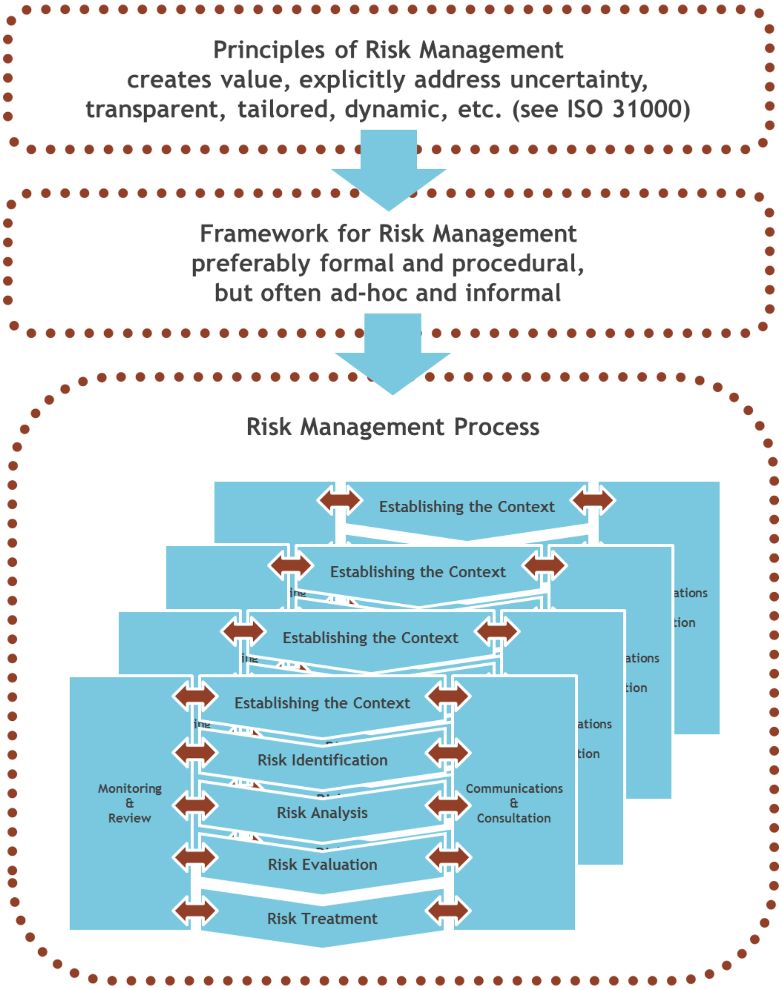


Figure: Monitoring & Risk Assessment Cycle as part of the ISO 31000 risk management process

The methodology followed by the ROAD project is to create a dynamic cycle of risk identification, analysis, evaluation and treatment, which was regularly reviewed. Input from internal teams, third parties and the parent companies was used at each stage and the results of the risk management approach was used by the ROAD management board in its communication with the parent companies of the ROAD project in order to get a positive Final Investment Decision (FID).

3.2 Objectives

The specific objectives of the ROAD's risk management approach were the following:

- Identification and tracking over time of the top 10 risks.
- Organizational procedure to ensure all major risks are covered.
- Methodology to rank the risks and define the level of "acceptance" for a given risk.
- Methodology to keep an overview of all risks.
- Satisfying both parent companies risk management standards.
- Ensure that the risks are addressed in each discipline.
- Ensure that the risks related to the interfaces are addressed.
- Ensure each risk is managed by (at least) one person.
- Track the risk matrix over time, as an input for knowledge build-up.

3.3 Implementation in Project Organisation

3.3.1 Risk review

First of all, it was necessary for the project to identify all the internal and external resources that could give an input to identify the risks. This meant that one person per ROAD department received the responsibility to collect all the risks in his/her own domain (Capture, Transport and Storage, Stakeholder Management, Project

Office & Governance), helped by the other experts of their department. In order to ensure that all the risks were identified, it was necessary to create bridges between the four ROAD departments, especially regarding the interfaces and the link between technical, financial and regulatory aspects.

This has been done via the organization of internal risk workshops, per theme (capture, transport, storage, interfaces, commercial agreements T&S, regulatory framework, funding, permitting and reputation) and with the participation of experts from the different departments. In order to have an external view on the project and to put experts together, third parties were also invited to contribute to the risk review and evaluation:

- Safety risks indicated by e.g. Tebodin, Marin, Royal Haskoning.
- Environmental risks, indicated by Royal Haskoning.
- Workshop with TNO (CATO2 framework).

The outcome of these risk workshops were mainly treated as business risks.

3.3.2 Determine the risk exposure

Based on the methodologies used by the parent companies, each risk was evaluated in terms of likelihood and financial impact, the combination of both aspects giving the project risk exposure. If the risk exposure was higher than the acceptable level (determined according to the methodologies of the parent companies), this meant that a mitigating action had to be taken to bring the project risk exposure below the acceptable level.

In this phase of the project ROAD focused on the financial impact of the risks (also when the undesired occurrence would be reputational, environmental or safety related).

3.3.3 Select the risk owner

In order to ensure that all risks with an excessive risk exposure were being treated, the mitigation of each risk was the responsibility of one person, namely the risk owner.

3.3.4 Risk Treatment

Once the risk was identified as non-acceptable, a multidisciplinary team (eventually assisted by third parties and/or parent companies) lead by the risk owner identified the possible counter measures:

- 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.

3.3.5 Action Plan Monitoring

Once the counter measures was defined and put in an action plan for implementation (what, who, when, costs), it was of prime importance to carefully monitor the action plan:

- Periodic evaluation of action plans as an input for project management.
- Implemented in the top risks presentation to the project management and parent companies.

3.3.6 Update Risk Cycle

An important step was to periodically update the risk register, including an identification of possible new risks. The reflection about the evolution of the risk also gave the necessary input to evaluate the project:

- Implement a decision matrix in the risk register.
- Evaluate expectation vs. actual outcome.
- Monthly/quarterly report to the parent companies.

- Reports to third parties (European Commission, Dutch Government, the Institute, etc.).

The risk register was updated on a monthly basis with the management board of ROAD. Prior to these sessions each department's top risks were discussed during the separate team sessions in which mitigating actions were developed and evaluated. The risk sessions with the management board were internally facilitated by the risk officer. In the draft monthly reports to the parent companies feedback on the risk management was requested. To ensure 'bridging' across functional areas fixed two-weekly meetings were planned between the core teams of Capture and Transport & Storage. Minutes were made during these meetings so decisions taken could be sent to the interested/ necessary parties and were also discussed during management board meetings.

During the monthly updates of the project top risks a lack of offshore risk experience was noted. A specialized third party was hired to support ROAD in the build up of a professional risk management process. This was done around August 2011 and therefore this process will be described in ROAD's special report on handling and allocation of business risks in CCS demonstration projects.

4. Risk Management Process

4.1 Organisational Integration of Risk Management Process

Risk management activities within the ROAD project organisation ware considered as an inherent part of the daily work of every project staff member, under the supervision of Discipline Managers and the Risk Manager. Both the identification of new emerging risks and risk control follow-up activities were divided into in manageable portions and allocated to organisational units or staff members that were responsible for managing particular sets of risks within their disciplines. Integration of the risk management process into daily work was aimed at establishing risk ownership with staff members and avoiding lengthy, extensive risk workshops, and enabling ROAD CCS project team members to act accountably in preventing risks from occurring and controlling their possible adverse effects.

In order to guarantee the quality of the risk analysis and risk control follow-up process, frequent validations of additions and changes to the Risk register took place during regular (multi)disciplinary meetings, already existing in the organisational and decision making structures. Exceptionally, for specific purposes and at the discretion of the responsible Discipline Manager or Director, a separate risk analysis workshop took place outside regular meeting structures.

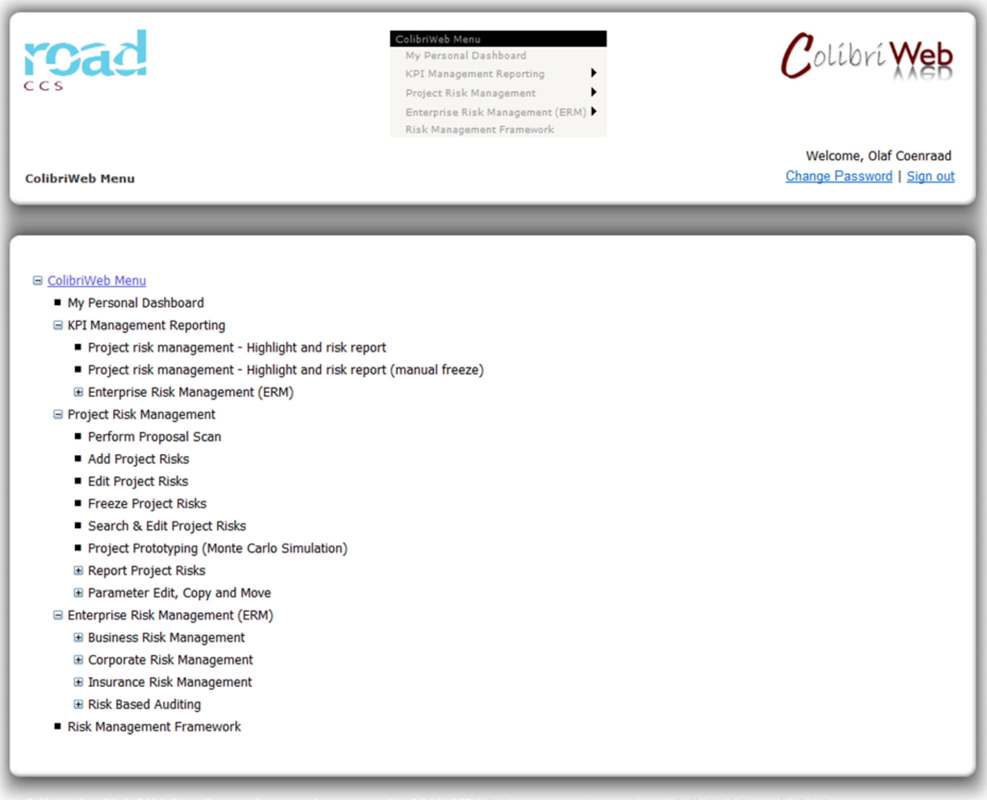


Figure: Self-active risk management is supported by the web based tool ColibriWeb

4.2 Qualitative Risk Analysis Process

The process of qualitative risk analysis focused on obtaining or updating a precise but concise description of a risk event and is comprised of following 5 steps:

1. Identify and describe the risk event (or opportunity) as a risk item decomposed into:

   1a. *(Un)desired Occurrence*: an (un)anticipated situation that may or may not materialise

   1b. *Cause(a)*: one or more conditions that may contribute to the event occurring

   1.c. *Effect(s)*: possible adverse effects of the event impacting project objectives

2. Select risk properties / reporting parameters from a predefined list:

   2.a. *Stakeholder*: possibly affected internal or external stakeholders

   2.b. *Work package*: the discipline work package within which the risk should be managed

   2.c. *Project stage*: the point in time or phase in which the event will likely occur

   2.d. *Risk owner*: party or parties that bear(s) the effects of the event

   2.e. *Responsible manager*: person responsible for the risk item as a whole

3. Assess the initial risk exposure level, i.e. before mitigation, (predefined in 5-10 categories) for:

   3.a. *Probability of occurrence (p)*: likelihood that the event will occur at some point

   3.b. *Cost effects (C)*: possible direct cost effects (out-of-pocket) of the event occurring

   3.c. *Time effects (T)*: possible delays incurred by the event occurring

   3.d. *Health effects (H)*: possible discomfort or damage to people or wellbeing

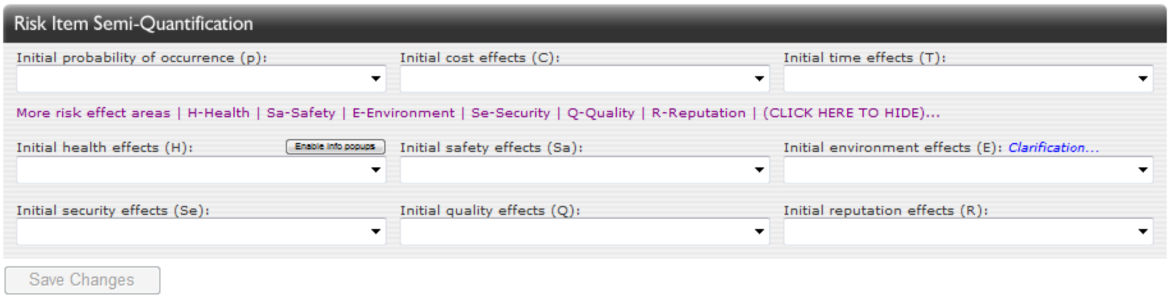
   3.e. *Safety (Sa)*: possible injury inflicted to persons, or fatality

   3.f. *Environment (E)*: possible environmental effects due to emissions and leakage

   3.g. *Security (Se)*: possible crime and corruption impacting personnel and assets

   3.h. *Quality (Q)*: possible effects on the quality and operability of the end product

3.i. *Reputation (R)*: possible negative publicity causing defection of partners and clients



4. Define a generic risk mitigation strategy followed by a set of actionable risk control measures:

   4.a. *Risk mitigation strategy*: generic risk control approach aimed at causes and/or effects

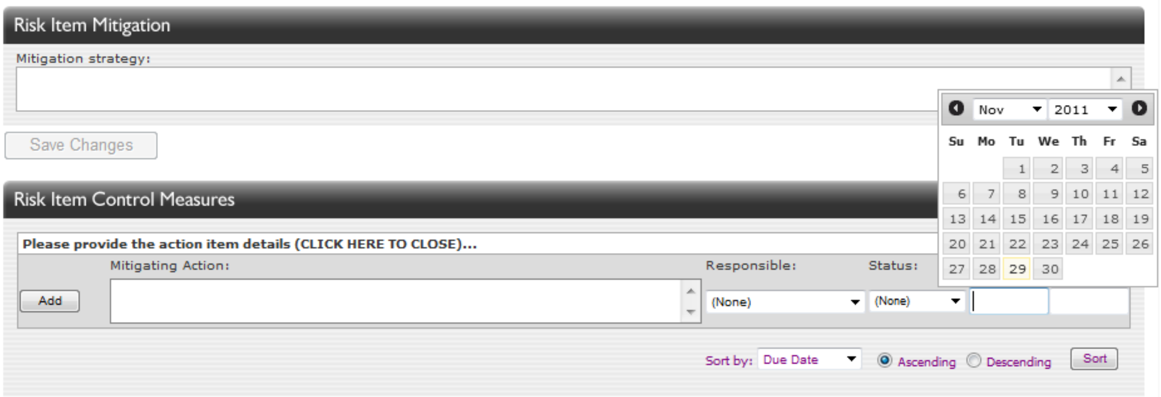
   4.b. *Mitigating action*: task(s) that need to be executed to fulfil the mitigation strategy

   4.c. *Action responsible*: person responsible for executing the risk mitigating task

   4.d. *Action status*: current status of task follow-up (selectable from a predefined list)

   4.e. *Start date*: Scheduled date of commencement of the task

   4.f. *Due date*: Scheduled date of completion of the task



5. Assess the residual risk exposure level, i.e. after mitigation, for:

   3.a. *Probability of occurrence (p)*: likelihood that the event will occur at some point.

   3.b. *Cost effects (C)*: possible direct cost effects (out-of-pocket) of the event occurring.

   3.c. *Time effects (T)*: possible delays incurred by the event occurring.

   3.d. *Health effects (H)*: possible discomfort or damage to people or wellbeing.

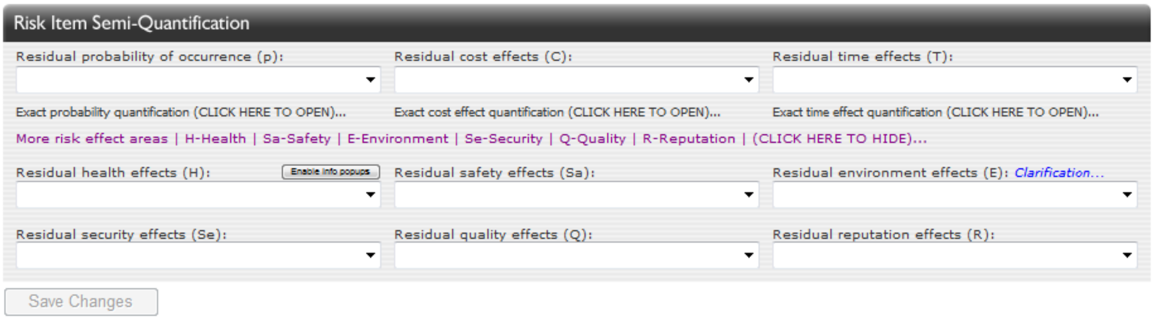
   3.e. *Safety (Sa)*: possible injury inflicted to persons, or fatality.

   3.f. *Environment (E)*: possible environmental effects due to emissions and leakage.

   3.g. *Security (Se)*: possible crime and corruption impacting personnel and assets.

   3.h. *Quality (Q)*: possible effects on the quality and operability of the end product.

3.i. *Reputation (R)*: possible negative publicity causing defection of partners and clients.



Risks were recorded in the online web based ColibriWeb Risk register. Recording of the above risk item definition elements were largely self-explanatory. Project team members were requested to be pro-active and self-active and fill out the 'Add project risk item' page promptly upon identification of a risk during their daily activities within their disciplines, or the 'Edit project risk item' form upon changed status of a risk control measure.

4.3 Risk Management Actions

The risk analysis process was configured to make risk management as actionable as possible by allocating risk items and risk control measures to individual team members. Risk management follow-up consisted of 2 elements:

1. Daily follow-up on management of risks and implementation of control measures:

Project team members consulted their 'Personal Dashboard' in ColibriWeb on a regular basis in order to perform tasks due and to report progress by updating action statuses.

2. Bi-weekly validation of discipline-cross sections of the Risk register within the peer groups:

During regular meetings, a 30-minute validation was performed on newly added and changed risk items and risk control measures. Following elements within each risk item were challenged, validated and agreed in equal presence of (a) representative(s) of Party A[1] and Party B[2]:

- The precise and complete description of the risk item (undesired occurrence, causes and effects).
- The affected stakeholder, the risk owner and the staff member responsible for managing the risk.
- The level of initial risk exposure (semi-quantification of probability, cost effects, time effects, HSES effects, quality and reputation effects).
- The proposed mitigation strategy, deliberating on whether to focus on controlling the causes or the effects of the risk, and whether to apply self-control (eliminate, avoid, reduce or accept) or to transfer risk control and/or exposure to a third party (partner, subcontractor, supplier, insurance).
- The definition, appropriateness, possible cost and expected or realized effectiveness of risk control measures and the allocation to action owners and time window for realization.
- The level of residual risk exposure (semi-quantification of probability, cost effects, time effects, HSES effects, quality and reputation effects).

[1] Party A: Uniper Benelux
[2] Party B: Engie Nederland

- The current status of the risk: Active (risk control measure implementation in progress), Managed (risk control measures implemented, residual risk remaining), Closed Out (risk considered no longer present).

The chairman of this meeting would provide relevant cross sections of the Risk register including an overview of recent changes to the meeting attendees, obtained directly from ColibriWeb. On his request, the Risk Manager would provide support in preparation of this item on the agenda. The chairman would record in the Decision register any decision taken around the status of the risk itself or its mitigation, referencing the unique risk identification number. The chairman would also appoint a delegate to update the Risk register in order to reflect decisions and changes in the Risk register.

4.4 Quantitative Risk Analysis and Forecasting

Semi-quantification of initial and residual risk exposures, and ranking risks by means of applying a sort order to risk scores obtained by multiplying probability and cost (or time) consequences of individual risks provided an overview of risks that may attract priority or extra focus in risk control.

A more comprehensive quantitative risk analysis (QRA) was required to obtain an overview of the overall impact of these risks to project objectives. The quantitative risk analysis provided a forecast of the expected time of project completion and the expected total project cost, including risk and uncertainty. A QRA model, which effectively prototypes the project, was based on the following inputs as a minimum:

- The project schedule, including uncertainty ranges on selected activity durations.
- The project budget, including uncertainty ranges on selected quantities and prices.
- The full risk register, comprising residual probabilities of occurrences of risk events, and cost and time effects.

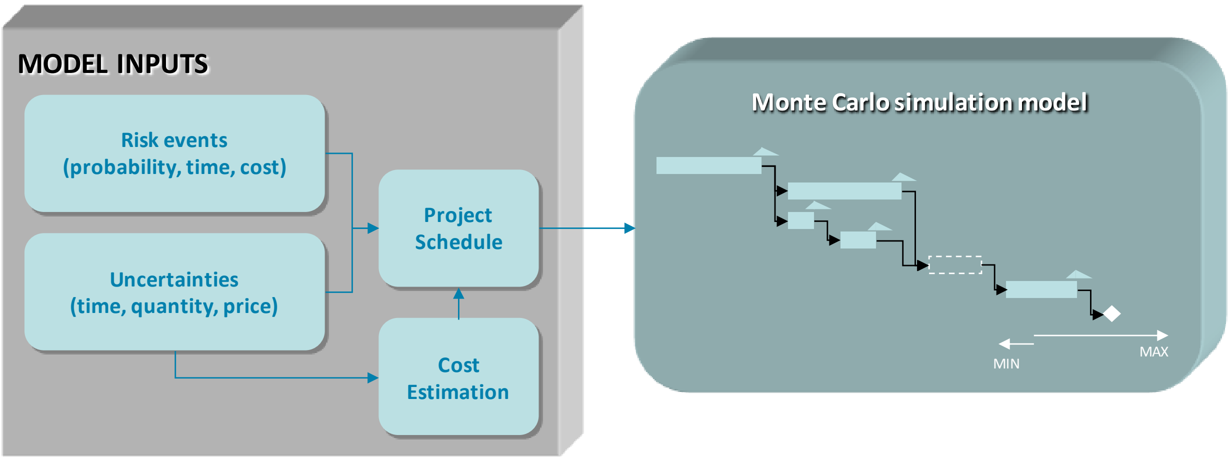


Figure: Project prototyping model defining components

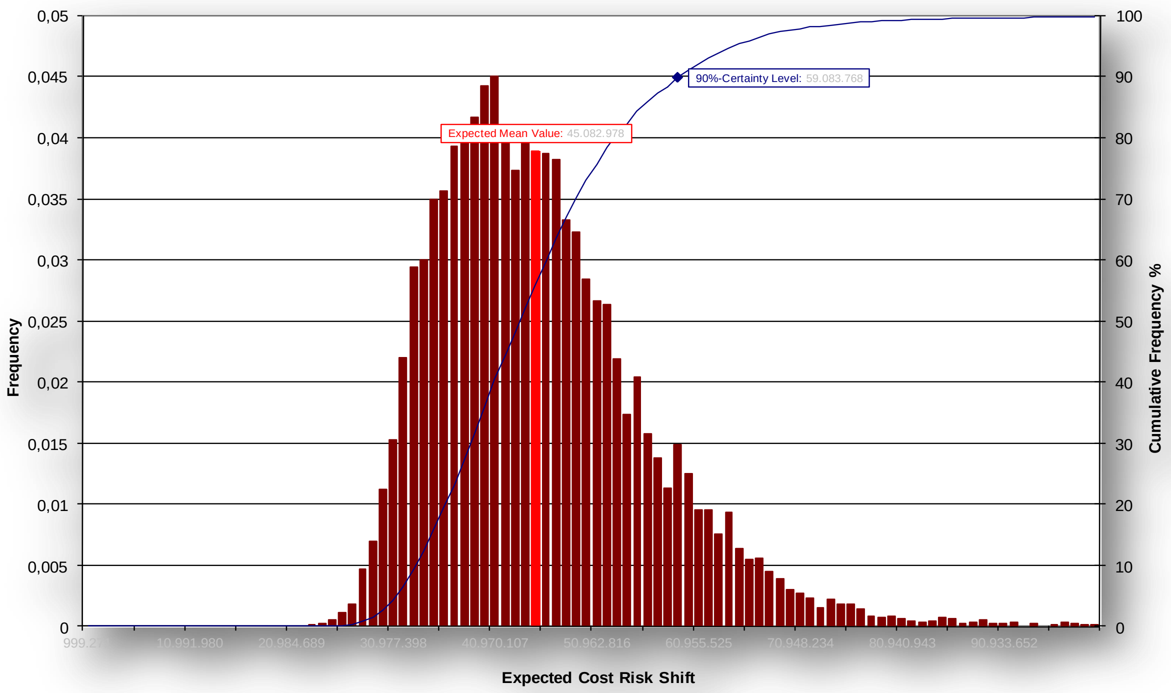
Project prototyping made use of the validated project baseline planning as a backbone for modelling and fictitiously executing the project up to 10,000 times, in order to assess how different combinations and concurrences of risks and uncertainties impact alternative critical paths in the project schedule and subsequently impact the feasibility of schedule milestones and project costs. Some risks and uncertainties (considering their order of magnitude and impact on critical path activities) could have caused larger contributions to overall risk shifts than others, resulting into an overall picture of schedule & cost sensitivities.

Essential for achieving a properly validated risk model and reliable risk simulation outputs was a full evaluation cycle of all project prototyping inputs, in close cooperation between the risk engineer, the project planner, the business controller and all key disciplines responsible for assessing individual risk items in the Risk register.

As a result of many possible combinations and concurrences of individual cost element uncertainties and risk events, the prototype model analysed the probability with which the project is likely to deliver a level of total budget overrun. Apart from the cost impact, the project prototype also examined the amount of days' time risk shift induced by risk events and activity duration uncertainties.

Prototyping the ROAD project and performing scenario simulations resulted in a number of key management inputs:

- Expected cost development vs. feasibility of overall CAPEX and OPEX budgets (mean values and 90%-certainties-of-not-exceeding, presented in probability density graphs).
- Sensitivity analysis on main contributors to budget risk shifts (risk events with direct cost effects, quantity & price uncertainties, time shifts causing indirect cost effects, liquidated damages).
- Expected feasibility of the project realization milestone by 31 December 2014 (mean values and 90%-certainties-of-not-exceeding).
- Sensitivity analysis on main contributors to risk shifts on schedule milestones.
- A CAPEX S-curve cost distribution, indicating points in time at which cost of risk occurs.



5. High Level Commercial Risks

5.1 Introduction

ROAD identified a number of high level commercial risks. These risks are mainly in the regulatory field of the project. MCP is analysing the business risk that could have an effect on the Final Investment Decision (FID) of the project. These risks were identified by closely following the national and international policies and laws. Also, by closely following the political views during sessions and discussions on CCS and sustainable energy the project was able to mitigate the possible risks as soon as possible.

5.2 Co-firing biomass in MPP3 in combination with CCS

This risk was not a technical risk. ROAD was confident that it was possible to capture, transport and store CO_2. The combination of CCS and Biomass was good for the planet and it could enable negative emissions.

MPP3 intended to co-fire biomass in the period that ROAD would capture CO_2. Although it was unclear at that moment how much biomass would be co-fired, any amount would have a negative impact on ROAD due to the way it is regulated. The EU-ETS did not incentivise Bio-CCS. In fact, there was a negative incentive in the EU-ETS for Bio-CCS while an emitter did not receive allowances for negative emissions. This lead to the situation that the emitter must have chosen whether it wanted to co-fire biomass or capture CO_2 (not both together). Due to the plans for co-firing biomass in MPP3, the EU-ETS allowances that ROAD would receive for reducing CO_2 would be reduced in proportion to the amount of biomass co-fired. This would lead, depending on the amount of biomass, to a substantial loss of income for ROAD.

Furthermore, the Netherlands was struggling to achieve the renewable energy targets of 20% renewable energy in 2020. The minister of Economic, Agriculture and Innovation agreed with the energy sector upon a so called 'green deal' to increase the renewable energy percentage in the coming years. This green deal in principle would expire in 2015. For the period between 2015 and 2020 an even more extensive voluntary agreement or obligatory regulations was expected. The co-firing of biomass was already the key instrument to achieve the targets in 2015 and would gain more importance in the period between 2015 – 2020. As high as average percentages of 40% co-firing biomass in coal-fired power plants in 2020 was already forecasted. MPP3 would probably also have to significantly co-fire biomass in the same period ROAD was capturing CO_2. This was a serious financial risk for ROAD.

Although Bio-CCS could contribute significantly to the reduction of CO_2-emissions and would even result in negative emissions, regulations prevented the development of Bio-CCS. The EC (see for example the roadmap 2050, published in December 2011) and other key decision makers considered Bio-CCS at this moment even necessary to keep the average surface **temperature** increase below **2**°. However, the perverse incentive in the EU-ETS needed to be removed in order to support the development of Bio-CCS. The obvious and most realistic solution was to provide allowances for negative emissions. ROAD and other stakeholders discussed this adjustment and tried to reach an agreement in 2012. But until these regulations were adjusted, it remained a serious risk.

5.3 Leakage of CO_2

The total amount of CO_2 stored in the period 2015-2020 was in the range of 4 Mton CO_2. This CO_2 would be permanently and indefinitely stored in the P18-4 reservoir. All the risks for potential leakage had been identified and all possible measures would be taken to prevent leakage. The injection of CO_2 would be constantly monitored and also after the abandonment of the well, monitoring would continue. Finally, a corrective measures plan was being developed to ensure that in case of a leakage sufficient measures could 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.c. TAQA) must surrender EU-ETS allowances for the amount of CO_2 that has leaked.

With a view to the storage permit application, the applicant needed to prove that the reservoir is sealed, but also what the leakage pathways would be in case CO_2 would leak unexpectedly.. The applicant also needed to calculate the amount of CO_2 that could leak to the atmosphere in case of a leakage. Furthermore, the permit holder needed to handover a financial security that covers the value of the EU-ETS allowances that is equivalent to the amount of CO_2 that could leak. Therefore, ROAD already had to take the financial risks into account that it would suffer in case of a leakage. The risk is:

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

The uncertainty for ROAD mainly was in (2) the allowance price, while ROAD had a reasonable estimation of the maximum amount of CO_2 that could leak to the atmosphere in case of a leakage. A sufficient and well thought corrective measure plan had been developed and ROAD was confident that in case of a leakage, ROAD could take sufficient corrective measures to stop the leakage.

However, the price of an EU-ETS allowance was a serious risk for ROAD. Because the handover of the EU-ETS allowances would be in the year that the leakage would occur, ROAD needed to pay the price at that time (this risk could to some extent be covered by hedging). For example, if a leakage occured in 2022, ROAD needed to pay the price in that year. At that time (2011), almost everybody agreed that the price would increase over time, but nobody knew how high the price would be. Estimations differed from 15 euro in 2020 to 140 euro in 2020. Furthermore, ROAD remained liable for leakage after the well and platform had been abandoned until the handover of responsibilities to the competent authority. According to the CCS-directive, this could take 20 years after the end of injection. Under certain conditions, ROAD could even be liable for leakage after the handover of responsibilities. The extended period of liability even increases the risk of high costs in case of leakage. The biggest concern was that an accurate estimation of the development of the EU-ETS price was not possible, but the amount of CO_2 that could leak would remain the same over time.

5.4 National and EU developments in energy legislation and regulations

As stated above, the Netherlands was struggling to reach the 14% renewable target in 2020. At that time (2011), voluntary agreements with the energy sector had been agreed upon, but as stated before, this so called ‘green deal’ would expire in principle in 2015. It was very difficult to predict what would happen after 2015. However, in the past years several proposals of the coalition parties, as well of the opposition parties, had been put forward. Examples of these proposals were a coal-tax, emission limits, obligatory co-firing of biomass percentages, CCS-mandatory regulations, moratorium on coal fired power plants, ‘Hybride leveranciersverplichting’ (obligation for electricity suppliers to supply a certain percentage of renewable energy), ‘producentenverplichting’ (obligation for electricity producers to produce a certain percentage of renewable energy) etc.

If the 2020 targets seemed to be unachievable the Dutch Government was expected to introduce additional legislation, so a change in legislation could be expected.

In principle, this would not per se have a negative impact on CCS nor ROAD. For example, if legislation would be introduced that sets an extra tax on the emissions of CO_2, this would create a positive incentive for CCS. However, the problem was not that the CO_2 reduction targets would not be met (most of the emissions were regulated by the EU-ETS and therefore it was certain that the reduction targets would be met), but the problem was that the renewable energy target would probably not be met. The main problem for ROAD was that CCS was not considered as a renewable technology. It was a CO_2-reduction technology, which was needed to achieve the reduction targets for the mid- and long-term in the most cost-effective way. But this CO_2 reduction target was regulated by the EU-ETS and not by national targets. Therefore, new legislation that probably would be introduced would focus on the increase of renewable energy percentages and would probably not give an incentive to the development of CCS. In fact, it probably always would create a negative incentive for ROAD because the proposals seemed to have a focus on discouraging fossil power plants in order to promote renewable energy. Even if legislation would be introduced that only in a positive way tried to increase the percentage of renewable, for example by additional subsidies for wind farms, this could have a negative impact on CO_2 reduction technologies for fossil fired power plants because the running hours of the fossil plant would be reduced.

Also it was not clear yet if additional regulations or other incentives would be proposed by the EC. The most important incentive for the development of CCS remained the EU-ETS. With phase III approaching and the inclusion of new industries (aviation), it was very probable the EU-ETS price would rise soon.

However, ROAD's opinion the EU ETS still suffered from the over allocation of allowances. Also the economic recession kept the price of allowances low. But it as probably not realistic to assume that the EU-ETS would be adjusted in the coming years. Therefore, other possibilities should have been examined. The United Kingdom for example, published plans for introducing a "carbon price floor" to give investors some security and minimize risks in the nearby future. If the allowances price decreased below the minimum price, participants in the EU-ETS should pay the difference. Such regulations could have reduced the risks for ROAD significantly. It was not expected that the Netherlands would follow this example. We hoped that the EC would come up with additional plans. As stated above, another important adjustment the EC could have made, was solving the problem of Bio-CCS (provide allowances for negative emissions).

In conclusion, it was realistic to assume that additional EU and/or Dutch legislation and regulations would enter into force the coming years. It was not clear what these exactly would be, but ROAD and other CCS stakeholders were trying to constantly raise awareness of the importance of the development of CCS (and Bio-CCS).

6. Summary of Risks, Mitigating Actions and Residual Risks

The following sections summarize the ROAD project top risks, as for September 2011. The buildup of each section is the following:

- Project risk description and possible consequence.
- Description and rationale of the corresponding mitigating actions to reduce/remove the associated risk. Note that not all the mitigating actions are yet in place.
- Description of the residual risk, still to be taken into account by the ROAD project

Note that a main part of the (short term) top risks are considered as such because of the uncertainties that will remain at the date of the Final Investment Decision (FID), which is expected in Q4 2011. If the FID date would have been later, some of the risks would have disappeared, highlighting the time dependence of the identification and evaluation of the risks. In any case, the reader must be aware that the summary given below was only valid at that time (September 2011).

Some previous risks are not mentioned as they have been already handled or removed. The risks that are not considered top risks are being discussed in ROAD's special report on handling and allocation of business risks in CCS demonstration projects draft for the Global CCS Insitute.

6.1 Capture

6.1.1 CAPEX Evaluation

The risk related to the CAPEX is that the actual CAPEX outcome will not be the same as the previously forecasted CAPEX, which could lead to:

- Unacceptable high CAPEX if overestimated – risk of project stop at FID.
- Unforeseen costs if underestimated – financial risk during project execution.

For the CAPEX risks of Capture three main costs were taken into account. These are:

- **Capture plant (EPC contract with the supplier).** As no FID was taken in November 2010, the EPC contract could not be signed before the end of 2010, leading to the need to renegotiate parts of the contract which could not be fixed and to a reimbursable contract due to the delay. The overall scope of the contract was clear and can still be applied for the final contract. Further clarification meetings were held with the selected (but also with the non-selected) supplier. Negotiations were also performed and would in order to update the final EPC contract and making it ready for signature by the end of 2011.
- **Interfaces with MPP3.** Accuracy of the scope of works included in the technical scope for the interfaces with MPP3.
- **Construction.** Accuracy of the estimates on the number of construction workers.

Mitigating Actions

Capture:

- Value engineering. As FID was expected to be taken in Q4 2011, a value engineering phase, in between the FEED and the detail engineering phase, was added. The aim of this value engineering was to optimize the design further, to minimize capital and operational expenditure and to adjust to previously unknown permitting requirements if necessary. The value engineering phase lead to 11 ideas to optimize the design and to reduce the expenditures, which did not have an significant impact on the overall design and equipment and therefore also no impact on the permitting and consenting documents.
- Start of detail engineering phase incl. HAZOP – August 2011.

- Defining compressor specifications based on the transport and storage flow assurance study – September 2011
- Updating technical specifications (employer's requirement) due to value engineering workshop and FEED study phase – Q3 2011
- Clarification and negotiation final bid – Q4 2011. In February 2011 a reimbursable contract had been signed with the chosen supplier, which would be valid until FID. After that the EPC contract would be signed.

Interfaces:

- Preparation of tie-ins report reports with MPP3 such as flue gas and steam. Those reports were drafted between August and December 2011.
- Long lead items (like the compressor) could be ordered after FID had been taken. Only some tie-in decisions needed to be taken in Q4 2011 before FID in order to fit with the planning of MPP3. For these a tie-in report was prepared.

Overall:

- Land lease agreement – 2011.
- Monitoring plan – Q3 2011
- Insurance – Q4 2011

Residual Risk

Capture:

- The residual risk for the ROAD project was the higher costs after final negotiation for the FID bid expected in Q4 2011. The project scope had not changed and the risk would be reduced once the EPC contract was signed.

Interfaces:

- Scope of work, man hours and tariffs were defined on budget estimates per tie-in, except for the flue gas tie-in. Out of scope work and increasing market prices could potentially be a financial risk for theproject. But these were not expected to be significant.

6.1.2 OPEX Evaluation

The risk related to the OPEX was that the actual OPEX outcome would not be the same as the previous forecasted OPEX, which could lead to:

- Unacceptable OPEX costs if overestimated – risk of project stop at FID.
- Unforeseen additional costs if underestimated – financial risk during operational phase.

When evaluating the OPEX, the challenges were linked to the capture plant performance, electricity and CO_2 price volatility and maintenance costs.

- Performance: ROAD would build a new CO_2 capture plant with technology that had not been operated on such a large scale. High OPEX costs were created on the steam consumption and electricity usage during operation. Also the solvent consumption could vary. These bandwidths were guaranteed by the supplier, but could need adjustments during the first year of operation to have the most efficient effect.
- Price volatility: for the operational period certain electricity and CO_2 prices were assumed. When the electricity price was outside of the assumed bandwidth these operational costs would vary accordingly. Maintenance: the assumption was made that a new capture plant that only has to run for a 5-year period would not need a lot of maintenance. But when an important spare part was needed, consequence could

be that operation would stop for months. Impact would be the loss of funding, in addition of the costs of the maintenance itself.

Mitigating actions

- Performance: a performance study on the modeling of the capture plant had been launched, in collaboration with experts of the parent companies. Goal was to model the design deliverance and compare these with the supplier guarantees – Q3 2011.
- Reliability: a reliability study was done on the capture design to check the availability of the capture plant – Q3 2011.
- Price volatility: 2 studies were performed (ECN and KEMA) to investigate the running regime (running hours and load profile) of MPP3 and the forward prices for electricity and CO_2 for the years 2015-2020. The prices for peak/off peak were taken into account and the bandwidths will be discussed with the parent companies and incorporated into the budget.
- Maintenance: all equipment considered as critical is covered by a spare part.

Residual risk

- Performance: lower availability of the capture plant. This had been taken into account in the business case. In the first year ROAD assumed a low availability that would slightly go up in the second year with a high availability in the last three years resulting in an average availability of 90%. This would give the supplier time for adjustments during the first year of operation.
- Price volatility: did not change. To predict the market after a 3 year forward period was very difficult. ROAD took into account the prices made available in the 2 studies.
- Maintenance: failure of equipment not covered by a spare part is unlikely.

6.2 Transport & Storage

6.2.1 Commercial Negotiations

The risks related to the commercial negotiations were both an unacceptable delay and/or a too high CAPEX that would stop the project.

At the time of the development of the risk management plan (2011), the storage concept was not finalized and results of studies were still expected. The commercial negotiations with TAQA were not completely finalized due to regulatory uncertainties and complexity of the site including ownership. A delay in contract finalization could mean a time delay of the project, resulting in higher CAPEX and possible loss of funding.

Mitigating Actions

- Commercial arrangements with TAQA were being finalized, on different levels with the partners. The aim was to finalize commercial arrangements with TAQA in Q4 2011.
- Alternative transport and/or storage fallback options were reviewed since all the commercial arrangements for transport and/or storage were not definitve yet.

Residual Risk

- Extra CAPEX and OPEX costs for the alternative storage solution.
- Timeline issues for the alternative project planning, which meant potential funding or long lead items issues.

6.2.2 CAPEX Evaluation

The risk related to the CAPEX was that the actual CAPEX outcome would not be the same as the previously forecasted CAPEX, resulting in:

- Unacceptable high CAPEX if overestimated – risk of project stop at FID.
- Unforeseen high additional costs if underestimated – financial risk at execution phase

Materials and construction works could not be contracted before the FID. The risks were the uncertainty to determine the actual prices/ costs for the T&S scope at that time. Also, the results of the important studies currently performed were to be expected around or after the FID.

The following risks (which have higher project costs as an impact) were taken into account:

- Uncertainty on the prices of the materials.
- Uncertainty on the scope of the project work.
- Change in project scope due to feasibility to inject and store CO_2.
- Other route for the pipeline.
- The planned horizontal directional drilling (HDD) plan is not sufficient and more engineering is needed.
- Uncertainty on the pipeline flow (two phase dense flow, more water than expected in the pipeline, etc.).

Mitigating actions

- Procurement philosophy for the materials that had to be ordered. The price of current (forward) proposals and the timeline would be incorporated.
- Concept select study (starting at the intake of the compressor till the reservoir bottom) to select the most optimal CO_2 transport, injection and storage concept. Also taking into account a minimal energy demand required and physical requirements, like the size of the platform.
- Route survey (offshore finished, onshore almost) for the route of the pipeline. Taking into account all constraints regarding harbor and shipping lane crossing.
- The flow assurance study would define the detailed specifications of the compressor and pipeline (insulation type, etc.).
- Proposal of material purchase options to base FID on actual offers.
- In addition to the technical work performed the commercial framework for the pipeline had been thoroughly discussed. The main contracts that were discussed:
    - Construction agreement (2011): subcontracting the engineering, procurement, construction and commissioning of the pipeline.
    - Operating and services agreement: arranging the operating and maintenance of the pipeline.
    - Transportation agreement: the commercial arrangement for the actual transport of CO_2
- For storage a monitoring plan provides information where the injected CO_2 is finally stored. The goals of the monitoring plan for P18 were:
    - Prove the top seal integrity.
    - Calibration of flow simulations.
    - Model the effects of CO_2 injection, the mitigation pathways, the effects on cap rock and faults. Therefore a 3D geological model was built. The model was historicallyy matched with the gas production data available

- Cap rock and fault integrity study was to evaluate the impact of induced stress changes, resulting from past gas production and future CO_2 injections, on top seals and faults.

Residual risk

Because of the phase the studies were in, there as now a 25% contingency on the budget. The flow assurance study would generate phase 1 results around September 2011. The contingency would then be lower than the current 25%. Around November 2011, the phase 2 results were expected from the flow assurance study. Contingency was expected to be 10-15% because of the detailed engineering performed. FID was expected after the phase 2 of the flow assurance study. The procurement phase was expected from Q1 2012.

6.2.3 OPEX Evaluation

The risk related to the OPEX could result in:

- Unacceptable high OPEX if overestimated – risk of project stop at FID.
- Unforeseen additional costs if underestimated – financial risk during the operational phase.

The regulatory uncertainties (regarding implementation of the European CCS directive) caused uncertainties on storage costs (e.g. monitoring costs) and long term liabilities, which could potentially become unacceptably high. Both the base case and all potential alternatives face these uncertainties. A consequence of the regulatory uncertainties could be a higher amount (for monitoring) per ton CO_2. Since the ROAD project aimed to capture (at least) 4 million tons the potential cost increase could be very high.

Mitigating actions

- ROAD monitored the regulatory process and offered support to the civil servants of the Ministry, for example by actively participating in the stakeholders meetings.
- ROAD was closely involved in the application process for the storage permit, addressed the key issues and found solutions for these issues. Transfer of responsibility to the competent authority and financial mechanisms for certainty.
- Commercial framework were discussed (not yet signed) with the operator. The commercial framework consisted of three contracts:
  - Project Development Agreement – Q4 2011.
  - Transporting, Processing, Operating and Services Agreement – Q4 2011.
  - Storage Service Agreement – Q4 2011.
  - Fixed contracts both for transport and storage – Q4 2011.

Residual risk

- Regulatory uncertainties still existed. ROAD expected to have more clarity on monitoring costs and liabilities around Q3 2011. There was still a possible high impact on the project costs.
- Commercial framework proposals was to be reviewed. Residual risks were still there until proposals were signed by both parties.

6.3 Interfaces

The risk related to the interfaces regarded the timing and costs, which could result in:

- A delay in the connections between ROAD and MPP3, putting at risk the funding and the project economics.
- If the costs were not correctly estimated, it could result in unforeseen additional costs.

In addition to the risk independently related to the capture, transport and storage, there was still a risk related to the whole chain of capture, transport and storage of CO_2. One major risk would be if the project was not operational as of 2015. This could be due to interfaces between capture, transport and storage or because of the interfaces between the capture unit and MPP3 power plant of Uniper.

Mitigating actions

- The flow assurance study would define the detailed specifications of the compressor (interface capture and transport) and the pipeline study (insulation type, etc.) was monitored by both the transport team as the capture team.
- Formal Interface meetings between the T&S team and the Capture team with written Minutes of Meetings ('MoM'). With these MoM's the decisions made for the interfaces between the departments were archived and responsible action owners (mainly from capture team) defined. During the project board meetings these decisions were discussed and approved.

Residual risk

- Because of the project specific characteristics (CO_2 capture plant on a large scale, specific compressor, and heater needed on the platform) there was always a likelihood that operational delay would occur at the start of the project. Residual risk was that the CO_2 storage would be delayed and the ROAD project could not store the required 4 million tons of CO_2.

6.4 Project timeline

The original project planning had a 6 months buffer, but due to a delayed FID, procurement and construction was delayed and no buffer was left. If the CAPEX period was delayed and substantial costs had to be made after 1 January 2015 these costs might not be eligible. Impact was a cost increase for the parent companies and loss of Dutch funding when ROAD would not store the required amount of CO_2 before 1 January 2020.

Mitigating actions

- Formal planning manager was selected who will monitor the critical path of the project – 2010.
- Procurement time buffer for the long lead items – Q1 2011.
- FID end 2011 at the latest.

Residual risk

- An assumption was that the ROAD project would have a delay of 3-6 months (intial commissioning period after 1 January 2015) in which the costs would not be eligible.

6.5 Funding

Project delays could have had a significant impact on the funding, like a partial or total loss of it, inducing unacceptable costs for the project.

In July 2009, MCP submitted its European Energy Program for Recovery ("EEPR") Grant Application for the ROAD project. The project plan foresaw an ambitious timeline as it aimed for significant early expenditures and commitments. The main focus therefore was to develop the project in 2009 and 2010 to such an extent that an FID could be taken by the end of 2010. After this FID, still in 2010, it would then be possible to commit to an Engineering, Procurement and Construction ("EPC") contract for the capture plant and to commit to laying the envisaged pipeline. Nevertheless, there was a delay of the FID to Q4 2011.

The risks related to the funding were hence as follows:

- The delay of the FID to Q4 2011 had as effect that expenditures and commitments were delayed as well. Impact could be the loss of total or partial funding from the EEPR and the Dutch funding.

- Some project costs would be non-eligible because not respecting the best value for money principle (EU Grants standard).
- Failure to report on other strict requirements to the European Commission which could lead to non-eligibility of costs.

Mitigating actions
- Hand in the new work plan and budget – Q1 2011.
- Ensuring EEPR Grant Agreement and Dutch Ministerial Order for funding the ROAD Project were agreed upon, finalized and signed – Q2 2010.
- Set up the formal procedure for best value for money. A decision matrix should be made for (contract) expenditures above € 60 thousand – Q1 2011.
- Setting up the (financial) administration and reporting processes – Q1 2011.

Residual risk
Assumptions were:
- New work plan accepted.
- (Original) budget expenditures as agreed with the EC and Dutch government are made before 1 January 2015.
- Amount of non-eligible costs according to the best value for money principle until the FID decision was known

6.6 Permitting

The main risks related to permitting were the following:
- The relevant permitting regime had undergone a number of changes in 2009 (State Coordination Scheme) and 2010 (Act for the Environmental Impact Assessment; WABO). These changes caused a lack of clarity about the process that should be followed and the identity of the relevant competent authorities, for both ROAD and the authorities, and the need to restart some activities, resulting in delays.
- The environmental consent application for the capture plant received only few comments from the Environmental Protection Agency of Rotterdam area. ROAD could facilitate these comments. The only discussion point that emerged was how to measure the air emission from the stack: should the emissions from the capture plant be treated differently from the emissions from MPP3, or should they be treated as one mixed stream? From the discussion in May 2011 emerged that the first approach could and should be chosen.

Mitigating actions
- Submission of additional studies underpinning the application for a permit under the Nature Protection Act for Capture.
- Additional study on potential archeological obstacles in the pipeline trajectory.
- Discussing the final draft EIA and permit applications with the authorities and the Commission for Environmental Impact Assessments.
- Submitting the storage plan for the P18-4 storage permit and the State Zoning Plan (D5.3).
- A strong working relationship with the authorities had been established in Q3/Q4 2010 and even grew stronger under the time pressure. ROAD also submitted information collected during the permitting process to the Ministry of Economic Affairs, Agriculture and Innovation, responsible for the zoning plan that concerns the pipeline.

Residual risk

- Uncertainty on the permit status when FID had to be taken by the parent companies.
- If permitting process is delayed (by ROAD, authorities etc.) this could have a significant impact on the overall project delay.
- Further calculations with regard to the indirect cost effects had to be made in case of a time delay on the critical path.

7. Conclusions

Because of the innovative characteristics of the Maasvlakte CCS project, it faced more risks than usual utilities projects. On the one hand, capturing, transporting and storing CO_2 at this scale involves managing new technical risks as the combination of the technologies involved has not yet been demonstrated. On the other hand, dealing with a project where the regulatory framework still had to be developed also created business risks for the ROAD project. Therefore, regarding the particular challenges of risk management, MCP committed itself to develop a risk management approach that would carefully identify, evaluate and mitigate by adequate measures the identified risks.

The construction contract for Capture, the main contract of the ROAD Project, had been derived via an extensive FEED study and had therefore the lowest percentage of contingency of the project. The storage area had the highest percentage of contingency in the FID phase of the project.

Since the beginning of 2011, the ROAD project started with an extensive Risk management approach to list, evaluate and treat the identified risks. Also, by using the knowledge within the parent companies and third parties, ROAD tried to identify unknown risks that had not been identified before. With the use of the knowledge from the Parent companies and third parties, ROAD started the process of completing the Risk Register and initiated successful mitigating actions to eliminate/ downsize the risks where possible.

Following the description of the funding principles extra requirements were made by the providers of the subsidies. Part of the obligations under the subsidies is the issuing of guarantees to be provided on behalf of both Uniper and Engie to cover the Partnerships obligations towards the Dutch State and the EU Commission in case the Consortium cannot fulfill part of its obligations under one or both of the subsidies.

ROAD mainly monitored policy developments and brought issues to the attention of parent companies who took the lead in engaging with policy-makers at the EU and national level.

The Project Management Board is confident that the ROAD risk register was as complete as possible. Therefore, ROAD expected that project risks would be mitigated to an acceptable level to allow the project to proceed.