Work package 2- Historical and recent attitude of stakeholders

Case 23:
CRUST CO_2 capture & storage project

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*C*ultural Influences on *R*enewable *E*nergy *A*cceptance and *T*ools for the development of communication strategies to promot*E* ACCEPTANCE among key actor groups

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Contents

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1. Introduction

This case study deals with the CRUST project: CO_2 Reuse through Underground Storage. The project originated from the 4th National Environmental Policy Plan (2001), in which the government expressed a need for a transition towards a more sustainable energy system including the use of cleaner fossil fuels. The Dutch government started the project in late 2001 with the aim of reducing (technical, financial and social) uncertainties about CO_2 storage and developing an implementation. The 1996 established 'CO_2 Reduction Plan Project office' carried out the project. In the first part of the project two feasibility studies were produced as well as an analysis of the societal support from various stakeholders. In the second part of the project Gaz De France received finance to start a demonstration in the North Sea (2004-2006). This case study aims to analyse how visions and expectations changed throughout the project.

2. Country overview: carbon capture and storage in the Dutch context

The Netherlands are a relatively small, but densely populated country. Fossil fuels (in particular coal and natural gas) dominate power and heat supply, although renewable sources are slowly emerging from minor niche market applications in the 1970s and 1980s. Still, local energy production from renewable sources only accounted for 2.4% of total domestic *energy* demand in 2005. In 2004 another 9% of all *electricity* demand was imported renewable electricity. Wind turbines and biomass technology dominate renewable energy supply nowadays and are expected to increase in the near future.

Interest in CO_2 storage arose in the early 90s when Dutch researchers began to investigate the feasibility of CO_2 storage. Other advocates like the Dutch Energy Council and the Dutch Environmental Council[1] began to emphasize the beneficial Dutch circumstances for CO_2 storage, arguing that the Dutch should exploit their strong position in the natural gas sector ('Nederland Aardgasland'). Indeed, since the discovery of huge amounts of natural gas in the late 1950s an extended natural gas grid was constructed and a large knowledge infrastructure emerged.[2] Both promise to be good starting points for developing CO_2 storage in the Netherlands. Pointing to an increasing number of depleted natural gas fields, the advocates also argue that these fields could be used for storing CO_2. In the 1999 Climate Policy white paper, the government has acknowledged the potential of clean fossil fuels on the long term and again in 2001 in the 4th National Environmental Policy Plan (NMP4) (Van Geel, 2005).

In 2002 the Dutch Energy council published an advice to the Minister of Economic Affairs for an energy policy in the post-Kyoto period (>2010-2012) (AER, 2002). The council argued that despite a lack of demonstration projects the Netherlands still have a strong position for developing and implementing CO_2 storage technologies and advised (among other things) to:

- Establish a joint research programme with research institutes, technology companies and other market stakeholders.
- Perform demonstration projects and develop an infrastructure for the storage of CO_2 in old natural gas fields, both on and off shore.
- Stimulate research and development on CO_2 storage technologies.

In the following years CO_2 storage was increasingly recognized in the policy domain as an essential step in the transition towards a sustainable energy sector. Still, real demonstration pro-

1 Full name: Netherlands Council of Housing, Spatial Planning and the Environment.
2 Current estimates are that Dutch natural gas resources are sufficient for another 25 years with similar production levels.

jects were lacking. In 2003 the Minister of Economic Affairs published a new policy paper on Clean Fossil Fuels arguing that:

> *"Clean fossil fuels are one of the three pillars in Dutch climate policy. However, it is only a fictive pillar; hardly any details exist. [...] There is no sufficient set of incentives for stimulating clean fossil fuels, nor has there hardly been any practical testing in the Dutch context." (EZ, 2003)*

The Minister emphasized the importance of CO_2 storage in particular for the long term, acknowledging the limited experience in the Netherlands and the fact that CO_2 storage was not necessary for complying with the Kyoto protocol. Yet the Minister also concluded that fossil fuels would continue to play a major role in the next decades (90% in 2020), while the share of renewable energy sources and energy saving would remain relatively small. Ambitious long-term goals in the NMP4 and expected high costs for post-Kyoto reduction aims would probably make CO_2 storage a necessary pillar next to energy savings and renewable energy generation. The Minister thus concluded that it was important to anticipate the need for CO_2 storage in the future by starting to align ongoing national activities on CO_2 storage and connect with international research, support demonstration projects and decide if and how to include CO_2 storage projects in the feed-in instrument for green electricity generation (MEP).

In this context the government initiated the CRUST project in 2001.

3. Summary: the CRUST project and carbon capture and storage

The ultimate goal of the CRUST project was to realize underground CO_2 storage facilities in such a way that CO_2 can be recovered and used in the future (e.g. for supply to greenhouses). The project's approach was to interest market players in the design and management of a storage project on the basis of feasibility studies (to be carried out by the market players) and an invitation to a tender. The 1996 established 'CO_2 Reduction Plan Project office' carried out the project on behalf of the Ministry of Economic Affairs (EZ) and the Ministry of Housing, Spatial Planning and the Environment (VROM). The project was divided in four phases (Dijk and Stollwerk, 2002). In the inventory phase (2001-2002) the aim was to produce an overview of the interest and willingness among market players to invest, familiarize relevant stakeholders with the government policies for CO_2 storage, invite them to participate in the societal debate, and identify and analyse constraints associated with a storage project. But no specific targets for CO_2 storage utilisation in the future were set.

In the second phase (2002) market players were invited to perform a feasibility study on a specific project. This resulted in two feasibility studies. The first one was a feasibility study by Shell and NAM on storing CO_2 from the Shell Pernis refinery in a depleted natural gas field called 'De Lier'.[3] The project envisioned an existing pipeline (operated by NAM) to transport CO_2 over a distance of 16 km's where it was to be pressurised to 80-100 bar and injected in De Lier. Optionally, the CO_2 could be recovered from the storage field and supplied to greenhouses. So De Lier could act as a storage buffer between CO_2 production and CO_2 supply. The second project was a feasibility study by Gaz de France on re-injecting CO_2 (already being captured from a natural gas production unit but released into the atmosphere) into an almost depleted gas field in the North Sea (K12b gas field).

The third phase (2003) was the investment and construction phase, in which the project by Gaz de France was financed with the Dutch government covering 90% of all costs related to CO_2 capture and storage.

[3] Nederlandse Aardolie Maatschappij (NAM, Dutch Oil Company).

The fourth phase (2004-) is still ongoing and is the operational phase in which the project is continuously monitored. This phase started with a trial, in which small scale CO_2 injection of about 30,000 tonnes/year was realised. Currently large-scale injection of approximately 400,000 tonnes/year is intended to start in 2006 with duration of up to 20 years, but a decision is pending.

In addition to technical matters the Dutch government explicated asked market players to give their views on the information and communication needed to inform stakeholders and stimulate awareness in society. In addition a special committee ('klankbordgroep') was installed existing of a broad range of different stakeholders (including research institutes, environmental organisations, representatives from the oil and gas industry and local governments) to give feedback on the project. This committee produced an extended report on the visions and concerns of all the stakeholders (Groot et al., 2003).

4. STEP ONE: Vision of the CRUST project

The Dutch government initiated the CRUST project in the context of 'transition policies'. Transition policies emerged after the publication of the fourth National Environmental Policy Plan NMP4 as an important policy paradigm to deal with long lasting environmental problems in various sectors. Transition policies aim to stimulate change towards a sustainable society by taking a long-term perspective (50 years or more) and develop visions together with stakeholders. The interactive approach in the CRUST project fitted this policy paradigm.

The original aim of the CRUST project was to realize CO_2 supply from industries to greenhouses. Because of large fluctuations in supply and demand CO_2 storage was seen as a necessary part of the project. So gaining experience with CO_2 storage was initially seen as a side effect of the project. Throughout various policy documents the government's vision shifted towards learning about storage with a perspective on future use rather then storage as a short buffer between supply and demand (Groot et al., 2003).

The CO_2 reduction plan project office summarized the ultimate goal of CRUST as:

> *"To realize a CO_2 buffer - 'underground CO_2 storage facilities that have been designed so that CO_2 can be recovered and used'" (Dijk and Stollwerk, 2002).*

More generally the government saw CO_2 storage as another pillar in the transition towards a sustainable energy sector next to renewable energy and energy savings (see also above), but for which more research was necessary. Another important aspect of the government's vision was that CO_2 storage could greatly benefit Dutch industry in terms of market opportunities. So stimulating innovation was part of EZ's agenda (EZ, 2003).

Gaz de France is a second stakeholder that was heavily involved in the CRUST project. Gaz de France is a large French energy company that mainly produces, transports, distributes and sells natural gas to 13.8 million customers (individuals, companies, local authorities) in Europe. The Group operates gas fields in France, the Netherlands, Germany, the UK, Algeria, Norway, Libya, Egypt, Mauritania and Kazakhstan. The CRUST project is part of wider research activities within the company regarding CO_2 storage. Gaz de France is also involved in the Snøhvit project in Norway and investigates social and regulatory aspects related to CO_2 storage in France. Gaz de France is also a partner in the recently started European CASTOR project on CO_2 storage in Denmark and investigates the Altmark region in Germany (Gaz de France, 2005).

In the Netherlands Gaz de France produced natural gas from various gas production installations on the Dutch continental shelf of the North Sea. In the beginning of the CRUST project, Gaz de France described their view as follows:

> *"As a player on the Dutch gas production market, GPN supports the idea of injecting CO_2 in depleted gas fields in order to reduce the atmospheric CO_2 emissions. […]The actual realisation of a (demonstration) facility for CO_2 injection at this location will contribute to the acquisition of further insight in this area and enhance awareness and support for this technique." (d'Hoore, 2003)*

More generally Gaz de France expected that the project would serve two goals: enabling Gaz de France to continue operating an almost depleted natural gas field, while providing hard evidence on whether carbon sequestration offers a potential solution for climate change.[4]

5. STEP TWO: What were the various expectations of the case?

There were a variety of actors directly or indirectly involved in the CRUST project. Important is that learning about different stakeholders views was an explicit objective of the project. Table 5.1 lists the main actors.

[4] http://www.emissierechten.nl/climate_changegaz_de_france_unve.htm.

Table 5.1 *Main actors directly and indirectly involved in the CRUST project*

Actor	Expectation	Speaking for ‘publics’
Ministry of Economic Affairs and the Ministry of Housing, Spatial Planning and the Environment	To learn about uncertainties and show that CO_2 storage is safe and feasible	General public
Gaz de France	To successfully demonstrate the feasibility of offshore re-injection of CO_2 into a depleted gas field in the North Sea	Employees / shareholders
Shell / NAM	To successfully demonstrate the feasibility of storing CO_2 captured from an industrial process in an on-shore depleted natural gas field	Employees / shareholders
Other market players	Clean fossil fuels is worth investigating, but the economics depend completely on the government	Industries / other market players
Environmental organisations / NGO’s	CO_2 storage only acceptable when risks are investigated and avoided and when it does not effect investments in renewables	General public / local resistance groups / ‘nature’
Scientific community	CO_2 storage is a necessary intermediary step in the transition, but a great deal of research is necessary on issues like safety and local impact. Future application is very much feasible.	Dutch scientists
European Union / CASTOR	CO_2 storage is important part of future energy systems. To develop and validate, in public/private partnerships, all the innovative technologies needed to capture CO_2 and store CO_2 in a reliable and safe way.	European Citizens
International Panel on Climate Change (IPCC)	CO_2 storage can play major role	International scientific community

As discussed above the main actors in the project are the Ministry of Economic Affairs (EZ) and the Ministry of Housing, Spatial Planning and the Environment (VROM). During the 1990s EZ and VROM was faced with research outcomes from the scientific community about clean fossil fuels and CO_2 storage as an option to fight climate change. Also the Energy council and the Environment council played a role in putting CO_2 storage on the agenda. Although promising, the perception of the ministries was that there were still a lot of uncertainties surrounding CO_2 storage. In particular important was to find out if there was sufficient support from market players to develop further this technology. The interactive approach applied in the CRUST project fitted a more general trend in environmental policy making towards participatory methods and processes of long-term vision building. Another important objective was to learn about safety issues, in particular related to gas leakage (on the short and long-term).

Three market players reacted to the invitation to perform a feasibility study; one was rejected because the proposal did not include a specific location for CO_2 storage. The other two (Shell and NAM, Gaz de France) continued with feasibility studies. Shell and NAM build upon an on-going project in which CO_2 from a hydrogen production process would be supplied to greenhouses in the area. They expected that CO_2 storage could very well be part of the project, and that there would be no particularly large problems with respect to technical feasibility. However, they did expect problems with non-technical issues and in particular related to legal conditions (no framework existed for CO_2 storage), economic viability (CO_2 had only limited economic value) and stakeholder support and social acceptance (about which hardly anything was known) (Luijk, 2003).

Gaz de France was even more positive. On the basis of the feasibility study the company expected that "the application of CO_2 injection and storage in depleted natural gas reservoirs had significant potential to substantially reduce the emission of CO_2 into the atmosphere". The investigated platform was expected to have excellent facilities for a demonstration project and the natural gas reservoir showed good characteristics for underground injection. Gaz de France also did not expect any substantial environmental effects nor did they expect any safety, legal or social impediments to stand in the way of underground CO_2 storage. The company did note, however, that it would be important to monitor acceptance of CO_2 storage among the various stakeholders (d'Hoore, 2003).

The general expectation among market players was less positive than the companies directly involved. In particular they hesitated because of high uncertainty about societal acceptance, about responsibility issues (in case of CO_2 leakage) and economic feasibility. Market players emphasized that CO_2 had no or only very limited market value. They argued (strategically) that the success of any CO_2 storage and supply project was therefore completely depended on public finance. Also important is that CO_2 storage would lower energy efficiency of industrial processes and in particular power generation. This contradicted a long-standing rule of thumb in many industries (and in particular energy industries) to design processes with a high energy efficiency - something which also the government had been stimulating ever since the first oil crisis (Groot et al., 2003).

Several environmental organisations participated in the committee supporting the CRUST project, including Greenpeace, the Netherlands Society for Nature and Environment (SNM) and the regional environmental federation of the province of Zuid-Holland. The general expectation of environmental organisations can be described as moderately positive. The organisations saw CO_2 storage as a necessary option, because energy saving and renewable energy sources would not be able to stabalise CO_2 levels at a desired level. Several organisations wrote a letter to the parliament to show their support for a demonstration project in 2002 in order to learn about desirability of CO_2 storage. They did so, however, with very specific conditions in mind. The most important condition was that CO_2 storage should not result in lowering investments in renewable energy and energy savings (Groot et al., 2003).

One organisation expressed their expectation as follows:

> *"Carbon dioxide storage could be a temporal solution on the way to sustainability, because it prevents that CO_2 gets into the air and the climate problem will be diminished. A big disadvantage however is that the problem is not dealt with at the source, while there currently are many effective technologies and measures that do so and prevent CO_2 emission in the first place. These alternative measures and technologies are not sufficiently used at all. With CO_2 storage the problem is almost being hidden this way, nothing is being done about the cause. The government and the energy sector can easily use this technology as an excuse not to take the difficult step towards sustainability." (Huijts, 2003).*

The scientific community was positive about future possibilities for carbon storage, but emphasized that there was still a lot of uncertainty. In particular safety issues like leakage into air and sea required major attention before large-scale introduction. Also costs were still considered a problem, but scientists expressed that they expected lower costs in the future. The scientific community expected that advancing knowledge could lead to large-scale availability of CO_2 storage between 2010-2020. (Turkenburg, 2004).

The European Commission was a more indirect participant in the project and not immediately involved from the beginning. However the project by Gaz de France was later linked with several international research programmes, including the CASTOR project financed by the European Commission. The European Commission proved to be an important advocate of CO_2 storage, arguing that:

> *"It is recognized that fossil fuels will continue to be used for the foreseeable future and it is therefore imperative that cost-effective solutions are found to establish near zero emission technologies of a high environmental standard. Accordingly, the capture and storage of CO_2 associated with cleaner fossil fuel power plants is deemed to be an essential factor for fossil fuels to be part of the sustainable energy scenario." (European Commission, 2004)*

Another actor worth mentioning is the International Panel on Climate Change (IPCC). Although not directly involved in the CRUST project, the IPCC (a UN-based scientific organisation) is often regarded to be an important authority in the field of climate change. In 2001 the IPCC published the Third Assessment Report in which CO_2 storage was only briefly discussed. Due to increasing political attention for CO_2 storage the IPCC started working on a special report in 2003, which was published in 2005. The report gave an extended scientific overview of the state of the art of CO_2 storage and concluded that it should be seen as an important climate change prevention option, which together with many other options could play an important role in future energy systems. The report was generally well-received, in the press as well as in the national scientific and policy communities. The report intensified the discussions within the Dutch policy domain (De Coninck and Bakker, 2005; Werkgroep Schoon Fossiel, 2006).

6. STEP THREE: Understanding 'participatory' decision-making: negotiation expectations

Various forms of participation and negotiating expectations occurred in the CRUST project. They are summarised in Table 6.1.

Table 6.1 *Forms of participation in the CRUST project*

Type	Organizers	Involvement	Purpose
Meetings of CRUST committee	CO_2 Reduction Plan Project office	Market players, environmental organisations, industry, scientists	Openly discuss opinions and viewpoints
Email reactions on propositions	CO_2 Reduction Plan Project office	Market players, environmental organisations, industry, scientists	Get insight in viewpoints of different stakeholders
Feasibility studies	CO_2 Reduction Plan Project Office	Shell, NAM, Gaz de France	Gain insight in various aspects related to CO_2 storage including stakeholder perspectives
Letter to parliament	Environmental organisations	Environmental organisations	Express willingness to support CO_2 storage
Policy papers	National government	Policy makers Other actors?	Show policy maker's viewpoint and inform stakeholders about policy direction.
Newspapers	Various stakeholders including NGOs, industry and scientists	Various stakeholders including NGOs, industry and scientists	Show viewpoints and/or scientific results to the wider public
(Inter)national scientific network	European Commission, Dutch government	CASTOR: various R&D-, oil and gas-, power- and manufacturing companies. CATO: various Dutch researchers, companies and environmental organisations	Advance knowledge on CO_2 capture and storage

An important part of the CRUST project was to learn about what the actors' opinions were regarding CO_2 storage. Within the project this was made explicit by installing a special committee for discussing viewpoints and opinions. The composition of the committee was such that it represented the different stakeholders within society. This included regional and national environmental organisations, scientists, industry and communication experts. The group met three times, but also gave their opinion about several propositions through email. For the group meetings the CO_2 reduction plan project office also prepared two papers - one covering an overview of recent policy papers, the other covering an overview of NGOs viewpoints found in various (news)papers.

Another forum for negotiating expectations were the feasibility studies by Shell/NAM and Gaz de France. The CO_2 Reduction Plan Project office explicitly asked participants to not only include technical aspects, but also discuss issues related to societal acceptance, the framework of laws and permits, safety aspects, a monitoring and management plan and the economic benefits of implementation. Shell/Nam and Gaz de France presented the reports on one of the meetings of the CRUST committee.

Several environmental organisations send a letter to parliament to discuss their point of view on CO_2 storage, in which they presented themselves as advocates of a demonstration project. Greenpeace, who considered themselves as one of the most critical organisations regarding CO_2 storage, participated in the effort with the explicit notion that CO_2 storage was only desirable when it would not result in lower investments in renewables. Indeed, ongoing discussions within parliament about decreasing financial support for renewable energy generation eventually caused Greenpeace to withdraw from the CRUST committee (Groot et al., 2003).

Another forum where discussions took place was on the government work floor, which became visible in various policy documents. In 2001 the CRUST project was mentioned in an evaluation document regarding climate change policy and again in the 2002 Energy Report. Also the 2003 policy document on clean fossil fuels was an outcome of discussions within the policy domain on clean fossil fuels and CO_2 storage. There is no information available about involvement and input from stakeholders, although it is very likely that various stakeholders gave input into these policy documents, e.g. through the CRUST project itself.

Several stakeholders published in newspapers and specialist journals to express their points of view regarding clean fossil fuels to the wider public. Many NGOs, but also industry and scientists did so. The CO_2 Reduction Plan Project office collected many of these and gave an overview of the viewpoints in one of the meetings.

Finally, the CRUST project also became embedded within wider scientific networks. Besides the already mentioned CASTOR project, monitoring results of the project were also discussed within the CATO project. The CATO project is a large Dutch research program running from 2004-2008 and represents the knowledge network in the field of CO_2 capture and storage in the Netherlands and aims to assess and develop new knowledge, technologies and approaches in this field.

7. STEP FOUR: From visions to actualities

The outcomes of the feasibility studies were not as straightforward as the Dutch government had hoped for. The two projects were completely different, both showing positive and negative aspects. The NAM/Shell project was on-shore project with a large storage capacity (0.5 Mton CO_2/yr) and a long duration (15 years of storage capacity). The costs of CO_2 storage were limited (€ 20 - € 40/ton), but the long duration of the project and the large capacity would require a large initial investment (€ 45 million). This was consistent with earlier promises of the government for financing a CO_2 project in the white paper on climate change (1999), but the investment greatly exceeded the budget allocated within the CRUST project (only € 13.6 million was allocated for the project). The Gaz de France project, on the other hand, was an off-shore project with a relative small storage capacity (20 kton CO_2/yr) and a short duration (2 years). The costs of CO_2 storage were large (€ 56/ton), but could be reduced in case of scaling up the plant (although it was uncertain if that was possible at all). Total investment costs could be covered within the CRUST budget, but the government had doubts whether the project had sufficient 'learning potential': Gaz de France already captured CO_2 at the plant and the technique was generally known in industrial processes. Re-injecting CO_2 into the natural gas field and pushing out additional gas (Enhanced Gas Recovery) was new, however, and the project could contribute to learning about the feasibility of such process (Groot et al., 2003; De Coninck, 2006).

The choice to finance one (or none!) of the projects was discussed within the CRUST committee. The committee argued that it was crucially important to have a clear view on what should be the learning effects of a project. Should a project only show that what is feasible on paper is also feasible in practice? Should a project focus on technical issues or learning about economic feasibility? Or should the focus be on learning about means of communication or regulatory and societal acceptance issues? The committee concluded that first there should be clarity about the learning potential before making a choice between the projects.

Other options discussed were to postpone the decision or increase the budget. The committee believed, however, that postponing the decision would not be smart, because the members expected that industry's interests would rather decrease than increase in the future. Increasing the budget was also not considered to be smart: although CO_2 storage was expected to be a relatively inexpensive method for CO_2 emission reduction, the committee argued that such a budget increase could very well lead to a decrease in available financial means for renewable energy sources - something which would result in ‘a drastic reduction of support from environmental organisations’ (Groot et al., 2003).

Taking the arguments into consideration the government decided to finance the Gaz de France project in 2003 (TK 2003-2004, 28241, nr. 6). The Dutch government financed 90% of the project costs related to CO_2 storage and Gaz de France the remaining 10%. In May 2004 Gaz de France started to compress and inject CO_2 into a part of the reservoir that was no longer producing natural gas. In the second phase (starting in January 2005) Gaz de France began injecting CO_2 in a producing part of the reservoir. Technical monitoring of the project has resulted in the preliminary conclusion that ‘[the project] was successful and proceeded entirely according to plan and expectation’, although ‘at the end of 2005 there was no clear evidence of measurable improvement in the gas-production performance of the tested compartment’ (Van der Meer et al., 2006).

While technical results seem to fulfill initial promises of the CRUST project, societal acceptance of CO_2 storage continued to be part of heated debates. The stakeholder participation approach of the CRUST project had shown that environmental organisations were reasonably favorable towards CO_2 storage, but most of them agreed that it should not be applied at the expense of renewable energy development and energy savings. In 2005, however, the Dutch government announced an additional € 250 million for investments in sustainable energy to compensate for a prior decision to allow the only Dutch nuclear power plant to continue power production (which conflicted with earlier an decision to close the plant). Of this amount 60% was allocated to CO_2 storage, which led one environmental organisation (‘Milieudefensie’) to conclude that ‘CO_2 storage directly effects the subsidies available for energy saving and renewable energy’. Together with CE (author of the final report of the CRUST committee) Milieudefensie published a report in which they resisted strongly against public finance of CO_2 storage, arguing that (De Bruyn and Wit, 2005):

- CO_2 storage is more expensive then energy saving and does not result in a transition towards a sustainable energy system.
- CO_2 storage increases the demand for fossil fuels, because efficiency of power plants decreases.
- CO_2 storage increases the emissions such as NO_x, while energy saving and renewable energy decrease less air pollution.
- CO_2 storage can cause certain side effects on waste streams from fossil fuel combustion, which are still very uncertain.
- CO_2 storage can lead to a lock-in in the existing energy infrastructure, which can complicate the transition towards a sustainable energy system.

Despite their strong position against public finance, Milieudefensie was still in favor of CO_2 capture and storage, arguing that it was technically feasible on the short term and advised that the government should oblige the use of this technology for new power fossil fuel power plants (although without public finance). This mixed position resonated with a more general tendency in the Netherlands to consider CO_2 storage necessary although many issues still needed to be investigated. International developments such as the publication of the IPCC report reinforced this vision. The CRUST project itself was part of this process and became embedded in follow-up projects such as the CATO project. Put otherwise, the CRUST project (although small) has acted as a stepping-stone for CO_2 storage to mature into an option worth investigating further. Recently, a working group of various stakeholders (including Gaz de France) even advised to make Clean Fossil Fuels a separate transition pathway among six other pathways that are the basis for current transition policies in the Netherlands, thereby referring to the project by Gaz de France (Werkgroep Schoon Fossiel, 2006). This does not imply that the CRUST project resulted in a wide societal acceptance of CO_2 storage in the Netherlands. However, the CRUST project did result in a global overview of different positions of various stakeholders and some of the conditions under which these positions might change.

8. Lessons learned

This paper discussed the CRUST project in the Netherlands. Several lessons can be drawn from the analysis.

First, CRUST can be seen as a deliberate attempt to organize a multi-stakeholder process in which societal acceptance was a focal point of interest from the beginning. The main elements of the process are a request to market players to explicitly address societal acceptance in their feasibility reports, the establishment of a special committee representing the industry, government, NGOs and scientists to monitor the process, and the collection of the various points of views from stakeholders from (news)papers and other sources. These specially created forums for multi-stakeholder interactions produced a lot of information on the viewpoints of various stakeholders regarding CO_2 storage in general, i.e. regarding the general desirability of CO_2 storage as an option in future energy systems.

Second, what CRUST did not result in was insight in local acceptance of a specific project. This can partly be explained with the distinct location of the Gaz de France project in the North Sea. However, also the feasibility study that NAM/Shell conducted did not explicitly discuss local acceptance issues and only focussed on general acceptance. However, Groot et al. (2003) rightly distinguish between the two levels of societal acceptance, arguing that the factors that effect general acceptance or probably different from the factors that effect local acceptance.

Third, despite the deliberate attempt to discuss general societal acceptance, the multi-stakeholder process did not necessarily result in an increased level of societal acceptance. NGOs still seem to have concerns regarding (financing of) CO_2 storage projects, while scientists still sketch promising futures for CO_2 storage and the government still sees CO_2 storage as a necessary option in future energy systems. CRUST should therefore not be seen as a blueprint for increasing societal acceptance of energy projects, but rather as an example of how to enable relevant stakeholders to present and discuss their opinions in a semi-democratic and open process.

Fourth, the case also shows that societal acceptance processes are hard to shape (let alone steer at the will of a single actor). Some actors might not want to participate or withdraw from the process for many reasons (such as Greenpeace's withdrawal from the CRUST project due to dissatisfaction with public policy). Moreover, societal acceptance is only partly the outcome of deliberate attempts to shape societal acceptance. Instead, this case suggests that also wider, ongoing (international) processes effect societal acceptance. In this case, the IPCC report and increasing international attention for research on and demonstration of CO_2 capture and storage technologies have increased legitimization for CO_2 research in the Netherlands. This makes it difficult (and maybe even impossible) to determine the outcome of any attempt to shape the societal acceptance of energy technologies. Any attempt to shape societal acceptance could probably benefit from taking a more moderate perspective, which allows for an open outcome to emerge, but also aims to anticipate the contextual conditions in which actors' perspectives are likely to change.

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