CreAte Acceptance

Work package 2- Historical and recent attitude of stakeholders

Case 25: Schwarze Pumpe CO_2 capture and 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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1. Introduction

This case study is about a pilot power plant that the Swedish-based power company Vattenfall is building in Spremberg in the state of Brandenburg, Germany. This pilot power plant will be the first plant in Europe to capture CO_2 from coal combustion. It is a first step in Vattenfall's long-term plan for reducing CO_2 emissions from power production. The 30 MW pilot plant is currently under construction, and will go into operation in May 2008. It is thus the first available example of its kind in Europe. This case study provides early experiences of its social acceptance.

The case study is based on an Internet press review and Vattenfall publications, as well as publications by other interested parties. Interviews with key players have also been conducted: with Vattenfall Germany representative Mr. Staffan Görtz, Head of Communications, Mr. Adam, Communications Officer for the City Council of Spremberg, and with some citizens of Spremberg. For more information about the interviews, see Appendix A. Appendix A presents a complete overview of the interviews. Due to the small number of interviews and the early stage of the project, only indicative conclusions can be drawn.

2. Country overview: CCS in the German context

Germany has quite recently emerged as one of Europe's leading countries in carbon capture and storage research and development, alongside Norway and the UK. The interest in carbon capture and storage in Germany is closely linked to the use of coal as an energy source, and to the capture of carbon dioxide from power plants. The power industry has become increasingly interested in CO_2 capture and storage, and has among other things, published a joint report on the state of the art (VGB, 2004).

Germany has made a large commitment to reduce CO_2 emissions, with an emission reduction target of 21% by 2012. About half of the electricity generated in the country is based on coal, and about one-tenth on natural gas. As the nuclear phase-out proceeds, it is envisaged that the share of fossil fuels in electricity generation could increase to up to 80% (BMWA, 2005). Alongside the nuclear phase-out, other changes are also imminent. It has been calculated that 40,000 MW of power generation capacity will reach the end of its useful lifetime within the coming 20 years.

BMWA, the Federal Ministry of Economics and Labour, has pursued the topic of carbon capture and storage since 2002, when it established an initiative called COORETEC and commissioned experts from research and industry to explore future requirements for fossil-fuelled power plants. One of the four working-groups of COORETEC has focused on CO_2 capture, utilisation and storage (COORETEC, 2006). The Federal Government has supported a number of R&D projects on the topic, with a total annual funding amounting to € 18 million (UBA 2006). The R&D projects will explore a diversity of capture technologies. All major technologies, including both post- and pre-combustion technologies, and gasification processes and oxy-fuel processes are included in the projects (BMWi, 2006).

The Federal Ministry of Economics and Labour (BMWA, 2005) has adopted a positive attitude to the problems commonly associated with carbon capture and storage. Energy efficiency is one such problem: carbon capture usually influences combustion efficiency negatively. Through the COORETEC programme, the Ministry has attempted to link carbon capture and storage to energy efficiency, arguing that increases in process or component efficiency can help to combat the efficiency losses due to carbon capture and storage processes - and that these two measures can be combined in future German power plants that are comparatively more efficient than the

world-wide average. The Ministry has also invested in R&D and field-testing on geological storage in order to gain insight on safety issues (BMWA, 2005). These measures indicate that carbon capture and storage is viewed as important, and that efforts are being made to surmount the problems inherent in the technology.

Others within the federal administration seem to have somewhat different opinions on the issue of carbon capture and storage. The Federal Environmental Agency (UBA, 2006) has recently issued a position paper on the impacts, potential and requirements for carbon capture and storage. The Agency views the negative impact on combustion efficiency as a significant counter-argument to large-scale of carbon capture and storage (UBA, 2006). The position paper stresses that carbon capture and storage is at best an interim solution and an end-of-pipe measure to mitigate climate change, and that energy efficiency and renewable energy should continue to be prioritised. The paper also argues that the discussion should focus on the limits to storage capacity, which according to the Agency's calculations would suffice for a maximum of 40 years. The paper stresses that environmental and health effects should be considered. It suggests a maximum allowable leakage rate of 0.01% per year from CO_2 repositories, and argues that ocean storage and 'artificial mineralisation' are not acceptable storage options. The paper also stresses the need to create a national and international legal framework, and to include issues of public acceptance and international justice in the debate on carbon capture and storage.

German non-governmental organisations have mainly been rather critical of carbon capture and storage. According to Fischedick (2005), the NGOs NABU (Naturschutzbund Deutschland) and BUND (Friends of the Earth Germany) are in opposition to carbon capture and storage. Greenpeace Germany is basically in opposition, but has also listed a number of boundary conditions if CCS were to be implemented in any case. WWF Germany follows the position of WWF International, which is mildly supportive, within certain boundary conditions. The North-South initiative Germanwatch is critical, but sees some opportunities in CCS as a transitional technology. Until quite recently, however, the topic has not been viewed as worth a lot of attention, and Schüwer (2005) reports that NGOs did not have plans for anti-CCS campaigns in 2005.

Two major pilot projects are underway in Germany at the moment[1]. One is an integrated gasification combined cycle power plant (IGCC) plant by RWE, which is currently in the project stage, with a potential decision to build scheduled for 2010 (Schiffer, 2006). The other is a pilot plant by Vattenfall, which is the focus of this case study. It is located in the state of Brandenburg, in the industrial district of Schwarze Pumpe in the municipality of Spremberg. This pilot plant will capture CO_2 from brown coal, and it is located in the brown coal region.

Brown coal (lignite) remains Germany's most important nationally produced primary fuel, accounting for 25% of the electricity supply. Brown coal is easy to extract because it is just below ground surface, which makes it an economical fuel for generating electricity (Krüger, 2006). Brown coal is extracted by open pit mining and used for energy production in power plants close to the mining facility. The East German brown coal deposits are the largest in Germany, and brown coal mining has over the years had an important impact on the local economy and on the landscape (Hehl and Lange, 1995).

3. Summary

Vattenfall's pilot plant is located in the industrial district of Schwarze Pumpe in the town of Spremberg, which has hosted a brown-coal fired power station since 1959. The power station is currently a part of the company Vattenfall Europe, the third-largest power company in Ger-

[1] Eon AG, a gas power company in Düsseldorf, also has a plan to rebuild a gas power station into a coal power station. This plant is not in use now. This power station that is going to be rebuild, should separate the CO_2 from other fuels. This project will be executed in Lincolnshire, Great Britain (Reimer, 2006).

many. The current brown coal power station on the site was opened in 1998. It generates 1600 MW with a relatively high operating efficiency (43% as compared with the industry average 35%). Vattenfall also has a brown coal briquettes company in Schwarze Pumpe. (Vattenfall Europe, 2006). The brown coal comes from a surface mine at Welzow-Süd, some kilometers north of the power station. The power station mainly delivers heat to the city of Spremberg (Vattenfall Europe, 2004), and generates electricity as a by-product.

Spremberg has a population of 8430, of whom about 2000 live in the Schwarze Pumpe district. The brown coal industry is the most important sector of the area. The area is structurally weak: the number of jobs in the sector (direct and indirectly related) declined by about 80% in the years 1989-1998 (Van Miert, 1998).Vattenfall Europe Mining & Generation is the largest employer in the East-German region. In total, there are 3546 people at Vattenfall Europe Generation AG & Co. KG, and 5097 employees at Vattenfall Europe Mining AG at the end of 2005 (Vattenfall Europe, 2006).

In May 2006, Vattenfall started building a 30 MW pilot power plant in next to the existing power station. This pilot power plant uses the oxyfuel process for separating CO_2. This pilot plant is being built in order to conduct research in order to later build a commercial-scale plant (Vattenfall, 2006).

The CO_2 will be stored underground. This will be in an old salt mine nearby Ketzin in Havelland (Vattenfall, April 2006). The research institute Potsdamer Geoforschungszentrum is doing research on whether this place is suitable. If a salt mine full of CO_2 pollution is not properly sealed and the CO_2 leaks out, it can result in a fatal disaster (Reimer, 30 May 2006). Thus, extensive research is underway on the safety, risk and legal liability issues involved (CO2SINK, 2006).

The project is closely linked to a number of European research and industry networks (Gortz, 2006). The Federal Government supports the project, because it is good for the brown coal industry and good for the area (Möschl, 2006). The local authorities are only informed about the project; they do not participate in it. Nevertheless are pleased with this project, because it is viewed as bringing new opportunities for the structurally weak region (Adam, 2006). Most of the residents of Spremberg appear to be satisfied with the project. They are mostly informed about the project via the media. They have not expressed a lot of interest in the project, because they are accustomed to the power plant.

4. STEP ONE: Possible futures?

The vision of the Swedish power station Vattenfall Group is to build the world's first power station that captures CO_2 from flue gases. Vattenfall has two main reasons for its interest in carbon capture from brown coal combustion. The first one is that the world is dependent on fossil fuels, or which coal is the most abundant. The second reason is that a solution must be found very soon in order to mitigate climate change. The solution should not be too expensive and should be easy to apply. Vattenfall considers that renewable alternatives require further development before they could be used on a commercial scale (Gortz, 2006).

The pilot plant will serve to test the process and gradually build up experience for a commercial-scale power plant. A test pilot plant of 0.5 MW was started in mid-2006. In May 2008, the 30 MW pilot plant will start operation. There are plans to expand to demo plant of 300 MW starting in 2015. The commercial-scale power plant (1000 MW) is planned to start operation in 2020. Topics that will be tested are the reaction of the components and how clean the emissions are. Experiences will also be collected about material requirements, invest possibilities and costs, and operating costs. The company will draw conclusions from the results for building a larger-scale power plant (Vattenfall, April 2006).

Among the available options[2], Vattenfall has decided to invest in the oxyfuel technology (Gortz, 2006). The combustion takes place in pure oxygen instead of normal air, leaving only steam and CO_2[3]. After condensation, the CO_2 will be stored. As in all processes with CO_2 capture, the combustion efficiency is lower than usual. But the oxyfuel process operates at a higher temperature than in the old techniques, and thus provides a better efficiency rate (Vattenfall, April 2006)

It is not yet proven which method for carbon capture is the most efficient and also most interesting from an economic point of view. Vattenfall believes that the oxyfuel method will be the best. (Mansel, 2005). The company has calculated that the oxyfuel process is competitive when the quota price is € 20 per ton of CO_2. The capturing costs lay around € 15.84, other costs ensure from storage and transport. (Tønseth, 19 April 2006). Other institutes have come up with different cost calculations. Wuppertal Institute calculated a price between € 30 and € 40 for the entire capture-storage process. The European research project Gestco, in Germany executed by Bundesanstalt für Geowissenschaften und Rohstoffe, calculated a cost of € 54 per ton. (Reimer, 20 May, 2006).

Vattenfall has its own, long-term interests in CO_2 free techniques. There is also pressure from the clients to search for an effective and efficient solution for climate change. According to Mr. Görtz, also the German government is interested in the problem of climate change and solutions for it, and is placing pressure on the industry.

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

Until now, the Vattenfall project has only involved a limited set of actors. Table 5.1 shows an overview of the actors, their expectations and how they are related to the publics.

[2] Research and development of carbon capture focuses on three technique - post-combustion capture, pre-combustion capture and the oxyfuel process - and there are different opinions on their relative merits.

[3] In this process, the combustion will not take place in normal air, but in pure oxygen and circulating flue gas. About 75% of the produced CO_2 will be led back to the kettle. The flue gasses will extort the sulphur connections. This will be turned into gypsum. The gypsum is a byproduct. (Vattenfall, April 2006). It will be sold to the building industry (excursion, 27 September 2006). The steam and coal will be condensed (Vattenfall, April 2006). It will be cooled to a temperature of -56 °C (S., 1 June 2006). This results in flue gasses with a concentration of 98% CO_2. With a pressure of more than 100 Bar the CO_2 will be liquidised. After the separation and liquidising, the CO_2 will be stored (Vattenfall, April 2006). The other stream will be enriched with oxygen, and used again for the combustion process. (Brandenburgische Technische Universität Cottbus, 12 May 2005).

Table 5.1 *Main actors directly and indirectly involved in the Vattenfall pilot power plant project*

Actor	Expectation	Speaking for 'publics'
Vattenfall	Take responsibility for climate change. Brown coal could be an environmentally friendly solution for the energy problem in the long term. Developing the oxyfuel process.	Owners Employees Other stakeholders 'Global climate'
Research institutes	Are involved in developing the pilot power plant and testing the oxyfuel process.	Knowledge-creation and technology development
Greenpeace	CCS will lead to an increase in the use of fossil fuels and CO_2 emissions.	Local resistance groups 'Nature/global climate'
Bund für Umwelt und Naturschutz Deutschland (BUND) and the environmental organization Robin Wood	CCS is used to cover-up business-as-usual fossil fuel use	'Nature'
German Federal Government	The technology gives opportunities for the country, the area and the brown coal trade in the future.	General public
City Council of Spremberg	The project has a lot of attention from abroad. Spremberg will become famous.	General public in Spremberg
Citizens of Spremberg	Most believe the project will be good for the city, for the environment and will be create more jobs.	General public in Spremberg

The project is a means for Vattenfall to take responsibility for climate change and to test the use of the oxyfuel method. Moreover, Vattenfall envisages that the pilot project will help to safeguard a future for brown coal in the region. The new technology could contribute to improving the environmental profile of brown coal in the long term. The oxyfuel process could enable a considerably cleaner process for coal combustion than has been available until now (Brandenburgische Technische Universität Cottbus, 12 May 2005).

The project is closely networked with a number of research institutes, universities and industry networks on carbon capture and storage[4]. The Universities of Stuttgard, Gothenburg, Dresden, Potsdam, the Technical University of Cottbus, the Technical University Harburg in Hamburg and many more are involved in developing the pilot plant. These different parties expect to create new knowledge about the prospects of applying carbon capture and storage on a large scale in the future.

[4] Vattenfall is cooperating in six CCS research projects (Vattenfall, April 2006). (1) ZEFFPP (technology platform CO_2 free power plant) is a part of the seventh EU-frame research program. Vattenfall is leading the committee of the technology platform and works in several projects for this platform. (2) ENCAP, which develops technologies to separate CO_2. The goal is to separate 90% and achieve a cost reduction of 50%. Vattenfall is coordinating this project, and is responsible for two of the six case studies. (3) CO_2 from capture to storage: this research project focuses on the technology for CO_2 capture and storage after combustion. (4) CO_2 SINK: developing knowledge about CO_2 storage. 30000 tons of CO_2 will be stored in a salt mine in Ketzin, East Germany. Vattenfall is one of the 14 European involvers in this project. (5) CO_2 STORE: experiences about storing CO_2 in salt mines will be shared in potential CO_2 storage projects. Vattenfall is working on one of the four case studies. (6) CO_2 NET: this is a network to make it easier for researchers, developers and testers to cooperate. In this network are 50 companies, universities and research institutes involved. Vattenfall is one of them.

Environmental organisations do not expect the project to mitigate climate change. Greenpeace argues that the pilot plant will increase the use of fossil fuels, and hence emissions of carbon dioxide. Furthermore, Greenpeace views the project as a barrier to change to clean and sustainable energy sources. (Reuters News Service, 20 May 2005). The project will enable Vattenfall to continue burning brown coal, whereas Greenpeace believes it should concentrate on renewable energy (Mansel, 2 July 2005).

The environmental organisation BUND is also apposed to the Vattenfall project, and its press release calls it a "Fig leaf, behind which power corporations want to hide their activities that damage the environment and climate"[5] (Bund Klimaschutz, 29 May 2006). The organisation says that 99% of the fuels used by Vattenfall are uranium and fossil fuels. The pilot project is just to improve the image. It argues that it is commonly known that investing in environmental friendly and reusable energy is the best option. BUND also stresses that is not known what the risks of storage are, and argues that there is not enough capacity to store all the CO_2. It also argues that it requires a lot of energy to transform the air into oxygen. (Bund Klimaschutz, 29 May 2006). Another point mentioned by BUND is that Vattenfall is building another power station of 2300 MW and this one is not applying carbon capture (Bund Klimaschutz, 15 September 2006).

The environmental organisation Robin Wood agrees with the BUND, and has titled its press-release 'Eco-Lies' (NGO-online, 29 May 2006). Also this organisation says that by calling the project a CO_2 free power station, Vattenfall is trying to improve their image. But using brown coal is harmful for the environment. Robin Wood argues that by using the oxyfuel process the output of the power station will decrease between 7-14%: to deliver the same amount of electricity the power station needs 40% extra fossil fuel. It also claims that Vattenfall will damage the landscape and drive away the people from their villages. The organisation points out that Vattenfall has plans to build three other power stations (675 MW in Standort Boxberg, 1640 MW in Hamburg-Moorburg and 800 MW in Klingenberg), and those power stations are not developed in a climate-friendly way. (NGO-online, 29 May 2006).

The environmental organisations claim that the cost of electricity will double due to the application of carbon capture. They stress that renewable energy is already competitive for commercial use. (NGO-online, 2006). Another point that they unanimously stress is the storage problem; arguing that there is not enough capacity (Möschl, 2006).Yet according to Mr. Görtz from Vattenfall, there are also NGOs that are not opposed to the project.

The German Chancellor Angela Merkel and the Minister President of Brandenburg Matthias Platzeck were in Schwarze Pumpe at the opening ceremony of the construction site on 29 May 2006. The chancellor said then that Germany will become the technology leader when projects like the Vattenfall oxyfuel process are implemented successfully. In the future, the technology can also be exported to other countries. The Federal Government supports the research. The Government believes that the project will provide security for using brown coal in the future. (Handelsblatt, 29 May 2006). Besides, the Government argues that the project is good for the city, the whole region and for the brown coal itself. The criticism encountered will be used in a productive way, to learn about what could be done better. (Möschl, 30 May 2006).

The City Council of Spremberg expects the project to bring advantages for business relations and the local hotels. It is believed that the people from abroad visiting Vattenfall will stay two days longer and spend their money in Spremberg. The city Council expects and hopes this pilot power plant will work, and that Vattenfall will decide to build a larger power station with the modern technology. Mr. Adam, speaking for the City Council, states: "That is all what we can expect for now. We should be realistic, and will look further in ten years" (see complete inter-

[5] "Feigenblatt, hinter dem der Stomkonzern seine umwelt- und klimaschädlichen Aktivitäten verstecken will".

view in Appendix A). Firms in the region see Vattenfall as a good customer. There are 150 people (builders, mechanics and engineers) building the pilot plant.

Many residents of Spremberg work for Vattenfall. Most of the people interviewed for this case study (see Appendix A for details) had positive expectations about the pilot plant. Half of the respondents were pleased that the project is located in Spremberg. They viewed it as an environmental friendly process: no CO_2 emissions will be discharged in the atmosphere anymore, and it will serve to combat climate change. So they are pleased that a new technology will be tested and used, and that Vattenfall takes responsibility for it. Only one person brought up an environmental concern, saying that the CO_2 will become a problem for the next generation. Some respondents had problems in understanding the technical capture process or how the storage will be organised. A group of four young women thought it was an expensive project. They said that they hoped the project would work; otherwise it would be a waste of money.

Five of the eleven local people interviewed believed that other people think positively about the power plant and the communication by Vattenfall. They explained that this was because people are working for Vattenfall, because the project is good for the environment and good for the brown coal industry, and because Spremberg gets a lot of attention. This was viewed as a good thing for Spremberg because visitors will spend more money in the area. The attention is not only due to the pilot power plant, but also due to the next commercial 'CO_2 free' power plant. Yet the local people do not talk much about the project. This is because other problems are more important, people are not directly involved and are not able to change the situation, or the project is not interesting for them personally. It was also stated that people who have been discharged by Vattenfall want to think about Vattenfall as little as possible. Another reason mentioned is that they are accustomed to living nearby a power plant.

It was also mentioned that there are local people who oppose the project, but the local opposition is not organised. For example, the environmental organisation Robin Wood, which has been very vocal in its opposition of the plant, is not active in Spremberg. According to the City Council representative Mr. Adam, the environmental groups that are protesting against the power plant are not coming from Spremberg.

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

Until now, the Vattenfall pilot project has involved very limited public participation or communication (Table 6.1). Most of the collaboration within the project has been with research and industry organisations. The communications about the project have been mainly via the media. Some self-organised participation has been organised in opposition to the project.

Table 6.1 *Forms of participation in the new Vattenfall project: building the pilot power plant*

Type	Organisers	Involvement	Purpose
Doing research and negotiating/sharing the results	Vattenfall and European Union	People from the industry and researchers	To search for a solution to decrease CO_2 emissions. Discussion and sharing of research results.
Inform the national authorities	Vattenfall	National authorities	To inform them about the project and gain their support, as well as gain visibility on the local level.
Launch the project during the Hannovermesse	Vattenfall	Visitors of the Hannovermesse	Introduce the project to the world.
Inform the media	Vattenfall	International, national and local media	Inform the world about the pilot plant.
Opening ceremony of the construction site	Vattenfall	Chancellor Angela Merkel, Brandenburgs Ministerpräsident Matthias Platzeck, Vattenfall representatives, visitors, media	Opening ceremony, celebrating the start of the construction of the power plant, inform the people about it.
Information provided at the visiting centre	Vattenfall	Visitors	Inform visitors about the current and pilot power plant.
Inform the local authorities	Vattenfall	Mayor and City Council	To inform them about the pilot plant To obtain the building and environmental permit.
No direct information provided to the local people	Vattenfall	Local people in Spremberg	They are informed by the media Vattenfall has many other decisions to make before informing them.
Protest against the pilot power plant	Environmental organisations	Environmental organisations, Vattenfall and the media	To voice the environmental organisations' opinion about the project and gain media attention.

According to Vattenfall representative Mr Görtz, the company considers that the key stakeholders of the project are on European level, including the power industry, the contractors that are building the pilot power plant, the gas companies and the EU. There is no competition over the available information, and Vattenfall wants to share its findings and information with other power stations and competitors. Contacts with the universities are, for example, via the COORETEC-programs of the BMWi (national level) in the research program Adecos, which focuses on the oxyfuel process. Some research centers have their own roles in the project. Continuous dialogue is maintained with research institutes participating in European ENCAP programme (Enhanced capture of CO_2). Vattenfall keeps these stakeholders and the teams working on the project informed via Email, telephone calls and conferences.

The Federal Government is interested in climate change and solutions for it. There is no legal framework about the responsibilities and tasks yet; that remains to be developed. That is a task for the government. Therefore, Vattenfall is communicating with the national authorities. According to Mr. Görtz, a solution would benefit both Vattenfall and the government.

Vattenfall presented the plan at the Hannovermesse 2006 (Innovations Report, 21 April 2006). This is a high-profile event where corporations present their new innovations, products and

ideas. The project has also attracted a lot of media attention. Mr. Görtz, Head of Communications for the power plant, reported that he talks about the project with journalists about three times per week. Mr Görtz was confident that local people learn about the project through the extensive media coverage.

A local event that attracted a lot of attention was the opening ceremony of the construction site. The Chancellor and Minister President of Brandenburg attended the opening, and the event created a lot of publicity for the project and for the district. The power plant in Schwarze Pumpe also has an information centre, which can be visited on request. Here, Vattenfall informs visitors mainly about the current power station and the history of the site. There is not much information available about the pilot plant (See also Appendix A).

Apart from the media coverage, there has not been a lot of communication with the local stakeholders. According to Mr Görtz, Vattenfall considers that it should resolve a number of open issues first before contacting them. The company has not yet started to identify the local stakeholders. There are plans to start this process, and when they are identified, Vattenfall will decide how to communicate with them.

The local authorities are not closely involved in the project. They know about it, because the mayor of Spremberg informed the City Council about the Vattenfall project during the summer of 2005, after receiving information from Vattenfall. After the announcement there was no discussion, and the project has not raised a lot of attention in the City Council. The city council issued a building permit to the plant in June 2006 and an environmental permit in mid-September 2006. Because the new pilot plant will be built on an existing industrial site, it was easy to make decisions about it.

The local authorities gain most of their information about the project from the newspapers. According to Mr. Adam, the city council does not, however, see a problem in the communication. Many people in the Council work for Vattenfall, so the city council has access to information. According to Mr. Adam, the cooperation between the City Council and Vattenfall has been good, as was the situation with the previous plant operator, Laubag. Vattenfall has a good reputation for cooperativeness in other towns, as well. The company has built lots of buildings in the center of Schwarze Pumpe, including churches, schools, child day care centres, community centres and apartments.

Vattenfall has not conducted a systematic survey of local opinion. According to Mr Görtz, Vattenfall received the first reactions from local people two years ago. The first reaction was that it was a stupid and useless idea of Vattenfall. When Vattenfall gave more information and explanation about the project, people were more positive about the ideas and the reasons for the pilot power plant. Some groups are still hesitating, including the NGOs. From the local people, the main complaint that Vattenfall has heard is that some people do not believe in climate change and are not happy with the extra costs (Gortz, 2006).

Mr. Adam, Communications Office for the City Council, explained that people are used to living with the brown coal industry for a long time. They earn their living via the power plant. The local authorities' impression is that most of the people are positive about the plant: they are happy that a new technology will be tested in Schwarze Pumpe and that the air will be cleaner compared to the old power plants. No concerns have been voiced about the storage of CO_2. Overall, people are pleased that something new is happening. The fact that there have been some protests was viewed as a normal part of this kind of process by Mr. Adam.

A much more disruptive change was experienced some years ago. In Spring 2000, about 550 residents of the village of Heidemühl were forced to move because the previous operator, Laubaug, needed to expand the mining site (Lausitzer Rundschau, March 3, 2000; Berliner Morgenpost, March 2, 2000). The residents were provided new housing in Spremberg. Accord-

ing to Mr. Adam, most of the residents agreed to the plan, but some launched a series of protests, culminating in a court case against the company, which they lost.

The local people in Spremberg interviewed for this study said that they are informed about the pilot plant via the media and not directly by Vattenfall. The newspapers drew a lot of attention to the opening ceremony of the construction site. The group of young women had heard about it at school. Some respondents heard about it via other people: friends, family, and the Mayor in connection with activities in the city hall. Four people said they get the information 'automatically'; they do not need to search for it. All the respondents, except for one woman, said that they have been sufficiently informed, and half of them said they could find more information if the needed it. One man would like to see a visiting centre with a focus on the new pilot plant, which one could visit spontaneously without making an appointment. Half of those interviewed were satisfied with the quality of information provided. The group of four young women said they would like to know what is going to change for them. They complained that there is only information about the technical changes, and nothing is said about changes for the people.

Environmental organisations have voiced their opposition toward the project. They organised protests against the power plant at the opening ceremony of the construction site, which attracted a lot attention in the media. Robin Wood was also at the opening ceremony on 29 May 2006, carrying a 30-meter high banner protesting against this power plant. (NGO-online, 29 May 2006). All environmental organisations informed the people via the newspapers about their opinion. Environmental groups have also continued their protests. The BUND provides a lot of information about the disadvantages and risks on its Internet site (Bund Klimaschutz, 29 May 2006). BUND also started an online protest, where people can sign a petition against the power plant (Bund Klimaschutz, 15 September 2006).

7. STEP FOUR: From visions to actualities

The project started in 2001. So far, Vattenfall is satisfied with how it has developed. The company has set out four steps for developing their new process for commercial purposes:

1. Around mid-2006: test pilot plant, 0.5 MW (Vattenfall, April 2006).
2. Around mid-2008: pilot plant will work, 30 MW (Vattenfall, April 2006). Between 2008-2011, the process will be tested for the extent that CO_2 can be separated from other exhaust gasses (Märkische Oderzeitung, 24 January 2006). Cottbus Technical University will do the research (Verivox, 26 May 2006). Also other parties are allowed to do tests.
3. From 2015: demo plant, 300 MW (Vattenfall, April 2006). The lessons learned from the pilot plant will be built into this demo plant. It will be planned in 2008, and built during the following years. In 2015, it starts operation. In this demo power plant, the thrift will be tested. (Märkische Oderzeitung, 24 January 2006).
4. From 2020: commercial power plant, 1000 MW. From then on, it should be possible to use this new process for commercial purposes (Vattenfall, April 2006).

In 2015, the existing power station will be replaced with a new one, as the current power station will have been in operation for 25 years then. It is still uncertain whether it would be possible to rebuild other, younger power plants and convert them to the oxyfuel process. This is because of the cost considerations. According to Mr. Görtz, these are aspects that need to be considered before deciding to rebuild an old pilot plant into an oxyfuel process power plant. Furthermore, research will be conducted to develop a more efficient power plant with the oxyfuel technique (Vattenfall, 2006).

There is still a need to conduct much more research concerning the long-term storage of liquid CO_2 below the ground. This research will be done on national and European level and it will take three years. Vattenfall is not directly involved in the tests, but will make use of the results. In this respect, Vattenfall's project is part of the worldwide search for suitable storage sites. Ge-

ologists consider old gas, coal and oil fields as most suitable according to geologists. If the technology is used on a larger scale, the CO_2 will be transported by ships, pipelines and trains (Vattenfall, April 2006). According to Mr. Görtz, it will probably not be easy to solve the storage problem, but efforts should be continued until a good storage solution is found.

The City Council thinks that when the pilot plant project is further developed, they will be informed better. Then the City Council will be able to inform the citizens better. Concerning the pilot power plant, they hope it is a good and safe power plant. According to Mr. Adam, Spremberg really wants the commercial 'CO_2 free' power plant in Spremberg.

8. Lessons learned

At the time of writing this report, the Vattenfall project had just started. People had only known about for a few months. The lessons learned are interim lessons, which might change in time. The current situation could be characterised as follows:

- At the moment, the pilot plant is a research and testing site, which cooperates mainly with European research and industry partners. Most of the information provided to the general public has been through the media. The company has, however, recognised the need to identify local stakeholders and develop a communications plan.
- The company and the project have managed to establish good relations with the City Council. This is partly due to a long history of good cooperation between the Council and energy companies at the industrial site, as well as the company's good reputation at other sites. Vattenfall is an important employer in the region. This provides for informal access to information through employees, and also makes the company a very important stakeholder for the City of Spremberg.
- The citizens of Spremberg have lived through large changes during recent history, such as the Reunification and the decline of the brown coal industry in the region. According to the small number of interviews conducted, they seem to appreciate the employment provided by the company, and the positive attention that the new leading-edge technology project will bring to the region. While many people feel adequately informed, there are also some who would like more information about the project. The project has not raised a lot of discussion locally, as it is still on a very small scale and people are preoccupied with other problems.
- The project is located on an existing industrial site and in an old industrial district. The local environmental impacts of the plant are positive - if it reaches full scale, it will replace an older, more polluting power plant. Land use for the pilot plant is not an issue, and the carbon dioxide will be stored elsewhere. It has thus been easy for the company to acquire the necessary permits, and the plan has not run into any siting controversies.
- The NGO's protests against the project have continued. As many NGOs' views about the project and those of Vattenfall are very different, it is not likely that they will be reconciled in the near future. The storage issue is the one that is most likely to raise immediate public interest.

References

Berlinews (20 May 2005): *Pilotanlage für CO_2-freies Kraftwerk. Vattenfall: Neubau am Standort Schwarze Pumpe für rund 40 Mio. € geht 2008 in Betrieb,* www.berlinews.de

BMWA (2005): *Carbon Capture and Storage Activities in Germany*. Federal Ministry of Economics and Labour. Document presented at the Carbon Sequestration Leadership Forum (CSLF) Meeting, Berlin, Germany, September 26-29, 2005. http://www.cslforum.org/documents/GermanCCS.pdf.

BMWi (2006): *Update on Carbon Capture and Storage Activities in Germany*. Federal Ministry of Economics and Labour. Document presented at the Carbon Sequestration Leadership Forum (CSLF) Meeting, New Delhi, April 4, 2006. Available online at: http://www.cslforum.org/documents/Delhi/pgtg_CCSUpdateGermany.pdf

Brandenburgische Technische Universität Cottbus (12 May 2005): *Saubere Energie aus der Lausitz.* CLEAN-COAL Symposium der BTU Cottbus am 19./20. Mai, www.uni-protokolle.de

Bund Klimaschutz (15 September 2006): *Feigenblatt 'Saubere Kohle',* http://vorort.bund.net/klimaschutz/

Bund Klimaschutz (29 May 2006): *CO_2-freies Kohlekraftwerk ist Feigenblatt von Vattenfall / BUND demonstriert für Klimaschutz,* http://vorort.bund.net/klimaschutz/

CO2SINK (2006): *CO2SINK project presentation website*: http://www.co2sink.org/widerissues/widerissues.htm

COORETEC (2006): *COORETEC CO_2 Reduktionstechnologien*. Website of the COORETEC initiative at: http://www.fz-juelich.de/ptj/projekte/index.php?index=1369

Eig. Ber./B.M. (27 May 2006): *Klimaforscher lobt Lausitzer Pilot-Kraftwerk,Vattenfall investiert 50 Millionen Euro in Schwarze Pumpe,* Lausitzer Rundschau

Excursion Vattenfall Visiting Center (27 September 2006): *Schwarze Pumpe.*

Fischedick (2005): *CO_2-Sequestration - Chancen und Risiken - Fokus: CCS im Bereich Kraftwerke*. Presentation at Zweites Berliner Klimagespräch CO_2 Sequestration - auf dem Weg in eine CO_2 emissionsfreie Zukunft? June 2, 2005. Available online at: http://www.wupperinst.org/ccs/index.html

Handelsblatt (29 May 2006): *Schwarze Pumpe für blauen Himmel, Erstes CO_2-freies Kraftwerk,* www.handelsblatt.com/news/

Innovations Report (21 April 2006): *Vattenfall Europe präsentiert CO_2-freies Kraftwerk auf der Hannovermesse 2006. Premiere: Modell der weltweit ersten Pilotanlage wird vorgestellt,* www.innovations-report.de

Krüger, S. (30 March 2006): *Ab in die Versenkung!* Rheinischer Merkur

Mansel, T. (2 July 2005): *Germany plans C02-free power plant,* BBC News

Märkische Oderzeitung (24 January 2006): *Vattenfall baut in Schwarze Pumpe kohlendioxidfreies Kraftwerk,* www.moz.de

Möschl, B. (30 May 2006): *Leisse und laute Proteste von Umweltschützern, Vorwürfe unde Bedenken gegen unterirdische Lagerung von Kohlendioxid und Kosten der Technologie,* Lausitzer Rundschau

Möschl, B. (30 May 2006): *Merkel begleitet Spitzenleistung Ost, Aufbruchstummung beim Spatenstich für Vattenfall-Pilot-Kraftwerk,* Lausitzer Rundschau

NGO-online (29 May 2006): *Pilotanlage von Vattenfall, CO_2-freies Braunkohlekraftwerk von Umweltschützern als Feigenblatt kritisiert,* www.ngo-online.de

Reimer, N. (20 May 2006): *Vattenfall will 90 Prozent weniger CO_2,* die Tageszeitung

Reimer, N. (30 May 2006): *Abgase tiefer gelegt,* die Tageszeitung

Reuters News Service (20 May 2005): *Vattenfall Plans CO_2-Free Power Plant in Germany,* www.planetark.com

S. (1 June 2006): *CO_2-neutrales Kraftwerk von Vattenfall,* http://umgebungsgedanken.momocat.de/

Schüwer, D. (2005): *Carbon Capture & Storage (CCS) - Akteure, Technologien und Potenziale*. Presentation at Arbeitsgruppe Klima & Energie (Forum Umwelt & Entwicklung), Bonn, May 9, 2005. Available online at: http://www.wupperinst.org/ccs/index.html

Shiffer, H.-W. (2006): *RWE's Programme for the construction of a zero-CO_2 power plant including CO_2 storage and initial views on the legal framework for CCS*. Second European Climate Change Programme. paper presented at the Working Group 3 Meeting: Carbon Capture and Geological Storage. Available online at: http://forum.europa.eu.int/Public/irc/env/eccp_2/library?l=/geological_storage/meeting_april_2006/

Hehl, S. & E. Lange (1995): *Visualizing virtual brown coal landscapes by merging GIS and Remote Sensing. I*RL-Institut, ETH ZürichData. Available online at: http://lrg.ethz.ch/lange/cottbus/cottbus.html

Tønseth, S. (19 April 2006): *A little piece of Sweden,* Gemini.

UBA (2006): *CO_2 Capture and Storage - Only an Interim Solution. Possible Impacts, Potential and Requirements. Summary.* Umweltbundesamt, Federal Environmental Agency Germany: Position paper, August 2006. Available online at: http://www.umweltbundesamt.de/energie/archiv/CC-4-2006-summary.pdf

Van Miert, K. (1998): *Beschikking van de commissie van 9 december 1999 betreffende de door Duitsland aan de bruinkoolkrachtcentrale te Cottbus verleende staatssteun,* Publicatieblad van de Europese Gemeenschappen (20 August 1999).

Vattenfall Europe (05/2004): *Aus Braunkohle wird Energie, Tagebau Welzow-Süd*, Vattenfall Europe Mining AG.

Vattenfall Europe (2006): *Mining & Generation, Energie aus dem Nordosten! Daten und Fakten 2005*, Vattenfall.

Vattenfall (April 2006): *Klimaschutz durch Innovation*, www.vattenfall.de

Verivox (26 May 2006): *Erste CO_2-freie Pilotanlage vor Baustart - Spatenstich mit Merkel,* http://verivox.de/

VGB (2004): *CO_2 Capture and Storage. VGB Report on the State of the Art.* Essen: VGB PowerTech eV.

Appendix A Information about the interviews

For this case study, some interviews were done. The first was with a representative from Vattenfall, Mr. Gortz. This was done by telephone on 18 September 2006. The main questions for this interview were sent by Email beforehand:

1. Could you briefly outline the history of the project and the reasons for Vattenfall to launch this project?
2. Who are the main partners or stakeholders involved in this project? What do you think are their main motivations to be involved?
3. What sort of communication strategy do you have for this project?
   - International, national and local level?
4. What sort of response have you received on the project until now?
   - Internationally?
   - In Germany?
1. Are there any special efforts to involve local stakeholders in the project (public consultation, etc.)?
2. What sort of response have you received from local people?
3. How do you view the current situation of the project and its future prospects?
4. Why does Vattenfall not sell the captured CO_2 to, for instance, greenhouses?

The second interview was with Mr. Adam. He is a representative of the city council in Spremberg. The interview was in the city hall in Spremberg on 26 September 2006. The questions were sent by Email beforehand:

1. When did the council first hear about the project?
2. How was the plan developed, which role had the city council?
3. What expectations did the city council have?
4. So far, did those expectations come out?
5. What does the city council think of the Vattenfall project (what kind of discussion have there been about the project)?
6. What does the city council think about the communication?
7. Which other actors were involved, and what were their expectations?
8. How and by whom were the citizens informed until now?
9. How did the citizen react? As planned?
10. What are the future expectations from the city council regarding Vattenfall?
11. What lessons did the city council learn from the project until now?

The last group that was interviewed were citizens of Spremberg. This was done on September 27-28, 2006. These were four men (age: 30-40, two men 40-50, 60-70 years old) three women who were interviewed independently (30-40, 40-50, 50-60 years old) and a group of four young women who were interviewed as a group (10-20 years old). All the interviews were in German. The interviews were done in shops and small firms. Some of the respondents were the owner, some were an employee, and some were a customer. They first looked to a German article (dpa/Eig. Ber./B.M., (27 May 2006), *Baustart für Lausitzer Pilot-Kraftwerk zur CO_2-Vermeidung*, Lausitzer Rundschau). This article explained the Vattenfall project. No one read it. The questions for the interview were:

1. What do you think about the Vattenfall project?
2. How were you informed?
3. What do you think about the communication (are you satisfied with the information)?
4. What should be different in the communication?
5. What do other people think about the project and the communication?

The final fieldwork done was an excursion to the Vattenfall visiting centre at Schwarze Pumpe on September 27, 2006. The visiting centre presentation focused on the current power plant, not the pilot plant. The Vattenfall representative told about the current process, the emissions and waste, and there was a guided tour in the power plant itself.