Work package 2- Historical and recent attitude of stakeholders

Case 24:
Snohvit 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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1. Introduction

This case study deals with the Snøhvit liquid natural gas (LNG) facility in northern Norway built by the oil and gas company Statoil. Among other innovative features, the plant includes an installation to capture CO_2 from the natural gas and return it to an underground formation below the gas reservoir in the Barents Sea. This carbon capture and storage scheme has attracted significant and positive international attention. The gas field and processing facility, on the other hand, have been controversial due to their location in a sensitive environment. Another controversy arose over constructing a power plant to service the facility. The case study shows how debates over carbon capture and storage can be embroiled in other debates surrounding fossil fuel use, and illustrates the massive communication and negotiation efforts that can be involved. The case study is based on documentary material, previous analyses of the social impacts of the Snøhvit plant, as well as an interview with Statoil's CO_2 specialist, Mr Olav Kårstad.

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

Norway has a population of 4.6 million, and is listed as one of the richest countries in the world. Petroleum and gas are a key industries in Norway, and the country is a major oil and natural gas exporter. Energy production equals more than 12 times the domestic consumption. In 2001, Norway was responsible for exporting 4.2% of global oil consumed, while also developing natural gas reserves equivalent to one-quarter of total future European supplies. North Sea pipeline infrastructure links Norwegian oil and natural gas to the European continent. Annual exports of natural gas to the European market were about 12% of total European gas consumption. (CO_2 Norway). Although Norway has the world's highest per capita electricity consumption (Hovden and Lindseth, 2002), the country has historically been able to produce its electric power with its ample hydroelectric capacity. In recent years, however, demand has grown, and dry years have created a demand for electricity imports.

While Norway is not an EU Member State, the EEA Agreement requires Norway to comply with most of the environmental legislation issued by the EU. Common European regulations are applied broadly, e.g., in chemicals, air, waste and water. Norway has established a quota system for emissions of greenhouse gases for the period 2005-2007, and has recently joined the EU Emissions Trading Scheme (Ministry of Environment, 2006a)[1]. Furthermore, the country has applied a CO_2 tax since 1991, and provides tax exemption and state support for renewables, including a preferential feed-in tariff for wind energy and financial incentives for non-electric renewable home heating. In spite of these measures, use of renewable energy (apart from hydropower) has been relatively lower than in Denmark and Sweden, for example (EIA, 2004).

Norway has been internationally active in promoting sustainable development and climate policy, but it has encountered many problems domestically (Hovden and Lindseth, 2002). The Kyoto Protocol allows Norway to increase its emissions of greenhouse gases by one percent from 1990 to the first commitment period 2008-2012. The country is experiencing difficulties in reaching this target, as Norway's aggregate greenhouse gas emissions rose by almost ten per cent in the period 1990-2004. Furthermore, from 2010 onward, a large increase is expected due

[1] The emission trading scheme covers only 10 percent of total Norwegian greenhouse gas emissions. Instead of permit obligations, the Federation of Norwegian Process Industries has entered into a non-binding arrangement with the Ministry of the Environment where it has agreed to reduce emissions voluntarily. The CO_2 tax still covers about two-thirds of the CO_2 emissions. Out of concern for competitiveness, however, several sectors are totally or partly exempted from CO_2 taxes. On average, the rate is close to NOK 200 per metric ton of CO_2. In comparison, the price of emission permits will probably range from NOK 50 to NOK 100 per ton, while the initial allocation will be free of charge (CICERO, 2005).

to increased petroleum operations, among other things, and emissions are expected to rise to 45 per cent above the 1990 level (SFT, 2006). In recent years, the focus of national climate policy has hence shifted from energy conservation and limiting domestic carbon dioxide emissions to international measures, e.g., flexible Kyoto mechanisms (Hovden and Lindseth, 2002).

Environmental issues were very high on the Norwegian agenda in the late 1980s, and popular concern for the environment was very strong. Environmental concern among the Norwegian population seems to have declined quite a lot, however, since the late 1980s[2] (Hellevik, 2002). Public perception of the oil and gas industry in Norway, on the other hand, is fairly positive. In surveys conducted in the past few years, about 60% of the population have at least a 'fairly good' general impression of the industry. Most people appreciate the industry's importance for the country's wealth. The industry is widely viewed as innovative and technologically advanced. Many (49%), however, would like to see the industry doing more for the environment, and consider that controls are needed on the industry's activities (MMI, 2004).

On the other hand, Norway also hosts an energetic NGO community, with eight times as many NGOs per inhabitant as in European countries on average (WRI, 2003). Environmental NGOs have been traditionally active in marine and other conservation issues, but also increasingly vocal in climate policy. Four major Norwegian environmental NGOs (Norwegian Society for Conservation of Nature, Nature and Youth, Greenpeace Norway, and The Future In Our Hands) have formed an alliance on climate change issues (UN, 2002). The environmental organization Bellona has a special focus on energy, climate and innovative solutions. Bellona started working on carbon capture and sequestration as early as 1993, and has been involved in international activities to develop and promote the technology (Soeyland, 2006)

Carbon capture and storage in Norway

Norway has been at the lead in European deployment of carbon capture and storage technologies. In 1991, the Norwegian government instituted a tax on CO_2 emissions, which motivated Statoil to capture the CO_2 emitted from its Sleipner oil and gas field in the North Sea and inject it into an underground aquifer (Kårstad, 2002). Approximately 1 million tonnes of CO_2 are separated annually (Stringer, 2001). This project has been internationally important as a source of experience of monitoring the safety of geological CO_2 storage. The Snøhvit plant in the Barents is another instance in which captured carbon will be stored, in this case below the gas reservoir (Kårstad, 2002).

Since the late 1990s, there have been a number of plans ongoing to construct Norway's first gas-fired power plants - with or without carbon capture and storage. These plans have been motivated by recent power shortages, on the one hand, and power companies eager to export more electricity, on the other. This has caused much political debate: it has been argued that Norway can produce relatively 'clean' electricity for export with natural gas, whereas environmentalists argue against increasing the use of fossil fuels and CO_2 emissions (Quiviger, 2001). The climax of this debate was in March 2000 when the centre-coalition government resigned over this issue, and uncertainty has continued due to an almost even political split between proponents and those arguing that Norway should wait and actively develop new technology for CO_2 capture and storage (CO_2 Norway, 2004).

The new Norwegian government that came into power in the autumn of 2005 aims to make Norway the forerunner in CO_2 capture and storage. It has also made a commitment to ensure that gas-fired power plants will be equipped with CO_2 capture technology, and has allocated a total of € 19 million to related R&D to be distributed through a new organization called Gass-

[2] For example, in 1989, 61% of respondents to a nation-wide survey agreed that "immediate and drastic measures are need", while the respective figure for 2001 was 26%. This decline is in part explained by the very high peak of environmental attention in 1989, and in part by a perception that some environmental problems have become less severe.

nova (Olje og Energidepartamentet, 2005). The country has also intensified its international collaboration in the field, e.g., with the UK.

The government has envisaged that carbon storage can provide financial benefits by helping to extend the lifetime of existing oilfields through enhanced oil recovery. There is wide disagreement, however, on how such projects should be financed (Gemini, 2006). These considerations led to the funding of a large project on 'value chains in CO_2', bringing together the main players in gas power and the oil companies to assess the financial potential existing in the CO_2 value chain and negotiate their willingness to invest. These negotiations have also served as a basis for determining the State's financial involvement. The concept of value chains is closely linked to using CO_2 as a medium to enhance oil recovery while reducing carbon dioxide emissions. Such solutions require sufficient volumes and right timing to make sure that sufficient volumes of CO_2 are brought from large point sources to the offshore fields at the right time in the lifespan of the field (Enoksen, 2005). Recently, eleven such potential value chains, i.e., existing fields that could use CO_2 from Norwegian or foreign sources, have been identified (Gassnova, 2006).

The political debate over the construction of natural gas fired power plants has not abated. In 2005, seven projects had indicated their willingness to invest new power generating capacity, partly on the grounds of 'socio-economic benefits' at the locations (CO_2 Norway, 2005). So far five licenses have been issued but only one investment decision has been made, for a power plant at Kårstø. Carbon capture and storage technologies for such power plants have been explored by different players, but have not proved economically feasible until now. Carbon capture has not been mandated by government, either, in spite of protests by environmentalists. The government, however, has made a commitment to ensure that the Kårstø plant will be equipped with carbon capture facilities as soon as possible (Enoksen, 2005). The overall policy seems to be to require license holders to make provisions for introducing carbon capture and storage for the operation at a later time, once technologies mature.

In Norway, the social acceptability of carbon capture and storage is quite different from other European countries. Some environmentalists have actually been advocating for carbon capture and storage (most notably, the environmental organizations Bellona and Zero), or at least trying to make sure that it is mandated for any new power plants that are to be constructed. Greenpeace Norway, however, has been in opposition to all forms of carbon storage (Greenpeace, 2006). Carbon capture and storage in the Sleipner oilfield in the 1990s did not raise a lot of debate. In contrast, a plan to test sea injection of CO_2 in 2002 was cancelled due to resistance by environmental NGOs (ENS, 2002). Newer plans such as the Snøhvit and plans to construct gas-fired power plants have raised a lot of controversy, but differently from other countries. Safety issues have not been a major point in the debate, as all plans are for offshore storage. The debate has rather been about whether oil and gas companies and the power sector should be forced to invest more in carbon capture.

3. Summary: the Snøhvit LNG facility and carbon capture and storage

This case deals with Statoil's Snøhvit natural gas field and liquid natural gas (LNG) facility in northern Norway, which is due to go into production in December 2007. The field consists of a fully subsea offshore development in the Barents Sea, a 160 kilometer pipeline to shore and a liquification plant for LNG. The separation of carbon is necessary for the LNG process, and the

plant includes an installation to capture CO_2 from the natural gas[3]. Furthermore, a 160 km pipeline has been built back to the field to store 0.7 million tones of CO_2 annually (Kårstad, 2002), which amounts to almost half of the carbon dioxide emissions from the plant.

The project has been vastly ambitious from the start (see Appendix A for a timeline). It is Europe's first, and the world's northernmost LNG facility. For Statoil, it provides access to the US market and entry into the Barents Sea, as well as new technological and organizational competencies. It has involved, among other things, the commissioning of the LNG plant from Spain and its transportation to northern Norway. It has also involved intensive development of the local infrastructure, as well as the employment of a multinational team of employees and subcontractors. The carbon storage scheme also involves some new features, such as pipeline transportation and storage in a subsea well (Kårstad, 2006). As a consequence of its high ambition level and the controversies surrounding it, the project has experienced a sequence of delays and cost overruns. Yet it has also been a communications feat, with intensive co-operation with international researchers, 'heroic' television documentaries of its progress shown all over Europe, large nation-wide media campaigns, and extensive local mobilization and attention.

Snøhvit is located near Hammerfest, which is Europe's northernmost town with a population of about 9000. Fisheries have been the town's main source of income. In recent decades, the town and the entire Finnmark region has been struggling economically and demographically. In this context, the project has been heralded as the first step in a series of great changes for Northern Norway. Most of the controversies surrounding this enterprise have centered on the location of the gas field in environmentally sensitive Barents Sea. Carbon capture and storage has been one of the means (although by far not the only one) to gain legitimacy for the plant. Carbon capture and storage has been especially important internationally and nationally, but has received less attention locally.

4. STEP ONE: Vision of the Snøhvit project

Statoil has a well-developed vision about carbon capture and storage, and it has accumulated experience by applying carbon storage in the Sleipner oil field. Developing the use of CO_2 for enhanced oil recovery has been part of Statoil's strategy since the 1990 Sleipner investment decision. Satoil's vision relates to the long-term decarbonization of fossil fuels (Figure 4.1), with natural gas used to produce electricity and hydrogen, while carbon dioxide is captured and stored underground (Kårstad, 2002).

[3] As produced, the natural gas from the Snøhvit Field will contain about 5% of CO_2 and this will need to be removed as part of the LNG manufacturing process. Instead of being released into the atmosphere, the carbon dioxide produced with the gas on the Snøhvit field is to be stored 2,600 metres beneath the seabed at the edge of the reservoir (CO_2 capture and storage projects, 2004)

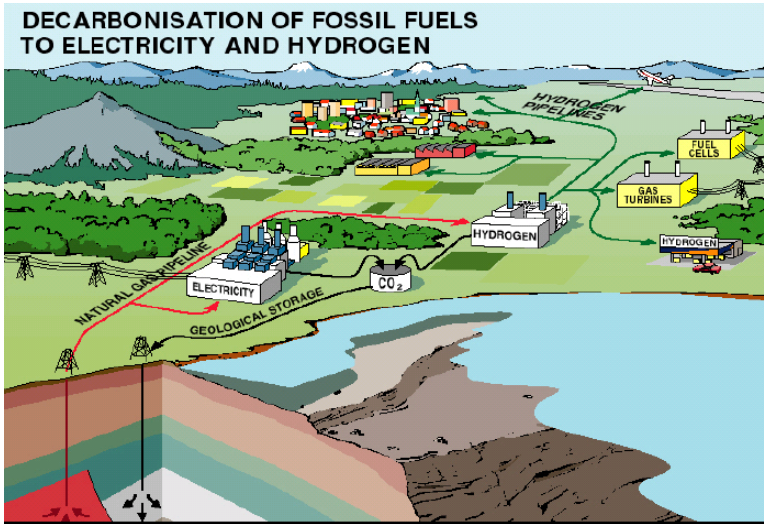

Figure 4.1 *Statoil's vision of the role of carbon capture and storage in the future energy supply*

In the context of carbon capture and storage, Snøhvit is only one step for the company. Carbon capture and storage is also applied in the In Salah oilfield jointly operated by Statoil and BP in Algeria. In March 2006, Shell and Statoil signed an agreement to examine the possibilities for the world's largest offshore project for the use of carbon dioxide for enhanced oil recovery[4]. Statoil is also involved in a number of international collaborations, such as the EU technology platform for electricity generation with zero emissions and the US Carbon Sequestration Leadership Forum (Statoil, 2006). The company has adopted a policy of openness on its projects, and views co-operation with the international expert community as an important means to ensure the long-term legitimacy of the technology.

Yet for Statoil and the Norwegian state, the Snøhvit gas field and LNG plant also relate to other visions and strategic plans (Snieckus, 2004). The opening up for oil exploitation in the Barents sea (barred from exploration since 1994) was an important step for Statoil's activities in the far North[5]. The company's vision for 2030 includes intense activities in the Arctic, including arctic offshore LNG technology, new pipelines from the North to Europe, creating competence for co-operation with local contractors, and developing low-emission technologies (Carlsen, 2005). With these resources and competencies, the company would be well-positioned to co-operate with other large oil companies (e.g., the Russians) in exploiting the untapped oil and gas reserves of the Arctic.

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

Actors and expectations involved in the project range from international to local ones (Table 5.1). Statoil has had many expectations concerning the project, which is strategically important for the company in many ways (outlined in the previous section). Yet the decision to apply carbon capture and storage at Snøhvit was only reached after a long internal debate, because the LNG plant was quite marginal for the company at its time of planning, and there were many uncertainties about its profitability. But Statoil was very interested in developing carbon storage technology, and an LNG plant provided a cost-effective setting for this, as the carbon needs to

[4] The project consists of a gas-fired power station in mid-Norway which will provide carbon dioxide to oil and gas fields in the Norwegian Sea. Statoil is also considering utilising the injection plant on Sleipner for handling the carbon dioxide that could be separated at gas-fired power stations and other sources in Norway (including the Kårstø plant), as well as other countries around the North Sea basin.

[5] In 1997, Statoil, Saga Petroleum, Elf, Agip, Norsk Hydro and Mobil were all awarded acreage in these waters. An appraisal well for the Snøhvit field was started 1999.

be removed in any case[6]. The carbon tax and envisaged changes in the oil and petroleum tax regime provided further financial incentives to invest in carbon capture and storage at Snøhvit.

Table 5.1 *Actors and expectations involved in the Snøhvit project*

Actor	Expectation	Speaking for 'publics'
Statoil	New operating area (Barents and far North in general) New product (LNG) and markets (US) New competences (CO_2 storage and Arctic operations) Financial possibilities to apply CCS	Company and its owners Local people in the North (employment and competence development) Norway International CCS community
Statoil's partners: Petoro (owned by Norwegian State), Total, Gaz de France, Amerada Hess and RWE Dea; and main contractors: Linde AG, Aker Kvaerner, Mitsui O.S.K. Lines	New supplies New technological competencies (primarily LNG)[7]	Owners and customers of the companies
Norwegian state	Develop cost-efficient technologies for CCS Develop Arctic competencies Gain influence and opportunities in Arctic resources Revitalize Northern Norway	Norwegian citizens As major shareholder of Statoil and full owner of Petoro
US and the European Union	Gas imports from a politically stable and reliable country	Consumers in the US and Europe
National and international environmental organizations	Project will destroy vulnerable local ecosystems and economies and increase greenhouse gas emissions	The environment Fisheries Endangered species Indigenous people
Municipal politicians, authorities and residents in Hammerfest (and beyond)	Economic opportunities	Local residents and businesses

The Norwegian State has also had great expectations concerning Snøhvit, as oil and gas exploration has been quite slow in recent years, and yet revenues from petroleum taxes and dividends from state-owned shares make up an important part of the state budget. CO_2 capture and storage has also been important for Norway as a means to regain the country's head start in applying the technology. In other ways, as well, Snøhvit has been a technological showcase, including environmentally sound solutions for Arctic conditions and solutions to accommodate gas exploitation with fishing (e.g., the sub-sea installation, which does not interfere with fishing vessel trawlers). As the facility is an important springboard to Arctic oil and gas reserves, and technologically advanced, it was expected to attract a lot of international attention and increase the attractiveness of the economically underdeveloped Finnmark region of Norway.

[6] Carbon capture makes up the largest share (about 5/6) of the capital expenditure of CCS. In an LNG plant, this cost is borne by the operating equipment of the plant. So the additional investment is not so large, and sets the CCS investment in a relatively positive light (Kårsta, 2006). For Snøhvit, the investment costs for the pipeline, well and compressor train investments were calculated to be about € 150 million (Kårsta, 2002). At the same period, the total investments for phase 1 of the project were calculated to be about € 2.9 billion, and all phases, € 4.3 billion (Statoil POD, 2001).

[7] CCS was not part of that original investment discussed by the consortium. But some partners have taken an active interest in the technology. Snøhvit is also mentioned on the website of Gaz de France as a project in which it participates in CO_2 capture and storage and in a similar manner in Total's *Special Corporate Social Responsibility Report on Climate Change* and its web information on Liquid Natural Gas.

As one of the first operations in the Barents Sea, Snøhvit is also at the head of what has been termed the 'Arctic Petroleum Rush' (Krauss et al., 2005). As scientists report that the Artic ice cap is diminishing while world oil prices are rising, more and more countries and corporations are interested in the Arctic. The US and the European Union have been eager to support Norway in Snøhvit and similar projects, because they need energy from politically stable and reliable supplier countries. Russia has a large presence in the Barents Sea, and there is some dispute between Norway and Russia about borders in the area. On the other hand, Norwegian petroleum companies are interested in co-operating with the large Russian companies, e.g., Gazprom's large development in the Barents called Shtokmann.

Environmental organizations (in Norway and elsewhere) have been opposed to increased oil and gas exploitation, and particularly to the utilization of oil and gas reserves in the Arctic, which constitutes a very vulnerable ecosystem, and where the indigenous people are extremely dependent on natural resources to maintain their traditional lifestyles. Thus, nothing good was expected to come of Snøhvit, but merely environmental and social disruption. Opposition toward the project focused on its potential for local environmental damage, and its role as a first step in exploiting oil and gas reserves in the Barents (and potentially, other Arctic areas)[8]. Finally, Norwegian environmental organizations argued that such projects would frustrate Norway's efforts to keep its Kyoto commitments. At this stage, carbon capture and storage was not part of the debate. Even Bellona has been in opposition to the project due to its impacts on the ecosystem and climate.

The municipality of Hammerfest has expected a significant boost to the local economy from the Snøhvit project. Statoil projected that the construction work would employ up to 1200 persons from different companies, and other new companies would be attracted to the town (in fact, the total number of employees eventually more than doubled from this projection). Before 2002, when the plan for development and operation was approved in Parliament, the municipality had developed an extensive investment plan to expand its infrastructure (e.g., shopping centres, a cultural centre, offices, fish farms, educational facilities and seaside apartments). Plans were also launched to extend the docks in the Hammerfest harbour (Oulu Chamber of Commerce, 2002). As the project was seen as a start for increased petroleum activities in the North, the interest in opportunities extended far beyond Hammerfest, while Hammerfest envisaged itself the future 'Petroleum Town of the North' (Hammerfest, 2004).

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

The project has involved both formal and informal participation at the international, national and local level (Table 6.1). Carbon capture and storage has been a minor item in the debate, but it has made a small positive contribution to the project's public image (Skogen, 2006; Kårstad, 2006).

[8] Utilization of these areas has been subject to considerable debate. In March 2006 the Government presented its first integrated management plan for the Barents Sea and the sea areas off the Lofoten Islands. The aim of the plan is to establish holistic and ecosystem-based management for existing and new activities in these waters. The plan sets restrictions on new petroleum developments in some areas off Northern Norway (Ministry of Environment, 2006b).

Table 6.1 *Forms of participation in the Snøhvit project*

Type	Organizers	Involvement	Purpose
International networking with researchers and government representatives	Professional and intergovernmental organisations for climate issues	Professional and intergovernmental organisations for climate and carbon issues	Exchange experiences, evidence and views on the role of carbon capture and storage in climate change mitigation
Debates in Parliament	Political parties (and Statoil by filing applications)	Political parties	Determine conditions for permit applications, investments and tax revenues
National media campaign	Statoil	Media readers and viewers	Highlight positive economic impact for entire Northern Norway
National and international press and documentary programmes	Media	Readers and viewers in different countries around the world	Inform public on interesting and exciting developments Sell more papers
Protests and campaigns by environmental organisations	Natur og Ungdom Bellona WWF	Members Readers, viewers	Raise critical aspects of the project Protect Barents and other Northern areas from exploitation
Complaint to EFTA Surveillance Authority Lawsuit filed in EFTA court	Bellona	Bellona, Norwegian Government, EFTA Surveillance Authority, EFTA Court	Challenge shorter depreciation period afforded to Statoil for investment equipment as unacceptable state aid
Comments requested to environmental impact assessment (EIA) plan for the LNG facility	Statoil	Sent to 43 State institutions and NGOs, comments received from 35.	Gain feedback on the scope of the EIA
Comments requested to environmental impact assessment (EIA) plan for the related power plant	Statoil	Sent to 21 State institutions and NGOs, comments received from 10	Gain feedback on the scope of the EIA
Consultation and seminars with interested parties for the EIS (several meetings 2000-2001)	Statoil	Municipal politicians and administrators Local businesses and organisations Officials responsible for the coast and fisheries Regional administration	Identify key local environmental, social and economic concerns to be included in the EIA and find common solutions
Meetings with local residents in Hammerfest	Statoil Hammerfest municipality	Local residents	Provide information and answer questions about the facility
Local activities mobilized as offshoots of the project	Diverse actors	Local companies Local and regional organisations	Gain local benefits from the project

Carbon capture and storage at Snøhvit has raised a lot of interest in the international carbon capture and storage community, and been an important continuation to the Sleipner project. Statoil expert Olav Kårstad (2006) has argued that experiences from real projects that are open with

their data and allow research institutes in to assure themselves of the safety, integrity and long-term impacts have been key for the international acceptability of carbon capture and storage - for example, the publication of the IPCC CO_2 report. Statoil also views the project (and other similar projects) as inspirational examples for the entire industry, globally. Statoil's openness about technical and financial aspects of the project raised some discussion among the project partners, as such information is usually considered commercial and confidential in the oil and gas industry. In the final analysis, this open approach was seen by all to be the sound policy in this special case.

The project has been debated in Parliament a number of times, in connection with amendments to the Petroleum Tax Act that allowed the project to apply shorter depreciation periods (2001), in connection with approval of the formal project plans (2002), and in connection with changes to the State budget due to increased investment requirements (2004). Carbon capture and storage played a low-key, but important role especially in the first of these debates, where it served as one argument for the public benefits of the project. The plan for development and operation (PDO) and the plan for installation and operation (PIO) for Snøhvit was approved in March 2002 by a 75-25 vote preceded by a long debate, while environmentalists protested outside Parliament and in the visitors' gallery. Key aspects of the debate included the costs of the project (and whether or not it had been in fact subsidized), the regional economic effects, whether it would lead to further oil exploitation in the Barents, and whether the remaining CO_2 emissions of the power plant are acceptable. There was relatively broad agreement that the permit should be granted, but that provisions should be made to install CO_2 capture technology for the power plant at a later time, or that Statoil should start a pilot project on carbon capture from power generation (Stortinget, 2002).

Statoil invested in a massive media campaign ('North Norway's future lies under water') to promote the positive economic effects of the project for the entire Northern Norway. This campaign, with startling photo-montages of construction sites, workshops and restaurants in Hammerfest all placed in 'under-water' settings with fish and seals swimming in an out, ran on national television and in national and regional newspapers (Kramvig, 2006). Statoil has also organized and participated in organizing a number of seminars and other high-profile events both nationally and regionally. One of the key selling points in these campaigns has been the boost to the local economy, morale and expertise provided by Snøhvit and potential future projects in the North. The project has also been presented in international television documentaries[9].

Environmental organizations have continued to protest against the project, further utilization of the Barents area, and CO_2 emissions from planned gas-fired power plants. Natur og Ungdom (Youth and Nature) have organized demonstrations at different locations, including Hammerfest. Bellona has criticized the project in press releases and complaints against permit conditions. It has adopted a 'two-prong approach' of trying to stop new developments, but also pushing for tougher controls and zero emissions of carbon dioxide once licenses have been approved (Norway…2006). WWF has publicly criticized Statoil's media campaign and requested public information on its costs (Kramvig, 2006). Most environmental organizations are totally opposed to any petroleum activities in the Barents or elsewhere in the Artic. All organizations have been very critical of directing state support to the project. Environmental NGOs have not commented on the CO_2 capture and storage facility, but rather stressed the amount of CO_2 that will be emitted in spite of it, demanding that the power plant should also be equipped with carbon capture equipment.

Bellona has also taken legal action against the Norwegian government concerning the shorter depreciation periods that the government allowed Statoil (by amendment to the Petroleum Tax Act) to apply for its investment equipment, which were argued to in fact constitute a tax relief,

[9] Discovery Channel: *Extreme Engineering: The Snohvit Arctic Gas Processing Platform* and *Kings of Construction: Snohvit A look at Europe's first liquefied natural gas plant.*

and thus provide an unfair competitive advantage to one company. Bellona filed a complaint against the Norwegian government with the EFTA Surveillance Authority, and when the Authority decided not to object to the measure (after Norway reorganized the tax relief so that it had a special regional focus[10]), Bellona together with a German company, Technologien Bau- und Wirtschaftsberatung GmbH, filed a lawsuit with the EFTA Court. This case was ruled against Bellona on the grounds that it (or its co-applicant) were not direct competitors of Statoil (EFTA Court, 2002). Even though these actions did not result in retraction of the new tax rules, they did cause delays in the project, as Statoil's business partners put the project on hold because of the EFTA investigation - leading to a € 130 million rise in the project's costs.

An environmental impact assessment of the LNG plant was conducted in 2000-2001. One of the forms of participation that it involved was soliciting comments on the EIA programme from various key stakeholders in early 1998. Comments were requested from 43 organizations, including state agencies and other institutions as well as non-governmental organizations. Thirty-five comments were received. Few of these referred to carbon capture and storage: the only one[11] that makes explicit reference is by the Norwegian Pollution Control Authority, who were "positive about the plans to inject CO_2 and requested Statoil to investigate the possibility to utilize CO_2 injection for enhanced oil recovery" (Konsekvensutredning, 2001, p.175).

Carbon capture and storage gained more visibility in the planning of the power plant to service the LNG facility, which did not include a plan for CO_2 capture. The plant was projected to emit 860 000 tons of CO_2 annually. Here, the Norwegian Pollution Control Authority was critical of the EIA programme, and its overall statement that alternatives for CO_2 capture have been investigated, but found unprofitable (and it was also critical of limited plans to reduce NO_x emissions). The Pollution Control Authority required that "the technical, environmental and economic aspects of *alternative solutions* for power supply and energy provision, alternative CO_2 and NO_x reducing technologies, energy efficiency measures, utilization of waste heat, etc. be *thoroughly* investigated." (SFT 2001, emphasis in the original)[12]. Also the environmental organization Bellona was highly critical of the cost calculations and overall scope of the EIA programme (Bellona, 2002).

Consultation seminars with different interest groups were also organized during the environmental impact assessment process. These include a variety of local and regional authorities, as well as representatives of the fisheries. For example, the route of the pipeline was planned in cooperation with the fishing organizations. Furthermore, Statoil has organized a number of meetings and information sessions for local residents. A large majority of the locals appear to be very positive - even if not totally unanimously[13]. An example of the local enthusiasm is that when the project was cleared with the partners and the Snøhvit plan was submitted, a flag was lifted at the city hall. The positive social impacts of the Snøhvit installation have gained much attention in the local media: it has been noted that there are increasing signs of optimism in the region. Kielland and Nielsen (2005) observed a high level of public engagement and support in Hammerfest[14], and a small survey indicated that young people in the town agree with Statoil's representation of natural gas as an environmentally-friendly fuel, and the petroleum industry as

[10] The original plan was to allow investors in Snøhvit to apply a shorter-than-usual depreciation period for capital goods such as production facilities, pipelines and the LNG plant. This was not acceptable to the EFTA Surveillance Authority, and hence the Petroleum Act was amended in this respect to concern any company operating in the industry in the Nord-Troms and Finnmark Area (Stortinget, 2002).

[11] According to summaries published in the Environmental Impact Statement. Only part of the organizations (e.g., Bellona) have published their comments in full.

[12] These considerations were also later brought up in connection with the Pollution Control Authority's comments on complementary information to the LNG EIS provided by Statoil. Nonetheless, the permit for the plant was approved in November 2004.

[13] For example, the youth organization of the Centre Party in the Finnmark region has opposed the project and the SV party, which opposes the project, has a larger-than average 16% vote in Finnmark (Stortinget, 2002b).

[14] More so, for example, than existed in Tromsø at same period for a plan to host the Winter Olympic Games (Kielland and Nielsen, 2005).

providing attractive jobs in the region. The positive social impacts have also served as an important part of Statoil's communication efforts. The company has made sure to use as many local contractors as possible, and has also instituted a supplier development programme to make sure that local contractors can meet the contract requirements (Statoil, 2003). Statoil has also closely monitored the social impacts of the project, documenting and publicizing an increase in births, employment and youth optimism (Carlsen, 2005).

As the significance of the project and its visibility have grown, a great many stakeholders have started their own, local 'offshoot' projects[15]. The most controversial one has been the local energy company's, Hammerfest Energi's[16] plan to build a 100 MW gas-fired power plant with carbon capture and storage (as well as NO_x scrubbing) together with energy technology company Sargas. The plant would use gas from the Snøhvit field, and use the facility's pipeline and storage repository for the captured CO_2. According to the permit application, the new plant would significantly reduce NO_x emissions as compared with the current status, and produce one-tenth of the CO_2 emissions of a corresponding plant without carbon capture (Hammerfest Energi, 2005). Hammerfest Energi has attempted to get Statoil to invest 30-55 MEUR in the plant as part of its commitment to reduce NO_x emissions through third-party contracts in connection with the permit for the LNG plant (Blix, 2006). It has also attempted to gain access to the gas and CO_2 pipeline at preferential conditions. Statoil has not been eager to support the project, as it views the proposals as placing unrealistic financial demands on Statoil (Kårstad, 2006). Hammerfest Energi has not, however, given up on its plan, but has applied for government support[17]. The debate has gained a lot of media attention, with much of the sympathy going to Hammerfest Energi[18].

To summarize the many negotiations surrounding the Snøhvit project, one could say that Statoil has managed to align some important interests, especially national, economic, regional and local ones. It has not succeeded to align environmentalists' interests to its project, and this might have been difficult in any case taking into account the fundamental opposition to exploitation of petroleum in the Barents. A more proactive approach to carbon capture in the power plant might have helped (but might have also alienated the shareholders). Some local interests, on the other hand, have been perhaps 'over-aligned' (from Statoil's perspective), as local players have started to pursue their own agendas in connection with the project. Statoil has viewed some of these as good complements to its own activities, but others as placing disproportionate economic demands.

7. STEP FOUR: From visions to actualities

Some of the expectations of this ambitious project had to be altered along the way. The original budget has almost doubled, and the original start of production has been delayed because of problems with deliveries and the delayed agreement with partners due to uncertainties about the tax scheme. Yet the problems are also partly attributable to the technological complexity and

[15] Expectations toward co-operation with Snøhvit range from an environmental monitoring project by local fishermen and plans to utilize the warm water to speed up growth of fish hatchlings to a plan to locate university-level engineering education in Hammerfest (Hammerfest NU, 2006; Finnmark Dagbladet, 2005-2006).

[16] The company has an annual turnover € 48 million, and it is owned by Hammerfest and two neighbouring municipalities. The gas-fired power plant also includes other local investors.

[17] Recently, Hammerfest Energi applied for government support of € 47.5 million to cover the additional cost for CO_2 capture. This application was forward to Gassnova (which administers the R&D funds), which has awarded about half a million euro to Sargas for R&D activities. The total budget of the project is € 2.3 million, and it will be financed by Siemens and other industrial partners. But Gassnova wants more information from Hammerfest Energi about verification of the technology, dimensioning of the plant and cost calculations (Gassnova, 2006) before allocating further funds. Meanwhile, Hammerfest Energi's permit is being processed at the Pollution Control Authority.

[18] Eg., *Finnmark Dagbladet* Sept 2, 2003; Sept 3, 2003; Feb 2, 2005; *Dagsavisen*, May 24, 2004; *Teknisk Ukeblad*, March 9, 2004; Peterson (2004).

novelty of the project and its location, and other similar projects have also experienced cost overruns (Petroleum Economist, 2006). At present, however, test drills and runs have been made, and company representatives assure that production will be started in December 2007, or even ahead of time (Statoil, 2006).

The Snøhvit project is internationally viewed as one of the leading carbon capture and storage demonstration projects in Europe. It is an important step for Statoil in this context, and the company has been eager to share its experiences with the international expert community. It is expected that the openness of the company will enhance the legitimacy of carbon capture and storage, and provide governments throughout the world with encouraging experiences. At the early stage of the project, engagement in carbon capture and storage also contributed to a positive overall impression of the project on the national political scene. It has also most probably contributed to the image of natural gas as a clean source of energy.

Yet Statoil's plan to capture and store carbon dioxide ensuing from the purification of natural gas to LNG (amounting to almost half of all carbon dioxide emissions) has not impressed all stakeholders in Norway. It has been greeted with support by environmental authorities and has been accepted by the press as part of the cleaner technology applied at the plant, but it does not seem to satisfy the level of expectations present in some sectors of Norwegian society. Failure to apply carbon capture at the power plant servicing the LNG plant has been one of the features (but not the only one) alienating the environmentalists from the project, which in part contributed to costly delays. As the project has slowly actualized, the NGO resistance has continued in the form of critical comments and complaints about project details, including permit requirements, finances, media communications and economic impacts on the local region.

Local opinion has continued to be favourable, as many of the promises concerning the local economy have been met and even exceeded by far. The project has made a significant contribution to local involvement, and the value of local contracts has surpassed all expectations[19]. This does not mean that everyone takes an unqualifiedly positive stand on developments: some have argued that a single-minded reliance on the oil and gas industry may lead to a vulnerable economic and social structure[20] (e.g., Kielland and Nielsen, 2005). NGOs have continued to raise the concern that increased oil and gas development in the region will oust the fishing industry from northern Norway (Daya, 2006). Fishing industry representatives, however, have taken a positive stand on the development due to its attention to fishing interests. Yet currently, there is an ongoing debate on whether or not to start drilling for oil at Snøhvit and elsewhere in the Barents. Another upcoming project is the ENI-operated Goliath oilfield located about halfway along the Snøhvit pipeline. Such projects, as well as increasing traffic in the Arctic by Russian oil tankers, might have a larger impact on fisheries than the current subsea gas pipeline.

8. Lessons learned

Carbon capture and storage is viewed quite positively in Norway. One environmental organization is actually very strongly in favour of the technology, and others, too, would like to see it used much more widely. So environmental organizations are actually demanding stronger en-

[19] For example, a recent report by the Energy and Environmental Committee of the Norwegian Parliament (Stortinget, 2005) documents the following impacts. The original estimate in Statoil's EIS was that the total value of local contracts in the construction phase would amount to about 600 million NOK. It turned out that by 2005, regional suppliers to the Snøhvit construction have been awarded contracts amounting to 2.8 billion NOK, of which 2.1 billion NOK of contracts have been awarded to companies in the Hammerfest region. Norwegian contractors have been awarded about 58% of the total value of contracts, of which about 5.6% has gone to contractors in the Hammerfest region. Altogether, 3761 people from Northern Norway were employed at the site in Melkøya.

[20] Along with the economic boom, press reports imply that pressures on the local infrastructure and social problems have arisen. There have been calls to increase the police force in Hammerfest (Finnmark Dagbladet), and domestic violence incidents have been reported (Dagens Nyheter, 2006).

forcement of carbon capture and storage. Most ordinary people seem to be relatively indifferent, and merely include it as one clean technology among others. Concern about safe storage is lesser than at other sites, as all current and envisioned sites would be in connection with offshore oil and gas fields. Norwegians are accustomed to oil and gas extraction on their shores, and seem to have a relatively high level of confidence in the industry.

Nonetheless, the Snøhvit project provides some lessons about carbon capture and storage projects:

- Carbon capture and storage is embroiled in other debates related to the oil, gas and coal industries. These industries often have a poor public image among environmentalists. Thus, it may be difficult to get support from environmentalists, and even where such support exists (as in the case of Bellona for carbon capture and storage in principle) it is often quite qualified and independently-minded.
- If concerns about safety and financial and other issues are solved, carbon capture and storage might evolve quite rapidly from an experimental technology to a social requirement. Demonstration projects could thus lead to increased demands for further carbon capture and storage, as has occurred in Norway.

The project also provides some more general lessons for renewable energy project management:

- The case underlines the importance of understanding local context and history. Without such an understanding, it would have been very difficult to envisage the evolution of the Snøhvit project. In some other settings, different stakeholders' views and positions might have been quite different. Had there not been local support, the project might have presented a very different picture today.
- The regional economic success story of Snøhvit is a good example of a 'virtuous cycle' where favourable press, intensive media communications and well-built up expectations along with strong local support contribute to socially constructed success that has real economic impacts, as reflected in the new jobs and subcontracts already generated by Snøhvit in the Finnmark region.
- Large, ambitious and visible projects such as the Snøhvit LNG plant attract a lot of attention and touch on many different interests. Intensive public communication and high visibility mean that more and more aspects of the project come under public scrutiny. In the case of Snøhvit, such aspects have included project finances, economic and social impacts on the local region, corporate communications, as well as environmental aspects. The costs ensuing from delays due to NGO legal action are evidence of the concrete financial value of social acceptance.
- Yet even when the attention is positive, local people's engagement can take on a life of its own. Thus, even local *support* cannot be totally controlled by the project managers, but may bring up some surprises, thus requiring a flexible attitude throughout the project.

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Appendix A Snøhvit timeline

1984	Statoil discovered Snøhvit on the Tromsø Patch in the Barents Sea
1991-1997	An attempt was made to establish a basis for developing the area. The plan was for an offshore field development and gas liquefaction plant on Sørøya near Hammerfest that would sell LNG to the Italian market. Statoil halted the planning process, citing cost and market factors. A new solution for developing the field was proposed, with a facility on Melkøya island outside Hammerfest and subsea production installations remotely operated from land.
1991-1993	Protests against various oil companies' exploration operations in the Barents. Bellona filed suit against Statoil to halt drilling activities.
1998	New proposal submitted to the ministry in the following year. This included both new impact assessments (?) and upgrading of preparatory work done in the previous development process. Carbon capture and storage now included in the plan (? check)
1998-2001	Negotiations and seminars with experts and authorities in Finnmark, information meetings with locals in Hammerfest
April 2001	New EIS published.
July 2001	Snøhvit's partners put the project on hold because of lack of clarity over government taxation terms.
Sept. 2001	Special tax benefits approved by ESA. Contract with partners signed. Statoil submitted a plan for development and operation (POD) of the field.
Oct. 2001	Long-term sales contracts signed with El Paso LNG, Iberdrola, Gaz de France and Total.
Dec. 2001	Due to poor economic situation of the project, Finance Minister announced that ways to support the project would be investigated.
Jan. 2002	POD presented to Parliament Environmentalists organize intensive protests
March 2002	POD for LNG plant approved by Norway's Parliament in March 2002. Statoil announces that tax position is unclear due to the involvement of the ESA.
May 2002	Pollution Control Authority allows Statoil to start construction work (preparation of the site and filling of land).
July 2002	Resolution of the tax position by the ESA
August 2002	Statoil announces that delays caused by the ESA tax investigation have increased costs by € 130 million.
Oct.-Dec. 2002	Following a detailed project review, CEO says that the project's management and organization need to be strengthened to ensure cost control and progress: costs have risen by € 740 million, to 5.75 billion.
June 2003	EFTA Court rules against Bellona's action against the ESA

June-October 2004	Following an 'extraordinary review', Statoil's board is notified that costs could rise by a further € 510-760 million. Risk of delay by 6-12 months. Measures implemented to deal with failures by contractors and equipment suppliers. Statoil's cost overruns discussed in the Oil and Energy Ministry and Parliament.
June 2005	Partners launch studies to assess doubling the plant's capacity.
July 2005	Hammerfest Energi submits EIS for 100 MW power plant to Pollution Control Authority, and complains in public that Statoil has refused to contribute to its project.
Sept. 2005	New review reveals that cost estimates have risen and further delays are expected. Cost estimate rises to € 7.42 billion. Deliveries scheduled to begin in December 2007. Statoil starts to secure alternative supplies to US and Spanish customers.
Nov.2005	Remote control system and power relay tested and remote monitoring system in operation.
Jan. 2006	Statoil announces that it will re-evaluate whether oil production from the Snøhvit field could be profitable
March 2006	Shell and Statoil signed an agreement to work towards developing the world's largest project using carbon dioxide (CO_2) for enhanced oil recovery (EOR) offshore. Gassnova is awarded funding to test and verify Hammerfest Energi's carbon scrubbing technology.

Source: Norway online 2006; Kårsta 2002; Natur og Ungdom 2002; Bellona 2006; Petroleum Economist 2006.