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SiteChar

Characterisation of European CO_2 storage

Deliverable N° D8.5
Final summary report on public awareness

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Content

1 Executive summary

The aim of the SiteChar project is to develop an effective methodology for the preparation of CO_2-storage license applications, incorporating all the technical and economic data, as well as the social dimension. This deliverable summarises the work on the social dimension within work package 8 of the Sitechar project. The most important aim of the research was to advance public awareness. To this end, social site characterisation and public participation activities were conducted at two prospective CCS sites: an onshore site and an offshore site. The onshore site is the Załęcze & Żuchlów site in Poland and the offshore site is the North Sea Moray Firth site in Scotland, for which the research focused on the communities in Morayshire.

The research consisted of four steps over a time period of 1,5 years, from early 2011 to mid-2012. The first step consisted of four related qualitative and quantitative research activities to provide a social characterization of the areas: desk research, stakeholder interviews, media analyses, and a survey among representative samples of the local community. The aim was to identify (a) stakeholders or interested parties and (b) factors that may drive their perceptions of and attitudes towards CCS. Results were used to as input for the second step, in which a new format for public engagement named 'focus conferences' was tested at both sites involving a small sample of the local community. The third step consisted of making available generic as well as site-specific information to the general and local public, by (a) setting up a bilingual set of information pages on the project website suitable for a lay audience and (b) organizing information meetings at both sites that were open to all who took interest. The fourth step consisted of a second survey among a new representative sample of the local community. The survey was largely identical to the survey in step 1 to enable the monitoring of changes in awareness, knowledge and opinions over time. Additionally, the second survey was used to obtain a quantitative measure of some commonly held public perceptions about CCS. In part these perceptions were derived from the focus conferences and in part from previous research.

Results provide insight in the way local CCS plans may be perceived by the local stakeholders, how this can be reliably assessed at early stage without raising unnecessary concerns, and how results of this inventory can be used to develop effective local communication and participation strategies. The main findings are listed below.

- *Relevant developments in the area that may affect the opinion about local CCS plans*
  Polish site: Unemployment, infrastructure, Natura2000 area, brown coal mine, shale gas
  Scottish site: Unemployment, tourism, other energy operations, marine life/fishing
- *Preferred and trusted communication channels and stakeholders*
  Both sites: the internet; local newspapers, councillors, political parties
  Unique at Polish site: local radio stations
- *Level of awareness and knowledge of CO_2 and CCS*
  Polish site: Very low, with at the end of the research still 78% reporting 'never heard about it'
  Scottish site: Low, with at the end of the research still 53% reporting 'never heard about it'
- *Misconceptions on CCS, CO_2, and related concepts*
  Polish site: Misconceptions such as 'reduce toxic waste' and 'reduce smog'. In all, results very tentatively suggest that public outreach in this low-knowledge community may have led to more uncertainty and questions. It would be interesting to investigate whether this is a common effect of public participation activities in a low-knowledge community and if this effect disappears over time as more participation efforts are being organized.

Scottish site: No misconceptions mentioned, and due to higher awareness and knowledge levels as well as on-going CCS activities in the area either the survey was too insensitive to register any changes or there was too much 'noise' in the measurement environment.

- *Expectations of local CCS plans*
  Polish site: Mainly related to either positive or negative environmental impacts, however expected positive impacts are often misconceptions ('reduce smog' or 'reduce toxic waste'). The negative impact mentioned most often is that 'CO_2 will escape to the surface (and suffocate people)', other concerns are about contamination of the ground water and whether the technology is 'proven'. Many Polish research subjects also questioned the costs of CCS.

  Scottish site: Mainly positive and related to economic impacts. The area is already used to offshore operations; CCS may be perceived as a logical, complementary activity to fishing, oil drilling and offshore renewables. There are some concerns among stakeholders about the connection between different infrastructural projects, and among survey respondents about effects of CO_2 leakage on marine life. Among the local public, expectations management regarding extra employment created by CCS may be necessary.

Generally, differences in knowledge levels about the consequences of CCS (much lower in Poland) and proximity of the site to the local community (much closer in Poland) appear key explanations for the differences observed in the perceptions and appreciation of the environmental risks of CCS (most prominent in the Polish discussions), versus the economic benefits of CCS (most prominent in the Scottish discussions). Despite environmental concerns, the Polish respondents were equally supportive of CCS in their area as the Scottish respondents.

Conditions for implementation of CCS on (inter)national as well as local scale
In both countries, acceptability of CCS was related to the implementation of other, preferred measures to combat climate change. The Scottish focus conference group stated that CCS should be a short-term solution implemented alongside an exit strategy as to not divert attention from other options such as renewable energy. The government is not entirely trusted on viewing CCS as part of a long-term strategy for curbing climate change instead of being just a "quick fix". The Polish focus conference group expressed concern that while the introduction of the technology in Poland could lead to increased influence of Poland on the European policy for climate protection, alternatively it could turn Poland into a 'garbage dump' for European CO_2 emissions. In contrast, Scottish participants discussed a possible role for Scotland as a main store of imported CO_2. In the end, most Polish focus conference participants did not vote in favour of CCS because of the many uncertainties, little if any direct benefits to their region, and high costs of CCS. Participants argued that the role of national governments and the European government should be to develop a vision and to stimulate public involvement in decision-making regarding solutions to climate change. Both groups agreed that the public should not just be informed about CCS, but also about alternative solutions to reduce CO_2 emissions into the atmosphere.

The research techniques for social site characterisation and public participation presented in this deliverable proved suitable for researching public perceptions of a complex issue such as CCS and to initiate local discussion. In future project development, if any, these results can be used to start up and inform the process of information provision (for example draft a FAQ page, address misconceptions, and manage expectations) and public engagement (for example involve the right stakeholders and media). Some questions remain regarding the duration of public engagement effects, generalizability of findings from social site characterization and public participation efforts to other sites, and applicability of the research methods and results to a real project setting.

2 Introduction

At the local level, public support has proven crucial to the implementation of CO_2 capture and storage (CCS) demonstration projects, as demonstrated by the public's reaction to CCS projects in amongst others the Netherlands [1], Germany [2], and Poland [3]. Although there are also examples in which local demonstrations received public support or have at least not been rejected, such as the Lacq project in France [4], the experiences emphasize that if local CCS projects are to take off, the public should be consulted and involved in decision-making about prospective CCS projects. Whereas no method exists to guarantee public acceptability of any project, a constructive stakeholder and citizen's participation process does increase the likelihood thereof. This implies a shift in focus from project to *process* in decision making (Figure 1).

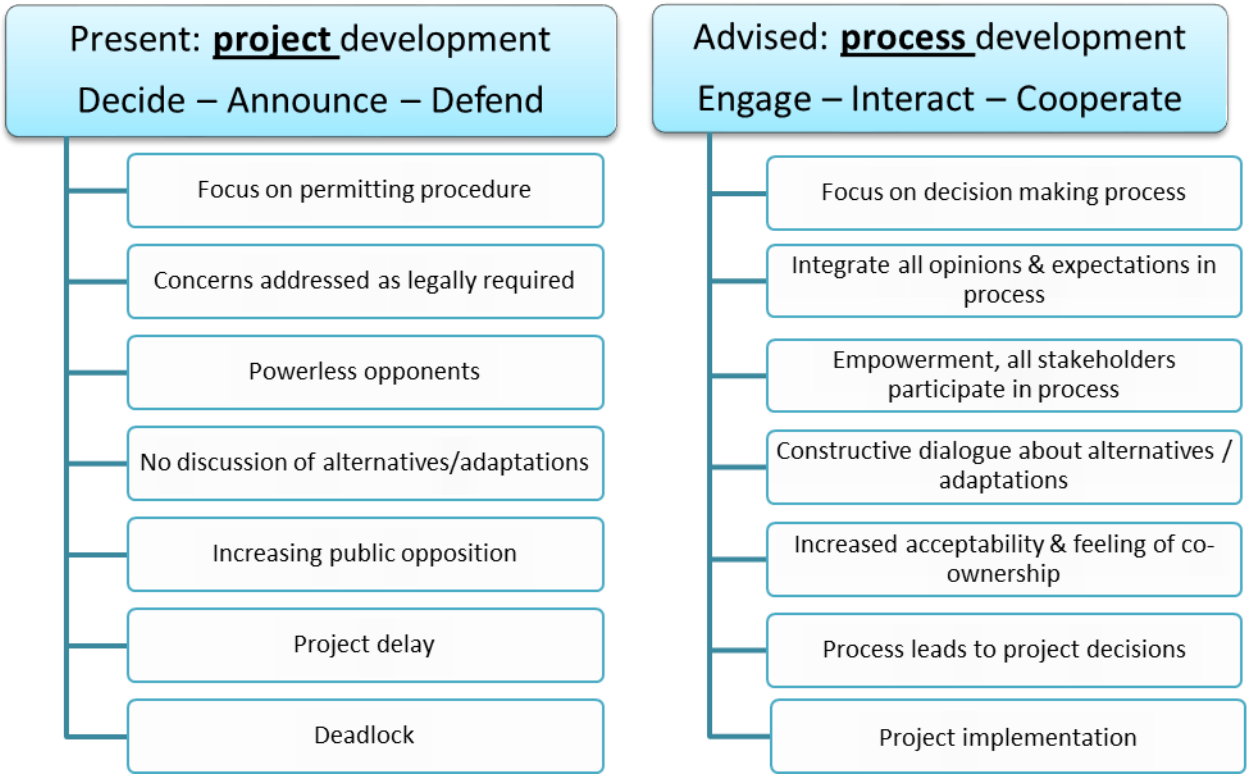

Figure 1. Differences between a focus on project versus process in decision making[1].

Social site characterisation is the process of investigating and monitoring the local social circumstances in the area, changes therein over time, and underlying factors shaping public awareness and public opinion [5,6]. It can be used as an instrument to design, plan and evaluate the process of active and constructive local stakeholder and citizen engagement with the aim of building trust, raising public awareness, and informing the public (see Figure 2).

[1] Inspired by NEA report *Stepwise Approach to Decision Making for Long-term Radioactive Waste Management, Experience, Issues and Guiding Principles* (2004), in which it is stated that "The new dynamic of dialogue and decision-making process has been characterized as a shift from a more traditional "decide, announce and defend" model, focused on technical assurance, to one of "engage, interact and co-operate", for which both technical assurance and quality of the process are of comparable importance to a constructive outcome.

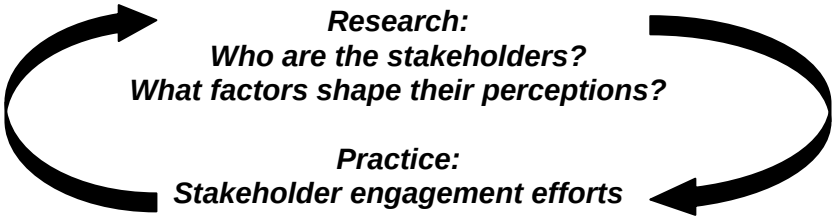

Figure 2. Social Site Characterisation

Similar to other aspects of site characterization [7], social site characterization is site-specific. Although there are general 'best practice' approaches which clearly describe the steps to follow [see for example 8-12 as well as comparative reviews of approaches in 3,13], the implementation of each step should be tailored to the area in question and to the needs of the participants in the process. Ideally, therefore, social site characterisation and public engagement activities should be an integral part of the site characterisation workflow addressing all relevant aspects of safe and secure storage as required by the EU Storage Directive. In line with this view, the general aim of the SiteChar project is to develop an effective methodology for the preparation of storage license applications, incorporating all the technical and economic data, as well as the social dimension.

The work summarized in the present deliverable consisted of social site characterisation and public participation activities at two of the five prospective CCS sites under study in the SiteChar project (see Figure 3): an onshore site and an offshore site. The onshore site is the Załęcze & Żuchlów site in Poland and the offshore site is the North Sea Moray Firth site in Scotland, for which the research focused on the communities in Morayshire.

The research consisted of four steps (see Table 1), each of which has been described extensively in previous deliverables [14, 15, 16, 17] and will be summarized in chapters 3-6. The first step (described in chapter 3) consisted of four related qualitative and quantitative research activities to provide a social characterization of the areas: desk research, stakeholder interviews, media analyses, and a survey among representative samples of the local community. The aim was to identify (a) stakeholders or interested parties and (b) factors that may drive their perceptions of and attitudes towards CCS. Results were used as input for the second step (chapter 4), in which a new format for public engagement named 'focus conferences' was tested at both sites involving a small sample of the local community. By then, the third step (chapter 5) – making available generic as well as site-specific information - had already commenced with the setup of a bilingual set of information pages on the project website suitable for a lay audience. As another part of step three, information meetings were organized at both sites that were open to all who took interest. The fourth step (chapter 6) consisted of a second survey that was largely identical to the survey in step 1, to monitor changes in awareness, knowledge and opinions over time. Chapter 7 will provide a discussion and recommendations based on the findings.

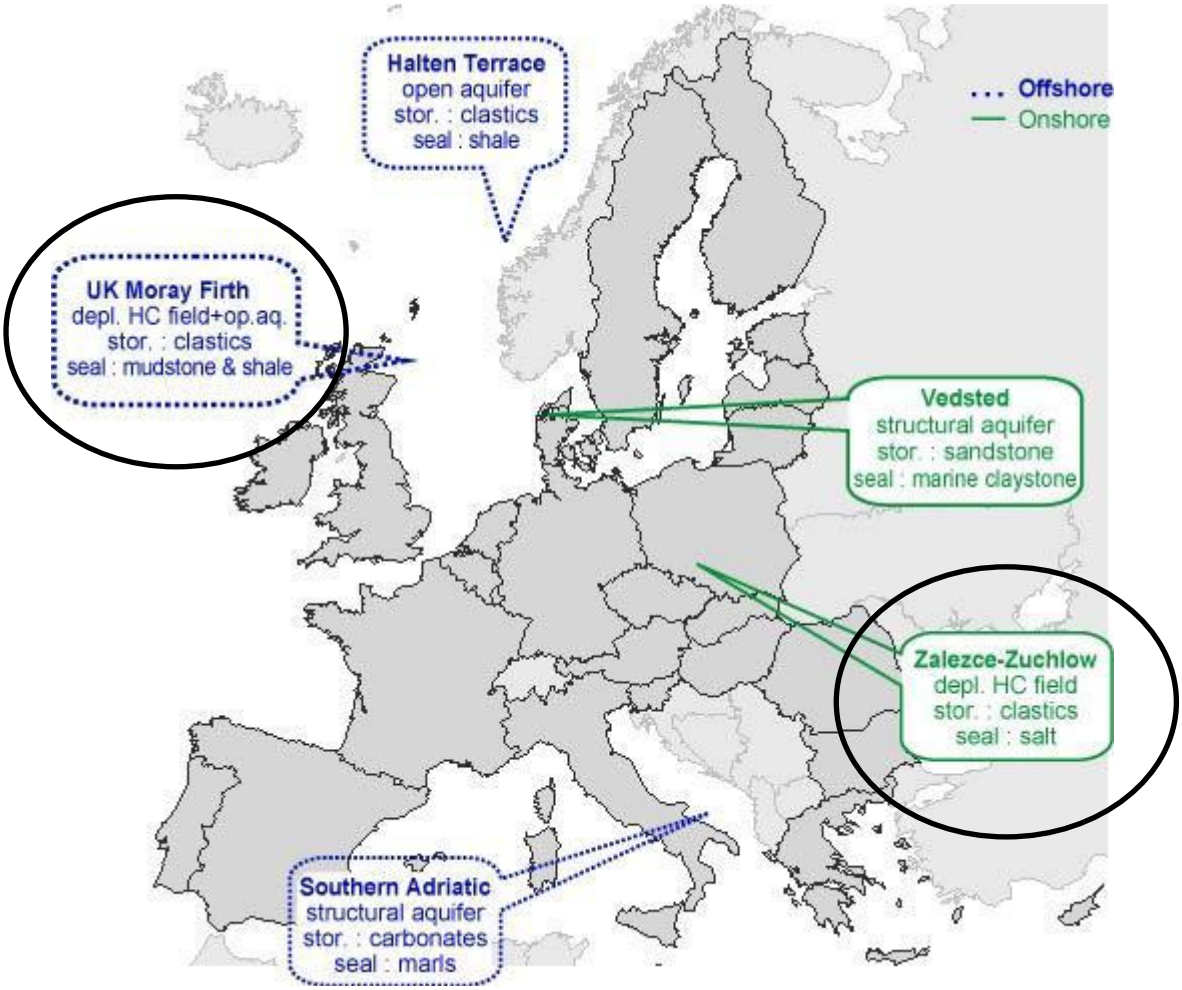

Figure 3. Sites under study in the SiteChar project with a focus on two sites in WP8

Table 1. Overview of the timing of all activities at both sites of WP8

Poland		Scotland
Fieldwork first half of 2011; data processing and reporting second half of 2012.	Step 1. Social Site Characterisation: - Desk research - Stakeholder interviews - Media analysis - Survey	Fieldwork first half of 2011; data processing and reporting second half of 2012.
30-31 March & 20-21-22 April 2012	Step 2. Focus conferences	30-31 March & 20-21-22 April 2012
June 25 2012 Continuously	Step 3: Information meeting Website information	September 6 2012 Continuously
July 2012	Step 4: Second survey	September 2012

3 Steps 1: social site characterisation of the local area

3.1 Method

To enable effective public engagement, key to social site characterisation is collecting information to answer two questions: (1) who are the stakeholders or interested parties? And (2) what factors drive their perceptions of and attitudes towards CCS? To collect reliable information to answer these questions, a set of complementary qualitative and quantitative methods was used:

1. Desk research into key historical, social, geographical, economic, industrial, and political characteristics of the site;
2. Interviews with local stakeholders to inform them about and involve them in the SiteChar project and record their questions, needs, concerns, and recommendations for local public participation (open, semi-structured interviews using a topic list);
3. Media analysis of national (Poland) and local (Scottish) newspapers to investigate the frequency and tone of media coverage of CCS in the region;
4. Telephone surveys using representative samples to characterise the local population in terms of awareness and opinions of CCS as well as present perceptions of the area, local needs, and which stakeholders are mentioned as trustworthy by the respondents.

The surveys were conducted by market research firms among a representative sample of the local population in both Poland and Scotland (N = 1.000 in Poland, N = 850 in Scotland), in the period May-June 2011. The survey took the shape of a telephone interview about satisfaction with the local area. The interviewer would introduce the research as a 15-minute interview about ‘life in your local area’ whereby local area was described as ‘the area within about 20 miles or 20 minutes driving from your home’. Apart from local plans for CCS, two other local issues were included in the questionnaire. Data from the desk research, interviews and media analyses were used to identify issues that are or may become a source of local tension or controversy, may impact people’s satisfaction with their living environment, and may transfer to feelings about yet other issues such as CCS. At both sites one ‘high-profile’ development was identified which had already given rise to local discussion and media attention, and one ‘low-profile’ development was identified which was still in an early stage and had not (yet) been a topic of much debate.

The survey addressed the following topics: Satisfaction with local area; Attachment to local area; Issues facing the area; Issue I (CCS); Issue II (high profile); Issue III (low profile); Perceived involvement in decision making; Extent of local activism; Trusted representatives and organisations; Preferred information sources; Personal information (e.g. occupation). The issue of CCS was always mentioned first; thus evaluations of other issues could not influence thoughts about CCS. The high-profile issue was mentioned second and the low-profile issue was mentioned last. The reason for placing the high-profile issue second was that questions about this issue are relatively easy for respondents to answer, thereby balancing difficult and easy questions across the survey which improves the validity of responses [18]. The interviewer asked similar questions for each issue, but here only results regarding CCS are reported. The technique of surveying people on satisfaction with their local area has a couple of advantages. Firstly, it allows for survey research early in the process of project development without giving rise to premature concerns about the technology within the community. Secondly, by collecting information about local issues and satisfaction with the area in general, the project team got a much richer picture of how the community views itself, what residents find important, etcetera. This is valuable information since people are likely to evaluate CCS in the context of other ongoing local issues.

To allow respondents to express their genuine thoughts and opinions and to avoid forcing them to state opinions while they may have none, the telephone interviews consisted as much as possible of open-ended questions and each question included a 'don't know' option. Furthermore, when respondents stated not to have heard about plans for CCS, no further questions on this topic were asked. This technique of asking people for their opinion on issues only when they indicate to have at least heard of them, and subsequently only asking to specify their opinion if they have one, works well for obtaining reliable measures of awareness, knowledge and perceptions of issues as it carefully avoids to force people to state an opinion about something they have never heard of and/or have no positive or negative feeling about [19].

3.2 Results and implications

Below are summaries of relevant results and implications from the desk research, media analysis, the local community survey and the stakeholder interviews.

- *Relevant local developments*. At both sites unemployment was seen as one of the main local problems. Climate change was not a salient issue. The Scotland area considers its coastline an asset for tourism, with dolphin spotting as one of the key activities advertised. In Poland, the area has a nature reserve that draws some visitors, however it is not actively promoted for recreational purposes, which is mainly due to the lack of facilities such as hotels. Even finding a suitable place for the focus conferences (see chapter 4) proved difficult. Nevertheless, the desire to develop tourism in the area may well become an argument when anticipated impacts of a local CCS project are perceived to interfere with this goal. It is recommended to anticipate this issue in future project planning and communication. Purity of drinking water is important to both areas. Furthermore, at the Polish site a drinking water reservoir is located on top of one of the two gas fields that are in view for possible CO_2 storage. This too is likely to be a discussion topic in future contact with the local public that communicators can anticipate.
- *Trusted information sources.* At both sites, almost half of the survey respondents reported the internet as most preferred medium for obtaining information. Other trusted sources were local councillors, community authorities, or local political parties. Family, friends and other personal contacts were mentioned by relatively few respondents. In Poland, the local radio was found to be a popular information medium too. Such site-specific findings may help communicators to plan targeted communication activities and media selection.
- *Level of awareness and knowledge of CO_2 and CCS.* At both sites, awareness and knowledge of CCS in general as well as of possible local CCS plans were low among the survey respondents, particularly in Poland. The Polish respondents held some clear misconceptions concerning the purpose and effects of CCS, for example that it would 'reduce toxic waste'. Low knowledge levels imply that apart from site-specific information on CCS, general information on CCS and its wider context (CO_2, climate change) is needed to help the local public understand the role of CCS as an emissions reduction technology. Knowing which misconceptions local community members hold may facilitate the discussion and rectification of such misconceptions in public engagement activities and information provision.
- *Expectations of local CCS plans.* At both sites, expectations of local CSS plans for the region were mainly positive. Particularly at the Scottish site, the majority of survey respondents expected that CCS would bring jobs to the region and improve the local economy. In future public outreach, management of these expectations may be necessary. The main perceived negative impacts were effects of leakage of CO_2 on marine life and visual impacts of CCS installations. At the Polish site, respondents did not appear to have a clear image of what CCS may and may not bring to the region. Regarding expectations of the effects of CCS, its main perceived advantage was that it will be beneficial for the environment. However, the main

perceived disadvantage was that it would be bad for the environment. This may indicate that people actually do not know that well what to expect of CCS. This conclusion is strengthened by the finding that 18% of those who expected positive impacts mentioned that CCS will 'reduce toxic waste'.

- *Media attention for CCS and its characteristics (e.g. arguments used).* The media debate was more extensive in Scotland than in Poland, but in both countries media attention was mainly positive. In Poland, the main arguments used in favour of CCS were that it is climate friendly and that it enables continued use of coal. A perceived downside was that it is costly. Opponents of CCS contested its safety. In Scotland, the main arguments used in favour of CCS were related to enterprise and not so much to climate change. CCS was depicted as creating a new industrial sector with significant opportunities for new job creation.

Among the Polish stakeholders interviewed, CCS technology and plans for carbon storage were largely unknown. Only one interview partner, an employee of a gas company had heard of plans for the implementation of CCS in the region. Most stakeholders responded neutrally to the idea that CCS could possibly be applied in the area in the future. As the greater part of the interviewees were not acquainted with the technology they were unable to articulate advantages or disadvantages and did not want to commit to either a positive or negative position toward CCS technology. Stakeholder questions were related to the technical process of capture, transport, and storage of CO_2, the risks and environmental impacts of CCS, how the project would be funded and why this particular region was chosen. Concerns were related to the risk of CO_2 leakage, such as possible contamination of the ground water reservoir of one of the towns that is located on top of one of the prospective storage sites. CO_2 was described as toxic, dangerous, poisonous, polluting and pathogenic, implying a need for basic information on CO_2 and CCS.

Similar to the general local public, stakeholders at the Scottish site were more knowledgeable about CCS than stakeholders at the Polish site. They expected to be involved/consulted in case of a real CCS project. The key priorities for stakeholders were related to local economic issues such as jobs and the effect on enterprises. To the extent that CCS would bring positive effects on the issues mentioned above, it was welcomed by most stakeholders. The area is already used to offshore operations. As the offshore environment is seen as a resource for fish, oil, offshore renewable energy (large-scale wind projects), to some it would only make sense to also look into CCS as an option. Objections to infrastructural development thus seem unlikely, provided it would fit on-going developments in the region. Scottish stakeholders had all heard of CCS and knew that it was about storing carbon dioxide. They asked a large number of detailed questions, e.g. where the CO_2 pipelines would be located. Among the interviewed there was some doubt whether CCS will bring many new jobs to the area, but CCS is seen as an opportunity to revitalise local ports. According to the stakeholders, environmental issues need to be assessed but are unlikely to be a show-stopper. And if consulted, the local public will likely see value for job creation and enterprise. Points of concern are the issue of integration with other operations, the impacts on the fishing industry, and possible objections from environmental protection organisations.

In all, survey, media and desk research results seem in line with and complementary to the results of the stakeholder interviews. These results were used to prepare for the second step of the research which is described in chapter 4.

4 Step 2: Focus conferences

4.1 Method

The objective of the second step was to apply and evaluate a newly developed participation method called the 'focus conference', which combines some effective elements from the already existing repertoire of other public participation methods [see for example 20-24] such as focus groups [25, 26], the Large Group Process [27], deliberative polling [28], consensus conferences [29], and citizen's juries [30]. This participation tool was developed by the Independent Institute for Environmental Issues (UfU) and this was the first time that the focus conference method was applied and evaluated in this particular form.

The aim of the focus conferences was to present and test a format in which project operators, authorities, and the local public could enhance their cooperation in project planning. As such, focus conferences aimed to serve as a "hinge" between social site characterisation as a research effort and as applied to real-life project settings. Therefore, the aim was to have prospective site operators and authorities take part in the discussion. At the Polish site, the operator was project partner PGNiG, who presented the industry perspective at the Polish Focus Conference. The presence of the project developer, as well as the site being onshore and easy to locate, made it possible in Poland to have a realistic discussion about possible local application of CCS. In Scotland, the operator was yet unknown and the site is offshore. Therefore, the discussion focused more strongly on national deployment of CCS. A Shell representative was found willing to present the general industry view on CCS and a representative from the Scottish Government was present to explain the national policy view on CCS.

The focus conference method structures the participation process into two weekends with at most one month between the weekends. In the setup of the focus conference, particular emphasis was given to providing knowledge, allowing space for open discussions, allowing each participant to gain their own experiences and creating opportunities to compare their own opinion with the opinion of others during as well as between the weekends. The focus conferences on CCS for the SiteChar project took place in two weekends in March and April 2012. A group of 11 (Scotland) and 16 (Poland) participants recruited from the local public gathered in two weekends to be informed about CCS technology, to discuss their perceptions of the rewards and risks of CCS technology, and to state their conditions for acceptable implementation of CCS projects. The same group participated in both weekends. Respondents were recruited by a market research firm taking into account several socio-demographic criteria (age, gender, social and labour market position). Participants received financial compensation for travel, were provided with food and lodging and received an allowance.

During the weekends, the participants had the opportunity to learn about the scientific, technical and social aspects of CCS technology and to learn about different points of view on CCS technology. Time was taken to create trust in the objectivity of the organizers, to create a safe environment in which participants did not feel inhibited to express themselves, and to select the speakers and discussion materials, ensuring that all key perspectives on CCS were represented and the discussion would be balanced. To this end, experts from research, politics, industry and NGOs were invited to participate in both weekends, during which they gave presentations and answered questions from the participants. However, despite great efforts, eventually an NGO was found willing to join only for the Polish focus conference. The focus conference process resulted in a positioning paper written by the participants representing a statement on CCS technology from their perspective, which they wrote during the last weekend of the conference.

4.2 Results and implications

Here we summarize the key messages from the focus conference participants. However, interested readers are strongly encouraged to read the citizens' own (more elaborate) wording of the issues [15].

In Scotland, the participants' most important condition for acceptable deployment of CCS is that if CCS is at all worth pursuing, it should only be developed as part of a suite of options to combat climate change. More specifically, most of them think that CCS should be developed on a parallel track with renewable energies. In Poland, the majority of the participants agree that there are too many open questions regarding risks, benefits to the region, costs, and the position of the government. In all, the Polish participants think that at present CCS is generally too costly to invest in and that there are too many uncertainties locally to justify a project that lacks a clear local benefit. On balance, of the Scottish participants, 5 want CCS along with other measures; 3 are undecided as to whether they want CCS; 2 do not want CCS but prefer other measures; 1 abstained from voting. Of the Polish participants, 11 think that there are too many uncertainties at present to opt for CCS. The other 5 participants are against the application of CCS in the gas fields in their area, Załęcze and Żuchlów. Key messages from both groups are summarized below.

1. Agreeing that climate change happens and that measures should be taken does not imply agreement on CCS as a suitable method to curb climate change.
Although eventually climate change is the only justification for CCS, the technology has other short-term and mid-term benefits that could be significant for implementation. Both groups mentioned that if CCS is to be effective against climate change, it is not enough to introduce this technology only in Scotland or in Poland. Its application should be worldwide.

2. Acceptability of CCS is related to other measures to combat climate change.
A majority of both groups agreed that they preferred other measures to combat climate change than CCS. Furthermore, albeit more explicitly in Scotland than in the Polish group, both agreed that if CCS would be applied it should be a short-term solution implemented along with an exit strategy as to not divert attention from other options which are perceived to be more sustainable in the long-term such as renewable energy.

3. Pay attention to national and local advantages and disadvantages.
On a national level, there may be benefits such as the further use of coal, which is the main argument in Poland, or the country taking a leading role in developing the technology, which was raised as an opportunity in both groups. The Polish participants mentioned that the introduction of the technology could lead to an increased influence of Poland on the European policy for climate protection. However, they could also think of international downsides such as becoming a 'garbage dump' for European CO_2 emissions. For the Polish group, therefore, one of the conditions for accepting a local CCS project was that only CO_2 produced within the region would be stored. In contrast, Scottish participants discussed a possible role for Scotland as a main store of imported CO_2. Nationally as well as locally, employment can be an issue. Attention should also be paid to possible local disadvantages. In Poland, the location of the storage site raises concerns with the participants about possible loss of value of surrounding real estate.

4. Pay attention to risks and uncertainties.
Regarding the acceptability of risk, both groups discussed the 'unknowns' of CCS and the reliability of information on risks. Among the Polish group, the acceptability of risks gained weight in the discussion when it became clear that a CCS project would have little if any direct benefits to the region. Along with the costs of CCS, the presence of too many uncertainties was the main reason for the Polish participants not to opt for CCS.

5. National and European governments should clarify their role/position.

The participants argued that the role of national governments and the European government should be to develop a vision and to stimulate public involvement in decision-making regarding solutions to climate change. The Scottish participants stated that if CCS is to be developed further, they would like to see a variety of regulations or conditions for the development. The government is not entirely trusted on viewing CCS as part of a long-term strategy for curbing climate change instead of being just a “quick fix” to get them out of the problem of needing deep carbon cuts to meet their targets. Regarding the regulation of safety, both groups stated that it should be made clear with whom the responsibility for the project lies. The Polish participants mentioned that the government should financially support the development of CCS and generally should provide clear legislation on CCS.

6. Citizens expect public communication and participation activities.

Both groups agree that for effective public engagement, information campaigns on CCS are needed. Moreover, both groups mentioned that the public should not just be informed about CCS, but also about alternative solutions to reduce CO_2 emissions into the atmosphere such as renewable energy. The Polish participants proposed a referendum to let citizens decide if they want a project in the area or not. The Scottish participants recommended public engagement to be built in to project development from the start, not just for CCS but also for other low carbon technologies.

5 Step 3: Public outreach activities

5.1 Method

As a third step of the research, generic and site-specific information regarding the site explorations within SiteChar was made available to the general public as well as to the local public at the Scottish site and at the Polish site. To this end, separate sections were added to the project website http://www.sitechar-co2.eu/ offering information in both English and Polish. The style and complexity of this information was tailored to (1) low awareness and knowledge levels of a general lay audience; (2) general good practices of information provision such as objectivity, balance, and validity [31, 32, 33]; and (3) specific information needs as derived from the social site characterisation (see chapter 3) and other research [34, 35]. The aim of making this information available was to support other public awareness activities: the focus conferences (see chapter 4) and the information meetings (see below). For example, the web pages were used to announce the focus conferences, to function as an information source between the two weekends, and as a place where the positioning papers could be published after the focus conferences. Information meetings were held on location at both the Polish site and at the Scottish site, about one month after the focus conferences and shortly before the second survey (see chapter 6). In publicity efforts these meetings were announced as 'climate change debates'. At the information meetings, participants in the focus conferences were given the opportunity to present their positioning paper.

5.2 Results and implications

The information meeting at the Polish site took place on the 25th of June 2012 in Góra and was open to everybody for participation. The aim of the information meeting was to inform the local public about CCS technology, the possibility of CO_2 storage in the region and to present the positioning paper and its importance for the Polish climate strategy. About 40 citizens, guests and experts participated in the information meeting, which the focus conference participants themselves helped to organise. To inform local residents about the meeting, the organizers wrote an article in a local newspaper about the SiteChar project and the focus conference results, in which citizens were also invited to the information meeting. The invitation to the meeting was also published on several local websites, partner and project websites, information boards in some of the villages in the area, and by word of mouth through the focus conference participants who invited their families, neighbours and friends to the meeting. Additionally, the organizer sent the positioning paper, along with an invite to the meeting, to five local newspapers and one local radio station. This resulted in the presence of two journalists at the information meeting. Ten experts from politics, industry, eNGOs and research who are engaged in the topic of CCS technology in Poland were invited to the meeting. Three of them accepted the invitation and two of them agreed to prepare short presentations explaining the CCS technology (Czesław Rybicki) and its development in Poland (Adam Wójcicki).

After a short introduction by the organizers to the SiteChar project and the two expert presentations, three participants in the focus conference presented the positioning paper. In the next part of the meeting the invited stakeholder from politics, research and industry were invited to share their view on the participants' positioning paper and CCS technology in general. Elżbieta Wróblewska from the Ministry of Economy, who represented the Polish government, emphasized that Poland will need to adopt CCS technology to fulfil EU agreements on reducing CO_2 emissions. She admitted that CCS is a new and expensive technology but that Poland should invest in its development. There was no statement from the industry. In the opinion of the local policy makers CCS technology is still an "unknown field" and they do not feel they can give a clear

statement in favour or against the technology. Tadeusz Pawłowski, mayor of Rawicz, mentioned that the water reservoirs for Rawicz are located on top of the Załęcze gas field, and that a CO_2 leak could therefore have catastrophic consequences for the region. The local decision makers did not believe the government's promise that the communities will get a high profit from the CCS projects. They have heard it too often and then nothing happened. In their opinion it is too early to discuss a CCS project in the area. The communities currently have other problems, like the opening of the brown coal mine in the region which citizens and local governments are against. After the statement round there was a lively discussion in which the following questions were asked:

- Is there really a project?
- If there is no project, why has this meeting been organized? Is this not too early?
- Has the test drilling started already? (Some of the citizens had seen cars with drilling machines in the area, however this was probably drilling equipment for a nearby shale gas operation).
- In this region there are Natura 2000 areas, will they be protected when the CCS project will be planned and realised?

The organisers and participants also discussed how to involve local citizens in decision making processes and what can be done to encourage citizens to participate in for example information meetings. The majority of participants stated that the local citizens are not very active, because there is no tradition of public participation in decision making processes. To gain residents' attention on some topic probably something bad must happen first, for example 'when they will have sparkling water in the tap'.

The Scottish public information meeting was held in Elgin, Moray in September 2012. This meeting was held later than the Polish information meeting due to developments in the area that could impact the interest in and results of such a meeting. Its aim was similar to that of the Polish information meeting, including the presentation of the positioning paper. Personal invitations to the public meeting were extended to all of the Focus Conference participants, all local councillors and a number of local community groups such as the Moray branch of the Green Party and the Moray Firth Partnership. An article about the meeting, which also invited local citizens to attend, appeared in two local newspapers during the week preceding the meeting. The meeting was also advertised on the Moray council website. Unfortunately, despite several invitations and reminders, none of the Focus Conference participants were able to attend the meeting – although some of them did send their apologies. Therefore, Dr. Leslie Mabon from SCCS agreed to present the outcomes of the positioning paper at the information meeting. Two local councillors also agreed to give short presentations – councillor Fiona Murdoch formally welcomed the guests and added some local context. Then Rhys Howell (SCCS) explained the process of CCS and its underpinning rationale in terms of climate change mitigation. Next, councillor Graham Leadbitter explained how he saw CCS fitting into a broader context of climate change and environmental issues. Finally, Dr. Leslie Mabon presented the positioning paper. A dozen local citizens in total attended the meeting. None of these people had had any previous involvement in the SiteChar project and all had heard about the meeting from the newspaper advertisements or email invitations.

There was a more formal question and answer session following the presentations, and plenty of time for informal discussion over food and drink. It transpired that a number of citizens were frustrated with the development of energy technologies, particularly wind and biomass, in the region and felt that developers were forcing these projects upon them. Others were open to the

idea of further developments in the region, including CCS, if it could be shown that developing these technologies was in the region‘s interest – particularly in terms of economic benefits. Pragmatically, there was a feeling that whichever technology could provide the most cost effective low carbon energy should be pursued.

The issue of public participation in decision making came up, particularly in the informal discussions. Some participants were keen to ask the organisers for advice on how they could respond to or challenge planning decisions made in their community, explaining they felt the process was too complicated and unclear for ordinary members of the public to engage in. Others expressed slight concern that – on the basis of what they had heard in the media – CCS in the North Sea was a ‘done deal‘ and that public consultation at this stage would not do much to change it. Questions were asked about who would have long-term liability for a CO_2 storage site, and about how much it would cost to build, operate and insure a CCS project. There was also a vocal minority of climate sceptics who did not believe that any climate mitigation activities were justified, and thus that CCS served no purpose. The more sceptical members of the audience were very keen to point out perceived weaknesses in the climate science and political processes under decarbonisation, and came well prepared with large volumes of material to support their arguments.

At the information meetings, the participants in the focus conferences were given the opportunity to present findings from their positioning paper that was published as part of D8.2. Eventually, only the Polish participants used this opportunity. Generally, interest in the information meeting was much lower in Scotland than in Poland. There are several explanations for this difference. First, it may be that interest at the Scottish site is lower than at the Polish site since it is located off shore. Second, too much time had likely passed since the focus conferences, causing people to lose interest. It therefore appears advisable not to allow too much time in between public engagement efforts. Third, the fact that particularly at the Scottish site discussions were about a rather ‘hypothetical’ project may also have caused respondents to lose interest. While plans for CCS at the Polish site were equally uncertain, the possibility to involve the prospective site operator may nonetheless have stirred a stronger feeling of personal relevance in the Polish local community when compared to the Scottish local community. Fourth, the active involvement of the Polish focus conference participants in the setup of the Polish information meeting has motivated them not only to join but also to bring others along, which explains why the event was well attended.

The organizers had built strong relationships with local stakeholders and residents during the social site characterisation activities and the focus conferences. This paid off when organizing the information meetings, where the organizers received help from several parties in the setup.

In all, the results discussed up to now demonstrate the usefulness of steps 1-3 not only to get acquainted with the area, but also to make oneself known to and trusted by the local community. It also demonstrates that in public awareness and engagement work, there is no clear divide between research and practice. In practice, prospective site operators may have more difficulty earning trust from local stakeholders discussing a real project than social researchers discussing a possible, hypothetical project. The principles of open interviewing, surveying and involving local residents would be equally helpful in both situations to identify questions, concerns, and obtain cooperation in local outreach activities. As mentioned in the previous chapter, the organizers of the Scottish focus conference did not succeed in involving an NGO, which may be even more difficult for prospective site operators. However results of the Scottish focus conference show that the absence of an NGO is not necessarily a showstopper for a balanced dialogue.

6 Step 4: Final survey

6.1 Method

The fourth and final step of the research consisted of a second survey that was again held at both sites. The survey, consisting of telephone interviews, was conducted in both Poland (N = 1,006) and Scotland (N = 864) by market research firms among new representative samples of the local population (other respondents than in the first survey). In Poland it was held in July and in Scotland it was held in September 2012. The market research firms were selected because of their research experience and familiarity with the area. A quota sample was used to guarantee representativeness on age, sex, and education/employment. The interviewer introduced the research as a 15 minute interview about 'life in your local area'. Respondents willing to participate subsequently received some screening questions (postal code, age, gender, employment) to determine whether they fit the profile. If so, the interviewer continued with the first question. If not, they were thanked and the interview was ended.

As one of the aims of the second survey was to measure changes in awareness and opinions over time, the survey largely contained the same questions regarding CCS as the first survey. There were two important differences however. Firstly, the first survey took the shape of a local area satisfaction survey. To this end, apart from questions on CCS, the questionnaire also contained questions regarding other issues relevant for the local area. In contrast, the second survey focused solely on CCS as a local issue. Secondly, in contrast to the first survey, the second survey contained several statements on CCS in general and respondents were asked to state to what extent they either agreed or disagreed with these statements. Some of these statements were based on opinions voiced in the focus conferences. Others were based on issues that have shown to be important explaining factors of CCS acceptability among general publics in previous research [36]. To keep the Scottish and Polish version of the survey the same, they were limited to aspects of CCS that were relevant for both sites, either onshore or offshore.

Including these statements in the survey ties it to the focus conference results (see step 2, chapter 4) since the survey data enhance the validity as well as the generalizability of the focus conference data. The focus conferences had only a small number of participants (11 in Scotland and 16 in Poland). Such qualitative research efforts provide unique in-depth and detailed insights in the public's thoughts and opinions about CCS, but it remains unclear to what extent opinions voiced in such small groups are representative for what the local community as a whole thinks about CCS. Replies to the statements, collected from a representative community sample, can be used to validate statements of the focus conference respondents and investigate to what extent opinions are shared within the local community.

6.2 Results and implications

Since two surveys at two sites result in a wealth of data, only the clearest between-survey and between-country differences are listed here. For a full overview the reader is referred to the reports of step 1 [14] and step 4 [17].

- *Level of awareness and knowledge of CO_2 and CCS.* Compared to the first survey, awareness and knowledge of both general and local plans for CCS were still low, particularly in Poland. However, in Poland a slight increase in awareness was found, which may be ascribed to the public participation efforts mentioned in chapters 4 and 5. Furthermore, Polish respondents who had at least heard of CCS more often correctly stated the aim of CCS than in the first

survey when asked to specify what they had heard ('will stop CO_2 from entering the atmosphere' or 'will help stop climate change'). This learning effect may also tentatively be ascribed to the public participation activities. No such effects were detected for the Scottish site for which there are at least two explanations. Firstly, because awareness and knowledge levels are already higher in Scotland, the survey instrument may have been too insensitive to detect further improvements. Secondly, during the SiteChar project, the Moray area faced other CCS-related developments that have likely interfered with the public participation efforts within SiteChar.

- *Presence of misconceptions on CO_2 and CCS*. Although knowledge of the aim of CCS appeared to be improved somewhat among Polish respondents who had at least heard of the technology, two misconceptions regarding its effects that had been found in the first survey persisted in the second survey: That CCS will reduce toxic waste and that CCS will reduce smog. Together, these misconceptions even occurred more frequently in the second survey than in the first survey. There is no clear explanation for this finding, except the speculation that perhaps among this low-knowledge audience the public participation efforts described in chapters 4 and 5 initially raise more questions than they answer. The answers of the Scottish respondents demonstrated awareness of Shell's plans for CCS at the Peterhead power station, but similar to the first survey the answers contained no misconceptions.
- *Expectations of local CCS plans.* Most respondents expected CCS to have a positive impact on the area. Similar to what has been found in the first survey, in Scotland these positive expectations were mainly related to perceived economic advantages, while in Poland these positive expectations were mainly related to perceived environmental advantages. This is in line with the findings from the media analysis (see chapter 1) that the Polish debate accentuates environmental effects, whereas the Scottish debate accentuates economic effects. Since the number of respondents reporting negative impacts was rather small in both countries, results are not reported here as they add little validity to the focus conference results. Interestingly, the number of Polish respondents who reported not to know whether CCS would have a positive or negative impact on the area significantly increased. Again, this may be an effect of information provision: providing information to audiences with low knowledge levels may well raise more questions initially than it answers. In Scotland, the number of respondents who expected 'no impact at all' increased significantly.
- *Perceptions of CCS technology.* Much more Polish than Scottish respondents perceived risks of leakage of CO_2. Nevertheless, in both samples the perceptions of CCS were rather positive. Most respondents reported to have trust in proper regulation and monitoring of CCS. Most also expected that CCS could help their country meet international targets for CO_2 reduction and buy time to develop renewable energy sources. Additionally, Scottish respondents believed that CCS might give Scotland a technological advantage over other countries. The Polish respondents were not so sure about this. Many respondents in both countries were uncertain about the costs of using CCS and whether the technique is ready for widespread use. Many respondents answered 'don't know' to this question. Particularly in Poland, CCS was perceived as essential for tackling climate change.
- *General sense of urgency of reducing CO_2 emissions.* In both samples, the majority of respondents agreed that 'something must be done' about climate change.
- *Support of local CCS plans.* Overall, the respondents tended to support the use of CCS both locally and nationally. Among those who were unsupportive or undecided, some highlighted the desire for more information, public consultation and – especially in Poland – guarantees for safety as factors that might make them more supportive. This should be taken into account in future public outreach concerning actual project plans.

In all, differences in knowledge levels about the consequences of CCS (much lower in Poland) and proximity of the site to the local community (much closer in Poland) appear key explanations for differences found in perceptions and expectations of the benefits or risks associated with CCS. This combination of factors is a likely cause of the differences observed in the perceptions and appreciation of the risks of CCS, which weighed heavier in the Polish discussions, versus the (economic) benefits of CCS, which weighed heavier in the Scottish discussions. Whereas systematic research into the effects of proximity has up to now been scant, previous research has shown correlations between knowledge and perceptions of CCS [34]. It must be noted however that knowledge is only a weak predictor of general attitudes towards CCS. This is supported by the present findings, which demonstrate that despite environmental concerns the Polish respondents were equally supportive of CCS nearby as the Scottish respondents.

7 Discussion and recommendations

Social site characterisation and public participation activities were conducted at two prospective CCS sites in Poland and Scotland. Social site characterisation and focus conferences can provide insight into the way local CCS plans will be perceived by the local stakeholders, which can be quite different across countries and even within countries across different sites. Using a combination of qualitative and quantitative methods, this research has resulted in first-hand accounts from Polish and Scottish citizens themselves on:

- The level of awareness and knowledge of CO_2 and CCS
- Presence of misconceptions on CCS, CO_2, and related concepts
- Questions and concerns about CCS (in the context of other climate mitigation methods)
- Expectations of CCS on (inter)national level
- Expectations of local CCS plans
- The most effective (preferred and trusted) communication channels
- The most important and trusted organisations stakeholders
- Relevant developments in the area that may affect the opinion of local CCS plans
- Conditions for implementation of CCS on (inter)national as well as local scale.

The results can be used to start the process of information provision (for example by drafting a FAQ page, addressing misconceptions, and managing expectations) and public engagement (for example involving stakeholders and selecting a proper location and format). Regarding the content of communication, the findings underline the importance of transparency in information provision, the need to discuss CCS in the context of climate change and mitigation options, the need for expectations management (for example regarding extra employment), information needed to fill knowledge gaps, and the need for an open dialogue about the risks of CCS, particularly CO_2 leakage. Regarding the process of project development, these findings show which stakeholders to involve and which communication channels to use.

In this research, two innovative techniques for obtaining public responses to project plans for CCS technology were applied. First, the surveying technique presented here shows that public awareness and perceptions of local plans for CCS can be measured reliably without alarming/frightening people upfront that something in their area may happen, and without encouraging them to develop opinions that have no base in awareness or knowledge of any plans. Second, the focus conference method is suitable for raising public awareness and to assist public opinion formation about complex issues such as CCS. Moreover, the method can be used to initiate local discussion and planning processes together with the local community in a balanced, informed way. Both techniques are complementary. Whereas surveys offer the opportunity to obtain results that can be generalized to the community as well as a baseline to measure shifts in local situations, focus conferences provide a rich, in-depth picture of the process of awareness raising and opinion formation within the community. In general, the use of a combination of qualitative and quantitative social research techniques require a great amount of effort, time, and expertise. At the same time, the use of a set of complementary methods for obtaining a ‘social map’ of the area produces the most reliable, consistent, and detailed lessons regarding effective public engagement strategies. Together they provide a full description of the area and minimize the chance that important issues are overlooked. The use of multiple methods enables verification of results against each other, which makes findings more robust and thus a more reliable base for developing public participation strategies such as the information meetings (see chapter 5).

Some questions remain regarding the duration of these effects and their applicability to a real project setting. One of the main critiques on 'public engagement' in the literature is that it is often a one-off intervention that satisfies funders and researchers, but does not provide long-term institutional capacity building of engagement or acceptance by policy makers [37, 38, 39]. Public engagement efforts are only effective if they make citizens feel listened to, involved, and empowered. In a real project setting, this can only be achieved if the citizens' suggestions are taken seriously and are truly taken into account in decision making regarding the project as well as in general policy making. To achieve this, key to a constructive focus conference is trust in the independence of the facilitators. In a real-life project, hiring independent facilitators would be recommended. Other key recommendations when using focus conferences or similar methods as public engagement tools are:

- Ensure trust in the facilitators and allow time to create a safe environment
- Embed focus conferences in a range of public engagement activities
- Do not extrapolate findings from small group research to communities (use surveys for that)
- Balance positions taken by speakers and in discussion materials.

Regarding the duration of effects of the focus conference on public attitudes and empowerment, the participants indicated they wished to stay involved. However, in Scotland this commitment did not last long enough to motivate any of the focus conference participants to present the Scottish positioning paper at the information meetings. To assess why, in-depth post-hoc interviews with the focus conference participants have been conducted as part of the European project ECO2[2], to see what they think of the event in retrospect. Results from this project are forthcoming.

The second survey offered the opportunity to validate and quantify findings from the focus conferences, but it has only been partially successful in detecting effects of the focus conferences and information meetings. At the Polish site, some results of the second survey indicate that the public participation activities have been effective in improving knowledge about CCS among those who have at least heard of the technology. However, other findings suggest that these activities, if anything, have increased uncertainty. As said before, this finding may demonstrate that in low-knowledge communities, public information and participation efforts may initially raise more questions than are answered. At the Scottish site, too many other CCS-related activities have probably been developed throughout the course of the SiteChar project to enable detection of effects of the focus conferences and information meeting in the second survey. Furthermore, the information meeting was not as well-visited as at the Polish site. However, those respondents who did participate in the public engagement activities did so very actively. Finally, since knowledge levels were already higher in Scotland than in Poland, additional improvements may have gone undetected in the survey.

In conclusion, the techniques for social site characterisation and public participation presented in this deliverable are suitable for raising public awareness about complex issues such as CCS and to initiate local discussion and planning processes with the appropriate type of information, through appropriate media, and involving all relevant stakeholders. However, the proof of the pudding is in the eating. For a long-term effect in a real life project setting, it will be vital that these efforts, as well as their outcomes, are embedded in real projects and are related to national policy agendas and priorities.

[2] http://www.eco2-project.eu/

8 References

[1] Brunsting S, De Best-Waldhober M, Feenstra CFJ, Mikunda, T. *Stakeholder Participation and Onshore CCS: Lessons from the Dutch CCS Case Barendrecht.* Energy Procedia 2011; 4: 6376-6383.

[2] Dütschke E. *What drives local public acceptance: Comparing two cases from Germany.* Energy Procedia 2011; 4: 6234-6240.

[3] Breukers S, Pol M, Upham P, Lis A, Desbarats J, Roberts T, Duetschke E, et al. *Engagement and communication strategies for CCS projects: Gaps between current and desired practices and exemplary strategies.* NEARCO2 report 2011.

[4] Ha-Duong M, Nadaï A, Campos AS. *A survey on the public perceptions of CCS in France.* Energy Procedia 2008; 1: 4757-4764.

[5] Wade S, Greenberg S. *Afraid to start because the outcome is uncertain?* Social site characterisation as a tool for informing public engagement efforts. Energy Procedia 2009; 1: 4641-4647.

[6] Wade S, Greenberg, S. *Social Site Characterisation: From Concept to Application.* A re-view of relevant social science literature and a toolkit for social site characterisation. Available at https://www.globalccsinstitute.com/sites/default/files/publications/16456/social-site-characterisation-concept-application.pdf, 2011.

[7] Neele F, Delprat-Jannaud F, Vincké O, Volpi V, Nepveu M, Hofstee C., et al. *The SiteChar approach to efficient and focused CO_2 storage site characterisation.* Energy Procedia, 2013; this volume.

[8] NETL. *Best Practices for: Public Outreach and Education for Carbon Storage Projects*, First Edition, National Energy Technology Laboratory, US Department of Energy, 2009.

[9] WRI. *Engaging Communities in Energy and Infrastructure Projects.* World Resources Institute, Washington DC, USA, 2009.

[10] Ashworth P, Bradbury J, Feenstra CFJ, Greenberg S, Hund G, Mikunda T, Wade S, Shaw H. Communication/Engagement. *Tool Kit for CCS Projects.* Energy Transformed Flagship, National Flagships Research, Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2011.

[11] Raven RPJM, Jolivet E, Mourik RM, Feenstra YCFJ. *'ESTEEM: Managing societal acceptance in new energy projects - A toolbox method for project managers'.* Technological Forecasting and Social Change 2009, 76: 963-977.

[12] IISD. *Carbon Capture and Storage Communication Workshops.* University of Calgary, International Institute for Sustainable Development (IISD), Climate Change Central (Canada) CCS projects Climate Change Central, 2007.

[13] Hammond J, Shackley S. *Towards a Public Communication and Engagement Strategy for Carbon Dioxide Capture and Storage Projects in Scotland.* A Review of Research Findings, CCS project experiences, Tools, Resources and Best Practices. Working paper SCCS, 2010.

[14] Brunsting S, Pol M, Paukovic M, Kaiser M, Zimmer R, Shackley S, Mabon L, Hepplewhite, F, Loveridge R, Mazurowski M, Polak-Osiniak D, Rybicki C. *Qualitative and quantitative social site characterisations.* Deliverable D8.1 of SiteChar: Characterisation of European CO_2 storage, 2011.

[15] Brunsting S, Mastop J, Pol M, Kaiser M, Zimmer R, Shackley S, Mabon L, Howell R. *Trust building and raising public awareness.* Deliverable D8.2 of SiteChar: Characterisation of European CO_2 storage, 2012.

[16] Brunsting S, Mastop J, Kaiser M, Zimmer R, Shackley S, Mabon L, Howell R. *Public Outreach Activities.* Deliverable D8.3 of SiteChar: Characterisation of European CO_2 storage, 2012.

[17] Brunsting S, Mastop J, Pol M, Kaiser M, Zimmer R, Shackley S, Mabon L, Howell R. *Quantitative social site characterisations.* Deliverable D8.4 of SiteChar: Characterisation of European CO_2 storage, 2012.

[18] Schuman H, Presser S. *Questions and answers in attitude surveys.* Academic Press, New York, 1981.
[19] Bishop GF, Tuchfarber AJ, Oldendick RW. *Opinions on fictitious issues: The pressure to answer survey questions.* Public Opinion Quarterly 1986, 50: 240-250.
[20] ÖGUT (Austrian Society for Environment and Technology). *The Public Participation Manual. Shaping the future together.* ÖGUT-News 01/2007.
[21] Creighton JL. *The Public Participation Handbook: Making Better Decisions Through Citizen Involvement*, San Francisco, 2005.
[22] Elliott J, Heesterbeek S, Lukensmeyer CJ, Slocum N. *Participatory Methods Toolkit. A practitioner's manual.* Joint publication of the King Baudouin Foundation and the Flemish Institute for Science and Technology Assessment (viWTA), 2005.
[23] Rowe G, Frewer, LJ. *A Typology of Public Engagement Mechanisms.* Science, Technology, & Human Values 2005, 30: 251-209.
[24] Beierle TC, Cayford J. *Democracy in Practice: Public Participation in Environmental Decisions*, Washington DC, 2002.
[25] Byers P, Wilcox, J. *Focus Groups: A qualitative opportunity for researchers.* Journal of Business Communication 1991, 28: 63-78.
[26] Bradbury J. *Public understanding of and engagement with CCS*, in Markusson, N. et al. (eds.), The Social Dynamics of Carbon Capture and Storage, Routledge, London; 2012, p. 45 – 73.
[27] Ashworth P, Carr-Cornish S, Boughen N, Thambimuthu K. *Engaging the public on Carbon Dioxide Capture and Storage: Does a large group process work?* Energy Procedia 2009, 1: 4765-4773.
[28] Fishkin JS, Luskin RC. *Deliberative polling and citizen consultation.* UK CEED Bulletin 1999, 55: 6-9.
[29] Einsiedel EF, Jelsoe E, Breck T. *Publics at the technology table: the consensus conference in Denmark, Canada, And Australia.* Public Understanding of Science 2001, 10: 83-98.
[30] Crosby N, Kelly JM, Schaefer P. Citizens Panels: *A New Approach to Citizen Participation.* Public Administrative Review 1986, 46: 170-78.
[31] S. Brunsting, P. Upham, E. Dütschke, M. De Best Waldhober, C. Oltra, J. Desbarats, H. Riesch, D. Reiner. (2011). *Communicating CCS: Applying communications theory to public perceptions of carbon capture and storage.* International Journal of Greenhouse Gas Control, 5, 1651-1662.
[32] Terwel, B.W., Harinck, F., Ellemers, N., Daamen, D.D.L., 2009. *How organizational motives and communications affect public trust in organizations: the case of carbon dioxide capture and storage.* Journal of Environmental Psychology 29, 290–299.
[33] Ter Mors, E., Weenig, M. W. H., Ellemers, N., & Daamen, D. D. L. (2010). *Effective communication about complex environmental issues: Perceived quality of information about carbon dioxide capture and storage (CCS) depends on stakeholder collaboration.* Journal of Environmental Psychology, 30, 347–357.
[34] Brunsting, S.; Best - Waldhober, M. de; Terwel, B.W. *'I reject your reality and substitute my own!' Why more knowledge about CO_2 storage hardly improves public attitudes.* Energy Procedia, accepted for publication in 2013.
[35] S. Brunsting, M. de Best-Waldhober, A.S. Brouwer, H. Riesch, D. Reiner. *Communicating CCS: Effects of text-only and text-and-visual depictions of CO_2 storage on risk perceptions and attitudes.* Energy Procedia, accepted for publication in 2013.
[36] Paukovic M, Brunsting S, Straver K, Mastop J, de Best-Waldhober, M. *The Dutch general public's opinion on CCS and energy transition in 2011: Development in awareness, knowledge, beliefs and opinions related to information and media coverage.* CATO-2 Deliverable, 2012. Available at: http://www.co2-cato.org/publications/publications/the-dutch-

general-public-s-opinion-on-ccs-and-energy-transition-in-2011-development-in-awareness-knowledge-beliefs-and-opinions-related-to-information-and-media-coverage

[37] Lovbrand E, Pielke R, Beck, S. *A democracy paradox in studies of science and technology.* Science, Technology, & Human Values 2011; 36: 474.

[38] Wickson F, Delgado A, Kjølberg KL. *Who or What is 'The Public'?* Nature Nanotechnology 2010;5: 757-758.

[39] Wynne B. *Public engagement as a means of restoring public trust in science: Hitting the notes, but missing the music?* Community Genetics 2006; 9: 211-220.