Social Site Characterisation: From Concept to Application

A review of relevant social science literature and a toolkit for social site characterisation

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Overview

Carbon dioxide (CO_2) capture and storage (CCS) is a relatively new greenhouse gas reduction technology that involves capturing CO_2 at large point sources, transporting it to a suitable location, and injecting it into deep geologic formations for permanent storage. This approach builds on the significant technical experience gained over the last one hundred years by the petroleum and natural gas storage industries. More recently a number of CCS demonstration projects have been implemented around the world.[1] These projects have significantly advanced our understanding of the subsurface and the technical aspects of CCS – those related to the natural sciences (e.g., geology, chemistry, physics, and hydrology) and engineering. Much of this experience is being codified in legislation, regulation, and public policy.

[1] Global CCS Institute, The Global Status of CCS: 2010, (2011), Canberra, Australia.

Global observation by the scientific community of these demonstration projects has permitted a much wider understanding of aspects of CCS more closely aligned to the social sciences (i.e., sociology, anthropology, psychology, communications, and economics). This experience has provided insight, to some degree, into the public's reaction to CCS and has been instrumental in informing several of the recent guides for designing CCS related public outreach, communication, and engagement programs. Many guides for public outreach recommend that the developer take the necessary time during project planning to obtain a solid understanding of the concerns and perspectives of a project's stakeholders. These should, in turn, be used in designing and implementing project deployment.

The term "*social site characterisation*" has been coined to describe this process of collecting and incorporating information about stakeholder views.[2,3] In many ways, it is similar to the common steps of stakeholder identification, mapping, and response. The term, however, was chosen to resonate with technical experts involved in CCS who are keenly aware of the importance of site characterisation for ensuring the integrity of a CCS project. Typically geological site characterisation has two important dimensions: (a) it is used to screen out unsuitable sites, and, (b) it is used to modify project design to address site specific conditions. Social site characterisation draws its reference from the critical role of geological

[2] Wade, S. and S. Greenberg (2008). Afraid to start because the outcome is uncertain? Social site characterisation as a tool for informing public engagement efforts. 9th International Conference on Greenhouse Gas Control Technologies. Washington DC, Elsevier.

[3] US DOE, Best Practices for Public Outreach and Education for Carbon Storage Projects, (2009), Morgantown, West Virginia.

site characterisation for CCS projects,[4] expanding the concept, however, to suggest that in addition to assessing the technical and/or physical characteristics of a site, one should also consider the social – or human – characteristics in selecting and designing projects.

For consideration as a potential CCS site, a location must possess certain physical characteristics; for example, there must be significant geological storage capacity, sufficient porosity and permeability, and an adequate confining, structure, zone or cap rock. Potential CCS locations are then further characterised to determine the most appropriate site for a particular project, and, importantly, to determine how to modify project design to take advantage of, or compensate for, particular site characteristics. This "technical" site characterisation leads to a process for designing a project that is well suited to the site-specific physical conditions. Likewise, the information gained through "*social" site characterisation* can be used to ensure that the same CCS project is also designed with the site specific needs, and collaboration of, the community in mind. There is potentially great value in achieving this kind of alignment. Existing social science literature suggests that the ability to work collaboratively with a community rather than in an adversarial fashion, particularly in the initial project development and design phase, can assist in improving stakeholder acceptance, reducing costs and improving the quality of technology transfer projects in general. This report begins to examine why and how to conduct *social site characterisation* for CCS projects. Part 1 reviews a selection of social science literature that could provide insights to CCS project development. Part 2 includes a Social Site Characterisation Toolkit that is proposed as a module to be added to the Communication/Engagement Toolkit for CCS Projects developed by CSIRO.[5]

[4] Working Group III of the Intergovernmental Panel on Climate Change (IPCC), Special Report on Carbon Dioxide Capture and Storage, summary for Policy Makers (2005): "With appropriate site selection based on available subsurface information, a monitoring programme to detect problems, a regulatory system and the appropriate use of remediation methods to stop or control CO_2 releases if they arise, the local health, safety and environment risks of geological storage would be comparable to the risks of current activities such as natural gas storage, EOR and deep underground disposal of acid gas." Page 12

[5] CSIRO, Energy Transformed Flagship, Communication/Engagement Toolkit for CCS Projects, (2011).

Part 1 – A Guide to Relevant Social Science Literature

Introduction

As a scientific field, the social sciences explore society and human behavior. Social scientists use qualitative and quantitative methods to attempt to understand and potentially predict social response and human behavior in the face of change, new technology, environmental concerns, and a host of other socio-economic impacts. Social scientists are not all alike, indeed they come from a number of different academic disciplines including psychology, sociology, anthropology, archeology, communications, and others. Information drawn from the work of social scientists illuminates various dimensions of human behavior while collectively underscoring the complexity of attempting to reliably predict human behavior. That said, the social sciences can provide important insights for project managers. For CCS project teams that are steeped in technical expertise, a first challenge may be recognising and accepting the need to include social science expertise within the project team. The second challenge then would be to ensure that information sourced from social site characterisation processes are adequately incorporated into project plans. Just as it requires certain expertise to acquire and interpret information from a core sample of a deep geologic formation, so it requires certain expertise to acquire and interpret information from people about their concerns, motivations, and feelings -- both about the project itself and the associated information and involvement processes. In combination, technical and social science expertise have a significant impact on potential project success.

This report serves as a guide for a selection of social science literature (See Appendix I) as it may pertain to CCS and inform the process of social site characterisation. The primary objective is to help project developers learn from the literature and apply social site characterisation to assist in improving CCS projects through effective public engagement. For convenience this report adopts a simplified approach for citing this literature:

- When summarising general points or concepts from the literature that is summarised in Appendix 1, the citation points the reader to that article as in (See Ashworth).

- When using a direct quotation from this literature or citing a source not included in Appendix 1, the full citation is included in a footnote.

Part 1 reviews general theories from social science that are relevant in understanding public reactions to CCS, and discusses the application of social science theories and methods in the key steps of social site characterisation: stakeholder identification, mapping and interpretation.

Appendix I contains a short annotated bibliography of select literature reviewed in this paper and Appendix II provides a more extensive bibliography that is not annotated but can be used as a source for further reading.

What Does Social Science Tell Us About Public Perception Of CCS?

In order to gain insight into potential public perceptions of CCS, it is useful to first consider public perceptions of the related issues of risk, science, and climate change. This section looks at how frames of reference and other factors influence public perceptions.

Perception of Risk

Risk is technically defined in quantitative terms using some form of the following equation:

$$R = P(E \text{ or } H) \times C$$

Where risk, (R), equals the product of the probability (P) an event (E) or hazard (H) occurs, and the cost of related damages (C), if that event or hazard occurs. Kasperson cites several indicators that support the assertion that public perception of risk accounts for a broader array of issues than our technical definition of risk including "intuitive biases and economic interests and … cultural values"[6]. For example, if a person views CCS as a form of waste disposal and believes that hosting a disposal facility is undesirable, then they may perceive CCS as having the risk of resulting in an undesirable effect, such as reducing their property values even if the project is unlikely to have a direct impact on their property.

In risk management, developers look for ways to reduce the probability of an event or the potential cost by taking mitigation measures. By analogy, social site characterisation can help a developer to begin to understand and potentially address the additional variables contributing to perceived risk of CCS projects. More importantly, social site characterisation can help developers to better understand the role of broader sociocultural factors in shaping public perceptions of a project.

The social science literature points to a number of frameworks or models developed by social scientists to help explain the influence and relationship of different factors on public perceptions. The early work conducted by Baruch Fischoff and Paul Slovic has informed many of these models. Other frameworks have been developed more recently. The two models below have been applied to CCS, however other models could be equally useful in helping to develop an understanding of the factors that influence public perception.

The Acceptability Diamond

Bradbury *et al.* conducted a study of different processes for involving the public in decisions

[6] Kasperson, R.E, *et al.* (1988). The social amplification of risk: a conceptual framework. Risk Analysis, 8(2), 177-187.

about the destruction of chemical weapons that had been stockpiled in their communities which found:

> Although the study was initially focused on community residents' perceptions of the risks of alternatives for dealing with the chemical weapons stockpile, responses revealed that residents did not think about technology or risk in isolation. Indeed, we found that very few persons mentioned risk per se. Our study confirmed the claims of the social science literature on risk that conflict is not only about risk but about a number of broader sociocultural and scientific issues that have been hidden by the nearly exclusive focus on risk assessment and communication. In addition, we found evidence supporting the claims of cultural theory that there are fundamental differences in viewpoints that affect the ways that issues are framed.[7]

Based on these findings, the authors developed a socio-cultural framework entitled the Acceptability Diamond (see Figure 1) that offers a structure for evaluating key factors that influence public attitudes towards controversial actions involving technology such as CCS projects. The acceptability diamond is predicated on the idea that people bring a cultural frame of reference to their perceptions of technology and their preferences for certain types of information and involvement processes. Sociocultural theorists argue that risk perceptions are only one aspect of what's called "a consistent set of biases" that constitute differing cultures by which humans interpret and respond to the world.[8] These responses include more than views of a technology but also differing views on involvement process.[9] Further, *and most importantly,* since decisions about project implementation are not just technical but also involve decisions concerning the level, acceptability and distribution of impacts the acceptability of a risk is essentially an ethical question of "How *fair* is safe enough?"[10]

The four points of the diagram represent factors that their research showed as influencing perceptions of the chemical weapons stockpile destruction process. When applied the CCS, the factors include:

- Decision making: To what extent were decisions about the selection of the capture and storage technology transparent and fair?

- Relationships: What is the nature of existing relationships between the project developer and the public? How do people feel they have been treated in the past? Has the developer demonstrated in previous actions that the well-being of the community is a factor or that it will be a factor influencing project decisions?

- Accountability: To what extent are project's decision makers viewed as accountable for their actions? What happens if something goes wrong?

[7] Evaluating Public Participation in Environmental Decisions; Working Draft Prepared for the National Research Council's Panel on Public Participation in Environmental Assessment and Decision Making. J.A. Bradbury of Pacific Northwest National Laboratory. February 2005

[8] Thompson, M., Ellis, R. Wildavsky, A., Cultural Theory, Westview Press, 1990.

[9] Tuler, S. and Webler, T. 2006. Competing perspectives on a process for making remediation and stewardship decisions at the Rocky Flats Environmental Technology Site, Research in Social Problems and Public Policy 13:49-77.

[10] Rayner, S. and Cantor, R. (1987), How Fair Is Safe Enough? The Cultural Approach to Societal Technology Choice. Risk Analysis, 7: 3–9. doi: 10.1111/j.1539-6924.1987.tb00963.x

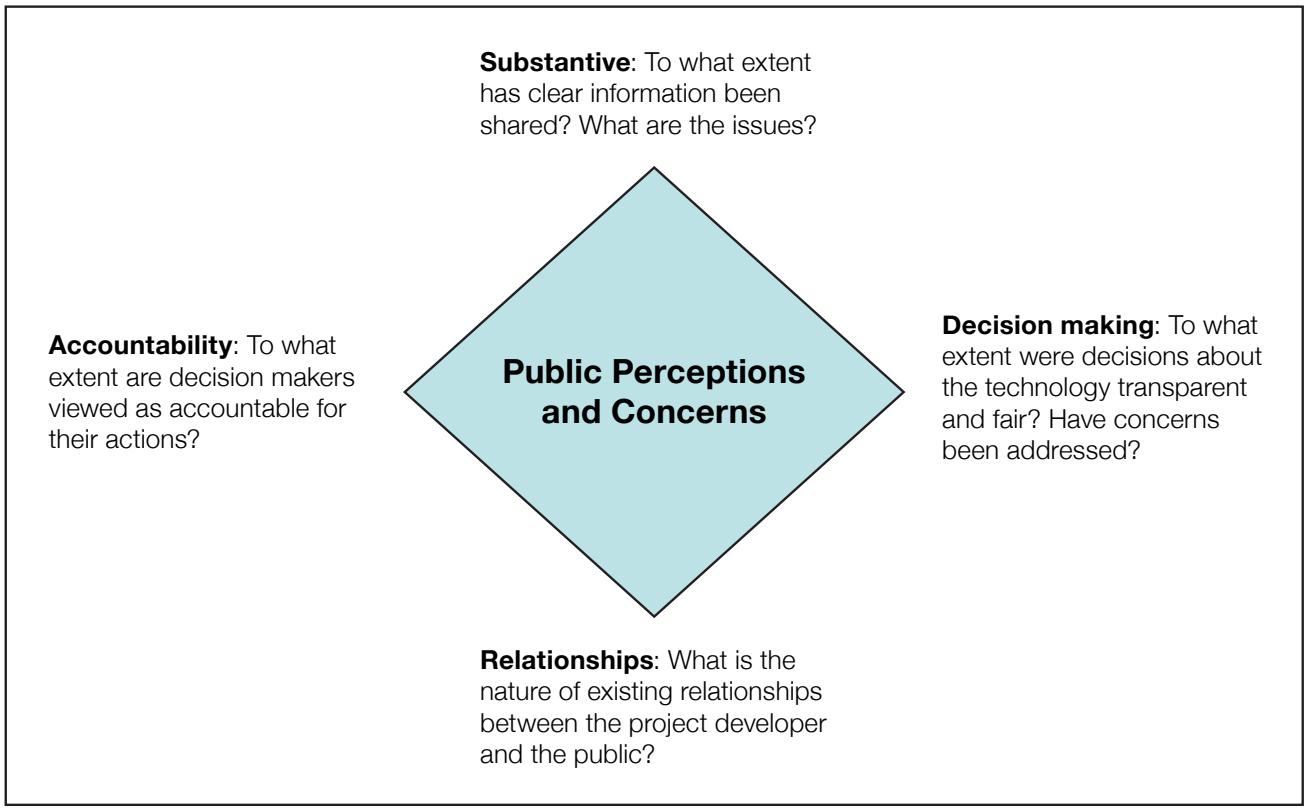

Figure 1 *– The Acceptability Diamond*[11]

- Substantive: What are the issues from the project developer and public viewpoints? To what extent has clear information been shared and have the public's issues been placed on the agenda and addressed?

Perceived deficiencies in any of these areas are likely to result in negative public responses. When applied to CCS, this suggests that these social factors will have an important role in the public's perception of CCS. If these factors are deemed deficient, the public may become skeptical of information provided by the project developer and/or associates.

The Psychometric Matrix

Singleton suggests a psychometric matrix (Figure 2) in which the extent to which a hazard is deemed "dreaded" is plotted against the extent to which the hazard is known (or unknown). Well-known and common risks, such as driving a car in rush hour or smoking cigarettes would be located in the low dread, highly familiar quadrant and not be perceived as overly risky.

[11] Adapted from: Bradbury, J., A., Branch, K.M., Malone, E.L., (2003). An Evaluation of DOE-EM Public_Participation Programs. Prepared for the U.S. Department of Energy under Contract DE-AC06-76RL01830. PNNL-14200.

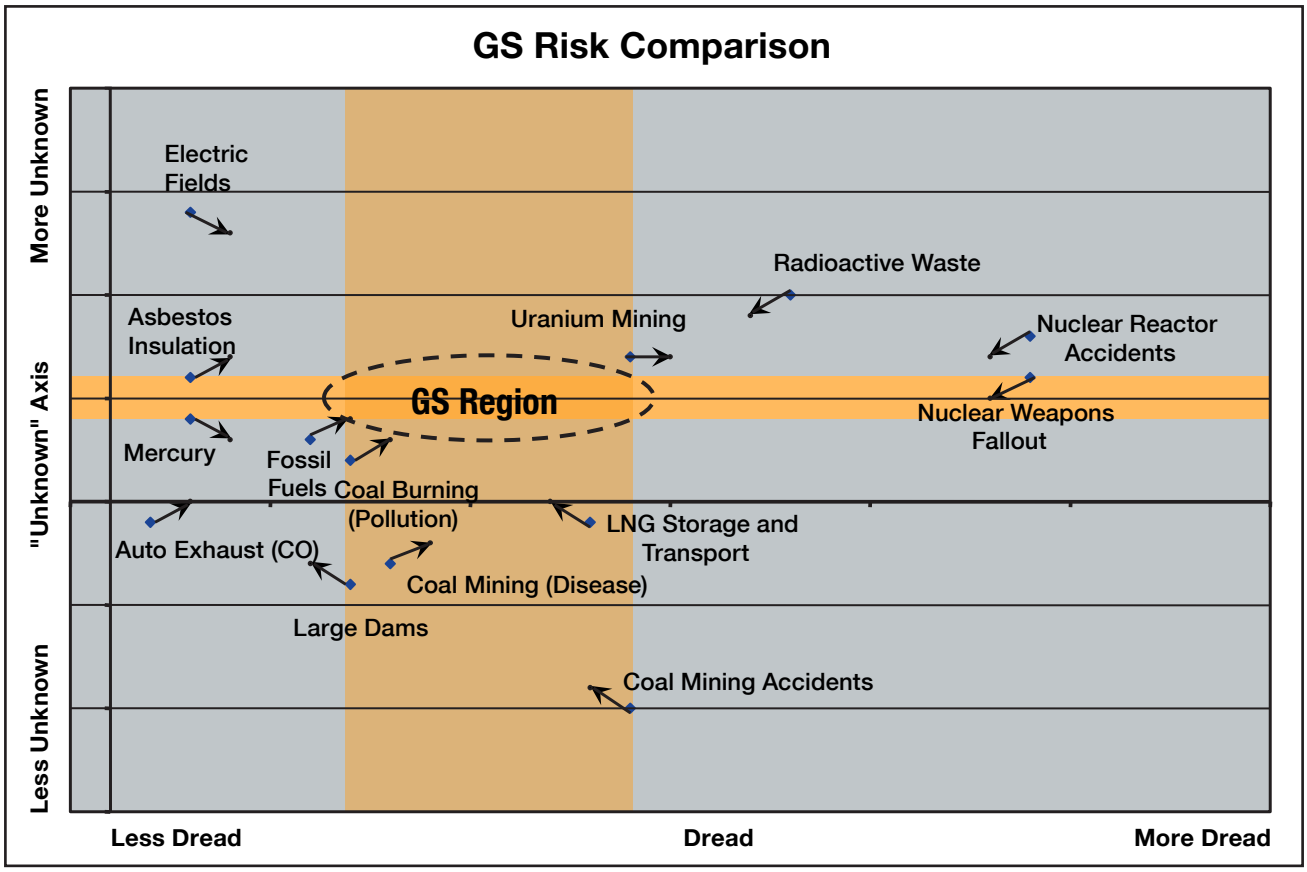

Figure 2 – *Psychometric Matrix*[12]

Once that matrix is populated with well-understood perceptions of risk, the likely relative risk of geologic storage (GS below) was estimated and is shown below as the "GS Region."

Technologies leading to high dread and less familiarity, for example, fear of radioactive waste, would be located in the high dread, highly unfamiliar quadrant and be perceived as very risky. Potentially, as CCS demonstration projects are successfully implemented, familiarity increases and dread decreases moving the perception of the riskiness of CCS closer to the view of energy technologies with similar technical risk profiles. For example, people may begin to see CCS as more like natural gas storage or power generation. Interestingly, this approach portrays a dynamic system of perceptions. In the image above, where there is an absence of major problems with nuclear reactors, the perception of nuclear energy appears to be moving towards less dread with increased familiarity. However, the recent tragedy in Japan has refocused attention on the potential impacts of nuclear materials and it is unclear how that would affect the trajectory shown above.

[12] Reproduced from Singleton, G. R. (2007). Geologic storage of carbon dioxide: Risk analysles and implications for public acceptance. Boston, M.I.T. Masters.

Perception of Scientific Information and Expertise

Although scientists may have a great deal of confidence in the application of existing technologies to CCS, and are trained to continue to conduct research and call for further study of potential impacts, this confidence may not be shared by the public.

Rather, social science suggests that in such situations, it may be likely that the public does not share, rely on, or trust the view of science or the scientists involved in CCS. The public is likely more influenced by peers or others who speak persuasively about the "science" of CCS, or more importantly about concerns about the science. (See Rowe) In early focus group work on CCS, participants indicated a lack of trust in government's ability to establish sufficiently protective regulations or to fully enforce them. Limited scientific literacy may also influence public perceptions. It has been suggested that there are four stages to learning science (See Mohan). The first level is an understanding of the fundamental differences between things based on observation, for example the difference between a glass of water and an ice cube. The second level involves a deeper understanding of these differences, for example, the understanding that ice is made of water. A third level brings understanding of processes, such as understanding that water transforms to ice when it is exposed to really cold temperature. And finally, the fourth level involves being able to make predictions about processes using scientific models and principles, for example, being able to predict whether precipitation will be in the form of rain, sleet, or snow. Most people do not pursue this higher level of understanding.

Perception of Climate Change

Social science literature suggests that the public's perception of climate change has an influence on their views of CCS. For those who believe climate change is a problem to be addressed, CCS is more likely to be viewed as a potential option for addressing it. With these audiences, climate change can be a useful context in which to communicate the role of CCS. For those who do not believe climate change is a problem, CCS may seem more like an unnecessary risk or an economic burden, although in some cases those who do not see climate change as a problem may still see benefits in from CCS related to more efficient and less emitting use of coal. Surveys show that there are diverse opinions about climate change. Several studies indicate that the perception that climate change is a problem is stronger in Europe and Japan than in the United States (U.S.) (See Johnson). A large national survey in the U.S. suggests a diverse segmentation with six unique profiles based on climate change views (See Leiserowitz) that are summarised as follows:

- The Alarmed are very concerned about climate change and taking action
- The Concerned are convinced but have not yet taken action
- The Cautious, Disengaged, and Doubtful represent the bulk of the population. They have different levels of knowledge and are not actively involved
- The Dismissive do not believe climate change is real and actively oppose action to limit emissions.

Perception of CCS

To many experts, CCS projects seem analogous with oil/gas production and natural gas storage than with disposal projects. All three (oil/gas, natural gas, and CCS) involve managing compounds in the pore space of deep geologic formations. Oil and gas production is an industry with more than a hundred years of experience that takes place in areas that tend to have long histories of involvement. Further, landowners and communities tend to reap some financial benefit from oil and gas production, and conversely, experience economic hardship when it declines. Natural gas storage provides an important function in ensuring adequate and economic supplies of fuel. There is perceived public value for this so public utilities are often involved in siting projects.

The social science literature suggests, however, there are also important analogies to disposal projects and that these are noted by the general public (See Palmgren). CCS projects differ from oil/gas and natural gas projects in scale and purpose. Although CO_2 storage can take place while it is being used to enhance the production of oil and gas in mature petroleum fields; the largest potential for storage is in saline formations where there may likely be little experience with subsurface operations, and few links to the local economy. Further, since the objective of CCS is permanent sequestration from the atmosphere, some, including the Natural Resources Defense Council (NRDC), have suggested that the term "storage" is a misnomer that should be replaced with "disposal."[13]

Although we successfully construct and operate facilities for the disposal of solid and liquid waste today, they tend to be smaller in scale than what is envisioned for large CCS projects, linked to pressing needs, and highly regulated (which implies that the risks and safeguards are well understood). Despite these factors, it is increasingly difficult to site waste disposal facilities because of public opposition.[14] Many involved in CCS observe that similar opposition may be one of the largest hurdles to CCS research, development, and deployment projects.

Based on the earlier discussion of how people perceive risk, science, and climate change, we can expect that large segments of the population are likely to look not at science, but at other influences to shape their opinions of CCS. This can take the form of being able to make comparative judgments among energy technologies based on cost, resource need, convenience and other attributes (See Fleischmann). Or it may take the form of considering issues of trust, empowerment, and process (See Bradbury). It is likely that reliance on these influences can lead to important misconceptions about CCS (See Wallquist).

[13] Hawkins, D., "Testimony of David G. Hawkins, Director of Climate Programs, Natural Resources Defense Council, before the Subcommittee on Energy and the Environment, Committee on Energy and Commerce, US House of Representatives," Hearing on "The American Clean Energy and Security Act of 2009," April 23, 2009.

[14] See for example: http://www.ceers.org/ijest/issues/full/v3/n4/304013.pdf and http://www.newsrecord.com/content/2011/01/31/article/northeast_residents_organise_landfill_opposition and http://www.timesdaily.com/article/20100224/ARTICLES/2245035?Title=Landfill-opposition-group-hires-expert

Conducting Social Site Characterisation

This section looks at three main tasks: stakeholder identification, mapping of stakeholder interests and concerns, and efforts to address those interests and concerns in CCS project design and implementation.

Identifying Stakeholders

A CCS project is going to be a local project carried out in the context of a national and even international debate. This means that the project may be likely to have a diverse group of stakeholders from local environs as well as national and even international arenas.

Social science literature suggests that it is important to identify and engage stakeholders as early as possible (See Bryson), (See Hund), (See Rich). This allows for meaningful engagement and permits the results to be fully leveraged for use in site selection. A traditional approach for defining stakeholders is to consider who has the interest and power to influence the project. Given that CCS is integrally related to climate change policy, though as yet still not well known, it may be difficult and inappropriate to use this traditional approach to defining stakeholders as many stakeholders interested in a CCS project may not realise their interest until well after a project has been proposed.

Project operators should identify stakeholders who are potentially impacted by or interested in the project because it is in or near their property or community. At the local level, this will include officials, regulators, landowners, citizens, civic groups (including environmental, business and religious groups), business leaders, media and other opinion leaders. In the case of FutureGen in Illinois, farmers were a key stakeholder group. Moving further away from the project boundary, others at the state level are likely to be very interested including elected and appointed officials (i.e., Members of Congress); regulatory agencies including those with oversight of pipelines, utilities, natural resources and environmental protection; economic development groups; and environmental and business groups (i.e., NGOs). Moving even further away, at the national level, stakeholders include: government agencies such as the US Environmental Protection Agency (EPA) and US Department of Energy (DOE); national environmental groups; potentially the financial community; and others. Figure 3 presents a graphic image of the types of stakeholders at various levels that a project developer may want to consider engaging.

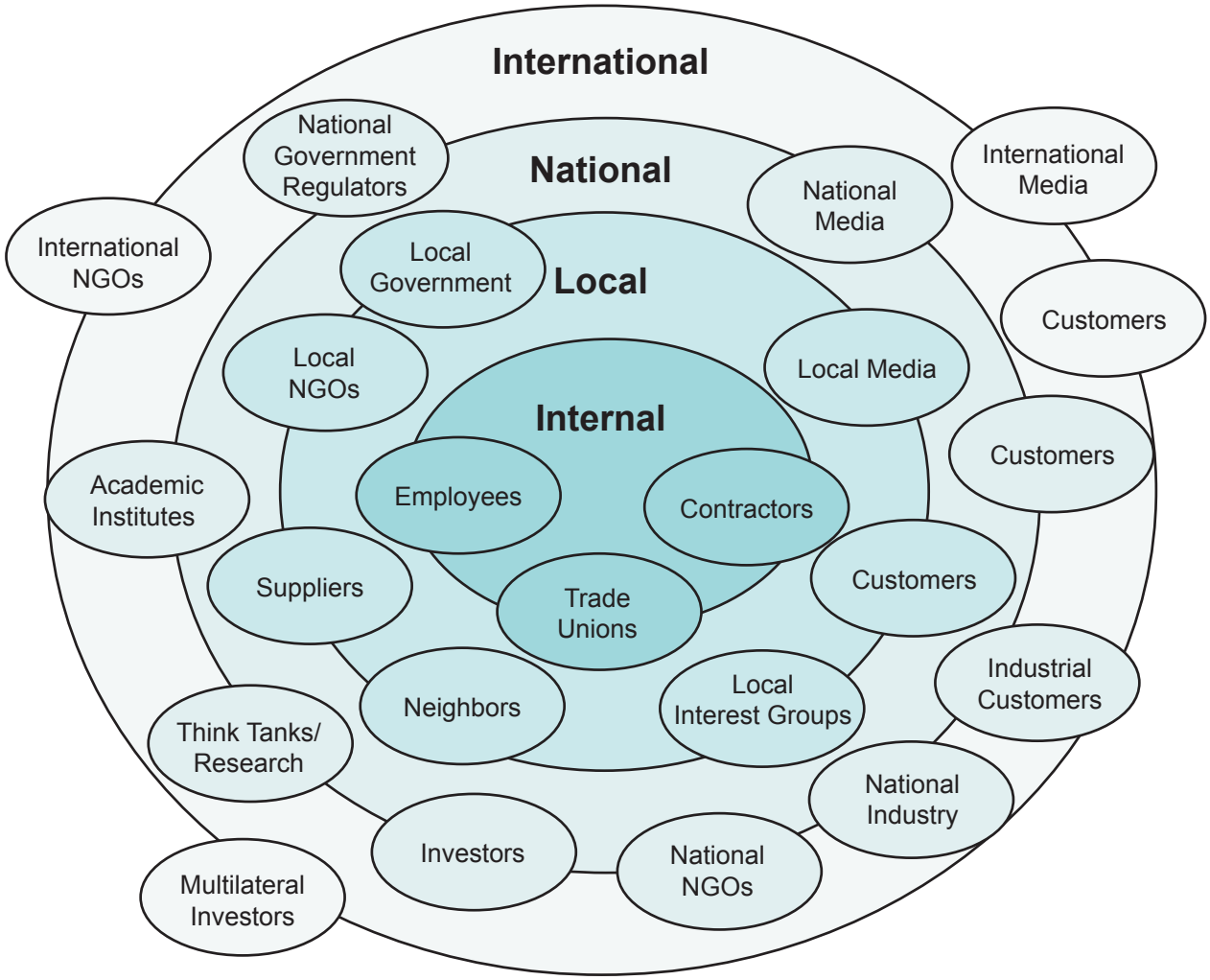

Figure 3 – *Types of Stakeholders*[15]

Operators can use an iterative approach including interviews and targeted research to assist in establishing this group. Once a preliminary list of stakeholders is identified, a useful step is to evaluate who or which segments are missing or not represented (See Bryson) and consider the importance of including them.

Stakeholder Mapping: What Do Stakeholders Think of CCS?

Stakeholders will have a variety of interests and concerns. It is useful to analyse these interests and concerns using a number of techniques that might be conducted within a project team, with both small and large groups of stakeholders (See Ashworth), (See Bryson), (See Palmgren).

[15] Adapted from: Hund, G., Engel-Cox, J., *et al.*, "Two Way Responsibility: The role of industry and its stakeholders in working towards sustainable development," Unfolding Stakeholder Thinking, Greenleaf Publishing, 2002.

Based on social science research, a number of areas have been identified that may be of interest and these should be explored with stakeholders. These include, but are not limited to:

- Local economic conditions: What are the major industries employing people in the community? Is the base more service oriented or more industrial? How is the economic health of the community and the region? What is the tax base? What are local energy costs?

- Local empowerment: How established/present are local property owners? Does the community feel that it has a voice in making decisions that impact the community? Are there cases of positive or negative examples of these? What is the community experience with industry or environmental concerns?

- Underlying views: What are the local views and experience related to climate change, coal-based energy, renewable energy, coal mining, drilling, oil production, natural gas storage, and emissions trading? Is there a local history of royalty payments for mineral or other property rights?

- Environment: Has a community experienced environmental damages in the past? How was it resolved?

As is the case with technical site characterisation, the process of gathering social data can be iterative. A first round of information to gather would be that which is readily available by reviewing websites, media, published surveys and opinion papers, and talking with stakeholders at all level (local, state and national) with whom the project team already has a relationship. Just as readily available information is used in technical site characterisation to develop a preliminary or regional reservoir model, so too can readily available social information provide the developer with a very preliminary understanding of regional or local concerns.

Subsequent rounds of information collection would involve more direct investigation. Important stakeholders – loosely defined as those who influence opinions or have the ability to "take the pulse" of public opinion – might be consulted through more detailed discussions or interviews. These kinds of discussions form the beginning of relationships that could impact the project as it moves forward. As a site becomes more likely to be selected for a project, the level of effort to gather information about stakeholder perceptions and concerns would ramp up. Several specific tools may help to identify particular concerns and potential mitigation options. These tools include focus group interviews (See Bradbury) (See Wong-Parodi); small, interactive project briefings; or structured discussions using frameworks such as the Princeton Wedge Game, energy portfolios (See Fleishman), or risk assessment frameworks. What each of these processes has in common is that they allow for open-ended conversation which can be very helpful in identifying factors that might not be obvious to someone from outside of the community.

These same kinds of tools can be used during project implementation to monitor changes in public perceptions over time. In addition, as the project progresses, other tools such as public opinion surveys may become useful as stakeholders gain experience with a project and the project team.

Data Interpretation and Use

In technical site characterisation, geologic data (i.e., seismic images, log graphs, and chemical results) are interpreted to determine how to design the components of a CCS project. Likewise, social data can be interpreted to determine how best to engage the public and to address public concerns in the design and implementation of a project. Key questions include:

- What are the information needs of various stakeholders?
- What are the important stakeholder perceptions and concerns in the project community?
- What are the best options for outreach and engagement, including stakeholders' preferences for engagement?

Information Needs

The social science literature provides two useful insights about information needs. When people are missing information or direct experience with a particular risk, they will seek information from sources around them (See Kasperson), particularly those source that share similar views are more likely to be trusted, and hence, are likely to support similar pre-existing opinions. However, where the risks for a particular activity or project are not well established through prior experience, some research indicates that people may look to peer or other trusted sources of information before turning to technical experts. (See Rowe)

Through stakeholder mapping efforts, the project team should have a sense of stakeholders' underlying technical understanding of CCS. Wallquist showed that there are frequent misconceptions about CCS that can contribute to an increased perception of risk. Some of the typical misconceptions relate to people's understanding of scale, pressure effects, and the nature of the storage space (many think storage takes place in large caverns that can burst rather than in microscopic pore spaces). It is important to evaluate misconceptions or gaps in knowledge in order to provide meaningful information (See Wallquist).

Concerns and Perceptions

It may be the case that primary stakeholder concerns are not as much about the technical risks of CCS but more about broader social factors, including the potential ancillary impacts or feeling of disempowerment (See Wong-Parodi) (See Bradbury). There are several approaches for engaging stakeholders in two-way communication that can be used to explore stakeholders underlying concerns. For example, focus groups and open-ended discussion can be useful in encouraging the stakeholder to use their own words to identify and describe their concerns. Such open ended discussion may reveal concerns that were not identified by the project team and can also give a sense of their level of importance. These kinds of activities need to take place over time and are most effective if the participants are able to achieve a level of mutual trust and candor.

Options for Outreach and Engagement

The literature cited in this paper provides guidance on designing and implementing communication and outreach programs (See Hebertson). The Communication Guide for Sustainable Development (See Hund) suggests a set of principles for engagement that includes: voluntary involvement, openness and trust, inclusiveness, common information and learning, and collaboration in decision-making. This caution is expanded in the Scientist's Guide to Talking with the Media (See Hayes). CCS project communicators need to consider the difference between technical accuracy and communicative accuracy which is measured by the extent to which the audience actually understands (and uses) the information.

CCS project teams need to exercise care to develop information materials that can be easily understood and provide enough background information to help stakeholders gain a meaningful understanding of CCS (See Mohan). Fleishman suggests an approach for placing CCS in the context of other energy technologies (See Fleishman). Ashworth suggests a similarly contextual approach involving large groups (See Ashworth).

There are a range of engagement activities that a CCS project can undertake to enhance collaboration with its host community (See Rich). This kind of effort starts with an exchange of information about the project including benefits and safeguards, but also a realistic assessment of potential risks and how they will be mitigated. Based on initial responses to this information exchange, a project may want to form a citizen advisory committee or some other approach for providing systemic information and obtaining informed feedback from interested stakeholders. As such groups proceed they may need access to additional technical information and may ask a project to address specific concerns in ways that are mutually agreeable.

Summary

CCS is an important option for addressing climate change. However, the technological potential of CCS may not be realised if efforts to deploy projects do not adequately address stakeholder interests and concerns. Social site characterisation is a tool that can help project developers to improve the processes for selecting and designing projects with stakeholder interests and concerns in mind and for developing communication processes that are compatible with community preferences. Practical experience suggests that this ability to work collaboratively with a community rather than in an adversarial fashion can help to reduce the cost and improve the quality of technology transfer projects.

Part 2 – Social Site Characterisation Toolkit

Introduction

The materials in this Part build on the Communication/Engagement Toolkit for CCS Projects[16] (Toolkit) developed by CSIRO. The main focus here is on the techniques used to identify stakeholders, to map their information needs and concerns, and to assess outreach strategies that are likely to facilitate productive engagement based on this information.

It is imperative to point out that even excellent outreach and communication cannot guarantee project success. Rather, it can contribute to project success by helping developers to accurately understand and address stakeholder concerns and by facilitating two-way communication between developers and stakeholders. The elements in this report are intended to provide prompts and aids for the operator to help improve their efforts. Throughout this section, company names and websites are provided to assist the reader. The authors do not necessarily endorse the use of these sites but present them for illustrative purposes and encourage readers to seek additional resources as more are developed.

Further, it is important to note that the operator will need to determine which techniques and tools make sense for the specific community in which they are operating. By implementing these tools the project team will both acquire information and also share it. The team should be mindful of this visibility as they do this work. For this reason, the process of social site characterisation is iterative. It may start with some preliminary information gathering that gradually moves into more visible information exchanges as it becomes clearer that a specific community is of interest for a project location.

[16] CSIRO, Energy Transformed Flagship, Communication/Engagement Toolkit for CCS Projects, EP105893, under grant from Global CCS Institute (2010)

Getting Started – Internal Assessment and Planning

One of the goals of social site characterisation is to help the project team develop an appreciation of the context in which they hope to operate. This includes an understanding of what is going on locally, how the project fits into this context, how the project (and the project team) will be perceived by its stakeholders, and how best to work collaboratively and communicate with them. An important factor in a project's ability to address these concerns is to have an internal group that consists of more than an outreach person, and that has responsibility for public outreach. The role of this group is also to ensure that public outreach is truly integrated into the overall project planning and management.

In order to make this assessment, it is suggested that the public outreach group consider doing a preliminary assessment of how the project fits into the overall context of the area in which it will be sited. This kind of assessment was done retrospectively in a case study comparison paper developed by CSIRO.[17] This paper served as background material for the development of the Toolkit. The research team who developed the case studies reviewed the results and developed a set of criteria that go beyond the merely technical to assess the extent to which the reviewed projects fit into their respective communities and integrated outreach into their overall strategies.

The evaluation uses a quick and somewhat subjective "traffic light" indicator to indicate the importance of the criterion and the extent to which is successfully addressed in each case. In this ranking, Green indicated that the criterion was addressed and/or had a positive impact on the project; Amber indicated that the criterion was not fully addressed and/or could have been important to the project; Red indicated that the criterion was not addressed or considered and/or likely had a negative, possibly a show-stopper, impact on the project; and, Blank indicates that either not enough information was available to assess the criterion or that is was not applicable in this case. Worksheet 1 presents a table where the full set of evaluation is contained. This worksheet can be used by the project team. Figure 4 shows the summary rankings for the five cases.

[17] Ashworth, P., Bradbury, J., Feenstra, C.F.J. (Ynke), Greenberg, S., Hund, G., Mikunda, T., and Wade, S. (2010a). Communication, project planning and management for carbon capture and storage projects: An international comparison. Prepared for Sarah Clarke, Global CCS Institute. CSIRO: EP104273.

Worksheet 1 – Evaluation Criteria

Context	Rank
National/State	
Are the priorities and values of all authorities related to the project aligned?	
Is there an appropriate regulatory system in place?	
Is there a process for gaining project approvals in place?	
Has the project identified and mitigated liability, or does it have a process to do so?	
Is there ENGO support for the project?	
Is there any open opposition to the project at the national or state level?	
Is there a history of industrial, environmental, or other problems on national level that might impact public perceptions of the project?	
Was public acceptability explicitly factored into the site selection process?	
Local	
Is the team sufficiently gathering and assessing information about community views, values, and perceptions?	
Does belief in climate change within the community impact their view of the project?	
Are local needs and trade-offs incorporated in the project?	
Communication	
General	
Has the team done a careful assessment of stakeholders and their concerns?	
Does the team prioritise stakeholders?	
Does the project have a robust communications plan?	
Is the team conducting early informal discussions with influential stakeholders?	
Is the team conducting early informal meetings with critical property and land owners?	
Informal	
Is the team developing early informal relationships with journalists?	
Is the team setting up grass roots level community groups?	
Is the team proactively utilising media releases?	
Is the team proactively seeking multi-stakeholder endorsement?	
Is the team proactively working with TV and radio interviews?	
Formal	
Will the project team proactively have flyers and fact sheets available?	
Will the project team proactively establish a website?	
Will the team proactively communicate through a shop front in the local	
Is the team prepared to evaluate their communication plan and make rapid adjustments as needed?	
Project Design	
Is the team consciously framing the project?	
Is this framing likely to positively influence its acceptance?	
Has the team conducted preliminary technical suitability studies of the storage?	
Can the team adequately monitor injected CO_2?	
Is the project team able to make adjustments in technical specifications and project implementation?	
Are local stakeholders and the community able to influence some project?	
Project Management	
Is the source of project funding likely to influence its acceptance?	
Is communications and outreach built in as an integral part of project?	
Will the project seek outside experts (independent or via a contracted reference group) to help them understand stakeholder concerns and work effectively with them?	
Has the team worked with local stakeholders at an early stage to identify concerns and potential benefits?	
Does the community have the ability to identify and work with a trusted expert to obtain their own information?	

Figure 4 – *Comparison Ranking*

As the project's outreach team is undertaking social site characterisation activities, they should be mindful of these criteria and use them periodically as a means for assessing the comprehensiveness of their planned outreach efforts and to identify potential gaps that should be addressed.

Stakeholder Identification

As will be discussed in this section, there are a number of tools and techniques that can be used to help in stakeholder identification. In order to take advantage of these, the operator needs to ensure that an appropriate internal team is assembled to conduct brainstorming and analysis, and that the overall process is comprehensive enough to identify the full range key stakeholder groups and individuals. The process of stakeholder identification will continue throughout the life of a project because new stakeholders will emerge as the both the project and external conditions change. The focus in this section is on the preliminary identification effort. The operator may want to repeat these steps as frequently as seems warranted based on the nature of the project, its reception in the community, and the potential influence of other events or factors on people's interest in the project. Table 3.1 highlights some tools currently used for stakeholder identification.

Key Points

- Define stakeholders broadly
- Key stakeholders will change over time
- The number of Key stakeholders will likely increase over time

Throughout the process of stakeholder identification, the project operator assesses the answers to the questions about who are the project stakeholders:

- Who believes that they are impacted by the project or presence of the project?
- Who may be impacted by the project or the presence of the project but does not yet realise it?
- Who is paying for or benefits from the project?
- Who are the resource providers for the project?
- Do individuals or groups have useful information about the project, for instance about historic land use or environmental impacts?
- Is the participation or support of someone or a group necessary or important to project success?
- Who else should be involved in the project?
- Who is missing from the list?

Table 3.1 Stakeholder Identification Tools and Techniques

Tools / Techniques	*Key Questions or Insights*
Social Data Collection*	- Who lives in the community? - What are the economic, education, and employment trends? - What does local news coverage indicate about views on climate change, energy policy, subsurface activity, environmental concerns, etc?
Baseline Survey*	- What are knowledge of and attitudes toward science and energy issues? - What are knowledge of and attitudes toward climate change and CCS? - What is the level of trust in government and host company(ies)?
Brainstorming	- Who are the project's stakeholders? - What is known about their perceptions and concerns?
Interviews & Focus Groups	- Who are the project stakeholders? - What is known about their perceptions and concerns? - What is their contact information?

* Indicates a tool that is already presented in the Toolkit

Social Data Collection

One of the first and least obtrusive ways to gain insights about a community is to look at background demographic information local economic and industrial trends, and insights from local media sources. The Toolkit contains a data sheet for gathering some of this information about a community and considering the potential benefits and impacts of a CCS project in light of the background data.

Information Sources

Demographic Data

These data can often be found online at the community, region, state, and/or federal or national level. The U.S. Census Bureau has a website that provides a link to the international statistical agencies of more than 150 nations:

http://www.census.gov/aboutus/stat_int.html; this site also includes a link to a site called "InfoNation" that enables the user to compare statistics from all Member Nations to the United Nations (see: http://cyberschoolbus.un.org/infonation3/menu/advanced.asp).

In addition to these national databases, many states and communities post their own statistical databases as sampled in Table 3.2.

Table 3.2 Demographic Information Sources

Level	***Locale***	***Website***
Region	France	CityPopulation – France http://www.citypopulation.de/France.html
State	Indiana, U.S.	Stats Indiana http://www.stats.indiana.edu/
City	Ottawa, Ontario, Canada	Ottawa Statistics http://www.ottawa.ca/city_services/statistics/index_en.shtml
Neighbourhood	United Kingdom	Office for National Statistics – Neighbourhood Statistics http://www.neighbourhood.statistics.gov.uk/dissemination/

In addition to these sites, several NGOs have developed indices that rate specific environmental and social issues such as poverty and air quality as indicated in Table 3.3.

Table 3.3 Other Community information Sources

Organisation	***Information Resource***	***Website***
World Resources Institute	Data Sets – Earth Trends; Climate Indicators	http://www.wri.org/publications/data-sets
American Lung Association	State of the Air – ranking worst air quality areas of the U.S.	http://www.lungusa.org/about-us/publications/
Worldwatch	State of the World	http://www.worldwatch.org/taxonomy/term/38

In this initial stage, demographic information is used to begin to understand the character of a community being considered for a project location. The Social Data worksheets in the Toolkit help the user to organise this information in ways that may help to point to potential local benefits or concerns that can be assessed through more in-depth outreach to the community.

Media Archive Review

Many communities have local media sources that preserve archives of local media coverage. These online databases can be helpful for developing deeper insights into the character of a community and potentially relevant events, conditions, environmental impacts, or other factors that could have an influence on public attitudes towards a project or the project developer.

It may be helpful to begin online searches by seeking sources that list major media sources. For example:

MondoTimes includes national and local media directories in eleven countries (Australia, Canada, China, France, Germany, India, Israel, Japan, Russia, U.K., USA) and additional links to locate "30,185 media outlets in 212 countries." (http://www.mondotimes.com/)

In the U.K., the website "MediaUK" provides links to nearly 5,000 online media sources. (http://www.mediauk.com/)

In the U.S., the website USNPL (US Newspaper List) offers links to media (including local TV and radio as well as print media) outlets and social media connections for newspapers throughout the U.S. and Canada. (http://www.usnpl.com/)

It is also worth noting that as a project progresses, it is useful to continue to follow these media sources. The project team can use private clipping services, subscribe to free services such as "Google Alerts," and/or subscribe directly to local media sources to help with this.

Social Media

Various forms of social media (e.g., Twitter, Facebook, Blogs) are increasingly relied on to share information and reactions to events. Some of these can be searched for links or information about a community being considered for a project location and can provide helpful background information about public concerns and views. For example, Google offers a tool to search blogs based on key words: http://blogsearch.google.com/.

Organising and Mapping Social Data

The Toolkit contains several worksheets in the Social Data section that will help the operator to organise and map the social data from a community and certain project characteristics. Using the tool, the operator can organise information under Demographics, Project Impact, and Local Attitudes. This step will help the operator to make sense of the collected information and develop insights regarding potential benefits, impacts, and concerns related to a proposed CCS project.

Baseline Survey

Project operators may want to consider conducting a baseline survey to assess knowledge, opinions and attitudes regarding the issues of climate change, CCS, other energy technologies and other factors in the local community. The results of such a survey could further aid in stakeholder identification. Results could also be used in the other steps of stakeholder mapping (by revealing factors that could have a bearing on stakeholder views towards a project) and assessing communication strategies (by revealing how stakeholders want to be informed and involved in a project). When conducted repeatedly over time, surveys can provide useful information about the course of a project. However, surveys are significant undertakings and should not be initiated without significant forethought. A project may decide to implement surveys after completing site selection rather than as part of the site selection process.

The Toolkit contains a series of questions (Who, What, Why, When, and How) to help the operator begin to think about the desired information, how it might be used, and the various methods for obtaining it. The Toolkit also contains a sample survey. Obtaining statistically relevant results may require responses from a relatively large number of people; when this is the case a firm specialising in survey work is contracted to obtain the results. Typically there are a number of survey options that may include online surveys, polling at locations with crowds (such as shopping malls), phone surveys, and written surveys. In addition, it is often possible to add a few questions to a general survey if there is enough overlap in sample populations, for example, Gallup[18] is one of many companies that conduct polls for clients around the world. There are a number of online resources available to people interested in learning more about surveys. These include "how-to guides" that can be found on online bookstores, and online survey sites such as surveymonkey.com, zoomerang.com, surveygizmo.com. These resources and sites may vary in quality and cost. The operator considering surveys is urged to do some research to determine their needs and how to best meet those needs.

The operator may want to develop and conduct a baseline survey after some initial research has been conducted in a community. Fleishmann *et al*. outlines a mental models approach to developing a tool for measuring public reactions to various energy technologies. This approach involved two stages, in the first, interviews were used to assess background levels of knowledge and to determine the words and imagery that average citizens used when discussing energy technologies. These mental models from the average citizen were then used to develop a tool that was used with a larger group of respondents. The value in this approach is that it can help in generating questions that are understandable by the general public and not overly technical. A similar approach was used in Canada to develop a national baseline survey.[19] A project operator could plan for a baseline survey but implement it after initial brainstorming work (described below) and any related interviews have been conducted.

[18] See: Gallup at http://www.gallup.com/corporate/115/About-Gallup.aspx

[19] Sharp, J. (2005). Public attitudes toward geological disposal of carbon dioxide in Canada. School of Resource and Environmental Management, Simon Fraser University. Master: 134.

Stakeholder Brainstorming

Brainstorming to identify stakeholder groups and individuals is done to achieve at least two objectives: (1) it helps to assure that the project has considered as comprehensive a group of stakeholders as it can, and (2) it helps to raise awareness among the project team members of the array of potential stakeholders with an important interest in the project. An operator is likely to repeat this kind of brainstorming process more than once during the course of the project, but the focus here is on a recommended set of brainstorming sessions to generate the initial list of stakeholders. Brainstorming can also be used to assist in stakeholder mapping and the two efforts may be combined.

Essentially, brainstorming is an exercise in which individuals or small groups of people are asked to develop ideas in response to a specific question or topic. In this case, the question is some formulation of 'who are the project's stakeholders'? Participants are asked to name stakeholder segments, groups, and/or individuals that they think will be a stakeholder for the project. There are a number of ways to stimulate creative thinking from participants:

- Secure the participation of a relatively diverse group of participants to avoid "group think"
- Have prompts or tools on hand to be used if needed
- Keep the tone of the session upbeat and encouraging
- Record all ideas in a visible place to help stimulate add-on thinking

A project operator will need to determine how much time and resource (in terms of participant's time) to put into this effort. The larger or more important the project, the more resources are warranted, especially at this early stage of project development.

A typical initial stakeholder brainstorming effort might involve at least two sessions:

- Convene a small working group (2-5 people) that includes the person responsible for public engagement and others representing specific project areas, this group should include member(s) who live and/or work in the community(ies) being considered as project locations. Members of this small group are likely to have other major areas of expertise and responsibility in a project, but their involvement in planning and overseeing public involvement is the perhaps the best way to ensure that it is integrated with other aspects of project management. Have the small group conduct a brief brainstorming session to generate information to prime a session in which a larger group of project team members participate. Either during this first session or in follow-up the small group should review the results and begin preliminary stakeholder mapping (as described below). In total, this might take about a day.

- Convene a larger group (5-10 people) of project team members, ensuring that some of the participants represent the highly technical aspects of the project and plan for a 2-3 hour session that includes stakeholder brainstorming and initial review and mapping (as described below).

Running a Stakeholder Brainstorming Session

- Find a comfortable room and obtain supplies such as white boards or flip charts (and pens) to record ideas. Bring supplies like pads and paper for participants.
- Set a clear agenda that specifies the amount of time that will be used in individual and/or group brainstorming and review of the results.
- Have individuals spend about 10 minutes brainstorming on their own before launching a group effort. The results can serve as the starting point for the group session and provide a vehicle for encouraging any quiet types to offer their ideas.
- Identify a facilitator whose job is to record ideas and keep the group upbeat, positive, and on track.
- To help keep the group focused, record ideas on a visible surface such as flip chart, white board, or LCD screen.
- Facilitate the flow of ideas by using a process to get everyone participating and then to allow the free flow of ideas. This could involve a quick round-robin which people state one idea from their individual session.
- As the flow of ideas slows, use prompts (see box below) to extract ideas.
- Stop when the group has exhausted ideas.

Keys To A Good Brainstorming Session

- Encourage all ideas
- Do not judge, criticise, or reject ideas
- Build off of or amplify the ideas from others
- Use prompts if idea generation stalls
- Seek input from all participants
- Go for speed

Brainstorming Prompts and Tools

Brainstorming is a free flow of ideas. Prompts and tools can be used to help this flow. It is useful to consider whether the types of people involved are visual or linear thinkers and whether they will be working individually or in groups. This section includes four prompts and tools that can be used as needed:

- Prompt 1: A list indicating general stakeholder types
- Prompt 2: An image indicating general stakeholder types
- Worksheet 2: A linear format for individual stakeholder brainstorming
- Worksheet 3: A cluster map format for individual stakeholder brainstorming

Stakeholder Type Prompts

Figure 5, is a detailed list of potential CCS stakeholders types. Figure 6, first appearing as Figure 3 in Part 1 of this document, is a visually oriented map of these potential CCS stakeholder types that is adapted from Hund, *et al.* It may be helpful to refer to either of these prompts during initial brainstorming or as a review once a first round has been conducted.

Typical Stakeholder group categories:

Government

- Policy makers
- Politicians
- Local officials
- Regulators
- Zoning / building code / construction approvals
- Solid waste management
- Emergency Response (police, fire)
- Public health officials

Neighbours

- Landowners
- People who live near site and might see or experience project activities (e.g. increased truck traffic)
- Access holders (for seismic data acquisition or project access)

Media

- Local
- National
- By type – print, radio, TV, web

NGOs

- Environmental groups
- Conservation groups
- Community interest groups / citizen groups
- Business groups
- Civic groups
- Student groups / youth groups

Education

- K-12 (grade school) teachers / professional development organisations
- Community colleges / universities
- Technical / vocational training

Land use / Agriculture

- Farmers / Farm bureau
- Mineral rights lease holders
- Support groups for local parks, historic districts

Business groups

- Chamber of commerce
- Community economic development groups
- Energy technology companies
- Unions

Other members of the local general public

- Indigenous groups / Tribes / First Nations
- Religious groups / churches
- Senior groups

Figure 5 *– Detailed List of Potential CCS Stakeholder Types*

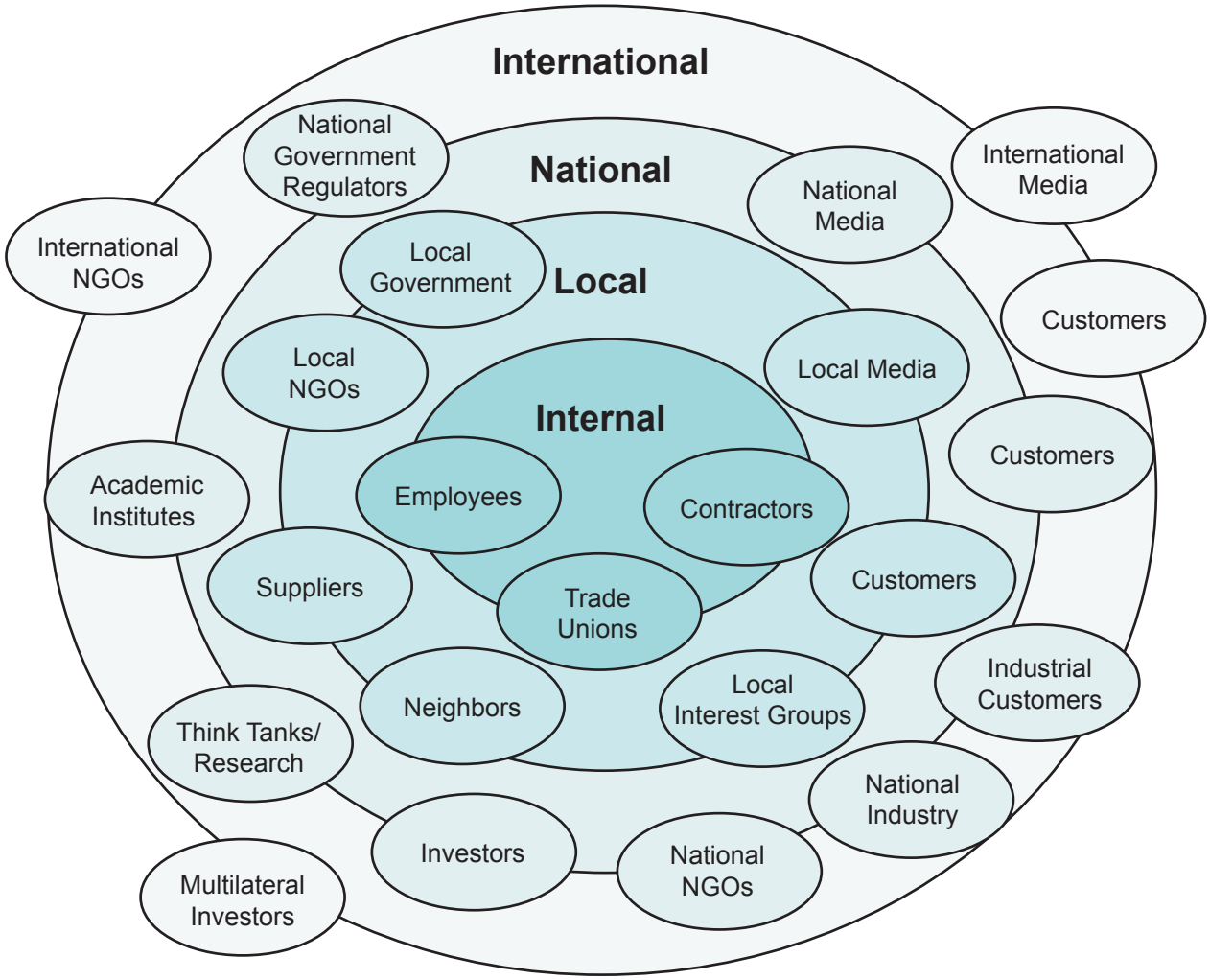

Figure 6 – *Map of Potential CCS Stakeholder Types*

Stakeholder List – Linear Format Tool

Some people are more linear in their thinking. These people may benefit by developing bulleted lists under stakeholder categories. Figure 7 shows a sample linear list of potential stakeholders. Worksheet 2 provides a model that may be used in a brainstorming session to generate a similar list.

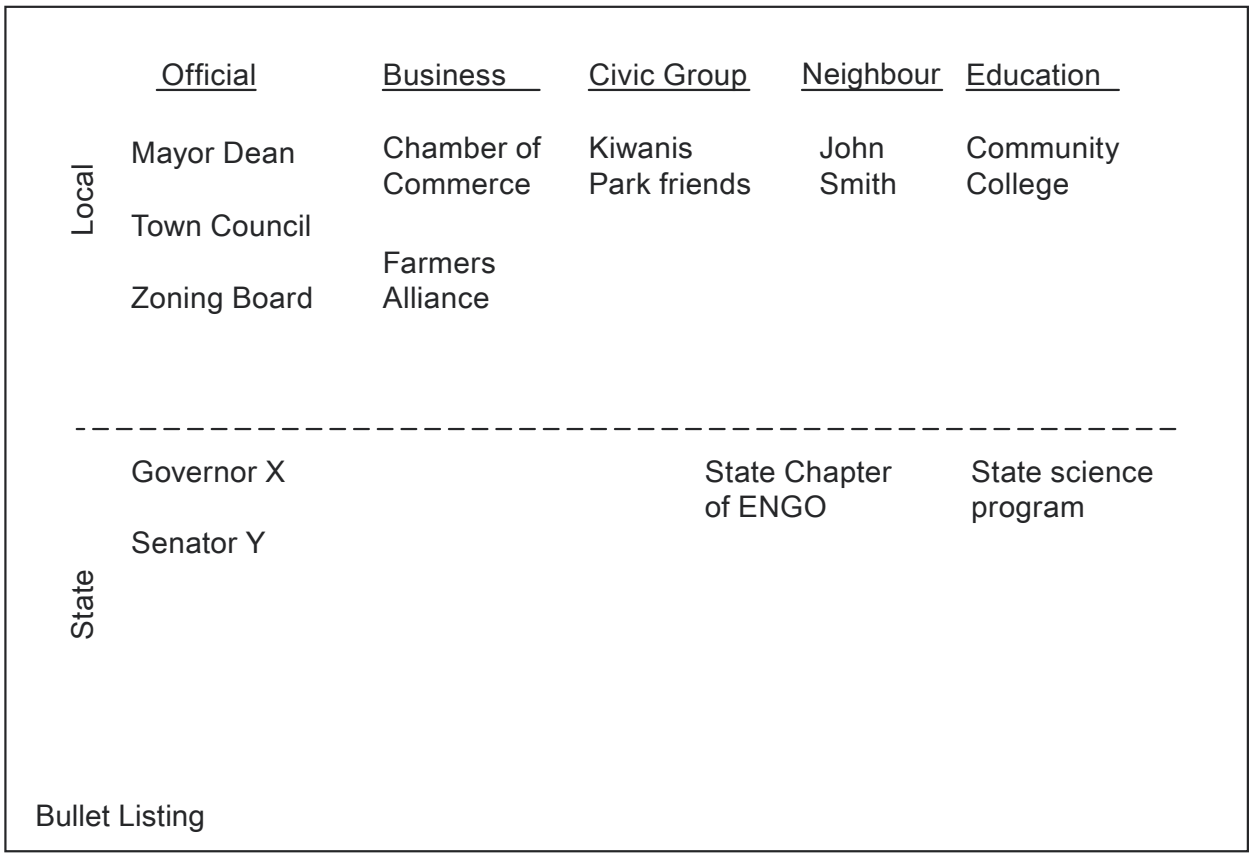

Figure 7 *– Sample of Linear List of Sample CCS Stakeholders*

Worksheet 2 – Linear Format for Stakeholder Brainstorming

	Government	Media	NGO	Neighbour	Education
Local	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
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	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
State	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
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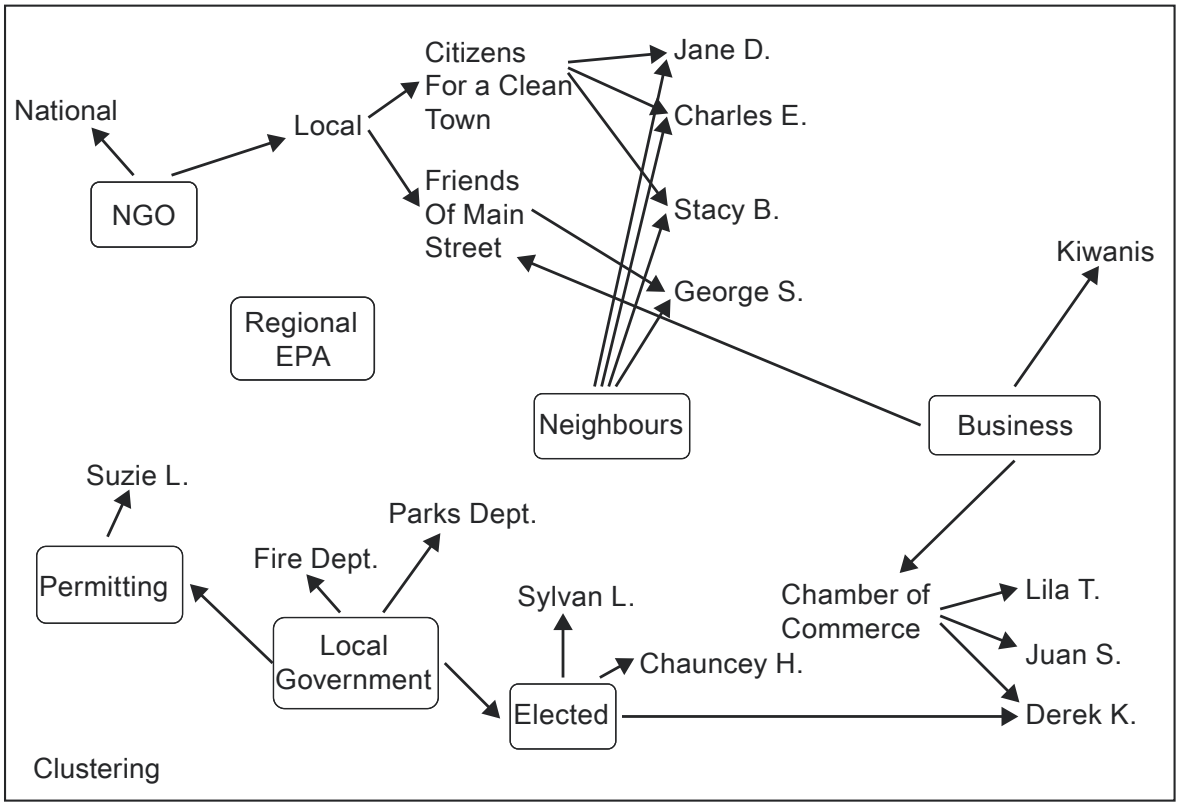
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
National	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-
	-	-	-	-	-

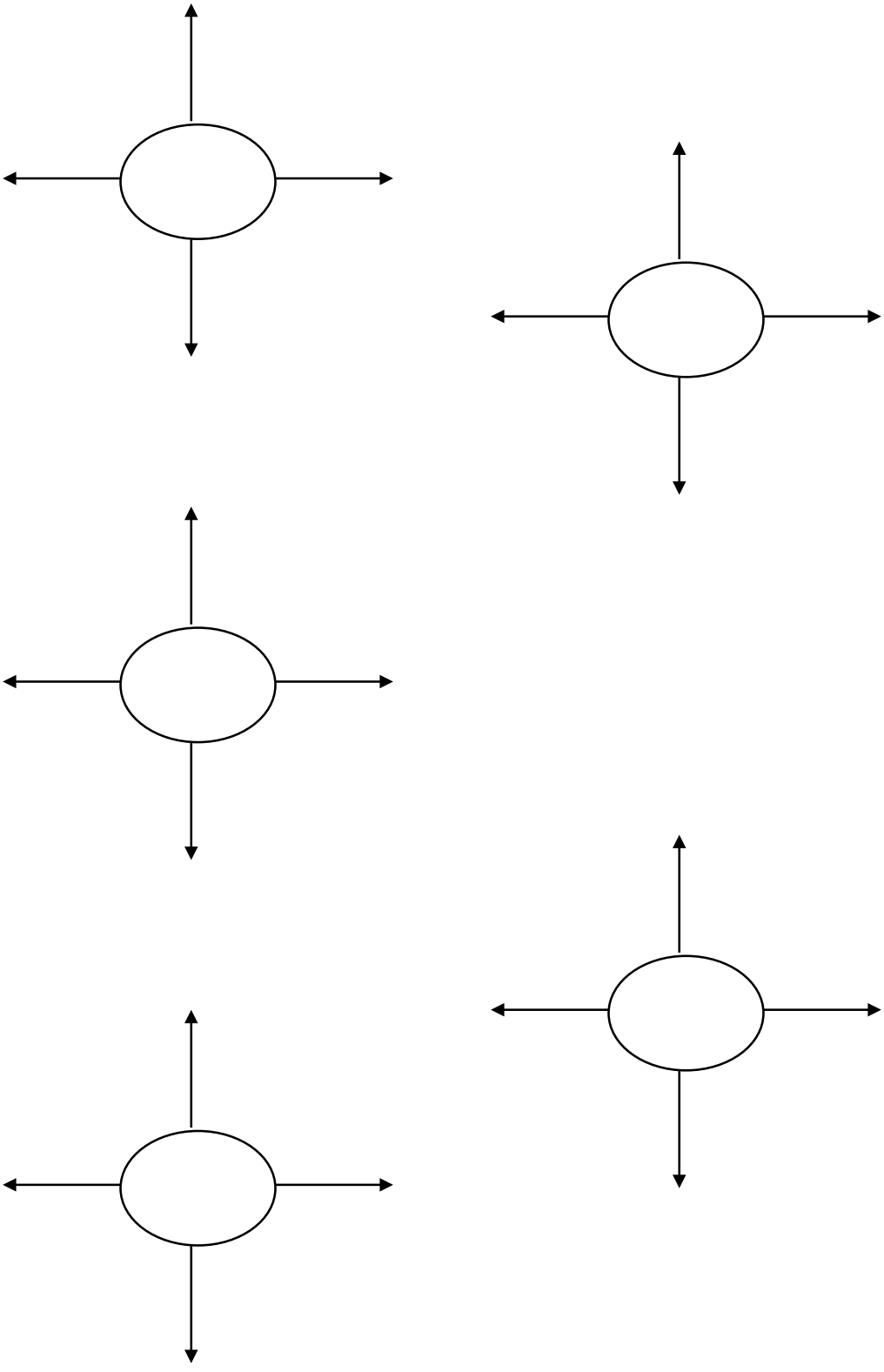
Stakeholder List – Cluster Map Tool

Some people are more visual and will gravitate to techniques that help them quickly create an array of thoughts such as cluster mapping. In this approach, the individual starts with a blank piece of paper and writes down their first idea in a region of the paper. Any related ideas are clustered or branched from that first idea. If a totally new idea strikes them, then they start in another region and exhaust the trains of thought stemming from that idea. These steps are repeated until exhausted. Figure 8 shows a sample stakeholder cluster map based on the list in Figure 6. Worksheet 3 provides a model that may be used in a brainstorming session.

Figure 8 *– Sample of Cluster Map of Sample CCS Stakeholders*



Worksheet 3 – Cluster Map Format for Stakeholder Brainstorming



For jump starting group discussion:

After individuals have spent time on their own to brainstorm ideas, it can be very helpful to work as a group to review the ideas and further refine them. The goal of working as a group is to challenge the members to ask the following questions:

- Who is missing from the list?
- Who else benefits from the project?
- Who else may be impacted by the project?

It may help to review a list of typical stakeholder categories to prompt any additional stakeholder identification.

Interviews and Focus Groups

Interviews and focus groups are common techniques in social science research. They involve an interviewer asking a series of planned questions to an individual or group of interviewees and then evaluating the results. These discussions can provide both qualitative and quantitative information at all stages of a project; however, because they involve interacting directly with stakeholders, they are also a form of outreach and have a bearing on how the project will be perceived by stakeholders. Therefore, as indicated in the Toolkit, it is very important for the project team to consider several questions when deciding whether to use and how to structure interviews or focus groups:

- What is the purpose of the information gathering activity? Interviews and focus groups can be used, among other purposes, to: identify other stakeholders; develop an understanding of a community's background familiarity with CCS, their initial perceptions of a project and the project operators; reveal initial concerns about CCS and potential perceived community benefits; involve stakeholders in project design and deployment as early as is feasible; and, to better align a project's design with community knowledge and values.

- Who is the target audience? Discussions can take place with groups that range in size from individuals to large groups. If the goal is preliminary information gathering, one-on-one and small group interviews are likely to be more appropriate because they provide the project team with information that can be used to improve interviews with larger groups. If the purpose of an interview shifts to testing messages and even presenting information, then larger groups may be useful. As the group size increases, one has to consider whether to do like peer groups (say a group of farmers) or to seek a more diverse mix of stakeholders.

- How will the discussions be conducted? Communication firms specialise in conducting some forms of interviews, such as focus group interviews, but the experience of being part of the interview can be invaluable to the project team. Decisions need to be made about how the interviews will be conducted including use of a moderator, choice of interview questions and materials, recording results, and analysis. Two common forms of interviews are one-on-one interviews in which only one or two interviewers meet with one or two interviewees and focus group interviews in which one or two interviewers moderate a discussion among a group ranging from small (3–6 people) to large (12–20 people).

Pros and Cons of Using Interviews and Focus Groups

In-depth discussions can be very useful tools that have the following benefits:

- Interviews and focus groups are in fact a form of outreach and can serve as the start of efforts to enhance or build relationships in a community.

- It may be less costly to do a few rounds of interviews or focus groups than to conduct some other form of social research such as using a survey.

- Combined, the responses from several interviews or focus groups can reveal a common language or conceptualisation of CCS. This, in turn, can inform the development of information materials that speak to the needs of the community.

- The interaction among participants in focus group interviews may yield deeper insights than can be obtained by one-on-one interviews because of the interaction among the participants and the free-flow of ideas.

It should be noted, however, that there are some concerns over the use of these tools:

- Despite significant efforts to overcome bias, the fact that interviews and focus groups will involve subjective decisions by the moderator mean that some bias is inherent in these tools. The moderator and the design of the questions are likely to have some influence over responses and that needs to be considered as part of the analysis.

- Group dynamics need to be considered. In some cases, participants may feel peer pressure to conform to "group think;" there is also a possibility that divergent views will be "averaged" resulting in a situation where important but relatively extreme opinions are not accurately weighted; and, there is some evidence suggesting that, in some cases, focus group participants have tried to please the moderator by saying what they think the moderator wants to hear.

- Interviews and focus groups also represent a snapshot in time, not necessarily a stable opinion. Social scientists sometimes refer to this as a pseudo opinion. Such opinions may accurately reflect what the participants feel at the time of the discussion, but those opinions may not be lasting.

- And, finally, even if the project team conducts a relatively large number of interviews or focus groups, they are still likely to only speak with a small percentage of project stakeholders. This small sample size may not be fully representative of community population.

Pointers on Conducting Interviews

All interviews share several steps:

- Recruiting participants
- Designing interview guides
- Conducting the interview
- Ensuring that you have an adequate response
- Concluding the interview
- Recording the data
- Analysing the data

Develop a Form for the Interview Guide

A blank protocol form can be filled out for each interviewee. It can be helpful in facilitating note-taking and guiding the interview. Typically the protocol includes the questions and instructions for each stage of an interview:

Preamble
- Identification data such as the interview date, location, name of interviewer and interviewee.
- Instructions including any opening statements to be shared with the interviewee (this might include a release form, the expected duration, the interview purpose, treatment of confidential information).

Questions
- Key questions
- Specific probes or areas of interest to pursue based on responses
- Transition messages or scripts to move through questions
- Space to record answers and notes

Closure
- Final comments/script
- Reminder to thank participants and guidance on follow-up.

Recruiting participants

Typically, a project that is considering locating in a community will have some initial contacts in that community. These contacts are good potential candidates for initial interviews that are focused on developing some understanding of the community and identifying other stakeholders. In many cases, the project team will already be familiar with these individuals and the process of setting up interviews may be very informal, for example a request to sit down over a cup of coffee. Even though these interviews may be informal, it is useful to begin to treat the information gained during the interview as "data" that should be recorded in a data base so that it can be included in subsequent analysis. Further, ensuring that even these informal interviews are treated with some level of formality will help to build project transparency. If the project team does not have a number of pre-existing contacts, it should begin by talking with the most obvious contacts in order to identify a first round of interviewees. A useful technique for identifying additional stakeholders is known as "snowballing," in which the first stakeholders interviewed are asked to identify a few additional stakeholders, the next round is also asked to identify additional stakeholders. After a few repetitions of this approach, the outreach team is likely to have identified a broad group of stakeholders that can provide a good feel for community reactions.

Once the round of interviews moves beyond this informal first round, it may be useful to adopt a more formal process for recruiting interviewees. This would include developing:

- A SHORT description of the project and the purpose of the interview, making sure that both DO NOT USE JARGON

- Making sure that you can clearly identify yourself and provide some contact information for the potential interviewee to verify your project affiliation

- Logistics for the interview including location, duration, the extent to which the information will be confidential.

Designing interview guides and questions

Since social science research in CCS is interested in the human response to this technology and to its deployment in a person's community, it is important that the interviewer has the flexibility to investigate those responses to reveal actual, underlying, and related perceptions and concerns. At the same time, the value of the research depends in part on the extent to which the revealed information is representative and relevant. One way to facilitate the achievement of both these aims is to use interview guides that provide latitude but also ensure that a full set of core questions will be asked in the interview.

An interview guide includes the questions that are to be asked of interviewees and guidance for the interviewer, sometimes referred to as a "probes." To the extent possible, questions should be open ended. The guidance for the interviewer is important because it will prompt them to follow-up on important ideas that may otherwise be overlooked. For example, if the response to a question about familiarity with the term CCS is "none," the interview may skip ahead to new topics; if the answer is "a lot," the interviewer may be instructed to proceed through a series of questions to probe the level of familiarity. The interview guide might also link to a set of presentation materials to be used during key points in the interview.

The project team should keep in mind the length of time it will take to go through all the questions they would like to ask. In general, people will expect brief interviews (20–30 minutes) unless they are explicitly asked to participate for a longer amount of time Some focus group interviews last as long as 2–3 hours. As interviews get longer, there is more of a risk that the interviewee will become bored or resentful of the impingement on their time.

Conducting the interview

The interviewer should prepare by gathering all the materials that they may need for the interview beforehand. This will include any information materials to be shared with the interviewee, note taking supplies, and recording devices. Depending on the nature of the interview, the interviewer may want to arrive early to set up the room.

As the interview gets started, the lead interviewer needs to create an atmosphere of open discussion. If the interview is a one-on-one, this could involve a brief conversation to have everyone present introduce themselves. If a larger group is present, this may involve some kind of

"ice breaker" exercise or discussion that helps people to get in the mode of talking and sharing information. This short period of time could also be useful in helping participants get comfortable with any recording devices if they are being used. The interviewer may want to practice their opening remarks as this will set the tone for the interview.

The interviewer should use the guide throughout the interview to help keep on track and to ensure that all of the questions or topics of interest are covered. That said, the interviewer needs to be well-versed enough on the issues being covered that they can adapt the discussion to pursue ideas raised by the interviewee and also avoid spending all of their time reading from the guide – it should be a touchstone that is referred to occasionally as needed.

Ensuring that you have an adequate response

Some interviewees will not be talkative and may offer only cursory responses. There are a number of probes or approaches that the interviewer can use in these cases to ensure that ideas are sufficiently expressed or explained during the interview. These include, among other conversational techniques, simply pausing to see if there is additional response; asking someone to add to, clarify, or further explain their response; and mirroring back information that was shared.

Recording the data

If left solely to their own note-taking, it is possible that interviewers will introduce their own bias in recording impressions from interviews. This can be overcome by using at least two interviewers in a session and/or by recording and transcribing interviews. If recording interviews, it is imperative to inform interviewees, to check the functioning of the equipment ahead of time, and to back up such recordings with notes. It is also important to note that many people will be uncomfortable having their interview recorded and it is appropriate to seek permission for recording during the recruiting process.[20] Once an interview is set up, the presence of the equipment itself could impact their responses. It may be helpful to use equipment that is as unobtrusive as possible and to plan on using the first few minutes of an interview to get the interviewees comfortable with any equipment being used.

Even if a recording is being made, note taking is useful because it helps the interviewee see that you value their opinion and can encourage conversation. It also serves as a back-up in case there are any problems with recording equipment. It is useful to establish some shorthand tricks before the interview takes place, for example the use of key initials for people, technologies, places, etc; the use of some notation for marking direct quotes versus a summary of what is being said; for noting your impressions or points related to probing the conversation; and, for noting the timing of key points so that you can have an easier time of finding those points in a transcript of the recording. Immediately after an interview is completed, it is useful for the interviewers to quickly review their notes and record any impressions that they may not have had time to record during the interview. Once even a night passes, memories of what was said may become less reliable. It may be useful to use a different colour pen for these after interview notes.

[20] Note – if the group conducting social site characterisation is associated with a university or other research institution, interviews and focus group procedures may need to be reviewed by the appropriate Institutional Review Boards (IRBs).

Concluding the interview

As the interview winds down, it is important to remember that the interview is as much about sharing information with the interviewee as it is about obtaining information from them. The way the interview is closed will have an impact on how the interviewee regards the project. Be polite; take a few minutes; thank the person for their time and thoughts. Explain what will happen with the results. Ask if there are any additional questions or information that the interviewee would like to ask. Ask for permission to follow-up. If questions are raised during the interview which the interviewer cannot answer but has promised to look into, be certain to follow through and return to the interviewee with an answer as soon as possible.

Analysing the data

Some of the information derived from interviews will be suitable for entry into a database, for example suggestions of additional stakeholders, specific references to concerns or requirements, or specific tasks for follow-up. Other information will be more subjective and will be analysed cumulatively over time. It may be useful to start this analysis by highlighting the areas of consensus and differences that emerge from a review of all the responses. Further, as stakeholders or stakeholder groups are identified, the project team may want to use data sheets to begin organising what is discovered about knowledge of, perceptions, and attitudes towards the project and project operators. Worksheet 2 in the Toolkit provides one tool for organising this information; additional tools will be discussed in the section on Stakeholder Mapping below.

Other Ways to Obtain Contact Information

The team may also obtain contact information through other means:

- Provide an opportunity for stakeholders to self-select by signing up for a mailing or other distribution list. Make sure that people include contact information and if possible an affiliation.

- Use online searches to complete searches. For example, one could search a town name "AND" environmental groups to obtain a listing of environmental groups that are affiliated in some way with a specific community. This list would have to be further refined to be of use in a project but may yield suggestions that have not otherwise come up.

- Local phone books often include municipal offices and groups that may not have been identified through other processes. These can often be found in a local library.

Stakeholder Mapping

Stakeholder mapping provides a mechanism for organising stakeholders and their concerns in different ways to better understand priorities and information gaps. This information can be used to help design initial public engagement activities. Three maps in particular will be discussed:

- Stakeholder Information Sheets
- Stakeholder Influence and Interest Maps*
- Issue Framing Stakeholder Maps

* Note – this tool is included in the Toolkit so will only be discussed briefly here

Stakeholder Information Sheets

Stakeholder information sheets provide a way to assess the project team's general understanding of stakeholder views. Figure 9 provides an example of a completed sheet and a blank is included in Worksheet 4. This information can be developed for individual stakeholders or stakeholder groups. The spaces at the top of the sheet allow for some contextual information: the identification of the stakeholder or stakeholder group, a description of how the information was gathered, and brief notes that are not captured in the issues list. Down below, the specific perceptions, concerns, and attitudes towards CCS and/or the project developer can be recorded. There is room in the Favourability Rating column on the left to record a preliminary assessment of the extent to which the identified issues are likely to be viewed as a benefit or a negative. There is room in the Influence Rating column on the right to indicate the perceived level of importance of each factor.

Stakeholder Information Sheet

Revision Date:	Mar-11
Stakeholder Name:	John Smith
Stakeholder Affiliation:	Citizens for Clean Energy
Summary of contact / information source:	Personal Interview; confirmed with meeting with town council member
Notes:	Local group actively opposes coal mining; works with national grass roots groups to challenge new coal plants
	Smith is an engineer who used to head local zoning board

Favourability	Perceptions, Concerns, Attitudes	Influence
	May help to address climate change	
	Will prolong use of coal	
	May add local jobs	
	May discourage use of new renewables	
	Not safe	
Negative	Red:	High
Unclear	Amber:	Unclear
Positive	Green:	Low
Unknown	Blank:	Unknown

Figure 9 *– Sample Stakeholder Information Sheet (Note names and issues are fictitious)*

Worksheet 4 – Stakeholder Information Sheet

Stakeholder Information Sheet

Revision Date:
Stakeholder Name:
Stakeholder Affiliation:
Summary of contact
/ information source:
Notes:

Favourability	Perceptions, Concerns, Attitudes	Influence
Negative	Red:	High
Unclear	Amber:	Unclear
Positive	Green:	Low
Unknown	Blank:	Unknown

Stakeholder Influence and Interest Maps

The section on identifying stakeholders in the Toolkit contains a stakeholder mapping tool that the project team can use to map stakeholder or stakeholder group power to influence the decisions affecting a CCS project against their interest or stake in the outcome of those decisions. This approach to stakeholder mapping can be completed using brainstorming techniques as discussed above. It is suggested that a small group within the project team use the stakeholder information sheets to generate a master list of known stakeholders. The name of each stakeholder or stakeholder group would be written on a post-it note or a small slip of paper. The stakeholders would be placed on a larger piece of paper (or a flip chart) based on group discussion. The benefit of placing names on separate paper is that they can be moved around more easily. The names could also be written directly on a chart. After the group has assembled a map, it should review the results in their entirety to confirm the results.

Two key groups of stakeholders may be identified through this kind of approach – (1) those who have a large interest or stake in the project and have significant influence over the decisions that may be made, and (2) those who have a large interest but have little influence of those decisions. The project team will likely have to address the concerns of the first group and they may gain significant but indirect acceptance by addressing the concerns of the second group. This approach also helps to identify those stakeholders who are unlikely to be interested in the project. Efforts to engage these stakeholders may not be effective.

Issue Framing Stakeholder Maps

Another dimension to be mapped is issue driven but connected to stakeholder interest and influence. In this approach, the small project group would first generate a master list of concerns, perceptions, and attitudes and allow a place to indicate stakeholders that share those views (See Figure 7).

Issue	Stakeholders	Sim?
Concern about property values	Vacation home owner, Angry landowner Dr. Rose, Assemblyman Smith, Appleview Farms	N
Jobs creation	Local union, Mayor, Economic development authority, Plumber Julie Smith	N
Climate change benefits	Local conservation group	Y
Groundwater safety	Town health department, Mayor, Dr. Rose	Y

Figure 10 *– Generic Sample of Issue / Stakeholder Chart (Note names and issues are fictitious)*

The group would evaluate all of the issues for which the level of influence differs among the group of stakeholders who hold the view in question. A slip of paper would be generated for each major issue/ stakeholder bloc and they would be mapped on a grid in which the level favourability of the perception, concern or attitude would be mapped against the level of influence of the stakeholders who hold those views (See Figure 11). This kind of a map, in combination with the Influence / Interest map will be helpful in setting priorities for communication and engagement programs. Those issues that garner support from key groups need to be highlighted and those issues that are likely to raise concerns of influential groups needs to be addressed.

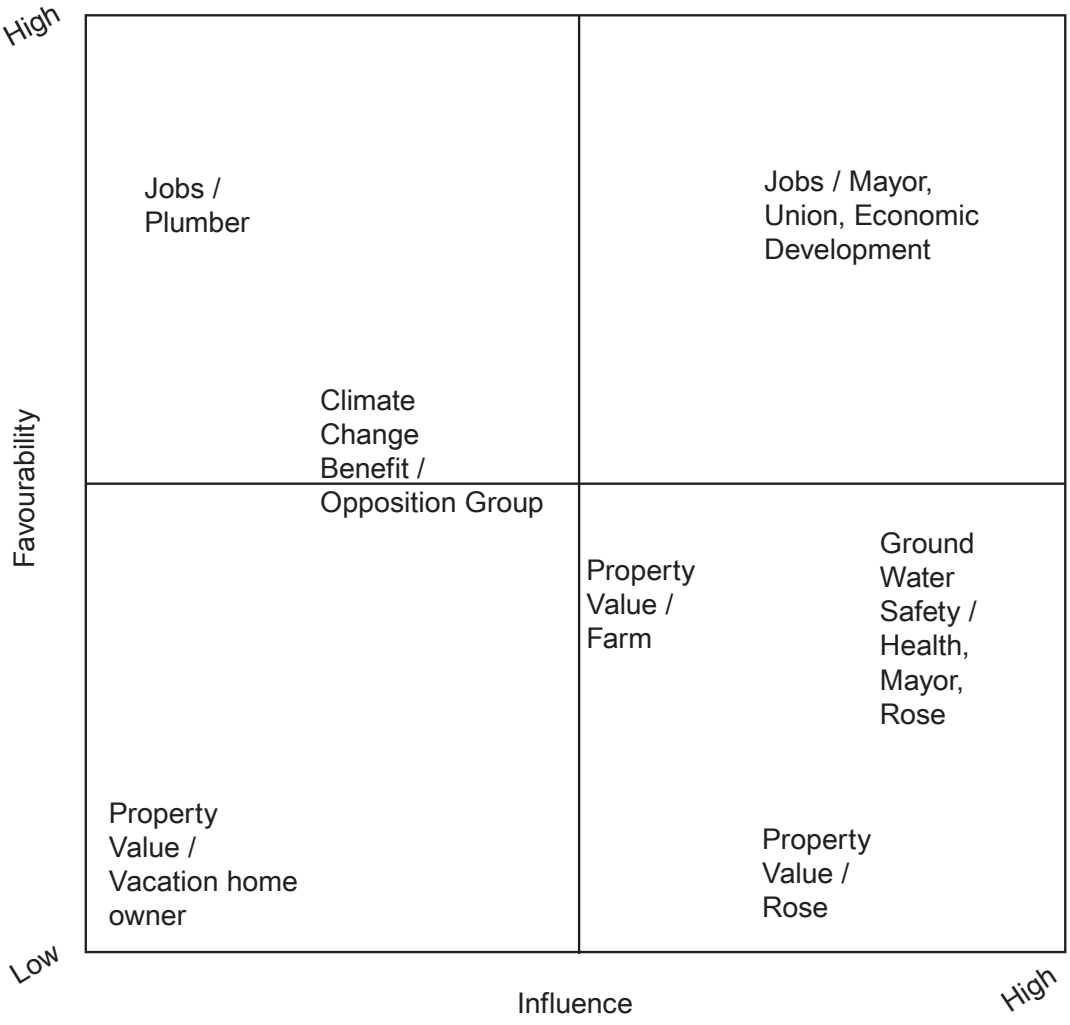
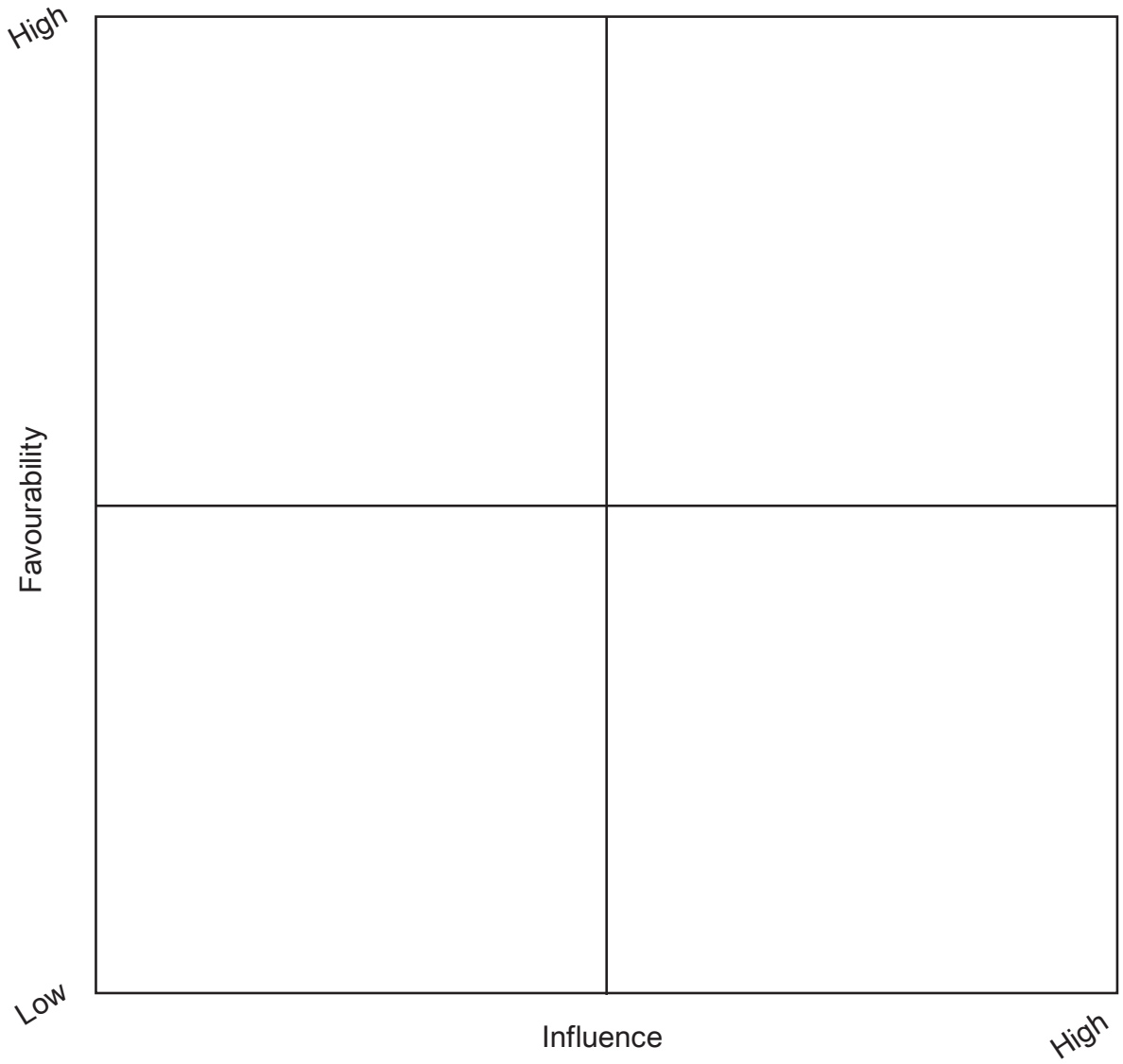


Figure 11 *– Sample Issue Framing Stakeholder Map (Note names and issues are fictitious)*

Worksheet 5 – Issues and Stakeholders Chart

Issue	Stakeholders	Similarities

Worksheet 6 – Issues Framing Stakeholders Map



Assessing Communication, Outreach and Engagement Strategies

Once the project team has completed a detailed round of stakeholder identification and mapping efforts, it needs to review the gathered to information to assess:

- The information needs of various stakeholders
- Important stakeholder perceptions and concerns
- Options for outreach and engagement including stakeholders' preferences for engagement in the process

Assessing Information Needs

The information gathered to this point should reveal the extent to which various stakeholders understand CCS technology in general and the specific details of the project. Or more importantly, this review should indicate key areas where stakeholders may not fully understand how the technology works. For example, some survey work has shown some common information gaps including understanding how CO_2 is stored in pore spaces within in a rock and how pressurised fluids can be contained in the subsurface. These kinds of knowledge gaps may be indicated by a conceptualisation of CO_2 storage taking place in large underground chambers or concerns about rapid release of large volumes of CO_2.

Once the team has identified potential information or knowledge gaps, it should consider using focus groups or additional interviews to further explore these specific knowledge gaps. These interviews could be used to test information materials to determine their usefulness and accessibility. Interviewees could be asked for feedback to help improve these materials for use in the local community.

Assessing Concerns and Perceptions

Some perceptions and concerns about CCS are not going to be directly related to information gaps but rather to emotional reactions to the information that has been presented and the personal experience of the stakeholder. Some of these perceptions will be positive and others will be negative, some may not seem to be related to CCS, and still others may not seem to be technically feasible. All of these reactions will contribute towards stakeholder support. There are a number of devices that can be used to engage stakeholders in two-way communication that can be used to explore these underlying concerns and perceptions:

- Interviews, as have already been discussed in detail, are a useful tool.

- Tools that help stakeholders to understand CCS in the large context of energy and/or climate policy may be helpful in revealing underlying perceptions. This kind of approach was used by Fleishmann *et al*[21] to assess stakeholder views on the tradeoffs among different energy technologies. A similar tool is the Stabilisation Wedges game developed by Princeton University.[22] In this game, individuals or teams select a set of energy technologies that has the capacity to generate enough electricity to meet projected global needs fifty years in the future while reducing greenhouse gas emissions by 7 billion tons per year by the same point in time. When working in teams, the groups have to agree on a preferred portfolio and the discussion leading up to these agreements often indicates values and other contributing factors to public perception.

- One of the US DOE regional carbon sequestration partnerships undertook a project risk assessment exercise involving stakeholders.[23] Although the purpose of the exercise was to assess and mitigate project risks, the exercise also led to increased awareness of stakeholder perspectives on the project. In this effort, the project team used a set of potential project risks identified by the IEA. Participants broke into groups and were asked to rank the risks in terms of potential likelihood and severity. Again, the process of reaching consensus within each group led to revealing discussions about perceptions and background experiences.

Assessing Options for Outreach and Engagement

The Toolkit provides several tools for planning and implementing outreach programs. It is important that the results of social site characterisation are integrated into project design from the outset of the project. As the communication team from the project gains information about and insight into the community, that information needs to be shared with the rest of the project team so that it can be sufficiently addressed and/or incorporated.

If the project team has not yet undertaken an internal evaluation as suggested in Work Sheet 1 (See Figure 3) it may want to conduct this evaluation before getting too far into project outreach planning. In particular, areas that are red flagged or that remain blank suggest areas where the team may need to do some additional preparation work.

There are several ways in which many of these perceptions and concerns might be addressed:

- Some feedback will present opportunities for modifying project design to alleviate specific concerns – or to take advantage of new information. It is important that the project team understand where it has the flexibility to make modifications and where it does not. With these parameters in mind, the team might want to create a citizen panel or undertake a series of workshops to more formally discuss these options and ways to incorporate them

[21] Fleishman, L., Bruine de Druin, W., Morgan, M.G., (2010). Informed Public Preferences for Electricity Portfolios with CCS and Other Low-Carbon Technologies. Society for Risk Analysis, DOI:10.1111/j.1539-6924.2010.01436.x

[22] Carbon Mitigation Initiative, Princeton University, Stabilisation Wedges, found online at http://cmi.princeton.edu/wedges/

[23] Hnottavange-Telleen, K., Krapac, I., and Vivalda, C., Illinois Basin – Decatur Project: initial risk-assessment results and framework for evaluating site performance, GHGT-9, El Sevier, (2008).

in the project. The Toolkit provides guidance on forming a steering group or creating a community liaison position. It is important to note that such advisory groups have been successfully used in other projects, but they need to be formulated with care and have transparent missions.

- The team can develop information materials that are geared towards addressing concerns that have been raised in interviews, specifically speak to local issues, and/or are fashioned to be more user-friendly in the community. For example, there are several hands-on demonstration materials that have been used to physically illustrate the concepts of CO_2 storage. These include a physical model of storage in saline formations and oil fields, rock samples used to demonstrate porosity and permeability, experiments using dry ice to show the properties of CO_2, children's books, multi-disciplinary curricula, brochures that accurately demonstrate the project scale (including deep wells), and other visual materials.

- If there are issues of trust, it may make sense to partner with local universities or environmental groups to convene briefing meetings or workshops involving trusted sources of information.

- Projects can create technical advisory or review groups that consist of technical experts. These panels can serve a number of functions. In the early stages of a project they can be used as an informal sounding board. As a project progresses, these panels can mature into a useful conduit for the project and community to share information. These panels can also be invited to review project design and information at key stages of a project. All of these roles can help the project gain broader perspective.

During this process, it may be invaluable to engage some stakeholders in the actual planning process. As indicated above, outreach efforts are much more likely to be effective when they are aligned with stakeholder's preferences for involvement.

As the team decides on engagement strategies for identified stakeholders and stakeholder groups, they should formulate these items into an overall communication and engagement plan. Developing such a plan allows the project team to more easily ensure that it is implementing the full plan, helps it keep track of the various elements planned for different stakeholder groups, and also helps to coordinate the whole project team. The Toolkit provides a sample communication plan and describes numerous outreach elements that might be included in the plan.

Appendix I – Annotated Bibliography

The following literature is presented in annotated form:

Author	Title
Ashworth, P., *et al.*	Engaging the public on carbon dioxide capture and storage: Does a large group process work?
Bradbury, J., *et al.*	Role of Social factors in shaping public perceptions of CCS: Results of multi-state focus group interviews in the U.S.
Bryson, J.	What To Do When Stakeholders Matter: Stakeholder Identification and Analysis Techniques
Fischhoff, B.	Risk Perception and Communication Unplugged: Twenty Years of Process
Fleishman, L. , *et al.*	Informed Public Preferences for Electricity Portfolios with CCS and Other Low-Carbon Technologies
Hayes, R., *et al.*	A scientist's guide to talking with the media: Practical advice from the Union of Concerned Scientists
Heddle, G. A.	Sociopolitical challenges to the siting of facilities with perceived environmental risks.
Herbertson	Breaking Ground: Engaging Communities in Extractive and Infrastructure Projects.
Hund, G., *et al.*	A communication guide for sustainable development: How interested parties become partners.
Johnsson, F., *et al.*	Stakeholder Attitudes on Carbon Capture and Storage – An International Comparison
Kasperson, R., E., *et al.*	The Social Amplification of Risk: A Conceptual Framework
Leiserowitz, *et al.*	Global Warming's Six Americas: An Audience Segmentation Analysis
Mohan, L., *et al.*	Developing a multi-year learning progression for carbon cycling in socio-ecological systems
Palmgren, C., *et al.*	Initial Public Perceptions Of Deep Geological And Oceanic Disposal Of Carbon Dioxide
Rich, R.C., *et al.*	Citizen participation and empowerment: The case of local environmental hazards.
Rowe, G., *et al.*	Differences in Expert and Lay Judgments of Risk: Myth or Reality?
Singleton, G., *et al.*	Public Risk Perspectives on the Geologic Storage of Carbon Dioxide
ter Mors, E.	Dealing with information about complex issues
Wallquist, L., *et al.*	Impact of knowledge and misconceptions on benefit and risk perceptions of CCS
Wong-Parodi, G. & Ray, I.	Community perceptions of carbon sequestration: Insights from California

Ashworth, P., Carr-Cornish, S., Boughen, N., and Thambimuthu, K. (2009). Engaging the public on carbon dioxide capture and storage: Does a large group process work? *Proceedings of the 9th International Conference on Greenhouse Gas Control Technologies*. Washington DC, Elsevier. doi:10.1016/j.egypro.2009.02.302

Summary:

The authors used a large group process to engage the public on low-emission energy sources and technologies. The authors found that the process was useful in exploring Australian society's acceptance of energy technologies. The large group process allowed participants to gain new knowledge and was determined to be successful in changing attitudes towards low emission energy technologies. The large group process proved to be a successful method for accessing and informing larger numbers of stakeholders.

Main Points:

This research demonstrates the carefully designed large group process used in this research, can be effective in informing individuals' knowledge and attitudes towards low emission technologies. However, the effectiveness in bringing about changes in attitudes will be influenced by an individual's strength of existing attitudes about the technology and whether they are exposed to information that will create dissonance with their current attitudes.

Important features to provide the opportunity for dissonance include the quality and objectiveness of the information, the use of a trusted and knowledgeable expert as the messenger, use of facilitators to build the group identity and keep the discussion focused, and ensuring adequate time for discussion and deliberation.

As expected it appears that most individuals have low levels of knowledge about technologies that are not currently deployed in their communities.

The richness of the information gained from this deliberative process is extremely valuable to policy makers and research developers and gives credibility to the research for participants. The researchers found participants had a keen interest in participating in the research knowing their messages would be delivered to the highest levels of government within Australia. Within these workshops recurring themes included the need for an identified path of action, strong leadership from government and the need for education and information on the range of low emission technologies available.

Given that CCS is a relatively unknown technology with perceived risks, it provided an opportunity to test the effects of information provision on the way the technology is perceived. The process indicated that participants were able to take in and process information about CCS and place it in the context of other technologies.

The large group process trialed in this research offers one possible method that can access larger numbers of stakeholders in a non-resource intensive way and that still provide rich insights into the societal acceptance of the technologies being proposed.

Bradbury, J., Ray, I., Peterson, T., Wade, S., Wong-Parodi, G., and Feldpausch, A. (2009). Role of Social factors in shaping public perceptions of CCS: Results of multi-state focus group interviews in the U.S. *Proceedings of the 9th International Conference on Greenhouse Gas Control Technologies*. Washington DC, Elsevier. doi:10.1016/j.egypro.2009.02.289

Sumary:

This paper analysed community perspectives on CCS through focus group and individual interviews in five communities. These perspectives were analysed in the context of each community's history and its social and economic characteristics. The results were considered for their insights into specific concerns within each region, as well as to assess inter-region commonalities.

Main Points:

The authors found that across the groups, factors such as past experience with government, existing low socioeconomic status, desire for compensation, and/or perceived benefit to the community were of greater concern than the concern about the risks of the technology itself.

This finding underscores the importance of considering social factors in planning and implementing CCS projects. Resolution of safety issues such as those related to potential leakage, seismicity, and long-term containment are, and will continue to be, essential to successful deployment of the technology. But, as highlighted by the focus groups and interviews, management of these safety risks is the critical factor for public acceptance.

- Based on these data, key management questions for the public are: How can we have a say in what happens? Who is in charge? Will the process be fair and will anyone listen to us?
- What will happen if something goes wrong? Can we trust the project developers and the government to take care of any problems
- What have our previous relationships with these entities shown us?
- What is the benefit to our community? How does the proposed project fit into or improve our way of life?

Project developers should consider a greater emphasis on upfront social analysis and planning than is currently practiced. It is recognised that practical constraints often make it difficult to undertake such consideration at the front end of a project. However, one-way "outreach" after site selection is not the same as a pre-site-selection, two-way mutual exchange of information and views between developers and potentially affected communities.

Bryson, J., (2004). What to do when stakeholders matter: Stakeholder identification and analysis techniques. *Public Management Review*, 6, 21-53. doi:10.1080/1471903041000167572 2

Publication Summary:

This article surveys the topic of stakeholder identification and analysis. Specifically, it reviews the role of stakeholders in meeting mandates, various techniques for identifying the full suite of relevant stakeholders, and ways to analyse stakeholder reactions. The techniques include: organising participation, strategic intervention, building coalitions, and implementing and monitoring. The authors suggest that such interactions with stakeholders can frame issues in a way to achieve technically feasible and politically acceptable outcomes.

Main Points:

Social science literature has varying definitions of stakeholders ranging from all those affected by to all those can effect outcomes. These definitions imply an assessment of stakeholder power to influence outcomes. The authors suggest using the more inclusive definition at the start of a stakeholder identification process to help create an "authorising environment" for projects.

The author describes an iterative approach for identifying stakeholders and evaluating the potential that key stakeholders are omitted. This step will likely need to be repeated during the course of a project. Basic techniques for analysis are reviewed:

- Power versus interest grids – used to help understand stakeholder views and potential actions
- Stakeholder influence diagrams – helps to indicate how stakeholders influence each other
- The participation planning matrix – used to prompt planners to engage specific stakeholder and groups at meaningful levels for each
- Directions of interest diagrams – used to help identify common ground and identify stakeholder interests.
- stakeholder-issue interrelationship diagrams – used to help understand the diverse interests of stakeholders and how they relate to each other.
- Problem frame stakeholder maps – used to help in problem definition (based on interests) that could inform the formation of coalitions
- Ethical analysis grids – used to help evaluate the ethics of proposed actions and plans

This information can be used to formulate engagement the most effective strategies, referred to as strategic intervention, including the activity range of "inform, consult, involve, collaborate, empower." Further, once stakeholder interests and concerns are well understood, plans can be formulated to take these interests and concerns into account, potentially increasing stakeholder support.

Fischhoff, B. (1995). Risk perception and communication unplugged: Twenty years of process. *Risk Analysis*, 15(2). 137-145.

Summary:

This article reviews the 20 year history of risk communication research, postulating that "every year some new industry or institution discovers that it, too, has a risk problem." It can start from scratch and make its own mistakes or it can learn from the efforts of others.

Main Points:

The author summarises the developmental stages of risk management as follows :

- All we have to do is get the numbers right
- All we have to do is tell them the numbers
- All we have to do is explain what we mean by the numbers
- All we have to do is show them that they've accepted similar risks in the past
- All we have to do is show them that it's a good deal for them
- All we have to do is treat them nice
- All we have to do is make them partners
- All of the above

Each of these stages yielded to the next as experience pointed to problems in the current stage.

The author suggests "communications is like an insurance policy. It is a fixed cost that can prevent larger damage. In evaluating a particular policy, one needs to decide how complete the coverage is, how much protection one can afford, and how much the attendant peace of mind is worth."

That said, communication is not a panacea. "Avoiding all conflict is not a realistic, or even legitimate, goal for risk communication." In the best case, the author contends, risk communication can help achieve "fewer, but better conflicts."

The key to useful risk communication is to be prepared. "One cannot rely on undisciplined speculation about the beliefs or motivations of other people. One cannot expect to quiet a raging controversy with a few hastily prepared messages. One cannot assume that expensively produced communications will work without technically competent evaluations."

Fleishman, L., Bruine de Bruin, W., and Morgan, M. G. (2010). Informed public preferences for electricity portfolios with CCS and other low-carbon technologies. *Risk Analysis*. doi:10.1111/j.1539-6924.2010.01436.x

Summary:

The authors conducted an exercise to obtain individual and group rankings of ten energy technologies and seven portfolios that presented realistic combinations of those technologies in the region where the exercise was conducted. "The ranking exercise asked participants to assume that the U.S. Congress had mandated a reduction in carbon dioxide emissions from power plants to be built in the future." Participants were provided "comprehensive and carefully balanced" information about the costs and benefits of the technologies. Individuals were asked to rank the technologies before and after receiving information in a small group setting. The groups were also asked to develop a group ranking. As discussed below, the exercise revealed technology preferences and also indicated a productive approach for sharing information.

Main Points:

Authors used a "mental models" approach to develop materials that addressed participants' information needs in wording that would be accurate and understandable. The information described costs and benefits of the 10 electricity-generating technologies that could "realistically be constructed in Pennsylvania (where we recruited participants) over the next 25 years: (1) four coal-based technologies, including pulverised coal (PC) and integrated gasification combined-cycle coal (IGCC), both with and without CCS; (2) natural gas combined cycle; (3) advanced nuclear plants; (4) three renewable technologies—modern wind turbines, solar photovoltaic (PV), and biomass using integrated gasification combined-cycle; and (5) reducing electricity consumption through energy efficiency. These technologies were also combined into portfolios that would each result in 70% less CO2 than the current energy mix.

The results showed that participants favoured "energy efficiency, followed by nuclear power, integrated gasification combined-cycle coal with CCS and wind." The reaction to portfolios showed both a preference for these technologies and a preference for a diverse mix – heavily weighted portfolios were not the favourite. The authors found that participants "preferred diverse portfolios that contained CCS and nuclear over alternatives once they fully understood the benefits, cost, and limitations of each." The results from this study suggest that informing stakeholders about the alternative energy options and the full range of costs and benefits may lead them to "a reluctant preference for CCS and nuclear power, and diverse low-carbon portfolios including these technologies."

Hayes, R. and Grossman, D. (2006). *A scientist's guide to talking with the media: Practical advice from the Union of Concerned Scientists*. New Brunswick, NJ: Rutgers Press.

Summary:

Hayes and Grossman's *A Scientist's Guide to Talking with the Media: Practical Advice from the Union of Concerned Scientists* puts forth the thesis that scientists [and project developers] have a role in communicating facts and the value of science. Scientists, they claim are often reluctant to speak to the media. This work is based on surveys conducted with hundreds of scientists in the United States who were asked what works and what does not work when speaking to the media. Interviews with scientists and reporters reveal differences in how each party uses language. The authors unpack the differences in communication style between science and media, which often lead to misunderstandings. This book offers practical advice and exercises that aim to increase the likelihood scientists will speak to media, increase coverage for their work and views, and increase chances coverage is factual and contextually accurate. The advice in this guide is based on principles scientists value such as intellectual honesty, forthrightness, and rigor, which scientists often feel are lost in translation from science to media reports.

Main Points:

- Scientists need to talk to the media but must be aware of distinction between technical accuracy and communicative accuracy (a measure of if general audiences understand the main thrust of scientific research reported on)
- How science is reported impacts story. Typically it is covered as series of "breakthroughs," discrete, disconnected events, where politics is covered as a continuing, unfolding story. This reinforces the misconception that scientific results are final end points, which makes new results confusing and leaves public feeling misled.
- Scientists [technical proponents] are reluctant to speak to the media because each time they put hard-won reputation on the line (scientific reputations take years to build and are based on precision and quality of work)
- To communicate more effectively you must be conscious of how package technical information such as presenting research in ways media can use and public can understand, and consolidating the message down to a few central points
- To communicate more effectively you must be conscious of how you present technical information, stay on message
- To communicate more effectively you must be conscious of who presents technical information and work to become a trusted source for reporters
- Public most interested in practical applications of science, want information about things that directly affect them
- Journalists/media focus on who, what, where, when, …not So What?
- Journalists focus on what can be done in one day – severely time limited, which results in following the Pack (including reworking other's stories), using interviews to support predetermined angle, and presenting both sides regardless of how accurate they are in the name of balance.

Heddle, G. A. (2003). *Sociopolitical challenges to the siting of facilities with perceived environmental risks* (Unpublished doctorial dissertation). Massachusetts Institute of Technology, Boston.

Summary:

This Masters thesis cites the increase in Not-In-My-Back-Yard (NIMBY) opposition to facilities diffuse benefits and potentially localised risks and uses case studies to illustrate recommendations for "preventing and, if required, dealing with local opposition" to such projects. Suggested solutions focus on realistically assessing the concerns of actual and potential opponents, the role of careful site selection, the role of meaningful public participation based on trust and compensation, and the role of education.

Main Points:

In the NIMBY syndrome, people may recognise the general need for a facility but oppose siting it in their community. Underlying causes are thought to include perceived inequitable distribution of costs and benefits. More recent literature suggests there is often justification for such perceptions. NIMBY is more typically seen in affluent communities where there are resources to mobilise opposition and people who feel they stand to lose more than gain from new projects (i.e., decreased property values). Environmental Justice (EJ) is described as a form of NIMBY opposition that is rooted in the civil rights movement and calls for "all communities to be protected from bearing a disproportionate share of environmental burdens."

Each of the projects in the three case studies has "the potential to negatively impact its surroundings." The three case studies (PVC facility, Wind farm, and Liquid Natural Gas (LNG) terminals provide valuable lessons in siting and public engagement:

- PVC facility siting fails in one community, primarily because of EJ complaints, but is able to successfully relocate in another community that on the surface is equally disadvantaged. Value of meaningful public participation efforts is illustrated. Three main concerns are identified and addressed during the process: local jobs, plant emissions, and the potential for accidents.
- Significant NIMBY opposition to an offshore wind farm demonstrates the real likelihood of NIMBY opposition even when a project enjoys huge support. Once NIMBY opposition was active, the absence of specific regulations for offshore wind became a lever for opposition.
- California's NIMBY opposition to LNG terminals and the resulting efforts to site them in nearby locations illustrates the role of negotiating community benefits.

Summary Points:

- Expect opposition to projects with diffuse benefits and localised risks
- Invest in careful site selection to find locations where there may be symbiosis
- Engage in meaningful public participation that aims to build trust and explore fair compensation for risks
- Actively respond to opposition
- Project teams should anticipate the level of public engagement necessary to develop a project and include people with appropriate expertise from the onset.

Herbertson, K., Ballesteros, A. R., Goodland, R., and Munilla, I. (2009). *Breaking ground: Engaging communities in extractive and infrastructure projects*. Washington DC: World Resources Institute.

Summary:

This World Resources Institute (WRI) report focuses on fundamental concepts for engaging communities in developing countries using ethical practices. WRI reviews current community engagement practices and identifies gaps in the application of community engagement principles and standards. Based on this review, WRI recommends seven key principles as an implementation framework for "*addressing core challenges in designing a community engagement strategy.*" The *WRI Principles for Effective Community Engagement* are explained in detail and broken into challenge, benefit, and approach. Examples are provided for each principle in practice. Application of the principles is recommended for three main stakeholder groups: 1) project proponents and industry associations, 2) financial institutions, and 3) citizen organisations.

Main Points:

- WRI Principles for Effective Community Engagement:
  - Prepare communities before engaging
  - Determine what level of engagement is needed
  - Integrate community engagement into each phase of the project cycle
  - Include traditionally excluded stakeholders
  - Gain free, prior and informed consent
  - Resolve community grievances through dialogue
  - Promote participatory monitoring by local communities
- Community engagement must create win-win situations for project developers and communities.
- Outcomes are dependent upon the integrity of the process
- Onus of community engagement falls to the project proponent
- Encourage collaboration between community and project proponents
  - Allows project proponents to effectively identify and mitigate potential impacts, prevent harm, and shape project to fit local conditions
  - Community gains voice in how they benefit from project and if project fits with their development priorities
  - Creates local ownership and support for project
- Project proponents can benefit from effective community engagement by reducing project costs, avoiding additional costs, identifying and managing risks, and enhancing reputation and trust.

Hund, G., Engel-Cox, J., and Fowler, K. (2004). *A communication guide for sustainable development: How interested parties become partners*. Columbus, OH. Battelle Press.

Summary:

A practical guide to fostering communication between interested parties and facilities. The authors provide guidance on creation of a sustainable development message using three dimensions: environmental, social, and economic. This guide offers considerable practical advice, guiding questions, and processes for communicating with interested parties. A six-step process for communicating with interested parties is outlined: 1) Establish communications team & plan, 2) Identify interested parties, 3) Define intent of communications, 4) Inform staff, 5) Engage interested parties), and 6) Respond to interested parties (feedback loop).

Main Points:

- Neighbours and other target groups respond to:
  - citizen advisory or community liaison committees
  - clarity of information
  - honest environmental reporting
  - plant open days
  - pollution prevention initiatives
  - well-designed environmental restoration plan
- The more active your community engagement program is, the more time you have to consider feedback when making critical decisions
- Principles of Communication and Interested Party Involvement
  - Voluntary involvement
  - Openness, honesty, and trust
  - Inclusiveness
  - Common information base
  - Mutual learning
  - Creative options
  - Collaboration in decision making
  - Coordination of interested party feedback
  - Avoid jargon
- Having a local presence matters
- Need underlying commitment to:
  - communicate with interested parties
  - be sincere in learning about interested party issues and concerns
  - be open to suggestions on how to connect and communicate with interested parties
  - be good listeners, avoid over-promising
  - provide credible proof of values and vision
  - invest in community
  - consider stewardship and sustainability
- Sustainable development requires senior management support

Johnsson, F., Reiner, D., Itaoka, K. and Herzog, H. (2009). *Stakeholder attitudes on carbon capture and storage – An international comparison. Proceedings of the 9th International Conference on Greenhouse Gas Control Technologies*. Washington DC, Elsevier. doi: 10.1016/j.ijggc.2009.09.006

Publication Summary:

This paper presents results from a survey on stakeholder attitudes towards CCS. The survey is the first to make a global comparison across three major regions; USA, Japan, and Europe. The 30-question survey targeted individuals working at stakeholder organisations that seek to shape, and will need to respond to, policy on CCS, including electric utilities, oil & gas companies, CO_2-intensive industries NGOs.

The results show generally small differences across the regions and between the different groups of stakeholders. All believed that the challenge of significant reductions in emissions using only current technologies was severe. There is a widespread belief both that renewable technologies such as solar power and CCS will achieve major market entry into the electricity sector within the next 10 to 20 years, whereas there is more skepticism about the role of hydrogen and especially nuclear fusion in the next 50 years. All groups were generally positive towards renewable energy. Yet, there were some notable areas of disagreement in the responses, for example, as expected, NGOs considered the threat of climate change to be more serious than the other groups. North Americans respondents were more likely to downplay the threat compared to those of the other regions. The Japanese were more concerned about the burden that would be placed on industry in the coming decade as a result of emissions constraints and NGOs were more likely to believe that the burden would be light or very light. NGOs believed CCS to be far more attractive than nuclear fusion power but much less than renewables. As expected, the risk for leakage from reservoirs was ranked number one of the risk options given."

Main Points:

"A majority of stakeholders surveyed believed the threat of climate change is one of the most severe threats society is currently facing and that significant efforts are required to solve this problem. In addition, most respondents think it will be a great challenge to solve the problem using available technologies. There is a widespread belief both that renewable technologies such as solar power and CCS will achieve major market entry into the electricity sector within the next 10 to 20 years. There was also an agreement on both the obstacles facing deployment of CCS and the opportunities driving CCS forward. There were some areas of disagreement in the responses such as the seriousness of the climate change threat and the burden that would be placed on industry in the coming decade as a result of emissions constraints. NGOs believed CCS to be far more attractive than nuclear (fission) power but much less than renewables."

Kasperson, R., E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X., and Ratick, S. (1988). The social amplification of risk: A conceptual framework, *Risk Analysis*, 8(2), 177-187. doi: 10.1111/j.1539-6924.1988.tb01168.x

Summary:

This article sets forth a conceptual framework that seeks to link systematically the technical assessment of risk with the psychological, sociological, and cultural perspectives of risk perception and risk-related behavior.

Main Points:

The technical definition of risk (probability of event times damages) is too narrow for the general public; they perceive risk based on intuitive biases, economic interests, and cultural biases. Traditional cost-benefit analyses fail to consider these complexities.

Hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify public perceptions of risk and related risk behavior. This may trigger secondary responses that further alter the perception of the risk. The resulting effects are described by the term "the social amplification of risk." As an example, the author cites the reaction to the accident at the Three Mile Island (TMI) nuclear reactor. Although "no one is likely to die from the release of radioactivity at TMI," response to the accident included much stricter regulations, reduced reliance on nuclear reactors globally, and significantly increased public opposition.

The authors proposed a conceptual framework for considering the amplification of risk. In the first stage, communications theory is used to illustrate how the amplification occurs during the transmission and reception of risk information. "The transmitter structures the messages that go to a receiver. The receiver, in turn, interprets, assimilates, and evaluates messages." (p 181) Transmitters include technical members of a project team, the media, opinion leaders, and personal networks. Each receiver filters, decodes, and processes the risk information, attaching their own values to it and determining their response. These responses will have secondary impacts such as enduring mental perceptions or images; political and social pressure; changes in regulation, emergency response, and increased liability.

The authors contend that this same process could lead to a reduction in the perception of risk.

At the heart is the role of information exchange. When a person does not have direct experience with a risk, they will gather information from other transmitters. The authors outline pathways in which receivers process information:

- heuristics and values: simplifying mechanisms to enable understanding of complex information),
- social group relationships: the role of peers in influencing perception,
- signal value: the extent to which the risk is new and signals an uncertain future, and
- stigmatisation: aversion to perceived negative association

Leiserowitz, A., Maibach, E., Roser-Renouf, C., and Smith, N. (2010). *Global warming's six Americas, June 2010*. New Haven, CT: Yale Project on Climate Change. Retrieved from http://environment.yale.edu/climate/files/SixAmericasJune2010.pdf.

Summary:

This report assesses public attitudes towards climate change and groups those responses into six unique segments within the American public. The general reactions of these segments provide insights to a frame of reference that could influence CCS perceptions. The authors believe the information will be useful to "climate educators and communicators throughout American society, including local, state, and national governments, academic institutions, environmental organisations, businesses, faith groups, doctors and scientists, and the media." Specifically, this information can be helpful in tailoring messages so that they touch on concerns that are meaningful to specific segments of the population.

Main Points:

The authors used a large nationally representative survey of American adults conducted in the fall of 2008 to identify segments. Survey questions assess the public's "climate change beliefs, attitudes, risk perceptions, motivations, values, policy preferences, behaviors, and underlying barriers to action." The segments are referred to as the "Six Americas" and they are unique in each of the assessed dimensions "display very different levels of engagement with the issue:

- The Alarmed (18%) are fully convinced of the reality and seriousness of climate change and are already taking individual, consumer, and political action to address it.
- The Concerned (33%) – the largest of the six Americas – are also convinced that global warming is happening and a serious problem, but have not yet engaged the issue personally.
- Three segments – the Cautious (19%), the Disengaged (12%) and the Doubtful (11%) – represent different stages of understanding and acceptance of the problem, and none are actively involved.
- The Dismissive (7%) are very sure it is not happening and are actively involved as opponents of a national effort to reduce greenhouse gas emissions.

This report briefly describes each segment highlighting differences; it concludes with detailed demographic, attitudinal, and behavioral profiles of each group.

Mohan, L., Chen, J., & Anderson, C.W. (2009). Developing a multi-year learning progression for carbon cycling in socio-ecological systems. *Journal of Research in Science Teaching*. 46(6), 675-698.

Summary:

This study asks the question, "*How well prepared are our citizens to understand and respond to research on global climate change?"* The learning progression from informal to scientific accounts is studied at four levels of achievement, which demonstrate increasingly complex understanding of carbon cycling. This learning progression can help identify where communications efforts should be focused for public engagement.

Main Points:

The progression of learning from informal to scientific accounts proceeds through four levels of understanding and include:

- Level 1 – recognition of the chemical basis of *life;* living things are seen as separate from inorganic inanimate objects and materials.
- Level 2 – characterising the *materials* involved in systems and processes; emergence of "hidden mechanisms" to explain microscopic events; gases are misunderstood.
- Level 3 – reasoning about systems and processes at multiple *scale;* includes understanding of matter transformation but there are misunderstandings about energy.
- Level 4 – using scientific *models* and principles; traced matter systematically through processes and understood conservation of matter and mass. Very few students in study achieved this level of understanding.

Ecological/environmental research has broad impacts and cannot be considered without understanding the interactions between ecosystems/environment and the public. The authors suggest "we are asking the American public to consider profound changes in their lifestyles on the basis of arguments from scientific evidence, that according to our data, they cannot understand." Level 4 reasoning is assumed to be the basic scientific knowledge for the general public (based on national standards). However, in this study, only 10% of students could explain processes with level 4 understanding. Most students gave level 2 (materials and process) explanations.

The transition from basic concepts, to materials involved in the basic concepts, to the scale of processes, to models for prediction are key scientific forms of communication which may each represent a level or point at which the public is left behind during discussion or explanations. Being aware of these levels through social site characterisation, communicators and CCS project developers can aid in building greater understanding. For example, by walking audiences through the production of models can provide more opportunity for understanding than simply stating that models are used for prediction. This removes the assumption that the layperson knows what goes into creating a model and helps them generate a personal conceptual model that builds buy-in. Communication strategies may benefit from more explicit explanation and visualisations.

Palmgren, C., Morgan, M.G., Bruine de Bruin, W., and Keith, D., (2004). Initial public perceptions of deep geological and oceanic disposal of carbon dioxide. *Environmental Science & Technology,* 38(24), 6441-6450.

Summary:

The authors undertook two studies to assess likely public perceptions of CCS taking place in geologic formations onshore and offshore. This study relied on a version of the mental model interview method. In the first study a small number of people were interviewed about perceptions of technical information. This feedback informed the development of a survey used in the second study with a larger group of people. The study found that people tend to frame CCS in the broader context of energy solutions for addressing climate change. The study also found that many people do not fully understand the impacts of various technologies. Concerns were raised about the temporary nature of CCS and there was less support for offshore CCS.

Main Points:

The mental models approach builds from general to increasingly specific questions about issues raised by the interviewee. This approach reveals the ways in which the interviewee frames the issues and their relative importance. The concerns, framing, and preferences revealed in the initial interviews are then used to develop a survey instrument that is used to assess perceptions on a larger scale. This is a nonjudgmental approach that can help to overcome inadvertent bias. The authors found that so few interviewees were familiar enough with CCS that they had to modify this approach by adding a third tier of information collection in order to provide some information and then obtain feedback.

The authors found that after the initial presentation of information the general favourability towards CCS dropped slightly. One of the largest noted effects was that people viewed CO_2 as a waste or pollutant and saw storage as disposal. The concerns raised included doubts about global warming, cost of CCS, intergenerational risk transfer, NIMBY, and a preference for alternative energy sources. That said, 83% said these concerns were not major. CCS in offshore geologic formations was not favoured.

The authors conclude that "the way in which the public becomes informed about this technology, the way the technology itself performs, and the way in which the public debate gets framed could dramatically shape future public perceptions."

Rich, R.C., Edelstein, M., Hallman, W.K., & Wandersman, A.H. (1995). Citizen participation and empowerment: The case of local environmental hazards. *American Journal of Community Psychology,* 23(5), 657-676.

Summary:

This paper examines citizen participation and engagement using a case study approach. Empowerment through decision-making is a key concept. The authors show how "meaningful participation can be empowering while a lack of opportunities for meaningful participation can be disempowering." Community empowerment, the capacity of communities to respond effectively to collective problems, is achieved by aligning the desired outcomes of individuals and institutions within a community. The authors provide a decision making approach to help achieve this goal by considering modes of participation, partnership approaches, and key factors in understanding empowerment.

Main Points:

- Types of Empowerment to consider:
  - Formal empowerment – institutionally provided mechanisms for public to influence decisions, such as regulatory processes
  - Intrapersonal empowerment – feelings of personal competence
  - Instrumental empowerment – individual capacity for influencing the decision making process through knowledge, resources, and persuasion
  - Substantive empowerment – ability to reach decisions which produce desired outcomes, citizens and institutions work together to achieve.
  - Community empowerment – occurs when individuals and institutions are empowered to achieve satisfactory outcomes.
- Process of participation
  - provide information
  - fully disclose information about problems and timelines
  - open process of acquiring and evaluating information
  - early response to concern by citizens
  - community committees with public officials and citizens selected by community
  - provide citizen representative full access to data
  - empower citizens by giving believable information on which to act
  - provide or facilitate independent technical advisors
  - release information in user friendly forms

Assessing the degree of community empowerment or disempowerment can help determine the power relationships that exist in a community or might develop as a result of a proposed project with environmental impacts. Considering the overlap between the individual characteristics, social institutions, and formal process and institutions in a community (potentially creating a map or ternary diagram) can help map alignment of community concern and/or response. This conceptual model of engagement through empowerment, participation, and partnership can help build trust and facilitate communication over the life of a project.

Rowe, G., & Wright G. (2001). Differences in expert and lay judgments of risk: Myth or reality? *Risk Analysis*, 21(2), 341-356.

Summary:

This paper examines the differences between expert and lay judgments of risk. It evaluates nine papers on this topic and finds in all cases, that methodological weaknesses in the papers do not support the conclusions drawn in the papers – namely (a) that experts judge risk differently than lay people and (b) that expert judgments are more correct than lay judgments. The authors identify confounding characteristics that they speculate may account for more of the differences identified in the base research than professional background (i.e., gender, education). The authors reach this conclusion by reviewing in detail the data presented in the research papers. The authors do not contend that there are no differences between expert and lay judgments of risk, but rather suggest that the papers do not successfully provide evidence for these assertions. The authors call for additional research to address the question.

Main Points:

There is evidence in the literature suggesting that communication of risk based purely on statistical response, (e.g. fatality rate) or provided by technical experts may not be as persuasive as risk assessments provided by lay people. A number of questions arise from this observation: do experts judge risk differently than lay people? Are expert judgments more accurate? Why would lay judgments be more readily accepted than expert judgments?

This paper presents an interesting perspective on these questions by suggesting the perception of expertise may fluctuate: literature suggests the "the title of 'expert' is conferred on those who hold particular roles rather than on the basis of the known accuracy of their risk judgments." The paper suggests this may be due to the fact that it may be "practically difficult to objectively assess performance." As examples, the authors compared the ability of psychiatrists to predict future patient behavior versus their ability to diagnose current conditions.

This paper provides insight to the assertion that public perception of risk is driven by numerous subjective factors in addition to the underlying "objective" measurement of risk. Specifically, the paper looks at whether expert judgments are better (more accurate, correct, or veridical) than lay judgments of risk. "Believable" risk assessments produced by those recognised as "experts" are not, necessarily, valid risk assessments.

The studies cited in the paper both contend and dispute whether assessments of risk from lay people may be deemed as more believable and/or accurate than expert assessments. The paper itself suggests some criteria that may contribute to increased importance or lay people's risk assessments and these may be useful to the project developer in developing risk communication materials.

Singleton, G., Herzog, H., & Ansolabehere, S. (2009) Public risk perspectives on the geologic storage of carbon dioxide. *International Journal Greenhouse Gas Control*, 3(1), 100-107. doi: 10.1016/j.ijggc.208.07.006

Summary:

This paper provides insight to the question of whether the public will accept CCS technology by utilising a psychometric risk assessment model to explore how CCS compares to other energy technologies and also other common risks. The study utilised psychometric risk assessment dimensions of "unknown" and "dread" to overcome low public awareness of CCS and avoid potential bias from provided information. Further, it developed objective measurements for subjective risk perceptions in order to understand how CCS might fit in the psychometric framework as compared to other established energy technologies. The paper explores approaches to improving the perception of CCS along the dimensions of "unknown" and "dread" to help improve overall public acceptance of CCS.

Main Points:

The paper explores two paradigms of risk assessment: the realist paradigm and the social constructivist paradigm. Where the former is considered to be objective, using actuarial, epidemiological, and probabilistic methods, the latter is more subjective but is considered to be more predictive of the public's perception of risk. The psychometric risk assessment model developed by Slovic is considered a rational and consistent framework within the social constructivist paradigm.

The author plots geologic storage on a grid whose axis are the extent of "dread" and "unkown." The author indicates that storage "evokes less dread than nuclear energy…[and] is likely to have a similar dread factor to that of natural gas storage." (p6)

This plot is an assessment of how the public perception of CCS might evolve over time presuming that the implementation of projects increases familiarity and eases concerns about safety. Interestingly, the plot suggests that the risks of CCS may become viewed as similar to the risks of other energy technologies. This does not mean that the public will not oppose CCS, just as they may oppose or favour energy projects today based on other site characteristics. "The analysis shows that GS technology will be perceived as having similar or slightly greater amounts of risk than fossil fuels, asbestos, and coal combustion pollution." (p7)

The paper suggests this perception could be improved by increasing awareness of CCS in general and of the techniques for mitigating risk in specific. "Together, expanded field trials and efforts to improve hazard mitigation and remediation techniques have the potential to improve the public perception and acceptance of GS technology."(p8)

ter Mors, E. (2009). *Dealing with information about complex issues* (Unpublished doctoral dissertation). Leiden University, Netherlands.

Summary:

The author tested the thesis that "the way people deal with information depends on their perceptions of information sources," by using informative (and not persuasive) communication in a structured experiment. The work also explored the impact of the receiver's of perceived credibility of source of information. Participants were provided with materials that provide factual information about CCS. Prior to reading these materials, participants were provided with background information on who wrote report (source manipulation). Then expectations of information quality were measured.

Main Points:

Informative communication is considered to be "communication that aims to create awareness and deeper understanding of the issue of consideration" enabling people to form informed opinions. In contrast, "persuasive communication is considered effective when people change their opinions as a result of the message."

The results suggest that credibility is grounded in trustworthiness, not expertise. Further, this study showed that people perceive information from trustworthy stakeholder as higher quality than when same information provided from untrustworthy stakeholder.

People select information based on perceptions of source credibility and this selection has a large impact on the resulting perceptions. People tend to select information from trusted sources that tends to reinforce their existing views or conceptual frameworks.

This study further found that people expect more trustworthy information from collaborative communication efforts, especially those involving groups with divergent views. NGOs and/or research organisations may be best suited to provide information about CCS. Single source, highly-credible source may not necessarily be the best messenger on CCS.

The author uses CCS in the Netherlands as an example of a complex issue to gauge how people deal with information. She argues that it is not necessarily the information or issues that drive people's view, but "the source of the information which determines the way people evaluate the information" (p. 3), and their position.

The findings from this study provide evidence for collaboration on CCS-related information. Credibility is an important factor for information creation and delivery. Shared or collaborative materials from dissimilar, credible, entities are perceived as higher quality than untrustworthy or single sources of information.

Wallquist, L., Visschers, V. H. M., and Siegrist, M. (2010). Impact of knowledge and misconceptions on benefit and risk perceptions of CCS. *Environmental Science Technology*. 44, 6557-6562.

Summary:

This article aims to explore the impact of preexisting knowledge and potential misconceptions on the public perceptions of the benefits and risks associated with CCS. The authors surveyed Swiss citizens on seven conceptual categories: pressurisation, leakage, storage mechanisms, CO_2 knowledge, diffuse impact, climate change awareness, and socioeconomics. Socioeconomic factors were found to have the most significant impact on risk perceptions. The study revealed commonly held misconceptions and suggested ways to address them in communication programs.

Main Points:

The authors found within that each of the 7 categories, public understanding of CCS was characterised by a number of misconceptions and that some pre-existing conceptions appeared to impact risk perception. Briefly:

- Pressurisation:
  - No concept that geostatic pressure gradient exists, or that it would be sufficient to keep CO_2 liquid
  - Injection of CO_2 will permanently increase reservoir pressure
  - Build up of pressure will result in (or cause) earthquakes
  - Storage of CO_2 can result in sudden/explosive leakage
- Leakage – the focus was on severity of leakage rates:
  - All leakage was considered bad, no matter how much over how much time
  - Slow, steady leakage is somewhat risky
  - Leaking can poison groundwater
- Storage mechanisms:
  - CO_2 will be stored in big underground caverns
  - There was a limited understanding of residual trapping, mineralisation
- CO_2 knowledge:
  - There was confusion over basic properties of CO_2 including odour
- Diffuse impact:
  - It was thought CO_2 can poison small organisms in subsurface
- Climate change awareness:
  - >60% believe climate change is happening
- Socioeconomic:
  - CCS was seen as an unsustainable solution

The authors suggest that communication remain simple and strive to "quickly help nonexperts improve their understanding and avoid information and images that might only increase risk perception without resulting in a better understanding of CCS."

Wong-Parodi, Wong-Parodi, G. and I. Ray (2009) Community perceptions of carbon sequestration: insights from California. *Environmental Research Letters*, 4, 1-8. doi: 10.1088/1748-9326/4/3/034002

Summary:

The authors used focus group interviews to better understand how two California communities located near proposed carbon sequestration sites view risks associated with sequestration. The two communities shared similar geologic characteristics but were socio-economically different, with one community having a higher minority population and less affluence than the other. Both communities were not in favour of hosting a CCS project however they differed in their sense of voice: the less affluent community expressed a lower sense of empowerment. Communities want a voice in determining risks to be mitigated associated with CCS projects.

Main Points:

Although both communities were against hosting a CCS site, the authors observed differences in the ways the communities perceived project risks. The main difference between the communities related to belief in their power of voice and redress, which can be traced to historical experiences by the communities respectively. The ability to influence risk mitigation to address specific community concerns leads to a sense of empowerment, which can protect communities against government and/or corporate neglect.

Both communities identified similar technical and social risks from CCS. Technical risks included concern about potential physical harm, CO_2 leaks, and increased seismicity. In general, both communities doubted the validity of expert knowledge. Social risks included concerns about a change in the nature of the community/quality of life caused by increased traffic, reduced property values, and other potential side impacts. Also, the community expressed concern about the trustworthiness of governments and corporations. In general both communities expressed preferences for receiving information from trusted sources and/or multiple sources. Also, both communities expressed greater concern about the social risks than the technical risks. However, the sense of empowerment had little impact on willingness to host a CCS site. Direct benefits and some community control were considered essential to hosting a CCS site.

Understanding community history and material and asset base is important to understanding sense of empowerment. The extent of community empowerment should be considered in project planning, communications, and risk assessments. Queries related to empowerment, voice, transparency, and past community experiences should be incorporated into social characterisation activities.

Appendix II – Full Bibliography

Adger, W. N. (2003). Social captial, collective action, and adaptation to climate change. *Economic Geography*, 79(4), 387-404.

Ashworth, P., Carr-Cornish, S., Boughen, N., and Thambimuthu, K. (2009). Engaging the public on carbon dioxide capture and storage: Does a large group process work? *Proceedings of the 9th International Conference on Greenhouse Gas Control Technologies*. Washington DC, Elsevier. doi:10.1016/j.egypro.2009.02.302

Ashworth, P., Boughena, N., Mayhew, M., & Millar, F. (2009). An integrated roadmap of communication activities around carbon capture and storage in Australia and beyond. Energy Procedia, 1(1), 4749-4756.

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