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The Dutch general public's opinion on CCS and energy transition in 2011: Development in awareness, knowledge, beliefs and opinions related to information and media coverage

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Executive summary

This report describes the results of two studies on public perceptions of CO₂ capture and storage (CCS) in the Netherlands. These studies are based on the idea that to understand public concerns and predict their future opinion it is necessary to know how people arrive at their evaluations about CCS. Earlier research in CATO showed that the general public has little knowledge on CCS and therefore also use different information when forming an opinion on CCS than what is expected by CCS experts. In the reported study we investigated this by (1) examining people's current knowledge and beliefs about CCS by administering a survey to a representative sample of the Dutch population and (2) by analyzing exposure and perceptions on CCS in the media. The survey was an extended version of the Knowledge and Beliefs Test administered in 2010 to a sample of the general Dutch population. The aim of this report is (1) to enhance insight into currently held beliefs and awareness among the general public about CCS and CO₂ and measure how these develop over time; and (2) to investigate the impact of media use and exposure to news about CCS.

Results of the current knowledge and beliefs test survey (2011) largely confirmed the results found in 2010; large numbers of respondents are unsure about the characteristics, effects and sources of CO₂. Furthermore, people are not aware of the current energy use in the Netherlands and its' relation to climate change. When comparing the current findings on public awareness of CCS with previous findings, results show that a majority of the population still does not know what CCS is or indicate that they have never heard of it.

Attitudes towards CCS are on average neutral, which is also in accordance with earlier findings. Structural equation modeling revealed that people's attitude towards CCS was best explained by whether they perceive CCS to have benefits, such as its necessity for climate change mitigation. When people perceive more benefits of CCS, their attitude towards CCS becomes more positive. Furthermore, misperceptions about CO₂ only influenced CCS attitude indirectly; they were a strong predictor of people's perception of the safety of CO₂ transport and their perception of risks related to leakage of CO₂. These risks perceptions in turn were a strong predictor of attitude towards CCS. When the chance of risks is perceived higher, attitudes towards CCS become more negative.

Results from the analysis of CCS in the media showed that although there seemed to be a slight tendency to report more negative than positive arguments in some newspapers, generally newspaper articles were quite neutral in their reporting on CCS. Topics that were most frequently mentioned were safety, climate and economy. Arguments on climate were usually positive, whereas for safety and economy arguments more negative arguments were mentioned. Finally, similar to findings in the knowledge and beliefs test, the articles often did not provide their readers with information or knowledge on CCS related topics, such as CO₂ and climate change. Instead, they seemed to report specific project plans, a finding that is also supported by results of the knowledge and beliefs test showing that people report knowledge of existing projects but not of the rationale for CCS or underlying concepts.

Overall, the current findings of the knowledge and beliefs test and the medialog replicate and expand previous findings on perceptions and attitudes concerning CCS. Awareness of CCS remains low, people have little knowledge on the underlying mechanism of CCS and have incorrect knowledge of CO₂ characteristics. Furthermore, the media continues to report on specific CCS projects rather than report on the underlying concepts, which holds incorrect beliefs

The Dutch general public's opinion on CCS

about CO₂ or CCS in place. From these results it can be concluded that a lot of effort is needed to increase knowledge on CO₂, energy use in the Netherlands and possible solutions to battle climate change. If the general population does not understand the problem our society faces when we do not mitigate CO₂ emissions, it will be extremely hard to get their approval of any kind of CO₂ mitigation option, be it large wind turbine parks, CCS, or home renovations to improve energy efficiency.



The Dutch general public's opinion on CCS

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Document Change Record

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Version	Nr of pages	Short description of change	Pages

Table of Content

1	Applicable/Reference documents and Abbreviations	7
1.1	Applicable Documents	7
2	Introduction	8
2.1	Introduction to the Knowledge and Beliefs Test (KBT)	9
2.2	Introduction to the Medialog	11
3	The Knowledge and Beliefs Test	12
3.1	Method of the Knowledge and Beliefs Test	12
3.2	Results of the Knowledge and Beliefs Test	17
4	Medialog	41
4.1	Method of the medialog	41
4.2	Results of the medialog	44
5	Comparison of the Knowledge and Beliefs Test results with the medialog	56
6	Conclusion	58
6.1	Public Knowledge	58
6.2	Trends in public awareness of CCS 2007 – 2011	59
6.3	Lay attitudes towards CCS	59
6.4	Medialog	60
6.5	Summary conclusions	61
7	Implications for communication: consequences of the current findings for earlier communication strategy advice	62
8	Bibliography	65
9	Appendix 1, Knowledge and Beliefs Test Sample	68
10	Appendix 2, Knowledge and Beliefs Test Dutch	69
11	Appendix 3, Knowledge and Beliefs Test English	81
12	Appendix 4, Medialog codebook (Dutch)	92

List of Tables

Table 4.1	Overview of the Knowledge and Beliefs Questionnaire measures	14
Table 4.2	Awareness of CO ₂	18
Table 4.3	Knowledge of CO ₂ characteristics, effects and sources	19
Table 4.4	Respondents' judgment of share of different resources in the electricity mix compared to real electricity production	21
Table 4.5	Beliefs about climate change in 2010 and 2011	21
Table 4.6	CCS awareness in 2011 and 2010	23
Table 4.7	Knowledge of CCS goals	24
Table 4.8	Likelihood perceptions of several CO ₂ storage options	25
Table 4.9	Perceptions of safety and inconvenience of three CO ₂ transport options	25
Table 4.10	Likelihood perceptions of CCS consequences	27
Table 4.11	Agreement with evaluative statements about CCS	28
Table 4.12	CCS attitude comparison 2010-2011	28
Table 4.13	CCS implementation acceptance	29
Table 4.14	Awareness of recent CCS developments	29
Table 4.15	CO ₂ knowledge factors and corresponding items	32
Table 4.16	CCS consequence and evaluative factors and corresponding items	33
Table 4.17	Correlations between knowledge and perception items and CCS attitude and acceptance	34
Table 4.18	Intercorrelations Between Variables in the Structural Equation Model	38

List of figures

Figure 4.1	The climate change chain and percentage of respondents following each step	22
Figure 4.2	Structural Equation Solution for the Attitude towards CCS model	39
Figure 5.1	Number of articles by newspaper	45
Figure 5.2	Impressions by Newspaper	46
Figure 5.3	Number of articles by month	47
Figure 5.4	Main topics related to CCS and number of articles in which the topic is mentioned	48
Figure 5.5	Stakeholders by number of articles	49
Figure 5.6	Locations by number of articles	50
Figure 5.7	Use of arguments per newspaper	51
Figure 5.8	Arguments by topic	51

1 Applicable/Reference documents and Abbreviations

1.1 Applicable Documents

(Applicable Documents, including their version, are documents that are the “legal” basis to the work performed)

	Title	Doc nr	Version date
AD-01	Beschikking (Subsidieverlening CATO-2 programma verplichtingnummer 1-6843)	ET/ED/9078040	2009.07.09
AD-02	Consortium Agreement	CATO-2-CA	2009.09.07
AD-03	Program Plan	CATO2-WP0.A-D.03	2011.12.12

2 Introduction

As the Netherlands continues to strive to meet national targets for climate change mitigation and energy use, the debate about which route to choose continues. A successful energy transition strategy depends on the involvement and support of the public. The better the public understands the energy and climate change issues, the better it can contribute substantially and meaningfully to the discourse and take appropriate actions. Whether it is development and implementation of energy efficiency measures, renewable energy or other energy technologies, public opinion can prove to be crucial. A carbon capture and storage (CCS) demonstration project, which planned to store CO₂ in the vicinity of the Dutch city of Barendrecht, was cancelled after two years due to protests against it from the local public and politicians (Brunsting et al., 2011; Feenstra et al., 2010). This proves it is important to involve the public early in the process and make an accurate assessment of their perceptions and opinion.

Unfortunately, some challenges exist which make this difficult to realize. Research performed in the Dutch program for CO₂ Capture and Storage research, CATO, has so far revealed that public interest in energy and climate change issues is low and serious knowledge gaps exist (De Best-Waldhober et al. 2009; Paukovic et al., 2011). Few people understand how much fossil fuels we use and how this usage affects the climate. The public's understanding of carbon, its sources and effects and the exact relation to climate change is limited (Paukovic et al., 2011; Whitmarsh, Seyfang & O'Neill, 2011). Moreover, these studies and others show that the climate change problem and CO₂ emissions are often confused with other environmental problems such as ozone depletion and pollution (Ashworth, Jeanneret et al., 2011).

Such low levels of awareness and knowledge can pose problems when the aim is to accurately assess public opinion. First of all, uninformed opinions can be unstable, because people are inclined to give an answer even if they have not heard about a topic before (Bishop, 1980). Such uninformed opinions are easily changed with any new information about the topic (De Best-Waldhober, 2006; Bishop et al., 1980) and as such hold little value for understanding or predicting the public's future reactions to any decision made. Secondly, without accurate assessment of the public's knowledge levels communication about these topics might not match the information needs of the recipients and therefore fail to provide them with the necessary building blocks for decision making.

This problem has to be taken into account when it comes to opinion research of a relatively new and unknown technology such as carbon capture and storage. In most countries the general public still knows very little, if anything, about CCS. In their 2006 study, Reiner and colleagues investigated CCS awareness levels in the United States, the United Kingdom, Sweden, and Japan. The highest awareness levels were found in Japan where 22% stated to have heard of CCS while as little as 4% stated this in the U.S. In France 27% indicated to have heard of CCS in 2007, making CCS the second to last known climate change mitigation technology among the public (Ha-Duong et al., 2009). In a recent study in six European countries Pietzner and colleagues (2011) found higher levels of awareness. While in Greece 18.7% stated to have heard 'a little bit' about CCS, in Norway this percentage was as high as 45.2%. Percentages of people indicating to have heard 'quite a bit' are, however, much lower. Although in Norway this is 17.4%, in all other countries the levels fall below 10% of the public.

In The Netherlands awareness levels have risen slowly at first, but quite sharply in the last two years, most likely because of the high profile Barendrecht project. The percentage of people from the general public stating to have heard a little bit about CCS or a lot rose from 20.2% and 3.6%

respectively in 2004 to 46.7% and 10.4% in 2008, indicating a modest rise in a period of four years (De Best-Waldhober & Daamen, 2011). In 2010 Paukovic et al. (2011) found considerably higher awareness levels after only two years, with 26.9% that had heard 'a little bit', and 37.7% that indicated to indeed have heard of CCS.

Although awareness levels are rising, there is evidence that awareness of the topic does not directly translate into knowledge. Despite the fact that respondents indicated to have heard of CCS, they have trouble indicating some basic aspects of CCS such as the problem it addresses (Sharp et al., 2006; Pietzner et al., 2011; de Best-Waldhober & Daamen, 2011). Less than 3% of respondents could identify climate change mitigation as the sole goal of CCS (Pietzner et al., 2011). Sharp and colleagues (2006) found similar results in Canada. Poor knowledge of CCS, its aims and its aspects, therefore, continues to pose a challenge to opinion research.

To avoid the issue of uninformed opinions, De Best-Waldhober and colleagues (2009) developed an Information Choice Questionnaire. This questionnaire measures informed opinions regarding seven energy options, including two CCS options, by providing a large representative sample of the Dutch general public with valid and well-balanced information from experts. The method of the Information-Choice Questionnaire is used to inform respondents and aid them in their decision making process, so as to obtain more stable opinions and make a better prediction of future public opinion on CO₂-capture and storage and other climate change mitigation technologies. Moreover, the ICQ method provides the possibility to analyse how the evaluation of certain aspects of energy options influences the opinions of the options overall.

2.1 Introduction to the Knowledge and Beliefs Test (KBT)

The results of these studies with the ICQ revealed that even though respondents' overall evaluations of the emission reduction options, including the two CCS options, were largely based on the information they received about the consequences of these options, this information did not explain their overall evaluations entirely. To a certain extent, respondents based their opinion of the two CCS technologies on other factors than the information experts believed to be relevant. This raises the question which other information, perceived consequences, arguments, thoughts, or feelings, besides the information provided by experts in the ICQ, account for people's evaluation of CCS. Finding out what these remaining factors are will improve understanding and future predictions of public opinion of CCS. This can form a stronger basis for the development of communications which will then include factors respondents find relevant in addition to the ones provided by experts.

Indeed, two studies found that lay people can have ideas and beliefs about CCS and related topics which are generally not addressed by experts and which sometimes are factually inaccurate (Palmgren, 2004; Wallquist et al., 2009). Wallquist and colleagues (2009) conducted 16 in-depth interviews with lay people which revealed that people had concerns about the risks of CCS. This included fears that the pressure in the storage site would be too high and would damage the storage site or that the CO₂ would rise to the surface and leak because it is a gas. Some compared it to nuclear waste storage and some attributed negative properties to CO₂, such as "unhealthy and smelly", or that it could alter DNA of organisms. A more elaborate exploration of lay people beliefs and their influence on opinion towards CCS therefore seems warranted.

To uncover these lay people beliefs and establish their prevalence in the general population Paukovic and colleagues (2011) developed a questionnaire, dubbed the Knowledge and Beliefs Test. This test measures lay people's awareness and knowledge of, and beliefs about CCS and related topics such as energy production, climate change and CO₂. The beliefs were uncovered

The Dutch general public's opinion on CCS

in interviews with non-experts and converted into a questionnaire which was administered to a random sample of the general Dutch population in 2010. The results showed large numbers of respondents who are unsure about all of the topics. Many were unfamiliar with the characteristics, effects and sources of CO₂. For example, 38% of the respondents were unsure about whether CO₂ causes cancer, and many about whether CO₂ is flammable, explosive or emits radiation. A substantial percentage of people was also in doubt of the effects of CO₂: whether it causes acid rain or smog. Furthermore, there was much doubt about the sources of CO₂ emissions. Around a third of the respondents did not know whether CO₂ is released when electricity is produced using natural gas, or coal, or oil, or using nuclear power. Most striking though is that there was quite a bit of confusion among the Dutch public as to our current energy use and its' relation to climate change. Although a majority of people stated to have some idea of global warming and understand that CO₂ emissions influence climate, much less people can give a reasonable estimate of how much fossil fuel is used in the Netherlands, or can answer correctly that the use of gas, oil or coal for electricity production emits CO₂.

As for CCS, although a large amount of people indicated to have heard of CCS either 'a little bit' (27%) or more (35%) their knowledge of CCS was limited. Only 8% identified mitigation of climate change as the sole aim of CCS, with many also selecting other environmental issues like improvement of air quality and ozone layer protection as likely goals. When asked about their perceptions of what suitable capture points could be, an equal number of respondents selected a correct option like 'power plants' and an incorrect option like 'intensive farming'. Similarly a lot of insecurity was found about suitable storage sites as well. Most respondents correctly believed storage in underground rock formations to be likely, but many also believed this to be true of large caves and cavities. This study also explored the relations of knowledge and perceptions of the topics with people's evaluation of CCS. Overall, people who were more positive about CCS tended to perceive CCS as posing less risk and provide more benefits. This was accompanied by a better knowledge of the goals of CCS. They had higher overall knowledge of CO₂ including better knowledge of the natural properties of CO₂ as well as the fact that CO₂ does not have hazardous properties such as harmful radiation or the potential of causing cancer. Nevertheless, although the more positive group about CCS had more knowledge, their overall evaluation of CCS was only slightly favourable towards CCS in absolute terms. This is in line with conclusions from earlier work in the CATO research programme, that being more informed leads to more informed and more consistent opinions on CCS, but not necessarily to more positive or negative opinions.

This first exploration of lay people's knowledge and beliefs about CCS and related issues revealed many knowledge gaps exist and some misconceptions are shared by large portions of the Dutch general public. Some of these misconceptions have an effect on people's attitude towards CCS. It seems warranted, therefore, to continue to develop a better understanding of what lay people base their opinion of CCS on.

The current study aims to contribute to the longitudinal measurement of the general public's knowledge of these topics. Parts of the previous research are replicated, the research sample is extended and some parts of the research are adapted to current CCS related developments in the Netherlands. An additional aim is to develop a model that describes the relation between the knowledge of the tested topics and perceptions, and CCS attitude.

2.2 Introduction to the Medialog

One factor that may influence people's opinions (and opinion development) regarding CCS and other mitigation options is the media. Kliest (2010) states that the increase in amount of articles about CCS in the media, compared to earlier studies (van Alphen, 2007), reflect the development of public opinion. However, as mentioned before, public awareness of CCS has increased only slightly and not until 2008, and understanding does not seem to increase at all. This raises the question in how far CCS in the media and public opinion regarding CCS interact. From May 1, 2010, until October 31, 2011, a log has been kept of how CCS is portrayed in the national media. This is an extension of the medialog kept in the first part of this study from May 1, 2009, until May 31, 2010. In the current report the results of the analysis of messages from the second media log, and results of linking insights from the media log to results from the Knowledge and Beliefs test.

Focus of this media analysis is the extent to which CCS is, or is not, related to other important knowledge concepts, as well as the extent to which the media reinforce particular misperceptions. Whereas the research design does not allow for drawing causal inferences between Knowledge Test results and the media log, it does allow investigation of the extent to which media content reflects lay people's knowledge, omissions in knowledge, and misperceptions as measured in the knowledge test.

A central assumption underlying this analysis is that an important part of the knowledge about CCS and related issues that experts deem essential for public understanding of the technology are not covered by the media. For example, newspaper articles on CCS seldom explain what CO₂ actually is. Furthermore, it is often not clarified to consumers what CCS would mean to them personally, for example by relating CCS to electricity production. For this reason, we have focused on coding factual knowledge transmitted by the national media about CCS and related concepts. We included measures to establish whether articles were overall positive, neutral, or negative about CCS. Furthermore, we coded arguments for and against CCS in the media landscape, to investigate what arguments and related topics of these arguments were used. We did not focus on evaluative matters such as judgments about stakeholder integrity, stakeholder opinions about CCS, or stakeholder opinions about each other. In short, we did not focus on the debate about CCS but on the role of the media as a vehicle for knowledge transfer.

To summarize, the focus of the current study is threefold and this report will address it in three parts. First, with the Knowledge and Beliefs test we aim to uncover lay people's knowledge and beliefs about CCS and related topics. In the next chapter we will describe how this second Knowledge and Beliefs Test was developed and describe the results found among a random sample of 936 people of the Dutch general public. Second, with the medialog we explore the factual knowledge transmitted about CCS by national newspapers. Third, we aim to explore the connection between the results from the Knowledge and Beliefs Test and the medialog. We will explore this link in Chapter four. In the final chapter we summarize the research and discuss the results that were found and their implications for opinion research on CCS and communication efforts.

3 The Knowledge and Beliefs Test

In this chapter the method and results of the Knowledge and Beliefs Test are discussed.

3.1 Method of the Knowledge and Beliefs Test

The types of beliefs about CCS held by lay people, as well as the prevalence of these beliefs in the population, were measured by a questionnaire especially developed for this purpose. The questionnaire used in this research was largely based on the Knowledge and Beliefs Test which was developed and administered in May 2010 and described extensively in Paukovic, Brunsting and De Best Waldhober (2011).

3.1.1 Questionnaire development

The questionnaire included questions about CCS and topics related to CCS technology; CO₂, electricity production and climate change. The first edition of the questionnaire was developed on the basis of 15 in depth interviews held with people with no professional involvement with CCS, climate or energy, to include relevant beliefs commonly held by lay people. Previous studies have shown 15 interviews are sufficient to elicit most commonly held beliefs as after this amount the emergence of new beliefs is negligible (Palmgren et al., 2004). The interviews were conducted using a very open protocol which allowed respondents to express their beliefs about these topics freely and only be prompted with general questions after a topic was exhausted. Respondents did not receive any information, nor were they corrected in this part of the interview if they expressed factually erroneous beliefs. A more elaborate description of this phase of research and the research sample can be found in section 4.2 of stated report.

Summarizing the results of the open interviews, they revealed all respondents were well aware of the issue of climate change and most could easily name possible consequences of it. However, respondents were much less confident about their own knowledge of the causes of climate change or they would not know exactly which human activities or used fuels were related to CO₂ emissions. Most seemed to confuse climate change with other environmental problems such as depletion of the ozone layer, acid rain, smog and air pollution. CO₂ proved to be a difficult topic for most respondents. All had heard of it and knew it was a gas which they often associated correctly with emissions and climate change. Many misperceptions and knowledge gaps existed, however, with respect to its characteristics, effects and sources. The most noticeable result when asked about energy production was the fact that respondents consistently overestimated the use of renewable energy and underestimated the use of fossil fuels.

Only a few respondents had heard of CCS. None of the respondents said to have a clear image of what the technology entailed. Respondents indicated it was hard for them to imagine how a gas can be captured. In addition to preventing climate change many respondents also ascribed several other environmental goals to CCS such as protection of the ozone layer. Some respondents did know it would be stored in depleted gas fields, but some of them however perceived the storage to be a "bubble of gas", lined with metal or concrete walls or that the CO₂ would be stored in tanks or barrels. As for possible consequences of CCS several respondents mentioned being afraid the CO₂ could catch on fire, explode, easily seep out of the storage because it is a gas or have negative long term effects on the health of those living near the storage. A few respondents believed implementing CCS in the Netherlands makes sense due to the existence of depleted gas fields.

The lay beliefs uncovered by the initial lay interviews were included in the 2010 version of the questionnaire and repeated in the 2011 version. In addition, some new elements were added to the 2011 questionnaire.

In 2011 several developments with regards to CCS in the Netherlands occurred. On shore storage was cancelled for the foreseeable future by ministerial decision due to lack of public support. The focus shifted to off shore storage and transport. Off the shore of the Dutch coast a storage demonstration project continued to be developed. To respond to these developments, items measuring perceptions of off-shore storage and CO₂ transport were added. Perceptions of off-shore storage were measured using items based on lay interviews from another project exploring public knowledge and perceptions of CO₂ and CCS, that the current researchers were also involved in. For the purpose of that project individual interviews and focus groups were held with lay people and perceptions of off-shore CO₂ storage were explicitly addressed. Because the methodology used in that project was similar to that of the questionnaire construction in this study the results of the interviews regarding the off-shore CO₂ storage were also used for the second edition of the Knowledge and Beliefs Test. Results of this other research are described in the report "Understanding how individuals perceive carbon dioxide: its relevance to CCS acceptance" (forthcoming).

Another set of items was added to explore the presence of experts' arguments about CCS in lay perceptions of CCS. Included were arguments appearing in media coverage of CCS as identified by the media log kept from mid-2010 to mid-2011 (Paukovic, Brunsting, & De Best-Waldhober, 2011) and some of the arguments contained in the 'Argument map' of CCS (Kalshoven, 2010).

Finally, several statements about the properties and effects of CO₂ and possible consequences of CCS were added for methodological reasons, in order to include positive incorrect statements about the two topics, which were not mentioned by lay respondents, but were necessary to present survey respondents with a balanced sets of statements.

Apart from adding several new items, some items from the previous measure were removed. To keep the questionnaire to a required length, items were removed if they were not necessary for longitudinal measurement of attitudes and if, in the previous measure, they had not proven to have a strong relation to CCS attitude.

3.1.2 Overview of the questionnaire and changes between 2010 and 2011

The beliefs mentioned by lay respondents and the new additions discussed above were included in the 2011 version of the knowledge and beliefs questionnaire. The table below shows the layout of the 2011 version of the questionnaire, compared to the 2010 version.

Table 3.1 Overview of the Knowledge and Beliefs Questionnaire measures

2010	2011	Remarks
Awareness of CO ₂	Awareness of CO ₂	Answer categories adapted (see measures)
Knowledge of CO ₂ : <ul style="list-style-type: none"> • Characteristics and effects of CO₂ • Sources of CO₂ 	Knowledge of CO ₂ : <ul style="list-style-type: none"> • Characteristics and effects of CO₂ • Sources of CO₂ 	Some statements removed based on relation to CCS attitude and new ones added for balance
Attitude about CO ₂	Attitude about CO ₂	8 semantic scales reduced to 4 semantic scales
Awareness of CCS	Awareness of CCS	Answer categories adapted (see measures)
Awareness of CCS project plans		
Knowledge of CCS capture points		
Aims of CCS	Aims of CCS	Amount of categories reduced to 4 most often mentioned ones
Perceptions of CCS storage	Perceptions of CCS storage	Off-shore storage perceptions added
Understanding of term "porous rock"		
	Perceptions of CO ₂ transport	
Current electricity mix	Current electricity mix	
Future electricity mix		
Beliefs about climate change	Beliefs about climate change	Reduced from 4 to 2 items
Statements about possible consequences of CCS	Statements about possible consequences of CCS	Off-shore storage consequences added, consequences with high correlation to other consequences or poor relation to CCS attitude removed
Evaluative statements about CCS	Evaluative statements about CCS	Mostly new statements from the media log and Argumentenkaart
Attitude about CCS	Attitude about CCS	8 semantic scales reduced to 4 semantic scales
	Acceptance of CCS implementation	
Awareness of media events related to CCS	Awareness of current developments related to CCS	
Amount of time spent using several media sources	Amount of time spent using several media sources	Scale changed: more refined categories of 15 minutes in the lower end of the scale and extended to 4,5 hrs and more instead of 3 hours and more.
Newspapers respondent reads	Newspapers respondent reads	Several new categories added
	Political party responded would vote for	

The updated survey was tested on 6 lay people using 'think out loud interviews' to ensure it was easily understood by lay respondents and did not contain any ambiguities.

3.1.3 Measures

Awareness of CO₂

Awareness of CO₂, CCS, and project plans was measured using the question: "have you heard of...". The scale used in 2011 contained four categories as opposed to the three categories used in 2010 (No, Yes, A little bit). The four categories in this version of the survey were: 1 = No, never heard of it, 2 = I have heard of it, but I don't know what it is, 3 = Yes, and I know a little about it, 4 = Yes, and I know quite a bit about it. It is expected that by making the scale more specific with more categories it will be possible to better measure the extent of respondents' knowledge about the topic. While awareness of CO₂ was measured at the outset of the survey, awareness of CCS was measured after all items about CO₂ knowledge and attitude and awareness of project plans was measured in the end of the survey.

CO₂ knowledge

Respondents' knowledge of CO₂ was measured using 17 items presenting either possible characteristics, effects or sources of CO₂. For example "CO₂ is explosive" was one of the possible characteristics of CO₂, "CO₂ influences the climate" was one of the effects and "CO₂ is released when spray cans with hair spray or deodorant are used" was one of the possible sources. The answers were measured on a 5-point scale ranging from 1: I am sure it is (or does) not, to 5: I am sure it is (or does). In this way the scale not only measures whether respondents think a statement is true or false, but also measures how sure they are of their answer. This scale was tested in several think out-loud interviews and respondents stated to correctly understand the meaning of the scale. The mid-point '3' meant the respondent was not sure of the answer or in other words 'I don't know'.

In a part of the analysis a 3-point version of this scale was used. All incorrectly formulated items (for example: "CO₂ causes cancer") were recoded so that a higher score meant a more correct answer. Also then the lowest 3 answer categories were aggregated to form one group of incorrect and "I don't know" answers. This was done so as not to imply a respondent who gave an incorrect answer knows *less* than a respondent who stated they did not know the answer. In this scale 1 = I don't know / wrong answer, 2 = I 'think' it's the correct answer and 3 = I'm sure of the correct answer.

Overall CO₂ knowledge

The scale of overall CO₂ knowledge was made by aggregating all 17 items on the 3-point scale formed previously. This way a higher score meant a respondent had answered more items correctly with more certainty.

Knowledge of CCS goals

Respondents' knowledge of the goals of CCS was measured by presenting respondents with a list of four possible alternatives of which they could select as many as they believed to be correct. For subsequent analysis the knowledge of aims of CCS was aggregated into one scale by giving respondent 1 point for every correct answer and subtracting 1 point for every incorrect answer. In the list of goals of CCS the two correct options were: "mitigate climate change" and "Limit rise in temperatures". Because the list contained 2 correct answer options and 2 incorrect ones, a score of 2 meant a respondent had selected only correct goals and a -2 that a respondent had selected only incorrect goals.

Perception of storage

Respondents' perceptions of possible CO₂ storage was measured using 6 items which described a possible storage with for example "The CO₂ will be stored in the sea, where it is absorbed by the seawater" and "The CO₂ will be stored underground in certain existing rock formations". For each description respondents could indicate how likely they perceived it to be the CO₂ would be stored in such storage. This was done on a 7-point scale ranging from 1: very unlikely, to 7: very likely.

CO₂ Transport

Respondents were asked about their perceptions of three modes of CO₂ transport: transport by road, by pipelines and by sea. For each they were asked how much inconvenience this transport would cause for the immediate surroundings during use on a 7 point scale ranging from 1 = No inconvenience to 7 = a lot of inconvenience. For pipelines it was in addition asked how much inconvenience they believed the construction of the transport route would pose for the immediate surroundings. For all three modes it was also asked how safe respondents perceived the transport to be, again on a 7 point scale, ranging from 1 = very unsafe to 7 = very safe.

Perceived consequences of CCS

Respondents were presented with 12 statements about what could possibly be consequences of CCS, but not necessarily so. These consequences were based on consequences indicated by respondents in the lay interviews of the previous edition of this study. For perceived consequences regarding off-shore storage lay interview results were used of the "CO₂ Understanding" study discussed in the beginning of this chapter. In addition, for methodological reasons a positive fictive statement regarding CO₂ storage was introduced by the researchers: "CO₂ storage helps keep ground water on appropriate levels". For each statement they were asked to indicate how likely they perceived the statement to be a consequence of CCS. Their answers were given on a 7-point scale ranging from 1: very unlikely, to 7: very likely.

Evaluation of CCS

Subsequently respondents were asked to state their agreement with 10 normative statements about CCS such as for example: "CO₂ storage is necessary to mitigate the rise in average temperature on earth" and "CCS technology is not developed enough for large scale use". Many of the statements were taken from arguments relating to CCS used in the media or in expert communications about CCS. Respondents' answers were measured on a 7-point scale ranging from 1: strongly disagree to 7: strongly agree.

CO₂ and CCS Attitude

After the CO₂ knowledge items and after the CCS evaluative items respectively, respondents were asked about their attitude towards CO₂ and CCS. Both were measured using 4 semantic scales, each presenting respondents with 2 opposing adjectives. Respondents were asked to indicate which adjective described their perception best on a 7-point scale. The closer their answer was to one of the scale ends the more the nearest adjective described their perception. For example one of the semantic scales had scale ends "positive – negative". Answer category 1 meant "positive" described their perception best, while answer category 7 meant "negative" described their perception best. For subsequent analysis all 4 scales were aggregated into one measure of CO₂ Attitude and CCS Attitude where a lower score signified a more negative attitude, while a higher score signified a more positive attitude.

Factor analysis of the 4 CCS scales revealed all the 4 items were indeed measuring the same construct and reliability analysis indicated the new CO₂ Attitude scale had a Cronbach's alpha of .85, and the CCS Attitude scale had a Cronbach's alpha of .83, which is high. This justifies aggregating the eight scales into one measure of CO₂ and CCS Attitude respectively.

CCS implementation acceptance

In addition to their overall attitude towards CCS respondents were also asked about their degree of acceptance of CCS being implemented in three differently described locations: the Netherlands, in their neighbourhood and under the sea bed under the North Sea. For each respondents could indicate whether they were “very much opposed” (1) to “very much in favour” (7).

CCS Developments

In the end of the questionnaire respondents were asked about whether they had heard of two developments in the Netherlands related to CCS. The first one concerned a CCS demonstration project off the shore of the Netherlands, for which respondents could indicate their awareness using a four point scale for CCS awareness as described above. The second concerned the 2011 ministerial decision not to allow in shore storage of CO₂ in the Netherlands. Here respondents could indicate whether they indeed had heard of it, had not heard of it or did not know whether they had heard of it.

Media consumption

Towards the very end of the questionnaire respondents were asked how much time they spend using four different media sources: newspapers, radio, television and internet. For each they were specifically asked how much time they use the media source for information about political and current affairs topics. In both cases answers were given in categories ranging from “fifteen minutes or less” to “more than 4,5 hours per day” with each category increasing in steps of 30 minutes per day, apart from the first half hour which was divided in steps of fifteen minutes. Subsequently respondents were asked which newspapers they read. The categories included all Dutch National daily newspapers, three freely distributed newspapers (De Pers, Metro and Spits), and a specialist newspaper Agrarisch Dagblad, a newspaper popular in Amsterdam Het Parool. In addition respondents could indicate they read a regional newspaper, another newspaper or no newspapers at all.

3.2 Results of the Knowledge and Beliefs Test

The data of the Knowledge and Beliefs Test was analysed with two goals in mind. The first aim is to test the lay public's knowledge about CO₂, energy production and their beliefs regarding climate change. In addition, we want to find out their awareness and knowledge of CCS, but also certain beliefs they might have about it and their attitude towards it. A longitudinal comparison of knowledge and perceptions of these topics is part of this goal as well. Secondly, we strive to unravel CCS attitude and find out which of these lay beliefs are most strongly related to respondents' attitude towards CCS.

In the first part of this results chapter, data is presented of all items in the questionnaire describing respondents' responses using frequencies and means. Where possible results will be compared to those of the previous version of the questionnaire and differences will be tested to reveal any change in the public's knowledge or perceptions over time. Furthermore, a new version of the 'climate change reasoning chain' will be created which shows the extent of public understanding of the relation of climate change to energy production and CO₂ emissions. In the second part of the results we turn to our aim of unraveling CCS attitude. Here we employ factor analysis to uncover underlying constructs and group items. These constructs are then correlated to CCS attitude and CCS acceptance items. Finally, a model is built revealing which perception constructs predict CCS attitude best and how knowledge influences these constructs.

Sample

The Knowledge and Beliefs Test was administered online in November of 2011. The sample consisted of 936 respondents of at least 18 years of age and was a representative sample for the Dutch population.

Based on the sample size of the KBT ($n \approx 950$) when interpreting the presented response percentages in this report one should reckon with an uncertainty margin of *maximally* plus or minus 3.2% (these margins apply with a 95% confidence level). An example: when 50% of the respondents give an affirmative response to a yes/no question then the real percentage is between 46.8% and 53.2%. However, when 90% of the respondents answers affirmative then the uncertainty margin is smaller (i.e., 1.9%) and the real percentage is between 88.1% and 91.9%.

3.2.1 Distribution of answers and comparisons to the first Knowledge and Beliefs Test

CO₂ awareness and knowledge

The first topic introduced in the questionnaire was CO₂. Respondents were asked whether they had heard of CO₂ and subsequently asked to answer whether they believed the 17 statements about CO₂ to be true or not true on a scale of 1: "I'm sure it is not/does not" to 5: "I'm sure it is/does".

Awareness

Almost all respondents have heard of CO₂ and a vast majority indicates to know a bit about it. Just over 11% claims to know a lot about CO₂. It can therefore be stated CO₂ is a concept almost everyone has heard of. The subsequent questions tested people's actual knowledge of the characteristics, effects and sources of CO₂.

Table 3.2 Awareness of CO₂

Have you heard of CO ₂ ?	Percentage
No, I've never heard of it	.9
I have heard of it, but I don't know anything about it	10.5
Yes, and I know a bit about it	77.2
Yes, and I know a lot about it	11.4

Knowledge items CO₂

Respondent's knowledge of the properties and sources of CO₂ shows a more mixed picture than their high awareness levels of CO₂. Some CO₂ characteristics are well known. Over 61% of respondents are to some extent convinced CO₂ is a naturally occurring gas. Respondents are also familiar with CO₂'s association with climate change as over 83% are to some extent sure CO₂ influences the climate and close to 73% state to believe or know for sure CO₂ is a greenhouse gas. In addition approximately 75% is familiar with the fact that some concentrations of CO₂ are hazardous for people. Also, over 63% are right to believe CO₂ is not explosive and similarly 65% correctly believe that CO₂ does not emit hazardous radiation.

However, uncertainties about CO₂'s characteristics exist as well. Although a majority knew CO₂ is not explosive, almost a quarter (23.5%) is unsure about this. Almost a third (31%) is unsure whether CO₂ is harmful in contact with skin and a similar portion (29.7%) is unfamiliar with CO₂'s role in making the earth's climate liveable. In the latter case another third is to some extent convinced CO₂ does not do that.

Table 3.3 Knowledge of CO₂ characteristics, effects and sources

	I'm sure it is / does not			I'm sure it is/ does	
	1	2	3	4	5
CO ₂ occurs naturally	6.4	9.7	22.4	22.3	39.1
CO ₂ is explosive	35.9	27.4	23.5	9.5	3.7
CO ₂ is a greenhouse gas	4.0	8.5	14.6	32.8	40.1
CO ₂ emits hazardous radiation	42.5	22.8	18.2	11.0	5.6
Some concentrations of CO ₂ are hazardous for people*	3.0	6.5	15.4	28.2	46.9
CO ₂ influences the climate	1.4	2.4	12.7	32.4	51.2
CO ₂ is used to protect metals from corrosion**	24.4	21.4	47.2	4.6	2.5
CO ₂ is harmful if in contact with skin	31.7	28.3	31.0	6.8	2.1
CO ₂ makes a liveable climate on earth possible	13.0	18.4	29.7	18.1	20.8
CO ₂ is used to treat brain injuries**	23.6	21.4	51.3	2.7	1.1
CO ₂ is released when you exhale	12.7	12.4	20.1	20.2	34.6
CO ₂ is released when spray cans with hair spray or deodorant are used	12.5	10.8	23.8	28.7	24.1
CO ₂ is released when old batteries leak	23.3	21.9	36.6	12.6	5.6
CO ₂ is released during energy production from natural gas	3.7	7.3	36.3	24.5	28.2
CO ₂ is released during energy production from coal	1.7	5.2	25.9	25.1	42.1
CO ₂ is released during energy production from biomass*	4.6	14.4	33.3	22.0	25.6
CO ₂ is released during energy production from nuclear power	30.6	18.6	33.7	11.5	5.7

* These items are new compared to the 2010 version of the Knowledge and Beliefs Test

** These items were made up and included by the researchers for methodological purposes and do not originate from the interviews held with lay people. It is noteworthy how unsure respondents are about these statements, showing a clear difference with statements that did originate from what lay people had said in interviews and underlining the importance of this step in knowledge test construction.

As for sources that emit CO₂, respondents were very familiar with a prominent fossil fuel being a source: 42.1% is very sure energy production from coal releases CO₂ and a quarter is somewhat sure this is so. Although slightly less than for coal, a majority is also to a certain extent sure natural gas is a source of CO₂ (52.7). However, with both coal and natural gas, there is a considerable portion of respondents unsure whether CO₂ is released during energy production from these sources; 25.9% in the case of coal and over a third (36.3%) in the case of natural gas. Uncertainty exists with other sources as well. A third is unsure whether CO₂ is released during energy production from biomass, and almost the same portion (33.7) is unsure whether CO₂ is released during energy production from nuclear power.

Confusion and a lack of knowledge exist with respect to non-energy related sources of CO₂. 52.8% of respondents wrongly believe CO₂ is released when spray cans with hair spray or deodorant are used. This belief might originate in people's general confusion of CO₂ and CFCs which became apparent in the interviews held with lay people during the development of the first Knowledge and Beliefs Test. Moreover, a quarter (25.1%) is to some extent convinced CO₂ is not released when you exhale and 20.1% is unsure about this. Although the majority (54.8%) does correctly believe this statement to be true, the insecurity of almost a half of respondents about this very basic aspect of CO₂ and our respiration is striking.

Comparison 2010

Of all the statements from the 2010 Knowledge and Beliefs Test that were repeated in this measure only answers to “CO₂ is explosive” were significantly different from those given in 2010. Respondents in 2010 scored significantly better, being closer to the correct answer which is “it is not” (1): 2010 M = 2.38; 2011 M = 2.18 F(1,1335) = 7,97; p=.005. Overall therefore, knowledge levels about this topic have not changed significantly between the first measure of the Knowledge and Beliefs Test and this one.

Knowledge vs awareness

Are self-stated awareness levels related to ones knowledge of CO₂? The first analysis reveals a correlation¹ of $r = .424$, $p < .001$ between awareness of CO₂ and overall knowledge² of CO₂. A comparison of CO₂ Knowledge scores between the four awareness groups reveals a predictable pattern. Respondents who state to know a lot about CO₂ have a significantly higher overall knowledge of CO₂ than those who state to know a little bit and both know more than those who have not heard of CO₂ or those who state not to know anything about it (I know a bit M = 1.86; I know a lot M = 2.37; F(3,932) = 77,16; $p < .001$). The only two categories that do not have significantly different scores from each other are those of people who have never heard of CO₂ (M = 1.57) and those who say to have heard of it but do not know what it is (M = 1,56). However, as only 8 respondents indicated not to have heard of CO₂ these groups are unequal in size and make the results somewhat unreliable.

Energy production

Halfway through the questionnaire respondents knowledge of the electricity mix was tested. To test knowledge of energy resource use, respondents were asked how much of different resources are used in the Netherlands to produce electricity. They could indicate the percentage of the share for which “fossil fuels”, “renewables” and “nuclear power” accounted for in electricity production. 53 respondents opted out of answering this question, leaving 883 respondents who answered the question. The results reveal an overestimation of the share of both renewable resources and nuclear energy in electricity production. Fossil fuel use on the other hand was underestimated. While the actual use of fossil fuels in 2010 was 84.5% (CBS, xxx 2010) respondents judged it to be 26.8% less (57.7%). The actual use of renewable resources in 2010 was 9.4%, which respondents judged to be much higher, estimating 23.5% on average. The share of nuclear energy was overestimated as well, as in reality it accounts for 3.4%, but was judged by respondents to be 18.9%. This confirms the pattern found in the previous edition of this questionnaire when the use of renewable energy was overestimated.

¹ Correlations are all single correlations between two variables. A correlation can vary between -1 and 1, with 0 meaning no relation between two variables. A correlation of 1 means a perfect linear relation between two variables, in the sense that the values of one variable are perfectly predictable from the value of the other variable. A correlation of -1 also means a perfect linear relation between two variables, however, a negative correlation means that as one variable increases, the other variable decreases, and vice versa. A positive correlation means that as one variable increases, the other variable also increases, and if one variable decreases, so does the other variable.

² In order to calculate an overall CO₂ knowledge score the data were transformed as to ensure a higher score on each item meant higher knowledge of CO₂. Subsequently points 1-3 (sure of an incorrect answer – unsure) were combined into one point. The reason for this is to avoid implying that being unsure of an answer (middle point) means a respondent has higher knowledge than when he or she gives an incorrect answer (point 1-2). This transformation produced a new three point scale: 1 = incorrect answer / unsure; 2 = to some extent sure of a correct answer; 3 = sure of the correct answer. The mean CO₂ knowledge score was 1.88 with a standard deviation of .45.

Table 3.4 Respondents' judgment of share of different resources in the electricity mix compared to real electricity production

Energy source	Mean %	Actual 2010
Fossil fuels	57.7	84.5%
Renewables	23.5	9.4%
Nuclear	18.9	3.4%

No answer N = 53; N = 883

Perceptions of global warming

After they were asked about their judgment of the electricity mix respondent's belief in global warming was assessed using two items. They were asked to indicate to what extent they were convinced the climate on earth will become warmer on average and to what extent they were convinced it was a result of CO₂ emissions by human actions. Respondents were more convinced of future average temperature rise (M = 5.1) than they were that this was caused by human actions (M = 4.6; $t(935) = 11.999$, $p < .001$). In both cases respondents were somewhat convinced of the statement being true.

The same question was posed in the last edition of the Knowledge and Beliefs Test in May 2010. A comparison of the results reveals that in November 2011, the current measurement, respondents were significantly more convinced that the climate will become warmer on average than they were in 2010 (M = 4.9; $t_{(1335)} = 3.144$, $p = .002$). However, they were not more nor less convinced that human actions are the cause of global warming as these levels stayed the same.

Table 3.5 Beliefs about climate change in 2010 and 2011

Statements about climate	Not at all convinced			Very convinced				
	M	1	2	3	4	5	6	7
To what extent are you convinced the climate on earth will become warmer on average?	5.1	2	4	7	13	29	27	18
2010	4.9	4	9	7	15	29	22	14
To what extent are you convinced global warming is a result of CO ₂ emissions by human actions?	4.6	4	7	10	19	30	18	11
2010	4.5	5	11	9	20	29	17	7

3.2.2 Climate change reasoning chain

The interviews prior to the first edition of the survey indicated people did not understand fully how human behaviour leads to climate change. People could name some of the fuels that emit CO₂, but often not all, and they would for instance not know very well from which source their electricity, or even electricity in general is produced. On the other hand, with regard to communication about CCS projects it is often said that the local community will understand the need for CCS better if they can see it as a necessary method to mitigate climate change. This relation has been found in some previous research (Shackley et al, 2005; Itaoka et al, 2006; Tokushige et al, 2007). Regardless of the strength of this relation, it can be argued that knowledge of a couple of aspects of our current energy production is necessary to understand the need for CCS, whether it has an influence on evaluation of CCS or not. This includes knowledge about the fact that a large amount of our electricity is produced from fossil fuels, that fossil fuels release CO₂, that CO₂

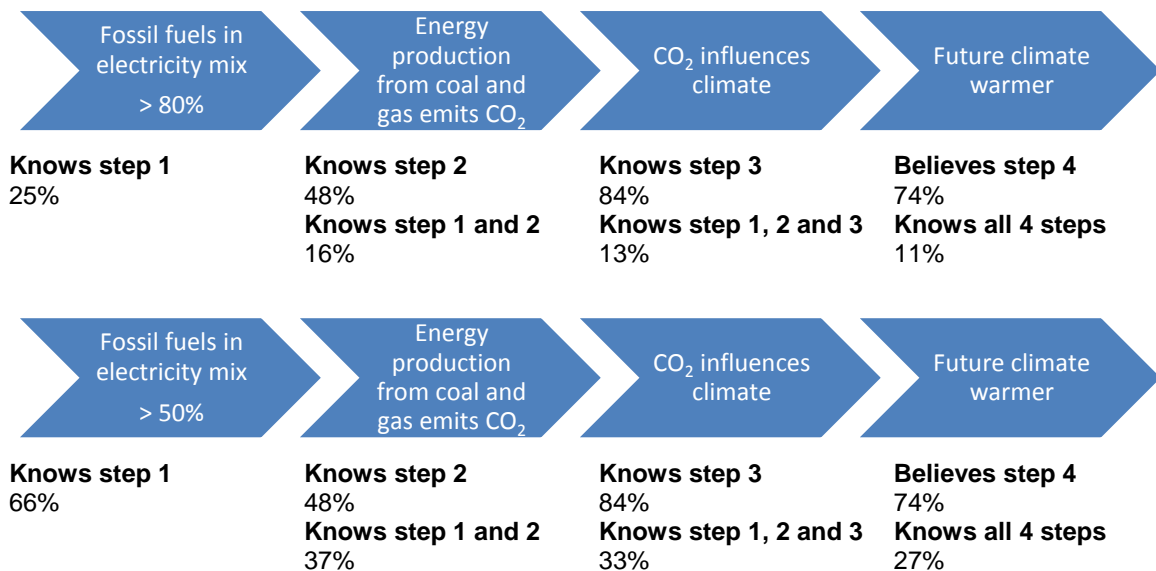
The Dutch general public's opinion on CCS

affects the climate and that average world temperatures are rising because of it. In the survey several items measured this knowledge. A schematic of this sequence from fossil fuels to climate change and the corresponding items that measured each step can be seen in Figure 3.1. Two versions of the reasoning chain are shown; the top one in which respondents where in the first step respondents were counted who indicated we use at least 80% of fossil fuels in our electricity mix (the real figure is approximately 84%) and the bottom one, which was less strict on this measure and counted everyone who indicated at least half of our electricity mix was made up of fossil fuels. Under each sequence of arrows the first row displays the percentage of respondents correctly answering the particular question, while the row of percentages beneath shows how many percent of the total sample correctly answered all the questions in the reasoning chain so far. For the items about fossil fuel sources of CO₂ and CO₂'s influence on climate answer categories 4 and 5 on the 5 point scale were counted as correct, 5 meaning 'I'm sure it does'. For the item measuring whether a respondent believes average temperatures will be higher in the future answer categories 5, 6 or 7 on the 7 point scale were counted as 'agree'.

The results reveal a steep decline in the amount of correct answers after each step. Only 25% of respondents indicated fossil fuels accounted for at least 80% of the electricity mix. Of these respondents roughly half also knew coal and gas emit CO₂, leaving 16% of the original sample. Only 13% of the total was left after questions were added about CO₂ influencing the climate. 11% of the total knew all this and agreed that average world temperature was rising.

The bottom chain in Figure 3.1 shows the percentages when less strict criteria are used. At the end of the causal chain 27% of respondents remain who have answered all the previous items correctly. About 34% of all respondents believe fossil fuels make up 50% or less of our electricity mix. The most incorrect answers are given in the second step, which reveals 52% of all respondents do not know that energy production from both coal and gas emit CO₂. Respondents generally do know that CO₂ influences the climate. Finally 26% do not agree with the statement that average future temperatures will rise. Put together however still a vast majority of respondents cannot complete or does not fully agree with this chain of reasoning.

Figure 3.1 The climate change chain and percentage of respondents following each step



Comparison to 2010

The results are similar to those found in the reasoning chain in 2010. Although the 'strict' version of the reasoning chain was slightly stricter in 2010, requiring knowledge of the fact that energy production from oil also emits CO₂ and that CO₂ is a greenhouse gas, the remaining 11% in 2011 that know all these four steps is similar to the 7% that knew this in 2010. The lenient version of the reasoning chain is identical to the one constructed in 2010 and shows a similar result. The 27% who knew all four steps in 2011 is similar to the 20% who knew all four steps in 2010.

3.2.3 Knowledge and perceptions of CCS

In the overview of results we now turn to answers given by respondents about CCS.

Awareness

After questions about CO₂, respondents were asked whether they had ever heard of carbon capture and storage. They could give their answer on a 4-point scale ranging from 1: never heard of it to 4: yes, and I know a lot about it. 34% indicated never to have heard of CCS. 27% indicated to have heard of it but not to know what CCS is, while 37% said to know a little bit about it. Only 3% indicated to know a lot about it.

Comparison to 2010

The answer categories in this edition of the test were different from the one used in 2010. The category "I have heard about it, but I don't know what it is" was added. Although a direct comparison of the results is not possible, there is an interesting pattern. In both years the amount of respondents that indicates not to have heard of CCS, is the same; 34 and 35 percent. In 2010, 27% indicates to have heard 'a little bit', while in 2011 exactly the same amount indicated to have heard of CCS but not to know anything about it. This might mean respondents will indicate to know a bit about a topic on the previous 3 point scale, even though they actually mean to say they have only heard of it and have no further knowledge. Similarly, in 2010 38% indicates to have heard of CCS, while in 2011 a very similar amount, 37%, indicates to know a little bit. Only 3% in 2011 indicates to know quite a bit about CCS. These results suggest that awareness measured on a 3-point scale might exaggerate respondents self-reported awareness and knowledge, as a scale that includes 'I have heard about it, but I don't know what it is' shows there is a considerable portion of respondents who indicate themselves they don't know anything about the topic.

Table 3.6 CCS awareness in 2011 and 2010

Have you ever heard of carbon capture and storage?	2011 %	Have you ever heard of carbon capture and storage?	2010 %
No, never heard of it	34	No	35
I have heard of it, but I don't know what it is	27	A little bit	27
Yes, and I know a little about it	37	Yes	38
Yes, and I know quite a bit about it	3		

Goals of CCS

To measure whether respondents knew what the purpose is of CCS they were presented with four possible goals of CCS, two of which were correct: "mitigate climate change" and "limit rise in temperatures". These four categories were often mentioned by people in the 2010 open interviews with lay people. The most often chosen goal in the survey was a correct one: "mitigation of climate change", which was selected by 60% of the respondents. The second most often selected goal was "protection of the ozone layer", with 54% of respondents believing this to be a plausible goal of CCS, followed by "limiting the rise of temperatures" (52%) and "improvement of air quality in the Netherlands" (50%). Although one of the correct options was

chosen most often, only a quarter (26%) of respondents chose at least one of the correct options, without selecting either of the two incorrect ones. Moreover, only 7% selected both correct options without selecting any of the incorrect ones. These results indicate respondents find the correct options plausible, but many don't really know what the intended purpose of CCS is and which environmental problem it is aiming to address.

Table 3.7 Knowledge of CCS goals

Goal of CCS	Percentage of respondents to select the category
Mitigate climate change	60
Protect the ozone layer	54
Limit rise in temperatures	52
Improve air quality in the Netherlands	50

Comparison to 2010

Although in the 2010 survey more categories were included, the results of the current reduced item show similar results. In 2010 improvement of air quality was the most often chosen goal of CCS, selected by 67% of respondents, followed by mitigation of climate change (63%), ozone layer (57%) and limitation of temperature rise (51%). In 2010 only 8% of all respondents chose only one of the climate change related options ('mitigate climate change', 'limit rise in temperatures' and 'limit the increase of the greenhouse effect') without selecting any of the incorrect ones. The higher percentage in the 2011 sample might be due to the fact that less incorrect categories were included in this version of the survey.

Perceptions of CO₂ storage

To find out respondent's perceptions of CO₂ storage they were presented with six descriptions of storage sites. For each respondents were asked to evaluate how likely they believed it to be the CO₂ would be stored in each of the 6 presented options. The objectively unlikely options "underground bunkers" and "underground caves and large cavities" were based on descriptions lay people gave in the 2010 interviews. Results indicate in all six cases between 21% and 34% of respondents did not know how likely it was CO₂ would be stored in the particular storage. Respondents perceived "existing underground rock formations" to be the most plausible storage for CO₂: 52% of respondents believed this to be likely to some extent. Respondents perceived storage of CO₂ directly in seawater to be the most unlikely storage option: 71% of respondents believed this to be unlikely to at least some extent. The other four options were evaluated similarly to each other. Respondents believed storage in underground bunkers, underground caves and under the seabed to be almost equally likely with all means ranging between M = 3.4 and M = 3.6. These means indicate they perceived these all to be slightly unlikely (scale middle is 4). Although respondents perceive these options to be equally plausible, in reality, bunkers and underground caves are indeed unlikely to be used as storage, but off-shore storage under the seabed is a very likely option, and the only option currently developed in The Netherlands.

The same question was asked in 2010 as well, with some of the same answer categories. We tested the two difference between the 2010 and 2011 measure of two likely storage options: existing rock formations and under the seabed. In 2010 people perceived storage in existing rock formations to be more likely (M = 4.9) than in the 2011 survey (M = 4.5: $F_{(1,1335)} = 20.78$; $p < .001$). There is no significant difference between the perception of likability of storage under the seabed between 2010 (M = 3.2) and 2011 (M = 3.4), even though currently there are projects in the Netherlands to implement CCS off-shore.

Table 3.8 Likelihood perceptions of several CO₂ storage options

Description of possible CO ₂ storage	% of respondents to choose answer category								
	M	Very unlikely					Very likely		
		1	2	3	4	5	6	7	
The CO ₂ will be stored underground in certain existing rock formations	4.5	6	6	9	27	26	16	10	
The CO ₂ will be stored in the sea, where it is absorbed by the seawater	2.6	29	27	15	21	5	2	2	
The CO ₂ will be stored in underground bunkers with solid, impermeable walls	3.5	18	14	15	26	17	6	5	
The CO ₂ will be stored underground in caves and large cavities	3.6	12	15	16	27	17	8	5	
The CO ₂ will be stored under the sea bed	3.4	14	19	16	28	15	5	3	
The CO ₂ will be stored in deep underground layers of salt water (aquifers)	3.9	9	12	14	34	18	8	5	

Perceptions of CO₂ transport

New to the survey was a question assessing perceptions of different modes of CO₂ transport. Respondents were asked about their perceptions of inconvenience and safety of CO₂ transport by road, pipeline and ship. Transport by pipeline was perceived to cause significantly less inconvenience during use than the other modes of transport ($F_{(2,1870)} = 241, 80$; $p < .001$; all paired t-tests below critical alpha values). It was also perceived to be significantly safer than any of the other transport options ($F_{(2,1870)} = 47.80$; $p < .001$). However, pipelines were perceived to cause some inconvenience during construction of the network ($M = 4.4$). Transport by ship was perceived to cause significantly less inconvenience for the surroundings during use and to be significantly safer than transport by road. Transport by road was overall perceived to cause more inconvenience during use and to be the least safe way of transporting CO₂.

The results show that none of the transport options is perceived as very safe as even pipelines, the option perceived as most safe, is evaluated on average with a 4.3.

Table 3.9 Perceptions of safety and inconvenience of three CO₂ transport options

Transport...	M	Very unsafe / No inconvenience				Very safe / a lot of inconvenience		
		1	2	3	4	5	6	7
..by road								
Inconvenience of transport by road for surroundings	4.4	5	10	11	27	22	17	10
Safety of transport by road for surroundings	3.8	7	15	21	30	12	10	5
..by pipeline								
Inconvenience of pipeline construction for surroundings	4.4	5	11	12	22	24	17	9
Inconvenience of pipeline transport for surroundings	3.1	17	26	16	23	11	6	3
Safety of pipeline transport for the surroundings	4.3	3	9	19	29	17	16	8
..by ship								
Inconvenience of transport by ship for surroundings	3.3	12	23	18	29	11	5	3
Safety of transport by ship for surroundings	4.1	4	12	18	30	17	14	6

Perceived consequences of CCS

Respondents were presented with statements describing potential consequences of CCS. These consequences were based on what lay respondents in interviews expressed to be possible consequences of CCS. The respondents in the survey could indicate whether they perceived the statements to be 1: very unlikely or 7: very likely consequences of CCS.

For most consequences about a third of respondents chose the middle option, indicating they had no particular opinion of the likelihood of the consequence. Respondents had least opinion about the possibility of hazardous substances being released during the capture process. 40% of respondents chose the middle option in response to this statement. This indicates that although discussed in the CCS community, this issue has not reached the public yet.

On the topic of several perceived risks of CCS respondents are divided. While 33% perceives it to be likely that people will suffocate if CO₂ leaks to the surface, 38% perceive it to be unlikely. While 20% perceive it to be likely to some extent that CO₂ storage will explode because it is under pressure, 43% believe this to be unlikely to some extent. However, 38% are unsure how likely this is to happen. Similarly, 30% believe it to be to some extent likely that the CO₂ will leak from the storage to the surface and 33% perceives this to be unlikely.

The CCS consequence respondents perceived most likely to occur is depreciation of property value in the immediate surroundings. 68% perceived this to be likely to some extent. It is followed by the perceived risk for the sea ecosystem, which 62% perceive to be likely to be drastically affected if the CO₂ would leak from the off-shore storage. It needs to be noted the percentage of respondents who actually believe the CO₂ is likely to escape from the storage is lower; with 30% believing it likely to some extent that the CO₂ will escape.

As for positive consequences of CCS 41% perceive it to be likely to some extent that investing in CCS will give the Netherlands a technological advantage over other countries. 39% also perceive it to be likely that implementing CCS will give time to develop renewable energy sources. However, on the other hand, 32% also perceive it to be likely that CCS will slow the development of these renewable resources.

Table 3.10 Likelihood perceptions of CCS consequences

Statements about consequences of CCS	M	Very unlikely				Very likely			
		1	2	3	4	5	6	7	
The stored CO ₂ will end up in the ground water	4.0	7	11	15	29	22	11	5	
CO ₂ storage helps keep ground water on appropriate levels	2.8	23	23	17	31	5	1	1	
People will suffocate if CO ₂ leaks to the surface*	3.8	9	13	16	30	18	10	5	
The CO ₂ storage will explode because it is under pressure*	3.5	11	16	16	38	12	5	3	
If CO ₂ leaks from storage under the seabed the (sea)water could acidify	4.3	4	7	10	36	23	13	7	
CO ₂ storage will slow the development of large scale use of renewable energy*	3.9	8	14	13	33	15	9	8	
CO ₂ will leak from the storage to the surface*	3.9	5	12	16	37	19	8	3	
Investing in carbon capture and storage will give the Netherlands a technological advantage over other countries*	4.2	5	7	12	34	25	12	4	
CO ₂ storage will decrease the value of properties in the immediate surroundings	5.2	2	4	6	20	20	28	20	
Implementing CCS will give us time to develop renewable energy sources such as wind and solar energy*	4.2	5	8	11	37	23	12	4	
If the CO ₂ would leak from storage under the seabed it would drastically affect the sea ecosystem	4.9	2	4	7	26	23	23	16	
When CO ₂ is captured hazardous substances are released in the vicinity of the factory	3.9	8	11	14	40	16	8	4	

* Same statements as in the 2010 survey

Comparison 2010

Of the consequences that were repeated from the 2010 survey only one consequence is evaluated significantly different in 2011 compared to 2010. Respondents in 2011 perceive it to be significantly more likely that people will suffocate if CO₂ leaks to the surface (2010 M = 3.53, 2011 M = 3.83 $F_{(1,1335)} = 9,88$; $p = .002$).

Evaluative statements about CCS

Following possible consequences respondents were presented with evaluative statements about CCS. Some of these statements were mentioned by respondents in interviews, while others reflect arguments about CCS occurring in the media as identified by the media log kept as part of this research. The aim was to explore the perceptions of the public of these arguments.

For some statements it was clearly hard for respondents to give a clear opinion. 52% did not know whether to agree or disagree with the statement that risks associated with CCS are much lower than those of natural gas extraction. Also, 50% did not know whether CCS is too costly compared to other CO₂ mitigating measures. Another 41% did not have a clear opinion on the risks for people associated with off-shore storage and 38% did not know whether they agreed with the statement that CCS technology is not developed enough for large scale use.

Table 3.11 Agreement with evaluative statements about CCS

Statements about CCS	M	Strongly disagree				Strongly agree			
		1	2	3	4	5	6	7	
CCS is necessary to mitigate climate change	4.4	5	6	8	31	28	15	7	
With the possibility to use CCS technology energy companies will build more coal fired power plants	4.1	5	10	12	36	20	10	6	
CCS technology is not developed enough for large scale use	4.7	1	4	7	38	22	17	10	
Risks associated with CCS are much lower than those of natural gas extraction	3.9	5	9	12	52	14	7	3	
Compared to other CO ₂ mitigating measures CCS is too costly	4.6	1	3	6	50	20	12	9	
I trust the legal norms CO ₂ storage has to adhere to are strict enough to make implementation of the technology acceptable	4.3	6	7	11	28	24	17	6	
CO ₂ storage under the seabed poses risks for people	4.2	3	7	12	41	19	11	6	
I trust that CO ₂ storage will be properly monitored by designated authorities over the long term.	4.2	7	10	12	26	26	14	6	
CCS will help the Netherlands meet international agreements on CO ₂ emission mitigation	4.5	3	5	7	33	29	17	5	
If we want to keep using fossil fuels, while lowering our CO ₂ emissions, CCS is a logical solution	4.5	5	4	8	31	28	17	6	

There were several statements many respondents agreed upon. Half of respondents agreed with the statement that CCS is necessary to mitigate climate change, while 31% was unsure about this. Only 19% disagreed that CCS is a necessary mitigation measure. Many respondents also trusted that legal norms CO₂ storage has to adhere to are strict enough to make implementation acceptable; 47% agreed with this statement to some extent. Similarly 46% to some extent agreed with the statement that CO₂ storage will be properly monitored by designated authorities over the long term. 51% agreed to some extent that CCS will help the Netherlands meet international agreements on CO₂ emission mitigation. These results suggest respondents perceive CCS to have some benefits and also reveal notable levels of trust in regulation and proper monitoring.

Comparison 2010

The statement that CCS is necessary for climate change mitigation was repeated from the 2010 measure. In 2011 respondents agreement with this statement is significantly higher: 2010 M = 4.20, 2011 M = 4.41, $F_{(1,1335)} = 5,91$ p = .015.

CCS Attitude

Respondent's perception of CCS was neutral to very slightly positive, measuring 4.06 on a 7 point scale. In 2010 this average was 4.11 (when based on the same 4 semantic scales as used in the 2011 survey). Although higher in the previous measure, this difference is not significant.

Table 3.12 CCS attitude comparison 2010-2011

2010	2011
M = 4.11, SD = 1.16	M = 4.06, SD = 1.17

ANOVA not significant $F(1,1335) = .61$, p = .434

CCS implementation acceptance

Apart from their attitude towards CCS respondents were also asked to indicate their acceptance of CCS implementation in three areas: the Netherlands, in their neighbourhood and under the seabed in the North Sea. Respondents were least opposed to CO₂ storage in the Netherlands, scoring a 3.7 average on the 7-point scale. This was followed by implementation under the seabed (M = 3.5) and they were most opposed to implementation in their neighbourhood (M = 2.9). The differences between these evaluations were all significant ($F_{(2,1870)}: 195,53; p < .001$. Paired t-tests, all pairs significant at $p < .001$ (below critical alpha).

The results show, overall, respondents were not very positive towards CCS implementation, although they were also not very opposed to it in the Netherlands in general and under the seabed. When it came to CO₂ storage in their neighbourhood they were notably more opposed to that option.

Table 3.13 CCS implementation acceptance

How do you feel about CCS being implemented:	M	Very much opposed			Very much in favour			
		1	2	3	4	5	6	7
...in the Netherlands	3.7	9	13	16	35	18	7	3
...in your neighbourhood	2.9	27	18	15	26	9	4	1
...under the seabed in the North Sea	3.5	15	15	15	30	15	8	3

Awareness CCS plans

In the last year some important developments occurred in the Netherlands regarding CCS. Respondents were asked whether they had heard of these developments.

First they were asked about their awareness of plans to implement CCS in the North Sea of the shore of the Netherlands. A majority indicated never to have heard of such plans (62%), 31% indicated to have heard of it but did not know what these plans are, 7% indicated to know a little bit about it and only .4% indicated to know quite a bit about it.

Second they were asked whether they had heard of the ministerial decision not to allow onshore underground storage in the Netherlands. Again a majority (69%) indicated not to have heard of this decision. 17% indicated to have heard of it and 14% did not know whether they had heard of it.

These results reveal respondents are generally not very much aware of developments related to CCS.

Table 3.14 Awareness of recent CCS developments

Have you heard of plans to implement CCS in the North Sea of the shore of the Netherlands?	%	Have you heard of the decision by minister Verhagen not to allow underground CO ₂ storage on shore?	%
No, never heard of it	62	Yes	17
I have heard of it, but I don't know what it is	31	No	69
Yes, and I know a little about it	7	I don't know	14
Yes, and I know quite a bit about it	.4		

3.2.4 Demographic differences in knowledge and perceptions

For all awareness, knowledge and perception items we explored whether there were differences between groups based on gender or age.

Gender

Between the two genders there are many significant differences. Women and men are equally aware of the fact CO₂ is a greenhouse gas, that it influences the climate, that some concentrations are hazardous for humans and that we exhale it. Women have slightly poorer knowledge of the characteristics and sources of CO₂. On all other items about CO₂, women give somewhat less correct answers. Women are somewhat more convinced on average that CO₂ is explosive (M = 2.3) than men (M = 2.0; $F_{(1,934)} =$; $p < .001$) and that CO₂ emits hazardous radiation (women M = 2.4, men M = 2.0; $F_{(1,934)} =$; $p < .001$). They are also somewhat less certain of the sources of CO₂, for example that it is released during energy production from coal (women M = 3.9, men M = 4.1; $F_{(1,934)} =$; $p < .001$) and that it is not released during the production of nuclear energy (women M = 2.7, men M = 2.2; $F_{(1,934)} =$; $p < .001$).

Male and female respondents judge fuels in the electricity mix similarly, but there are significant differences in their belief in anthropogenic climate change. Women have a significantly stronger belief in the fact that climate change is caused by human actions (women M = 4.5, men M = 4.8; $F_{(1,934)} =$; $p = .015$), although both are in the same agreement that future temperatures are getting warmer on average.

As for CCS there are many differences between the groups. Men claim to be significantly more aware of CCS (women M = 1.9, men M = 2.3; $F_{(1,934)} =$; $p < .001$). They also score higher on the item measuring the correct goals of CCS (women M = -.01, men M = .16; $F_{(1,934)} =$; $p < .009$). Men have an on average significantly more positive attitude towards CCS than women (women M = 3.9, men M = 4.2; $F_{(1,934)} =$; $p < .001$) and are less opposed to CCS implementation in the Netherlands (women M = 3.6, men M = 3.9; $F_{(1,934)} =$; $p < .001$), their neighbourhood (women M = 2.7, men M = 3.1; $F_{(1,934)} =$; $p < .001$) and under the seabed (women M = 3.7, men M = 3.3; $F_{(1,934)} =$; $p < .001$). This could be because women perceive more risks related to CCS: they believe it to be more likely that CO₂ storage will explode due to pressure (women M = 3.7, men M = 3.3; $F_{(1,934)} =$; $p < .001$), that hazardous substances are released in the vicinity of the factory during the capture process (women M = 4.1, men M = 3.6; $F_{(1,934)} =$; $p < .001$) and they are also more likely to agree with the statement that CO₂ storage under the seabed poses a risk to humans (women M = 4.4, men M = 4.1; $F_{(1,934)} =$; $p < .001$).

Education

To explore the influence of education, respondents' highest level of education attended was correlated to the knowledge, awareness and perception items. Many significant correlations between the knowledge and awareness items existed. Because of the large number of these only the ones higher than .3 or lower than -.3 will be reported here. All are significant at a level of $p < .001$.

Respondents with higher education were more likely to give the correct answer regarding the natural properties of CO₂. They were more likely to indicate CO₂ is a naturally occurring substance ($r = .36$) and that it is exhaled when we breathe ($r = .33$). A higher educational level correlates positively with a better knowledge of the electricity mix as well. Respondents with a higher educational level judge the share of fossil fuels to be higher ($r = .32$) and the share of renewable energy ($r = -.32$) to be lower. This corresponds better with the real figures. There is hardly any relation between the belief in climate change and education level.

Respondents with a higher education also report a higher awareness of CCS ($r = .35$). The relations between the perception items of CCS, CCS attitude and CCS implementation acceptance on the one hand and educational level on the other are much lower than those with knowledge items. The highest correlation between perceptions of CCS (transport, storage, possible consequences, evaluative statements) and education is $r = .15$. The relation with CCS Attitude is as low as $r = .06$ and with implementation acceptance in the Netherlands $r = .04$.

Age

No significant differences were found between age groups, which would indicate a clear pattern of differences in knowledge or perceptions.

3.2.5 CCS attitude and acceptance explained

In this section, results are analysed to meet our second aim of exploring the relation of the knowledge and perception measures to their attitude towards and acceptance of CCS. First the factor analyses of the knowledge and perception items are described, followed by a description of direct correlations of these constructs with CCS attitude and acceptance. Following this the model is created which best described the relation between the constructs and their influence on attitudes towards CCS.

To explore what knowledge and which beliefs most strongly relate to a person's attitude towards and acceptance of CCS in a first step we correlated the CO₂ items, energy mix, climate change, storage and transport perceptions and the CCS consequence and CCS evaluative items to both CCS attitude and the three CCS acceptance items.

Factor analysis of knowledge and perception items

In order to reduce the amount of CO₂, CCS storage perception and CCS consequence items we performed a factor analysis for all three groups of items. Often in such cases a pattern can be found between the items, showing what kind of knowledge and perceptions a certain person has. Just like in the previous analysis of the Knowledge and Beliefs Test in the first attempt all the items in the test were entered into the factor analysis. This, however, did not reveal an interpretable pattern. What this analysis mainly did was to separate the items depending on the scale they were measured on, so the 5 point scale CO₂ items, from the 7 point evaluations of CCS etc. Therefore it seemed more informative to do three separate factor analyses for each of three groups of items: one with the 17 CO₂ items, one with the 6 items about the perceived storage of CO₂ and finally a third with the 22 items measuring perceived consequences of CCS and evaluative statements about CCS.

CO₂

For further analysis of the items measuring CO₂ knowledge the items were transformed in such a way that an answer on the higher end of the scale (answer points 4 and 5) also means the answer is correct. A factor analysis of the 17 CO₂ items revealed three factors with an eigenvalue of 1 or higher. As a general rule of thumb only factors with at least an eigenvalue of 1 or higher are considered to be significant enough to interpret (Stevens, 2002). Together the factors explain 47% of the variance. The first factor has mainly incorrect and negative CO₂ items loading on it, such as "CO₂ is explosive", "CO₂ protects metals from corrosion" and "CO₂ is released during production of nuclear energy". This factor is dubbed "CO₂ Incorrect". The second factor has mainly items describing natural aspects of CO₂ loading on it, such as: "CO₂ occurs naturally" and "CO₂ is released when you exhale". Finally on the third factor we find loadings of climate and emission related aspects of CO₂, such as: "CO₂ influences the climate" and "CO₂ is released during the production of energy from natural gas". Table X shows the three factors and the

The Dutch general public's opinion on CCS

corresponding items. Below, for each list of items the reliability is given of the scale containing all corresponding items. The scales are named after the factors and are used in subsequent analyses.

Table 3.15 CO₂ knowledge factors and corresponding items

CO ₂ Incorrect Eigenvalue (EV) 4.1		CO ₂ Natural EV 2.3		CO ₂ Correct & Climate EV 1.6	
Is explosive	.58	Occurs naturally	.76	Is a greenhouse gas	.74
Emits radiation	.68	Creates liveable climate	.75	Influences climate	.67
Protects from corrosion	.57	Source: exhale	.75	Source: natural gas	.61
Hazardous for skin	.67	Source: biomass	.71	Source: coal	.55
Source: spray cans	.47				
Source: battery	.69				
Source: nuclear	.61				
Cronbach's α : .741		Cronbach's α :.756		Cronbach's α : .696	

Note: The numbers represent factor loadings after VARIMAX rotation

Perceived CCS consequences and evaluative items

The items measuring respondent's perceptions of possible consequences of CCS as well as the evaluative items were included in one factor analysis. A forced six-factor outcome produced the clearest results, which left least doubts about their underlying constructs. In addition it also created a factor which combined the two items measuring trust and separated them from the other factors. This gave us the advantage of being able to explore the role of trust in further analyses, as trust is often said to be an important factor in public's perceptions of CCS projects (Terwel, 2010). The first factor had items loading on it which conveyed either positive consequences or positive evaluations of CCS. Examples include "Investing in carbon capture and storage will give the Netherlands a technological advantage over other countries" and "CCS is necessary to mitigate climate change". This factor is named CCS Benefits. The second factor, named CCS Leak, included mainly items related to CO₂ leakage and risks such as: "CO₂ will leak from the storage to the surface", "The CO₂ storage will explode because it is under pressure" and "When CO₂ is captured hazardous substances are released in the vicinity of the factory". The third factor collects items related to off-shore storage of CCS, including "If the CO₂ would leak from storage under the seabed it would drastically affect the sea ecosystem" and "CO₂ storage under the seabed poses risks for people". This factor is therefore dubbed CCS Sea. The fourth factor has two items loading on it which both imply the creation of a lock-in in the current energy system if CCS is implemented: "With the possibility to use CCS technology energy companies will build more coal fired power plants" and "CO₂ storage will slow the development of large scale use of renewable energy". This factor is named CCS Lock-in. The fifth factor included three items which all seem to imply some relation to the costs of CCS. This includes: "CO₂ storage will decrease the value of properties in the immediate surroundings" and "Compared to other CO₂ mitigating measures CCS is too costly". This factor is named CCS Costs. Finally, the sixth factor combined two items both measuring perceived trust in CCS regulations and responsible authorities. This factor, which included "I trust that CO₂ storage will be properly monitored by designated authorities over the long term" and "I trust the legal norms CO₂ storage has to adhere to are strict enough to make implementation of the technology acceptable" was named CCS Trust. Table 3.16 gives an overview of the six factors and the corresponding items.

Table 3.16 CCS consequence and evaluative factors and corresponding items

CCS Benefits Eigenvalue (EV) 5.6		CCS Leak EV 2.9		CCS Sea EV 1.5	
Technical advantage	.69	Will end up in groundwater	.52	Sea water could acidify	.74
Time for renewables	.72	People will suffocate if it leaks	.62	Leak affects sea ecosystem	.67
Necessary for climate change mitigation	.72	It will explode due to pressure	.76	Sea storage poses risks for people	.61
Helps meet international targets	.70	It will leak to the surface	.71		
Makes longer use of fossil fuels possible	.68	Hazardous substances at capture	.69		
Cronbach's α : .784		Cronbach's α : .738		Cronbach's α : .754	
CCS Lock-in Eigenvalue (EV) 1.2		CCS Costs EV 1.0		CCS Trust EV 0.9	
Slows renewables	.69	Property prices drop	.73	Trust in storage regulations	.55
More coal fired power plants	.73	Not sufficiently developed	.71	Trust in long term monitoring	.54
		Too expensive compared to other option	.40		
Cronbach's α : 502		Cronbach's α : .545		Cronbach's α : 828	

Note: The numbers represent factor loadings after VARIMAX rotation

3.2.6

Correlations with CCS attitude and acceptance

The CO₂ and CCS perception factors were turned into variables by aggregating the matching items. These 9 variables were used in subsequent analyses. In addition, one other new variable was created: storage score. This variable showed one's knowledge of suitable CO₂ storage sites. It was created by recoding the three unlikely storage options: underground bunkers, underground caves and directly into the sea water. The result of this recoding was that a higher score signified a more correct answer, or in other words, that the person perceives these options to be less likely to be used. The maximum score a person could achieve when their scores on all items were put together was 42 (6x7) and the lowest 6.

These new factor items and the storage score were correlated to CCS attitude and the three CCS acceptance items, together with items measuring knowledge of the energy mix, of CCS goals, perceptions of climate change and CO₂ transport and CCS awareness.

Table 3.17 Correlations between knowledge and perception items and CCS attitude and acceptance

Knowledge and perception items	CCS Attitude	Acceptance Netherlands	Acceptance neighbourhood	Acceptance off-shore
CO ₂ knowledge				
CO ₂ Correct	.073	.033	-.008	.015
CO ₂ Incorrect	-.170**	-.059	-.126**	-.097**
CO ₂ Natural	.095**	.054**	.119**	.093**
Energy mix				
Fossil fuels	.068	.000	.056	.039
Renewables	-.062	.000	-.026	-.046
Nuclear	-.036	.000	-.057	-.009
Climate change				
Getting warmer	.027	.017	-.032	-.056
Man-made	.013	.042	-.019	-.056
CCS Awareness	.092**	.019	.029	.073
Goal CCS	.088**	.074	.085**	.048
Storage Score	.214**	.148**	.105**	.182**
CO ₂ transport				
Truck – Inconvenience	-.117**	-.146**	-.166**	-.127**
Truck – Safety	.291**	.213**	.248**	.242**
Pipeline – Inconvenience	-.131**	-.108**	-.098**	-.132**
Pipeline – Safety	-.270**	-.190**	-.120**	-.194**
Ship – Inconvenience	.279**	.231**	.202**	.178**
Ship – Safety	-.154**	-.120**	-.076	-.125**
CCS perceptions				
CCS Benefits	.599**	.602**	.408**	.392**
CCS Leak Risks	-.443**	-.356**	-.321**	-.328**
CCS Sea Risks	-.367**	-.326**	-.346**	-.460**
CCS Lock-in	-.356**	-.313**	-.251**	-.282**
CCS Costs	-.410**	-.453**	-.454**	-.353**
CCS Trust	.526**	.565**	.419**	.428**
Current develop.				
Plans North Sea	-.002	-.001	.029	.047
Decision Minister	-.040	-.035	-.015	-.057

** Correlation is significant at the 0.01 level (2-tailed).

The result that immediately stands out is the fact that the CCS perception and evaluative items have the highest correlation with all the CCS attitude and acceptance items. Another clear result is that the relations of all items are similar, whether one looks at CCS attitude or either of the three acceptance items. This indicates respondents' acceptance of CCS implementation is

associated with knowledge and beliefs in a similar way to their general attitude towards CCS. The correlations between the four items, CCS attitude and the three acceptance items indeed correlate highly with each other. The correlation between CCS attitude and implementation acceptance in "The Netherlands" is $r = .75$. With implementation acceptance in "your neighbourhood" it's slightly lower, $r = .59$ and similarly with implementation acceptance "under the seabed in the North Sea" $r = .57$. Some differences exist therefore, but the pattern of results is similar between the four attitude and acceptance items and the knowledge and perceptions measured in this questionnaire.

CCS Attitude and CO₂ knowledge, climate change and the electricity mix

First, looking at the knowledge of CO₂ factors, energy mix judgments and perceptions of climate change we can see the correlation with CCS attitude and acceptance exist mainly with the CO₂ knowledge items, although even these are not very high. The highest correlation exists between CCS Attitude and the factor CO₂ Incorrect, $r = -.17$, which indicates misconceptions about CO₂ are accompanied with a more negative attitude towards CCS. Relations between judgment of the share of fossil fuels or renewables in the energy mix and CCS Attitude are close to non-existent, and so is the relation between CCS attitude and a belief in climate change (correlation range between $r = 0.000$ and $.068$).

Respondents are not more positive about CCS when they believe climate change is happening or that climate change is caused by human actions. This result corresponds to what was found in the previous study with the Knowledge and Beliefs Test (Paukovic et al., 2011) which already noted the lack of this relation. Just like last year there is no belief between CCS attitude and a belief in climate change, but there is a relation between CCS attitude and agreement with the statement that "CCS is necessary to mitigate climate change" ($r = .47$; $p < .001$). A possible way to interpret this pattern is that even though to a certain extent respondents who believe in anthropogenic causes of climate change believe CCS is necessary, this does not make them more positive about CCS. This corresponds with the often heard perception of CCS as a 'necessary evil'. Even if people think CCS is necessary, does not mean they will *like* it more.

CCS Attitude and awareness and knowledge of CCS

The relation between CCS attitude and acceptance, and awareness of CCS is very low, falling below $r = .10$. The same is true for the relation between CCS attitude and correct knowledge of the goals of CCS. Respondents who selected more correct aims of CCS are only slightly more positive than the ones who scored less on this item ($r = .09$). As for perceptions of CCS storage the correlations with CCS attitude are somewhat higher, reaching $r = .21$ with CCS attitude. This means respondents who perceive the correct storage sites to be more likely and the incorrect storage sites less likely tend to be somewhat more positive about CCS. This correlation is fairly weak, however, and even weaker with the acceptance items.

Slightly higher correlations are found with CO₂ transport perceptions. Especially correlations of perceived safety of transport with CCS attitude are worth noting, ranging between $r = .26$ (ship) and $r = .29$ (truck). Inconvenience of pipeline construction also correlates to a similar extent with CCS attitude ($r = -.270$), the more inconvenience people believe this will cause, the more negative they are about CCS. The highest correlation with acceptance of CCS in the neighbourhood is found with the perceived safety of trucks ($r = .25$).

CCS Attitude and perceived consequence and evaluative statements

As noted earlier CCS attitude and acceptance correlates mainly with perceived consequences and evaluative statements of CCS. The relation between CCS attitude and the factor CCS Benefits is as high as $r = .60$. This means respondents' attitude towards CCS is mainly related to items conveying benefits of CCS such as its necessity for climate change mitigation or the belief

that it will give the Netherlands a technological advantage. The more people agree with these statements the more positive they are about CCS. The second highest correlation with CCS attitude is the one with CCS Trust. Again, this suggests respondent's belief in appropriate regulations and monitoring is related to a more positive attitude towards CCS. Fears of risks related to CO₂ leakage are the third factor relating to CCS attitude, with a moderate correlation of $r = -.44$.

Acceptance of CCS implementation in The Netherlands follows a pattern very similar to that CCS attitude, indicating it is based on similar considerations as overall CCS attitude. The main difference is that cost considerations are relatively more strongly related to acceptance of CCS implementation in the Netherlands than one's general CCS attitude. Costs are the factor with the highest relation to acceptance of CCS in the neighbourhood having a correlation of $r = .45$. This means concerns regarding property value are relatively more strongly related to acceptance of CCS in the neighbourhood than one's overall attitude towards CCS. It is followed by trust in regulations and monitoring ($r = .42$) and perceived benefits of CCS (with CCS Benefits $r = .41$). Perceptions of risks associated with leakage are only the fifth strongest relation to acceptance of CCS in one's neighbourhood. As for acceptance of CCS implementation in the North Sea we find, not surprisingly, the items measuring the perceived effects on sea ecosystems and its safety to have the strongest relation to acceptance ($r = -.46$), followed by trust in regulations and monitoring ($r = .43$).

Overall, the high correlation of CCS Benefits with CCS attitude and the acceptance items is noteworthy. In all cases it is more strongly related to attitude and acceptance than factors measuring perceptions of leakage or lock-in. This indicates respondents' perception of benefits of CCS could be important predictors of their attitude towards CCS, more so than their perceptions of risks. The current analysis does not justify a causal relation, however. Another interesting finding is the fact that in most cases the correlations between the CCS factors and CCS attitude are stronger than those between the CCS factors and CCS acceptance. This could indicate that compared to overall evaluation of CCS, decisions about CCS implementation are to a larger extent based on other issues and factors than the ones measured by the items in the current questionnaire.

3.2.7 Developing a model for attitude towards CCS³

So far we have explored the single, direct correlations between the knowledge and perception items with CCS attitude. These do not take into account how these concepts relate to each other. Here we attempt to create a model, which best describes the relations between the concepts measured in the questionnaire and their effect on CCS attitude.

In the previous deliverable (Paukovic et al., 2011) in which we used regression analyses to investigate the influence of perceptions and knowledge on CCS attitudes, we found that perceptions are much stronger predictors of attitude towards CCS than knowledge. We concluded that knowledge probably has an indirect influence that is mediated by perceptions. For the present deliverable, we decided to investigate this by building a model in which the impact of all relevant clusters of knowledge and perceptions (as determined by exploratory factor analysis) on attitude towards CCS is calculated at once, taking into account covariances between the predictors.

³ In a paper by Brunsting et al. (2012) in Energy Procedia, this model has been updated and improved.

For this we used a statistical procedure called structural equation modelling using the program SPSS AMOS Version 20.0.0 (Arbuckle, J. L., 2003). The conventional test of statistical significance when evaluating a structural equation model is the chi-square goodness-of-fit index. For this index, better fit is represented by lower chi-squares, and higher chi-squares indicate worse fit. A non-significant chi-square test statistic indicates that the difference between the estimated and observed variance-covariance matrices is not reliable; hence, that model fits the data well. Other indices provide additional information about the fit of the model and are designed to provide more stable estimates of fit. We report the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). The CFI is an index of the degree to which the model in question is superior to a null model, which specifies no covariance between the variables. CFI may vary from 0 to 1, with 0 indicating no fit and 1 indicating a perfect fit. Values greater than .90 are generally considered to reflect adequate fit of the model to the data. Similar to chi-square, RMSEA is an index of absolute fit. The index ranges between 0 and 1, with an RMSEA of .05 or lower indicating a good fit.

Below we will first describe how we selected the relevant clusters of knowledge and perceptions for inclusion in the model. After this we will describe the process of model construction and present the results.

Factors of perceptions and knowledge used in the model

We used the correlations in 4.17 to identify concepts which were relevant to be included in the initial model. As the energy mix, climate change, knowledge of CCS goals and CCS awareness items did not correlate with CCS attitude in any meaningful way these were left out of the model.

In order to improve the reliability of the new variables, and because they were similar in content, some of the CCS factor variables were combined. CCS Leak and CCS Sea were combined into CCS Leak Sea. The reliability of the construct increased to Cronbach's $\alpha = .613$. All items in this construct were in some way related to perceptions of CO₂ leakage and its effects, whether on land or at sea. CCS Lock-in and Costs were also combined into CCS Lock-In / Costs, and the reliability of this construct improved as well to Cronbach's $\alpha = .819$. These items all shared a focus on non-hazardous drawbacks of CCS implementation.

In addition a new construct was created "Transport Safety". Because the three safety perception items correlated relatively strongly with CCS attitude these were included in the model as well. A factor analysis of all seven transport perception items revealed the three safety perception items were indeed one separate construct. They were combined into one variable with a Cronbach's α of .650.

Eventually the following constructs were included in the model:

- CO₂ Correct / Climate
- CO₂ Natural
- CO₂ Incorrect
- Storage Score
- Transport Safety
- CCS Lock-in / Costs
- CCS Leak / Sea
- CCS Benefits
- CCS Trust.

The constructs CO₂ Natural and CCS Lock-in / Costs did not prove to be a meaningful predictor of CCS Attitude in the testing of the model. In the final model, therefore, these two constructs were left out.

The correlations between the final set of constructs and the dependent variable are shown in 4.18.

Table 3.18 Intercorrelations Between Variables in the Structural Equation Model

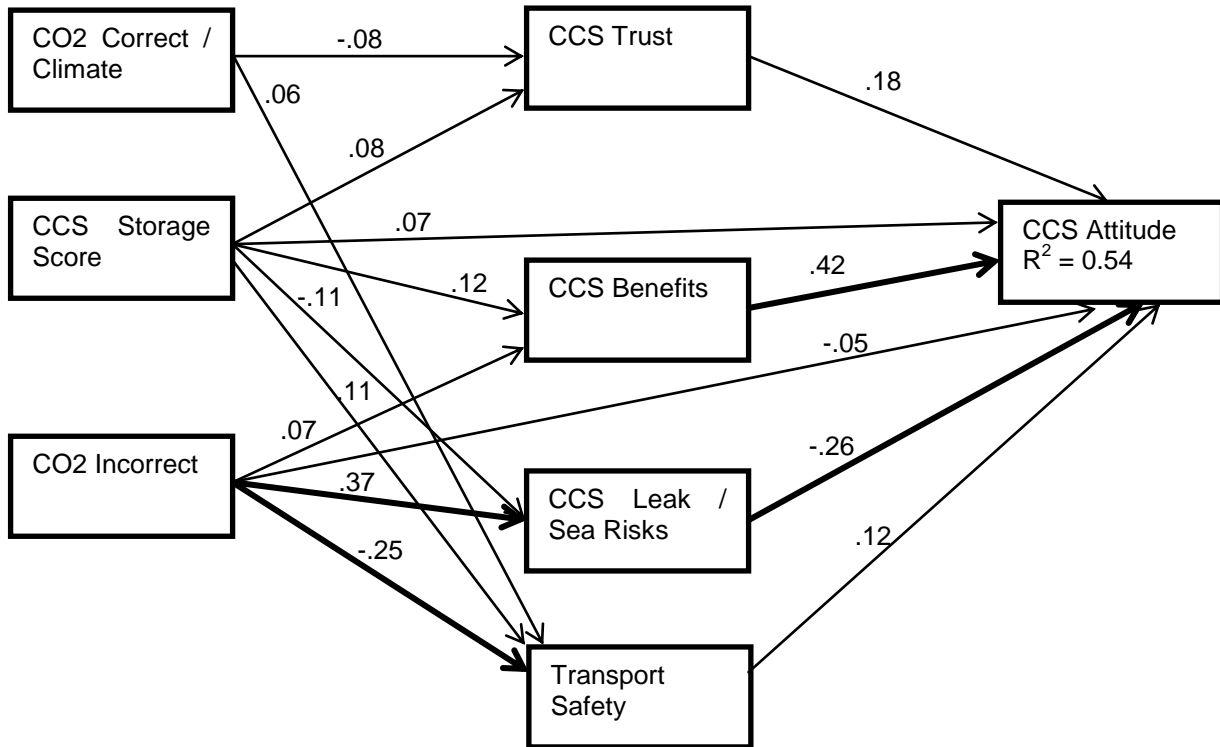
	1	2	3	4	5	6	7
1 CCS Attitude							
2 CO ₂ Incorrect	-.170**						
3 CO ₂ Correct / Climate	.073*	-.152**					
4 Storage Score	.214	-.275**	.267**				
5 CCS Leak / Sea	-.461	.384**	-.103**	-.213**			
6 CCS Benefits	.599	.066*	.047	.099**	-.177**		
7 CCS Trust	.526	.040	-.041	.056	-.281**	.581**	
8 Transport Safety	.363**	-.282**	.139**	.194**	-.369**	.195**	.203**

Structural Equation Model for Attitude towards CCS

First we tested an independence (or null) model in which all of the parameters are set to zero. This model tests the assumption that there is no covariance between the variables in the model. As expected the null model did not fit the data well: $\chi^2(6) = 756.325, p < .001, CFI = .57, RMSEA = .26$. To improve the model, we first allowed the three knowledge clusters to covariate as is also the case in multiple regression analysis; second, we added all significant relationships between the independent (knowledge clusters), mediating (perceptions) and dependent (attitudes) variables. Third, we removed all relationships that were not significant. Fourth, we allowed the error terms of the perceptions clusters to covariate.

The final model displayed in 4.2 fit the data well: $\chi^2(4) = 3,657, p = .454, CFI = 1.00, RMSEA = .00$. This model accounted for 54% of the variance in attitude towards CCS. The model shows that positive expectations about CCS are the strongest positive predictor of attitude towards CCS and perceptions of chance of leakage of CCS on land or at sea are the strongest negative predictor of CCS. Interestingly and perhaps surprisingly, perceived trust in monitoring authorities is only a weak predictor of attitude towards CCS, as are perceptions of transport safety. With regard to the indirect influence of knowledge about CO₂ and CCS, the model demonstrates that incorrect knowledge about the characteristics and effects of CO₂ is strongly related to perceptions of risk of leakage and to perceptions of transport safety. The relation with perceived risks of leakage is positive, meaning that when a person has more misconceptions about CO₂ and its effects they tend to perceive the risks of leakage as higher. The relation between CO₂ misconceptions and transport safety is negative, meaning that more incorrect knowledge makes respondents perceive CO₂ transport as less safe.

Figure 3.2 Structural Equation Solution for the Attitude towards CCS model



3.2.8 Media use and CCS knowledge and perception

Within the questionnaire we were interested to find out about respondent's use of media with the aim to relate this information to their knowledge and perceptions of the measured topics. In the end of the questionnaire respondents were asked about their use of several media channels. First of all, they were asked to indicate how much time they spend watching TV, listening to radio, reading newspapers and using the Internet. For each of these four information channels they were also asked how much of the time they use it for information about politics and current events. Answers were given on a scale ranging from "fifteen minutes or less" to "more than 4,5 hours per day" with each category increasing in steps of 30 minutes per day, apart from the first half hour which was divided in steps of fifteen minutes. In general, respondents spend most time watching television, followed by listening to radio and browsing the Internet. Relatively little time is spend reading newspapers. To catch up with news and current affairs, respondents again spend most time watching television but the newspaper is the second most often used medium, followed by radio and the Internet.

General media use and awareness and knowledge

The relations between the amount of time spent on any of the information channels and awareness and knowledge of the topics asked about in the questionnaire were extremely low, being rarely above $r = .15$. The relations with awareness of CCS and project plans were very low as well. The highest correlation was only $r = -.16$ ($p < .001$) which showed the more time respondents spend surfing the internet for politics and news the less likely they are to have heard of CCS. No consistent pattern could be distinguished from the results. This is different from the results of the previous survey when a pattern seemed to exist where amount of time spent

reading newspapers had the highest correlations with awareness and knowledge of surveyed topics. In the current research these findings have not been replicated.

Differences newspapers

In addition to the amount of time spent using different information channels, respondents were asked to indicate which newspapers they read. The list included all national newspapers, including the freely distributed ones, but respondents could also indicate they read a regional newspaper or any other newspaper which was not listed. Respondents could select as many newspapers as necessary. The results of the previous questionnaire were added to the sample to increase sample size per newspaper. The categories were the same as in the previous version, apart from the addition of the free newspaper 'De Pers', 'a regional newspaper' and 'none of these'. Subsequently each of the newspapers, having a value of 0 (don't read it) or 1 (I read this one) were correlated with the awareness, knowledge and perception items in the survey. As with the previous media use measures the correlations were overall very low, rarely reaching $r = .15$. Some interesting correlations were found with awareness of CCS. Respondents who indicated to read the 'Volkskrant' were more likely to be aware of CCS ($r = .24$; $p < .001$), as were those indicating to read 'NRC Handelsblad' ($r = .22$; $p < .001$) and 'NRC Next' ($r = .17$; $p < .001$). Correlations of the other newspapers with the CCS Awareness item were not significant and below $r = .1$. Readers of these newspapers also tended to judge the share of fossil fuels in the electricity mix more correctly (Volkskrant and share of fossil fuels $r = .22$; $p < .001$ and NRC $r = .23$).

4 Medialog

This chapter presents the method and the results of the medialog.

4.1 Method of the medialog

4.1.1 Population of media messages

Aim of this research is to investigate a representative sample of messages about CCS, which together reflect all opinions on CCS currently present in society. To achieve this goal we have opted to focus the analyses on messages in the national newspapers for which CCS was the main topic. Together, these newspapers reflect what we call the 'media landscape'. This means that all angles from which CCS is reported on, and the prominence of these angles, are reflected by newspaper articles. Events from the outside world, such as television reports on CCS, which generate a lot of attention, are also reported on in the national media. Thus by analyzing newspapers, one can obtain a complete impression of the ways in which a topic, in this case CCS, is written about, by whom, using which arguments, and leading to what types of opinions. Because of our main interest in the arguments used by newspapers we focus solely on articles which had CCS as a central topic. When CCS was merely mentioned in an article, this article was left out of analyses, for several reasons which will be explained further on in this section.

Besides collecting relevant newspaper articles, we also recorded large media events in the weeks before and during the surveying period. Furthermore, we added questions to the surveys to measure the extent to which respondents have been exposed to these events, which enables us to check if and how these events have influenced their opinion. If relations between exposure to events and opinions are found, we will use the recordings of the media events (e.g. of television news items) for additional analyses.

Social media (twitter, blogs, etc.) have been excluded from the current research. First of all, their different nature would require an entirely different approach to the media analysis. Furthermore, social media do not reflect the distribution of opinions in society the way national newspapers do. Rather, social media reflect special interests, and/or extreme positions of people willing and able to share their opinion with others. These opinions are not a reliable indication of general public perceptions and understanding of the technology which we want to obtain in WP5.3. Therefore, we decided to leave social media out of the current analyses.

4.1.2 Research Sample

The research sample includes all national daily newspapers: AD, Het Financieele Dagblad, Nederlands Dagblad, NRC.next, NRC Handelsblad, Reformatorisch Dagblad, De Telegraaf, Trouw, DeVolkskrant, and the free newspapers Metro, Spits and De Pers. The present sample also includes Parool, which is a newspaper for the Amsterdam region, and Agrarisch Dagblad, which is a specialist newspaper. Despite these newspapers being deviant in these respects from the national newspapers, we have decided to retain them in the sample, because we expect these newspapers to contain perceptions that are comparable with perceptions in national newspapers and because we expected more frequent discussion of CCS in a specialist newspaper.

Articles are retrieved from the database LexisNexis, www.lexisnexis.nl.
Data were collected using the following search string:

(CO2! OR kooldioxide! OR koolstofdioxide!) AND (afvang! OR opsla!)

This search string results from several rounds of data collection and pre-coding of parts of the material. We will not describe this process in detail, but we do think it is necessary to explain omission of the word 'transport' being the link between capture and storage. The initial search string contained the word 'transport!', but this yielded many irrelevant results. We have investigated if leaving out the word 'transport' in the search string would result in missing relevant articles about CCS. This was not the case.

For the present report we monitored from May 1, 2009, until the 31st of October, 2011, which is the end of the data collection period of the ICQ and knowledge test. The start date of the medialog is adjusted to the end date of the newspaper analysis conducted within CATO1 (Kliest, 2010, Van Alphen, 2011), from July 2006 until 30 April 2009. Using these studies as a reference, in particular the most recent one by Kliest (2010) en Van Alphen (2007), we have adopted a similar method for coding stakeholders, locations, and arguments. However, because the previous analysis had a different purpose we did not copy the method one on one. Rather than continuing a timeline of events and monitoring developments in stakeholder positions, we developed a methodology to assess to what extent national newspaper articles transfer knowledge about CCS and related concepts as measured in the Knowledge Test.

4.1.3 Defining and coding 'essential' Knowledge

To meet the aims of the media log and develop a codebook (see Appendix 4) for capturing essential knowledge, a definition of this concept was needed. The definition of 'essential knowledge' of CCS as 'being predictive of opinion' is a topic of ongoing research. To develop a solid working definition nonetheless, we approached this concept from three angles.

Firstly, we examined what constitutes complete, relevant, and correct information on CCS according to experts. To this end, we used three sources of expert information:

- The 'Argument map' of CCS (Argumentenkaart CCS, Kalshoven, 2010)
- IPCC report about most important barriers to ccs implementation (IPCC, 2005)
- Expert information and knowledge test from the ICQ conducted in 2010 (Paukovic et al., 2011)

Secondly, we examined what constitutes relevant knowledge from the point of view of respondents to the Knowledge Test (See section 3.2) and ICQ 2010 (Paukovic et al. 2011). We have used the quantitative results from the Knowledge Test and the qualitative results from the ICQ 2010 (i.e. responses to the open-ended questions about each CCS option and responses to the concluding interviews) to enable ourselves not only to determine to what extent the 'blanks' in lay people's knowledge match 'blanks' in transferred knowledge by newspapers, but also to determine to what extent lay people may have knowledge and thoughts that are different from what experts deem relevant and the extent of coverage of these in newspapers.

Thirdly, we sampled several months of news coverage from the medialog itself to see how CCS and related topics are covered. On the one hand, to ensure we would not waste time attempting to code information that turned out absent in all articles. On the other hand, to ensure that we would not forget to code of a new piece of information introduced by newspaper articles but overlooked by experts and lay people. To facilitate consistent coding of the contents of articles, we adjusted the wording of the items in the codebook to the way in which newspapers write about it and/or the way in which lay people talked and wrote about it in the interviews and open-ended

questions to the ICQ 2010. Development and testing of the codebook took several iterations. In the end, the codebook was put online and tested using an additional sample month that is not part of the present results.

After a year of coding CCS news articles, we adjusted several questions in the medialog because of newly gained insights. Several detailed questions were merged because of absence of information in previous coded articles and because of the gained knowledge from the Knowledge Test 2011 and ICQ 2010. Several detailed questions about effects, sources, causes and applications of CO₂ were summarized or removed as it was time consuming and did not render a lot of information. We also chose to summarize questions about the topic 'energy production and energy use', 'use of electricity', 'Climate change', and 'Climate skepticism'.

There were two topics added to the medialog because of events taking place which could be relevant for this study. The question about media coverage concerning international accidents with CO₂ was extended with coverage concerning the CCS site of Weyburn-Midale in Canada. Additionally, the coding of a governmental decision about CCS on land was added. Results were analyzed using Excel and SPSS. The codebook addressed the following topics:

4.1.4 Measures

The full codebook is included in Appendix 4 of this report. Below we summarize the measures relevant to the present report.

Basic Features of Articles

- Basic features of each article (e.g. date published, in which newspaper, number of words)
- Whether CCS is the main topic or a subtopic
- To which topics is CCS related (e.g. policy issues, economic issues, scientific issues)
- Coverage of events, stakeholders, and projects

Arguments of the following topics

- Pro's & con's Climate
- Pro's & con's Climate targets
- Pro's & con's *Energy supply*
- Pro's & con's Environment
- Pro's & con's Ethics
- Pro's & con's Safety
- Pro's & con's Economy

Evaluative Questions

- How is CCS is portrayed (positively, neutral, negative, or just mentioned)?
- Does the article contain signs of climate skepticism, e.g. that climate change is exaggerated?

CCS

- Capture mentioned and explained?
- Transport mentioned and explained?
- Storage mentioned and explained?

Similar to the Knowledge test, we investigated to what extent the following events were described and linked in newspaper articles:

Energy production and use

- Anything mentioned about why, how and for whom is electricity produced?
- Is mentioned or explained that a large percentage of our energy comes from fossil fuels, or that which source of energy accounts for which percentage in the energy mix?
- Does the article explain that fossil fuel use causes CO₂ emissions?

Climate change

- Is climate change discussed?
- Is temperature rise discussed?
- Is the greenhouse effect discussed?

Misconceptions

Does the article contain information about CCS or related topics that is clearly incorrect?

4.2 Results of the medialog

The following analyses have been conducted on the data from May 1, 2009, until October 31, 2011. This includes the period in which the public opinion surveys (ICQ and test of knowledge and attitudes) were conducted and thus encompasses messages and events that may have influenced survey responses.

4.2.1 Descriptives

The search resulted in 392 relevant articles with CCS as main topic, which is on average 13 articles per month. On average these articles contain 336 words, which is the equivalent of about almost three quarters of an A4-sized page of text. Of the 392 articles, 56 (14%) articles contain at least one illustration or photo. Of the articles, 320 (82%) are news or background items, and 34 of the articles (9%) are expert opinions or columns. The remainder of the articles are letters from readers, interviews, book reviews, or announcements of radio and television broadcasts on CCS. The large majority of the articles are focused on events in the Netherlands (370 articles or 94%), a much smaller group of articles has a worldwide scope (1%) or European scope (2%). The remainder of the articles is about specific countries or regions within or outside Europe.

Figure 5.1 shows the number of articles by newspaper. This chart shows that the free newspaper De Pers gives least attention to CCS, together with Het Parool which is focused on the Amsterdam region and Agrarisch Dagblad which is a special interest newspaper. NRC.Next often bases its' articles on articles from their main newspaper: NRC Handelsblad. The highest number of articles concerning CCS is found in Reformatorisch Dagblad, followed by Trouw and Het Financieële Dagblad.

Figure 4.1 Number of articles by newspaper

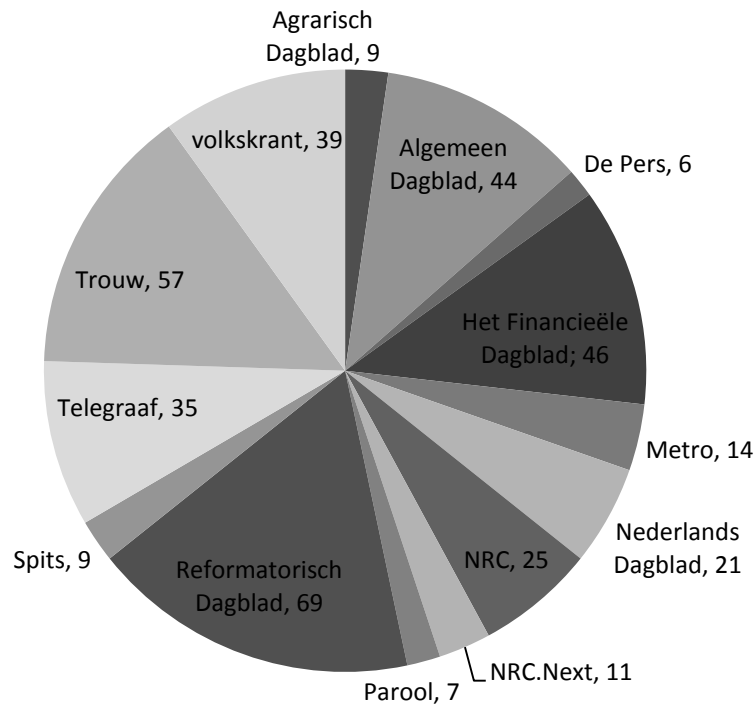


Figure 4.1 shows the total number of newspapers printed (which is called 'impressions') for all titles in 2011 (CEBUCO, 2011). The six newspapers in the Netherlands with the highest number of impressions and thus the largest audiences are De Telegraaf, Algemeen Dagblad, the free newspapers Metro, Spits and De Pers, and De Volkskrant. The graphic shows that there is a weak relation between the size of the newspaper and the number of articles it contains about CCS. The three titles that most often report on CCS have relatively few impressions, meaning that a relatively small group of newspaper readers is exposed to a relatively high number of CCS messages.

Figure 4.2 Impressions by Newspaper

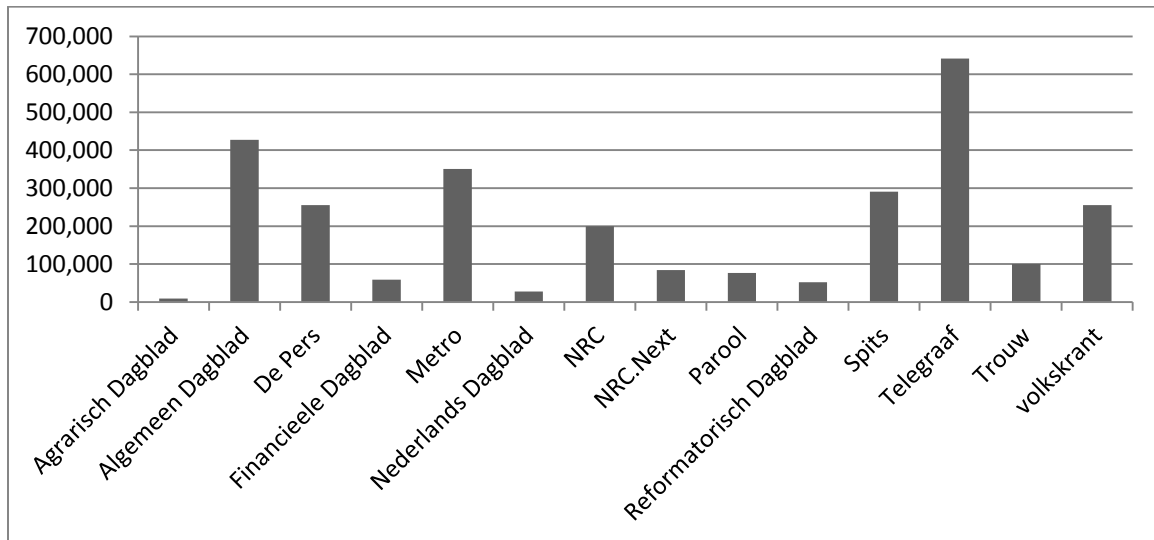
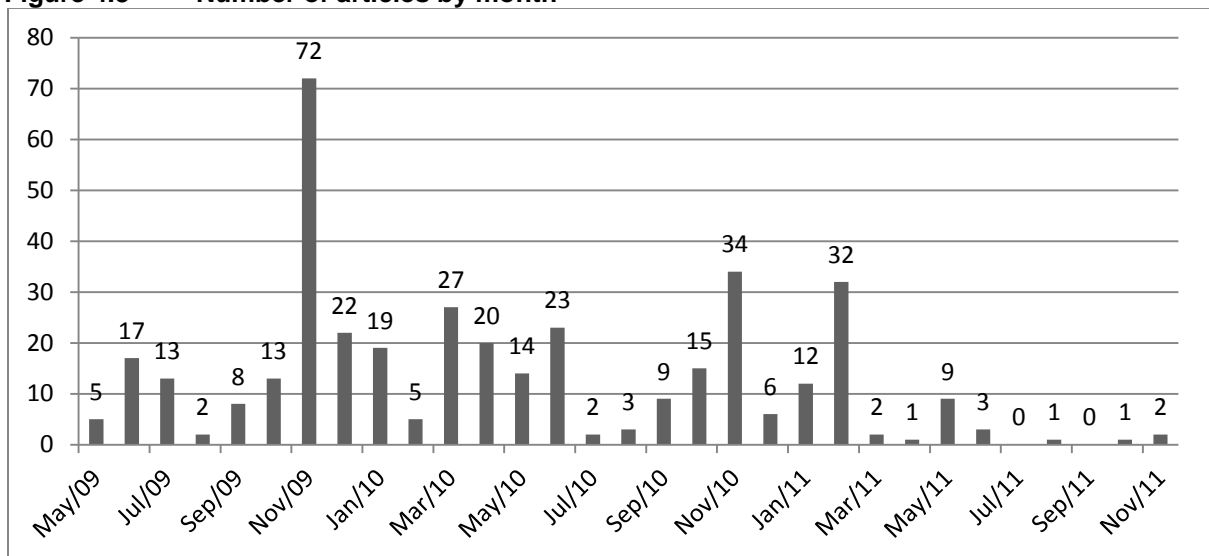


Figure 4.2 shows the number of articles by month. As his graph shows, the number of articles peaked in November 2009. When looking at the exact dates, we found that the peak days were November 19 and November 20. The related event is the announcement of the decision of the Dutch government to grant permission to the Barendrecht CCS project. After these dates, however, the attention to CCS quickly levels off to the same height as before the announcement of the governmental decision. Attention increases again in March 2010, after the fall of the government and the announcement that the CCS project in Barendrecht will be subject to a new law ('Crisis- en Herstelwet'). This law had already been announced early in 2009. In March, however, it was apparent that the law had been approved, would take effect on April 1st, 2010, and would apply to the Barendrecht project. The so-called 'crisis law' enables the government to bypass certain environmental and construction rules and procedures, thus speeding up projects thought necessary to boost the national economy. Application of the law to Barendrecht was said to disable the municipality of Barendrecht to protest against the plan. However, the media also reported that because the government has fallen in February 2010, the final decision about Barendrecht would be in the hands of a new government after the elections in June 2010. The announcement of the 'crisis law' and the postponement of a final decision, against the background of preparations for new elections in June, were followed by a period of discussion about the Barendrecht project and about CCS in general between, amongst others, experts, politicians, and project developers by the end of March 2010 and throughout April 2010. Two television items on CCS were broadcasted by the Dutch news shows Zembla (28-03-2010) and Netwerk (06-04-2010). In these shows, as well as in several newspaper articles, the suggestion was raised that scientists do not at all agree about, for example, the risks of CO₂ storage, and that scientists who are critical towards CCS are silenced. This gave rise to several debates in the second chamber which were extensively covered by the newspapers. April 2010 ended with a series of essays and interviews by several experts and stakeholder representatives. Topics are, amongst others: the activities and strategic choices of Shell; the safety of CCS; the importance of CCS for climate mitigation; and the costs of CCS. Then finally May 2010 is a quiet month, the only event being the announcement of the local authorities in Barendrecht of a 'principal decision' to say no to the project, which would be reinforced in June 2010.

The Dutch general public's opinion on CCS

After the announcement in June 2010, there are a few quiet months, after which two announcements of the government provides more articles in October and November. One of the announcements contains plans for CCS on land in the North of the Netherlands. These plans involve three locations, within several provinces. The last week of September the plans are announced, and the following months articles are published e.g., of residents of small towns who are anxious about the plans, and about how provincial representatives and local representatives of government are divided about the plans of the cabinet. The second announcement is the official decision of the new cabinet not to allow the CCS project in Barendrecht. The following months are again less dense, with a peak in the beginning of February; The minister of Economy, Agriculture and Innovation, minister Verhagen, announces a visit to the Northern provinces for meetings with several local government representatives. Afterwards he decides not to allow CCS in the Northern provinces, and not on land anywhere in the Netherlands. Instead he announces there will be looked at the opportunity of CCS under the sea. Several articles reflect on the decision of the minister and the related energy policies of the Netherlands. After that there are a few articles about CCS because of a visit to the Eifel of the researchers of CATO. The natural CO₂ storage of the Eifel is linked with CCS in the Netherlands. After that CCS is hardly mentioned as a main topic.

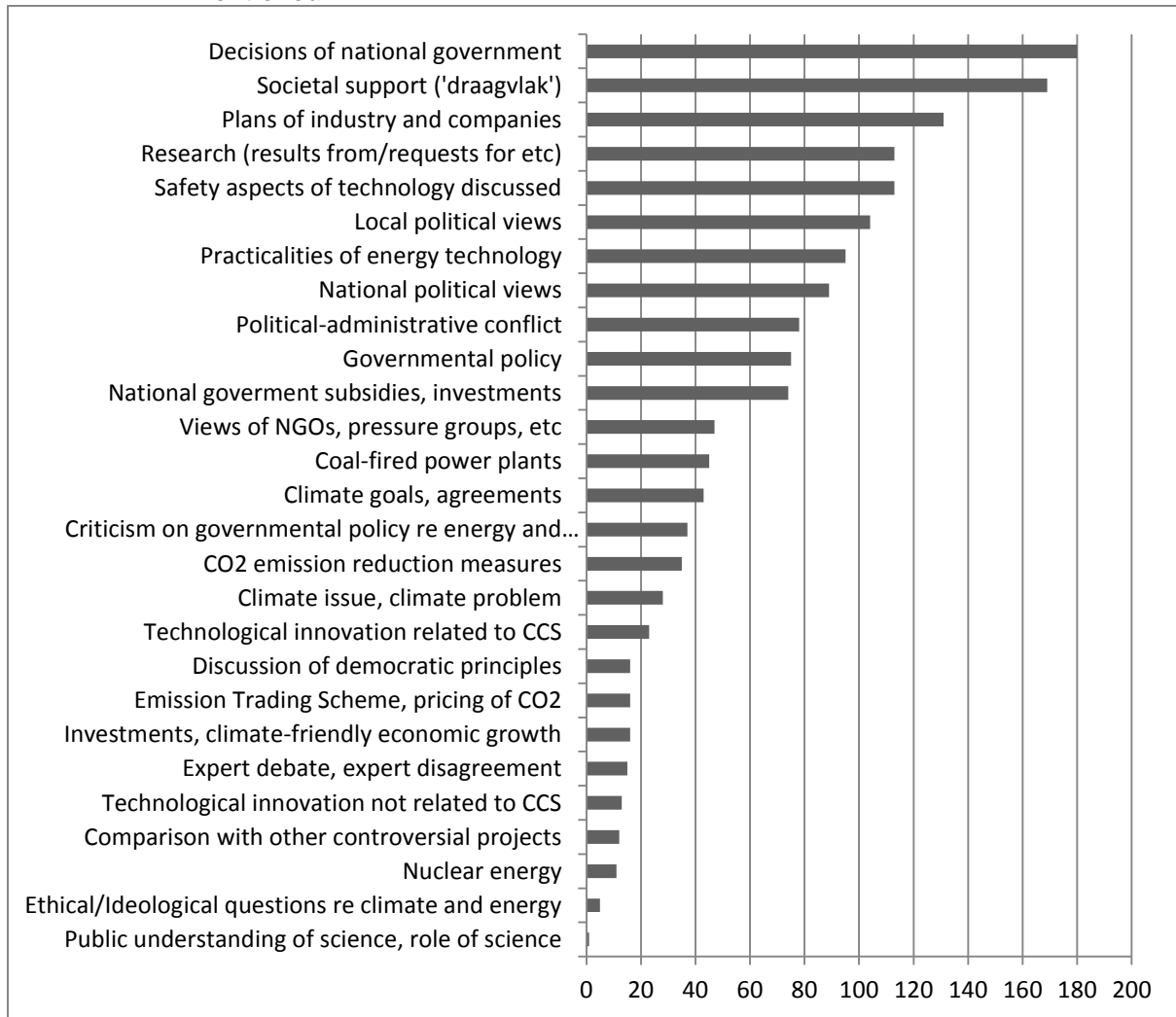
Figure 4.3 Number of articles by month



The Dutch general public's opinion on CCS

Figure 4.4 shows the frequencies with which CCS is related to particular subtopics. As this figure shows, CCS is most often discussed in relation to decisions of the national government (within 30% of the articles), public acceptance (26.5%), plans of industry and companies (25%), and views of local political parties (24%). Views of NGOs are a much less frequent topic (7%), as is climate change as a problem to which CCS is one of the possible solutions (less than 4%). In all, it appears that CCS is mainly discussed from an economic and political perspective and to a much lesser extent in the context of climate change and CO₂ mitigation.

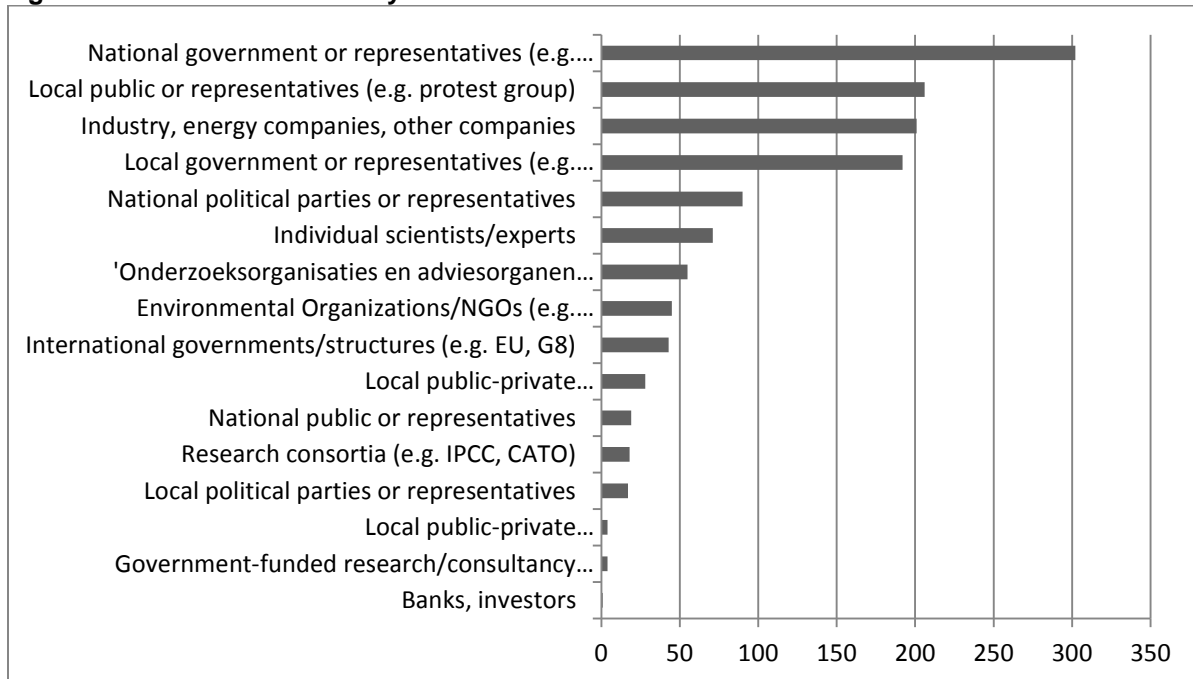
Figure 4.4 Main topics related to CCS and number of articles in which the topic is mentioned



4.2.2 Stakeholders, Locations, and Events

An overview of stakeholders and frequency of occurrence is mentioned in Figure 4.5. As this figure shows, the Dutch government is the most frequently mentioned stakeholder, followed by the local public, the industry and local government. This might be seen as an example in what way the media cover CCS; with political and local stakeholders, and less mentioning of research organizations or consortia, or the mentioning of experts.

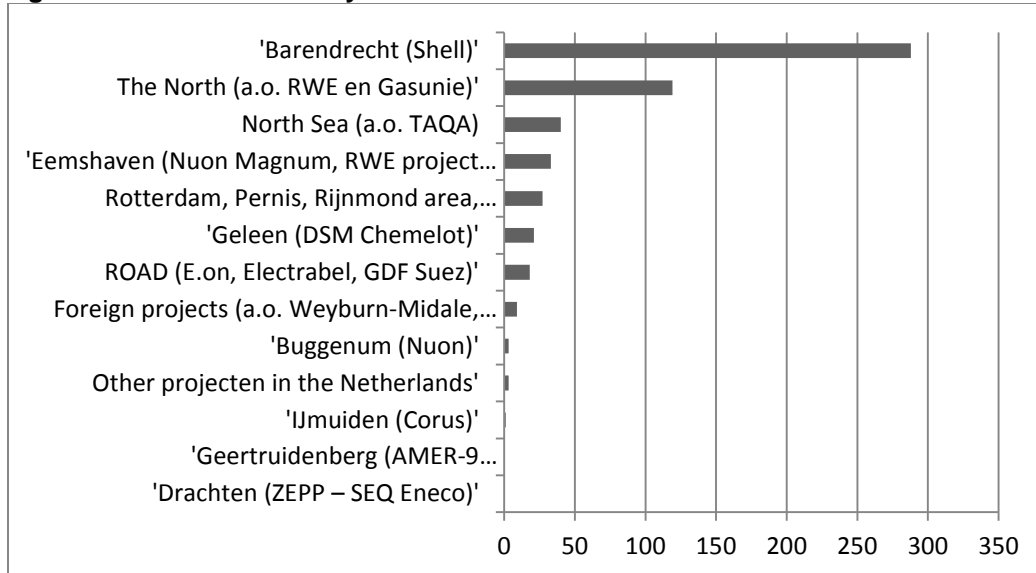
Figure 4.5 Stakeholders by number of articles



An overview of locations and frequency of occurrence is mentioned in Figure 4.6. As this figure shows, Barendrecht is mentioned most often by far; 51% of the total mentionings. Followed by the mentioning of the locations in the North of the Netherlands, where the second possible governmental plans for CCS storage were located.

Only 19 articles (5%) contain one or more references to previous accidents involving CO₂, such as lake Nyos in Cameroon (9 times), Mündchengladbach in Germany (7 times) and Weyburn-Midale in Canada (3 times).

Figure 4.6 Locations by number of articles



4.2.3 Argumentation and Evaluation of CCS

As we are interested in the use of arguments in the Dutch newspapers, we divided the arguments into several topics to see whether differences could be found amongst these topics. The seven topics for which arguments were mentioned positively and negatively are: Climate, Climate Targets, Energy supply, Environment, Ethics, Safety and Economy.

We found a total amount of 975 arguments. We coded 452 positive arguments (46%), and 523 negative arguments (54%), which shows that there is a tendency for the use of negative arguments. Figure 4.7 shows the use of positive and negative arguments for each Dutch newspaper. The differences between the use for positive and negative arguments are balanced for most newspapers, with three newspapers showing a tendency to use more negative than positive arguments (The Reformatorisch Dagblad, the Trouw and the Volkskrant). But when comparing the newspapers, only the tendency of using negative arguments for these newspapers was found.

Figure 4.7 Use of arguments per newspaper

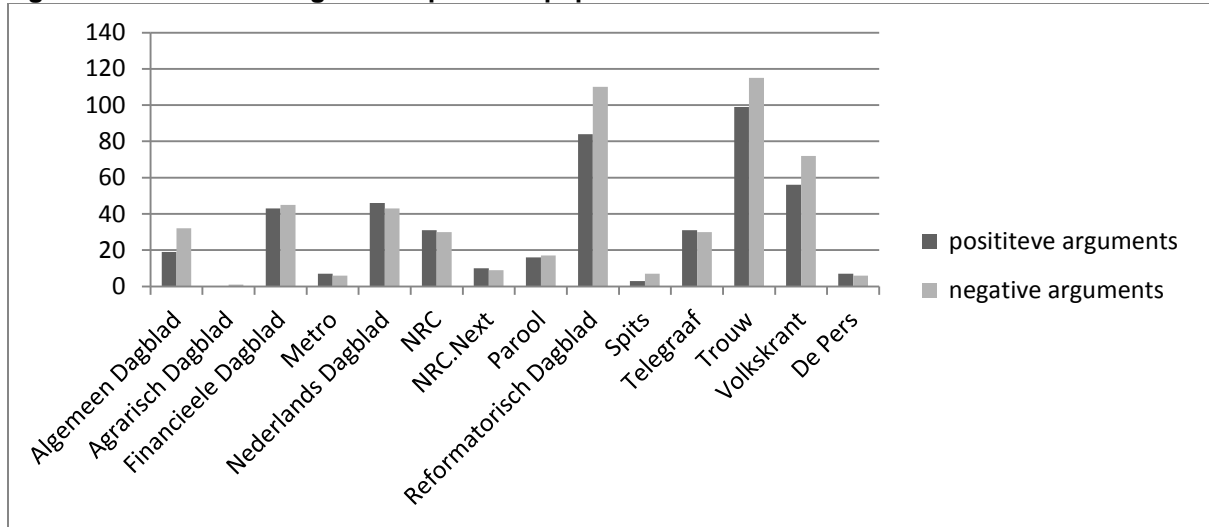
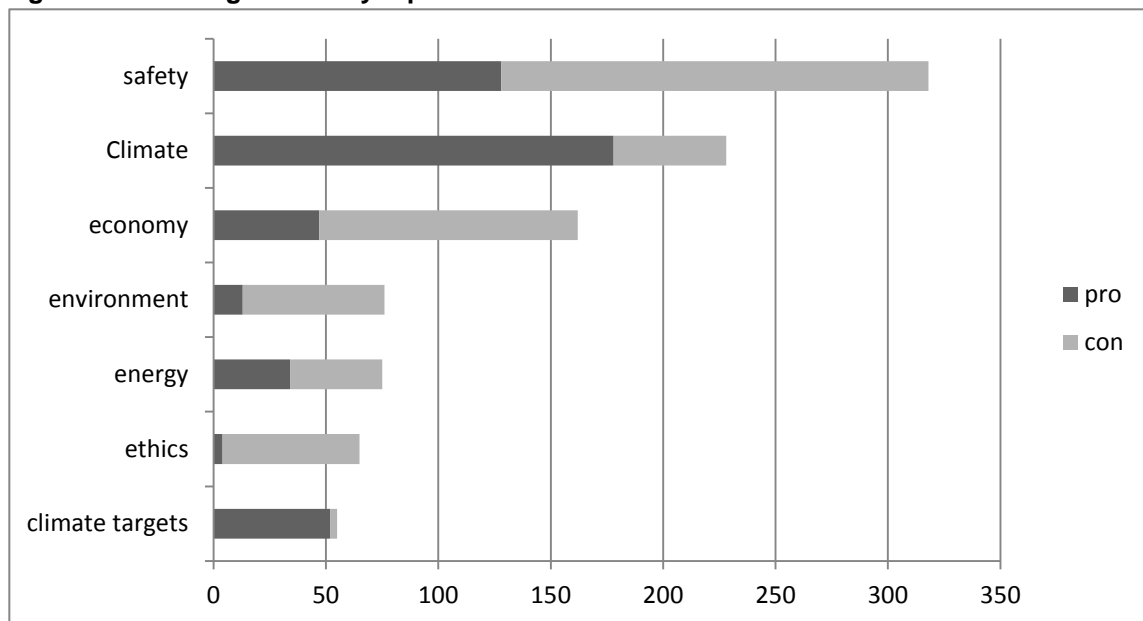


Figure 4.7 shows the total arguments used per topic, and the differentiation between the use of positive and negative arguments within a topic. As can be seen in Figure 5.8, the topics Safety, Climate and Economy are mentioned most as arguments. The arguments of these topics combined, add up to 73% of all the arguments. For all topics we will address the arguments which are mentioned most, therefore some arguments will not appear within these results because of their small numbers of mentioning.

Figure 4.8 Arguments by topic



Safety

Safety as a topic, is mentioned mostly of the seven topics, 320 arguments of the total 975 arguments (33%). There are more negative arguments used against CCS, in comparison to

The Dutch general public's opinion on CCS

positive safety arguments (190 negative vs. 130 positive). The positive argument which was mentioned most (61 times, 47% of all positive arguments) was 'CCS is safe/effects are known/technologically reliable/a proven technique', followed by the argument which was mentioned 15 times (12%), coded if one of these sentences was mentioned; 'research (or research calculations) shows that the risk is within (acceptable/legal) norms. The risk is mostly theoretically. The risk is very small. The risks are controllable'. Two arguments were mentioned 8 times (both 6%) 'there are already successful (pilot) projects around the world' and 'gas fields have been proven gastight, gas is stored in these fields for millions of years'.

From the negative arguments one argument was mentioned most, namely 70 times (37%). This argument contained the following statement: 'CCS is unsafe/ risks of CCS are unknown/CCS is too complex, consequences are unpredictable (implication that safety cannot be guaranteed)/ residents are concerned', the argument 'Concerns for leakage to the surface' was mentioned 26 times (14%), 'CCS is dangerous for public health' 20 times (11 %) and the negative argument 'CCS has never been applied on a large scale, or never as the current project, or only separate parts of the chain of CCS have been applied' was used 19 times (10%)

Climate

The topic 'Climate' has more use of positive arguments (178 times mentioned vs. 50 times mentioned). The positive argument used most is 'CCS reduces CO₂ emissions', 42 times (24% of all positive arguments), but this does not mean that any further explanation is given about how does works. 'CCS limits the temperature rise on earth' mentioned 25 times (14%), 'CCS is a necessary part for a transition to a sustainable economy' 24 times (13%), 'CCS reduces greenhouse gas emissions' 23 times (13%), 'CCS helps against climate change' 21 times (12%), but only 3 times (2%) was the argument 'CCS helps reducing the reinforcement of the greenhouse effect' mentioned. The argument 'reduction of polluting emissions/improvement of air quality' is used 18 times (10%). Of the negative arguments, the argument 'CCS legitimizes the built of new coal or gas powered plants, but without mandatory regulations for CCS, these power plants will continue emitting just as much CO₂' was used most (12 times, 24%), together with the argument 'The advantages or effectiveness of CCS is uncertain, or not enough', also named for 24% of the negative climate arguments. 'The climate problem can be solved without CCS (e.g. saving energy, sustainable energy, nuclear energy, etc.)' is mentioned 10 times (20%), and the argument 'There is no climate change/it is uncertain there is a climate change, therefore CCS is not necessary' was mentioned 5 times (10%), and 3 times (6%) the argument 'CCS is not yet ready for large scale implementation'

Economy

There is a distinct difference for the use of positive and negative arguments for the topic 'Economy' (47 vs 115 mentionings). There were five positive arguments used mostly relating to the topic economy. The argument 'Business opportunities (business can market the knowledge, technology and storage capacity/CCS can be good for companies to make money)' was mentioned 13 times (28%), 'The Netherlands have a head start (or can get one by investing) with applying or developing CCS in comparison to other countries' is mentioned 10 times (21%), 'the Netherlands have a good starting position' and 'the Netherlands have good capacity storage' are both mentioned 9 times (both 19%) and the argument 'CCS creates employment/good for the local economy' was mentioned 7 times (15%). From the negative arguments, the most named argument was 'CCS has a potential negative effect on prices of local houses', with 43 times (37%). The argument 'CCS is too expensive/there are cheaper alternatives available' was used 28 times (24%), 'CCS can only be realized with governmental money (subsidies; from EU or national)' 19 times (17%), CCS is only realistic in combination with international agreements about CO₂ emission reduction, and a good price for CO₂ in the ETS' 14 times (12 %).

Environment/surroundings

The only positive argument mentioned was 'there are eligible storage locations/reservoirs available' and it was mentioned 13 times. Negative arguments were used most, with 'Discussion about suitability of storage sites or capacity' used 28 times (45%), 'Storage on land/under densely populated area', 22 times mentioned (36%) and 'CO₂ is a waste product, you shouldn't/can't put that in the ground' named 5 times (8%), and 'challenges for the infrastructure, or infrastructure not available yet, or lots of adaptations are needed (pipelines, transport by road or ship) was mentioned 4 times (6%), and 'Challenges location selection (space needed, population density)' was mentioned 3 times (5%).

Energy

The topic 'Energy' is reasonably balanced between positive and negative arguments (34 positive vs. 41 negative). The positive argument used most was 'CCS is a good transition technology, which buys time for renewables to be implemented on a large scale', used 22 times (65%). The positive argument 'CCS is the only manner of continuing to use fossil fuels (coals, etc) and at the same time reduce emissions (clean fossil)' was mentioned 10 times (29%). Most negative argument used was 'the energy penalty: CCS costs extra energy, therefore the efficiency of a power plant will be lower, and/or the recourses of coal and/or gas will diminish faster', mentioned 24 times (59%). The negative argument 'CCS will go at the expenses of investments for renewable energy/CCS will hinder the large scale implementation of sustainable energy' was mentioned 13 times (32%).

Ethics

For the 'Ethics' topic, we found hardly any positive arguments used in the national newspapers. Three times the argument 'local demonstration projects serve a national interest' was mentioned, and only once 'acting on climate change is a moral issue, not a political issue'. The most negative arguments mentioned for 'Ethics' were 'There is not enough support for CCS/there is lack of confidence regarding law and regulation on CCS' 23 times (38%), 'the choice for CCS is a financial one, there is no attention for issues as safety and support', 17 times (29%), 'CCS is "green washing" fossil fuels, companies use it to legitimize the current way of producing energy', was mentioned 6 times (10%).

Climate targets

Newspapers mention significantly more positive arguments on the topic 'Climate targets' compared to negative arguments for this topic. Mentioned by far the most was the positive argument 'CCS contributes to realizing (international) climate targets'. It was mentioned 46 times (88%) and the other 12% was the argument 'CCS helps to realize environmental targets'. The only negative arguments coded were 'the permissiveness for companies is too large. Only the ETS will not motivate companies to get companies to go for CCS' and 'CCS is useless if developing countries will not change their behavior'.

Associations

Positive associations, such as 'environmental solution' or 'clean coal', were found in 37 articles (9%). Negative associations, such as 'no real solution', 'controversial project', or 'dumping' were found in 151 articles (39%). We like to note that this number includes instances of conflict (e.g. 'a slap in the face', 'Shell's powerful lobby') mentioned by opponents to CCS in Barendrecht, which we also coded as negative associations. These associations arguably pertain to the process of project development rather than to the technology per se. However, perceptions of the process are likely to transfer to perceptions of the technology. We coded the times CCS was mentioned in combination with the words 'test', 'experiment', 'demonstration project', or 'pilot'. These descriptions were mentioned in articles 183 times (47%). This might implicate the association of the technique being experimental and perhaps not safe.

The overall evaluation of CCS in the article was derived from the presence of arguments, the number and type of arguments, the presence of positive or negative associations, choice of words in title and body of the article, and tone of voice. In 11% of the articles CCS is evaluated positively, in 32% of the cases negatively, and 56% was neutral because of the article being balanced, or with just the mentioning of CCS within a short article. We analyzed whether the number of positive and negative articles differed by newspaper. The 4 titles with the smallest number of articles were not included in the analyses since results could otherwise not be interpreted.

4.2.4 Newspapers as a source of misperceptions

In 20 articles information was encountered of which the correctness can be questioned or which could induce misunderstanding by the way it was written down. For example, it was mentioned that CO₂ would be transported through an existing pipeline whereas transport would take place through a new pipeline within an existing corridor of pipelines. However, few instances of bare nonsense were found. Expressions that may possibly give rise to misperceptions (it is a topic for further research if they indeed do) were found 90 times in 392 articles. The most often occurring expressions were:

- 'CO₂ storage in the soil' (sounds as if storage is just below the surface)
- '(back) into the sea' (sounds like CO₂ is pumped directly into the sea).

This implies that in a substantial part of the articles contains an expression which might give rise to misperceptions about CCS storage. Even though misperceptions might be in news paper articles concerning the depth of storage, Brunsting, et al. (2011, NEARCO₂) found that the attitude about CCS, was not influenced by correctly knowing the depth of storage.

4.2.5 CCS in context

We also investigated in what way and to what extent CCS is linked to other climate and energy issues such as climate change, energy production, energy use (in particular electricity), and CO₂ emission reduction measures. As noted in the method section, we summarized and deleted several knowledge questions because of the focus of this study on arguments and associations used within newspaper articles, and to a lesser extent on the details of related topics.

CO₂

In 232 of the articles (59%), some explanation is given about CO₂. This explanation is limited in the majority of cases with the feature of CO₂ that is mentioned (e.g. 'same as carbon dioxide', or 'greenhouse gas').

In 23 articles (6%) there is mentioning of a relationship between fossil fuels and CO₂ emissions. We coded the articles if there was a clear relationship between the use of fossil fuels and CO₂ emissions; if there was mentioning of a electricity central which emits CO₂, but there was no mentioning of what the fossil fuel it uses, we did not consider this as a valid explanation of the relationship between fossil fuels and CO₂ emissions.

Energy production and use

We found only 32 (8%) of the 392 articles mentioning something about the subject of energy production and energy use. We coded articles which mention why energy is being used (electricity, fuels, heating) or for whom (e.g. companies, households), growing energy needs, or the availability of fossil fuels.

Carbon Capture, Transport, and Storage

283 articles (72%) mention either the capture, transport, or storage part of the CCS chain. Storage of CO₂ is mentioned in 269 articles (69%). Capture of CO₂ is mentioned in 97 articles (25%). Transport of CO₂ is mentioned in 49 articles (13%).

Of the 49 articles mentioning transport, most articles mention pipeline (41 times, 10%) as method of transport. Ship as a means of transportation was mentioned only 5 times (1%), and transportation by truck just 4 times. Twenty-two articles (6 %) mention further details of transportation, such as where transport takes place, or what kind of pipeline is used.

Of the 269 articles mentioning storage, by far the most frequently mentioned method of storage is in an empty gas field (182 articles or 46%). In 130 articles (33%) the terms 'underground' or 'below the surface' were mentioned as to where the CO₂ would be stored.

With 35 articles (9%) it was mentioned that CO₂ would be stored 'under the sea' and 17 articles (4%) mentioned 'in the sea'. Further details about storage are found in 46 articles (12%). Further specifying the location of potential storage sites, 264 articles (67%) mention an onshore site, 51 articles (13%) mention an offshore site, and 51 articles (13%) mention both. For the remaining 7% of the articles it was not mentioned. Storage on land is mentioned significantly more often than off-shore storage (land $M = 0.67$, off-shore $M = 0.12$; $t(1, 360) = 20.91$; $p < .001$).

Climate change, Greenhouse effect and Climate skepticism

The words 'climate change' or 'temperature rise' are mentioned in 50 articles (13%). This means that one of these two topics is mentioned at least one time in an article. There is an explanation that CO₂ contributes to climate change and/or temperature rising in 98 of the 392 articles (25%). This is explained by the fact that we coded 'CO₂ is a greenhouse gas' also as an explanation that CO₂ contributes to climate change or temperature rise.

The greenhouse effect is mentioned in 6 articles (1%), but only 1 of these articles explains what this term means. The phrase: 'helps to counter the greenhouse effect' (instead of merely mitigating it) suggests that the greenhouse effect in itself is a bad thing. This phrase was, however, only encountered two times. It appears that the term is too complicated to mention and explain in a newspaper article, and better be avoided.

Climate skepticism is also found in 5 articles (1%), all of which propose that the climate is not changing as fast as scientists claim or that its effects will not be as averse. Additionally, 1 article states that the influence of men in curbing climate change is overrated and another article mentions that there is nothing men can do to prevent climate change.

5 Comparison of the Knowledge and Beliefs Test results with the medialog

To investigate which relations (if any) exist between media use and other characteristics of the public such as general interest in climate/energy issues, knowledge, attitudes, and particular beliefs, questions about media use have been included in these surveys. Results have been reported in section 4.2. Below we will relate results of the Knowledge and Beliefs Test to results of the medialog as reported above. Overall patterns found amongst knowledge and awareness of respondents and results from the medialog will be discussed.

One of the most noticeable results of the medialog is the fact that in most of the articles CCS is discussed in relation to a specific project. In 2010-2011 this was specifically in relation to the project in Barendrecht, a project most respondents in the previous Knowledge and Beliefs Test, who had heard of CCS, had heard of. This result indicated that possibly most respondents hear about CCS only through information that reaches them about specific project plans. In the current edition of the Knowledge and Beliefs Test respondents' awareness of more recent CCS project than Barendrecht plans was tested; those off-shore under the North Sea. The relation between awareness of CCS in general and these specific project plans was lower than previously found with awareness of the Barendrecht plans. Of those who have heard of CCS, 48.8% have also heard of plans for CCS in the North Sea. In the previous test, 76% of respondents who has heard of CCS had heard of project plans in Barendrecht. This decrease mirrors the lower attention in the media for project plans in the North Sea compared to the project plans in Barendrecht in the past. Nevertheless, it is likely that still most people who have heard of CCS have heard it in news about high profile project plans, such as Barendrecht, although the current project plans are likely to attract less attention.

When it comes to knowledge and misperceptions found in the Knowledge and Beliefs Test, several points in relation to the medialog can be made. The most often conveyed knowledge about CO₂ and CCS in the media is also what is generally best known by respondents. About CO₂, newspaper articles most often say it influences the climate, which in the test is stated correctly by 84% of the respondents. Hardly any misconceptions about CO₂ are conveyed in the media, while results of the KBT show that in reality many misconceptions exist. As for sources of CO₂, in the media in about 10% of the articles fossil fuels are in some way mentioned, but the actual fuel is rarely specified. A majority of respondents does associate at least one of the fossil fuels with CO₂ emissions, however they often do not know accurately about all of the fuels whether they emit CO₂ or not.

Even though newspapers do not convey any misperceptions found amongst lay people in the Knowledge and Beliefs Test, they also do not inform people about these issues. For example, very little attention is given to the fact that CO₂ is *not* explosive. Information about knowledge gaps lay people have about the natural properties of CO₂ is also usually absent, such as the fact that CO₂ is in the air around us or that we exhale CO₂ ourselves. Results of the Knowledge and Beliefs Test show that a large part of respondents did not know and ascribe to all parts of the causal chain from fossil fuel use in electricity production to the occurrence of global warming. The analysis of newspaper articles showed that most of the time when any of these steps was mentioned it only pertained to a part of the causal chain. The article would either mention the influence of CO₂ on the climate or the link between energy production and CO₂ emissions, but rarely the complete picture.

Awareness levels of CCS found in the KBT do not seem related to the newspapers that report most about the topic. While only Volkskrant and NRC readers tended to have heard of CCS more

The Dutch general public's opinion on CCS

often, these are not the top three newspapers in terms of articles on CCS. As for CCS knowledge, there is some correspondence between reporting on CCS and knowledge found amongst the public. Most respondents believe CO₂ will be stored in underground rock formations and indeed, the fact that the CO₂ would be stored in depleted gas fields is the most often mentioned storage option in newspaper articles. A lot of people, however, also believe the CO₂ will be stored in underground cavities or caves. This might indicate that although specific geological formations where CO₂ could be stored are mentioned, they are not explained in newspapers. Another similarity is that storage on land is mentioned much more often than off-shore storage. Respondents indeed perceived off-shore storage to be a much more unlikely storage for CO₂ than storage on land.

Climate change mitigation as an aim of CCS is not mentioned very often in newspapers in absolute terms, even though relatively it is the most often mentioned reason for CCS. Most respondents in fact do believe this to be a plausible goal of CCS. Nevertheless, as mentioned previously, respondents also select a lot of other environmental problems as possible aims of CCS. Even though the newspaper articles rarely convey any erroneous information about the aims of CCS countering air pollution is mentioned several times or it is said to do something for "the environment". This term is often used instead of "climate change" or "global warming". Possibly people then confuse different environmental problems with the climate change problem. The largest portion of respondents in the KBT perceived a decrease in nearby property values to be a likely consequence of CCS. This is also a relatively often reported argument in the media. Another correspondence found between arguments reported in the media and respondent's beliefs is that CCS can play an important role in helping the Netherlands reach its climate goals. A relatively high number of respondents agreed with this statement, and it is also a relatively often mentioned argument in the media. The same is true for the argument that CCS is not developed enough for large scale use and its consequences are not well known. A discrepancy is found with respect to trust. While respondents in the KBT displayed high levels of trust in regulation and monitoring of CCS, in the media these issues are hardly discussed. When it was discussed, this was often in negative terms, reporting worries about long term monitoring and lack of strict and accurate regulations.

The attitude towards CCS, found in the survey, is in par with the portrayal of CCS in the media. People's on average neutral attitude is reflected in the media, where a majority of articles portray CCS in a neutral way and no significant differences were found between the use of negative and positive arguments. There is, however, a discrepancy regarding the topics that influence people's attitudes and their occurrence in the media. Safety is at the top of most often mentioned arguments about CCS and topics that it is related to. It is indeed also the second strongest predictor of people's attitude towards CCS. Nevertheless, the strongest predictor, perceived benefits, is mentioned less often in the media.

6 Conclusion

The Netherlands, just like most other countries, are faced with a changing energy system and many possibilities to handle different problems and opportunities. How the public views these issues can be of crucial influence on decisions made for future energy systems. But how involved is the public in fact in these matters? Earlier research in CATO, the Dutch program for CCS research, showed a major lack of awareness and knowledge of the public, not just regarding new energy technologies such as CCS, but also regarding current energy issues such as current use of fossil fuels and its relation to climate change (De Best-Waldhober et al. 2009; Paukovic et al., 2011) These studies also show that although respondents base their opinion for a large part on the information from experts that was provided during these studies, part of their opinion remains unexplained and is therefore based on beliefs or arguments that were not mentioned by experts. For both the prediction of future opinion and effective communication that fits the need of the public, however, it is essential to gain understanding what constitutes the base for the unexplained part of people's opinion.

In the reported study we investigated this by (1) examining people's current knowledge and beliefs about CCS by administering a survey without any information to a representative sample of the Dutch population and (2) by analyzing exposure and perceptions on CCS in the media. The survey was an extended version of the Knowledge and Beliefs Test administered in 2010 to a sample of the general Dutch population, which was based on interviews with Dutch laypeople. Not only was the sample of the population enlarged to a sample size that ensures representative results, but the survey itself was extended to reflect current CCS related developments in the Netherlands, such as offshore storage and transport.

The current report therefore described two studies that go beyond earlier studies in gaining understanding of the public view on CCS and energy innovation in the Netherlands.

6.1 Public Knowledge

The results of the second Knowledge and Beliefs Test largely confirmed results found in the 2010 version of this survey. This study first of all showed large numbers of respondents who are unsure about the characteristics, effects and sources of CO₂. Of a large number of statements a third or more of the respondents did not know what the correct answer was. For example, 31% of the respondents are unsure whether CO₂ is harmful in contact with skin. The characteristics of CO₂ that have a substantial percentage of people in doubt are whether CO₂ is explosive, emits radiation or makes a livable climate on earth possible. A small percentage is erroneously convinced of several harmful effects of CO₂ that have no scientific basis. Furthermore, there is much doubt about the sources of CO₂. Around a third, sometimes up to half of people do not know whether CO₂ is released when old batteries leak, when we exhale or during the use of spray cans. Most striking though is that there is quite a bit of confusion among the Dutch public as to our current energy use and its' relation to climate change. A large majority of people state to have some idea of global warming and understand that CO₂ emissions influence climate. It was also found that the percentage of people who believe the average temperature is getting warmer has increased significantly since the last measurement. Nevertheless, again, only a minority of people can give a reasonable estimate of how much fossil fuel is used in the Netherlands, or can answer correctly that the use of gas or coal for electricity production produces CO₂. Even when the analyses are much less restrictive and answers that are near correct are counted as correct, still, only around a quarter of people understand all four steps. This has major implications, not just for the possible use of CCS in the Netherlands, but for other technologies or options as well. If the vast majority of Dutch people do not understand where CO₂ emissions come from and in what amounts, it is less likely that they will support any action towards emission reduction or even take action themselves. It also implies that many people do not understand the major benefit of several mitigation options, which makes it harder to justify any disadvantages. The authors of this

report therefore strongly advocate the development of national effort to close this knowledge gap as much as possible in the Netherlands.

6.2 Trends in public awareness of CCS 2007 – 2011

People's awareness of CCS has been measured in the Knowledge and Beliefs Test in 2010 and 2011, as well as in earlier CATO studies, providing opportunity for longitudinal monitoring of awareness development. The previous studies showed an increase of awareness in 2009, with the percentage of people that claim to know a bit about CCS or specific CCS technologies rising from around 25% in 2004-2008 to around 30% in 2009 (De Best-Waldhober & Daamen, 2011; De Best-Waldhober et al., 2008). Compared to the sample in 2009 receiving a similar, though not identical, question, the percentages of the sample that state to know a little bit decreases in the 2010 survey of the Knowledge and Beliefs Test (KBT), but the percentage that states to know quite a bit increases substantially from 10% to 38%. In the current 2011 edition of the KBT adapted answer categories revealed interesting results when compared to the previous study. The percentage of people who had never heard of CCS remained exactly the same, but a substantial amount, 27%, chose a newly added category, indicating they had heard of CCS, but did not actually know what it is. The results suggest this is the same amount of people that previously indicated to have heard a little bit about CCS. Only 3% in this study indicated to know quite a bit about CCS. It seems, therefore, that the rise in awareness observed in the last few years has not necessarily led to a rise in self-reported knowledge, and a majority of the population still states they do not know what CCS is or that they have never heard of it. This corresponds with the lack of change in knowledge levels that are again found in this study.

6.3 Lay attitudes towards CCS

Compared to the previous 2010 measure, lay people's attitudes towards CCS remained the same and are on average very neutral. People's opinion about implementation of CCS in The Netherlands is more negative than their overall attitude, although only slightly so. They are, however, significantly more negative about implementation in their neighbourhood and under the seabed of the North Sea.

Regarding the public awareness of the necessity of CCS, one might argue that a belief in man-made climate change could be a necessary prerequisite for supporting the use of CCS technology. However, as in previous studies, we found no relation between the attitude towards climate change and the attitude towards CCS. Knowledge about the aims of CCS was also hardly related to people's opinion of it, nor was their knowledge of the share of fossil fuels or renewable energy in the electricity mix.

Structural equation modeling revealed that people's attitude towards CCS was best explained by whether they perceive CCS to have benefits, such as its necessity for climate change mitigation, help in meeting climate change targets and potential for the Netherlands to gain technological advantage. The next best predictor were people's perceptions of risks related to leakage of CO₂ and the possible effects. People who perceive the risks of the CO₂ escaping, the storage exploding and subsequently people suffocating as higher, are more negative about CCS. Similarly, people who perceive CO₂ transport to be less safe are more negative about CCS. Interestingly, when it comes to the CCS attitude of the general public, trust in monitoring and regulations is not a very strong predictor. This is different from the results found in research of local public's acceptance of CCS projects (Terwel, 2011; Ter Mors, 2010) where trust often proved to be one of the most important aspects in people's perceptions of CCS.

Misperceptions and knowledge of CO₂ proved to have an important, although indirect, effect on CCS attitude. The direct effect was very low, but the misperceptions did influence people's judgments about safety of transport and risks of leakage. The more misperceptions people had, the higher they perceived the risks to be, which in turn made them more negative about CCS. These misperceptions had no relation to people's perceptions of the benefits of CCS. These findings indicate knowledge of CO₂ plays an important role in judging the risks of CCS. It also means that access to reliable information about CO₂ could be helpful for people near proposed transport or storage who are worried or even scared about the risks

6.4 Medialog

One of the most significant conclusions after analyzing the Dutch newspapers on arguments and knowledge transfer concerning CCS, is the focus on events and people, rather than on processes and detailed knowledge. Most mentioned stakeholders are government representatives, and local public or representatives, where government decisions and societal support are the most used topic in relationship to CCS.

The timeframe of when articles are published, shows the peaks of media coverage around governmental plans and decisions concerning CCS, but these articles published around the events do not transfer abundant contextual knowledge as to how CCS works or why. The newspapers Reformatorisch Dagblad and Trouw mentioned most arguments, but have a relative small edition of published papers. This might imply that a relatively small group of the Dutch population is informed well, or at least more frequent, compared to other newspapers, where the readers of free newspapers (which is a relatively large group) have small chance of getting information on CCS.

A conclusion based on the argument analysis is that the arguments used, differ per topic and differ between positive and negative arguments within a topic. When looking at the arguments mentioned by the Dutch newspapers, several conclusions might be drawn; The amount of arguments used for all newspapers differed between the use of positive and negative arguments. There were more negative arguments used overall, and newspapers published more negative associations as well. We evaluated more articles negatively than positively, but most articles were still evaluated neutral, which implies there is a tendency for using more negative arguments, but the overall 'tone' of the articles wasn't as colored as might appear. We realize this conclusion might be subject to discussion; the coding of articles is not completely objective because the choice of coding is still a consideration, not completely free of interpretation.

Regarding the use of topics for the arguments, several findings emerged: arguments of three topics were mentioned most (safety, climate, and economy), and the use of positive versus negative arguments differed per topic. For the topics climate, and climate targets more positive arguments were mentioned, such as 'CCS reduces CO₂ emissions', whereas for the topics safety, economy, ethics and (local) environment more negative arguments were mentioned, such as 'CCS is unsafe' and 'CCS has a potential negative effect on prices of local houses'.

Even though we coded a substantial amount of positive arguments regarding climate issues, this did not mean we found the same for the related transferred knowledge in articles. For the transferred knowledge concerning related topics of CCS, such as energy production and the greenhouse effect, we found relatively small mentioning, which relates to the fact that articles are usually focused on events and people, not the additional context which might have a more informative character.

6.5 Summary conclusions

Summarizing we can state that the results of these studies give several valuable insights in the public view on CCS with substantial implications for future policy and communication efforts. First of all, the knowledge and beliefs test made abundantly clear how much doubts and knowledge gaps there are amongst the general Dutch public regarding our energy system, CO₂, climate change and CCS. Only very few people understand how our current use of fossil fuels leads to CO₂ emissions which lead to climate change, even though almost all people state to know about global warming. Several misconceptions that were shared by a major percentage of people were revealed. The results from the survey in 2011 are largely the same as the results from the survey in 2010, showing no significant increase in knowledge level.. It can be argued that the knowledge gaps found in this study are not influential to attitudes towards CCS alone. If the general population does not understand the problem our society faces when we do not mitigate CO₂ emissions, it will be extremely hard to get their approval of any kind of CO₂ mitigation option, be it large wind turbine parks or home renovations to improve energy efficiency.

The medialog showed that the discrepancy between trends in public awareness and knowledge is consistent with what is described in newspaper articles mentioning CCS. Only very few articles explain the rationale for CCS, hardly mentioning climate change or the fact that over 90% of our energy comes from fossil fuels. Most often mentioned are specific CCS project plans with an emphasis on the persons and events without explanation of the technology itself. The arguments used in Dutch newspapers are balanced, though slightly more negative arguments were mentioned. Our analyses do not yield evidence that national newspapers reinforce or create particular misperceptions as found in the knowledge test. However, they also do little to correct misperceptions or fill the 'blanks' in people's knowledge. That said, we do not state that this should be a primary task of newspapers. News media and information media are two very different things. However, it is one of the tasks of journalists to take into account their readers' level of comprehension of the issue they write about. Since our research has shown that most people have little knowledge on the topic, it could be argued that news articles on CCS may need to be enriched with a bit more context information to be understandable for and not to mention appealing to a wider audience beyond people who are already knowledgeable about CCS.

7 Implications for communication: consequences of the current findings for earlier communication strategy advice

Parallel to the 2011 report on the first Knowledge and Beliefs Test, we provided a communication strategy advice to increase knowledge levels among the general Dutch population about CO₂ and CCS. (Brunsting et al. 2011 <http://www.co2-cato.org/publications>) Three strategies were provided by which beliefs about CO₂ and CCS could be addressed: A strategy to change wrong beliefs, a strategy to reduce uncertainty, and a strategy to prime correct beliefs. Furthermore, three audience features were described that should be taken into account in the design and dissemination of communication efforts: Opportunity to process information, ability to process information, and motivation to do so. In the current deliverable we discuss the previously provided strategies and audience features in the light of the current findings on the knowledge and beliefs test and the medialog.

Summary of previous conclusions

There are mainly two goals that are important in informing people: to correct misperceptions and to add correct knowledge to the existing knowledge. To address public knowledge on CCS, three strategies are distinguished in research that can influence public attitudes (Fishbein, Ajzen, & McArdle, 1980; Fishbein & Yzer, 2003). First, information can be provided that correct misperceptions (e.g. that CO₂ is hazardous for the skin). This strategy is called the 'change' strategy. The second strategy is called 'uncertainty reduction' strategy, since it aims at providing information on which people are uncertain. For example, people may be uncertain whether CO₂ can be stored under the seabed, providing people with information about this aspect may reduce uncertainty and thereby alter the general attitude towards CCS. The third strategy is 'priming'. Correct beliefs that people have may be reinforced by communication, thereby strengthening their relation with attitude. For example, if a majority of the public generally believes that CO₂ is in the air around us, assessing that feature of CO₂ in communication may lead the public to associate CCS even more strongly with this feature at the expense of other associations, for example the belief that CO₂ may cause cancer. It is important to emphasize that these strategies are aimed to provide people with correct information rather than persuade them to think that CCS is positive. For example, when changing an incorrect belief about CO₂ that has a positive effect on attitude towards CCS, people may get a more negative attitude towards CCS.

The report also emphasized that it is important for communication to tailor it to fit the targeted public. Communication about CCS should be presented as personally relevant to the audience. Awareness should be shown that for many people the presented information will be counterintuitive and that many people are uncertain about a subject. Also, if the communicator knows that a belief constitutes something a large part of the audience already knows, communication about this belief will be experienced as more personalized and thus more personally relevant if the communicator shows awareness about this.

There are three major basic and equally important aspects that should be taken into account when developing communication: The opportunity for the audience to be exposed to the message, the ability of the audience to understand and process the message, and their motivation to do so (MacInnis, Moorman, & Jaworski, 1991; Van Knippenberg & Daamen, 1996). First, the basic requirement for communication effectiveness is that the audience knows that the information exists, is able to gain access to the information, and is able to attend to the message without limitations in exposure time and without the presence of distractions (MacInnis, Moorman, & Jaworski, 1991). Second, it is important to take into account whether audience members are able to process the information offered to them. Information should be tailored to the audience's ability

to understand complex information (MacInnis, Moorman & Jaworski, 1991). If not, communicators run the risk of the information being either misunderstood or, more likely, ignored altogether. One could, for example, make tailored information for people with different knowledge on CCS. Since knowledge levels are still low in the general public, it is however mainly important to keep information simple when communication strategies are aimed at the general public. Third, information, regardless its quality, will not be processed if members of the audience do not perceive the information to be relevant to themselves (Petty & Cacioppo, 1986; Petty, Priester, & Briñol, 2002).

The overall advice for communication based on these audience features is that given overall low knowledge levels of the public, it is not cost-effective to develop communication strategies for particular target groups. We therefore recommend the use of a mix of mass media that have a high number of potential exposures while at the same time being suitable for conveying complex information in a simple manner.

There are also limitations discussed in the previous report. Most importantly, the strategy to change misperceptions on CO₂ and CCS can only be used to correct beliefs that are clearly incorrect and is not meant to address ideas about CO₂ and CCS that are open to discussion, such as whether or not we actually need CCS to fight climate change, or to change ideas about CCS that cannot be refuted as 'false'. When using this strategy to address ideas that are open to debate, one runs the risk of the communication having a reverse effect and it may also lead to increased attention to a subject that is open to debate ('priming').

Furthermore, it is crucial to keep in mind that any tactic presented here can be used to influence public opinion either in one direction or in the other. If applied consistently, completely, and continuously, the strategy outlined in this document will assist communicators in achieving their goals regardless the nature of these goals. Communication strategies have since long been proven not to be silver bullets, however. Ultimately, it remains up to the audience to decide if and how to weigh information in opinion formation.

Results

The previous deliverable showed that beliefs about whether CO₂ is natural or hazardous influenced attitudes about CCS. Furthermore, when people had a stronger belief that CCS was stored in natural underground layers this influenced CCS attitude positive while when people believed that CCS was stored in man-made constructions such as barrels CCS attitude was negatively influenced. Based on these findings, the communication advises discussed above were constructed.

In the current deliverable, a more complex model is constructed that has a large predictive value of attitude towards CCS. This new model showed that positive expectations about CCS are the strongest positive predictor of attitude towards CCS and perceptions of chance of leakage of CCS on land or at sea are the strongest negative predictor of CCS. Furthermore, incorrect perceptions of CO₂ was the strongest predictor for perceptions of chance of leakage, meaning that these incorrect perceptions have a large indirect effect on attitudes towards CCS.

While there may be several differences between the new model and the model that was presented in the previous deliverable, the implications for communication strategies are quite similar. Instead of focusing on specific beliefs, the new model shows that not only incorrect beliefs about whether CO₂ is hazardous influenced CCS attitudes, but generally all incorrect perceptions that were investigated had a combined negative effect on attitude towards CCS. Furthermore, these incorrect perceptions are shown to have an indirect effect on the perceptions of chance of leakage, which was the strongest negative predictor of CCS attitude.

The consequences of these results lead to more specific knowledge on which information communication strategies may focus. Similar as in the previous advise, the present results consistently make clear that changing misperceptions may be the main focus of communication. Combined with the knowledge gained from the medialog, that shows that newspaper hardly write about what CO₂ and CCS actually is, communication should aim to provide factual information on these topics and correct the common misperceptions. Only when general knowledge is increased one may aim to provide more specific information or target different groups in the population.

Again, we feel it is important to emphasize that the incorrect perceptions that are discussed are for example that people think that CO₂ is explosive, that it emits radiation, and is hazardous for the skin, since these are perceptions that are clearly incorrect. The current suggestions for communication strategies thus do not apply to changing perceptions on debatable arguments, such as whether CCS is a necessary strategy to fight climate change.

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9 Appendix 1, Knowledge and Beliefs Test Sample

	Dutch population 2008		Knowledge and Beliefs Test sample	
	N	%	N	%
Sex				
Male	8,243,482	49.5%	484	51,7
Female	8,412,317	50.5%	452	48,3
Age				
< 20	3,913,819	23.5%	24	2,6
20-40	4,162,599	25.0%	259	27,7
40-65	5,984,435	35.9%	366	49,9
65-80	1,927,399	11.6%	263	17,3
80+	667,547	4.0%	24	2,6
Province				
Groningen	16,655,799	100%	936	100%
Friesland	579,036	3.5%	33	3,5
Drenthe	647,282	3.9%	38	4,1
Overijssel	491,411	3.0%	22	2,4
Flevoland	1,134,465	6.8%	57	6,1
Gelderland	391,967	2.4%	16	1,7
Utrecht	2,004,671	12.0%	100	10,7
Noord-Holland	1,228,794	7.4%	66	7,1
Zuid-Holland	2,691,477	16.2%	156	16,7
Zeeland	3,528,324	21.2%	191	20,4
Noord-Brabant	381,530	2.3%	26	2,8
Limburg	2,454,215	14.7%	156	16,7
	1,122,627	6.7%	75	8,0

10 Appendix 2, Knowledge and Beliefs Test Dutch

Onderzoeksinstituut ECN voert in samenwerking met de Universiteit Leiden en de Universiteit Utrecht een onderzoek uit naar uw mening over een aantal onderwerpen. De resultaten van dit onderzoek worden in een rapport verwerkt, dat bijvoorbeeld regering en parlement kan helpen beslissingen te nemen over beleid op deze gebieden.

CO₂

De volgende vragen gaan over CO₂, ook wel kooldioxide of koolstofdioxide genoemd.

1 *Awareness*CO₂ Hebt u wel eens gehoord van CO₂?

- a) Nee, nooit van gehoord
- b) Ik heb ervan gehoord, maar ik weet niet wat het is
- c) Ja, en ik weet er een beetje van af
- d) Ja, en daar weet ik behoorlijk wat van af

2 *Eigenschappen*CO₂. Hierna volgt een aantal stellingen over eigenschappen en effecten van CO₂. Deze stellingen kunnen waar of onwaar zijn. Geef voor elke stelling aan in hoeverre u zeker weet dat deze stelling waar of niet waar is.

CO₂ is een gas dat in de natuur voorkomt

Ik weet zeker van niet					Ik weet zeker van wel
1	2	3	4	5	

CO₂ is explosief

Ik weet zeker van niet					Ik weet zeker van wel
1	2	3	4	5	

CO₂ is een broeikasgas

Ik weet zeker van niet					Ik weet zeker van wel
1	2	3	4	5	

CO₂ geeft schadelijke straling af

Ik weet zeker van niet					Ik weet zeker van wel
1	2	3	4	5	

Bepaalde concentraties CO₂ zijn gevaarlijk voor mensen

Ik weet zeker van niet					Ik weet zeker van wel
1	2	3	4	5	

CO₂ beïnvloedt het klimaat

Ik weet zeker
van niet
1

2

3

4

Ik weet zeker
van wel
5

CO₂ wordt gebruikt om metaal te beschermen tegen roest

Ik weet zeker van
niet
1

2

3

4

Ik weet zeker van
wel
5

CO₂ is schadelijk bij huidcontact

Ik weet zeker
van niet
1

2

3

4

Ik weet zeker
van wel
5

CO₂ maakt een leefbaar klimaat op aarde mogelijk

Ik weet zeker
van niet
1

2

3

4

Ik weet zeker
van wel
5

CO₂ wordt gebruikt om hersenbeschadiging te behandelen

Ik weet zeker van
niet
1

2

3

4

Ik weet zeker van
wel
5

3 *Bronnen*CO₂. Hierna volgt een aantal stellingen over waar CO₂ vandaan komt.

CO₂ komt vrij als je uitademt

Ik weet zeker
van niet
1

2

3

4

Ik weet zeker
van wel
5

CO₂ komt vrij bij gebruik van spuitbussen met haarlak en deodorant

Ik weet zeker
van niet
1

2

3

4

Ik weet zeker
van wel
5

CO₂ komt vrij bij lekkage uit oude batterijen en accu's

Ik weet zeker
van niet
1

2

3

4

Ik weet zeker
van wel
5

The Dutch general public's opinion on CCS

CO₂ komt vrij bij het opwekken van energie uit aardgas

Ik weet zeker van niet								Ik weet zeker van wel
1	2	3	4	5				5

CO₂ komt vrij bij het opwekken van energie uit kolen

Ik weet zeker van niet								Ik weet zeker van wel
1	2	3	4	5				5

CO₂ komt vrij bij het opwekken van energie uit biomassa (o.a. hout, planten)

Ik weet zeker van niet								Ik weet zeker van wel
1	2	3	4	5				5

CO₂ komt vrij bij het opwekken van kernenergie

Ik weet zeker van niet								Ik weet zeker van wel
1	2	3	4	5				5

4 Hierna volgt aantal steeds tegengestelde uitspraken over CO₂. Kies alstublieft de uitspraken die uw mening over CO₂ het beste weergeven, door steeds 1 van de 7 antwoordmogelijkheden te kiezen. Hoe dichter uw antwoord bij één van de uitspraken ligt, hoe beter die uitspraak bij uw eigen mening past.

Ik vind CO₂:

Negatief	1	2	3	4	5	6	7	Positief
Onnatuurlijk	1	2	3	4	5	6	7	Natuurlijk
Vies	1	2	3	4	5	6	7	Schoon
Gevaarlijk	1	2	3	4	5	6	7	Ongevaarlijk

CO₂ afvang en opslag

De volgende vragen gaan over CO₂ afvang en opslag.

5 Hebt u wel eens gehoord van CO₂ afvang en opslag?

- e) Nee, nooit van gehoord
- f) Ik heb ervan gehoord, maar ik weet niet wat het is
- g) Ja, en ik weet er een beetje van af
- h) Ja, en daar weet ik behoorlijk wat van af

The Dutch general public's opinion on CCS

6 Waarom zouden wij CO₂ afvang en opslag toepassen? Kruis hieronder aan welke doelen u denkt dat met CO₂ afvang en opslag bereikt zouden kunnen worden in Nederland. Meerdere antwoorden mogelijk.

Doelen van CO₂ afvang en opslag kunnen zijn:

- Om de luchtkwaliteit in Nederland te verbeteren
- Om de temperatuurstijging op aarde te beperken
- Om de ozonlaag te beschermen
- Om klimaatverandering tegen te gaan

7 CO₂ afvang en opslag is bedoeld om de CO₂ uitstoot naar de lucht te verminderen. Voor toepassing van CO₂ afvang en opslag moet de CO₂ voor lange tijd worden opgeslagen.

Hierna volgt een aantal stellingen over de manier waarop CO₂ voor lange tijd zou kunnen worden opgeslagen, in Nederland of daarbuiten. Deze stellingen kunnen waar of onwaar zijn. Geef van elke manier aan hoe waarschijnlijk u het vindt dat de CO₂ op die manier opgeslagen zal worden.

CO₂ zal ondergronds worden opgeslagen in bepaalde aanwezige steenlagen

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ zal worden opgeslagen in de zee, waar het door het zeewater wordt opgenomen

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ zal worden opgeslagen in ondergrondse bunkers met dikke, ondoordringbare wanden

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ zal worden opgeslagen in onderaardse grotten en grote holtes

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ zal worden opgeslagen onder de zeebodem

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ kan worden opgeslagen in diep in de grond gelegen zoutwaterlagen (aquifers)

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

8 CO₂ kan vervoerd worden per vrachtwagen over de weg, via pijpleidingen of per zeeschip. Het is niet zeker welke methode in Nederland toegepast zal worden en waar precies. Geef voor elke methode aan in hoeverre deze volgens u overlast zou kunnen bezorgen en in hoeverre deze volgens u veilig is voor de omgeving.

a) Transport van CO₂ over de weg (per vrachtwagen)

Overlast voor de omgeving bij het weggebruik voor CO₂ transport

Helemaal geen overlast 1 2 3 4 5 6 7 Heel veel overlast

Veiligheid voor de omgeving

Zeer onveilig 1 2 3 4 5 6 7 Zeer veilig

b) Transport van CO₂ via pijpleidingen

Overlast voor de omgeving bij aanleg nieuwe pijpleidingen

The Dutch general public's opinion on CCS

Helemaal geen overlast 1 2 3 4 5 6 7 Heel veel overlast

Overlast voor de omgeving bij het gebruik van de pijpleiding voor CO₂ transport

Helemaal geen overlast 1 2 3 4 5 6 7 Heel veel overlast

Veiligheid voor de omgeving

Zeer onveilig 1 2 3 4 5 6 7 Zeer veilig

c) Transport van CO₂ per zeeschip

Overlast voor de omgeving bij gebruik vaarroute voor CO₂ transport

Helemaal geen overlast 1 2 3 4 5 6 7 Heel veel overlast

Veiligheid voor de omgeving

Zeer onveilig 1 2 3 4 5 6 7 Zeer veilig

Energieopwekking

De volgende vraag gaat over energieopwekking in Nederland.

9 In Nederland worden verschillende energiebronnen gebruikt om elektriciteit op te wekken. Kolen, aardgas en olie zijn zogenaamde fossiele brandstoffen. Daarnaast zijn er hernieuwbare energiebronnen zoals zonne-energie, wind, aardwarmte en biomassa (planten, hout). Ten slotte is er nog elektriciteit uit kerncentrales.

Geef hieronder bij de drie groepen energiebronnen aan voor welk percentage u denkt dat elk van deze groepen in Nederland gebruikt wordt om onze **elektriciteit** op te wekken. Het totaal moet optellen tot 100%. Het is mogelijk om bronnen 0% toe te kennen als u denkt dat deze in Nederland helemaal niet gebruikt worden.

[programmeur: men kan per optie een willekeurig percentage invullen. De 100 mag niet overschreden worden]

Fossiele brandstoffen (kolen, olie, aardgas)

Hernieuwbare energie (zon, wind, aardwarmte, biomassa, waterkracht)

Kernenergie

Ik weet het niet

Klimaatverandering

De volgende vragen gaan over klimaatverandering.

10 In hoeverre bent u ervan overtuigd dat het klimaat op aarde de komende eeuw gemiddeld warmer zal worden?

Helemaal niet overtuigd 1 2 3 4 5 6 7 Zeer overtuigd

In hoeverre bent u overtuigd dat opwarming van de aarde het gevolg is van CO₂ uitstoot door de mens?

The Dutch general public's opinion on CCS

Helemaal niet overtuigd 1 2 3 4 5 6 7 Zeer overtuigd

CO₂ afvang en opslag

CO₂ is een broeikasgas dat een grote bijdrage levert aan de temperatuurstijging op aarde. De Nederlandse overheid maakt daarom plannen de CO₂-uitstoot in Nederland te verminderen. CO₂ afvang en opslag wordt gezien als een mogelijkheid om de hoeveelheid CO₂ in de lucht te beperken.

11 Hierna volgt een aantal stellingen over mogelijke gevolgen van CO₂ afvang en opslag in Nederland. Geef alstublieft voor elk van deze stellingen aan hoe onwaarschijnlijk of waarschijnlijk u deze vindt. Het gaat hierbij om uw mening.

De opgeslagen CO₂ zal in het grondwater terecht komen

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ opslag helpt het grondwater op peil te houden

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

Mensen zullen stikken als CO₂ vrij komt via een lek

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

De CO₂ opslag ontploft omdat deze onder hoge druk staat

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

Als CO₂ uit een opslag onder de zeebodem ontsnapt dreigt verzuring van het (zee)water

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ opslag vertraagt de ontwikkeling van hernieuwbare vormen van energie, zoals windenergie en zonne-energie voor gebruik op grote schaal

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ zal vanuit de opslagplaats naar de oppervlakte ontsnappen

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

Investeren in CO₂ afvang en opslag geeft Nederland een belangrijke technologische voorsprong op andere landen

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ opslag zal in de directe omgeving de huizenprijzen doen dalen

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

CO₂ opslag toepassen geeft meer tijd om hernieuwbare vormen van energie, zoals windenergie en zonne-energie, te ontwikkelen voor gebruik op grote schaal

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

Als de CO₂ uit een opslag onder de zeebodem lekt zal dit het ecosysteem van de zee drastisch beïnvloeden.

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

Bij het afvangen van CO₂ komen schadelijke stoffen vrij in de directe omgeving van de fabriek

Zeer onwaarschijnlijk 1 2 3 4 5 6 7 Zeer waarschijnlijk

The Dutch general public's opinion on CCS

12 Hieronder ziet u een aantal stellingen over CO₂ afvang en opslag. Geef alstublieft voor elk van deze stellingen aan hoe oneens of eens u het hiermee bent.

CO₂ opslag is noodzakelijk om de temperatuurstijging op aarde te beperken
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

Met de mogelijkheid om CO₂ opslag toe te passen zullen bedrijven meer kolencentrales bouwen.
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

De technologie voor CO₂ opslag is voldoende uitontwikkeld voor grootschalige toepassing
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

De risico's van CO₂ opslag zijn veel kleiner dan die van aardgaswinning
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

Vergeleken met andere beschikbare maatregelen om CO₂-uitstoot te verminderen is CO₂ opslag een veel te dure oplossing
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

Ik heb er vertrouwen in dat de wettelijke normen waaraan CO₂ opslag moet voldoen streng genoeg zijn om toepassing van de technologie acceptabel te maken
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

CO₂ opslag onder de zeebodem vormt geen risico voor mensen
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

Ik heb er vertrouwen in dat de CO₂ opslag op lange termijn goed in de gaten zal worden gehouden door verantwoordelijke instanties
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

CO₂ opslag zal Nederland helpen te voldoen aan internationale afspraken over om CO₂ uitstoot te beperken
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

Als we fossiele brandstoffen willen blijven gebruiken en tegelijk onze CO₂ uitstoot willen verlagen dan is CO₂ opslag een logische oplossing
 Zeer mee oneens 1 2 3 4 5 6 7 Zeer mee eens

13 Hierna volgt een aantal steeds tegengestelde uitspraken over CO₂ afvang en opslag. Kies alstublieft de uitspraken die uw mening over CO₂ afvang en opslag het beste weergeven, door steeds 1 van de 7 antwoordmogelijkheden te kiezen. Hoe dichter uw antwoord bij één van de uitspraken ligt, hoe beter die uitspraak bij uw eigen mening past.

Ik vind CO₂ afvang en opslag:

Negatief	1	2	3	4	5	6	7	Positief
Vies	1	2	3	4	5	6	7	Schoon
Gevaarlijk	1	2	3	4	5	6	7	Ongevaarlijk
Nutteloos	1	2	3	4	5	6	7	Nuttig

14 We willen u graag vragen naar uw mening over de toepassing van CO₂ Afvang en Opslag

a) Wat is uw mening over het toepassen van CO₂ afvang en opslag in Nederland?
Heel erg tegen 1 2 3 4 5 6 7 Heel erg voor

b) Wat is uw mening over het toepassen van CO₂ afvang en opslag in uw buurt?
Heel erg tegen 1 2 3 4 5 6 7 Heel erg voor

c) Wat is uw mening over het toepassen van CO₂ afvang en opslag onder de Noordzee?
Heel erg tegen 1 2 3 4 5 6 7 Heel erg voor

Actualiteit

We leggen u nog een aantal onderwerpen voor, omdat we willen weten van welke onderwerpen u wel eens gehoord hebt.

15 *Plannen*CCS. Weet u van plannen om in de Noordzee voor de kust van Nederland CO₂ afvang en opslag toe te passen?

- a) Nee, nooit van gehoord
- b) Ik heb ervan gehoord, maar ik weet er niets over
- c) Ja, en ik weet er een beetje van af
- d) Ja, en daar weet ik behoorlijk wat van af

16 **Verhagen** Hebt u gehoord van het besluit van minister Verhagen (Economische Zaken, Landbouw en Innovatie) om ondergrondse CO₂ opslag op land niet toe te staan?

Nee / Ja / Weet ik niet

17 Hieronder volgt een aantal vragen over de mate waarin u verschillende media gebruikt. Hoeveel tijd besteedt u gemiddeld per dag aan televisie kijken?

- 1 kwartier of minder
- meer dan 1 kwartier tot een half uur
- meer dan een half uur tot drie kwartier
- meer dan drie kwartier tot 1 uur
- meer dan een 1 uur tot 1,5 uur
- meer dan 1,5 uur tot 2 uur
- meer dan 2 uur tot 2,5 uur
- meer dan 2,5 uur tot 3 uur
- meer dan 3 uur tot 3,5 uur
- meer dan 3,5 uur tot 4 uur
- meer dan 4 uur tot 4,5 uur
- meer dan 4,5 uur
- weet niet

Hoeveel van de tijd die u gemiddeld per dag naar de televisie kijkt, kijkt u naar nieuws of programma's over politiek en actualiteiten?

The Dutch general public's opinion on CCS

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier
meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur
meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Hoeveel tijd besteedt u gemiddeld per dag aan naar de radio luisteren?

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier
meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur
meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Hoeveel van de tijd die u gemiddeld per dag naar de radio luistert, luistert u naar nieuws of programma's over politiek en actualiteiten?

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier
meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur
meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Hoeveel tijd besteedt u gemiddeld per dag aan het lezen van kranten, zowel gedrukt als online?

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier

The Dutch general public's opinion on CCS

meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur
meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Hoeveel van de tijd die u gemiddeld per dag aan het lezen van kranten besteedt, zowel gedrukt als online, leest u over politiek en actualiteiten?

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier
meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur
meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Hoeveel tijd besteedt u gemiddeld per dag aan het gebruik van internet voor privé-doeleinden?

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier
meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur
meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Hoeveel van de tijd die u op internet doorbrengt voor privé doeleinden bezoekt u pagina's met nieuws of informatie over politiek en actualiteiten?

1 kwartier of minder
meer dan 1 kwartier tot een half uur
meer dan een half uur tot drie kwartier
meer dan drie kwartier tot 1 uur
meer dan een 1 uur tot 1,5 uur

The Dutch general public's opinion on CCS

meer dan 1,5 uur tot 2 uur
meer dan 2 uur tot 2,5 uur
meer dan 2,5 uur tot 3 uur
meer dan 3 uur tot 3,5 uur
meer dan 3,5 uur tot 4 uur
meer dan 4 uur tot 4,5 uur
meer dan 4,5 uur
weet niet

Kranten titels

19 *WelkeKrant*. Welke van de volgende kranten leest u wel eens? Kruis alle antwoorden aan die van toepassing zijn.

- AD / Algemeen Dagblad
- Agrarisch Dagblad
- De Telegraaf
- De Volkskrant
- NRC Handelsblad
- NRC.NEXT
- Trouw
- Het Financieele Dagblad
- Reformatorisch Dagblad
- Nederlands Dagblad
- Het Parool
- Metro
- Spits!
- De Pers
- Een regionaal dagblad
- Geen van deze

Tot slot een achtergrondvraag.

Partij. Op welke politieke partij zou u stemmen als er vandaag Tweede Kamerverkiezingen zouden zijn?

- CDA
- PvdA
- VVD
- SP
- PVV
- Groen Links
- D66
- Christen Unie
- SGP
- Partij voor de Dieren
- 50PLUS
- Andere partij

- Ik zou niet stemmen
- Ik heb geen stemrecht
- Ik zou blanco/ ongeldig stemmen
- Dat wil ik niet zeggen
- Dat weet ik nog niet

Hartelijk dank voor het invullen van deze vragenlijst. Deze vragenlijst is een onderdeel van een groter onderzoek naar de kennis, ideeën en meningen van Nederlanders over klimaat en energie. Sommige vragen of stellingen in de vragenlijst zijn gebaseerd op wat andere mensen eerder in interviews geuit hebben over energie en klimaat. Met de vragenlijst proberen we onder andere te onderzoeken hoeveel mensen ook deze vragen of meningen hebben. Niet alle vragen of stellingen in de vragenlijst zijn echter feitelijk correct.

Mocht u betrouwbare informatie willen over CO₂ afvang en opslag die samengesteld is door deskundigen uit milieuorganisaties, het bedrijfsleven, de wetenschap en de overheid kunt u kijken op

www.co2afvangenopslag.nl

11 Appendix 3, Knowledge and Beliefs Test English

The Energy research Centre of the Netherlands in cooperation with Leiden University and Utrecht University is conducting a study on your opinion on several topics. The results of this research will be compiled in a report which can, for example be used by the government and parliament to make policy decisions on these topics.

CO₂

The following questions are about CO₂, also known as carbon dioxide.

1 Have you ever heard of CO₂?

- i) No, I've never heard of it
- j) I have heard of it, but I don't know anything about it
- k) Yes, and I know a bit about it
- l) Yes, and I know a lot about it

2 Following statements are about possible characteristics and effects of CO₂, which can be true or untrue. Please indicate for each to what extent you are convinced the statement is true or untrue.

CO₂ occurs naturally

I'm sure it does					I'm sure it does
not					
1	2	3	4	5	

CO₂ is explosive

I'm sure it is not					I'm sure it is
1	2	3	4	5	

CO₂ is a greenhouse gas

I'm sure it is not					I'm sure it is
1	2	3	4	5	

CO₂ emits hazardous radiation

I'm sure it does					I'm sure it does
not					
1	2	3	4	5	

Some concentrations of CO₂ are hazardous for people

I'm sure it is not					I'm sure it is
1	2	3	4	5	

CO₂ influences the climate

I'm sure it does					I'm sure it does
not					
1	2	3	4	5	

The Dutch general public's opinion on CCS

CO₂ is used to protect metals from corrosion
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is harmful if in contact with skin
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ makes a liveable climate on earth possible
 I'm sure it does
 not
 1 2 3 4 I'm sure it does 5

CO₂ is used to treat brain injuries
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

3 Following statements are about possible sources of CO₂.

CO₂ is released when you exhale
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is released when spray cans with hair spray or deodorant are used
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is released when old batteries leak
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is released during energy production from natural gas
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is released during energy production from coal
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is released during energy production from biomass
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

CO₂ is released during energy production from nuclear power
 I'm sure it is not
 1 2 3 4 I'm sure it is 5

The Dutch general public's opinion on CCS

4 Following are scales with opposing adjectives describing CO₂. Please choose the adjective that most closely reflects your opinion of CO₂ by choosing one of the seven answer categories. The closer your answer is to one of the adjectives the more this adjective describes your opinion.

I think CO₂ is:

Negative	1	2	3	4	5	6	7	Positive
Unnatural	1	2	3	4	5	6	7	Natural
Dirty	1	2	3	4	5	6	7	Clean
Dangerous	1	2	3	4	5	6	7	Safe

CO₂ capture and storage

The following questions are about CO₂ capture and storage.

5 Have you ever heard of carbon capture and storage?

- a) No, I've never heard of it
- b) I have heard of it, but I don't know what it is
- c) Yes, and I know a little about it
- d) Yes, and I know quite a bit about it

6 Why would we employ CO₂ capture and storage? Select below which aims you think can be met using CO₂ capture and storage in the Netherlands. Multiple answers are possible.

Aims of CO₂ capture and storage can be to:

- Improve air quality in The Netherlands
- Limit rise in temperatures on earth
- Protect the ozone layer
- Mitigate climate change

7 The aim of CO₂ capture and storage is to decrease CO₂ emissions in the air. To employ CO₂ capture and storage the CO₂ has to be stored underground for a very long time.

Following are several statements about possible ways CO₂ could be stored for a long time, in the Netherlands or elsewhere. These statements can be true or untrue. Please indicate for each how likely you believe it is the CO₂ will be stored in the way presented in the statements

The CO₂ will be stored underground in certain existing rock formations

Very unlikely 1 2 3 4 5 6 7 Very likely

The CO₂ will be stored in the sea, where it is absorbed by the seawater

Very unlikely 1 2 3 4 5 6 7 Very likely

The CO₂ will be stored in underground bunkers with solid, impermeable walls

Very unlikely 1 2 3 4 5 6 7 Very likely

The Dutch general public's opinion on CCS

The CO₂ will be stored underground in caves and large cavities

Very unlikely 1 2 3 4 5 6 7 Very likely

The CO₂ will be stored under the sea bed

Very unlikely 1 2 3 4 5 6 7 Very likely

The CO₂ will be stored in deep underground layers of salt water (aquifers)

Very unlikely 1 2 3 4 5 6 7 Very likely

8 CO₂ can be transported by road, pipeline and ship. It is unsure which method will be used in the Netherlands and where. Please indicate for each method to what degree you think it would cause inconvenience and to what degree you think it is safe for the environment.

d) Transport of CO₂ by road

Inconvenience of transport by road for surroundings

No inconvenience 1 2 3 4 5 6 7 a lot of inconvenience

Safety of transport by road for surroundings

Very unsafe 1 2 3 4 5 6 7 Very safe

e) Transport of CO₂ by pipeline

Inconvenience of pipeline construction for surroundings

No inconvenience 1 2 3 4 5 6 7 a lot of inconvenience

Inconvenience of pipeline transport for surroundings

No inconvenience 1 2 3 4 5 6 7 a lot of inconvenience

Safety of pipeline transport for the surroundings

Very unsafe 1 2 3 4 5 6 7 Very safe

f) Transport of CO₂ by ship

Inconvenience of transport by ship for surroundings

No inconvenience 1 2 3 4 5 6 7 a lot of inconvenience

Safety of transport by ship for surroundings

Very unsafe 1 2 3 4 5 6 7 Very safe

Energy production

The following questions are about energy production in the Netherlands.

9 In The Netherlands different sources of energy are used to produce electricity. Coal, natural gas and oil are so called fossil fuels. Additionally, renewable sources of energy exists, such as solar,

The Dutch general public's opinion on CCS

wind, geothermal and biomass (plants, wood). Furthermore, also electricity from nuclear power plants exists.

Below you see the three groups of energy sources. In front of each you can indicate how large you think the percentage is of each fuel used to produce **electricity** in the Netherlands. The percentages should add up to 100%. It is possible to state an energy source makes up 0% of the mix if you believe this source is not used in the Netherlands.

- Fossil fuels (coal, oil, gas)
- Renewables (solar, wind, geothermal, biomass, water)
- Nuclear power

- I don't know

Climate change

The following questions concern climate change.

10 To what extent are you convinced the climate on earth will become warmer on average?
Not at all convinced 1 2 3 4 5 6 7 Very convinced

To what extent are you convinced global warming is a result of CO₂ emissions by human actions?
Not at all convinced 1 2 3 4 5 6 7 Very convinced

CO₂ capture and storage

CO₂ is a greenhouse gas strongly contributing to the rise in average temperatures on earth. The Dutch government therefore aims to reduce emissions of CO₂ in the Netherlands. CO₂ capture and storage is considered as a possibility of limiting the amount of CO₂ in the air.

11 Following are statements about possible consequences of CO₂ capture and storage in the Netherlands. Please indicate for each statements to whether you believe this is likely or unlikely to be a consequence of CO₂ capture and storage.

The stored CO₂ will end up in the ground water
Very unlikely 1 2 3 4 5 6 7 Very likely

CO₂ storage helps keep ground water on appropriate levels
Very unlikely 1 2 3 4 5 6 7 Very likely

People will suffocate if CO₂ leaks to the surface
Very unlikely 1 2 3 4 5 6 7 Very likely

The CO₂ storage will explode because it is under pressure
Very unlikely 1 2 3 4 5 6 7 Very likely

If CO₂ leaks from storage under the seabed the (sea)water could acidify
Very unlikely 1 2 3 4 5 6 7 Very likely

The Dutch general public's opinion on CCS

CO₂ storage will slow the development of large scale use of renewable energy

Very unlikely 1 2 3 4 5 6 7 Very likely

CO₂ will leak from the storage to the surface

Very unlikely 1 2 3 4 5 6 7 Very likely

Investing in carbon capture and storage will give the Netherlands a technological advantage over other countries

Very unlikely 1 2 3 4 5 6 7 Very likely

CO₂ storage will decrease the value of properties in the immediate surroundings

Very unlikely 1 2 3 4 5 6 7 Very likely

Implementing CCS will give us time to develop renewable energy sources such as wind and solar energy

Very unlikely 1 2 3 4 5 6 7 Very likely

If the CO₂ would leak from storage under the seabed it would drastically affect the sea ecosystem

Very unlikely 1 2 3 4 5 6 7 Very likely

When CO₂ is captured hazardous substances are released in the vicinity of the factory

Very unlikely 1 2 3 4 5 6 7 Very likely

12 Following are statements about CO₂ capture and storage. Please indicate to what extent you agree with each statement.

CCS is necessary to mitigate climate change

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

With the possibility to use CCS technology energy companies will build more coal fired power plants

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

CCS technology is not developed enough for large scale use

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Risks associated with CCS are much lower than those of natural gas extraction

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Compared to other CO₂ mitigating measures CCS is too costly

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I trust the legal norms CO₂ storage has to adhere to are strict enough to make implementation of the technology acceptable

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

CO₂ storage under the seabed poses risks for people

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I trust that CO₂ storage will be properly monitored by designated authorities over the long term

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

The Dutch general public's opinion on CCS

CCS will help the Netherlands meet international agreements on CO₂ emission mitigation
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

If we want to keep using fossil fuels, while lowering our CO₂ emissions, CCS is a logical solution
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

13 Following are scales with opposing adjectives describing CO₂ capture and storage. Please choose the adjective that most closely reflects your opinion of CO₂ capture and storage by choosing one of the seven answer categories. The closer your answer is to one of the adjectives the more this adjective describes your opinion.

I believe CO₂ capture and storage is:

Negative	1	2	3	4	5	6	7	Positive
Dirty	1	2	3	4	5	6	7	Clean
Dangerous	1	2	3	4	5	6	7	Safe
Useless	1	2	3	4	5	6	7	Usefull

14 We would like to ask your opinion on the implementation of CO₂ capture and storage

d) How do you feel about CCS being implemented in the Netherlands?

Very much opposed 1 2 3 4 5 6 7 Very much in favour

e) How do you feel about CCS being implemented in your neighborhood?

Very much opposed 1 2 3 4 5 6 7 Very much in favour

f) How do you feel about CCS being implemented under the seabed in the North Sea?

Very much opposed 1 2 3 4 5 6 7 Very much in favour

Current events

We would like to know whether you are familiar with several topics.

15 Have you heard of plans to implement CCS in the North Sea of the shore of the Netherlands?

- e) No, I've never heard of it
- f) I have heard of it, but I don't know anything about it
- g) Yes, and I know a bit about it
- h) Yes, and I know quite a bit about it

16 Have you heard of the decision by minister Verhagen not to allow underground CO₂ storage on shore?

No / Yes / I don't know

17 Following are several questions about the degree to which you use different media.

How much time do you spend watching television a day on average?

The Dutch general public's opinion on CCS

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- more than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

How much of the time you watch television a day on average do you spend watching broadcasts about news or current events and politics?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- more than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

How much time do you spend listening to the radio a day on average?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- more than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

How much of the time you listen to the radio a day on average do you spend listening to broadcasts about news or current events and politics?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- more than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour

The Dutch general public's opinion on CCS

- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

How much time do you spend reading newspapers a day on average (both on paper and online)?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- More than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

How much of the time you read newspapers a day on average do you spend reading about news or current events and politics?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- More than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

How much time do you spend on the internet a day on average for private use?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- More than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours

The Dutch general public's opinion on CCS

- More than 4½ hours
- (I don't know)

How much of the time you spend on the internet a day on average do you spend reading about news or current events and politics?

- 15 minutes or less
- More than 15 minutes to a maximum of ½ hour
- More than ½ hour to a maximum of 45 minutes
- more than 45 minutes to a maximum of 1 hour
- More than 1 hour to a maximum of 1½ hour
- More than 1½ hour to a maximum of 2 hours
- More than 2 hours to a maximum of 2½ hours
- More than 2½ hours to a maximum of 3 hours
- More than 3 hours to a maximum of 3½ hours
- More than 3½ hours to a maximum of 4 hours
- More than 4 hours to a maximum of 4½ hours
- More than 4½ hours
- (I don't know)

Newspapers

19 Which of the following newspapers do you read? Check all answers that apply to you.

- AD / Algemeen Dagblad
- Agrarisch Dagblad
- De Telegraaf
- De Volkskrant
- NRC Handelsblad
- NRC.NEXT
- Trouw
- Het Financieele Dagblad
- Reformatorisch Dagblad
- Nederlands Dagblad
- Het Parool
- Metro
- Spits!
- De Pers
- Een regionaal dagblad
- Geen van deze

Partij

To conclude we would like to ask one background question.

For which political party would you vote if there would be elections today?

- CDA
- PvdA
- VVD
- SP
- PVV
- Groen Links
- D66
- Christen Unie
- SGP



The Dutch general public's opinion on CCS

- Partij voor de Dieren
- 50PLUS
- Other party
- I would not vote
- I am not allowed to vote
- I would vote blank
- I don't want to answer this question
- I don't know yet

Thank you very much for filling out this questionnaire. The questionnaire is part of a greater research on knowledge, ideas and opinions of Dutch people on climate and energy. Some questions or statements in the questionnaire are based on what other people about climate and energy said in earlier interviews. With the current questionnaire, we aim to investigate how much people share these ideas or opinions. Not all questions or statements in the questionnaire are factual. If you would like reliable information on CO₂ capture and storage which has been put together by experts from environmental organizations, stakeholders, scientists and the government you can go to: www.co2afvangenopslag.nl

12 Appendix 4, Medialog codebook (Dutch)

Page 1 - Heading

Startinstructie

Page 1 - Heading

Neem het eerstvolgende artikel voor je, zowel op je computerscherm als uitgeprint. Beoordeel nu eerst of het binnen de steekproef valt (dus relevant is). Zo ja, start de vragenlijst. Beoordelen op relevantie doe je als volgt:

1. Check op doublures

Check of je dit artikel niet al gecodeerd hebt, want soms zit een artikel uit dezelfde krant 2x in de steekproef. Uitzondering: artikelen in NRC en NRC.Next zijn soms ook vrijwel 1 op 1 maar dit zijn aparte kranten, dus aparte artikelen die we beide coderen.

2. Check op relevantie

Definitie van irrelevantie is: Artikel bevat geen enkele melding van CCS, maar is door gebruik van keywords in combinatie met iets anders toch in selectie beland (e.g. artikelen over CO₂ uitstoot en warmte/koude opslag). Bepalen relevantie gaat het snelste via de keywords uit de zoekstring. Deze zijn in het artikel zijn vetgedrukt en onderstreept. Check eerst of deze keywords in de context van het artikel ook echt naar CO₂- afvang, transport en/of opslag verwijzen.

Enkele bijzondere situaties

Soms bestaat een record uit een kort stukje tekst met verwijzing naar hele artikel op een andere pagina in de krant. Dit coderen we evengoed als zelfstandig artikel. Het komt namelijk voor dat het eerste gedeelte van het artikel wel in de steekproef valt maar het tweede deel niet, omdat onze keywords daar niet in voorkomen. Het omgekeerde kan ook. Het is te tijdrovend om dat allemaal te controleren.

In een enkel geval kan het onduidelijk zijn of naar CCS technologie verwezen wordt. Overleg indien mogelijk met andere codeur. Bij twijfel geldt, codeer het artikel niet.

Ik ben vorige keer 1 rectificatie tegengekomen. Die heb ik toen niet gecodeerd, want geen op zichzelf staand/begrijpelijk artikel.

Page 2 - Heading

Algemene informatie

Page 2 - Question 1 - Choice - One Answer (Bullets)

Codeur ID

The Dutch general public's opinion on CCS

- Suzanne
- Koen
- Codeur 3

Page 2 - Question 2 - Open Ended - One Line

Wat is de datum van publicatie van het verhaal?Codeer in dd-mm-jjjj formaat, dus [dd-mm-jjjj]

Page 2 - Question 3 - Choice - One Answer (Bullets)

Uit welk dagblad is het item afkomstig?

- Algemeen Dagblad
- Agrarisch Dagblad
- Financieele Dagblad
- Metro
- Nederlands Dagblad
- NRC
- NRC.Next
- Parool
- Reformatorisch Dagblad
- Spits
- Telegraaf
- Trouw
- Volkskrant
- De Pers

Page 3 - Heading

Algemene informatie

Page 3 - Question 4 - Open Ended - One Line

Op welke pagina staat het artikel?Wanneer artikel op meerdere pagina's staat, beginpagina coderen.waar nummering ontbreekt, niet duidelijk is, of afwijkt, codeer 999

Page 3 - Question 5 - Open Ended - One Line

Hoe groot is het bericht in woorden?Bij de berichten in de sectie 'kort nieuws' klopt het gerapporteerde aantal woorden niet. Het aantal woorden slaat terug op alle korte berichten samen. Je moet bij korte berichten zelf met word count het aantal woorden tellen van alleen het relevante CCS bericht.

The Dutch general public's opinion on CCS

Page 3 - Heading

Lees nu het hele artikel door. Ga dan door naar de volgende pagina.

Page 4 - Question 6 - Open Ended - One Line

Wat is de headline van het artikel? Let op: De headline is vaak fout ingevoerd. Voer in dat geval de correcte headline in. Met name in rubrieken met meerdere korte berichten staat bovenaan meestal geen headline. Zoek in dat geval in de body van het bericht. Het kan ook zijn dat er geen headline is. Als het bericht geen headline heeft, codeer dan 999

Page 4 - Question 7 - Choice - One Answer (Bullets)

Wat voor soort bericht is het?

- Nieuwsbericht of (hoofd)redactioneel commentaar, achtergrondverhaal
 - Opiniestuk/column (inclusief inzendingen/verhandelingen experts)
 - Brief van lezer
 - Interview
 - (Boek)bespreking, recensie
 - Aankondiging radio- of televisieuitzending
 - Anders, namelijk
-

Page 4 - Heading

Kijk of er ondertekeningen zijn. Meestal staan deze bij 'graphic' onderaan het bericht, soms ook onderaan de berichtbody. Aanwezigheid van ondertekening impliceert aanwezigheid afbeelding.

Page 4 - Question 8 - Choice - One Answer (Bullets)

Zijn er afbeeldingen bij het bericht? Bij kort nieuws/ingezonden brieven slaat de afbeelding soms op een ander bericht dan het CCS bericht – in dat geval coderen als 'nee'

- Nee [Skip to 5]
 - Ja
-

Page 5 - Heading

Hoofdonderwerp artikel

Page 5 - Question 9 - Choice - One Answer (Bullets)

Op welke plaats/regio hebben de gebeurtenissen in het artikel hoofdzakelijk betrekking?

The Dutch general public's opinion on CCS

- Nederland
 - Ander specifiek EU land [Skip to 7]
 - Westers land of deel van de wereld buiten EU (Canada, VS) [Skip to 7]
 - Niet-Westers land of deel van de wereld buiten EU (Azie, China, India) [Skip to 7]
 - Europa algemeen/diverse landen [Skip to 7]
 - Wereld algemeen/diverse landen [Skip to 7]
 - Niet gespecificeerd/onduidelijk [Skip to 7]
 - Anders, namelijk
-

Page 6 - Question 10 - Choice - Multiple Answers (Bullets)

Stakeholders/Actoren Welke van onderstaande stakeholders worden - behalve de schrijver van het stuk! - in het artikel benoemd/besproken/ geciteerd? Dus: als het artikel een opiniestuk is van een onderzoeker, dan deze hieronder niet nog eens coderen als onderzoeker.

- Internationale overheden/overlegorganen (EU, G8, Brussel)
- Rijksoverheid of representanten van (Ministers, Ministeries, Projectdirectie CCS)
- Lokale overheid of representanten van (Provincie, Gemeente, College B&W)
- Landelijke politieke partijen (representanten van - dus die ook echt namens hun partij spreken)
- Lokale politieke partijen (representanten van - dus die ook echt namens hun partij spreken)
- Landelijk publiek-privaat partnership/consortium/stichting (Taskforce CCS, co2afvangenopslag.nl)
- Lokaal publiek-privaat partnership/consortium/stichting (RCI, Borg)
- Aan rijksoverheid gelieerd onderzoeks/adviesorgaan (Energieraad, CBS, SCP)
- Onderzoeksorganisaties en adviesorganen (Universiteiten, TNO, DNV, ECN, IEA, KEMA)
- Onderzoeksconsortia (IPCC, CATO)
- Individuele wetenschappers/experts, mensen die op persoonlijke titel schrijven/reageren
- Industrie, het bedrijfsleven, energiebedrijven, netbeheerders (representanten van)
- Banken, investeerders, (particuliere) beleggers
- Milieuorganisaties/NGOs (Natuur&milieu, Greenpeace)
- Nationaal publiek (representanten van)
- Lokaal publiek (representanten van)
- De media, journalisten (als actor wiens gedrag ter discussie staat)
- Geen van deze

Page 7 - Heading

Hoofdonderwerp artikel

The Dutch general public's opinion on CCS

Page 7 - Question 11 - Choice - One Answer (Bullets)

Staat CCS centraal in het artikel? Met 'CCS' wordt bedoeld: De keten van CO₂ afvang, transport, en/of opslag bij energieproductie, ook bekend als Carbon Capture and Storage.

CCS (de hele keten of een deel ervan) staat 'centraal' wanneer genoemd in titel of wanneer bij lezing duidelijk wordt dat de titel direct op CCS terugslaat en/of het grootste deel van de tekst aan CCS gewijd is. Als CCS slechts kort wordt aangestipt als voorbeeld (bv van een technologie die veel geld kost, CO₂-uiststoot kan helpen verminderen, waar onderzoek naar is gedaan, etc.) dan is het niet het hoofdonderwerp.

- Nee
- Ja [Skip to 9]

Page 8 - Heading

CCS is niet het hoofdonderwerp

Page 8 - Question 12 - Choice - One Answer (Bullets)

Wat is het hoofdonderwerp van het artikel? Hoofdonderwerp bepalen op basis van titel in combinatie met body van het bericht. Aan welk onderwerp wordt de meeste aandacht besteed? Eén antwoord mogelijk.

- Klimaatprobleem (temperatuurstijging, gevolgen e.d.), mogelijke oplossingen
- Klimaatdoelstellingen: (benodigde of feitelijk gemaakte) afspraken, verdragen, doelstellingen emissiereductie, bijeenkomsten, besprekingen, klimaatop
- Ethische/ideologische kwesties rond klimaatverandering en oplossingen, e.g. prevalentie markt over klimaat, vrijgeven technologie aan ontwikkelingslanden, voorbeeldfunctie
- Onderzoeksrapport of wetenschappelijke bijeenkomst, congres, symposium, aankondiging onderzoek, bespreking onderzoeksresultaten ('dat blijkt uit onderzoek'), oproep tot meer onderzoek.
- Plannen, activiteiten, en investeringen (benodigd of feitelijk) van bedrijven/industrie
- Overheidsbeleid/-doelstellingen/-visie/plannen/voornemens (aankondiging, plan, wijziging, realisatie)
- Overheidsbesluiten/-wetten/-regels (aankondiging, plan, wijziging, realisatie)
- Overheidsinvesteringen/-subsidies (aankondiging, plan, wijziging, realisatie)
- Pleidooi voor en/of kritiek op overheidsbeleid energie en klimaat, e.g. inzet subsidies, (gebrek aan) korte- en lange termijn visie, oproep tot actie, discussie nut/noodzaak
- Maatregelen (benodigd of feitelijk) CO₂-emissiereductie, energietransitie, duurzame ontwikkeling (algemeen beleids- en/of technologisch issue)
- Investeringen (benodigd of feitelijk), kosten/opbrengsten, klimaatneutrale groei (algemeen economisch issue)
- Handel in CO₂, prijs van CO₂, emissierechten, ETS (algemeen economisch issue)
- Technologische innovatie, nieuwe technologische oplossingen voor CO₂-emissiereductie, (duurzame) energietoekomst, geo-engineering, alternatieven CCS (algemene zin, dus niet CCS zelf)
- Technologische ontwikkelingen gerelateerd aan CCS (e.g. vernieuwingen in / details over de keten van afvang, transport en opslag of in toepassingen van CCS zoals

- EOR/EGR)
- Technologische, infrastructurele, ruimtelijke ordenings- of andere praktische aspecten van energietechnologie en voorzieningen (e.g. locatieselectie, gebruik van bodem en diepe ondergrond, noodzaak grensoverschrijdende projecten zoals elektriciteitsnetwerk)
 - Veiligheidsaspecten energietechnologie en voorzieningen (e.g. veiligheidsdiscussie CCS)
 - Kernenergie en/of opslag nucleair afval (vergelijking met/alternatief voor CCS)
 - Kolencentrales, bouw van nieuwe centrales, uitstoot kolencentrales
 - Politieke overtuigingen landelijk, standpunten bestuursorgaan algemeen of specifieke politieke partijen, kamerdebatten, acties (hieronder ook alles coderen wat aan opkomende verkiezingen relateert)
 - Politieke overtuigingen lokaal, standpunten bestuursorgaan algemeen of specifieke politieke partijen, acties (hieronder ook alles coderen wat aan opkomende verkiezingen relateert)
 - Maatschappelijk draagvlak, publiek protest, houding publiek (NIMBYism)
 - Overtuigingen en/of acties van landelijke en/of lokale NGOs, lobbygroepen, gelegenheidscoalities, consortia (RCl), stichtingen, e.d.
 - Politiek/bestuurlijk conflict, discussie, strijd, onenigheid, verwijt, beschuldiging, patstelling, dreigement (moet expliciet in deze of soortgelijke bewoordingen benoemd worden) e.g. EU versus lidstaten, kabinet versus partijen, landelijke vs lagere overheden, bestuurders vs burgers, of interne verdeeldheid in elk van deze groepen.
 - Expert/kennis conflict, discussie onenigheid, e.g. experts spreken elkaar tegen
 - Algemene discussie democratische principes/besluitvormingsprocedures (ref aan Barendrecht)
 - Algemene discussie veranderende relatie wetenschap en burgers (ref aan Barendrecht)
 - Vergelijkingen CCS project (e.g. Barendrecht) met andere omstreden of 'mislukte' projecten (vaccinaties, windmolens Urk, etc.)
 - Anders, namelijk
-

Page 9 - Heading

Relaties CCS - andere onderwerpen

Page 9 - Question 13 - Choice - Multiple Answers (Bullets)

In relatie tot welke onderwerpen wordt CCS in het artikel besproken? Meerdere antwoorden mogelijk. Deze vraag beantwoorden voor alle artikelen, ongeacht of CCS is aangemerkt als hoofdonderwerp of niet.

- Klimaatprobleem (temperatuurstijging, gevolgen e.d.), mogelijke oplossingen
- Klimaatdoelstellingen: (benodigde of feitelijk gemaakte) afspraken, verdragen, doelstellingen emissiereductie, bijeenkomsten, besprekingen, klimaatop
- Ethische/ideologische kwesties rond klimaatverandering en oplossingen, e.g. prevalentie markt over klimaat, vrijgeven technologie aan ontwikkelingslanden, voorbeeldfunctie
- Onderzoeksrapport of wetenschappelijke bijeenkomst, congres, symposium, aankondiging onderzoek, bespreking onderzoeksresultaten ('dat blijkt uit onderzoek'), oproep tot meer onderzoek.
- Plannen, activiteiten, en investeringen (benodigd of feitelijk) van bedrijven/industrie

- Overheidsbeleid/-doelstellingen/-visie/plannen/voornemens (aankondiging, plan, wijziging, realisatie)
- Overheidsbesluiten/-wetten/-regels (aankondiging, plan, wijziging, realisatie)
- Overheidsinvesteringen/-subsidies (aankondiging, plan, wijziging, realisatie)
- Pleidooi voor en/of kritiek op overheidsbeleid energie en klimaat, e.g. inzet subsidies, (gebrek aan) korte- en lange termijn visie, oproep tot actie, discussie nut/hoodzaak
- Maatregelen (benodigd of feitelijk) CO₂-emissiereductie, energietransitie, duurzame ontwikkeling (algemeen beleids- en/of technologisch issue)
- Investerings (benodigd of feitelijk), kosten/opbrengsten, klimaatneutrale groei (algemeen economisch issue)
- Handel in CO₂, prijs van CO₂, emissierechten, ETS (algemeen economisch issue)
- Technologische innovatie, nieuwe technologische oplossingen voor CO₂-emissiereductie, (duurzame) energietoekomst, geo-engineering, alternatieven CCS (algemene zin, dus niet CCS zelf)
- Technologische ontwikkelingen gerelateerd aan CCS (e.g. vernieuwingen in / details over de keten van afvang, transport en opslag of in toepassingen van CCS zoals EOR/EGR)
- Technologische, infrastructurele, ruimtelijke ordenings- of andere praktische aspecten van energietechnologie en voorzieningen (e.g. locatieselectie, gebruik van bodem en diepe ondergrond, noodzaak grensoverschrijdende projecten zoals elektriciteitsnetwerk)
- Veiligheidsaspecten energietechnologie en voorzieningen (e.g. veiligheidsdiscussie CCS)
- Kernenergie en/of opslag nucleair afval (vergelijking met/alternatief voor CCS)
- Kolencentrales, bouw van nieuwe centrales, uitstoot kolencentrales
- Politieke overtuigingen landelijk, standpunten bestuursorgaan algemeen of specifieke politieke partijen, kamerdebatten, acties (hieronder ook alles coderen wat aan opkomende verkiezingen relateert)
- Politieke overtuigingen lokaal, standpunten bestuursorgaan algemeen of specifieke politieke partijen, acties (hieronder ook alles coderen wat aan opkomende verkiezingen relateert)
- Maatschappelijk draagvlak, publiek protest, houding publiek (NIMBYism)
- Overtuigingen en/of acties van landelijke en/of lokale NGOs, lobbygroepen, gelegenheidscoalities, consortia (RCI), stichtingen, e.d.
- Politiek/bestuurlijk conflict, discussie, strijd, onenigheid, verwijt, beschuldiging, patstelling, dreigement (moet expliciet in deze of soortgelijke bewoordingen benoemd worden) e.g. EU versus lidstaten, kabinet versus partijen, landelijke vs lagere overheden, bestuurders vs burgers, of interne verdeeldheid in elk van deze groepen.
- Expert/kennis conflict, discussie onenigheid, e.g. experts spreken elkaar tegen
- Algemene discussie democratische principes/besluitvormingsprocedures (ref aan Barendrecht)
- Algemene discussie veranderende relatie wetenschap en burgers (ref aan Barendrecht)
- Vergelijkingen CCS project (e.g. Barendrecht) met andere omstreden of 'mislukte' projecten (vaccinaties, windmolens Urk, etc.)
- Anders, namelijk

Page 10 - Question 14 - Choice - One Answer (Bullets)

Noemt het artikel voor- of nadelen van CCS of argumenten voor of tegen toepassing ervan? Instructie hoe te bepalen of iets een argument is, zie onder.

- Nee [Skip to 12]
 Ja

Page 10 - Heading

Wanneer zijn opmerkingen argumenten?

Soms is lastig te coderen wanneer iets een genoemd voordeel/nadeel of argument voor/tegen is. Sommige berichten bevatten korte opmerkingen als "burgers vinden het onveilig, Shell bestrijdt dit" in artikelen die verder helemaal ergens anders over gaan. Meestal codeer ik dat als 'nee' omdat het meer meningen zijn zonder onderbouwing en uitleg. Bovendien scheelt het tijd.

Dat lijkt inconsequent, want in andere gevallen waarin het bericht iets meer aandacht aan draagvlak geeft neem ik dit soort stellingen wel weer mee als argumenten. Reden is dat in dat soort artikelen de twijfels over veiligheid politieke implicaties krijgen (zie je wel er is geen draagvlak) of zich echt uiten in publiek protest.

Wanneer het echter korte, losse en redelijk neutrale opmerkingen zijn dat veiligheid een issue is heb ik dat niet gecodeerd als argumenten veilig/onveilig, maar door aankruisen van het subtopic "veiligheidsdiscussie" bij de vraag over subonderwerpen CCS toch gecodeerd dat het veiligheidsissue wordt aangestipt.

Soms gebruik ik dus niet de argumentenpagina maar het rijtje subonderwerpen bij CCS om aan te geven waar het bericht over gaat, vooral bij korte berichten. Dat heeft als voordeel dat het coderen sneller gaat. Maar het onderscheid tussen iets coderen als subonderwerp CCS en als argument is tot op zekere hoogte gevoelsmatig.

Regels voor het coderen van iets als voordeel, nadeel, of argument voor/tegen

Het maakt niet uit door wie het argument wordt genoemd (e.g. de journalist, iemand die in het artikel geciteerd wordt, een onbenoemde bron).

Iets is pas een voordeel of nadeel, of een argument voor of tegen, als het letterlijk genoemd wordt en direct in verband wordt gebracht met CCS.

Voorbeeld argument. Als er staat 'een meer klimaatneutrale groei kan worden bereikt door [...] en CO2 opslag' dan is dat een argument voor CCS. Er wordt een verband gelegd tussen CO2 opslag en de doelstelling 'klimaatneutrale groei'.

Voorbeeld geen argument. Als er staat 'het broeikasgas CO2 wordt opgeslagen' dan impliceert dat wel dat CO2 opslag als doel vermindering van het broeikaseffect en CO2-reductie heeft, maar er staat niet expliciet dat dit het doel of effect is. Dus telt het niet als genoemd argument of voordeel.

Ook zinnen als "Shell krijgt hier miljoenen subsidie voor omdat het goed zou zijn voor het milieu" geldt niet als argument pro-milieu want de zin insinueert dat de journalist dit in twijfel trekt. Dit soort zinnen draagt wel bij aan over-all codering van berichtgeving als negatief/suggestief (zie verderop).

Page 11 - Heading

Onderwerpen/argumentatie CCS

Aandachtspunt bij deze pagina voor het coderen: Sommige van de hierna genoemde antwoordopties zijn opzettelijk breed geformuleerd, met voorbeelden van wat genoemd zou kunnen worden in het artikel. Niet alles hoeft echter precies zo te zijn genoemd in één artikel. Kies de best passende antwoordopties.

Let op: Sommige argumenten lijken erg op elkaar, maar de kop en de onderkop boven het cluster argumenten geven aan in relatie tot welk thema het argument moet zijn genoemd. Sommige nagenoeg identieke argumenten worden afwisselend in verschillende contexten aangehaald, bv de ene keer irl milieu en de andere keer irl veiligheid. Gebruik de koppen om te bepalen hoe het argument gecodeerd moet worden.

Page 11 - Heading

Klimaat – voor

Page 11 - Question 15 - Choice - Multiple Answers (Bullets)

CCS is goed voor het klimaat Let op, de bijdrage aan klimaat moet ook echt de reden zijn.

- CCS is goed voor het klimaat (zonder verdere toelichting)
- CCS vermindert de uitstoot van 'broeikasgas'
- CCS vermindert de CO₂-uitstoot
- CCS gaat klimaatverandering tegen
- CCS beperkt de temperatuurstijging op aarde
- CCS gaat versterking van het broeikaseffect tegen
- Schadelijke stoffen komen niet in de atmosfeer, reductie vervuilende uitstoot, verbetering luchtkwaliteit
- Nodig uit milieuoogpunt, goed voor milieu, afwenden milieuramp (zonder verdere toelichting)
- Ander argument, namelijk

Page 11 - Question 16 - Choice - Multiple Answers (Bullets)

Relatie industrie/andere technologie

- CCS is een noodzakelijk/effectief onderdeel van het portfolio aan maatregelen tegen klimaatverandering/CO₂-reductie/transitie naar duurzame economie
- CCS kan toegepast worden in industrie waar alternatieven voor CO₂-reductie ontbreken
- CCS kan de CO₂ uitstoot zelfs negatief maken (combinatie energieopwekking biomassa)
- CCS kan grootschalige waterstofproductie CO₂ neutraal maken (transitie/brug naar waterstofeconomie)

The Dutch general public's opinion on CCS

- CCS kan elektrisch vervoer CO2 neutraal maken
 - Ander argument, namelijk
-

Page 11 - Heading

Klimaat – tegen

Page 11 - Question 17 - Choice - Multiple Answers (Bullets)

Er is geen klimaatprobleem

- Er is geen klimaatprobleem/klimaatverandering is niet zeker/bijdrage CO2 is niet zeker, dus CCS is niet zinvol
 - Wat mensen doen heeft weinig invloed op klimaat, het loopt niet zo'n vaart, dus CCS is niet zinvol
 - We kunnen beter een methode kiezen die naast CO2 reductie nog meer voordelen heeft, zoals herbebossing wat ook goed is voor waterhuishouding en biodiversiteit (hier zit vaak de implicatie in dat de oplossing dan ook nog nuttig is als het 'onzekere verband' tussen CO2 en klimaatverandering niet blijkt te kloppen)
 - Ander argument, namelijk
-

Page 11 - Question 18 - Choice - Multiple Answers (Bullets)

CCS is onnodig voor het klimaatprobleem

- De gevolgen van het klimaatprobleem kunnen ondervangen worden door adaptatie
 - Het klimaatprobleem kan opgelost worden zonder inzet van CCS (e.g. energiebesparing, duurzame energie, kernenergie, CO2 opslag in bos- en landbouw, alternatieve methoden)
 - We zijn al voorbij het 'point of no return', omslagpunt bereikt, het klimaatprobleem kan al niet meer opgelost worden, CCS is dus zinloos
 - Ander argument, namelijk
-

Page 11 - Question 19 - Choice - Multiple Answers (Bullets)

CCS is slecht voor het klimaat

- Elektriciteitscentrales op fossiele brandstoffen blijven, ook met CCS, CO2 uitstoten
 - CCS legitimeert de bouw van nieuwe kolen- en gascentrales die, zonder CCS-plicht, onverminderd CO2 blijven uitstoten. CCS is dus helemaal geen middel voor emissiereductie
 - CCS kan juist leiden tot stijging in CO2-uitstoot (rebound effect)
 - De urgentie van energiebesparing en/of duurzame energie kan door CCS verloren gaan
 - Ander argument, namelijk
-

Page 11 - Question 20 - Choice - Multiple Answers (Bullets)

CCS lijkt veelbelovender dan het is

- Technologie is te laat marktrijp, toekomstmuziek, nog in kinderschoenen, tegen de tijd dat CCS grootschalig mogelijk is zijn alternatieven voor CO2 reductie al aantrekkelijker
 - Voordelen en nut van CCS nog te onzeker, effectiviteit tegen emissiereductie is twijfelachtig of onvoldoende
 - Toekomst van waterstof nog te onzeker om te spreken over transitie naar waterstofeconomie
 - Het is onzeker of de CO2 voldoende lang onder de grond blijft om klimaatverandering tegen te gaan
 - Ander argument, namelijk
-

Page 11 - Heading

Klimaatdoelstellingen – voor

Page 11 - Question 21 - Choice - Multiple Answers (Bullets)

Faciliteert het maken van klimaatafspraken en het halen van klimaatdoelstellingen

- CCS maakt (internationale) klimaatafspraken/doelstellingen/ (beter) haalbaar
 - Als rijke landen zoals Nederland het voorbeeld geven, zullen landen met veel kolencentrales zoals China eerder volgen
 - CCS helpt om milieudoelstellingen te realiseren
 - Ander argument, namelijk
-

Page 11 - Heading

Klimaatdoelstellingen – tegen

Page 11 - Question 22 - Choice - Multiple Answers (Bullets)

Stimuleert freeloaders

- CCS toepassen is zinloos als ontwikkelingslanden niet eveneens hun gedrag aanpassen
 - Als rijke landen zoals Nederland voorop gaan lopen, zullen andere landen juist minder geneigd zijn iets te doen
 - Vrijblijvendheid voor bedrijven te groot. Bedrijven vragen wel om subsidie maar leggen zichzelf nergens op vast. Alleen het ETS zal bedrijven niet motiveren aan CCS te gaan doen. Dat werkt alleen als kolencentrales CCS plicht krijgen opgelegd
 - Ander argument, namelijk
-

Page 11 - Heading

Energie(voorziening) – voor

Page 11 - Question 23 - Choice - Multiple Answers (Bullets)

CCS houdt fossiele energievoorraden toegankelijk

- CCS is enige manier om fossiele brandstoffen (e.g. kolen) te blijven gebruiken en tegelijk de emissies te verlagen ('schoon fossiel')
 - CCS is nodig om aan de groeiende vraag naar elektriciteit te kunnen voldoen zonder ernstige klimaatgevolgen
 - CCS past in huidige energievoorziening. Burgers hoeven hun leefstijl minder snel te veranderen om de klimaatdoelen te halen
 - Ander argument, namelijk
-

Page 11 - Question 24 - Choice - Multiple Answers (Bullets)

CCS draagt bij aan de succesvolle implementatie van duurzame energie (transitie duurzame energiehuishouding)

- CCS geeft de tijd die nodig is voor efficiënte grootschalige implementatie van hernieuwbare/duurzame energie (transitietechnologie/tijdelijke oplossing/tussenoplossing in positieve zin)
 - Verplichte CCS verhoogt de prijs van elektriciteit, duurzame energie wordt hierdoor eerder rendabel/concurrerend met fossiele energie
 - Centrales met CCS zijn een stabiele aanvulling op het wisselende energieaanbod van zon en wind (dus leveringszekerheid in combinatie met hernieuwbare energie in het net)
 - Ander argument, namelijk
-

Page 11 - Heading

Energie(voorziening) – tegen

Page 11 - Question 25 - Choice - Multiple Answers (Bullets)

CCS kost extra energie

- Energy penalty; CCS kost (tien tot veertig procent) extra energie, dat put kolen- en gasvoorraden sneller uit, efficiency centrale daalt
 - Ander argument, namelijk
-

The Dutch general public's opinion on CCS

Page 11 - Question 26 - Choice - Multiple Answers (Bullets)

CCS remt de ontwikkeling van hernieuwbare energie

- De investeringen in CCS gaan ten koste van de investeringen in hernieuwbare/duurzame energie, CCS zal efficiënte grootschalige implementatie van hernieuwbare energie verhinderen
 - CCS vergt investeringen in kolencentrales, waardoor deze langer gebruikt zullen worden. CCS houdt zo juist het gebruik van fossiele brandstoffen in stand (lock-in)
 - CCS is geen zinvolle investering, voorraad fossiele brandstoffen is immers eindig, met CCS gaan kostbare tijd en middelen verloren in een tussenoplossing
 - Ander argument, namelijk
-

Page 11 - Heading

Milieu/Omgeving – voor

Page 11 - Question 27 - Choice - Multiple Answers (Bullets)

CCS is goede oplossing gezien Ruimtelijke Ordening/Milieu

- CCS is vergeleken met zonne- en windenergie efficiënt met ruimte en materiaal
 - Een CO2 opslag (op land) is onzichtbaar, lage infrastructurele impact voor omwonenden
 - Geschikte opslaglocaties/reservoirs aanwezig
 - Opslag op zee veroorzaakt geen/weinig overlast voor de omgeving
 - Ander argument, namelijk
-

Page 11 - Heading

Milieu/Omgeving – tegen

Page 11 - Question 28 - Choice - Multiple Answers (Bullets)

CCS is slecht voor het milieu

- CCS heeft (teveel) risico's voor het milieu (zonder verdere toelichting)
 - CO2 is afval/een afvalproduct, dat kan/mag je niet in de grond stoppen
 - Kolenwinning is schadelijk voor het milieu in de omgeving van kolenmijnen
 - Kolengebruik in centrales is vervuilend, slecht voor luchtkwaliteit
 - Bij CO2-afvang komen grote hoeveelheden chemisch afval vrij zoals amines
 - Bij afvang CO2 na verbranding kunnen schadelijke/kankerverwekkende stoffen worden uitgestoten
 - CCS leidt door extra energieverbruik tot extra luchtverontreinigende emissies (fijnstof)
 - Ander argument, namelijk
-

Page 11 - Question 29 - Choice - Multiple Answers (Bullets)

Problemen met ruimtelijke ordening/regelgeving

- Uitdagingen infrastructuur, nog niet beschikbaar en/of veel aanpassingen nodig (pijpleidingen, transport over de weg of per schip)
 - Uitdagingen locatieselectie (ruimte nodig, dichtbevolktheid, drukte in bodem)
 - Discussie over geschiktheid opslaglocaties en/of opslagcapaciteit
 - Opslag op land/onder dichtbevolkt gebied (nog) niet verantwoord
 - Ander argument, namelijk
-

Page 11 - Heading

Ethiek – voor

Page 11 - Question 30 - Choice - Multiple Answers (Bullets)

Het is onze plicht CO2 op te slaan

- CO2 is een restproduct van elektriciteitsopwekking, dat hoor je niet in de lucht te 'lozen'
 - Een rijk Westers land zoals Nederland hoort het initiatief te nemen / voorbeeld te geven
 - Lokale demonstratieprojecten dienen een nationaal belang
 - Iets aan klimaatverandering doen is een morele kwestie, geen politieke
 - Ander argument, namelijk
-

Page 11 - Heading

Ethiek – tegen

Page 11 - Question 31 - Choice - Multiple Answers (Bullets)

CCS is niet verantwoord

- CCS is een pseudo-oplossing, geen 'echte' oplossing, niet 'duurzaam' (zonder verdere argumentatie)
- End-of-pipe oplossing: Met CCS pak je het probleem niet bij de bron aan, een restproduct stop je niet voor eeuwig in de grond
- Transitietechnologie in negatieve zin: CCS houdt een niet-duurzaam systeem in stand, houdt ons verslaafd aan fossiele brandstoffen, verlengt fossiel tijdperk
- CCS is het 'groenwassen' van fossiele energie, bedrijven gebruiken het alleen maar om huidige fossiele energieopwekking te legitimeren, excuus voor doorgaan met fossiel
- Er is (nog) onvoldoende draagvlak voor CCS, geen vertrouwen in wet- en regelgeving rond CCS

The Dutch general public's opinion on CCS

- Keuze voor CCS (o.m. selectie van opslaglocaties) is puur financieel, geen aandacht voor issues zoals veiligheid en draagvlak
 - Issue mensenrechten/arbeidsomstandigheden in landen waar kolen worden gewonnen
 - Je verschuift het probleem naar de toekomst (toekomstige generaties)
 - Je verplaatst het probleem naar andere landen, geen oplossing voor mondiaal probleem, niet solidair, arme landen kunnen dit niet toepassen
 - Kosten-baten verdeling: je zadelt mensen lokaal op met de lasten van een project waarvan de voordelen onduidelijk zijn en/of op nationaal of internationaal niveau liggen.
 - Ander argument, namelijk
-

Page 11 - Heading

Veiligheid – voor

Page 11 - Question 32 - Choice - Multiple Answers (Bullets)

CCS is veilig

- CCS is veilig, effecten zijn (voldoende) bekend, technologisch volledig verantwoord/betrouwbaar, techniek is beproefd, we hebben er ervaring mee
 - Delen van de keten zijn veilig gebleken, CO2-afvang, -transport en ondergrondse CO2-opslag zijn elk apart al veilig toegepast
 - Onderzoek/risicoberekeningen laten zien dat het risico binnen (wettelijke/aanvaardbare) normen blijft, risico is vooral theoretisch, risico verwaarloosbaar klein, risico's zijn 'beheersbaar'
 - Elders in de wereld is het injecteren van CO2 in olievelden een beproefde techniek om olieopbrengsten of gasopbrengsten te vergroten. EOR / EGR
 - Er zijn reeds (succesvol verlopende) CCS (pilot)projecten elders in de wereld
 - Er zijn natuurlijke CO2 velden die al miljoenen jaren stabiel zijn
 - Gasvelden zijn bewezen gasdicht; aardgas zat er immers ook miljoenen jaren in
 - Op lange termijn stabilisatie in ondergrond (e.g. doordat CO2 mineraliseert)
 - Ander argument, namelijk
-

Page 11 - Question 33 - Choice - Multiple Answers (Bullets)

CCS is veiliger dan...

- Vergeleken met bijvoorbeeld methaan (aardgas) is CO2 een ongevaarlijk gas, eigenschappen CO2 gunstiger dan eigenschappen andere gassen
 - Vergeleken met andersoortige operaties (gaswinning, gasopslag, chloortransport) zijn de risico's van CCS niet groter of zelfs (veel) kleiner
 - Vergeleken met 'ander specifieke project X' (e.g. betuwelijn) zijn de risico's van dit specifieke onshore CCS project veel lager
 - Ander argument, namelijk
-

Page 11 - Question 34 - Choice - Multiple Answers (Bullets)

CCS heeft een positief effect op andere veiligheidsproblemen

- CCS vermindert de behoefte aan kernenergie / is vervanger voor kernenergie
 - CCS beperkt bodemdaling, het herstelt gedeeltelijk het drukevenwicht na gaswinning
 - Toename geopolitieke veiligheid, e.g. CCS vermindert afhankelijkheid van olie - of gasleveranciers buitenland
 - Ander argument, namelijk
-

Page 11 - Heading

Veiligheid – tegen

Page 11 - Question 35 - Choice - Multiple Answers (Bullets)

De gevolgen van CCS zijn onvoorspelbaar

- CCS is onveilig, de risico's van CCS zijn onbekend, CCS is (te) complex, gevolgen onvoorspelbaar (implicatie dat veiligheid nooit voldoende gegarandeerd kan worden - ook meldingen dat bewoners bang zijn of zich zorgen maken hieronder coderen)
 - CCS is nieuw en nooit grootschalig toegepast, of nooit eerder zoals in huidig project; experimentele fase, delen keten alleen afzonderlijk toegepast, (implicatie dat de techniek en de risico's niet volledig/voldoende bekend zijn, in elk geval niet voor het project of de situatie die in artikel wordt besproken)
 - Risicocalculaties/modellen zijn niet op werkelijkheid gebaseerd, geen praktijkervaring, huidige modellen niet toereikend om veiligheidsrisico's nauwkeurig te berekenen
 - Beschikbare ervaring vooral over CCS op zee, niet op land
 - Geen consensus onder experts, informatie over CCS soms tegenstrijdig, burgers vertrouwen experts niet
 - Extra energiegebruik vergroot onze afhankelijkheid van (kolen)leveranciers fossiele brandstoffen (geopolitieke veiligheid kan afnemen)
 - Ander argument, namelijk
-

Page 11 - Question 36 - Choice - Multiple Answers (Bullets)

Lekkage, monitoring en regelgeving

- Zorgen over lekkage naar oppervlakte op land (e.g. als bij transport en/of opslag onder lage druk CO₂ vrijkomt, kan dit op windstille dagen verstikking veroorzaken)
- Zorgen over lekkage naar oppervlakte op zee, (e.g. as CO₂ uit een opslag onder de zeebodem ontsnapt dreigt verzuring van het (zee)water)
- Zorgen over ondergrondse lekkage van CO₂ in grondwater (verzuring grondwater, ontstaan koolzuur)
- Zorgen/onzekerheid over andere ondergrondse effecten CO₂ (e.g. migratie, chemische

The Dutch general public's opinion on CCS

- reacties, reacties met ondergronds gesteente, cement, leidingen)
- Onzekerheid over effecten CCS op de bodem (e.g. daling of stijging, aardbevingen)
 - Stelling dat CO₂-opslag kan leiden tot kleine aardbevingen, vergelijkbaar met die bij aardgaswinning
 - Blijvend toezicht/monitoring nodig, wie is verantwoordelijk, niet haalbaar eeuwig goed te monitoren, locatie wordt vergeten, situatie bovengronds verandert, geen vertrouwen dat autoriteiten dit kunnen managen
 - Nog geen goede regelgeving voor CO₂ opslag
 - Ander argument, namelijk
-

Page 11 - Question 37 - Choice - Multiple Answers (Bullets)

CCS is gevaarlijk voor de volksgezondheid/welzijn

- CCS heeft (teveel) risico's voor de volksgezondheid (statement zonder toelichting)
 - De CO₂ opslagplaats kan doelwit worden van terroristische aanslagen
 - De CO₂ opslagplaats ontploft (blow-out) omdat deze onder hoge druk staat
 - CCS veroorzaakt (geluids)overlast, (mogelijk) een negatief effect op lokale volksgezondheid, (gevoelde) veiligheid, leefbaarheid, etc.
 - Ander argument, namelijk
-

Page 11 - Heading

Economie – voor

Page 11 - Question 38 - Choice - Multiple Answers (Bullets)

CCS is goed voor economie

- CCS genereert werkgelegenheid, CCS genereert lokale bedrijvigheid, goed voor lokale economie
 - Business opportuniteiten; Het bedrijfsleven kan kennis, technologie en opslagcapaciteit (internationaal) vermarkten, CCS levert bedrijven geld op, belastingvoordeel door afvangen CO₂ (e.g. in Noorwegen)
 - CCS vergroot de bedrijfszekerheid van bestaande kolen- en gascentrales
 - Afvangtechnologie levert kennis op die bruikbaar is voor de productie van waterstof, dus investering in toekomstige waterstofeconomie
 - Ander argument, namelijk
-

Page 11 - Question 39 - Choice - Multiple Answers (Bullets)

Met CCS zijn de klimaatdoelen economisch haalbaar

- CCS maakt klimaatneutrale economische groei mogelijk, CCS maakt klimaatbeleid betaalbaar

The Dutch general public's opinion on CCS

- CCS is relatief goedkoop, elektriciteit uit centrales met CCS is op middellange termijn goedkoper dan elektriciteit uit zon en wind
 - Verplichte CCS laat de vervuiler (via de energierekening) betalen
 - Met CCS verruimt een land zijn emissierechten
 - Ander argument, namelijk
-

Page 11 - Question 40 - Choice - Multiple Answers (Bullets)

Gunstige uitgangspositie NL

- Kennis en kunde. Nederland heeft vergeleken met andere landen een voorsprong in het ontwikkelen/toepassen van CCS, of kan deze verwerven door investeren in CCS
 - Geschikte locaties. Nederland heeft (dicht bij elektriciteitscentrales) geschikte gasvelden/velden met grote opslagcapaciteit (grote potentiële afvang/opslag mogelijk)
 - Ander argument, namelijk
-

Page 11 - Heading

Economie – tegen

Page 11 - Question 41 - Choice - Multiple Answers (Bullets)

CCS kost bedrijfsleven geld, lage investeringsbereidheid

- CCS is (te) duur (zonder verdere toelichting), er zijn aantrekkelijker/relatief goedkopere alternatieven beschikbaar
 - De kosteneffectiviteit van CCS is onzeker/betwistbaar, kosten en baten niet in verhouding, van de hoge startinvesteringen voor technologie en infrastructuur is onzeker of deze terugverdiend worden, initieel negatief voor concurrentiepositie, CCS is vooralsnog "geen economisch gezonde optie"
 - CCS is alleen levensvatbaar bij internationale afspraken over CO2 emissiereductie en goede prijs voor CO2 in het ETS
 - Van de hoge exploitatiekosten is onzeker of deze in de elektriciteitsprijs verrekend kunnen worden
 - Er is geen markt voor CCS, onwil om in CCS te investeren, bv bij banken/fondsen
 - Ander argument, namelijk
-

Page 11 - Question 42 - Choice - Multiple Answers (Bullets)

CCS kost de burger/maatschappij geld

- CCS is alleen realiseerbaar met geld van overheden (subsidies, EU/nationaal)
- De kosten van CO2 opslag zullen worden doorberekend aan belastingbetalers (CO2 belasting). Dit is unfair, gaat tegen het principe "de vervuiler betaalt"
- De elektriciteitsrekening stijgt mogelijk door CCS

The Dutch general public's opinion on CCS

- CCS heeft mogelijk een negatief effect op de lokale huizenprijzen
- Ander argument, namelijk

Page 12 - Heading

Woordkeuze/associaties CCS

Page 12 - Question 43 - Choice - One Answer (Bullets)

Maakt het verhaal in de beschrijving van CCS zonder nadere toelichting/argumentatie gebruik van woorden die een positief gevoel (kunnen) oproepen (e.g. schoon fossiel, milieuproject, duurzaam, transitie, klimaatneutraal, efficiënt, noodzakelijk)?

- Nee [Skip to 14]
- Ja

Page 13 - Heading

Woordkeuze/associaties CCS

Page 13 - Question 44 - Choice - Multiple Answers (Bullets)

Welke positieve associaties worden gelegd met CCS?
Meerdere antwoorden mogelijk.

- Innovatief: veelbelovende techniek, nieuwste techniek, goede technologie, voorbeeldproject
 - Celebrity endorsement: belangrijk publiek figuur met een 'groen' imago (Lubbers, SNM) of een 'onafhankelijk expert' breekt een lans voor CCS
 - Politieke steun: overheid, politicus of politieke partij spreekt expliciete steun uit voor CCS
 - Schoon fossiel: schone steenkooltechnieken, moderne kolencentrales, schone kolen, etc.
 - Klimaat, milieu, duurzaam, transitie: associatie met duurzaam, verduurzaming, in 1 adem met andere duurzame projecten/activiteiten van bedrijven, milieuvriendelijk, klimaatvriendelijk
 - Anders, namelijk
-

Page 14 - Heading

Woordkeuze/associaties CCS

The Dutch general public's opinion on CCS

Page 14 - Question 45 - Choice - One Answer (Bullets)

Maakt het verhaal in de beschrijving van CCS zonder nadere toelichting/argumentatie gebruik van woorden die een negatief gevoel (kunnen) oproepen (e.g. pseudo-oplossing, niet echt duurzaam, dumpen afval, whitewashing, risico, noodzakelijk kwaad)?

- Nee [Skip to 16]
 Ja

Page 15 - Heading

Woordkeuze/associaties CCS

Page 15 - Question 46 - Choice - Multiple Answers (Bullets)

Welke negatieve associaties worden gelegd met CCS?
Meerdere antwoorden mogelijk.

- Celebrity endorsement: belangrijk publiek figuur met een 'groen' imago (al Gore) of een 'onafhankelijk expert' spreekt zich expliciet negatief uit over CCS
 - Politieke steun: overheid, politicus, of politieke partij spreekt zich expliciet negatief uit tegen CCS
 - CO2-dumping: dumpen van afval, vuilnisbelt, CO2 weggemoffeld, 'rommel onder een woonwijk blazen'
 - CO2 is een afvalproduct, afvalgas, gevaarlijk, giftig, dodelijk
 - Noodzakelijk kwaad, allerlaatste redmiddel, noodgreep
 - Omstreden: omstreden opslag, omstreden plannen, omstreden proef, proeftuin, onbewezen
 - Groupthink/groepsdruk: Weinig ruimte voor wetenschappelijke kritiek op CO2-afvang en -opslag, gebrek aan 'onafhankelijke deskundigen', wetenschappelijke informatie niet openbaar
 - Complotdenken: informatie achtergehouden, 'geheime' bijeenkomsten experts, mogelijkheden extra onderzoek wettelijk ingeperkt, overheid en bedrijven spelen onder 1 hoedje
 - Procedurele fairness: CCS wordt door overheid en bedrijven doorgedrukt ondanks gebrek aan draagvlak, milieuregels worden opzij geschoven (in Crisis- en Herstelwet), lokale bestuurders gepasseerd 'via een achterdeurtje' - ongelijke machtsverdeling, burgers als proefkonijnen gebruiken, bewoners 'zijn woedend'
 - Kosten-baten verdeling: veronachtzaming maatschappelijke impact (door overheden en/of bedrijven), suggestie dat overheid teveel luistert naar lobby bedrijfsleven en geen rekening houdt met burgers
 - Veiligheid: risicovol project, onduidelijkheid over gevolgen, vergelijking eerdere rampen, onbeproefde technieken, explosiegevaar, 'verstikkingsdrama'
 - Waargenomen angst: inwoners zijn bang, vinden het eng (waarom blijft onduidelijk)
 - Anders, namelijk
-

The Dutch general public's opinion on CCS

Page 16 - Heading

Woordkeuze/associaties CCS

Page 16 - Question 47 - Choice - One Answer (Bullets)

Wordt gebruik gemaakt van taal of woorden waarin een specifiek CCS project wordt geassocieerd met een proef, experiment, test, demonstratieproject, of pilotproject?

- Nee
- Ja

Page 17 - Heading

Woordkeuze/associaties CCS

Page 17 - Question 48 - Choice - One Answer (Bullets)

Wordt een vergelijking of associatie gemaakt tussen CCS en kernenergie/kernafval? Toelichting: In eerdere coderingen ben ik de associatie met kernafval niet tegengekomen maar dat kan nu anders zijn door Fukushima. Wat je wel zag waren standpunten van partijen die van CCS en Kernenergie een EN-EN pakketje maken (VVD) of partijen die er juist een OF-OF verhaal van maken (GroenLinks).

- Nee
- Ja

Page 17 - Question 49 - Open Ended - Comments Box

Eventueel specificeren. Meerdere woorden/uitdrukkingen scheiden met puntkomma's

Page 18 - Heading

Woordkeuze/associaties CCS

Page 18 - Question 50 - Choice - One Answer (Bullets)

Wordt een vergelijking of associatie gemaakt tussen CCS en schaliegas? bv vergelijking tussen projecten, projectplannen, eigenschappen technologie, enz.

- Nee
- Ja

Page 18 - Question 51 - Open Ended - Comments Box

Eventueel specificeren. Meerdere woorden/uitdrukkingen scheiden met puntkomma's

.....

.....

.....

Page 19 - Heading

Woordkeuze/associaties CCS

.....

Page 19 - Question 52 - Choice - One Answer (Bullets)

Wordt beweerd of geïmpliceerd dat discussie over CCS een kwestie is van verstand tegen gevoel/emoties, experts tegen niet-experts, bekendheid versus onbekendheid/onwetendheid?

- Nee
- Ja

Page 19 - Question 53 - Open Ended - Comments Box

Eventueel specificeren. Meerdere woorden/uitdrukkingen scheiden met puntkomma's

.....

.....

.....

Page 20 - Heading

Overall evaluatie

.....

Page 20 - Question 54 - Choice - One Answer (Bullets)

Over-all evaluatie CCS positief/negatief
Hoe kan de houding in het artikel t.o.v. CCS over het geheel worden getypeerd? Bepaal dit op grond van woordkeuze in titel, aantal argumenten voor/tegen, sterkte argumenten, wie de argumenten noemt (e.g. journalist of geïnterviewden), aandacht voor mening voorstanders en tegenstanders, woordkeuze/associaties CCS en over-all tone of voice.

- CCS alleen genoemd, geen argumenten voor of tegen
- Positief (meer argumenten voor dan tegen, of vooral positieve associaties)
- Neutraal (balans argumenten voor/tegen, of verschillende associaties)
- Negatief (meer argumenten tegen dan voor, of vooral negatieve associaties)

Page 21 - Heading

Projecten

Page 21 - Question 55 - Choice - Multiple Answers (Bullets)

Projecten en projectlocaties Komen in het verhaal specifieke projecten of projectlocaties ter sprake, zo ja welke? Ook aankondiging bouw energiecentrale met wellicht CCS in toekomst coderen als project.

- Geen
- Barendrecht (Shell)
- ROAD, Maasvlakte/Noordzee (E.on, Electrabel, GDF Suez - alleen ROAD project hier coderen!)
- Rotterdam, Pernis, Rijnmondgebied, Maasvlakte (onduidelijk welk project precies)
- Het Noorden, Noord-Nederland (div. projecten o.m. RWE en Gasunie)
- Noordzee (div. projecten, e.g. TAQA, K12B) ROAD niet hieronder coderen maar hierboven!
- Geleen (DSM Chemelot)
- Eemshaven (Nuon Magnum, RWE project Delfzijl)
- IJmuiden (Corus)
- Buggenum (Nuon)
- Drachten (ZEPP – SEQ Eneco)
- Geertruidenberg (AMER-9 Kolenvergassing)
- Andere projecten in Nederland
- Buitenlands project (e.g. Weyburn-Midale, Sleipner)

Page 22 - Heading

Actualiteiten/Side events

Page 22 - Question 56 - Choice - Multiple Answers (Bullets)

Wordt gerefereerd aan internationale incidenten/ongelukken met CO2, zo ja welke?

- Geen
 - Kameroen (Lake Nyos, 1986 en/of Lake Monoun, 1984)
 - Sleipnerveld (Noorwegen, offshore gasveld, Statoil)
 - Mönchengladbach (Duitsland, ongeluk blusinstallatie)
 - Weyburn-Midale
 - Andere, namelijk
-

The Dutch general public's opinion on CCS

Page 22 - Question 57 - Choice - One Answer (Bullets)

Wordt in het artikel verwezen naar recente televisieuitzendingen over CCS (of grote radio-items maar ik verwacht eigenlijk niet dat dit voorkomt)? Bijvoorbeeld de uitzending van 'Uitgesproken WNL' op 9 februari 2011. Deze vraag is vooral bedoeld als check of ik misschien belangrijke items gemist heb.

- Nee
- Ja

Page 22 - Question 58 - Choice - One Answer (Bullets)

Wordt in het artikel verwezen naar het besluit van minister Verhagen om ondergrondse CO2 opslag op land niet toe te staan?

- Nee
- Ja

Page 23 - Heading

Kennisoverdracht - CO2

Page 23 - Question 59 - Choice - One Answer (Bullets)

Wordt iets gezegd over de eigenschappen, effecten, bronnen, of toepassingen van CO2? Dus wordt iets uitgelegd over wat CO2 is, wat het doet, waar het vandaan komt of waar het voor kan worden gebruikt? Bijvoorbeeld dat CO2 een (broeikas)gas is, of dat kolencentrales het uitstoten, of dat het in de tuinbouw gebruikt wordt. De uitleg moet wel redelijk expliciet zijn, zodat iemand zonder kennis van CO2 het snapt.

- Nee
- Ja

Page 24 - Heading

Kennisoverdracht - CO2 afvang, transport, opslag

Page 24 - Heading

CCS – Afvang

Page 24 - Question 60 - Choice - One Answer (Bullets)

Wordt de afvang van CO2 in het artikel besproken? dwz het artikel vermeldt minstens dat CO2 ergens afgevangen wordt of moet worden. Alleen het woord CO2-afvang in het artikel telt niet als besproken.

The Dutch general public's opinion on CCS

- Nee [Skip to 26]
- Ja

Page 25 - Heading

Kennisoverdracht - CO2 afvang, transport, opslag

Page 25 - Heading

CCS – Afvang

Page 25 - Question 61 - Choice - Multiple Answers (Bullets)

Welke mogelijkheden voor CO2 afvang worden in het artikel genoemd?

- Geen/niet gespecificeerd
 - Bij 'het opwekken van energie', energiecentrales; bij 'stroomproductie', elektriciteitscentrales
 - Bij opwekken van elektriciteit/energie uit kolen, kolencentrales, kolenvergassing
 - Bij opwekken van elektriciteit/energie uit aardgas, gasgestookte centrales
 - Bij opwekken van elektriciteit/energie uit biomassa, biomassacentrales
 - Bij waterstofproductie, waterstofcentrales
 - Bij gebruik/verbranding olie, bij raffinaderijen
 - Wel bron genoemd maar soort bron niet uitgelegd (e.g. 'de Magnum centrale', 'de raffinaderij in Pernis')
 - (Zware) industrie (algemeen, geen specifieke sector)
 - Industrie specifiek (specifieke bron genoemd, e.g. ammoniakfabriek, staalfabriek)
 - Anders, namelijk
-

Page 25 - Question 62 - Choice - One Answer (Bullets)

Worden verder nog details besproken van het afvangpunt en/of de afvangprocedure, e.g. het proces van kolenvergassing? Ruimhartig coderen. Ook als er bv alleen maar staat hoeveel % van de CO2-uitstoot men van plan is af te vangen is dat al een detail (over het algemeen is het in kranten droef gesteld met het detailniveau).

- Nee
- Ja

Page 26 - Heading

Kennisoverdracht - CO2 afvang, transport, opslag

The Dutch general public's opinion on CCS

Page 26 - Heading

CCS – Transport

Page 26 - Question 63 - Choice - One Answer (Bullets)

Wordt het transport van CO2 in het artikel besproken?dwz het artikel vermeldt minstens dat CO2 getransporteerd wordt of moet worden. Alleen de term CO2-transport telt niet als besproken.

- Nee [Skip to 28]
 Ja

Page 27 - Heading

Kennisoverdracht - CO2 afvang, transport, opslag

Page 27 - Heading

CCS – Transport

Page 27 - Question 64 - Choice - Multiple Answers (Bullets)

Welke transportmethoden worden genoemd?

- Geen/niet gespecificeerd
 Schip
 Vrachtwagen, tankwagen
 Pijpleiding
 Anders, namelijk
-

Page 27 - Question 65 - Choice - One Answer (Bullets)

Worden verder nog details van het transport besproken, e.g. hoe CO2 getransporteerd wordt (gas of vloeibaar), soort pijpleiding, waar vindt het transport plaats, plannen nieuwe infrastructuur?

- Nee
 Ja

Page 28 - Heading

Kennisoverdracht - CO2 afvang, transport, opslag

The Dutch general public's opinion on CCS

Page 28 - Heading

CCS – Opslag

Page 28 - Question 66 - Choice - One Answer (Bullets)

Wordt de opslag van CO2 in het artikel besproken?dwz het artikel vermeldt minstens dat CO2 wordt opgeslagen of opgeslagen moet worden. Alleen de term CO2-opslag telt niet als besproken.

- Nee [Skip to 37]
 Ja

Page 29 - Heading

Kennisoverdracht - CO2 afvang, transport, opslag

Page 29 - Heading

CCS – Opslag

Page 29 - Question 67 - Choice - Multiple Answers (Bullets)

Wordt de aard van de opslag in het artikel besproken?

- Nee
 (bijna) Leeg olieveld (ook voor Enhanced Oil Recovery)
 (bijna) Leeg (aard)gasveld (ook voor Enhanced Gas Recovery)
 Diepe steenkoollagen
 Diepe (zout)waterhoudende lagen, saline aquifers
 Ondergrondse zoutkoepels
 In de grond, onder de grond, in (diepe) ondergrond, (diepe) steenlagen, (poreuze) aardlagen
 In de bodem (volgens deskundigen slechts de toplaag maar voor journalisten 1 pot nat)
 Onder de zeebodem, onder de zee
 In de zee (ipv eronder - soms staat er dat CO2 'in zee' gepompt wordt, kan aanleiding zijn voor misperceptie)
 Anders, namelijk
-

Page 29 - Question 68 - Choice - One Answer (Bullets)

Liggen de besproken opslagmogelijkheden/locaties op land, zee, beide, of is het niet duidelijk?

- Niet gespecificeerd/onduidelijk
 Land

The Dutch general public's opinion on CCS

- Zee
- Beide

Page 29 - Question 69 - Choice - One Answer (Bullets)

Worden verder nog details van de opslag besproken, bv benoeming type aardlaag of steensoort? Vaak wordt iets gezegd over de opslagcapaciteit, bv hoeveel megaton er in het veld past. Of de opmerking dat we zowel opslaglocaties op land als op zee nodig hebben. Of dat de aardlaag uit zandsteen bestaat. In alle gevallen is dat een "ja" op deze vraag. Als details beschouw ik ook informatie over hoeveel ton CO2 erin gaat, hoe groot het veld is, wat er onder de grond gebeuren moet (bv 'gesteente kraken' enz.)

- Nee
- Ja

Page 30 - Heading

Kennisoverdracht - Energieproductie en energiegebruik

Page 30 - Question 70 - Choice - One Answer (Bullets)

Wordt in het artikel iets gezegd over het onderwerp energieopwekking en gebruik? Bijvoorbeeld waarom energie wordt opgewekt (electriciteit, warmte, brandstof), voor wie (huishoudens, bedrijven), energiebehoefte, groeiende energievraag, beschikbare (fossiele) energiebronnen, beschikbaarheid fossiele brandstoffen, enzovoort.

- Nee [Skip to 32]
- Ja

Page 31 - Heading

Kennisoverdracht - Electriciteitsopwekking

Page 31 - Question 71 - Choice - One Answer (Bullets)

Wordt in het artikel iets gezegd over de verhoudingen (i.e. welke bron, welk percentage) waarin elektriciteit momenteel met bepaalde bronnen wordt opgewekt? De bronnen zijn: Fossiel (Kolen, Aardgas, Olie), Hernieuwbaar (Windenergie, Zonne-energie, Biomassa, Waterkracht, Aardwarmte), Kernenergie.

- Nee
- Ja

Page 31 - Heading

Kennisoverdracht - Relatie fossiel en CO2

Page 31 - Question 72 - Choice - One Answer (Bullets)

Wordt een relatie gelegd tussen fossiele energievoorziening (olie, kolen, gas) en CO2 uitstoot? Let op, er moet duidelijk een relatie worden gelegd tussen gebruik/verbranding van fossiele brandstoffen en CO2-uitstoot. Dus als wordt vermeld dat elektriciteitscentrales CO2 uitstoten maar er wordt niet verteld wat de centrale stookt, telt het niet als relatie.

- Nee
- Ja

Page 32 - Heading

Kennisoverdracht - Klimaatverandering en temperatuurstijging

Page 32 - Question 73 - Choice - One Answer (Bullets)

Wordt het onderwerp klimaatverandering en/of temperatuurstijging besproken? dwz het woord 'klimaatverandering' of 'temperatuurstijging' of 'opwarming' of 'klimaatopwarming' komt minstens 1x in het artikel voor.

- Nee [Skip to 34]
- Ja

Page 33 - Heading

Kennisoverdracht - Klimaatverandering en temperatuurstijging

Page 33 - Question 74 - Choice - One Answer (Bullets)

Wordt uitgelegd dat CO2 bijdraagt aan klimaatverandering en/of temperatuurstijging? NB. Als wordt gezegd dat CO2 een 'broeikasgas' is dan telt dat ook.

- Nee
- Ja

Page 34 - Heading

Kennisoverdracht - Broeikaseffect

Page 34 - Question 75 - Choice - One Answer (Bullets)

Wordt gerefereerd aan of melding gemaakt van het broeikaseffect?dwz het woord 'broeikaseffect' komt minstens 1x in het artikel voor, of het artikel verwijst direct naar het broeikaseffect via uitleg over het proces.

The Dutch general public's opinion on CCS

- Nee [Skip to 36]
- Ja

Page 35 - Heading

Kennisoverdracht - Broeikaseffect

Page 35 - Question 76 - Choice - One Answer (Bullets)

Wordt uitgelegd wat de term 'broeikaseffect' inhoudt? Een correcte uitleg is van deze strekking: Van de warmte van de zon die aarde bereikt wordt een deel vastgehouden in de dampkring. Tegenwoordig kan een minder groot deel van de warmte ontsnappen uit de dampkring doordat hogere concentraties CO₂ een groter deel van die warmte vasthouden

- Nee
- Ja
- Nee en het artikel suggereert bovendien ten onrechte dat het broeikaseffect op zichzelf een schadelijk iets is ('tegengaan broeikaseffect', 'verminderen broeikaseffect')

Page 36 - Heading

Klimaatscepsis

Page 36 - Question 77 - Choice - One Answer (Bullets)

Wordt in het artikel gesteld dat klimaatverandering/temperatuurstijging/versterking broeikaseffect wordt overdreven, of dat de rol van de mens hierin wordt overdreven (en we dus toch niets kunnen doen)?

- Nee
- Ja

Page 37 - Heading

Mispercepties en overige opvallende zaken

Page 37 - Question 78 - Choice - One Answer (Bullets)

Bevat het artikel informatie/kennis over CO₂, CCS (al dan niet in relatie tot andere mitigatiemaatregelen), energieopwekking, klimaatverandering, temperatuurstijging, of het broeikaseffect die overduidelijk onjuist is (en niet al gecodeerd)? Het gaat niet om informatie die discutabel is, maar alleen om dingen die echt als 'fout' bestempeld kunnen worden.

- Nee
- Ja [Vul veld hieronder in]

The Dutch general public's opinion on CCS

Page 37 - Question 79 - Open Ended - Comments Box

Indien hierboven 'Ja' geantwoord, vul hier in welke misvattingen het artikel bevat. Meerdere misvattingen scheiden met puntkomma's.

Page 37 - Question 80 - Choice - One Answer (Bullets)

Zijn er bijzonderheden aan dit artikel die in het codeboek niet zijn behandeld?

- Nee
- Ja [Vul veld hieronder in]

Page 37 - Question 81 - Open Ended - Comments Box

Indien hierboven 'Ja' geantwoord, vul hier in welke bijzonderheden het artikel bevat. Meerdere opmerkingen scheiden met puntkomma's.

Page 37 - Question 82 - Choice - One Answer (Bullets)

Is een 2e codeurscheck op dit artikel gewenst? Kan bv aan de orde zijn bij lange, complexe artikelen Vorige keer was ik de enige codeur maar als ik iets vergeten was heb ik hier 'ja' gezegd zodat ik het later nog in de database kon aanvullen.

- Nee
- Ja

Page 37 - Question 83 - Open Ended - Comments Box

Indien hierboven 'Ja' geantwoord, vul hier eventueel in waarom het artikel een check nodig heeft. Meerdere opmerkingen scheiden met puntkomma's.