Public perceptions and preferences regarding large scale implementation of six CO_2 capture and storage technologies

Well-informed and well-considered opinions
versus
uninformed pseudo-opinions
of the Dutch public

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Summary

In the past four years, the Centre for Energy and Environmental Studies of Leiden University, in close cooperation with NWS of Utrecht University, has engaged in a research project that focussed on studying informed opinions of the general public regarding Carbondioxide Capture and Storage options (CCS options). This study has investigated the choices the general public would make after having received and evaluated expert information on the consequences pertaining to these choices. The method used to collect these informed preferences is called the Information-Choice Questionnaire (ICQ). By comparing informed public preferences, obtained through administration of the ICQ, with current public opinions and preferences regarding CCS options, collected in a more conventional survey, the outcomes of this project can indicate what options would be considered acceptable given sufficient knowledge, and how much and in what respect the current situation deviates from this possible future situation.

Information-Choice Questionnaire
The method of the ICQ was originally developed by Saris, Neijens and De Ridder (1983a/b, see e.g. Neijens, 1987; Neijens et al. 1992) to assess preferences for different ways of generating electricity in the Netherlands. The aim of the ICQ is not only to provide respondents with the necessary information to reach an informed opinion, but also to help them make use of this information to form opinions about different policy options: part of its aim is to guide respondents' information processing. Before respondents in the ICQ choose between policy options, they receive information to make a more informed choice. First, the choice is explicitly framed as a decision problem and respondents are informed about the background of the decision problem (e.g. they are told why these specific options are included in the decision problem). Second, respondents are provided with information about the consequences of the different policy options. To stimulate information processing and to help respondents reach a decision, they are requested to give a quantitative evaluation of each consequence (a rating on a scale with nineteen response categories ranging from -9 "a very big disadvantage" via 0 "totally irrelevant" to + 9 "a very big advantage"). On the basis of these quantitative evaluations, the subjective utility of each option may be determined, to evaluate each option overall and to choose which option is preferred and which option(s) is (are) unacceptable (Paragraph 1.2).

The effects and usefulness of the ICQ has been studied in extensive evaluation research (Neijens, 1987; Neijens, de Ridder & Saris, 1988; Van Knippenberg & Daamen, 1996; Van der Salm, Van Knippenberg & Daamen, 1997). Combined, the results from prior research analyzing the ICQ suggest that the ICQ's effect on respondents' preferences is due to both the information provided – which may wholly or in part contain new information relevant to the decision problem – and to better integration of the available information (due to the ICQ's structuring of information processing) (Paragraph 1.2). The fact that ICQ respondents may report different preferences than respondents in a more traditional survey shows that it may indeed be worth the trouble to use the ICQ in public opinion research. At the same time it implies that the results of an ICQ do not necessarily reflect *present* public support for a policy. Rather, the ICQ is especially suited to assess how public opinion may be *after* the public is informed about an issue or to assess the *potential* (i.e. after extra information is provided to the public) support for alternative policies.

Development of the ICQ on CCS options

The current study focuses on a complex environmental problem (global warming) and on the complex future energy technologies that may contribute to solving this problem. When informing lay people about such complex matter via an ICQ, several precautions are needed to guarantee that the public is presented with a relevant policy problem and with valid and balanced information regarding a restricted set of viable options to solve this problem (Paragraph 1.3).

First, it is essential to define a clearly specified and policy relevant choice problem that is not overly demanding for respondents. Furthermore, only *policy relevant* options to solve the problem should be presented, that is, options which are according to experts viable and not unlikely to be implemented. Three leading experts on CCS were consulted (NWS, Ecofys, ECN) to carefully define the policy problem and choose the most viable options (Paragraph 2.2.1). The policy problem was defined as:

"Which CCS option is the best to implement in the Netherlands by 2030 at the latest in order to reduce CO_2 emissions by 20% compared to the status quo?"

Six CCS options were chosen by the experts as most likely to be implemented on a large scale within 10 to 25 years in order to reduce CO_2 emissions. Each of these options on its own reduces CO_2 emissions by 20% and thus solves the policy problem. These six options were (first the label for lay people[*], next –in italics- the expert label and finally, between quotation marks, the brief expert label for the option, which we will use in this summary):

1. Large modern coal fired power stations (for private and commercial use) with CO_2 capture and storage *(Integrated Gasification Gas Combined Cycles with CCS for all kinds of end use)* "IGCC with CCS"

2. Conversion of natural gas into electricity (for private and commercial use) with CO_2 capture and storage *(Solid Oxide Fuel Cells with CCS for private and commercial use)* "SOFC with CCS"

3. Large coal fired hydrogen stations (for industrial use and for bus and freight transport) with CO_2 capture and storage *(Hydrogen production via coal gasification with CCS for industrial use)* "Hydrogen production via coal gasification with CCS"

4. Conversion of natural gas into hydrogen in large plants (for private and industrial use and bus and freight transport) with CO_2 capture and storage *(Hydrogen production via steam reforming with CCS for private and industrial use)* "Hydrogen production via steam reforming with CCS"

5. Retrieval of methane gas by storing captured CO_2 in coal beds *(Enhanced Coal Bed Methane for similar use as natural gas)* "ECBM"

6. Conversion of natural gas into hydrogen (for motor vehicles) with CO_2 capture and storage *(Small Scale reforming based on membrane technology with CCS for motor vehicles)* "Small Scale reforming based on membrane technology with CCS"

[*] Obviously, these options were not merely labeled in the ICQ but fully described for lay people. For an example of such a description for "SOFC with CCS" see Table 2 at the end of this summary.

Second, when informing people about the defined policy problem and about the consequences of the options that can solve this problem, it is essential that this information is valid and balanced. In the case of complex topics this means that in order to keep the amount of information manageable for all respondents, one must make a selection of the available expert information. With relatively complex and controversial topics such a selection could arouse debate. The information for this ICQ is therefore compiled by experts from different backgrounds and different organizations and checked by another, similarly differentiated group of experts. Fourteen experts of institutions such as the Central Plan Bureau, the ministries of Economical Affairs and VROM, the ECN, EcoFys, NOVEM, NAM, Natuur en Milieu, TNO-MEP, TNO-NITG and the Departments of Anorganical Chemistry and of NW&S of Utrecht University were interviewed and a literature study was done by several researchers of Utrecht University on the basis of which more quantification of storage potential and price was achieved. Seven experts checked the final document with all information (Paragraph 2.2.2 and 2.2.3). This information was translated by psychologists to lay language and then checked again by a different group of independent experts ("the resonance committee") (Paragraph 2.2.5). After this, the information for lay people and the procedure of the current ICQ was tested twice, on a sample of 23 teenagers on a low education level (VMBO), and furthermore on a sample of 100 average Dutch citizens (Paragraphs 2.2.4 and 2.3. See Appendix 2 for the English translation of the final information for lay people). The resonance committee judged the final information as valid, impartial and even-handed. Per option, respondents were presented with a general description of the option, such as how it works and when, where and in what form it would be implemented. The aspects and consequences, ranging from 8 to 12 per option, that were presented at this point concerned requirements for new installations and lines, for technological breakthroughs or vehicles, safety-issues, environmental issues, reliability, economic consequences, price, and number of years the technology may be applied (given the energy stocks and the CO_2 storage capacity). As an example, the information on "SOFC with CCS" that was presented to respondents is depicted in Table 2 in this summary. It is essential to realize that although many details that experts have given will not be mentioned literally in the translation for lay people, these details are the basis for the consequences that are described in the translation for lay people. For instance, efficiency of a technology is an aspect that was frequently specified by experts. However, efficiency will not be mentioned in the translation, but taken into account for the specification of the price of energy, which will be mentioned in the translation, mostly stated as the percentage customers have to pay extra for energy or fuel. Therefore, although it might seem that a lot of expert information has been omitted, this information has in fact been taken into account for the statements in the translation for lay people.

The final ICQ was administered to a representative sample of the Dutch population (995 respondents) in November and December 2004. The questionnaire was send to respondents as a computer program by TNS-NIPO to fill in at home (See chapter 3 for the procedure and Appendix 3 for the text of the entire questionnaire).

The more traditional questionnaires

Simultaneous with the administration of the ICQ, another questionnaire was given to a different smaller sample of respondents from the same access panel of TNS-NIPO (327 respondents). This questionnaire was designed to address both current public knowledge and overall evaluations of global warming, overall evaluations of CCS, and overall evaluations of six CCS options, as well as to study the preference for a certain CCS option. It was furthermore designed to test the usefulness and stability of uninformed opinions (see Paragraph 3.2 for the procedure and Appendix 4 for the text of the questionnaire). A second more traditional questionnaire was administered a year later to a different sample of 300 respondents from the access panel of TNS-NIPO. This questionnaire was designed to give a deeper insight in the factors that influence uninformed opinions. This questionnaire also addressed both current public knowledge and overall evaluations of global warming and of CCS options, as well as the presentation of the choice problem (Paragraph 3.3). Neither of the two more traditional questionnaires contained the full descriptions of the options and the descriptions of the aspects and consequences that were in the ICQ, although the same labels for the options were used in all three questionnaires.

Results

Evaluations

Before asking respondents in the ICQ about the CCS technologies, they were first explained how CO_2 emissions affect the climate. Respondents were given information regarding nine consequences of a temperature rise caused by the greenhouse effect to read and evaluate. Overall, the greenhouse effect was evaluated quite negatively: on a scale from 1 (very bad) to 7 (very good), the mean overall evaluation is 2.29. After evaluation of the greenhouse effect, respondents were given information on CO_2 emission reduction goals and how those could be achieved. CO_2 capture and storage was suggested as a possible technology that could reduce CO_2 emissions.
After having read and evaluated five consequences of CO_2 capture, transport and storage, respondents were asked for their overall evaluation. Overall, CO_2 capture, transport and storage is evaluated positively. On the same scale as the greenhouse effect was evaluated, the mean overall evaluation is 5.54. This means CO_2 capture, transport and storage is generally considered to be quite good (Paragraph 4.2.1.1-4.2.1.2).

To further investigate how people evaluate specific CCS technologies after reading and evaluating the technologies’ aspects and consequences, respondents were asked to grade the six specific CCS technologies in the questionnaire. In the Dutch school system, grades are on a scale from 1 to 10, with 1 meaning the lowest score possible and 10 meaning a perfect score. A 6 is considered a just acceptable score (“adequate”). This means in the Dutch grading system you did just good enough to pass but not any better. A 5 or lower means you failed the test.

In the ICQ, all technologies are evaluated as “adequate” on average (see for grades Table 1 in this summary). Only “ECBM” is evaluated very slightly lower than a 6 on average (5.94). The gas options are graded higher than the coal options, although “hydrogen production via steam reforming with CCS” is evaluated only very slightly higher than “hydrogen production via coal gasification with CCS” and “IGCC with CCS” are. Statistically, the mean overall evaluation of “IGCC with CCS” does not differ from that of “hydrogen production via coal gasification with CCS”, and the latter does not differ from the mean overall evaluation of “hydrogen production via steam reforming with CCS”. “SOFC with CCS” and “small scale reforming based on membrane technology with CCS” both receive a significantly higher mean overall evaluation than the other CCS technologies. “ECBM” receives a significantly lower mean overall evaluation than the other CCS technologies in the ICQ. Although the average overall evaluations of several CCS technologies are significantly different, the absolute differences are small. This does not mean that respondents all feel slightly positive about the CCS options and do not differentiate. Although on average the differences are small, the percentages of respondents with more extreme grades should not be neglected. Depending on the specific CCS option, 12% (“ECBM”) to 24% (“SOFC with CCS” and “small scale reforming based on membrane technology with CCS”) of respondents is very positive about the technology (grades 8, 9 or 10). Percentages of respondents that give extremely low grades (1 – 3) to the CCS options are restricted to 4% regarding five of the six options, and to 6% regarding “ECBM”. These very low percentages of very low grades are in line with the very low percentages of respondents that consider specific CCS options unacceptable.

In the more traditional questionnaires, not all CCS technologies are evaluated as adequate. All coal options are graded below 6 on average. This is different from the average grades in the ICQ and shows respondents in the ICQ have been affected by the expert information they were given. In the more traditional questionnaires, respondents were asked to evaluate the CCS options again after a bit of information or no information. After a little bit of information, the grades mostly went slightly up, although they are mostly still different from the average grades in the ICQ. After no information, but an annoying irrelevant filler task, two of the grades remained equal, but four went down. Similar to what others (e.g., Strack, Schwarz & Wänke, 1991) have found before this study, the uninformed opinions in the more traditional questionnaire were easily changed and very unstable. Large percentages of the respondents in the traditional questionnaire admitted not to have heard of the specific CCS options (between 60.0% and 91.4% depending on CCS option). Still, a substantial part of the respondents did not refrain from giving their overall evaluation (63.0-76.9%). This resulted in evaluations that were easily changed within 12 minutes. Only 9% of the variance of the second evaluation can be explained from the first evaluation. As these overall evaluations can hardly predict the exact same overall evaluations within 12 minutes, they are totally worthless for predicting future evaluations of the CCS options by the Dutch public.

Choice

The analyses of the overall evaluations in the ICQ show that the average grades for the CCS options vary between 5.9 and 6.5. This means that a substantial part of the respondents perceives only little difference in attractiveness between technologies. This makes the outcome of the choice task (pick one out of six) less informative than with big evaluative differences. However, we do find that the pattern of the evaluations is reflected in the choices respondents make. They seem to have a general preference for the gas options, which are chosen by more respondents than the coal options. Especially “SOFC with CCS” and “hydrogen production via steam reforming with CCS” are preferred by more respondents than the other technologies, by 23.2% and 23.0% of respondents, respectively. “IGCC with CCS” and “small scale reforming based on membrane technology with CCS” are preferred by a bit less respondents, by 16.7% and 19.4% respectively. Less than 10% of respondents prefer “hydrogen production via coal gasification with CCS” (9.5%) or “ECBM” (7.7%).(Paragraph 4.2.3)

Acceptance

Only minute percentages (1.4 to 6.4%) of respondents stated to find specific CCS technologies so unacceptable, that they considered taking action when this technology were to be implemented on a large scale in the Netherlands. Of the six CCS technologies, “ECBM” was named most as unacceptable. Still, only 6.4% of all 995 respondents in the ICQ considered this technology unacceptable. “IGCC with CCS”, “hydrogen production via coal gasification with CCS” and “small scale reforming based on membrane technology with CCS” were considered unacceptable by less than 5% of respondents. “Hydrogen production via steam reforming with CCS” and “SOFC with CCS” were considered to be unacceptable by less than 3% and less than 2% of respondents respectively. It seems therefore unlikely that many Dutch residents would object to the implementation of any of these CCS technologies (Paragraph 4.2.3).

Summary Table 1: Overall evaluations of technologies in the ICQ: percentages for grades, mean grades, percentages of preference and rejection

Technology	Percentages for grades				Mean grade	Preferred option	Unacceptable option
	1-3	4-5	6-7	8-10			
IGCC with CCS	4%	21%	59%	17%	6.23	16.7%	4.9%
SOFC with CCS	4%	16%	57%	24%	6.51	23.2%	1.4%
Hydrogen production via coal gasification with CCS	4%	20%	60%	16%	6.27	9.9%	4.1%
Hydrogen production via steam reforming with CCS	4%	20%	55%	21%	6.35	23.0%	2.7%
ECBM	6%	27%	55%	12%	5.94	7.7%	6.4%
Small scale reforming based on membrane technology with CCS	4%	18%	54%	24%	6.46	19.4%	3.6%

We analyzed whether respondents background variables influenced overall evaluations, choices and acceptance of CCS options. Variables such as gender, education, involvement with the issue, donations to environmental NGO’s or involvement with the issue seem to cause little to no difference in the overall evaluations of the technologies (see Paragraph 4.2.5. for more details).

Relationship between evaluations of aspects or consequences and CCS technology grades

Before respondents in the ICQ evaluated the CCS technologies overall, they were asked to evaluate the aspects and consequences of these technologies. By analyzing the relationship between the overall evaluations and the evaluations of the aspects and consequences, it becomes clear how respondents’ evaluation of the aspects and consequences influences respondents’ overall evaluation of a technology (Paragraph 4.2.4). The analyses have shown that what respondents’ think of the aspects and consequences moderately influences how respondents evaluate the technologies overall (5 of 6 multiple regression coefficients above .50). In other words, although the respondents did base their judgment of the technologies for a reasonable part on the aspects and consequences of the technologies, part of their judgment is not explained by this. Although the aspects and consequences of the technologies in the ICQ were selected by experts as the most important aspects and consequences, it seems that either not all the arguments that are important to respondents are stated in the given information, or respondents had not quite made up their mind yet. An important conclusion that can be drawn from the low to moderate correlations between most of the aspects or consequences and the overall evaluations is that none of the overall evaluations seem to be

Summary table 2: Example for one of the six CCS options (i.e. SOFC with CCS). Description of option in lay terms. Information on aspects and consequences. Average evaluations of aspects and consequences, average overall evaluation expressed as a grade between 1 and 10. And strength of the relation between these two evaluations expressed in a correlation coefficient.

Average evaluation (-9 to 9) | ***Correlation (-1 to 1)*** | ***Average overall evaluation (1 to 10)***

Conversion of natural gas into electricity (for private and commercial use), with CO_2 capture and storage.

Natural gas is converted to electricity and heat in small fuel cells. Fuel cells are relatively cost-efficient, quiet and clean installations of various sizes in which fuel can be converted into electricity and heat. The CO_2 released through this process is captured and stored underground in the Netherlands. Hundreds of fuel cells would be necessary to ensure that 20 percent less CO_2 is released into the air annually. Nearly all of the electricity the Netherlands will need in the future is generated in these fuel cells. The electricity and heat are supplied to households, businesses and organisations. These fuel cells would be installed near businesses and within urban areas. This technology on such a large scale will probably not be possible to implement before 2020. The necessary technical advances are expected to have been realized by then, but this is not a complete certainty.

New installations needed
In order to implement this technology, the existing large electricity plants would have to be replaced by smaller fuel cells which convert natural gas into electricity and heat.

New lines needed
Many new electricity and warm water lines would have to be installed to supply users with the electricity and heat generated by the fuel cells. The necessary work would cause inconvenience.

New CO_2 pipelines needed
Many new pipelines would have to be installed to convey the CO_2 captured from fuel cells to storage. The necessary work would cause inconvenience because of groundwork.

Contribution to the greenhouse effect
The contribution to the greenhouse effect by generation of electricity would be greatly reduced through the use of this technology: The emission of CO_2 into the air would be less than one twentieth of the amount that is currently being emitted by existing electricity plants.

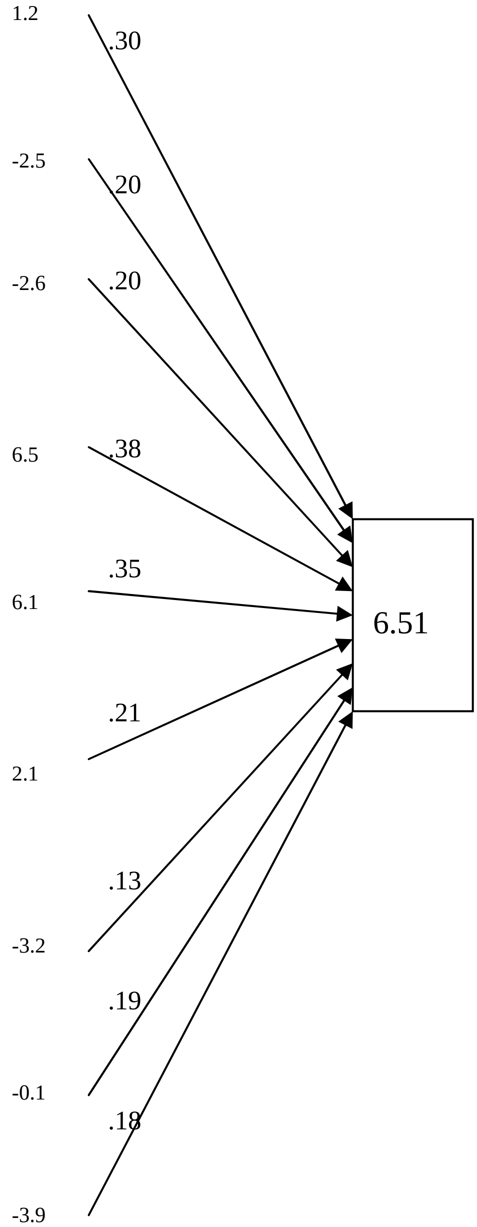
Contribution to acidification
Acidification may lead to the extinction of plant and animal species, the death of trees, damage to agriculture, damage to monuments and property, the over-grassing of moors, and a lower quality of drinking water. The existing gas-fuelled electricity plants contribute less to acidification than they did twenty years ago. The modern gas-fuelled electricity plans would hardly contribute any more to acidification.

The number of years this technology can be used
Including the gas supply from abroad, this technology could be used for a few centuries, but experts have calculated that the small-scale underground CO_2 storage space necessary for this technology is available in the Netherlands for at least 50 years, and possibly as long as 250 years.

Reliability of the energy supply
Experts place a great deal of importance on our being able to generate enough energy. The use of gas as a fuel is less reliable when this gas must be imported from abroad, which will be the case as from 2020. In order to ensure high reliability it is possible to store reserves of gas for later use, but this leads to a higher gas price.

Reliability of energy supply through fuel cells
By using fuel cells, the reliability of energy supply improves. In order to do so the electricity network must be adapted.

Price
If electricity and heat are generated by means of fuel cells, businesses will have to pay approximately half more than they do now. Households will have to pay approximately one fifth more.



based on one or a certain kind of aspect or consequence (see Paragraph 4.2.4 for a detailed discussion).

Summary Table 2 contains an example of the analyses that have been done for all six options. As is explained fully in Paragraph 4.2.4, none of the aspects or consequences that are evaluated in the ICQ can solely predict the overall evaluation of a technology in the questionnaire. This suggests that it will be very hard to influence the publics overall evaluations of a technology by changing single aspects or consequences of a technology. On a more positive note, as all technologies are evaluated as adequate and as there seem to be no aspects or consequences that are such a negative influence that this could solely bring down the overall evaluations, there seems to be no reason to change single aspects or consequences.

General comments

In this study, it is clearly shown that the current public opinions on CCS options, assessed by traditional questionnaires, are mostly *pseudo-opinions*: they are unstable (change within twelve minutes) and are affected by tiny amounts of non-diagnostic information and by the mood of the respondent. These uninformed opinions are totally worthless for predicting future public opinions on CCS options

All in all, the results of the ICQ suggest that, after processing relevant information, people are likely to agree with large scale implementation of each of the six CCS options. Respondents find all CCS options on average “adequate”, seldom find these options unacceptable and do not choose one of the options over the others with a majority of respondents.

Some reservations are important when interpreting these ICQ results. The evaluations and choices are made by the respondents within the context of the presented choice problem. This choice problem restricted the choice of respondents for energy options to CCS options. When the CCS options are compared with other energy options, such as renewables, nuclear energy or efficiency options, overall evaluations might change. Preparations are being made by the authors and experts from Ecofys, the environmental NGO’s, and Utrecht University to perform an ICQ study with such a broader choice context.

Another reservation concerns the prediction the ICQ results can make for future opinions on CCS options. Respondents in the ICQ processed valid and balanced information on aspects and consequences of the CCS options. The evaluations that result from this are not as much an indication for current public opinions on CCS options, rather they are an indication for potential public support for CCS options after the public is fully informed about pros and cons of CCS options.

1. Introduction

In januari 2000, NWO and the Dutch Organization for Energy and Environment (Novem) assigned a grant to three universities (NWS of Utrecht University, E&M of Leiden University and ES of Technical University Delft) for a major project encompassing several research projects, titled “Sustainable use of fossil fuels”. Two of these three projects research projects focussed on technical aspects of advanced fossil fuel options with CO2 capture and storage (CCS). The third research project however focussed not on the advanced fossil fuel option itself but on studying informed opinions of the general public regarding advanced fossil fuel options. This study has investigated the choices the general public would make after having received and evaluated expert information on the consequences pertaining to these choices. The method to collect these informed preferences is called the Information-Choice Questionnaire (ICQ). By comparing informed public preferences, obtained through administration of the ICQ, with current public opinions and preferences regarding fossil fuel options, collected in a more conventional survey, the outcomes of this project can indicate what options would be considered acceptable given sufficient knowledge, and how much and in what respect the current situation deviates from this possible future situation. Answering these questions constitutes the main goal of this project.

This report describes the development and deployment of the Information-Choice Questionnaire on advanced fossil fuel options. It furthermore describes the parallel deployment of a more traditional questionnaire without expert information and a second measure of this more traditional questionnaire. This report encompasses all parts of the project “Informed opinions of the general public as a tool for policy measures regarding advanced fossil fuel options”. This report will explain the ICQ methodology and its usefulness for this project. Furthermore, this report describes the development of the current ICQ, the method of the ICQ and of the more traditional questionnaires, and the results thereof.

1.1 Review of research on public perception of CCS technologies

As of yet, no studies have been done that can answer the questions we stated above. There is little knowledge of the current public opinion concerning CCS. Does the average person in the Netherlands currently even have an opinion about CCS? And what are the factors that influence opinions about CCS? In the past decade, several studies, in the Netherlands and in other countries, begun to explore the perceptions that the public has of global warming and of modern technologies that contribute less or not at all to global warming. In this paragraph, we will discuss four studies that investigate public perception of CCS.

Shackley, McLachlan & Gough (2004) explored public perception of CCS in the United Kingdom with two research methods; Citizen panels and a questionnaire. They formed two Citizen panels, one panel with 8 respondents in Manchester and one panel with 9 respondents in York, who each met 5 times for 2 hours and heard from a variety of technical experts. Each session, one or two experts would present information concerning global warming or CCS and would answer questions that the panel had. The third expert session had two contrasting experts’ perspectives, unlike the first and second expert session which each had one expert. After the expert(s) had answered the panels questions, he or she would leave the group to continue their discussion within the panel. Shackley et al. (2004) observed a moderate support for CCS, provided that a range of other decarbonisation options are also supported. Support for CCS was, however, conditional on understanding the reasons for CO_2 mitigation. One of the panels showed several shifts in opinion about CCs, first towards more positive perceptions after hearing about global warming and CCS as part of the solution to global warming. The second shift was towards more negative perceptions after a critical presentation by an independent academic energy expert.

Subsequent to the Citizen panels, Shackley et al. (2004) designed a questionnaire by drawing upon the citizen panel findings, as well as drawing upon other climate change questionnaires (e.g. Lorenzoni, 2003). Part of the questionnaire was one page with information on aspects and consequences of CCS, that respondents would receive half way through the questionnaire. The questionnaire was administered face-to-face within the Liverpool John Lennon International Airport to 212 respondents. Results from the questionnaire showed that the majority of respondents beliefs that human activities cause climate change. Respondents on average had a moderate to high concern about climate change. Respondents were rather negative about CCS, when asked their initial reaction of CCS. A sizeable amount of respondents either did not like CCS (24%) or were ambivalent or neutral towards CCS (23%). A quarter said not to know. Interestingly, after information about CCS had been given, respondents became more positive about CCS. Less respondents stated not to like CCS and more respondents stated to like or really like CCS. However, compared to other options to reduce CO2 emissions, respondents stated less support for CCS than for other options such as wind energy, solar energy or efficiency, but much more support for CCS than for nuclear power or higher energy bills.

Although this is an interesting study, several aspects of it make the results unfit to answer our questions. The use of Citizen panels is a valuable approach when exploring people's opinion of complex issues such as CCS. This method gives room for respondents to ask the experts questions and gives them time to discuss their thoughts and feelings with other respondents, which ultimately helps them to develop their opinion. Because of the discussion with other respondents though, respondents are not just influenced by the information they are given by the experts, but also by the opinions of other respondents. Group processes influence what is said, by whom en how much of that is remembered by respondents. This makes it hard to deduce which information led to what opinion. Another aspect of both the Citizen panels and the survey is that the both the small size and the selectivity of the samples make it impossible for these samples to be statistically representative of the UK population or a segment thereof. But the fact that respondents changed their opinion of CCS after having been given information is an important find and gives reason to further explore what causes this effect. Unfortunately, this study does not give much insight into the cause of the opinion change. It is likely that the information that respondents received, either during the face-to-face interview or during the Citizen panels, causes this change. However, it remains unclear how much of this information has been carefully read or listened to and furthermore processed by the individual respondent, and what part of the information caused the shift to a more positive opinion.

Shortly after the study of Shackley et al. (2004), Curry, Reiner, Ansolabehere & Herzog (2004) published a report on public awareness of CCS in the United States. They conducted a survey of public attitudes on energy use and environmental concerns to which 1205 US citizens, representing a general population sample of the United States, responded. The survey results show that the environment is not a top priority for the US public and global warming is not the top environmental concern. When asked about their knowledge of energy technologies, less than 5% states to have heard or read about CCS. Curry and colleagues also report much confusion among the respondents concerning the carbon cycle (in this case how different kinds of energy production and use increase or decrease carbondioxide in the atmosphere, and the role of trees and oceans). They furthermore report much confusion about the causes of global warming. To explore the effects of two consequences of different approaches to address global warming, an experiment was included in the survey. Respondents were given seven electricity options that address global warming and they were asked to choose the one that they preferred. About half of the respondents received no information, the other half of the respondents received information about the fuels used to produce the electricity in 2002 and the consequences of some options for electricity price and CO_2 emissions. Of the group that had been given this information, 16% thought CCS was best to address global warming, whereas of the no information group, only 6% thought so. The percentage of respondents that thinks renewables are the best option to address global warming, also differs remarkably between groups; whereas 49% of respondents think so in the group that had not been given information about CO_2 emissions and price, only 25% of the group that had been given information think so. This leads Curry and colleagues to suggest that accurate price information is essential to the public making a decision about climate change. However, price information was not the only information that was given, which makes it difficult to separate which information led to the difference between groups. Even if price was the information that caused the differences between groups, it remains unclear how price information will influence the general opinion of CCS when respondents have knowledge of other consequences. Still, this study makes some useful points; it shows that very little people know about CCS, at least in the US, it shows that there is much confusion concerning the carbon cycle and how energy use influences global warming, and it shows that providing respondents with information influences their preferences for certain options addressing global warming.

In 2003, Huijts studied public perception of carbondioxide storage in the Netherlands. For this study, a small, nonrepresentative sample of the local population of Alkmaar and Bergen was used to explore possible opposition to CCS from people that live above possible CO_2 storage sites. 112 respondents that live in residential areas above a gas field participated. Before they answered any questions, they were given written information about CCS and its' possible risks. The results show that respondents are somewhat positive about CCS in general, but not at all positive about CCS under their residential area (Huijts calls this a "NUMBY" effect: "Not Under My BackYard"). Huijts also finds that trust in government and trust in industry are relevant for general trust in storage of carbondioxide and for the general attitude towards storage. She furthermore states the importance of good information for opinion formation:
"*The expectation that people form their opinion on a limited amount of information was supported by the fact that more than half of the participants indicated that the information sufficed to form an opinion. On the other hand, more than one third of the participants did not find the information sufficient to base an opinion on. In addition, about one quarter of the people chose the middle or neutral answering category when answering questions about carbon dioxide storage. This indicates that many participants did not yet have an outspoken opinion. These people might need more information. Both risks and benefits need to be made clearer to them.*" (Huijts, 2003, pp 58)

A recent Japanese study (Itaoka, Saito & Akai, 2004) sought to identify various factors that influence public acceptance of CCS in Japan. Itaoka and colleagues administered two versions of a survey questionnaire to 1006 adults residing in Tokyo or Sapporo. Because focus groups and pretests had revealed that most of the Japanese public did not know about CCS, the questionnaire had been redesigned to incorporate education on this topic. One version of the questionnaire provided limited education about CCS; the other version provided more extensive information about CCS. Itaoka and colleagues found that the general Japanese public generally supports CCS as a part of larger national climate policy. Their respondents were much more negative about specific types of storage though. Respondents were mostly negative or ambivalent towards implementation of the deep-sea dilution option of ocean storage, the lake type option of ocean storage, the onshore option of geological storage and the offshore option of geological storage. The education that respondents had received about CCS affected public acceptance. Specifically, the more information respondents obtained about CCS, the more likely they were to support those storage options except for the onshore option of geological storage. This study furthermore explored which factors influenced public opinion. These factors were established by asking respondents 66 questions about possible attitudes and concerns, and grouping the questions that correlated highly together to form factors. Itaoka et al. (2004) found four important factors influencing public opinion, which they describe as: "environmental impacts and risks caused by injection of CO_2 (including possibility of leakage)", "effectiveness of CCS based on realizing the CCS option as one of useful mitigation options of the climate change", "societal responsibility for the environment", and "relation of CCS with maintenance on fossil fuel use". Each of these factors influenced public acceptability for CCS in general as well as support for implementation of four specific technology types of CCS.

Although each of these studies has its drawbacks when it comes to shedding light on current and future public opinion of CCS in the Netherlands, they do give some hints for our research questions. It seems few respondents know about CCS. In the US study, less than 5% knew, and in the UK study, 25% did not have an opinion, and the other 75% easily changed their opinion after some information. Pretests in the Japanese study disclosed so little familiarity with CCS, that they included education about CCS in their design (Itaoka et al., 2004). A sizeable amount of the Dutch participants also stated to have too little information to form an opinion, and this is after information has been given. This means it is likely that few Dutch citizens have knowledge of CCS and few have an opinion of CCS. In order to understand how people evaluate CCS when they have had the opportunity to inform themselves, and what aspects and consequences of CCS influence this information, people's evaluation of the aspects and consequences itself should be studied.

Such a study has been done in the Netherlands in 1994 by Van Knippenberg and Daamen, the first study to investigate informed opinions about one specific CCS option. This study focused on perception of six options for generating electricity in 2010 in the Netherlands, including coalfired plants with CCS. Participants (n = 991) were not only given information about aspects and consequences of the options, but were also asked to evaluate the consequences. For each option, expert information on 5 to 7 most important consequences were given. For the coalfired plants with CCS, this concerned safetyrisks, environmental risks, coal supplies and electricity price. After evaluation of the consequences, the respondents were asked to sum up the negative and positive evaluations, and furthermore asked to evaluate the option in general. With this method, conclusions can be drawn about respondents' opinion of the consequences and how these evaluations of consequences affect their overall evaluation of a CCS option. Another sample of 986 respondents did not receive information before giving their opinion. Most respondents were reasonably to very positive about coalfired plants with CCS after they had read and evaluated information about this option. On a scale of 1 to 10, coalfired plants with CCS had an average evaluation of 6.0, whereas coalfired plants without CCS had an average evaluation of 4.3. The evaluation of the coalfired plants with CCS was significantly influenced by the consequence of less CO_2 emissions. Respondents were also asked which two options of the six options they preferred to be implemented in 2010 in the Netherlands. Little over a third of respondents choose coal with CCS as one of their preferred options, independent of having read and evaluated information or not. Unfortunately, the aim of this study was not to investigate public opinion on CCS in general, but to compare options, with one of those options being "coalfired plants with CCS". Because of this, this study does not provide insight into the publics' evaluation of all the consequences that are specific to CCS, or consequences that are specific to other CCS options than "coal with CCS". The information about the consequences inserted in the study by Van Knippenberg and Daamen (1994) was based on the most recent scientific knowledge available at the time. However, some of this information (e.g. on acidification) is now outdated. As understanding the publics' evaluation of specific consequences is the key to understanding public acceptance of CCS, the current study investigates public opinion concerning CCS by using an Information-Choice Questionnaire, the same method that Van Knippenberg and Daamen (1994) used. The ICQ method enables us to gain understanding of the publics' evaluation of specific consequences of CCS technologies. In the next paragraph, we will explain what the potential of an Information-Choice Questionnaire is, and why it fits the aim of the current research.

1.2 Why the Information-Choice Questionnaire is an appropriate instrument when assessing public opinion on CO_2 emission reduction options.

Traditional public opinion surveys present a representative sample of the population with questions about the topic at hand, which can be policy measures. Traditional questionnaires are often a useful instrument to assess the public acceptance of policy. However, for some goals the traditional questionnaire is not an adequate tool. The main drawback of traditional public opinion surveys, especially when the survey topic at hand is new to the public, is that a substantial part of the general public lacks the knowledge to have a well considered opinion. Part of them may refrain from answering but a significant part of the respondents may respond with "pseudo-opinions" or "non-attitudes" (cf. Converse, 1964). An early demonstration of this phenomenon was presented in a survey in the US on attitudes towards a non-existing act: A substantial part of the sample expressed (strong) views regarding this fictitious act (Bishop, Oldendick, Tuchfarber, & Bennet, 1980). Thus, respondents are inclined to give an opinion even on topics they know nothing about (Bishop, Oldendick & Tuchfarber, 1986, Schuman & Presser, 1981). Other research showed that such pseudo-opinions are unstable and easily changed by contextual information (e.g., Strack, Schwarz, & Wänke, 1991). Another drawback of traditional surveys may be that respondents are not encouraged to compare policy options. Most policy measures are simply the choice of certain options above other policy options. But whereas the policymaker has had to make a choice between several policy options, respondents are seldom presented with a choice problem in traditional opinion research. Usually, respondents are asked to evaluate options rather than choose between them. As a consequence, responses are often isolated (Neuman, 1986). Especially if a policy problem is complex with a number of options to solve the problem, such isolated instead of comparative responses may be less useful because they are ephemeral and not really diagnostic for societal support or opposition. First of all, the isolated evaluation is without frame of reference and therefore its quantification is rather meaningless. But secondly and more importantly, isolated instead of comparative evaluations of options do not lead to the solution of the policy problem and can even lead to the wrong conclusions concerning societal support of or opposition to an option. For instance, if a respondent is asked to evaluate a number of options without the instructions or even implication to compare these options, all options could be evaluated as very negative. In traditional questionnaires, respondents are not warned that by evaluating all options as negative, no option can be chosen to solve the policy problem and hence the policy problem cannot be solved. By concluding that the public rejects all options, the outcome of the survey becomes useless information for policymakers.

Measures of "informed" public opinion
The Information-Choice Questionnaire that is discussed in this report is one of the possible instruments that tries to meet these objections to traditional questionnaires. For one, the ICQ focuses not only on evaluation but also on the choice of one option over the alternative options. Secondly, respondents are informed on the most important consequences of the choice options before they are asked to evaluate the options and make an actual choice. The ICQ is not the only instrument that meets these criteria. In an extensive review of research on informed opinions, Price and Neijens (1998) name four main new techniques that aim at increasing the quality of public opinion. Among surveys of informed opinion they single out the method of the American Talk Issues Foundation (ATIF, e.g. Kay, Henderson, Steeper, Lake, Greenberg & Blunt, 1994) and the Information-Choice Questionnaire (e.g. Neijens, 1987). Among deliberative polls they focus on work on deliberative polls by Fishkin (e.g. 1995) and the Planning Cell method as developed by Dienel (1978, 1989). The description and comparison of these methods is based on Price and Neijens' review (1998).

The ATIF formats are designed to assess what difference it makes for measured public support of particular proposals if survey respondents are fully aware of multiple options and encouraged to consider possible outcomes of each. Although this is not very different from the ICQ method, the ATIF format differs on several important aspects from the ICQ method. The ATIF format uses telephone interviews with questions that are ordered such that respondents are forced to consider the consequences of proposals. These questions are framed as persuasive arguments supporting and opposing a proposal. Unlike in the ICQ, respondents are not given time to deliberate.

The deliberative polls by Fishkin (e.g. 1995) and the Planning Cell method as developed by Dienel (1978,1989) are both very different methodologies compared to the ICQ method. The procedures in these studies are very elaborate as "to model what the electorate would think if, hypothetically, it could be immersed in intense deliberative processes" (Fishkin, 1991, p 81). These studies involve random selection of a group of citizens, paying their leave from their working obligations, and transporting them as "delegates" to a single site for several days of debate and deliberation. After debating issues with political leaders or technical advisors and with each other, the delegates are then polled on their preferences. The method of these two deliberative polls has a much more ambitious aim than the ICQ. Fishkin states that the goal is nothing less than "direct democracy", carried out by "a statistical microcosm of the society" that is empowered to deliberate for the whole (1991, p. 93).

The ICQ as a method has other ambitions than either the ATIF formats, the deliberative polls by Fishkin (1991, 1995) or the Planning Cell method (Dienel, 1978, 1989). It limits its efforts to improving the evaluation phase of collective decision making. It does not try to engage in a democratic process by letting respondents debate with politicians, experts and-or each other, as for instance Shackley and colleagues (2004) have done. As we stated before, the Citizen cells of Shackley and colleagues (2004) had the advantage of respondents being able to ask experts and each other questions, and respondents being able to develop a stable opinion through debate. However, by foregoing debate the ICQ generates several advantages that make this method a more suitable instrument for the prediction of future public opinion on the policy problem of CO2 emission reduction. In the ICQ, written information is presented to respondents, which not only makes careful private deliberation possible, but also makes it much more feasible to study public opinion by investigating a large sample of the population. This gives the ICQ an advantage over the deliberative polls, if a large sample is needed to ensure a representative sample. The fact that careful private deliberation of objective, non-persuasive information is possible in the ICQ and not in the ATIF formats, gives the ICQ an advantage if the choice problem concerns complex new technology instead of more familiar political issues. And the careful private deliberation ensures that group processes do not influence information processing or deliberation, as is likely in to happen in deliberative polls (Fishkin, 1991, 1995), Planning cells (Dienel, 1978, 1989) or Citizen cells (Shackley et al, 2004). This makes the ICQ a very useful instrument for the purpose of the current study.

Information-Choice Questionnaire: Potential[1]

The ICQ was originally developed by Saris, Neijens and De Ridder (1983a/b, see e.g. Neijens, 1987; Neijens et al. 1992) to assess preferences for different ways of generating electricity in the Netherlands. In the recent past, the ICQ method has been applied to a number of issues: the method to increase the energy production in the near future (e.g. Neijens, 1987), euthanasia in the USA (Alcser et al., 1996), ecological transport policy in Switzerland (Bütschi, 1997), car free zones in the inner city (Neijens, Minkman, de Ridder, Saris & Slot, 1996), child care (Boomsma, Neijens & Slot, 1996), new housing (Molenaar, Neijens & Saris, 1997a), metro system (Molenaar, Neijens & Saris, 1997b) and options for the electricity supply in the Netherlands in 2010 (Van Knippenberg & Daamen, 1994). The aim of the ICQ is not only to provide respondents with the necessary information to reach an informed opinion, but also to help them make use of this information to form opinions about different policy options: part of its aim is to guide respondents' information processing. Before respondents in the ICQ choose between policy options, they receive information to make a more informed choice. First, the choice is explicitly framed as a decision problem and respondents are informed about the background of the decision problem (e.g. they are told why these specific options are included in the decision problem). Second, respondents are provided with information about the consequences of the different policy options. To stimulate information processing and to help respondents reach a decision, they are requested to give a quantitative evaluation of each consequence(a rating on a scale with nineteen response categories ranging from -9 "a very big disadvantage" via 0 "totally irrelevant" to + 9 "a very big advantage"). On the basis of these quantitative evaluations, the subjective utility of each option may be determined. If respondents base their choices on these evaluations of consequences, they will choose the alternative(s) with the highest subjective utility (Neijens, 1987; Neijens et al, 1992). The ICQ procedure does, however, neither require nor request that respondents base their choices on their evaluations of consequences.

The effects and usefulness of the ICQ has been studied in extensive evaluation research (Neijens, 1987; Neijens, de Ridder & Saris, 1988; Van Knippenberg & Daamen, 1996; Van der Salm, Van Knippenberg & Daamen, 1997). For one, Neijens shows that nonresponse in the ICQ is not substantially different from nonresponse in traditional opinion surveys (nonresponse is low and the group of nonrespondents has the same profile as the group that does respond) and concludes that the ICQ may be used to collect opinions of representative samples of the general public. Several studies show a discrepancy between informed opinions and uninformed opinions, although some studies report larger dicrepancies (Neijens, 1987;

[1] Part of this section is taken from Van Knippenberg and Daamen (1996).

van Knippenberg & Daamen, 1996; Van der Salm et al, 1997) than others (Bütschi, 1997a, 1997b; Alcser et al, 1996). However, as the ICQ method entails more than just informing respondents, the question remains what the contributions are of the different aspects of the Information-Choice Questionnaire to informed choices. Neijens (1987) used an experimental design to distinguish the effects of three aspects of the ICQ. In this design, the seperate effects of provision of information, the evaluation of consequences task and the book-keeping system (whereby the evaluations are totaled per option) were studied by comparing the consistency of respondents choice in four information conditions. In the first condition, respondents were asked to make a choice between options without information. In the second condition, respondents were given information in the form of an article before making a choice, but they were not asked to evaluate this information about consequences. In the third condition, the respondents were given information per consequence and were asked to evaluate each consequence. The fourth condition contained one more step; in this condition, respondents were given information, asked to evaluate this information about consequences, and were requested to provide overall evaluation of the option by summing the evaluations of the consequences. The information in condition 2, 3 and 4 were the same. In condition 1 and 2, respondents were asked to evaluate the information on the consequences after they had made a choice. This allowed subsequent investigation of the consistency between their choices and their evaluations of the consequences. A decision to select a particular option was deemed consistent if it agreed with a respondents' summed positive and negative evaluations of consequences across options. Neijens (1997) mentions that by chance alone, only 5% of respondents would have offered such a consistent decision. The results of Neijens (1987) study show that when no information was provided on the energy options, 37% of the respondents made a consistent choice (Condition 1). A majority of the respondents thus made a choice that did not agree with their own judgment of the consequences of the options. Comparing Conditions 1 (´no information') and 2 ('information in article format only') we see that the provision of information has an effect: in Condition 2, the percentage of consistent decisions is 48% (11 percentage points higher in than in Condition 1). The task of evaluating the consequences also has an effect: the percentage of consistent decisions in condition 3 ('information + evaluations') is 57% (9 percentage points higher than in condition 2). The determination of overall evaluations also has an effect on the percentage of consistent decisions: in Condition 4 it is 68% (11 percentage points higher than in Condition 3). This shows that just giving information is not enough, because although it does raise the percentage of consistent choices, the majority of respondents still makes an inconsistent choice based on information alone. Both evaluation of the separate consequences and the aggregation of these evaluations clearly add to helping respondents with their choice problem, which is shown by the raise in consistent choices of another 20%.

This shows that giving respondents information alone, albeit better than not giving information, is not enough. Information in article or story format, which is the format that is used by several studies regarding public perception about CCS (Huijts, 2003, Shackley et al., 2004, Itaoka et al., 2004), is not processed as well as information that is given in little pieces, evaluated as such and evaluated overall.

Although the conclusion is warranted that ICQ surveys may result in different preferences than traditional surveys (Neijens, 1987; van Knippenberg & Daamen, 1994; Alcser et al, 1996; Van der Salm et al, 1997; Bütschi, 1997a, 1997b) and that evaluations and choices are relatively highly correlated (Neijens et al 1992), some (Wagenaar 1984; Vlek, 1987,1988; Van Knippenberg & Daamen, 1994) argue that this still does not prove that the information provided affects choices. They argue that the fact that respondents in the Information-Choice

Questionnaire make different choices than respondents in a different survey without reading or judging information does not necessarily mean that respondents base their choice on the information. Their choices can be influenced by other factors, such as the difficulty of the procedure, longer exposure to the issue, special attention to the issue or the fact that respondents know that they participate in an innovative kind of survey (cf. the Hawthorne effect, McGregor, 1960). Van der Salm et al (1997) provide experimental evidence for the fact that ICQ respondents' preferences are indeed affected by the information provided in the ICQ. In their experiment, respondents were presented with identical Choice-Questionnaire procedures but with slightly different information about the consequences of two of the six options. These two options were coalfired plants with CO2 removal and natural gas-fired plants. In version A (the "Coal-CO2 positive/Gas negative" condition) the consequences of the coal with CO2-removal option were described more favourably and the consequences of the natural gas option were described less favourably than in version B (the "Coal-CO2 negative/Gas positive" condition). As one would logically expect, respondents evaluated the consequences of coal with CO2 removal more negatively in version B than in version A and evaluated the consequences of gas more negatively in version A than in version B. When asked which of the six options were preferred, respondents choose Coal with CO2 removal more often when the consequences were described more favourably (version A) than when the consequences were described less favourably (version B). Similarly, respondents choose Gas more often when the consequences were described more favourably (version B) than when the consequences were described less favourably (version A). This difference in choices proves that respondents use the information provided to base their choice on. Thus, this study ruled out that the effect of the ICQ is merely due to non-substantive methodological differences with a traditional survey. Combined, the results from prior research analyzing the ICQ suggest that the ICQ's effect on respondents' preferences is due to both the information provided – which may wholly or in part contain new information relevant to the decision problem – and to better integration of the available information (due to the ICQ's structuring of information processing). The fact that ICQ respondents may report different preferences than respondents in a more traditional survey shows that it may indeed be worth the trouble to use the ICQ in public opinion research. At the same time it implies that the results of an ICQ do not necessarily reflect *present* public support for a policy. Rather, the ICQ is especially suited to assess how public opinion may be *after* the public is informed about an issue or to assess the *potential* (i.e. after extra information is provided to the public) support for alternative policies.

1.3 Important aspects of development of an ICQ

The current study focuses on a complex environmental problem (global warming) and on the complex, future energy technologies that may contribute to solving this problem. When informing lay people about such complex matter via an ICQ, several precautions are needed to guarantee that the public is presented with a relevant policy problem and with valid and balanced information regarding a restricted set of viable options to solve this problem. These precautionary procedures are crucial when preparing an ICQ and will be discussed here.

First, it is essential to define a clearly specified and policy relevant choice problem that is not overly demanding for respondents. The policy problem should be *clear* regarding what, when, where and to what end (in the current ICQ for instance "Which CCS option is the best to implement in the Netherlands by 2030 at the latest in order to reduce CO_2 emissions by 20% compared to the status quo?"). Only *policy relevant* options to solve the problem should be presented, that is, options which are according to experts viable and not unlikely to be implemented. Obviously, it is more worthwile to predict public support (or lack of support) for feasible options. This restriction to police relevant options also reduces the number of options, which helps to keep the choice problem manageable for lay people. But to fully attain the latter goal (i.e. a choice problem tuned to the capabilities of lay people) a further reduction of options as well as a less complicated structure of the choice problem may be needed. For instance, while preparing the current ICQ, the experts identified more than six CCS options. These options may all be implemented to different degrees. There are a huge number of combinations of these options and each combination may solve the policy problem. Exclusion of options that were not policy relevant reduced the number of options and restriction of choice to combinations of options which were policy relevant also helped but still the choice problem was rather complicated. After ample deliberations it was decided to confine choice to options that led to a substantial and *equal* emission reduction (20 Mt CO2 per year) and to options where energy conversion was located in the Netherlands. Such simplification and limitation is subject to debate. In this report the assumptions and criteria for the definition of the choice problem and for the selection of the options are described and it is recommended that an independent group of various experts will check whether they can approve the choices made in this report

Second, when informing people about the defined choice problem and about the consequences of the options that can solve this problem, it is essential that this information is valid and balanced. To compile this kind of information is a project on its own. The information that is generated in this way, should be extensive and detailed. However, when the need for a representative sample of the general public calls for the inclusion of respondents that are not very motivated or not highly educated, the amount of information that can be provided is limited. In the current ICQ, the amount of information that can be given to respondents is one page per option, for reasons that will be explained in Paragraph 2.2.4. In the case of complex topics this means that in order to keep the amount of information manageable for all respondents, one must make a selection of the available expert information. With relatively complex and controversial topics such a selection could arouse debate. It is therefore recommended that the information for an ICQ is compiled by experts from different backgrounds and different organizations and checked by another, similarly differentiated group of experts. This method also results in the avoidance of another possible problem that arises with controversial issues, namely the credibility of the source of the information.

When the responsibility for the choice problem definition and the given information is not carried by a differentiated group of experts, an ICQ runs the risk of losing accuracy, balance and credibility in the eyes of the respondents. For these reasons, the task of the problem definition and the compilation of the expert information were carefully done by experts from different backgrounds and institutions. How this was done exactly and what measures were taken to ensure that the information was the most recent and accurate information available will be discussed in the next chapter.

2. Development and test

This chapter will address the plan and procedure of the studies that have been done for the project "Informed opinions of the general public as a tool for policy measures regarding advanced fossil fuel options". After a discussion of the plan of the studies, the development of the policy problem and the gathering of the expert information will be addressed, as well as the procedure of the ICQ and the procedures of the two more traditional questionnaires.

2.1 Plan

To study informed opinions, an Information-Choice Questionnaire was developed. This required the specification of a relevant policy problem (Paragraph 2.2.1) and the study of the most recent and accurate information concerning implementation of Carbondioxide Capture and Storage (CCS) options in the Netherlands (Paragraph 2.2.2-2.2.5). The ICQ that was thus developed, has first been tested on a sample of 97 Dutch citizens (Paragraph 2.3 -2.7). The improved version of the ICQ was administered to a representative sample of Dutch citizens (n=995). These respondent were presented with information about the aspects and consequences of global warming, CCS and six CCS options and were asked to evaluate these aspects and consequences, as well as to evaluate global warming, CCS and six CCS options. They were furthermore asked to choose a preferred CCS technology (ICQ procedure: Paragraph 3.1; ICQ results: chapter 4). To gain insight in the effects of giving information as is done in the ICQ, a more traditional questionnaire was also developed. In this questionnaire, the same policy problem was presented to respondents as in the ICQ, but without previously offering information about the aspects and consequences of the CCS options (procedure: Paragraph 3.2 and 3.3; results chapter 4). In this first more traditional questionnaire, (TQ1) administered parallel to the ICQ, respondents did receive very little information about the current Dutch energy situation, global warming, CCS and the CCS technologies before choosing a preferred CCS option. Respondents evaluated global warming, CCS and the CCS technologies before they received very little information and after they had received very little information. In the second more traditional questionnaire, respondents did not receive any information at all before choosing a preferred CCS technology. Respondents evaluated global warming, CCS and the CCS technologies before and after they received a slightly annoying filler task.

2.2 Development procedure of the ICQ

2.2.1 The definition of a specific and relevant policy problem

As it was stated above, developing a specific policy problem is essential, sensitive and subject to debate. To make sure this was done correctly, the researchers took much care in the process of developing the policy problem. Three leading experts on CCS were consulted (NWS, Ecofys, ECN). They are known for their helicopter view and were asked to comment on a start document by Faay and Daamen (2000). In this document, ideas of the researchers of UU/TUD/UL were compiled regarding goals, options, area, time and frame. Based on the interviews with experts and discussions within the researcherteam of this project the assumptions of the policy problem and the most likely options to solve this policy problem were defined. The policy problem was defined as " *Which CCS option is the best to* *implement in the Netherlands by 2030 at the latest in order to reduce CO_2 emissions by 20% compared to the status quo?"*

Further assumptions were:

-The project is aiming on a period (transition period) from now till 2030. It may be expected that clean fossil fuel options play a significant role starting in 2010 and onwards.

-The geographical area that the project aims at is the Netherlands and the Dutch Northsea

-"Clean"fossil fuel options should contribute "very significantly" to the total national energy supply during a substantial period of time. As an indication, one can think of about 30% of the total energy supply in the expected period (maximum range of 1000- 1500 PJ/year, on national level) and a use of infrastructure of 30-50 years after implementation. Another way of expressing the contribution of options is to commit to the contribution of an option to the total amount of avoided emissions of greenhouse gas. This could be 10-20% of the total yearly (national) CO_2 production (10-20 Mton in 2020, about 40 Mton in 2030). The rationale for such a target has also been discussed in "het Nationaal Milieubeleidsplan-4"; in 2020 the national emissions should be reduced from a baseline level of 240 Mton to 110 Mton. It is likely that "clean fossil fuel options" should contribute about 40 Mton in 2030 (compared to 47 Mton for renewable sources). For this study, it is therefore assumed that every option contributes 40 Mton CO_2 emission reduction per year. (This means that indications of the potential of an option are also given in the amount of years that the described option can add this contribution).

-The project aims at comparing CCS options as such and not at comparing CCS options with other energy sources, such as renewable sources or with efficiency options and saving energy.

Six CCS options were chosen by the experts as most likely to be implemented on a large scale within 10 to 25 years in order to reduce CO_2 emissions. Each of these options on its own reduces CO_2 emissions by 20% (40 Mton) and thus solves the policy problem. These six options were (first the label for lay people, next –in italics- the expert label and finally, between quotation marks, the brief expert label for the option, which we will use in this summary):

1. Large modern coal fired power stations (for private and commercial use) with CO_2 capture and storage *(Integrated Gasification Gas Combined Cycles with CCS for all kinds of end use)* "IGCC with CCS"

2. Conversion of natural gas into electricity (for private and commercial use) with CO_2 capture and storage *(Solid Oxide Fuel Cells with CCS for private and commercial use)* "SOFC with CCS"

3. Large coal fired hydrogen stations (for industrial use and for bus and freight transport) with CO_2 capture and storage *(Hydrogen production via coal gasification with CCS for industrial use)* "Hydrogen production via coal gasification with CCS"

4. Conversion of natural gas into hydrogen in large plants (for private and industrial

use and bus and freight transport) with CO_2 capture and storage *(Hydrogen production via steam reforming with CCS for private and industrial use)* “Hydrogen production via steam reforming with CCS”

5. Retrieval of methane gas by storing captured CO_2 in coal beds *(Enhanced Coal Bed Methane for similar use as natural gas)* “ECBM”

6. Conversion of natural gas into hydrogen (for motor vehicles) with CO_2 capture and storage *(Small Scale reforming based on membrane technology with CCS for motor vehicles*) ”Small Scale reforming based on membrane technology with CCS”

2.2.2 Interviews with experts on new technology and CO_2 sequestration

To establish the most recent and accurate information on these six options, several steps were taken. First, interviews were held with 14 experts of institutions such as the Central Plan Bureau, the ministries of Economical Affairs and VROM, the ECN, EcoFys, NOVEM, NAM, Natuur en Milieu, TNO-MEP, TNO-NITG and the department of Anorganical Chemistry and NWS of Utrecht University. Interviews were based on the policy problem and its assumptions and solutions. The experts were given this information beforehand, so as to be able to prepare for the interview. Interviews took about three to four hours per expert. The experts were urged to solely give information on aspects of the options that fell within the area of their expertise. They were asked to give information on these aspects or try to complete information that was already there, to quantify their information as much as possible and to state what consequence or aspects of the options were most important according to them. The information that came forward in these interviews was formatted into six large tables with information on the consequences of the six advanced fossil fuel options. (See Appendix 1 for content of these information tables. See also Faaij, Daamen, De Best-Waldhober & Wolf, 2004) This information was organized in a matrix with as columns categories of aspects and consequences and as rows the phases of the energy production process. Columns were “costs energy carriers”, “development costs”, “environmental consequences”, “safety risks”, “reliability energy supply”, “total potential of option”, “infrastructure adjustments and possible conflicts other developments”, “required innovations” and “macro-economical consequences”. Rows were “primary fuel”, “technology”, “energy infrastructure”, “CO_2-infrastructure”, “CO_2-storage facility” and “end use”. The tables contain all information that was given by experts, information that was different of conflicting was written down completely, representing all possible information.

The second step in establishing the most recent and accurate information was a careful search of international literature on the possible consequences of the six advance fossil fuel options. This search was done by Ph.D. students (drs. Kay Damen, drs. Martijn van Troost) of NWS at Utrecht University. Based on this search and on existing databases, calculations were made to refine the information even further. Specifically, quantification was improved regarding two aspects: 1 energy price for industrial users as well as households, 2 storage potential, i.e. number of years we could safely store CO_2 under Dutch mainland and North Sea for each option. The information in the questionnaire concerning global warming was based on the IPCC report of 2001. This information was based on the literature first and then checked and improved by several experts.

2.2.3 The second expert round

After all information had been gathered as described above, the same experts (plus one more from ES of Technical University Delft) were asked to look once more at the information now that the information was supposed to be complete. The experts would receive all six tables and a list of statements on a consequence that were very different or even conflicting. The experts were asked to check the information in the tables. They were asked to specifically check if their own information had been stated correctly in the tables. They were asked to search for information in general that they thought was wrong, and they were asked to state which information they thought was absolutely necessary for lay people to form an opinion about the option at hand. Six experts returned these questionnaires. Based on their comments, the information in the six tables was improved further and it was established which consequences were considered more or less important for evaluating the options and deciding between them.

2.2.4 Selection and translation of the expert information

There were several demands for the information on the consequences of the technologies. The information on consequences had to apply to the specific technologies. The information aims to describe the specific consequences of the implementation of one of the technologies, given the assumptions of the choice problem.
Another demand for the information in the questionnaire is that it needs to be understandable for nearly all groups in Dutch society. When the need for a representative sample of the general public calls for the inclusion of respondents that are not very motivated or not highly educated, the amount of information that can be provided and understood is limited. To avoid drop out of groups like the elderly, who are usually more slow completing questionnaires, the more difficult groups should not need more than two hours to complete. Than the average sample will take 1 hour to complete. Of this hour, half is needed for instructions, presentation of the problem and information about current situation and global warming. This means half an hour is left for six options, 5 minutes per option. This reduces that possible amount of information that can be given concerning one option to a single page. After the experts evaluated the importance of all the pieces of information in the second round of expert information, it was established which information was essential to the public according to the experts we consulted. Several extra steps were taken to make sure that the information was limited and understandable enough for most respondents to process properly. First, the information on consequences is formulated per consequence, so that respondents are able to evaluate each consequence separately. In this way, respondents are able to evaluate one by one how much of an advantage or disadvantage they think the relevant consequences are. This method of giving respondents little “blocks” of information and asking them to evaluate this information helps respondents process the information (Neijens, 1987). Second, the information on the consequences is almost always given relative to the status quo. For instance: “When this technology is implemented, the costs of power for households will be 10% higher than now”. Relative information was chosen over absolute information because the latter is more difficult to process, results in extended processing, and will not be retained as long as relative information (Van Raaij, 1977).

Information on consequences was omitted from the questionnaire when it was either non-discriminatory or a so-called null-effect. These two points will be explained in the next paragraphs.

Non-discriminatory information.
When a consequence results from all options equally, the information on this consequence is not informative to the decision making process, because the information does not discriminate between options. For instance, an important consequence of all the options in the questionnaire is that they produce enough energy. This information does not help in making a choice, as it is true for all options.
Null-effects.
With information on null-effects we mean information on the lack of a certain consequence. For instance “a gas fuelled power plant poses no risk for humans living on a distance of more than five miles”. The information that was gathered by the experts contained several of such null-effects. Most null-effects concerned information on consequences that did not differ from the status quo. A null-effect can be a consequence that lacks absolutely, it can also be a consequence that does not differentiate from the current consequences of the same sort of technology. There were several reasons to omit these kinds of information from the information on consequences that was given to respondents. First, omitting this kind of information leads to less information to read and process for respondents, but does not lead to much information loss. Even when null-effects are not added to the information, they are still implicitly assumed when options are compared. The contrast between options that do contribute to global warming and options that do not is remains present, as the consequence of actual contribution to global warming is still mentioned. (See also Neijens, de Ridder & Saris, 1988).

The second reason to omit null-effects is that if they are not omitted they count twice. For instance, when it is mentioned that the use of coal does contribute to more deaths in coalmines and that the use of natural gas does not, this information is counted twice, namely as an advantage to natural gas and as a disadvantage to coal. In this case, for reasons of equality, it would be fair to mention that the use of power from coal or gas does not contribute to the need for new vehicles that run on hydrogen or the use of rigs that pump carbondioxide into old coalbeds. This would lead to the addition of great amounts of trivial information. Not only would this lead to the exponential growth of the amount of information that must presented, it is also likely to annoy the respondents. Given all these negative results of null-effects, it was decided to omit this kind of information from the questionnaire.

Translation
To make the information understandable for lay people, we also translated the text from expert language to lay language. We used several methods to adapt the text so that lay people would be able to understand it. First, we replaced expert terms with terms that were more understandable for lay people. For instance, all the names of the technologies have been changed for the respondents. The expert terms for the technologies and their translations are depicted in Table 2.2.4. This table shows the technical term of the technologies and the translation thereof, both the title and the description of the technology that respondents in the ICQ were presented with.

We also added extra explanation of processes or installations if we thought this might be unclear for respondents but could be an issue. These explanations could be redundant for experts and therefore not mentioned in the information of experts, but necessary for lay people to understand and evaluate consequences. For instance, in all the descriptions of the technologies that involve hydrogen, a few sentences were added to explain what hydrogen is and how it would be used specifically for a technology.

Table 2.2.4 Expert terms for technologies and their translation for lay people

After the expert title the brief expert label is printed in italics and between quotation marks. We will use these brief expert labels to refer to the CCS options in this report.

Expert title	Lay title
Integrated Gasification Gas Combined Cycles with CCS for all kinds of end use ("*IGCC with CCS*")	**Large modern coal fired power stations (for private and commercial use) with CO_2 capture and storage**
Description of the technology in ICQ: In these plants, coal is converted into electricity. The CO_2 released in this process is captured and stored under the floor of the Dutch part of the North Sea. About 20 of these large plants would be needed to ensure an annual 20 percent reduction of CO_2 released into the air. These 20 plants would generate nearly all the electricity the Netherlands will need in the future. The electricity would be supplied to homes, businesses and organisations. All the plants would be built in the industrial zones near Amsterdam, Delfzijl, IJmuiden and Terneuzen, and in the Rijnmond region. Realization of this technology is envisaged in the near future, i.e. from 2010 onwards. The technical know-how for this is largely available.	
Solid Oxide Fuel Cells with CCS for private and commercial use ("*SOFC with CCS*")	**Conversion of natural gas into electricity (for private and commercial use) with CO_2 capture and storage**
Description of the technology in ICQ: Natural gas is converted to electricity and heat in small fuel cells. Fuel cells are relatively cost-efficient, quiet and clean installations of various sizes in which fuel can be converted into electricity and heat. The CO_2 released through this process is captured and stored underground in the Netherlands. Hundreds of fuel cells would be necessary to ensure that 20 percent less CO_2 is released into the air annually. Nearly all of the electricity the Netherlands will need in the future is generated in these fuel cells. The electricity and heat are supplied to households, businesses and organisations. These fuel cells would be installed near businesses and within urban areas. This technology on such a large scale will probably not be possible to implement before 2020. The necessary technical advances are expected to have been realized by then, but this is not a complete certainty.	
Hydrogen production via coal gasification with CCS for industrial use ("*Hydrogen production via coal gasification with CCS for industrial use*")	**Large coal fired hydrogen stations (for industrial use and for bus and freight transport) with CO_2 capture and storage**
Description of the technology in ICQ: In these plants, coal is converted into hydrogen through gasification. Hydrogen is a gas that releases energy in the process of combustion. This hydrogen is mainly used by large businesses in order to generate electricity. It can also be used to power trucks and buses, in which case it replaces petrol and especially diesel oil. The CO_2 released in the process of converting coal to hydrogen is captured and stored under the Dutch part of the North Sea. Approximately 10 of these large plants are required to ensure a 20% annual decrease in CO_2 emission in the Netherlands. The hydrogen supplied by these plants can generate all the electricity required by large-scale industry in the Netherlands. In addition, this hydrogen can be used to power bus and freight transport in the industrial areas. All plants would be built in the industrial zones around Amsterdam, IJmuiden, Delfzijl, Terneuzen and in the Rijnmond region. This can be carried out in the near future (2010) because the technical know-how is already available. In the long run (2020-2030), technical advances are expected to make the plants cheaper and more efficient.	

Expert title	Lay title
Hydrogen production via steam reforming with CCS for private and industrial use *("Hydrogen production via steam reforming with CCS")*	**Conversion of natural gas into hydrogen in large plants (for private and industrial use and bus and freight transport) with CO_2 capture and storage**

Description of the technology in ICQ:

Natural gas is converted to hydrogen in large and small plants. Hydrogen is a gas that releases energy in the process of combustion. Hydrogen is mainly used to generate electricity and heat for households and businesses. This hydrogen will be used in a lesser amount to power trucks and busses, in which case it replaces petrol and especially diesel oil. In order to ensure a 20% annual decrease in CO_2 emissions in the Netherlands, the use of hydrogen would have to be used to generate approximately half of the present of electricity consumption, as well as one quarter of the current consumption of natural gas for heating homes and, finally, one quarter of the current of petrol and diesel fuel consumption. The CO_2 released in the conversion of natural gas to hydrogen would be captured and stored in underground spaces, both under land and under the Dutch part of the North Sea.
It is the intention to realize this technology in the near future (as from 2010) in urban areas. The technical knowledge is available. The use of this technology necessitates many new installations and very many new pipelines to supply the hydrogen to businesses, fuel stations and households.

Enhanced Coal Bed Methane for similar use as natural gas ("*ECBM*")	**Retrieval of methane gas by storing captured CO_2 in coal beds**

Description of the technology in ICQ:

Methane gas is found in and between underground coal beds. In these deep-lying layers of coal that are unfit for mining, CO_2 can be stored. CO_2 that has been captured at installations or electricity plants is pumped into such a coal bed through a drill hole, and methane gas can be extracted through another drill hole. This methane gas would be used for the same purposes as natural gas, for example for generating electricity in plants and for heating and cooking. In order to ensure a 20 percent annual reduction of CO_2 emissions, methane gas would have to replace approximately one third of the current use of natural gas. There is little experience with the extraction of methane gas through the storage of captured CO_2 in coal beds. There is, however, enough technological know-how at present to realize this technology. The technology can probably be implemented within the near future (as early as 2010).

Small Scale reforming based on membrane technology with CCS for motorvehicles (*"Small scale reforming based on membrane technology with CCS")*	**Conversion of natural gas into hydrogen (for motor vehicles) with CO_2 capture and Storage**

Description of the technology in ICQ:

Natural gas would be converted into hydrogen by small installations located at fuel stations. Hydrogen is a gas that releases energy in the process of combustion. This hydrogen would be used to power motor vehicles such as cars and trucks. In order to ensure a 20% annual decrease in CO_2 emission in the Netherlands, the use of hydrogen would need to replace nearly all current use of petrol and diesel fuels, necessitating new installations the size of a large caravan at all fuel stations. The CO_2 released in the process of converting natural gas to hydrogen is captured and stored in underground storage under the Netherlands and under the Dutch part of the North Sea. This method can probably be implemented on a large scale as from 2030. Technical advances are expected to be realized by then, but this is not certain. By approximately 2030, nearly all motor vehicles would have to be replaced with hydrogen-powered models

Second, we converted the information, if necessary, from expert standard measures to measures that are understandable for lay people. For instance, instead of framing the costs of a technology in terms of eurocents per kWh, it was framed as the percentage people would have to pay more compared to what they pay now for the same kind of energy.

Third, a real effort was made to specify to what extend a consequence might occur, as well as to specify the probability of occurrence. For instance, how high the chance was of something occurring, how much more this would happen than now, or for a more literal example: how many accidents and deaths of miners would occur. Of course, sometimes expert knowledge was simply not yet available and then it was just not possible to get an exact number or even a quantitative estimate.

It is essential to realize that although many details that experts have given are not mentioned literally in the translation for lay people, these details are the basis for the consequences that have been described in the translation for lay people. For instance, efficiency of a technology is an aspect that was frequently specified by experts. However, efficiency will not be mentioned in the translation. It will be taken into account for the specification of the price of energy, which will be mentioned in the translation, mostly stated as the percentage customers have to pay extra for energy or fuel. This is something that is more clear and more important to lay people (Daamen & Bos, 2000). Therefore, although it might seem that a lot of expert information has been omitted, this information has in fact been taken into account for the statements in the translation for lay people.

2.2.5 Adjustments following the preliminary test and the review of the resonance committee ("klankbordgroep")

A test on VMBO-students

After selecting and translating the information in the questionnaire to the level and proportion suitable for almost all respondents, we tested the information on 23 VMBO students. These students were between 14 and 16 years of age. VMBO is the lowest level of secondary vocational training in the Netherlands except for the level with students with serious learning problems. The questionnaire they were given contained information on the current Dutch use and sources of energy, it's relation to global warming and the consequences of global warming. This information was based on the IPCC report of 2001, and had been checked and improved by several experts. The students were asked to evaluate these consequences. The questionnaire furthermore contained information on the ways to reduce carbondioxide emissions and on the technology of carbondioxide capture and storage. The students were then asked to evaluate the consequences of carbondioxide capture and storage. After this, they received information on two specific CCS technologies. For both technologies, students were first given a general description and then information on consequences to evaluate.

As the purpose of this test was to measure the amount of time it would take the students to complete the questionnaire and to measure how understandable the text was, we were not interested in students' opinions on CCS, but rather recorded additional measures. We recorded the time students used to finish the questionnaire. Questions about the comprehensibility of the information were inserted multiple times after every few sentences of information that could be misunderstood. Students were asked to underline words or sentences that they did not understand, and were asked to rewrite parts they did not understand in their own words. After finishing the questionnaire, students were asked to answer a few knowledge questions that they should be able to answer after having seen the information in the questionnaire. The purpose of these questions was twofold. On the one hand, it was another measure of the comprehensibility of the text. On the other, it was a measure of how seriously students had participated.

Although the text was found comprehensible for the most part, the students mentioned several sentences more than once as being difficult to understand. These sentences or the paragraphs containing these sentences were rewritten to become more comprehensible. When rewriting, we took into account what information had been misunderstood as apparent from the frequent wrong answers on the knowledge test. We were not able to avoid all difficult terms though, for instance "CO_2" was mentioned a lot as being a difficult "word", but this term was well-explained and furthermore unavoidable in this questionnaire.
The time it took students to finish the questionnaire ranged from .5 to 1.5 hour. (Keep in mind here that they did not receive the entire questionnaire.) This was less than expected and gave no reason to try to shorten the questionnaire.
Last but not least, most students seem to have done their best at reading and processing all the information, as they answered the majority of the knowledge questions correctly.

The "Klankbordgroep"
The second translation check came from the "klankbordgroep". This group consisted of 9 experts from different backgrounds that had not participated during the gathering of information. The purpose of the "klankbordgroep" was to independently check the quality of the research that was being done. An important check was the check of the selection and translation of the expert information. After improving the text that was tested on the VMBO students, the "klankbordgroep" checked the information again on accuracy and balance. With their help, the text on a few consequences that was less comparable between options, was improved. The balance of positive and negative consequences of one of the six options (i.e. "ECBM") was found to be off compared to the situation as expected by members of the "klankbordgroep". This option was altered based on the suggestions of the "klankbordgroep". All in all, the "klankbordgroep" approved the ICQ information as being valid, impartial, and even-handed.

2.3 The test of the ICQ

2.3.1 Procedure of the test

The test ICQ was designed to test the comprehension of language and procedure as well as to measure the amount of time needed to finish the ICQ. In order to test the comprehension of language and procedure, we added two questions to every part of the questionnaire. After every bit of information or each small series of questions we asked respondents if they thought this information was clear, and if they thought it was not clear, we asked if they could state in their own words what wasn't clear. In order to measure the time needed to finish the questionnaire without all these extra questions, half of the respondents would receive a test ICQ with the extra questions and the other half of the respondents would receive a test ICQ as it was intended, without the extra questions. The test ICQ was a computer-assisted questionnaire, which was send to respondents by TNS-NIPO so they could fill in the questionnaire at home, on their own computer.

2.3.2 Explanation of the ICQ procedure

Callibration
After a quick introduction of the purpose of the ICQ and kind of task respondents could expect, respondents were given several exemplary questions and exercises to practice the ICQ procedure with. These examples and exercises were used to explain how to evaluate consequences. Respondents were given four negative consequences to evaluate on a scale of one to nine, one being a very small disadvantage, nine being a very big disadvantage. These four consequences differed on two dimensions; the negativity of the consequence and the chance the consequence would occur. The purpose of this was to explain to respondents that it would be logical to rate a certain more negative consequence as more negative, and that it would be logical to rate a chance of less than 100% on something negative (e.g. 50% chance on 100 casualties) as less negative than a certainty (100%) of the same thing occurring.

Evaluation of consequences
Respondents were then given an exemplary ICQ about painkillers. With this exemplary ICQ, respondents were explained how to fully evaluate consequences; For every consequence respondents were asked to state if they thought this consequence was an advantage, a disadvantage or not important. If the consequence was evaluated as an advantage or a disadvantage, respondents could state to what extend they saw it as an advantage or disadvantage on a scale of one to nine (1= "a very small disadvantage" or "very small advantage", and 9= "a very large disadvantage" or " a very large advantage"). After evaluating several consequences of painkillers, respondents received more suggestions on how to evaluate as logical as possible.

Value and consistency
When a respondent evaluated one or more of the negative consequences as an advantage, it was explained that it would be reasonable to evaluate side-effects of a medicine as a disadvantage. As one of the consequences in the exemplary ICQ was the same as in the first four negative consequences, respondents that gave equal evaluations of this consequence were explained that this was the logical thing to do. Respondents that gave different evaluations to the same consequence were suggested to consider that equal consequences should receive equal evaluations.

2.3.3 Presentation of the choice problem and background information

After familiarizing respondents with some elements of the ICQ procedure, respondents were explained in detail what the questionnaire was about. They were told that the questionnaire had been made with the help of a diverse group of energy experts and that the information in the questionnaire was acknowledged by these experts as a trustworthy account of energy dilemmas and of the consequences of six options to produce energy. The respondents were given information on the current use of energy in the Netherlands and the current ways in which energy is produced in the Netherlands. Next, they were explained what the frequent use of oil, gas and coal mean for our climate, by explaining the role of carbondioxide in global warming. They were then given 11 consequences to evaluate that are expected to occur when the earth's temperature rises as much as expected by scientists. They were also asked to state their overall evaluation on global warming. This overall evaluation was asked for twice; the respondents were asked to give their overall evaluation on a scale of 1 to 7, first 1 being very bad and 7 being very good, than 1 being very disadvantageous, 7 being very advantageous.

2.3.4 Knowledge tests

Following the information on global warming, respondents were given information on ways to reduce emissions of carbondioxide. It is explained that this questionnaire focuses on six new technologies that can help to reduce carbondioxide emissions. At this point, respondents received information on the aspects of these policy options that are equal for all six options. Respondents were made clear that only one of these six options is necessary to reduce carbon dioxide emissions by 20%. As respondents have had a lot of information to take in so far, it was questionable if they remembered all of it. To test respondents' knowledge at this point and to fill in any omissions, respondents received 10 multiple-choice questions on information they had just been given to read. After respondents gave their answer, the right answer would always be displayed on screen once more.

2.3.5 General information on carbondioxide capture and storage

The aspect that all six policy options in the questionnaire have in common, is the use of carbondioxide capture and storage. As the consequences of carbondioxide capture and storage are the same for all six policy options, we asked respondents to evaluate these consequences in general and not per option. Respondents received a general description of carbondioxide capture and storage and information on six aspects and consequences and were asked to evaluate these consequences and asked to provide their overall evaluation of CCS. The evaluation of the consequences does not only serve the purpose of purely finding out how respondents evaluate these consequences, but also serves to help respondents process the information, because the information is presented per consequence, and has to be processed immediately in order to give an evaluation of the consequence. Respondents were asked to provide their overall evaluation on two 7-point scales, on ranging from 1 (very bad) to 7 (very good), the other scale ranged from 1 (very disadvantageous) to 7 (very advantageous).

2.3.6 Another example: choice procedure

Respondents received a summary of all the information they had to process before. It was announced at this point that they would not only be asked to evaluate the options and their consequences, as they had done in an example before, but that they would also be asked to make a choice between the six options by choosing one of the options. We used an exemplary choice procedure to explain what the real choice procedure would be like. Respondents were shown in a table, what evaluations they had given before in the earlier example of the ICQ procedure of "medicine X". They were then asked to evaluate "medicine X" as a whole. They were asked to evaluate a few more consequences, this time from "medicine Y". These evaluations were also shown in a table. After respondents were asked to make an overall evaluation of "medicine Y", it was shown on screen what overall evaluations both medicine had received. The respondents were then asked to choose between the medicines. It was stated that respondents, if they wanted to, could take all or part of the evaluations of the consequences into account, and that they could, if they wanted to, take the overall evaluations into account as well.

2.3.7 Evaluating consequences and aspects of six CCS options

At this point, respondents would receive the information on each of the six policy options in general as well as information on the aspects and consequences of each option. Per option, respondents would first get a description of the technology. Descriptions of the technologies contained information on, for instance, the essence of the technologies, the amount and location of plants or fuel cells, the kind of end use, the timing of implementation and the technical development that is needed for implementation. After the general description, respondents were asked to evaluate all the aspects and consequences of the technology in question.

The criteria for the information about the options was explained to respondents; first it was explained that the respondent would receive information on consequences that experts found important, but we added the comment that experts obviously could not decide for the respondent whether they thought a consequence was important or not. The second criterion for the information on consequences was that only consequences that differed per option would be mentioned. It was explained that although consequences caused by all options could be important, this information would not aid in the decision making process. The third criterion was the relevance of a kind of consequence for a policy option. If the consequence of one option is more research and development whereas the other option does not cause this, only the consequence of more research and development is mentioned. The fourth criterion was a difference from the status quo. For instance, if the safety consequences of a technology do not differ from the safety consequence of the currently used technology, these safety consequences were not mentioned.

The information about an aspect or a consequence was given to respondents in such a way that it was possible for them to evaluate this aspect or consequence. As in the exemplary ICQ, respondents were asked to state for every consequence if they thought this consequence was an advantage, a disadvantage or not important. If the consequence was evaluated as an advantage or a disadvantage, respondents could state how much of an advantage of disadvantage on a scale of one to nine, with one being a very small disadvantage or very small advantage, and nine being a very large disadvantage or advantage. This way, respondents could evaluate all the relevant aspects and consequences of a technology, one by one, as they had been practising with the exemplary ICQ. In the ICQ that was originally developed by Neijens (1987), respondents were asked at this point to accumulate all the evaluations of a technology, and were asked to base their overall evaluation of the technology on the resulting total. In the current study this was not possible however, due to the nature of the information that was given to respondents. Neijens' procedure (1987) calls for the presentation of information about consequences only, and not aspects too. By including aspects of the technology as well, the evaluations of respondents cannot be considered independent of each other anymore. If the evaluations are not independent, accumulating them is not correct. We therefore replaced the original step of accumulating the evaluations by an oversight of the evaluations. After the respondents had evaluated all consequences and aspects, a table would appear on screen with all the aspects and consequences and their evaluations. If an aspect of consequence had been evaluated as unimportant, this would presented as a "0" in white colour, if it had been evaluated as a disadvantage the evaluation would be presented in red colour, and if it had been evaluated as an advantage the evaluation would be presented in green colour. Respondents were now asked how they thought about the technology as a whole, and were suggested to base this on their evaluations of the consequences and aspects. They were asked to give an overall evaluation of the technology on two different scales. First they were asked to state on one scale of one to seven what they thought all in all, with one meaning “very unattractive” and seven meaning “very attractive”. They were furthermore asked to grade the technologies on a scale of one to ten.

2.3.8 Choice between six CCS options

When respondents had evaluated all six policy options, a table would appear on screen with all six options and their overall evaluations. Respondents were told they could now change the overall evaluations if they wanted, having now read all of the information on the six policy options. Following this respondents were asked which technology they preferred to be implemented on a large scale. They could choose one technology. It was suggested that they could base their choice on their overall evaluations of the policy options. Respondents were subsequently asked if there were any policy options in the questionnaire of which they thought implementation on a large scale was absolutely unacceptable, to a level that they considered taking action if Dutch society considered implementing this technology on a large scale.

2.3.9 Perception of information and involvement

After the respondent had made a choice, the actual Information-Choice-Questionnaire was over. However, several additional measures were taken. First, thirteen questions were asked to evaluate whether – subjectively- the goal of the ICQ had been reached. These questions concerned the amount, the impartiality, the clarity and the completeness of the information. The questions furthermore concerned how the procedure of the ICQ had aided respondents’ decision, how comprehensible it was and how complicated. Respondents were also asked if they had felt restricted in their choice for a technology.

Second, respondents received five questions on opinion change due to the information in the questionnaire. For instance: “To what extend did the information in the questionnaire give you more arguments for your choice for one of the options to produce energy?”

Third, respondents were asked nine questions that were meant to measure their involvement with issues regarding energy and environment. Involvement indicates to what extend people inform themselves on, think about and feel engaged to a topic. Involvement in this topic was measured with the use of questions from a validated and reliable questionnaire that was developed by Verplanken (1989; 1991). Some questions were slightly altered to fit the current situation and questionnaire, one question was added.

Measures of backgroundvariables were not asked but were already known through earlier work of TNS-NIPO, the institute that has done the fieldwork of programming and administering the questionnaire to a representative sample of 100 Dutch respondents. These backgroundvariables were sex, year of birth, education, kind of employment and work hours per week, residence, province, region, and urbanisation.
As the political arena was shifting quickly during the time of the data collection, we did add one backgroundvariable to the questionnaire itself, namely the question; ”If there were national elections today, which party would you vote for?”

2.4 The necessity for testing the Information and Choice Questionnaire

There are two main reasons for testing an ICQ. First, as an ICQ in general and our ICQ in particular tries to explain difficult subjects, it is essential to find out if explaining these subjects succeeds using the ICQ. Since one of the goals of the ICQ is to inform respondents, it is necessary to test how well respondents are informed. Second, the ICQ functions as a decision aid. Respondents are not only informed, but the way they are informed is such that it structures the decision making process. Respondents are asked to evaluate options by evaluating the consequences of an option, after which they are able to compare the options and their consequences and make an informed decision. Before evaluating consequences, however, respondents are given several suggestions and exercises to help them decide and evaluate more rationally. As the second goal of an ICQ is to structure the decision process, it is necessary to test if respondents understand these suggestions and exercises and if they make use of these suggestions when evaluating consequences.

Furthermore, as the ICQ entails a complex procedure as well as a lot of difficult information, it is expected that most respondents need quite some time to complete the ICQ. The amount of time that is needed to fill in a questionnaire can become a problem when the questionnaire takes so much time that certain groups of respondents will drop out (e.g. elderly respondents, less interested respondents, etcetera). As this will cause an unrepresentative sample, it is necessary to design a questionnaire that is short enough for all groups in the expected sample. Therefore, it is necessary to test how long it takes respondents to finish the questionnaire.

2.5 Results of the test and consequent adjustments

2.5.1 Sample

The respondents in the sample were invited by the NIPO to participate in this study in exchange for a bonus. These respondents are part of huge access panel that the NIPO maintains and which consists of all kinds of people. The bonus respondents received for participating in this study was worth approximately 9 euros and could be paid out in cash, airmiles, used for store credit or given away to a selection of charities.

The questionnaire was send to the respondents as a computer program that could be very easily opened on their home computer. Respondents were free to participate at a time that suited them. Of the people the NIPO invited to participate, 101 respondents participated and filled in the questionnaire completely. However, of these 101 respondents, 4 respondents did not take the questionnaire seriously. This became apparent when the time it had taken them to finish the questionnaire was computed (<15 minutes), and confirmed by their answers. Most of the answers of these 4 respondents were the same, in the sense that independent of the question, the value that was filled in remained the same. As their answers were practically random, the data from these respondents was removed from the sample.

The sample was of the same composition as the Dutch population. It consisted of 47 men and 50 women, of all ages between 18 and 86. Most respondents (33%) had an MBO education, 26.8% had an LO-LBO education, 20.6% had an HBO education or WO-candidacy, 11.3% had an MAVO education, 3.1% had a VWO education, 2.1% had an WO or postdoctoral education and the rest was unknown. All the provinces of the Netherlands were represented as expected.

2.5.2 Understanding

Three dimensions of the comprehensibility of the questionnaire were analyzed. We will first discuss the results for the difficulty of the language. We will then go into the results concerning the issue of processing the technical information and finish with an analysis of the use of the decision aid in the questionnaire.

2.5.2.1 Difficulty of language

After each piece of information and every evaluation of consequences, 46 of the 97 respondents were asked “Do you find this information clear?”. This question was asked 105 times. Most information was evaluated as clear by all respondents. 69.5% of information was found clear by all respondents, 21.9% of information was found clear by all but one respondent, 3.8% of information was found clear by all but two respondents and 4.8% of the information was found clear by all but three respondents. When one or more respondents had stated to find a piece of information unclear, the explanation of the respondent was read and compared to the information to see what the problem could be. However, most of the times the comments respondents made referred not to the incomprehensibility or difficulty of the text but to unrelated matters respondents wanted to share. Only 5 pieces of information were actually criticized for their content or comprehensibility. In two cases, the critique was judged by the researchers as unfounded, as respondents stated to miss information that was actually already in the information. In three cases, the comments respondents made did refer to the incomprehensibility or difficulty of the text. This concerned the text about the four aspects all options had in common, the aspect “needed new installations” of the option “Conversion of natural gas into electricity for private and commercial use with CO_2 capture and storage” (SOFC) and the aspect “Price” of the option “Conversion of natural gas into hydrogen for motor vehicles with CO_2 capture and storage” (small scale reforming based on membrane technology). Based on the comments on these texts, the three texts were adjusted.

2.5.2.2 Processing the technical information

To study how difficult the technical information in the questionnaire was for respondents to process, we asked two sets of questions. First, we tested the knowledge that respondents had about the information that was just given to them. Second, after the questionnaire several questions were asked to study the opinion of the respondents on the quality of the information. We will first discuss the results of the knowledge test.

Knowledge test
To check whether respondents were able to process the information that was given in the first part of the questionnaire about the current use of energy, global warming and general aspects of the technologies in the questionnaire, they were asked ten multiple choice questions. Most questions were answered correctly by a large majority of the respondents. Five questions were answered correctly by at least 90% of respondents. We will discuss the questions that proved more difficult for respondents. Three questions were answered correctly by at least 83.5% of respondents. These were the questions about the percentage of energy that is currently produced from coal, gas and oil, about the difference between current use of energy and the

advanced fossil fuel options in the questionnaire, and about the contribution of captured CO_2 to the greenhouse effect. Although the percentage of respondents that answered these questions wrongly is still small, it is nevertheless higher than the percentages found for other questions. It seems respondents found it more difficult to recollect the information that was needed to answer these questions. We therefore adjusted the text about this information, to explain this information more thoroughly and to repeat some of this information in the text.

Two questions were answered correctly by much less respondents. The first question is the question about the amount of degrees the average temperature on earth will rise if CO_2 emission keeps rising as it does now. This question was correctly answered by 75.3% of respondents with the answer: “probably rise 1 to 5 degrees Celsius”. Most of the respondents that answered wrongly (17.5%) choose the answer: “will certainly rise 5 to 10 degrees”. Only one respondent (1%) choose the answer: “might drop 1 to 5 degrees”. Apparently, respondents did remember that the temperature would rise, just not if it was certain and how much exactly. The text on this information was therefore adjusted as well to explain and repeat the information more thoroughly.
The second question that was answered correctly by much less respondents was the question about the amount of CO_2 emission that each of the six advanced technologies in the questionnaire tries to avoid. A small majority of respondents (64.9%) correctly choose the answer: “about 20%”. Several respondents (21.6%) choose the answer: “about 50%”, and a few respondents (10.3%) choose the answer: “about 100%”. Three (3.2%) of the respondents choose the answer: “these technologies do not strive to reduce CO_2 emissions”. It seems that most respondents had understood that the six technologies strive to reduce CO_2 emission, they just did not remember how much exactly. Therefore the text was adjusted to repeat more often that the amount of CO_2 emission reduction the six technologies strive for is 20%.

Respondents’ evaluation of difficulty
The second set of questions that was asked to study how difficult the information was for respondents, consisted of seven questions about respondents’ evaluation of the quality of the information on a scale of 1 to 7. These questions concerned the amount, the impartiality, the clarity and the completeness of the information. The amount of information was satisfactory for most respondents. When asked if they thought they had enough information to make a choice between the different energy options, only 16.4% of respondents remained on the “not enough” end of the scale. However, 51.6% of respondents did state a wish for more information before evaluating the aspects and consequences of the policy options. When asked to what extend they thought the information in the questionnaire was partial or impartial, most respondents (70.1%) answered on the “impartial” end of the scale and 19.6% of respondents answered neither partial nor impartial. A majority of respondents (59.8%) also thought the information was not one-sided, but 20.6% did feel the information was one-sided. This is to be expected however, as the questionnaire is only about CCS options, and does not include other possible options (e.g. renewables, nuclear energy, etc).
Furthermore, a majority of respondents (79.4%) thought that the information was clear, and 13,4% of respondents thought it was not clear.
When asked if they thought the amount of information was appropriate, 21.6% of respondents thought the amount of information was neither too little nor too much. A substantial part of respondents thought the amount of information was a bit too much (35.1%) or more than a bit too much (24.7%). Only few of the respondents thought the information was either much to much (8.2%), or much too little (1.0%). A substantial part of respondents (42.3%) stated to

think that it was comforting that the information was regularly repeated, whereas 33% of respondents admitted to find this irritating.

As the background and interests of the respondents in the sample are very different, it was expected that there would be differences in the perception that respondents would have of the information in the questionnaire. What is too much for one is too little for another. However, in general the amount and quality of the information seemed to be appreciated by the majority of the respondents. These results therefore gave no reason to change the amount or wording of the information.

2.5.2.3 Calibration, calibration of probability, evaluation valence and consistency

To study whether the explanation in the text about the use of the decision aid was understood and used properly, several measures were taken. How respondents evaluated several key consequences was one measure, the other was a number of questions concerning respondents' opinion on the method of the ICQ.

The first measure of the use of the decision aid is the percentage of respondents that evaluated consequences in a logical way, in the sense that the evaluations were calibrated, took probability into account, had logical valence and were consistent.

Calibration
It was explained to respondents in the beginning of the questionnaire that it would be logical to rate a certain more negative consequence as more negative. Respondents who followed this advice should not rate something that is not as negative as another consequence at the end of the scale. If something less negative is already rated as the most negative consequence possible, it is not possible anymore to rate something more negative as more negative on the scale. It seems that most respondents understood this already, as only 19.6% of respondents rate "an accident with as a consequence *several* deaths" as negatively as possible on the scale, but 71.1% of respondents rate "an accident with as a consequence *thousands* of deaths" as negatively as possible.

Calibration of probability
Furthermore, it was explained to respondents in the beginning of the questionnaire that it would be logical to rate a chance of something negative occurring as less negative than a certainty of something occurring. It seems that some respondents also understood this already. When respondents were asked to rate "a very small change of an accident with as a consequence a thousands of deaths", the percentage of respondents that rated this as a very big disadvantage dropped to 29.9%, opposed to the 71.1% of respondents that rated a certainty of thousands of deaths as a very big disadvantage.

Evaluation valence
After respondents had received 4 consequences of medicine "X", the computer would check if the respondent had evaluated all disadvantages as disadvantages. If this was not the case, the respondent received the following text: "You have evaluated one or more of the consequences of medicine "X" as an advantage. Although you are of course free to think so, something could be said for considering the possible side-effects of a painkiller to be a disadvantage." A minority of respondents actually received this message, 17.5% of respondents considered one

of the consequences to be an advantage, 3.1% of respondents considered both consequences to be an advantage.

Consistency
As one of the consequences in the exemplary ICQ about medicine "X" was the same as in the first four negative consequences, respondents that gave equal evaluations of this consequence were explained that this was the logical thing to do. A minority of respondents gave exactly the same evaluation (15.5%). The other respondents were explained that there might be something to be said for giving the same evaluation to the same consequence. To analyze if this comment helped improve respondents consistency, we compared the evaluations of equal consequences of different policy options, which were evaluated after this explanation. A comparison of evaluations of the consequence "safety of miners" showed that a majority of respondents (51.5%) evaluated this consequence exactly the same, and 25.7% of respondents evaluated this consequence nearly the same.[2] It seems respondent did take notice of the explanation that the same consequence should be evaluated the same, and behaved accordingly.

Respondents' evaluation of the method
The second measure of the comprehensibility of the method of the ICQ consisted of three questions concerning the opinion of respondents on this matter. The first question was only addressed to the half of the respondents that had not been frequently asked if the information was clear. They were asked if there had been a moment during the answering of the questions that something was not clear or that they had not understood what they were supposed to do. Some of the respondents (15.7%) confirmed there had been such a moment. When asked to specify, some respondents could not specify, but 3 respondents found it difficult to evaluate some of the consequences because they thought part of the consequence was negative, but part of the consequence was positive. This is true, some consequences start by mentioning something very negative, to go on stating that this has been resolved, diminished or has only a very small change of occurring. However, although this information is not easy to comprehend for some respondents, it is information that experts deemed important and therefore an essential part of the information in the questionnaire. This information was not adjusted.

A majority of respondents thought the method of the ICQ was comprehensible. A minority (8.2%) thought the method was neither comprehensible nor incomprehensible and only a few respondents (4.1%) thought the method was incomprehensible. When asked if the method was simple or complicated, 19.6% of respondents thought it was neither simple nor complicated, 39.2% thought it was a bit or rather complicated and 3.1% thought it was very complicated.
It seems that although respondents think the method is complicated, most of them did understand the method.

2.6 Time

As explained before, the amount of time it took respondents to finish the questionnaire was important because if it takes to much time, specific groups of respondents drop out and this endangers a representative sample. Two different measures of time were therefore important;

[2] with a margin of 1 point on the totally 19 point scale (i.e. advantage and disadvantage are rated on a nine-point scale, together with "not important" this makes a 19 point scale)

first of course the total amount of time it took respondents on average to finish the questionnaire, and second, if this was too long, which parts of the questionnaire took respondents are relatively large amount of time. However, time was recorded by the computer of the respondents, not the respondents themselves. This might look more objective, but the computer does not take into account that some respondents took one or more pauses during the questionnaire, which were sometimes very long (up to several hours). After calculating the amount of time it took respondents to finish all specific parts of the questionnaire, we therefore replaced all clearly deviant times to finish a part of respondents with the average time it had needed all respondents to finish that particular part of the questionnaire.
The mean total time to finish the questionnaire was 71 minutes and 6 seconds. As we had aimed for a maximum amount of time of 65 minutes, we looked at the mean time it took to finish the parts of the questionnaire. There were a few parts that took respondents a long time to finish compared to the other parts of the questionnaire. Specifically evaluating the consequences of global warming took relatively long (6.16 minutes). The second explanation of the procedure also took relatively long (5.5 minutes). As there was no indication that these parts were difficult for the respondents, the text of these parts was diminished and the amount of questions respondents had to answer in these texts was diminished also.

2.7 Conclusions from the test

Respondents understood most of the test. The language was mostly comprehensible, only a few pieces of text needed to be adjusted. The technical information seemed mostly comprehensible too, although some text had to be adjusted based on the objective measures of difficulty. The subjective measures of difficulty showed that respondents perceived the quality of the information in the test as quite good. The decision aid, the explanation at the beginning of the test about how to evaluate rationally, was either already being used or picked up by respondents. Most respondents were content with the method, although it was not evaluated as simple by most respondents. This gave us no reason to change this part of the questionnaire.

The time it took respondents to finish the questionnaire was unfortunately slightly too long. In order to reduce the amount of time respondents would need to complete the questionnaire, two sections were adjusted. This concerned the consequences of the temperature rise due to the greenhouse effect, and the second explanation of the procedure.

3. Procedure of the ICQ, TQ1 and TQ2

3.1 Procedure of the ICQ

The ICQ was a computer-assisted questionnaire, which was send to respondents by TNS-NIPO so they could fill in the questionnaire at home, on their own computer, at a time that suited them.

3.1.1 Explanation of the ICQ procedure

Calibration
After a quick introduction of the purpose of the ICQ and kind of task respondents could expect, respondents were given several exemplary questions and exercises to practice the ICQ procedure with. These examples and exercises were used to explain how to evaluate consequences. Respondents were given four negative consequences to evaluate on a scale of one to nine, one being a very small disadvantage, nine being a very big disadvantage. These four consequences differed on two dimensions; the negativity of the consequence and the chance the consequence would occur. The purpose of this was to explain to respondents that it would be logical to rate a certain more negative consequence as more negative, and that it would be logical to rate a chance of less than 100% on something negative (e.g. 50% chance on 100 casualties) as less negative than a certainty (100%) of the same thing occurring.

Evaluation of consequences
Respondents were then given an exemplary ICQ about painkillers. With this exemplary ICQ, respondents were explained how to fully evaluate consequences; For every consequence respondents were asked to state if they thought this consequence was an advantage, a disadvantage or not important. If the consequence was evaluated as an advantage or a disadvantage, respondents could state to what extend they saw it as an advantage or disadvantage on a scale of one to nine (1= "a very small disadvantage" or "very small advantage", and 9= "a very large disadvantage" or "a very large advantage"). After evaluating several consequences of painkillers, respondents received more suggestions on how to evaluate as logical as possible.

Value and consistency
When a respondent evaluated one or more of the negative consequences as an advantage, it was explained that it would be reasonable to evaluate side-effects of a medicine as a disadvantage. As one of the consequences in the exemplary ICQ was the same as in the first four negative consequences, respondents that gave equal evaluations of this consequence were explained that this was the logical thing to do. Respondents that gave different evaluations to the same consequence were suggested to consider that equal consequences should receive equal evaluations.

3.1.2 Presentation of the choice problem and background information

After familiarizing respondents with some elements of the ICQ procedure, respondents were explained in detail what the questionnaire was about. They were told that the questionnaire had been made with the help of a diverse group of energy experts and that the information in the questionnaire was acknowledged by these experts as a trustworthy account of energy dilemmas and of the consequences of six options to produce energy. The respondents were given information on the current use of energy in the Netherlands and the current ways in which energy is produced in the Netherlands. Next, they were explained what the frequent use of oil, gas and coal mean for our climate, by explaining the role of carbondioxide in global warming. They are then given 9 consequences to evaluate that are expected to occur when the earth's temperature rises as much as expected by scientists. They are also asked to state their overall evaluation on global warming. This overall evaluation was asked for twice; the respondents were asked to give their overall evaluation on a scale of 1 to 7, first 1 being very bad and 7 being very good, than 1 being very disadvantageous, 7 being very advantageous.

3.1.3 Knowledge tests

Following the information on global warming respondents were given information on ways to reduce emissions of carbondioxide. It is explained that this questionnaire focuses on six new technologies that can help reduce carbondioxide emissions. At this point, respondents receive information on the aspects of these policy options that are equal for all six options. Respondents were made clear, that only one these six options is necessary to reduce carbon dioxide emissions by 20%. As respondents have had a lot of information to take in so far, it was questionable if they remembered all of it. To test respondents' knowledge at this point and to fill in any omissions, respondents received 10 multiple-choice questions on information they had just been given to read. After respondents gave their answer, the right answer would always be displayed on screen once more.

3.1.4 General information on carbondioxide capture and storage (CCS)

The aspect that all six policy options in the questionnaire have in common, is the use of carbondioxide capture and storage (CCS). As the consequences of CCS are the same for all six policy options, we asked respondents to evaluate these consequences in general and not per option. Respondents received a general description of CCS and information on six aspects and consequences and were asked to evaluate these consequences and asked to provide their overall evaluation of CCS. This overall evaluation was asked for twice; the respondents were asked to give their overall evaluation on a scale of 1 to 7, first 1 being very bad and 7 being very good, than 1 being very disadvantageous, 7 being very advantageous.

3.1.5 Another example: choice procedure

Respondents received a summary of all the information they had to process before. It was announced at this point that they would not only be asked to evaluate the options and their consequences, as they had done in an example before, but that they would also be asked to make a choice between the six options. We used an exemplary choice procedure to explain what the real choice procedure would be like. Respondents were shown in a table, what evaluations they had given before in the earlier example of the ICQ procedure of "medicine X". They were then asked to evaluate "medicine X" as a whole. It was explained that this could also be done for a "medicine Y", and that one could imagine now choosing between "medicine X" and "medicine Y" based on the consequences. Respondents were told that the procedure of the evaluation of aspects and consequences of the technologies and the procedure for the choice for one of the technologies would be similar to this exemplary ICQ.

3.1.6 Evaluating consequences and aspects of six CCS options

At this point, respondents would receive the information on the six CCS options in general as well as information on the aspects and consequences of each option. Per option, respondents would first get a description of the technology. Descriptions of the technologies contained information on, for instance, the essence of the technologies, the amount and location of plants or fuel cells, the kind of end use, the timing of implementation and the technical development that is needed for implementation. After the general description, respondents were asked to evaluate all the aspects and consequences of the technology in question.

The criteria for the information about the options was explained to respondents; first it was explained that the respondent would receive information on consequences that experts found important, but we added the comment that experts obviously could not decide for the respondent whether they thought a consequence was important or not. The second criterion for the information on consequences was that only consequences that differed per option would be mentioned. It was explained that although consequences caused by all options could be important, this information would not aid in the decision making process. The third criterion was the relevance of a kind of consequence for a policy option. If the consequence of one option is more research and development whereas the other option does not cause this, only the consequence of more research and development is mentioned. The fourth criterion was a difference from the status quo. For instance, if the safety consequences of a technology do not differ from the safety consequence of the currently used technology, these safety consequences were not mentioned.

The information about an aspect or a consequence was given to respondents in such a way that it was possible for them to evaluate this aspect or consequence. As in the exemplary ICQ, respondents were asked to state for every consequence if they thought this consequence was an advantage, a disadvantage or not important. If the consequence was evaluated as an advantage or a disadvantage, respondents could state how much of an advantage of disadvantage on a scale of one to nine, with one being a very small disadvantage or very small advantage, and nine being a very large disadvantage or advantage. This way, respondents could evaluate all the relevant aspects and consequences of a technology, one by one, as they had been practising with the exemplary ICQ. In the ICQ that was originally developed by Neijens (1987), respondents were asked at this point to accumulate all the evaluations of a technology, and were asked to base their overall evaluation of the technology on the resulting total. In the current study this was not possible however, due to the nature of the information that was given to respondents. Neijens' procedure (1987) calls for the presentation of information about consequences only, and not aspects too. By including aspects of the technology as well, the evaluations of respondents cannot be considered independent of each other anymore. If the evaluations are not independent, accumulating them is not correct. We therefore replaced the original step of accumulating the evaluations by an oversight of the evaluations. After the respondents had evaluated all consequences and aspects, a table would appear on screen with all the aspects and consequences and their evaluations. If an aspect of consequence had been evaluated as unimportant, this would presented as a "0" in white colour, if it had been evaluated as a disadvantage the evaluation would be presented in red colour, and if it had been evaluated as an advantage the evaluation would be presented in green colour. Respondents were now asked how they thought about the technology as a whole, and were suggested to base this on their evaluations of the consequences and aspects. They were asked to give an overall evaluation of the technology on two different scales. First they were asked to state on one scale of one to seven what they thought all in all, with one meaning “very unattractive” and seven meaning “very attractive”. They were furthermore asked to grade the technologies on a scale of one to ten.

3.1.7 Choice between six CCS options

When respondents had evaluated all six technologies, a table would appear on screen with all six technologies and their overall evaluations. Respondents were told they could now change the overall evaluations if they wanted, having now read all of the information on the six technologies. Following this respondents were asked which technology they preferred to be implemented on a large scale. It was suggested that they could base their choice on their overall evaluations of the technologies. They could choose one technology. Respondents were subsequently asked if there were any technologies in the questionnaire of which they thought implementation on a large scale was absolutely unacceptable, to a level that they considered taking action if Dutch society considered implementing this technology on a large scale.

3.1.8 Perception of information, opinion change and involvement

After the respondent had made a choice, the actual Information-Choice Questionnaire was over. However, several additional measures were taken. First, thirteen questions were asked to evaluate if the goal of the ICQ had been reached. These questions concerned the amount, the impartiality, the clarity and the completeness of the information. The questions furthermore concerned how the procedure of the ICQ had aided respondents decision, how comprehensible it was and how complicated. Respondents were also asked if they had felt restricted in their choice for a technology.

Second, respondents received five questions on opinion change due to the information in the questionnaire. For instance: “In what amount did the information in the questionnaire give you more arguments for your choice for one of the options to produce energy?”

Third, respondents were asked nine questions that were meant to measure their involvement to the problems of energy and environment. Involvement is a measure for the way people inform themselves on, think about and feel engaged to a topic. Involvement with this topic was measured with the use of questions from a validated and reliable questionnaire that was developed by Verplanken (1989;1991). Some questions were slightly altered to fit the current situation and questionnaire, one question was added.

Measures of backgroundvariables were not asked but already known through earlier work of TNS-NIPO, the institute that has done the fieldwork of programming and distributing the ICQ (n = 995), TQ (n= 327) and TQ2 (n= 300) to a representative sample of Dutch respondents. These backgroundvariables were sex, birthyear, education, kind of employment and fte, residence, province, region, and urbanisation.
As the political arena was shifting quickly during the time of the data collection, we did add one backgroundvariable to the questionnaire itself, namely the question; ”If there were national elections today, which party would you vote for?”

3.2 Procedure of the more traditional questionnaire (TQ)

Simultaneous with the administration of the ICQ, another questionnaire was given to a different, smaller sample of respondents from the same access panel of TNS-NIPO. The aim of this questionnaire was to be able to compare overall evaluations and choice of respondents that had been informed about the aspects and consequences of the CCS technologies and respondents that had not. However, this more traditional questionnaire is different than the usual public opinion study, in the sense that this questionnaire does present respondents with a choice problem, which is not common in real traditional questionnaires. The phrasing “more traditional questionnaire” must be read as “more traditional than the ICQ”. However, the design of the more traditional questionnaire, further to be addressed as “TQ”, goes beyond the scope of really traditional public opinion questionnaires. The next paragraphs will explain how the design of the TQ addresses both current public knowledge and overall evaluation of global warming and CCS technology, as well as the presentation of the choice problem. This questionnaire, similar to the ICQ, was also computer-assisted, and was send to respondents by TNS-NIPO so they could fill in the questionnaire at home, on their own computer, at a time that suited them.

3.2.1 Awareness and overall evaluation of global warming, CCS and six CCS technologies

Before respondents were asked any questions, they received a brief introduction about the study. It was explained to them that our current manner of energy use influences the environment and the climate and that the Netherlands are looking for other methods of energy use. It was explained to respondents that it was therefore necessary to study the evaluation of the public concerning a few possibilities for future energy use. It was furthermore explained that it was likely that most people knew very little about these technologies, and that therefore, some respondents would be given information about these technologies. It was then explained that they, however, were in the group of respondents that would not receive elaborate information. This way, the researchers would be able to study current public opinion that is not yet informed and compare the two groups of respondents to study the effect of the information that was given to one of the groups.

Respondents were then explained thoroughly that it was likely that they had never heard of most of the technologies that they were to receive questions about. They were told that each time, they would first receive a question if they had heard about something, and would then be asked to state their overall evaluation of this. Respondents were urged not be afraid to admit they had never heard of the topic of question, and were explained how they would be able to refrain from giving their evaluation by using the “no opinion button” on the screen. After the first question, respondents were again reminded that they should not be afraid to admit they were unaware of a technology.

Respondents received a combination of an awareness question and an overall evaluation question eight times, about global warming, about CCS, and about the six CCS technologies. They first received a multiple choice question; “have you heard of..”, which they could answer with “no”, “a bit” or “yes”. They would then be asked what they thought overall of this, which they could answer on a scale of 1 to 7. If the evaluation concerned on of the six technologies, the scale ends were 1 for very unattractive and 7 for very attractive, and they were also asked to give a “rapportcijfer”, a grade on a scale of 1 to 10, like respondents were asked in the ICQ. If the evaluation concerned CCS in general or the greenhouse effect, the respondents were asked to give their overall evaluation on a scale of 1 to 7, first 1 being very bad and 7 being very good, than 1 being very disadvantageous, 7 being very advantageous. The "no opinion" button was clearly visible on screen all the time and usable.

3.2.2 Knowledge tests

At this point, respondents would receive thirteen knowledge questions. Appendix 4, page 229 contains the exact wording of these questions. Eight of the questions were the same as the questions in the ICQ, about our current energy use, the greenhouse effect and global warming. Five questions were added, concerning the nature of CO_2, H_2 and the greenhouse effect. As in the ICQ, these questions were multiple choice, with a choice from one right answer and several wrong answers. However, for the TQ, we added the possibility of answering "I don't know".

3.2.3 A little bit of information

After the knowledge questions, respondents were given a little bit more information about our current use of energy, the greenhouse effect and global warming, CCS and the six CCS technologies. This information was still very limited though, and the text did not contain any information about the consequences of global warming, CCS and the six CCS technologies. Respondents were however told about the nature of CO_2, how our current manner of energy use leads to global warming and how many countries in the world want to reduce CO_2 emissions. It was then stated how the six technologies in the questionnaire aim to prevent more CO_2 emissions via CCS, literally stated as "because the CO_2 is stored, it is not released in the atmosphere and can therefore no longer contribute to the greenhouse effect". Respondents were furthermore explained how the six CCS technologies in the questionnaire were selected by a broad group of energy experts, how they are all able to reduce 20% of CO_2 emissions when implemented on a large scale in the Netherlands by 2030, how they all use coal or gas and how they are all likely to be temporary. On the whole, some of this information in the introduction probably led respondents to believe that CO_2 emission reduction is worth aiming for and that CCS options are viable options to attain this goal.

After this information, respondents were asked to give their overall evaluation of global warming, CCS and the six technologies again. Before the evaluation questions about a technology, a few sentences with general information about the technology would be given. This technology was purely descriptive, as neutral as possible and did not contain information about consequences. The wording of the questions was exactly the same, only this time respondents could not use the "no opinion" button anymore.

3.2.4 Choice procedure

At this point, respondents were asked which technology they preferred to be implemented on a large scale. It was suggested that they could base their choice on their overall evaluations of the technologies. Respondents were subsequently asked if there were any technologies in the questionnaire of which they thought implementation on a large scale was absolutely unacceptable, to a level that they considered taking action if Dutch society considered implementing this technology on a large scale.

3.2.5 Perception of information and involvement

After the respondent had made a choice, several additional measures were taken. First, they received two questions that were also asked in the ICQ, about the information provided and the limitation of choice options. Literally, respondents were asked if they had enough information to choose which CCS technology they preferred. They were also asked if they had felt restricted in their choice for a technology.

Second, respondents were asked nine questions that were meant to measure their involvement concerning the problems of energy and environment. Involvement is a measure for the way people inform themselves on, think about and feel engaged to a topic. Involvement to this topic was measured with the use of questions from a validated and reliable questionnaire that was developed by Verplanken (1989;1991). Some questions were slightly altered to fit the current situation and questionnaire, one question was added. As analyses showed that this questionnaire was reliable (Cronbach's alpha was high, .74), the mean of the ratings (after recoding of the values of negatively framed questions) on these questions was taken as the measure of involvement.

Measures of backgroundvariables were not asked but already known through earlier work of TNS-NIPO, the institute that has done the fieldwork of programming and distributing the ICQ, TQ an TQ2 to a representative sample of respectively 995, 327 and 300 Dutch respondents. These backgroundvariables were sex, year of birth, education, kind of employment and ftu, residence, province, region, and city size.
As the political arena was shifting quickly during the time of the data collection, we did add one backgroundvariable to the questionnaire itself, namely the question; "If there were national elections today, which party would you vote for?"

3.3 Procedure of the second more traditional questionnaire (TQ2)

In October and November of 2005, the second TQ was presented to a sample of 300 respondents from the TNS-NIPO access panel. These respondents had not participated the previous year. This questionnaire was very similar to the first TQ. The second TQ was designed with several main goals in mind. First, in the first TQ, respondents were asked which of the six CCS technologies they preferred after they had received a little bit of information. One of the goals of the second TQ was to study how this information had influenced respondents' change in overall evaluation. The second goal was to study if general public knowledge about global warming, CCS and the CCS options had changed in a year.

3.3.1 Differences and similarities between the first and second TQ

The introduction of the second TQ was similar to that of the first TQ. The first part of the questionnaire with the awareness questions and overall evaluation questions about global warming, CCS, and the six CCS options was also similar. Different from the first TQ though, the second TQ had a different order of questions from that point. In the second TQ, not the general knowledge questions but a filler task followed the knowledge and overall evaluation questions. A filler task is commonly used in experimental psychology, to let some time pass without enabling the respondents to actively process information and without influencing them in some way that could have effect on their answers on the following questions. In this case, the filler task consisted of the questions of the Need for Cognition scale from Cacioppo, Petty & Kao (1984), and the questions of two subscales of the Need for Closure scale of Webster and Kruglanski (1994).

After the filler task, respondents in the second TQ did not receive information, but instead were again asked the same overall evaluation questions they were asked in the first part of the TQ. After this, respondents were asked to choose between the six CCS options. This part of the procedure was the same again as in the first TQ. The questions that were asked after choosing were also the same as in the TQ, with one exception; the question concerning the commercials about water management that had been part of the questions concerning commitment was omitted from TQ2.

4. Results

4.1 Samples

For the ICQ, TQ1 and TQ2, there were three different samples of the Dutch population. The ICQ and TQ1 were administered in November and December of 2004, the TQ2 was administered in October and November of 2005. The sample for the ICQ consisted of 995 respondents of at least 18 years of age and was a representative sample for the Dutch population. Originally, 1005 respondents had completed the ICQ. However, 10 respondents had completed the questionnaire so fast they would never have been able to read all the information. A check of their answers and evaluations showed clearly that these respondents had not participated seriously (e.g., most of these 10 had given the same evaluation to all consequences throughout the questionnaire, which is rather suspicious with at least 60 very different consequences to evaluate on an 18-point scale) and that they had probably typed their way through the questionnaire to receive the bonus from TNS-NIPO that each respondents received. These 10 respondents were omitted from our sample, leaving 995 respondents. This sample was tested to find if there were any differences in the most common demographic variables between our sample and the Dutch population. The distributions of all demographic variables we tested (sex, age, education and province, see also Appendix 5) were the same for the ICQ sample and the Dutch population (data from Central Bureau for Statistics), which means the ICQ sample is representative for the Dutch population.

The sample for the TQ1 consisted of 327 respondents, also 18 years of age or more. Similar to the ICQ, analyses showed that 6 of the 333 respondents had not participated seriously. These respondents were omitted from the sample, leaving 327 respondents. This sample was also tested to find if there were any differences in the most common demographic variables (see also Appendix 5) between this sample and the Dutch population. As in the ICQ, no differences were found. However, as this sample contains only 327 respondents, use of the term representative is not correct for this sample.

The sample for TQ2 consisted of 300 respondents. Although the sample has been checked for non-serious participants, as in the ICQ and TQ, all respondents seemed to have participated seriously. No respondents were omitted from the sample.

Based on the sample size of the ICQ (n = ± 1000) 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%. The sample size of both TQ’s (n = ± 300) is such that the *maximum* uncertainty margin is plus or minus 8%.

4.2 Evaluation and Choice in the ICQ

As was also pointed out in Paragraph 3.1.6, the overall evaluations of global warming, carbondioxide capture and storage (CCS) and the six CCS technologies were all measured with two different scales. Concerning global warming and CCS, respondents were asked to give their overall evaluations on two rating scales one scale ranging from 1 “very bad” to 7 “very good”, the other scale ranging from 1 “very disadvantageous”, to 7 “very advantageous”. Concerning the six CCS technologies, respondents were asked to state on one scale of one to seven what they thought all in all, with the poles “very unattractive” and “very attractive”. They were furthermore asked to grade the technologies on a scale of one to ten. This means that there are two measures for all overall evaluations. To find out if respondents evaluate differently depending on scale type or size, we analyzed the correlations between these two measures for global warming, CCS and the six CCS technologies. The correlations were high, ranging from .72 to .79. This means that these measures are close to the same. To avoid redundant analyses and results, we will use just one of these measures for further analyses from here on. For global warming and CCS, the scale with the poles “very bad” and very good” were used, and for the six CCS technologies the grade between one and ten was used as a measure for the overall evaluation.

To avoid the possible influence of order effects on the overall evaluations, the order in which respondents received the information on aspects and consequences of the six CCS options was not the same for all respondents. Three versions of the ICQ were made with different orders. The order of the first version was t1 (“IGCC with CCS”), t2 (“SOFC with CCS”), t3 (“Hydrogen production via coal gasification with CCS”), t4 (“Hydrogen production via steam reforming with CCS”), t5 (“ECBM”), t6 (“Small scale reforming based on membrane technology with CCS”). The order of the first version was reversed for the second version, t6-t5-t4-t3-t2-t1. The order of the third version was t3-t2-t1-t6-t5-t4. By varying the order in which respondents evaluated the technologies, the chance that a technology receives higher or lower evaluations than the other technologies purely based on its position in the questionnaire becomes very small. To completely rule out this possibility, we analyzed the effect of order on the average overall evaluations of the technology. Although the average evaluations of some technologies did differ depending on their position in the questionnaire, the effect sizes (partial eta square) of these differences were not higher than .039, which is considered a small effect size by definition of Cohen (Cohen, 1973, 1988). Cohen defines .01 as a small effectsize, .058 as a medium effect size, and .137 as a big effect size. As the overall evaluations that are further used in the analyses are an average of overall evaluations from three different order versions, the very minor effect of position is averaged out and it is not considered to be a factor in the analyses that are described below. A table with the average overall evaluations of the technologies per version of the questionnaire is presented in Appendix 6. Further explanation of effect size is given in Paragraph 4.2.5.

4.2.1 Evaluation of separate consequences and aspects

Before respondents made a choice between the six policy options, they evaluated, one by one, all the consequences and aspects of the six policy options. Respondents stated whether they thought the consequence or aspect was an advantage, a disadvantage or not important. When the consequence or aspect was thought to be an advantage or disadvantage, they evaluated how much of an advantage or disadvantage the consequence or aspect was on a scale of one to nine. The same method was used for the evaluation of the consequences of CO_2 transport and storage in general and for the evaluation of the consequences of global warming. Table 1-8 contains the evaluations of each aspect or consequence of global warming, CO_2 transport and storage and all six policy options. For this report, the evaluations have been diminished to seven categories: “big disadvantage” (disadvantage evaluated as 7, 8 or 9), “moderate disadvantage” (disadvantage evaluated as 4, 5 or 6), “small disadvantage”(disadvantage evaluated as 1, 2 or 3), “not important”, “small advantage” (advantage evaluated as 1, 2 or 3), “moderate disadvantage” (advantage evaluated as 4, 5 or 6) and “big advantage” (advantage evaluated as 7, 8 or 9).

In some cases, the evaluations of a few respondents can seem quite illogical. For instance, when a consequence is a very obvious disadvantage, some respondents still evaluate this as an advantage. Sometimes this can be explained by relative evaluation rather than absolute evaluation, for instance when a consequence is still a disadvantage, but much less so than it used to be or in comparison with the other policy options. When such an explanation is possible, it will be mentioned in the description of the results, Paragraph 4.2.1.1-4.2.1.8. However, in some cases the more illogical evaluations are not attributable to a difference between relative and absolute evaluation. In such cases, explaining what respondents rationalization could be becomes pure guessing. We will therefore not go into possible explanations for such anomalies.

The information in the consequence of “contribution to the greenhouse effect” was very similar for five of the six policy options. It is therefore not surprising that the evaluations of those consequences were also very alike. To prevent repetition, we will discuss these evaluations here in general. Only for the policy option “Coal bed methane gas production”, this consequence will be discussed separately. The majority of respondents (66 - 74%) evaluated the consequence of less “contribution to the greenhouse effect” as a big advantage for all five policy options. Only few respondents considered this to be unimportant (4-5%) or a disadvantage (3-5%). Respondents seem to have focused on the very small amount of contribution, rather than on the disadvantage of the contribution itself.

4.2.1.1 Evaluation of consequences of global warming

Table 4.2.1.1 contains the evaluations of the consequences of a 1 to 5 degree Celsius rise in global temperature in the next 50 years. The exact wording of the information on these consequences is given in Appendix 2.

The first four consequences, more droughts, more chance of flooding, more intense storms and rise of sea level are all evaluated very negatively. The majority of respondents (73%-3%) evaluate these consequences as a big disadvantage, and almost all other respondents (13%-21%) evaluate this as a moderate disadvantage. Only few respondents (2-4%) evaluate these consequences as a small disadvantage or as unimportant. Less than 1% of respondents evaluate these consequences as an advantage.

The fifth consequence, need for costly measures, is evaluated by the majority (69%) as a big disadvantage and by some (19%) as a moderate disadvantage. However, 8% evaluates this as unimportant.

The sixth consequence, poor countries being most affected, was evaluated by the majority (78%) as a big disadvantage and by some (15%) as a moderate disadvantage.

The consequences more heat waves and stop of warm currents are also evaluated as a disadvantage, although not as much so as the consequences above. Although the majority (58%-60%) evaluates these consequences as negative, about 10% of respondents evaluates these consequences as unimportant.
One consequence is evaluated mostly positive, and this is the consequence of less cold waves. The majority of respondents (68%) evaluate this consequence as an advantage. Still, 20% of respondents evaluate this consequence as a disadvantage.

Overall, the greenhouse effect is evaluated very negatively on average. On a scale of 1 (very bad) to 7 (very good), the mean overall evaluation is 2.29. This means the greenhouse effect is generally considered to be quite bad.

Table 4.2.1.1 : Evaluations of consequences of global warming

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate Advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
More droughts	79%	17%	2%	2%	-	<1%	<1%	-7.19
Higher probability of flooding	80%	16%	2%	2%	-	1%	<1%	-7.16
Storms more intense	73%	21%	4%	1%	<1%	<1%	<1%	-6.97
Sea level rise	83%	13%	2%	3%	-	<1%	<1%	-7.47
Need for costly measures	69%	19%	4%	8%	-	1%	<1%	-6.5
Poor countries affected most	78%	15%	3%	4%	-	1%	<1%	-7.2
More heat waves	58%	25%	6%	9%	1%	1%	1%	-5.99
Less cold waves	9%	7%	4%	13%	15%	25%	28%	2.63
Very uncertain sudden cold climate change in Northern hemisphere due to change of ocean currents	60%	24%	5%	10%	<1%	<1%	<1%	-6.09

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

4.2.1.2 Evaluation of consequences of CO_2 capture, transport and storage

Table 4.2.1.2 contains the evaluation of the consequences of CO_2 transport and storage. These consequences are equal for all six technologies and were therefore evaluated in general. Although most consequences of CO_2 transport and storage are disadvantages, not all respondents evaluate them as such. The first three consequences, “very small chance of leakage from lines”, “very small chance of CO_2 cloud” and “very small chance of leakage from storage”, are evaluated as an advantage by a much higher percentage of respondents (38-43%) than expected. It is a possibility that these respondents have focused more on the very small change of occurrence, which is positive, rather than on the negative consequence itself. A sizeable amount of respondents (25-31%) evaluates these consequences as unimportant.
The consequence of “small chance of damage to life under ground and basements” is evaluated by the majority as a big (46%) or moderate (31%) disadvantage. Only 6% of respondents evaluates this consequence as unimportant, and very few respondents evaluate

this consequence positively. The consequence of “chance of small earthquake” is also evaluated by the majority as a big (32%) or moderate (30%) disadvantage, although a bit more respondents (15%) evaluate this as unimportant.
As could be expected, the consequence of “no contribution to the green house effect” is evaluated by the majority of respondents (76%) as a big advantage. Some respondents (15%) evaluate this consequence as a moderate advantage, and very few respondents evaluate this consequence as a small advantage (3%) or unimportant (3%).

After having read and evaluated five consequences of CO_2 capture, transport and storage, respondents were asked for their overall evaluation of CO_2 capture, transport and storage. Overall, CO_2 capture, transport and storage is evaluated very positively. On the same scale as the greenhouse effect was evaluated, the mean overall evaluation is 5.54. This means CO_2 capture, transport and storage is generally considered to be quite good.

Table 4.2.1.2 : Evaluations of consequences of CO_2 storage

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate Advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Very small chance of leakage from lines	6%	8%	13%	31%	3%	11%	29%	1.8
Very small chance of CO_2 cloud	10%	11%	13%	29%	3%	11%	24%	0.89
Very small chance of leakage from storage	7%	10%	16%	25%	3%	11%	27%	1.37
Small chance of damage to life under ground and basements	46%	31%	16%	6%	<1%	<1%	1%	-5.5
Chance of small earthquake	32%	30%	23%	15%	-	<1%	<1%	-4.49
No contribution to greenhouse effect	1%	1%	<1%	3%	3%	15%	76%	6.8

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

4.2.1.3 Evaluation of aspects and consequences of “IGCC with CCS”[3]

Table 4.2.1.3 contains the evaluations of the aspects and consequences of the large scale use of big modern coal fired power stations with use of CO_2 capture and storage. The aspect of “need for new power plants” is evaluated by a near majority of respondents (48%) as unimportant. About 19% of respondents consider the need for new power plants as an advantage. These respondents might have focused on the possible positive effects of new installations. More respondents (33%) evaluate the aspect of new installations as a disadvantage. The consequence for “accidents & deaths in mines” is evaluated by most respondents (89%) as a disadvantage, and by almost no respondents as an advantage. It is considered, however, to be unimportant by 8% of the respondents.

[3] Obviously, this technical label for this CCS option was translated. For a full description of the options in lay terms see table 2.2.4

The consequence of less “contribution to acidification” is evaluated by most respondents as a big (44%) or moderate (28%) advantage. Respondents seem to have focused on the very small amount of contribution, rather than on the disadvantage of the contribution itself. Still, 15% of respondents does evaluate this consequence as a disadvantage.
The consequence of “possible pollution of coalmine surroundings” is evaluated by a majority of respondents (87%) as a disadvantage. Some respondents (9%) evaluate this consequence as unimportant however, and a few respondents (6%) consider this consequence to be an advantage.
The evaluations of the consequence of the “number of years use of the technology will be possible: 25-100” are very distributed, although more respondents evaluate this consequence as a disadvantage (53%) than as an advantage (27%).
A majority of respondents (82%) evaluate the consequence of “high reliability of energy supply” as an advantage. Some respondents (11%) evaluate this consequence as unimportant.
The consequence of a higher “price” is evaluated by a majority of respondents (64%) as a disadvantage. Still, a sizeable amount of respondents (25%) considers this consequence to be unimportant.

Table 4.2.1.3 : Evaluations of aspects and consequences of “IGCC with CCS”

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Need for new power plants	6%	17%	10%	48%	2%	8%	9%	-0.44
Accidents & deaths in mines	47%	31%	11%	8%	<1%	1%	1%	-5.41
Much less contribution to greenhouse effect	2%	2%	<1%	4%	4%	21%	66%	6.06
Less contribution to acidification	7%	6%	2%	6%	7%	28%	44%	4.1
Possible pollution of coalmine surroundings	46%	31%	10%	9%	<1%	3%	3%	-5.07
Number of years use of the technology will be possible: 25-100	17%	26%	10%	21%	4%	12%	11%	-1.29
High reliability of energy supply	2%	3%	1%	11%	5%	27%	50%	5.02
Price: 10-25% higher *	22%	25%	17%	25%	2%	5%	4%	-2.78

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.
**** Note 2: See Appendix 2 for wording of price information. Often price information was given separately for households and industry. Percentages in the table are the lowest and highest. This note also goes for the next five tables***

4.2.1.4 Evaluation of aspects and consequences of "SOFC with CCS"[4]

Table 4.2.1.4 contains the evaluations of the aspects and consequences of large scale use of "Conversion of natural gas into electricity for private and commercial use with CO_2 capture and storage". The first three aspects concern the "need for new installations", "need for new lines" and "need for new CO_2 lines. A substantial percentage of respondents (34-42%) considers these aspects unimportant. Although the aspect "need for new installations" is evaluated as an advantage by 40% of respondents, the aspects of "need for new lines" and "need for new CO_2 lines" are considered to be a disadvantage by the majority of respondents (57-58%).
The consequence of "less contribution to acidification" is evaluated by the majority of respondents (73%) as a big advantage. Respondents seem to have focused on the very small amount of contribution, rather than on the disadvantage of the contribution itself. Still, 7% of respondents does evaluate this consequence as a disadvantage.
The aspect "number of years use of the technology will be possible: 50-250" is evaluated by a small majority (53%) as an advantage, however, 20% of respondents evaluate this aspect as unimportant and 27% of respondents evaluate this as a disadvantage.

Table 4.2.1.4 : Evaluations of aspects and consequences of "SOFC with CCS"

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate Advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Need for new installations	7%	11%	8%	34%	3%	16%	21%	1.21
Need for new waterpipelines and powerlines	13%	27%	17%	40%	<1%	1%	2%	-2.53
Need for new CO_2 lines	12%	25%	19%	42%	<1%	1%	1%	-2.55
Much less contribution to greenhouse effect	2%	1%	<1%	4%	2%	20%	71%	6.49
Less contribution to acidification	4%	3%	<1%	4%	2%	13%	73%	6.12
Number of years use of the technology will be possible: 50-250	5%	14%	8%	20%	4%	19%	30%	2.07
Reliability of energy supply: less from 2020	21%	36%	17%	17%	2%	4%	5%	-3.22
Better reliability through fuel cells	6%	16%	12%	41%	4%	10%	11%	-0.08
Price: 20-50% higher	29%	28%	19%	20%	<1%	1%	1%	-3.94

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

[4] Obviously, this technical label for this CCS option was translated. For a full description of the options in lay terms see table 2.2.4

The consequence of "reliability of energy supply: less from 2020" is evaluated by a majority of respondents (74%) as a disadvantage, but mostly as a moderate disadvantage (36%). A sizeable amount of respondents (17%) evaluate this consequence as not important.
The consequence of the "better reliability through fuel cells" is evaluated as unimportant by a substantial part of the respondents (41%). A bit more respondents evaluate this consequence as a disadvantage (34%) than as an advantage (25%).
The consequence of a higher "price" is mostly considered to be a disadvantage (76%), although a sizeable amount of respondents (20%) evaluates this consequence as not important.

4.2.1.5 Evaluation of aspects and consequences of "Hydrogen production via coal gasification with CCS"[5]

Table 4.2.1.5 contains the evaluations of the consequences of a large scale use of "Big coal fired hydrogen stations for industrial use with CO_2 capture and storage". Several of the consequences of this technology are the same as the consequences of "big coal fired power stations". Not surprisingly, the evaluations of these consequences are almost the same for these technologies. We will therefore not discuss these consequences, unless their evaluations deviate substantially from what was already mentioned.
The aspect of "need for 10 new power plants with new lines" is evaluated by a substantial part of respondents as unimportant (31%). More respondents evaluate this aspect as a disadvantage (42%) than as an advantage (26%).
The consequence of "need for new vehicles" is evaluated similarly, a substantial part of respondents (34%) evaluate this consequence as unimportant and more respondents evaluate this consequence as a disadvantage (41%) than as an advantage (26%).
The consequence of "maybe less safe power stations" is evaluated by a majority of respondents (69%) as a disadvantage, although a sizeable amount of respondents (23%) considers this consequence to be unimportant. A few respondents (9%) evaluate this consequence as an advantage.
The consequence of "safety hydrogen transport equal to current fuel transport" is evaluated by a sizeable amount of respondents as unimportant (35%). Slightly more respondents evaluate this consequence as an advantage (37%), than as a disadvantage (29%), although most respondents that evaluated this as a disadvantage were only mildly negative (13%), whereas most respondents that evaluated this as an advantage were very positive (18%).
The consequence of "much less contribution to acidification" is evaluated by the majority of respondents (59%) as a big advantage. Respondents seem to have focused on the very small amount of contribution, rather than on the disadvantage of the contribution itself. Still, 10% of respondents does evaluate this consequence as a disadvantage.
Most respondents evaluate the consequence of "moderate contribution to improvement of air quality" as a big advantage (68%) or a moderate advantage (21%). Almost no respondents evaluate this as a disadvantage.
A majority of respondents (80%) evaluate the consequence of "high reliability of energy supply" as an advantage. Some respondents (13%) evaluate this consequence as unimportant.
The consequence of a higher "price" is evaluated by a majority of respondents (75%) as a disadvantage. Still, a sizeable amount of respondents (19%) considers this consequence to be unimportant.

[5] Obviously, this technical label for this CCS option was translated. For a full description of the options in lay terms see table 2.2.4

Table 4.2.1.5 : Evaluations of aspects and consequences of "Hydrogen production via coal gasification with CCS"

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate Advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Need for 10 new power plants with new pipelines	11%	19%	12%	31%	1%	10%	15%	-0.42
Need for new vehicles	9%	18%	14%	34%	2%	11%	13%	-0.35
Accidents & deaths in mines	46%	31%	11%	10%	<1%	1%	2%	-5.24
Maybe less safe power stations	24%	29%	16%	23%	<1%	4%	4%	-3.10
Safety hydrogen transport equal to current fuel transport	5%	11%	13%	35%	3%	16%	18%	1.05
Much less contribution to greenhouse effect	1%	2%	<1%	5%	2%	17%	74%	6.61
Much less contribution to acidification	5%	4%	1%	5%	4%	22%	59%	5.28
Moderate contribution to improvement of air quality	<1%	<1%	<1%	4%	6%	21%	68%	6.51
Possible pollution of coalmine surroundings	40%	32%	11%	11%	<1%	2%	3%	-4.61
Number of years use of the technology will be possible: 20-100	17%	21%	11%	22%	3%	13%	12%	-1.03
High reliability energy supply	2%	3%	1%	13%	4%	27%	49%	4.97
Price: 25-75% higher	29%	32%	14%	19%	1%	3%	2%	-3.97

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

4.2.1.6 Evaluation of aspects and consequences of "Hydrogen production via steam reforming with CCS"[6]

Table 4.2.1.6 contains the evaluations of the aspects and consequences of large scale use of "conversion of natural gas into hydrogen, for private and industrial use, with CO_2 capture and storage.

The aspects of required "need for many new installations", "need for many new lines", "need for new installations at home" and "need for new vehicles" are evaluated quite similar, with about 44% to 56% of respondents evaluating these aspects and consequences as a

[6] Obviously, this technical label for this CCS option was translated. For a full description of the options in lay terms see table 2.2.4

disadvantage. A substantial amount of respondents (25-40%) evaluates these aspects and consequences as unimportant. Only few respondents evaluate these aspects and consequences as a moderate (4-8%) to big (5-8%) advantage.

The aspect of “few technological breakthroughs needed” is evaluated by nearly as much respondents as a disadvantage (37%) than it is considered an advantage (38%), although respondents who consider it an advantage are more positive than respondents who consider it a disadvantage are negative. This aspect is evaluated as unimportant by 24% of respondents.

The consequence of “equal safety in daily life” is evaluated as an advantage by almost half of the respondents (49%). A substantial amount of respondents (31%) considers this consequence to be unimportant.

The consequences of “much less contribution to acidification” and “moderate contribution to improvement of air quality” are evaluated by a majority of the respondents (64 and 65%) as a big advantage and by a sizeable amount of respondents (20 and 25%) as a moderate advantage. Only few respondents consider these consequences to be unimportant (6 and 5%) or a disadvantage (7 and 3%).

Table 4.2.1.6 : Evaluations of aspects and consequences of “Hydrogen production via steam reforming with CCS”

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Need for many new installations	15%	26%	14%	36%	<1%	4%	5%	-2.2
Need for many new pipelines	16%	28%	12%	25%	2%	8%	8%	-1.89
Need for new installations at home	17%	19%	10%	39%	1%	6%	7%	-1.59
Need for new vehicles	13%	18%	13%	40%	1%	7%	8%	-1.19
Few technological breakthroughs needed	10%	17%	10%	24%	5%	17%	16%	0.43
Equal safety in daily life	4%	8%	8%	31%	5%	19%	25%	2.16
Much less contribution to greenhouse effect	<1%	1%	<1%	5%	3%	20%	69%	6.44
Much less contribution to acidification	3%	3%	1%	6%	4%	20%	64%	5.77
Moderate contribution to improvement of air quality	<1%	<1%	<1%	5%	4%	25%	65%	6.42
Number of years use of the technology will be possible: 50-300	4%	8%	7%	19%	4%	22%	37%	3.26
Reliability energy supply: less from 2020	19%	33%	16%	22%	2%	3%	5%	-2.95
Price: 25-200% higher	30%	33%	16%	18%	1%	1%	2%	-4.15

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

The consequence of "number of years use the technology will be possible: 50-300" is evaluated as a moderate to big disadvantage by a majority of the respondents (59%). A sizeable amount of respondents (19%) considers this consequence to be unimportant.
As the consequence of "reliability of energy supply: less from 2020" is exactly the same for this technology as it is for conversion of natural gas into electricity, the evaluations were expected to be the same, which indeed they were. Most respondents (68%) evaluate this as a disadvantage. A considerable amount of respondents (22%) think this consequence is unimportant. Most respondents (79%) also evaluate the consequence of a higher "price" as a disadvantage. This consequence is also considered to be unimportant by a sizeable amount of respondents (18%).

4.2.1.7 Evaluation of aspects and consequences of "ECBM"[7]

Table 4.2.1.7 contains the evaluations of the aspects and consequences of "Coal bed methane gas production". The aspect of "need for temporary new derricks" is considered to be unimportant by almost half of the respondents (48%). Most of the other respondents (44%) evaluate this aspect as a disadvantage.
The aspect of "need for many new wells" is evaluated as a big (29%) to moderate (36%) disadvantage by most respondents. A sizeable amount of respondents (19%) consider this aspect to be unimportant.

Table 4.2.1.7 : Evaluations of aspects and consequences of " ECBM"

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Need for temporary new derricks	13%	17%	14%	48%	<1%	3%	4%	-1.69
Need for many new wells	29%	36%	12%	19%	<1%	2%	2%	-4.11
Practically enough knowledge for implementation	9%	20%	13%	29%	4%	13%	12%	-0.25
Contribution to greenhouse effect: 20% less than 1990	<1%	1%	<1%	9%	5%	28%	54%	5.68
Number of years use of the technology will be possible: 5-50	29%	26%	10%	14%	4%	10%	8%	-2.61
Good reliability expected	3%	7%	3%	16%	9%	32%	29%	3.45
Positive economic consequences	<1%	<1%	<1%	5%	4%	27%	62%	6.26
Price: 33-300% higher	23%	23%	12%	18%	3%	11%	9%	-1.92

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

[7] Obviously, this technical label for this CCS option was translated. For a full description of the options in lay terms see table 2.2.4

The aspect of “practically enough knowledge for implementation” is considered to be unimportant by a substantial amount of respondents (29%). Somewhat more respondents evaluate this aspect as a disadvantage (42%) than as an advantage (29%).
Contrary to the evaluations of the other technologies concerning the contribution to the greenhouse effect, for this technology the consequence “contribution to the greenhouse effect: 20% less than 1990” was not evaluated as a big advantage by as many respondents. However, it is still a majority of respondents (54%) that consider this consequence to be a big advantage. More than for the other technologies, respondents think this consequence is a moderate advantage (28%), or unimportant (9%).
Most respondents (65%) evaluate the consequence of “number of years use of the technology will be possible: 5-50” as a disadvantage. However, a sizeable amount of respondents (22%) think it is an advantage.
The consequence of “good reliability expected” is evaluated as an advantage by a majority of respondents (70%). Still, some respondents consider this consequence to be either a disadvantage (13%) or unimportant (16%).
The “positive economic consequences” are evaluated as an advantage by almost all respondents (93%), and mostly as a big advantage (62%).
The consequence of “price: 33-300% higher” is considered to be a disadvantage by a majority of respondents (58%). A sizeable amount of respondents (18%) think this consequence is unimportant however.

4.2.1.8 Evaluation of aspects and consequences of “Small scale reforming based on membrane technology with CCS”[8]

Table 4.2.1.8 contains the evaluations of the aspects and consequences of “conversion of natural gas into hydrogen for motor vehicles”. The aspect of “replacement of gas stations with hydrogen stations” is evaluated as a disadvantage by almost half of the respondents (48%). Surprisingly, 28% of respondents evaluate this consequence as a moderate to big disadvantage. The aspects of “need for many new CO_2 lines” and “more technological breakthroughs needed, expected, not assured” are evaluated as a disadvantage by a majority of respondents (55-68%), although a sizeable amount of respondents (20-42%) evaluate these aspects as unimportant. The aspect of “need for replacement of all motor vehicles” is also evaluated as a disadvantage by a majority of respondents (64%), but a substantial part of respondents (25%) think this aspect is unimportant.
The consequence of “equal safety of fuel station and vehicles” is evaluated as unimportant by a substantial amount of respondents (38%), but is considered an advantage by half of the respondents (51%). The consequences of “much less contribution to acidification” and “improved air quality expected to say many lives” are evaluated by a majority of the respondents (69 and 80%) as a big advantage and by a sizeable amount of respondents (19 and 14%) as a moderate advantage. Only few respondents consider these consequences to be unimportant (5 and 4%) or a disadvantage (6 and 3%). The aspect of “number of years use of the technology will be possible: 20-250” is considered to be an advantage by the majority of respondents (60%), although 22% of respondents think this aspect is unimportant and another 19% of respondents consider this aspect to be a disadvantage.
As the consequence of “reliability of energy supply: less from 2020” is exactly the same for this technology as it is for the other two technologies that use natural gas, the evaluations

[8] Obviously, this technical label for this CCS option was translated. For a full description of the options in lay terms see table 2.2.4

Table 4.2.1.8 : Evaluations of aspects and consequences of "Small scale reforming based on membrane technology with CCS"

	Big	Moderate disadvantage	Small	Unimportant	Small	Moderate advantage	Big	Mean
	-9 to -7	-6 to -4	-3 to -1	0	1 to 3	4 to 6	7 to 9	
Replacement of gas stations with hydrogen stations	18%	20%	10%	24%	1%	10%	18%	-0.66
Need for many new CO_2 lines	14%	24%	17%	42%	<1%	2%	2%	-2.46
Need for replacement of all motor vehicles	30%	22%	12%	25%	2%	7%	13%	-3.07
More technological breakthroughs needed, (expected, but not assured)	28%	29%	11%	20%	1%	6%	5%	-3.22
Equal safety of fuel stations and vehicles	3%	4%	4%	38%	5%	20%	26%	2.6
Much less contribution to greenhouse effect	2%	1%	<1%	5%	2%	22%	68%	6.42
Much less contribution to acidification	3%	2%	<1%	5%	2%	19%	69%	6.13
Improved air quality expected to save many lives	<1%	<1%	<1%	4%	2%	14%	80%	7.15
Number of years use of the technology will be possible: 20-250	4%	9%	6%	22%	5%	21%	34%	2.96
Reliability energy supply: less from 2020	20%	33%	16%	22%	1%	3%	4%	-3.05
Economic consequences are unknown	30%	30%	11%	24%	<1%	3%	1%	-3.82
Fuel price: 10-40% higher	11%	11%	10%	25%	5%	17%	21%	0.96

Note: The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequences was nuanced and elaborate. See Appendix 2 for a full description.

were expected to be nearly the same, which indeed they were. Most respondents (69%) evaluate this as a disadvantage. A considerable amount of respondents (22%) think this consequence is unimportant.

The "economic consequences are unknown" were considered to be a disadvantage by most respondents (71%). A sizeable amount of respondents (24%) evaluate this consequence as unimportant though.

The consequence of "fuel price: 10-40% higher" is evaluated a bit more often as an advantage (42%) than as a disadvantage (32%). Again, a sizeable amount of respondents (25%) evaluate this consequence as unimportant.

4.2.2 Overall evaluations of the six technologies

After respondents had seen an overview of their evaluations of the aspects and consequences of a technology, they were asked to give their overall evaluation of this technology. Respondents were asked to give the technology a “rapportcijfer” (Dutch school grade), which is a grade on a scale from 1 to 10, with 1 meaning the lowest score possible and 10 meaning a perfect score. A 6 is considered an acceptable score (adequate). This means in the Dutch grading system you did just good enough to pass but not any better. 5 or lower means you failed the test.

After respondents had evaluated all aspects and consequences of the six technologies and given their overall evaluations of all six technologies, they were shown a table with an oversight of all their overall evaluations of the six technologies. At this point, respondents were given the opportunity to change the overall evaluations of the technologies, based on the argument that they might have changed their mind about some of their overall evaluations now they had received and evaluated the information on all six technologies. Only a small percentage of respondents used this possibility. Depending on the technology, between 9.7% and 11.1% of respondents changed their overall evaluation of a technology. The following calculations are based on respondents’ *final* overall evaluations.

Table 4.4.2 contains the distribution of the overall evaluations per technology and the mean overall evaluation given by respondents in the ICQ. On average, all technologies are evaluated as adequate (>6). Only “ECBM” is evaluated very slightly lower than a 6 on average (5.94). Compared to the other technologies, a bit larger percentage of respondents evaluates this technology with a very low grade (1-3), 6% compared to 4% of respondents for the other technologies. Of course, this is still a very small percentage of respondents. “ECBM” is also evaluated as below adequate (4-6) by a larger percentage of respondents (27%) compared to the other technologies, followed by both technologies for hydrogen production with CCS (both 20%) and “IGCC with CCS” (21%). All technologies are evaluated by a majority of respondents as adequate (>6). Both “SOFC with CCS” and “Small scale reforming based on membrane technology with CCS” are evaluated by 24% of respondents with a very high grade (8-10), followed by the third gas option, “Hydrogen production via steam reforming with CCS”, which is evaluated by 21% of respondents with a very high grade. The three coal options, “IGCC with CCS”, “Hydrogen production via coal gasification with CCS” and “ECBM” are evaluated with a very high grade by a bit smaller percentage of respondents, 17%, 16% and 12% respectively. On average, the gas options are graded higher than the coal options, although “Hydrogen production via steam reforming with CCS” is evaluated only very slightly higher than “Hydrogen production via coal gasification with CCS” and “IGCC with CCS”. Statistically, the mean overall evaluation of IGCC does not differ from that of hydrogen production via coal gasification, and the latter does not differ from the mean overall evaluation of hydrogen production via steam reforming. The mean overall evaluation of SOFC does not differ from the mean overall evaluation of small scale reforming based on membrane technology, which means that these technologies both receive a significantly higher mean overall evaluation than the other technologies in the ICQ. All other comparisons of mean overall evaluations are significantly different. This means that “ECBM” receives a significantly lower mean overall evaluation than the other technologies in the ICQ.

Table 4.2.2: Overall evaluations of technologies in the ICQ: percentages for grades and means and standard deviations[9]

Technology	1-3	4-5	6-7	8-10	Mean	SD
IGCC with CCS	4%	21%	59%	17%	6.23	1.41
SOFC with CCS	4%	16%	57%	24%	6.51	1.44
Hydrogen production via coal gasification with CCS	4%	20%	60%	16%	6.27	1.39
Hydrogen production via steam reforming with CCS	4%	20%	55%	21%	6.35	1.48
ECBM	6%	27%	55%	12%	5.94	1.46
Small scale reforming based on membrane technology with CCS	4%	18%	54%	24%	6.46	1.52

To test whether respondents were likely to grade certain technologies alike, we did several analyses. First, we tested if the overall evaluations of the technologies were correlated. Correlations between the grades for the six technologies are mostly moderate, ranging from .39 to .57. This means that although respondents do differentiate between technologies, most respondents also evaluate the technologies somewhat alike; those who are positive about one technology tend to be positive about the others, and those who are negative about one technology are likely to be negative about the other technologies. (For a more thorough explanation of the concept of correlation, see Paragraph 4.2.4). We furthermore tested whether respondents graded technologies in such a way, that certain clusters of technologies are recognizable. For instance, respondents might have evaluated technologies that have much in common more alike than technologies that are more different. With factoranalysis, we can determine if respondents overall evaluated certain groups of technologies more alike than others. However, results from the factoranalysis show that all technologies load high on the same factor. In other words, respondents individually evaluated the technologies in the same way. This means that respondents who evaluated one technology very positively, are likely to also evaluate the other technologies very positively. Reliability tests which include the overall evaluations of all six technologies show the same pattern, Cronbach's alpha is high (.84). This means that the six CCS options were evaluated homogenously, which means that respondents had a homogenous perception of the six CCS technologies. This is in contrast with the perception that experts have of these technologies, as one of the criteria for selection of a technology for the choice problem was that a technology was different on some aspect than the other technologies. During the selection of the options, the experts judged that these options were different on aspects like input (coal versus natural gas) and conversion (to electricity or hydrogen). But in the mind of the respondents, these six CCS technologies are quite alike, perhaps because they are all technologies that use fossil fuels and are combined with the capture and storage of CO_2.

4.2.3 Choice and acceptance

After respondents had seen the oversight of all their (final) overall evaluations of technologies, they were asked to choose which technology they preferred to be implemented on a large scale. As only one of the six technologies is needed to attain the goal of 20% carbondioxide emission reduction, respondents had to choose only one technology. Table 4.2.3 contains the percentages of preferences for the technologies. As could be expected from

[9] Obviously, the technical labels used in this paragraph for the CCS options were translated. For a full description of the options in lay terms see table 2.2.4

the overall evaluations of the technologies that respondents gave, the gas options are chosen by more respondents than the coal options. Especially “SOFC with CCS” and “Hydrogen production via steam reforming with CCS” are preferred by more respondents than the other technologies, by 23.2% and 23.0% of respondents, respectively. “IGCC with CCS” and small scale reforming based on membrane technology are preferred by a bit less respondents, by 16.7% and 19.4% respectively. Even less respondents (9.9%) prefer “Hydrogen production via coal gasification with CCS”. “ECBM” is preferred by the least percentage of respondents (7.7%).

After respondents stated their preferred technology, they were asked if there were one or more technologies among the technologies they had evaluated that they thought to be so unacceptable, that they considered taking action when this technology were to be implemented on a large scale in the Netherlands. A minority of respondents answered this question affirmatively. When asked which technology (ies) they considered to be so unacceptable that they considered taking action when this technology were to be implemented on a large scale, most of these respondents consider “ECBM” to be unacceptable. Of all 995 respondents in the ICQ, 6.4% consider this technology to be unacceptable. “IGCC with CCS”, “Hydrogen production via coal gasification with CCS” and “Small scale reforming based on membrane technology with CCS” are considered unacceptable by less than 5% of respondents, by 4.9%, 4.1% and 3.6% respectively. “SOFC with CCS” and “Hydrogen production via steam reforming with CCS” are considered to be unacceptable by a very small percentage of respondents, 1.4% and 2.7% respectively.

Table 4.2.3: Percentages of respondents that prefer and reject a technology

Technology	Chosen	Unacceptable
IGCC with CCS	16.7 %	4.9 %
SOFC with CCS	23.2 %	1.4 %
Hydrogen production via coal gasification with CCS	9.9 %	4.1 %
Hydrogen production via steam reforming with CCS	23.0 %	2.7 %
ECBM	7.7 %	6.4 %
Small scale reforming based on membrane technology with CCS	19.4 %	3.6 %

4.2.4 Relationship between choice, overall evaluations and evaluations of aspects and consequences

It is logical to assume that most respondents choose the technology they consider most preferable, given the choice options. Moreover, it seems reasonable to assume that if respondents base their overall evaluations of the technologies on the given information there should be a relationship between the evaluations of the aspects and consequences of the six technologies and the overall evaluations of the technologies. In this paragraph we discuss the relationship between the overall evaluations of the technologies and choice as well as the relationship between the evaluations of the aspects and consequences, and the overall evaluations of the technologies. In order to fully understand which aspects and consequences are meant in these paragraphs exactly, it is recommendable to first read Appendix 2. This appendix contains the English translation of the information the respondents received about the aspects and consequences of global warming, CCS and the six CCS technologies. In the following paragraphs, abbreviations will be used for the aspects and consequences in the text and tables.

When respondents base their choice for one of the six technologies on their own overall evaluations of the technologies, they should choose the technology they have given the highest grade. The majority of respondents does in fact do so, 88.6% of respondents choose the technology they had given the highest grade or, in case a respondent gave their highest grade to more than one technology, chooses from these technologies.

To study the relationship between the evaluations of the aspects and consequences on the one hand and the overall evaluation of the CCS technologies on the other, six regression analyses were performed. Table 4.2.4 contains the results of these analyses.

In the second column of Table 4.2.4, the correlations between the evaluation of an aspect or a consequence and the overall evaluation of a technology are given. These correlations are all single correlations between one aspect or consequence and the technology it concerns. These correlations give some insight in the relative influence of the different aspects or consequences. A correlation can vary between -1 and 1, with 0 meaning no relationship 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. As the correlation between the evaluation of an aspect or consequence rises, the aspect or consequence is likely to play a more important role in the determination of the overall evaluation. In the third column of Table 4.2.4, the multiple correlation between the evaluations of the aspects and consequences of a technology and the overall evaluation of that technology is given for all technologies. These multiple correlations represent how much the evaluations of the aspects and consequences of a technology together are connected to the overall evaluation of a technology. A multiple correlation can vary between 0 and 1. The squared multiple correlation (R^2) represents the proportion of variance that can be explained. In this case, the multiple correlation gives an indication of the degree to which the overall evaluation of a technology can be explained or predicted from the evaluations of the aspects and consequences of that technology.

The analyses show a significant multiple correlation between the evaluations of the aspects and consequences on the one hand and the overall evaluation on the other for all technologies. With the exception of “IGCC with CCS”, all multiple correlations are moderate. The “single” correlations between the aspects or consequences and the overall evaluations are mostly low to moderate, with just a few exceptions. This seems to implicate that although the information that is given about the aspects and consequences does influence the overall evaluations of the technologies, the overall evaluations are based on more than this information. A possible explanation for this could be that not all the arguments that are important to respondents are stated in the given information. An important conclusion that can be drawn from the low to moderate correlations between most of the aspects or consequences and the overall evaluations is that none of the overall evaluations seem to be based on one or a certain kind of aspect or consequence.

To be able to draw more specific conclusions on the effect of the evaluations of aspects and consequences on the overall evaluations of technologies, the effects that the aspects and consequences have on the overall evaluations of the technologies were compared to the average evaluations of these aspects and consequences. Without comparing the evaluations of the aspects and consequences with their correlation to the overall evaluation, it is possible to find out how aspects and consequences are evaluated, and it is possible to find out what evaluations of aspects and consequences influence the overall evaluation. It is however not possible to find out how a certain aspect or consequence influences the overall evaluation without comparing. Comparing evaluations with correlations gives several different insights. First, it shows what kind of aspects or consequences is really important to respondents' decision making and what kind is not. Second, it shows if there are any aspects or consequences that cause a significantly better or worse overall evaluation of a technology. Third, it shows if there are any aspects or consequences that respondents are completely indifferent to.

Table 4.2.4: Correlation per technology of the evaluations of the aspects and consequences on the one hand and the overall evaluation on the other

	Correlations	Multiple correlation
IGCC with CCS		
- Need for new power plants	0.22	
- Accidents & deaths in mines	-0.01	
- Much less contribution to greenhouse effect	0.27	
- Less contribution to acidification	0.28	0.40
- Possible pollution of coalmine surroundings	-0.01	
- Number of years use of the technology will be possible: 25-100	0.19	
- High reliability of energy supply	0.25	
- Price: 10-25% higher	0.10	
SOFC with CCS		
- Need for new installations	0.30	
- Need for new waterlines and powerlines	0.20	
- Need for new CO_2 lines	0.20	
- Much less contribution to greenhouse effect	0.38	
- Less contribution to acidification	0.35	0.53
- Number of years use of the technology will be possible: 50-250	0.21	
- Reliability of energy supply: less from 2020	0.13	
- Better reliability through fuel cells	0.19	
- Price: 20-50% higher	0.18	
Hydrogen production via coal gasification with CCS		
- Need for 10 new power plants with new pipelines	0.29	
- Need for new vehicles	0.24	
- Accidents & deaths in mines	0.02	
- Maybe less safe power stations	0.08	
- Safety hydrogen transport equal to current fuel transport	0.32	
- Much less contribution to greenhouse effect	0.33	0.52
- Much less contribution to acidification	0.31	
- Moderate contribution to improvement of air quality	0.36	
- Possible pollution of coalmine surroundings	-0.01	
- Number of years use of the technology will be possible: 20-100	0.15	
- High reliability energy supply	0.23	
- Price: 25-75% higher	0.10	

Table 4.2.4 continued	Correlations	Multiple Correlation
Hydrogen production via steam reforming with CCS		
- Need for many new installations	0.21	
- Need for many new pipelines	0.26	
- Need for new installations at home	0.27	
- Need for new vehicles	0.27	
- Few technological breakthroughs needed	0.28	
- Equal safety in daily life	0.39	0.56
- Much less contribution to greenhouse effect	0.39	
- Much less contribution to acidification	0.32	
- Moderate contribution to improvement of air quality	0.41	
- Number of years use of the technology will be possible: 50-300	0.27	
- Reliability energy supply: less from 2020	0.10	
- Price: 25-200% higher	0.16	
ECBM		
- Need for temporary new derricks	0.28	
- Need for many new wells	0.05	
- Practically enough knowledge for implementation	0.20	
- Contribution to greenhouse effect: 20% less than 1990	0.27	0.54
- Number of years use of the technology will be possible: 5-50	0.30	
- Good reliability expected	0.41	
- Positive economic consequences	0.32	
- Price: 33-300% higher	0.25	
Small scale reforming based on membrane tech with CCS		
- Replacement of gas stations with hydrogen stations	0.38	
- Need for many new CO_2 lines	0.25	
- Need for replacement of all motor vehicles	0.21	
- More technological breakthroughs needed. (expected, but not sure)	0.20	
- Equal safety of fuel stations and vehicles	0.31	
- Much less contribution to greenhouse effect	0.42	0.59
- Much less contribution to acidification	0.33	
- Improved air quality expected to save many lives	0.33	
- Number of years use of the technology will be possible: 50-250	0.27	
- Reliability energy supply: less from 2020	0.08	
- Economic consequences are unknown	0.30	
- Fuel price: 10-40% higher	0.35	

The aspects and consequences in this table are merely labels. In fact, information regarding aspects and consequence was nuanced and elaborate. See Appendix 2 for a full description.

This comparison of the average evaluations of aspects and consequences with the correlations between the evaluations of aspects or consequences and the overall evaluations is a qualitative analysis and a few examples will be given here to explain how this comparison will give more insight. The easiest example would be if a consequence was on average evaluated as neither negative nor positive, had no influence on the overall evaluation of the technology (a correlation close to zero), and that this was agreed upon by most respondents (a low standard deviation, which means that many respondents evaluated close to the average evaluation). This would be a good example of a consequence that can be discarded as influential to public evaluation of a technology. However, such clear examples are not present in our dataset. The other easy example would be if a consequence was evaluated on average as very positive or very negative, had significant influence on the overall evaluation (a correlation close to 1 or -1) and that this was the case for many respondents (a low standard deviation; for the evaluations of the aspects and consequences, the standard deviations ranged from 1.89 to 5.46 with an average of 3.85) This would be a good example of a consequence that is considered important and has a significant influence on the public's overall evaluation of a technology. In other words, a consequence that should be taken into account as a possible source of public conflict in case the consequence is considered very negative. An example that comes close to this is the consequence "much less contribution to the greenhouse effect" of the technology "small scale reforming based on membrane technology with CCS". This consequence was evaluated on average as very positive (6.4 on a scale of -9 to 9) by many respondents (SD = 3.12) and has a moderate (r = .42) influence on the overall evaluation of the technology. This means that "much less contribution to the greenhouse effect" is considered a big advantage by most respondents, which causes respondents' overall evaluation of "small scale reforming based on membrane technology with CCS" to be more positive.

Interpreting the comparison of average evaluation of an aspect or consequence with the correlation between that evaluation and the overall evaluation of the technology becomes less straightforward when either the evaluation of the aspect or consequence is extreme but this does not influence the overall evaluation of the technology; or the evaluation of the aspect or consequence is neither negative nor positive, but this does influence the overall evaluation of the technology. An example of the first case is the consequence of "accidents and deaths in mines" of the technology "IGCC with CCS". Although "accidents and deaths in mines" are evaluated very negatively (-5.41) by many respondents (SD = 3.19), this does not influence the overall evaluation of the technology at all (r = -.01). This means that respondents do not evaluate the technology more negatively because of this negative consequence. They do acknowledge the consequence as a big disadvantage, but do not consider this to be an important argument for the evaluation of the technology as a whole. The second less straightforward example is when an aspect or consequence is evaluated on average as neither negative nor positive by many respondents, but still influences the overall evaluation of the technology. For example, the consequence "replacement of gas stations with hydrogen stations" of the technology "small scale reforming based on membrane technology with CCS" is evaluated on average as neither negative nor positive (-0.67), but does moderately influence the overall evaluation of the technology (r = .38). This seems illogical, but can be explained by the high standard deviation (SD = 5.46), which means that there was a lot of variation in the evaluations of the consequence. Respondents evaluate this consequence both very negatively and very positively, which consequently influenced their overall evaluation in the same direction. In other words, such an aspect or consequence is more likely to be a possible cause of controversy than other aspects or consequences, as some groups find it a big disadvantage and a reason to evaluate a technology negatively, whereas other groups find it a big advantage and a reason to evaluate a technology positively.

In the next paragraph, we will discuss how specific types of aspects or consequences are evaluated in general and how this influences the overall evaluations of CCS technologies. After this, we will go into detail and discuss the specific aspects and consequences per technology that stand out, either because of their influence, or their unexpected lack of influence.

Over technologies, one kind of consequence has a positive influence on the overall evaluations and this is contribution to greenhouse effect, acidification and air quality. As could be expected since all these consequences are positive (much less greenhouse effect, less acidification, better air quality), these consequences are all evaluated very positively (averages between 4.1 and 6.9 on a scale of -9 to 9). These consequences also all have moderate influence on the technologies (correlations vary between .27 and .42). (Keep in mind however, that not all technologies have acidification and air quality changes as a consequence.) This means that these consequences are considered important, big advantages and have a moderate yet significant positive influence on public evaluation of the six CCS technologies.

The requirement for new installations, lines and vehicles has a low to moderate influence on the overall evaluations of the technologies (correlations vary between .20 and .38). These aspects are evaluated mostly as unimportant or as a small disadvantage. (Except for new installations for “SOFC with CCS”, which is considered a very small advantage). A large percentage of respondents evaluate these aspects as unimportant, ranging from 24% to 48% of respondents. However, standard deviations of the evaluations of these aspects are mostly high, which means that a substantial number of respondents evaluate these aspects as either a big advantage or a big disadvantage. This is the case especially for new installations and new vehicles (all vehicles as well as only buses and trucks). These aspects seem to be more controversial than others. However, as the influence that the evaluation of these aspects has on the overall evaluation of the technologies is low to moderate, it seems unlikely that these aspects cause rejection of a technology. Still, it might be wise to consider these aspects as a possible downside of these technologies to at least a small part of the public.

The energy price of the technologies, compared to current prices, is higher for all technologies. Respondents mostly consider this only a small to moderate disadvantage, and a reasonable amount of respondents even finds this consequence unimportant (18 – 25%). This consequence seems to have little influence on the overall evaluations of the technologies, as correlations range between .10 and .25, with one exception (r= .35). It seems that the price of energy from CCS technologies is not a very important issue for respondents.

Surprisingly, two consequences are evaluated very negatively but had no effect on the overall evaluations of the technologies whatsoever. “Accidents and deaths in mines” and “possible pollution of coalmine surroundings”, both consequences of the technologies “IGCC with CCS” and “hydrogen production via coal gasification with CCS”, are evaluated by a majority of respondents as a big or moderate disadvantage, with few respondents evaluating this as unimportant or an advantage (average evaluations between -5.41 and -4.61). However, the correlations between these consequences and the overall evaluations are close to nonexistent (-.01 to .01). This means that respondents do not evaluate these technologies more negatively because of these negative consequences. They do acknowledge the consequences as a (big) disadvantage, but do not consider this to be an important argument for the evaluation of the technology as a whole. It seems highly unlikely that these consequences will cause rejection of these technologies.

Above, we discussed the aspects and consequences that seemed to have mostly the same evaluation and mostly the same influence on the overall evaluation of the technology, independent of technology. Some aspects or consequences’ evaluations and their influence on the overall evaluation of the technology do vary much per technology. This is not unexpected, as some consequences have a higher occurrence or chance of occurrence for one technology than for the other. We will now discuss these consequences, not per kind, but per technology.

For the technology “IGCC with CCS”, the consequence of “high reliability of energy supply” is evaluated rather positive (5.02) and has a moderately low influence (.25) on the overall evaluation of “IGCC with CCS”. This means the reliability of coal supply has a moderately low but positive influence on the evaluation of “IGCC with CCS”. The reliability of coal may have a very slight positive influence on the public opinion of “IGCC with CCS”. The consequence of “number of years use of the technology will be possible: 25-100” has even less influence (.20) on the overall evaluation of “IGCC with CCS”, but respondents differ in their opinion if this a positive or a negative consequence. The time this technology can be used might therefore be a minor downside to some people and an upside to others, but not of great influence.

For the technology “SOFC with CCS”, the consequence of “reliability of energy supply: less from 2020” is evaluated negative (-3.22) and has a low influence (.13) on the overall evaluation of “SOFC with CCS”. This means the reliability of gas has a very low influence on the evaluation of “SOFC with CCS”. The reliability of gas is therefore not expected to have much influence on the public opinion of “SOFC with CCS”. Although the consequence of “better reliability through fuel cells” has just a bit more influence (.19), a very sizeable amount of respondents consider this consequence unimportant. The reliability of fuel cells can therefore not be expected to have much influence on the public overall evaluation of this technology. The consequence of “number of years use of the technology will be possible: 50-250” has only very slightly more influence (.21) on the overall evaluation of “SOFC with CCS”, but for most respondents, this influence is positive. The time this technology can be used might therefore be a minor downside to a few people and an advantage to others, but not of great influence.

For the technology “Hydrogen production via coal gasification with CCS”, the consequence of “high reliability of energy supply” is evaluated rather positive (4.97) and has a moderately low influence (.23) on the overall evaluation of “Hydrogen production via coal gasification with CCS”. This means the reliability of coal has a moderately low but positive influence on the evaluation of “Hydrogen production via coal gasification with CCS”. The reliability of coal may have a very slight positive influence on the public’s overall evaluation of “Hydrogen production via coal gasification with CCS”. The consequence of “number of years use of the technology will be possible: 20-100” has even less influence (.15) on the overall evaluation of “Hydrogen production via coal gasification with CCS”, but respondents differ in their opinion if this is a positive or a negative consequence. The time this technology can be used might therefore be a minor downside to some people and an upside to others, but hardly of any influence.
The consequence of “maybe less safe power stations” is evaluated as a minor disadvantage. Some respondents do find this a big disadvantage, but as the influence of this consequence is very low (.08), this consequence is of little influence. That the safety of hydrogen transport is mostly expected to be equal to current fuel transport is seen by a substantial part of respondents as positive, but almost as much respondents consider this unimportant, and only a little less respondents consider it to be a disadvantage. As this consequence has a moderate influence (.31) on “Hydrogen production via coal gasification with CCS”, it might be wise to consider that this consequence is a downside with some influence to a minor part of the population.

For the technology of “Hydrogen production via steam reforming with CCS”, the consequence of “reliability of energy supply: less from 2020” is evaluated negatively

(-2.95) and has a low influence (.10) on the overall evaluation of “Hydrogen production via steam reforming with CCS”. This means the reliability of gas has a very low influence on the evaluation of “Hydrogen production via steam reforming with CCS”. The reliability of gas is therefore not expected to have much influence on the public’s overall evaluation of “Hydrogen production via steam reforming with CCS”. The consequence of “number of years use of the technology will be possible: 50-300” has a moderate influence (.27) on the overall evaluation of “Hydrogen production via steam reforming with CCS”, but for most respondents, this influence is positive. The time this technology can be used can therefore expected to be an upside to most people, but only of moderate influence.
The aspect of “few technological breakthroughs needed” has a moderate influence (.28), and respondents differ in their opinion if this is negative or a positive aspect. This means that for some people, the few technological breakthroughs needed moderately but positively influence their evaluation of the technology, whereas for others, this aspect is a moderate but negative influence on their overall evaluation of the technology. A consequence of more influence (.39) is the “equal safety in daily life”. For a substantial amount of respondents, this consequence is a big advantage, which also has a moderate but positive effect on their overall evaluation of the technology. A substantial number of respondents find this consequence unimportant however, and a small number find it a disadvantage. How respondents evaluate this consequence still has a moderate influence though, and although it is unlikely that this is cause for controversy, it might be wise to consider this consequence as possibly important to some.

The overall evaluation of the technology of “ECBM” is most influenced by the consequence of the good reliability that is expected. Most respondents find this consequence moderately to very positive (3.45), and it has a moderate influence (.41) on the overall evaluation of “ECBM”. This means that this consequence is likely to have a rather positive effect on the public’s overall evaluation of this technology. The same can be said for the consequence “positive economic consequences”, which is evaluated very positively, and also has a moderate (though slightly less) influence (.32) on the overall evaluation of the technology.
The consequence of “need for temporary new derricks” seems to influence the overall evaluation of “ECBM” moderately (.28), but almost half of the respondents finds this need unimportant. This makes it unlikely that this consequence is a source of much positive or negative influence. The aspect of “practically enough knowledge for implementation” had a low to moderate influence (.20) on the overall evaluation of “ECBM”, but respondents differ in their opinion if this an advantage, a disadvantage or unimportant. However, as the influence is only low to moderate, this does not seem a likely cause for conflict. The aspect of “the number of years use of the technology will be possible has a moderate influence (.30), and mostly negative (-2.61). This consequence could be expected to have a negative effect on the overall evaluation of “ECBM”, albeit only moderately.

The technology of “Small scale reforming based on membrane technology with CCS”, the consequence of “reliability of energy supply: less from 2020” is evaluated negative (-3.05) and has a very low influence (.08) on the overall evaluation of the technology. This means the reliability of gas has a very low influence on the evaluation of “small scale reforming based on membrane technology with CCS”. The reliability of gas is therefore not expected to have much influence on the public opinion of this technology. The consequence of “number of years use of the technology will be possible: 50-250” has low to moderate influence (.27) on the overall evaluation of “Small scale reforming based on membrane technology with CCS”, but for most respondents, this influence is positive. The time this technology can be used might therefore be a minor downside to a few people and an advantage to a somewhat larger group, but of modest influence. The unknown economic consequences are evaluated as a disadvantage by most respondents, and this has a moderate influence (.30) on the overall evaluation of the technology. This consequence could be expected to have a negative effect on the evaluation of “Small scale reforming based on membrane technology with CCS”, albeit only moderately. The aspect of the technology that more technological breakthroughs are needed and expected, but not sure, has a low to moderate (.20) influence on the overall evaluation of the technology. As this aspect is evaluated rather negatively (-3.22), it could be expected that this aspect is a downside to people, but not of great influence. The consequence of “equal safety of fuel stations and vehicles” has a moderate influence (.31) on the overall evaluation of “Small scale reforming based on membrane technology with CCS”, and as most respondents evaluate this consequence as an advantage, this influence is positive. However, a very substantial amount of respondents evaluate this consequence as unimportant. It does not seem likely that this consequence will be seen as an important advantage of “Small scale reforming based on membrane technology with CCS”.

All in all, it is apparent that none of the variances of the overall evaluation of the technologies are explained by one single aspect or consequence, but by almost all aspects and consequences of the specific technology. This means that none of the aspects or consequences that are evaluated in the questionnaire can solely predict the overall evaluation of a technology in the questionnaire. Although there are some aspects or consequences that have a moderate influence on the overall evaluation of a technology, none of the aspects or consequences sticks out as a major predictor of the evaluation of one or more technologies. This suggests that it will be very hard to influence the public overall evaluations of a technology by changing single aspects or consequences of a technology. On a more positive note, as all technologies are evaluated as adequate (average grades between 6 and 6.5) and as there seem to be no aspects or consequences that are such a negative influence that this could solely bring down the overall evaluations, there seems to be no reason to change single aspects or consequences.

4.2.4.1 Relationship between evaluations of consequences of global warming and the overall evaluation of global warming

To study the relationship between the evaluations of aspects and consequences of global warming on the one hand and the overall evaluation on the other, a regression analysis was performed. Table 4.2.4.1 contains the results of this analysis. Like Table 4.2.4, that contained the results of the regression analyses of the technologies and their aspects and consequences, the second column of this table states the correlations between the evaluation of a consequence and the overall evaluation of global warming. These correlations are all “single” correlations between the overall evaluation of global warming and one of the consequences thereof. These correlations give some insight in the relative influence of the different consequences. As the correlation between the evaluation of a consequence rises, the consequence is likely to play a more important role in the determination of the overall evaluation. The multiple correlation in the third column represents how much the evaluations of the consequences of global warming together are connected to the overall evaluation of global warming. In this case, the multiple correlation gives an indication of the degree to which the overall evaluation of global warming can be based on the evaluations of the consequences of global warming.

Table 4.2.4.1: Correlation of the evaluations of the consequences and the overall evaluation of global warming

	Correlations	Multiple correlation
More droughts	0.48	
Higher chance of flooding	0.47	
Storms more intense	0.38	
Sea level rise	0.49	
Need for costly measures	0.31	0.52
Poor countries affected most	0.41	
More heat waves	0.41	
Less cold waves	0.05	
Stop of warm currents	0.47	

The multiple correlation between the evaluations of the consequences and the overall evaluation of global warming is moderate. As was the case for the information about the technologies, this moderate correlation seems to implicate that although the information that is given about the consequences does influence the overall evaluation of global warming, the overall evaluation is based on more than this information. A possible explanation for this could be that not all the arguments that are important to respondents are stated in the given information. Contrary to the "single" correlations between evaluations of aspects or consequences and overall evaluations of the technologies, the "single" correlations between the evaluations of the consequences and the overall evaluation of global warming are mostly moderate. Only the consequence of "less cold waves" has an almost nonexistent correlation with the overall evaluation of global warming. Apparently, most respondents did not base their evaluation of global warming on their evaluation of less cold waves.

4.2.4.2 Relationship between evaluations of consequences of CCS and overall evaluation of CCS

To study the relationship between the evaluations of the consequences of CCS on the one hand and the overall evaluation of CCS on the other, another regression analysis was performed. Table 4.2.4.2 contains the results of this analysis. Again, the second column states the "single" correlations between the separate consequences of CCS and the overall evaluation of CCS. The third column gives the multiple correlation between the evaluations of the consequences and the overall evaluation of CCS. See the paragraph about global warming above (4.2.4.1) for further explanation of the statistical meaning of correlation and multiple correlation.

Table 4.2.4.2: Correlation of the evaluations of the consequences and the overall evaluation of CCS

	Correlation	Multiple correlation
Very small chance of leakage from lines	0.26	
Very small chance of CO_2 cloud	0.26	
Very small chance of leakage from storage	0.30	0.52
Small chance of damage to life under ground and basements	0.01	
Chance of small earthquake	0.08	
No contribution to greenhouse effect	0.48	

The multiple correlation between the evaluations of the consequences and the overall evaluation of CCS is moderate. As was the case for the information about the technologies, this moderate correlation seems to implicate that although the information that is given about the consequences does influence the overall evaluation of CCS, the overall evaluation is based on more than this information. A possible explanation for this could be that not all the arguments that are important to respondents are stated in the given information. The "single" correlations between the evaluations of the consequences and the overall evaluation of CCS differ from moderate to nonexistent. Especially the evaluations of the consequences "damage caused by the escape of CO_2"and "small earthquake" do not seem to have any relationship with the overall evaluation of CCS. The overall evaluation of CCS does seem to be partly based on the consequence of "no contribution to the greenhouse effect", at least a bit more than on the consequences "very small risk of a leak in a pipeline", "very small risk of an escape and accumulation of CO_2", and "very small risk of an escape of CO_2 from subterranean areas". Still, these last three consequences do have an influence on the overall evaluation of CCS.

4.2.5 Influence of personal characteristics on overall evaluations of global warming, CCS and the six CCS technologies and on acceptance

Several demographic and personal background variables were assessed. We will not discuss the effects of all characteristics of respondents that were assessed or known, as this would generate a lot of information that is far from enlightening. This also has the negative side-effect of false hits: When testing if groups differ on certain variables, there is a small chance that the test will suggest that groups differ, when in fact they do not. How small this chance is depends on the parameters of the test. It is customary to use a confidence interval of 95%, which means that there is a 5% chance that you are wrongfully rejecting the hypothesis that there is no effect. In other words, a chance of 5% that there is a false hit: The test suggests the hypothesis of no effect should be rejected, when there is in fact no effect. However, if more tests are done, the chance becomes greater that one of these tests shows an effect that is coincidental. Testing all the effect of all personal characteristics on all major dependent variables –overall evaluations, choice, acceptance- would result in hundreds of tests and a very great chance of false hits. To avoid this, we will only test the personal characteristics that can reasonably be expected to have some influence on opinion about global warming, CCS and the six CCS technologies. We will however discuss the effects of gender, education, involvement, political preference and regular donations to Greenpeace or WWF. To further avoid reporting tiny and trivial effects, we will only consider effects of a certain effect size as actual effects. After establishing that there is very likely an effect, it becomes important to know how large this effect is. For instance, if two groups differ in their evaluation of a technology by 0.09 on a scale of one to ten, this might be a statistically significant difference, but it hardly has any practical impact. Therefore, we only considered effect sizes that were at least "small" – partial eta square above .01 - by definition of Cohen (1973, 1988). To analyze the influence of personal characteristics on overall evaluations we used analyses of variance. To analyze this influence on the percentage of rejection of technologies, we used Pearson Chi-square tests.

4.2.5.1 Influence of gender

If the respondent was a man or a woman had not much influence on the main dependent variables. Men only differed from women on their overall evaluation of the technology "Hydrogen production via coal gasification with CCS". Men evaluated this technology significantly more positive than women, F(1,995) = 10.02, p = .002, partial eta square = .01. The overall evaluations of global warming, CCS and the other five CCS technologies did not differ depending on gender, and neither did the percentage of rejection of technologies.

4.2.5.2 Influence of education

For these analyses, respondents were divided in two groups: low to medium education (lo, lbo, mavo, mbo) and higher education (havo, vwo, hbo, wo). These groups did not differ much on the main dependent variables. There was no effect of education on the overall evaluation of global warming, and there was no effect of education on the overall evaluations of the technologies, nor on the rejection of the technologies. There was however an effect of education on the overall evaluation of CCS. Respondents with low to medium education evaluate CCS more positive than respondents with higher education, F(1.995) = 15.15, p , .001, partial eta square = .015.

4.2.5.2 Influence of involvement

For these analyse, respondents were divided in two groups of equal size via a median split: a group with the 50% of respondents that scored relatively low on involvement, and a group with the other 50% of respondents that scored relatively high on involvement. Involvement was measured with a questionnaire, of which the details have been described in Paragraph 3.2.5. Involvement had an effect on the overall evaluation of global warming. More involved respondents evaluated global warming more negatively than did less involved respondents, F(1,995) = 42.16, p < .001, partial eta square = .041. More involved respondents evaluated CCS more positively than less involved respondents, F(1,995) = 10.4, p < .001, partial eta square = .015. More involved respondents evaluated the technologies that use gas –"SOFC with CCS", "Hydrogen production via steam reforming with CCS" and "Small scale reforming based on membrane technology with CCS"- higher than did less involved respondents. (Respectively, F(1,995) = 17.31, p < .001, partial eta square = .017; F(1,995) = 11.59, p < .001, partial eta square = .012; F(1,995) = 14.8, p < .001, partial eta square = .015.) More involved respondents were also less likely to reject the technology "SOFC with CCS", than did less involved respondents. Of the 486 less involved respondents, 11 did not accept the technology, whereas of the 509 involved respondents, only 3 did not accept. Caution should be taken when interpreting this result though, as the amount of respondents that did not accept are very low. This makes the test statistically less reliable. Involvement had no effect on the percentage of acceptance of the other technologies.

4.2.5.3 Influence of regular donations to Greenpeace of World Wildlife Fund

Of 76.6% of the respondents in the ICQ, it was known if they were regular donators to either Greenpeace or the World Wildlife Fund. This means the following results are not based on 995 respondents, but on 763 respondents. There was no effect of donation to the WWF on the overall evaluations of global warming, CCS or the CCS technologies. Donators to the WWF were equally likely to accept each of the technologies as were respondents that were not regular contributors. Donators to Greenpeace also did not differ on these variables, except for global warming: Regular contributors to Greenpeace evaluated global warming more negatively than other respondents, F(1,763) = 12.18, p < .001, partial eta square = .016.

4.2.5.4 Influence of political preference

In the questionnaire, respondents were asked to state which party they would elect, if there were national elections that day. All official parties present at that time were on the list. However, a few parties (SGP, LPF) were mentioned by so few respondents, that they were omitted from the analyses to avoid statistical inaccuracies. The groups of respondents that stated not to vote, not to know, or did not want to tell, were much larger and were therefore included in the analyses. Table 4.2.5.4 shows the average overall evaluations of global warming, CCS and the CCS technologies per political group. However, not all averages are significantly different depending on political preference. For global warming, CCS, "SOFC with CCS', "Hydrogen production via coal gasification with CCS", and "Hydrogen production via steam reforming with CCS", there is a significant main effect of political preference. However, when analyzing further which groups differ from which other groups (with Tukey HSD post-hoc tests), only few groups appear to differ from each other. Concerning the overall evaluation of global warming, there is a main effect (F1,970) = 4.41, $p < .001$, partial eta square = .044. But only the overall evaluation of global warming of respondents that choose CDA differs from the overall evaluations of the groups with preference for PvdA, SP or GroenLinks. Respondents that choose CDA were less negative about global warming than were respondents that choose PvdA, SP or GroenLinks. Political preference also had a significant main effect on CCS, $F(1,970) = 3.52$, $p < .001$, partial eta square = .035. Here, the group that choose PvdA differs from the group that preferred SP and the group that did not want to tell their preference. Respondents that choose PvdA were on average more positive than these two groups.
The technology "hydrogen production via coal gasification with CCS" was evaluated more positively by the group of respondents that choose CDA than the group that choose GroenLinks, $F(1,970) = 2.01$, $p = .03$, partial eta square = .021. Political preference also had a significant main effect on "SOFC with CCS" and on "Hydrogen production via steam reforming with CCS", but after further post-hoc tests to analyze which groups differed from which other groups, no specific significant differences were found.

If we interpret the results in Table 4.2.5.4 very crudely, there seems to be a tendency for the left side of the electorate to be more negative about global warming, but also about most technologies, than the right side. The overall evaluation of CCS does however not fit in this pattern. To further analyze this observation, we again analyzed these variables but we divided political preference in three groups: the left, with PvdA, SP, GL en D66, the right, with CDA, VVD, LPF and LijstWilders, and the undecided or secretive, with the respondents that would not choose, could not choose, did not want to tell, did not know or choose CU, a party that itself states not to want to choose if they are rightwing or leftwing. Global warming was indeed evaluated much more negative by the left side than by the right side or the rest of the respondents. There was no effect on CCS, which is not surprising considering the values in Table 4.2.5.4. However, the technologies were also not evaluated more negatively by the left side than by the right side or the rest of the respondents. Only "IGCC with CCS" and "Hydrogen production via steam reforming with CCS" showed a significant effect of political side, and specific tests showed that the rest of the respondents was more negative than the right side about "IGCC with CCS", and more negative than both the right side and the left side about "Hydrogen production via steam reforming with CCS". It seems these analyses do not confirm our hypothesis that the left side of the electorate is more negative about the technologies. Respondents that choose for leftwing parties are however very convincingly more negative about global warming than respondents choosing rightwing and other respondents.

Table 4.2.5.4 Average overall evaluations per political preference

	CDA	PvdA	VVD	SP	GL	D66	CU	LW	Niet	Geh.	Onb.
Global warming	2.76	2.07	2.40	1.89	1.95	2.33	2.05	2.41	2.39	2.62	2.34
CCS	5.57	5.74	5.40	5.01	5.52	5.00	5.32	5.47	5.52	4.81	5.31
IGCC with CCS	6.51	6.33	6.30	6.00	5.93	5.76	6.00	6.37	6.17	5.81	6.15
SOFC with CCS	6.55	6.68	6.45	6.61	6.55	6.14	6.32	6.46	6.52	5.77	6.28
Hydrogen production via coal gasification with CCS	6.67	6.33	6.32	6.17	5.83	5.95	5.89	6.27	6.39	6.00	6.14
Hydrogen production via steam reforming with CCS	6.62	6.52	6.49	6.33	6.29	6.14	5.73	6.35	5.89	6.12	6.31
ECBM	6.05	6.08	6.00	5.90	6.07	5.67	5.84	5.85	5.79	5.54	5.90
Small scale reforming based on membrane technology with CCS	6.54	6.61	6.51	6.52	6.62	6.19	5.87	6.39	6.35	5.96	6.43

Notes:

1. *Overall evaluations are seven-point ratings for global warming and CCS. Overall evaluations are grades for the six CCS technologies*
2. *CDA: Christen Democratisch Appel, PvdA: Partij van de Arbeid, VVD: Volkspartij voor Vrijheid en Democratie, SP: Socialistische Partij, GL: Groen Links, D66: Democraten '66, CU: Christen Unie, LW: Lijst Wilders, Niet: I would not go and vote, Geh.: I don't want to disclose my vote, Onb.:I don't know what to vote*
3. *Obviously, the technical labels used in this table for the CCS options were translated. For a full description of the options in lay terms see Table 2.2.4.*

To test whether political preference also had an effect on the rejection of certain technologies, we again analyzed by dividing the respondents in three groups; respondents that choose leftwing parties, respondents that choose rightwing parties and the rest, same as above. We did not analyze this for separate parties as this would the groups to small to do this kind of analyses (Pearson Chi-square) reliably. However, we did not find differences in the percentage of respondents that would not accept a technology. Only for “IGCC with CCS”, we found a difference between the respondents that choose leftside and the respondents that choose rightside. Of 370 respondents that choose leftwing, 27 would not accept the implementation of “IGCC with CCS”, whereas of the 344 respondents that choose rightwing, only 9 would not accept this technology. Still, as these groups are rather small for this kind of analysis, we urge to interpret these results with much caution.

4.2.5.5 Influence of informed opinion concerning global warming on CCS and CCS technologies

As CCS and the technologies in this questionnaire are all aimed at the reduction of CO_2 emission, it is possible that how respondents feel about global warming affects their evaluation of CCS and the CCS technologies. To test whether is a relationship between the evaluation of global warming and the overall evaluations of the CCS technologies, we calculated the correlations between these evaluations. The overall evaluation of global warming is only very slightly negatively correlated with the overall evaluations of the CCS technologies (correlations ranging from 0 to -.12). To further test the effect of the evaluation of global warming on the overall evaluations of the CCS technologies, we divided respondents in two groups, one with the respondents that evaluated global warming relatively very bad, and one group with the other respondents, that evaluated global warming also as bad, but less. (It was not possible to divide respondents equally, because 641 respondents out of 995 evaluated global warming as very bad, value 1 or 2 on a scale of 1 to 7, so either the “very bad group” was bigger than the other group, or the other group would have been much bigger. We choose the median as a cut-off point for the groups.) There was no effect of respondents’ opinion concerning global warming on their evaluation of CCS. However, there was an effect on all of the technologies that use gas. These were all evaluated more positively by respondents that evaluated global warming as very bad, (all $F > 9$, p’s $< .001$, partial eta square $> .01$.) than by respondents who evaluated global warming as less bad. However, the average overall evaluations of the groups differ no more than .04 on a scale from 1 to 10. The same pattern is found when comparing these groups on their percentages of acceptance of technologies. The group of respondents that evaluate global warming as very bad, is less likely to reject the technologies that use gas than the group of respondents that evaluate global warming as less bad. (Percentages of respondents that think that one of these three technologies is unacceptable are .7%, 1.6% and 2.3% for the group that evaluates global warming as very bad, versus 2.5%, 4.8% and 5.9% for the other group.) There is no effect on the technologies that use coal. The respondents are informed that all technologies reduce CO_2 emissions an equal amount. Why the informed opinion of global warming has such a systematic effect on the technologies that use gas and not on the other technologies remains an interesting question.

4.3 Evaluations concerning the quality of the information and the method of the ICQ

In the ICQ, a number of questions was asked to gain insight in the evaluations of respondents concerning the quality of the information, the special method of the ICQ and the amount of information. The exact wording of the questions can be found in Appendix 3, page 216. In the next paragraphs, the answers to these questions are discussed. For this discussion, the original seven answer categories have been reduced to three categories; a neutral statement (the original middle of the scale; 4), statements on the low end of the scale (1, 2 and 3 on the scale), and statements on the high end of the scale (5, 6 and 7 on the scale). The percentages of respondents in these three categories will be discussed. Due to rounding of the decimals, the percentages do not always accumulate to 100%.

We furthermore tested the effect of education and involvement on the perception of respondents concerning the quality of the information, the special method of the ICQ and the amount of information. As respondents with a higher education are probably more used to processing a lot of information, they might perceive the information in the questionnaire differently. For more involved respondents, they might find the information more interesting and therefore be more positive about certain aspects of it. For these analyses, we divided respondents in two groups, one with low to medium education and one with higher education. We also divided respondents in two groups depending on involvement, one with low involvement and one with high involvement. For details of these splits, see Paragraph 4.2.5.

4.3.1 Evaluations concerning the quality of the information

Respondents were asked four questions about their evaluation of the quality of the information on a scale of 1 to 7. These questions concerned the impartiality, the one-sidedness, the clarity and the completeness of the information. When asked how much they thought the information in the questionnaire was partial or impartial, most respondents (62.6%) answered on the "impartial" end of the scale and 25.8% of respondents answered neither partial nor impartial. A majority of respondents (58.8%) also thought the information was not one-sided, but 18.8% did feel the information was one-sided. This is to be expected however, as the questionnaire is only about CCS options, and does not include other possible options (e.g. renewables, nuclear energy, etc.). Most respondents (70.6%) thought that the information was complete, although some did think it was incomplete (13.2%). Furthermore, a majority of respondents (79.1%) thought that the information was clear, and 9.7% of respondents thought it was not clear. Based on these results, it seems rightful to conclude that the quality of the information was more than adequate in the eyes of the respondent. A majority of the respondents thinks the information is impartial, even-handed, clear and complete, although some respondents are less positive about these aspects.

The group of respondents that was more involved, evaluated the information as more impartial, less one-sided, more clear and more complete. (all $F(1,995) > 7$, all p's $< .006$). There was a significant effect of education on the completeness of information, higher educated respondents evaluated the information as less complete ($F(1,995) = 23.3$, $p< .001$). There was no effect of education on impartiality, one-sidedness and clarity.

4.3.2 Evaluations concerning the method of the ICQ

Respondents answered four questions about the method of the ICQ. They were first asked if there had been a moment during the answering of the questions that something was not clear or that they had not understood what they were supposed to do. Some of the respondents (12.7%) confirmed there had been such a moment.
A majority of respondents thought the method of the ICQ was comprehensible. A minority (9.4%) thought the method was neither comprehensible nor incomprehensible and only a few respondents (7.0%) thought the method was incomprehensible. When asked if the method was simple or complicated, most respondents thought the method was either simple (42.6%) or neither simple nor complicated (21.9%). A minority of respondents (32.0%) considered the method to be a bit or rather complicated, and only few respondents (3.5%) thought it was very complicated. Respondents were also asked if the method of the ICQ had helped them to make a choice. A majority of respondents (75.6%) did feel helped by the method, but 24.4% of respondents answered this question neutral and 11.9% stated not to have been helped by the method. Based on these results, it seems justified to conclude that the method of the ICQ was understandable for most respondents, although some did think that it was not simple. On average, respondents felt helped by the method of the ICQ.

Respondents with higher education perceived the method as more comprehensible and more simple than less high educated respondents. ($F(1,995) = 6.83$, $p = .009$ and $F(1,995) = 17.92$, $p < .001$). More involved respondents also perceived the method as more comprehensible and more simple than less involved respondents. ($F(1,995) = 55.78$, $p < .001$ and $F(1,995) = 11.92$, $p < .001$). If respondents perceived the method of the ICQ as helpful depended on both their education and their involvement. Respondents with a low to medium education that had high involvement, perceived the method as more helpful than respondents with a higher education and respondents with a low to medium education that had low involvement. ($F(1,995) = 8.14$, $p < .004$).

4.3.3 Evaluations concerning the amount of information in the ICQ

To study the evaluations of the amount of information in the ICQ, five questions were asked concerning the amount of information needed to make a choice, the amount of information to evaluate the aspects and consequences, the appropriateness of the amount of information, the repetition of the information and the limited amount of choice options. The amount of information was satisfactory for most respondents. When asked if they thought they had enough information to make a choice between the different energy options, only 14.3% of respondents remained on the “not enough” end of the scale. However, 45.8% of respondents did state a wish for more information before evaluating the aspects and consequences of the policy options.

When asked if they thought the amount of information was appropriate, 27.7% of respondents thought the amount of information was neither too little nor too much. A substantial part of respondents thought the amount of information was a bit too much (30.9%) or more than a bit too much (24.4%). Only few of the respondents thought the information was either much to much (7.9%), or much too little (1.1%). A substantial part of respondents (55.0%) stated to think that it was comforting that the information was regularly repeated, whereas 31.2% of respondents admitted to find this irritating.

As the background and interests of the respondents in the sample are very different, it was expected that there would be differences in the perception that respondents would have of the information in the questionnaire. For example, highly educated respondents who are able and used to process large amounts of not so simple information, might perceive the amount of information in the questionnaire as moderate or even little. For others, the amount of information might be on the though side. It was however more important to make sure that the amount of information was not too much for all respondents, than to service the more intellectual respondents with more information. In general the amount and quality of the information seem to be appreciated by the majority of the respondents.

Respondents with a higher education actually were less convinced that they had enough information to make a choice between options than were respondents with a lower education. They also thought that the amount of information was less appropriate than did respondents with lower education, in the sense that they thought of the information more in the sense of too little than too much compared to the other group. And respondents with a higher education were more irritated by the repetition of information than were respondents with a lower education. (all $F > 4$, p’s $< .036$). More involved respondents perceived the information more as too little than as too much in comparison to less involved respondents. ($F(1,995) = 6.23$, $p < .013$). The more involved respondents were less irritated by the repetition of the information than were less involved respondents. ($F(1,995) = 11$, $p < .001$.

Respondents were also asked how limited they felt concerning their choice options. Considering that respondents were limited in their choice to the six CCS options, and could not choose from, for instance, renewables, nuclear energy or efficiency options, a large part of respondents stated not to feel limited (62.8%). A substantial amount of respondents did feel limited (22.9%). This is not that surprising as their choice options actually were limited. There was no effect of education or involvement on the feeling of being limited.

4.3.4 Subjective opinion change

To study in how far respondents thought their opinion had changed due to the information in the ICQ, three questions were asked concerning the change of opinion about different ways to produce energy, the greenhouse effect, and CCS and its consequences. Two questions were asked concerning a change in arguments needed for choice and a general change in opinion. The majority of respondents stated their opinion about different ways to produce energy had changed. Some respondents reported their opinion has not changed (13%), and a sizeable amount of respondents reported only a small change (21%). The majority of respondents furthermore stated that the information has changed their opinion on the greenhouse effect and its consequences. However, a substantial amount of respondents reported either no change (23%), or only a small change (26%). Most respondents reported the information has changed their opinion about CCS and its consequences. They reported either a substantial (35%) or large (42%) opinion change. A small percentage (9%) of respondents reported no opinion change. A majority of respondents (54%) reported the information in the ICQ has given them rather a lot of new arguments and a substantial percentage (31%) reported to have a lot more new arguments. A very small percentage of respondents (6%) stated the information did not give them any new arguments. When asked if the information had made them think differently about producing energy in general, a majority of respondents (92%) answered the information had indeed done so. Although comparing the opinions of respondents from the ICQ with the opinions of respondents from the TQ would give a more accurate and objective estimate of opinion change due to the information in the ICQ, these results do show that at least the respondents themselves mostly feel they have changed their opinion in general about energy.

4.4 Results of the Traditional Questionnaire (TQ)

4.4.1 Awareness of technologies and willingness to evaluate

In the more traditional questionnaire, the first questions respondents received were about their awareness of the six CCS technologies, CCS and the greenhouse effect. The percentages of respondents' self-reported awareness concerning the technologies and the greenhouse effect are depicted in Table 4.4.1. With the exception of global warming, the majority of respondents reported not to have heard of most technologies. Especially "ECBM" is mostly unheard of, 91.4% admits to be unaware of this technology, and 7.3% states to know a bit. "IGCC with CCS" and "SOFC with CCS" are reported to be known to a few more respondents, 4.3%-5.2% states to know about these technologies and 28.1%-30.3% states to know a bit about these technologies. Not surprisingly, the majority of respondents also states either not to be aware of CCS in general (76.1%), or just a bit (20.2%). Almost half of the respondents does state to be aware of the greenhouse effect (48%), and just over half of the respondents states to know a bit about the greenhouse effect (50.5%).

When options are new with relatively unknown consequences, respondents may simply lack the knowledge to have opinions. Part of them may refrain from answering but a significant part of the respondents may respond with "pseudo-opinions" or "non-attitudes" (cf. Converse, 1964). An early demonstration of this phenomenon was presented in a survey in the US on attitudes towards a non-existing act: A substantial part of the sample expressed (strong) views regarding this fictitious act (Bishop, Oldendick, Tuchfarber, & Bennet, 1980). Thus, respondents are inclined to give an opinion even on topics they know nothing about (Bishop, Oldendick & Tuchfarber, 1986, Schuman & Presser, 1981). Other research showed that such pseudo-opinions are unstable and easily changed by contextual information (e.g., Strack, Schwarz & Wänke, 1991). The results show that a substantial part of the respondents lacks even the most basic knowledge that is needed to have (or construct) a well considered opinion on these issues. Not only does the majority of respondents admit to be unaware of most CCS options, but for instance 38% did not know what carbon dioxide is (faced with a multiple choice question only 62 percent of people chose the correct answer "a greenhouse gas", whereas 23 percent chose incorrect and 15 percent admitted to not knowing. See also Paragraph and Table 4.4.5). The results furthermore show that only part of the respondents who state their unawareness of a technology withhold themselves from giving their overall evaluations. For instance, on average half the respondents who just admitted to having never heard of a specific modern technology, gave an overall evaluation of this technology when they had the possibility to refrain from evaluating (Table 4.4.1). This means that a substantial amount of respondents gives pseudo-opinions. As an example we added a table for the technology "ECBM". In this table (4.4.1a) the percentages of respondents are shown that will or will not give their opinion crossed with their answer to the question "Have you heard of methane gas extraction through storage of captured CO_2 in coal beds?" As can be seen in the table, 56.0% of all respondents (n=327) in the sample stated not to know of "ECBM", but did give their evaluation of this technology. This means that in the case of "ECBM", almost half the respondents gave pseudo-opinions. Of the 299 respondents that had just stated not to have heard of "ECBM", 183 respondents did give their evaluation. This means that more than half of the respondents without any knowledge of the technology were willing to give their opinion of this technology.

Table 4.4.1a: Percentages of respondents self-reported awareness of "ECBM" crossed with evaluation willingness in TQ1

	Have you heard of ECBM		
	No	A bit	Yes
Gave their evaluation	56.0%	6.7%	1.2%
Refrained from evaluation (answered: "no opinion")	35.5%	0.6%	0%

The percentages of respondents that first stated not to have heard of a technology but did give their evaluation ranged from 40.1% to 56.0% of the total of 327 respondents, depending on the technology they were asked about.

Table 4.4.1: Percentages of respondents self-reported awareness of technologies and evaluation willingness in TQ1

Have you heard of…..	No	A bit	Refrained from evaluation *Answered: no opinion**
IGCC with CCS	67.6%	28.1%	26.9%
SOFC with CCS	64.5%	30.3%	26.0%
Hydrogen production via coal gasification with CCS	82.0%	15.3%	27.5%
Hydrogen production via steam reforming with CCS	70.6%	26.0%	27.8%
ECBM	91.4%	7.3%	36.1%
Small scale reforming based on membrane technology with CCS	72.2%	22.3%	27.5%
The greenhouse effect	1.5%	50.5%	2.8%
CCS	76.1%	20.2%	37.0%

**This is the percentage "no opinion" at the first overall evaluation.*
Note: These technical labels for options were translated. However, these translations were restricted to the lay titles (boldfaced) in table 2.2.4. So respondents in the TQ were not presented with full descriptions of CCS options in lay terms as depicted in table 2.2.4

4.4.2 Effect information on opinion change and stability

In the first TQ, respondents first evaluated the CCS technologies, CCS and the greenhouse effect without having been given any information. They evaluated these concepts a second time; Within twelve minutes, we asked again for the overall evaluations of each of the six technologies (the only difference was that the second time we added two sentences with some information, for instance on the number of power plants to be build).
How easily pseudo-opinions are changed can be tested by comparing the first evaluations of these concepts with the second evaluation of these concepts. Table 4.4.2 contains the first and second overall evaluations of the CCS technologies and the correlation between them. The second overall evaluations of the technologies are higher than the first overall evaluations. When tested with paired-samples t-tests, the first overall evaluations of the first five technologies in the table are significantly different from these technologies' second overall evaluations ($p < .001$). The first overall evaluation of "Small scale reforming based on membrane technology with CCS" is not significantly different from the second overall evaluation. This means that the information respondents received between the first and the second overall evaluation has on average influenced the overall evaluations of respondents on these technologies positively. Another strong indication of how easily pseudo-opinions are changed comes from the correlation between the first and second overall evaluation. As was

explained in Paragraph 4.2.4, a correlation can vary from -1 to 1, with 0 meaning no relationship between two variables. In this case, the correlation between the first and the second overall evaluation is a measure for the stability of respondents' opinion. As can be seen in the fourth column of Table 4.4.2, these correlations are low. The correlations between the first and the second evaluation of each of the six technologies ranged around a mere 0.35 for all respondents. This means that only 9% of the variance of the second evaluation can be explained from the first evaluation. This means not only that the stability of the opinions respondents had is low, but also that not all respondents were influenced positively by the information they had received between the first and second overall information. In other words, it means that the overall evaluations of respondents in the TQ were easily changeable and unstable. As these overall evaluations can hardly predict overall evaluations within 12 minutes, they are totally worthless for predicting future evaluations.

Table 4.4.2: Mean first and second overall evaluation of technologies in TQ1

Technology	First overall evaluation	Second overall evaluation	Correlation 1st and 2nd evaluation
IGCC with CCS	5.72	6.22	.36
SOFC with CCS	6.08	6.38	.35
Hydrogen production via coal gasification with CCS	5.83	6.37	.48
Hydrogen production via steam reforming with CCS	6.23	6.50	.34
ECBM	5.61	6.45	.39
Small scale reforming based on membrane technology with CCS	6.11	6.22	.32

Notes:

1. *Overall evaluations are expressed as a grade between 1 and 10*
2. *Within 12 minutes, the overall evaluations of most respondents changed (merely 9% of the variance in the second evaluation may be predicted from the scored of the first evaluations).*
3. *These technical labels for options were translated. However, these translations were restricted to the lay titles (boldface) in Table 2.2.4. So respondents in the TQ were not presented with full descriptions of CCS options in lay terms as depicted in Table 2.2.4*

After respondents had evaluated the CCS technologies, CCS and the greenhouse effect for the second time, they were asked to choose their preferred technology. Originally, this was planned to compare the choices respondents made in the ICQ, after having been well-informed, with the choices respondents made in the TQ1. However, our analyses show that the opinion of respondents in the TQ are not only pseudo-opinions and easily changeable, but are in fact influenced by the tiny amount of information in the TQ. The choice that respondents make in the TQ is made after the second evaluation, which is a pseudo-opinion. The choices that respondents make are based on these pseudo-opinions and thus are not reliable. We will therefore not compare the choices made in the ICQ with choices made in the TQ.

However, we can compare the first overall evaluations of the CCS technologies in TQ1 with the overall evaluations in the ICQ. With the exception of the overall evaluations in "hydrogen production via steam reforming with CCS", all the technologies are evaluated significantly different depending on whether they had received expert information or no information at all. Respondents that had not received any information evaluated the technologies less positive than respondents that had received and processed the expert information. Still, the differences are only small. This fact that the differences are small does however not mean that a more traditional questionnaire might as well have been used to study overall evaluations of the six CCS technologies. The opinions in the more traditional questionnaire have been proven to be very unstable and easily changed. The overall evaluations in the traditional questionnaire could have been very different, depending on for instance wording of the questions or the mood of the respondents. Using such unstable opinions could easily lead to the wrong conclusion about the publics' opinion and its' preferences.

4.4.3 Awareness of technologies and willingness to evaluate in TQ2

Like in TQ1, in TQ2 the first questions respondents received were about their awareness of the six CCS technologies, CCS and the greenhouse effect. The percentages of respondents' self-reported awareness concerning the technologies and the greenhouse effect are depicted in Table 4.4.3. With the exception of global warming, the majority of respondents reported not to have heard of most technologies. Especially "ECBM" is mostly unknown, 86.3% admits to be unaware of this technology, and 12.0% states to know a bit. "IGCC with CCS" and "SOFC with CCS" are reported to be known to a few more respondents, 7.3%-8.0% states to be aware of these technologies and 29.0%-29.3% states to be a bit aware of these technologies. Not surprisingly, the majority of respondents also states either to be completely unaware of CCS in general (61.7%), or to know just a bit (32.3%). Over half of the respondents does state to be aware of the greenhouse effect (53.3%), and almost half of the respondents states to be a bit aware of the greenhouse effect (43.7%).

The results furthermore show that only part of the respondents who state their unawareness of a technology withhold themselves from giving their opinions. For instance, on average half the respondents who just admitted to having never heard of a specific modern technology, gave an overall evaluation of this technology when they had the possibility to refrain from evaluating (Table 4.4.3). This means that, like in TQ1, a substantial amount of respondents gives pseudo-opinions (see also Paragraph 4.4.1).

Table 4.4.3: Percentages of respondents self-reported awareness of technologies and evaluation willingness in TQ2

Have you heard of…..	No	A bit	Refrained from evaluation *Answered: no opinion**
IGCC with CCS	60.0%	31.7%	23.3%
SOFC with CCS	60.0%	31.0%	23.3%
Hydrogen production via coal gasification with CCS	77.0%	20.7%	26.7%
Hydrogen production via steam reforming with CCS	69.3%	25.0%	26.3%
ECBM	86.3%	12.0%	32.7%
Small scale reforming based on membrane technology with CCS	70.7%	23.7%	25.0%
The greenhouse effect	3.0%	43.7%	4.3%
CCS	61,7%	32.3%	34.3%

**This is the percentage "no opinion" at the first overall evaluation.*
Note: These technical labels for options were translated. However, these translations were restricted to the lay titles (boldface) in Table 2.2.4. So respondents in the TQ were not presented with full descriptions of CCS options in lay terms as depicted in Table 2.2.4

4.4.4 Evaluations in TQ2

As the comparison of the first overall evaluations with the second overall evaluations of CCS technologies, CCS and the greenhouse effect had shown that these evaluations were easily changeable, we designed the second TQ to confirm that this change did indeed result from the information that was given to respondents in TQ1. In TQ2, respondents were not given any information at all, but were distracted between the first and second evaluations by a filler task. If the respondents opinion had been influenced by the information and nothing else, than the respondents in TQ2 should not change their opinion between the first and second evaluation. Than these two evaluations should be nearly the same. The results from TQ2 show that the average first overall evaluation of the CCS technologies, CCS and the greenhouse effect differ only very minimally from the second overall evaluation. This can be tested with paired samples t-tests, as we did in TQ1. In TQ1, five of the six pairs were significantly different. In TQ2, four of the six pairs are different. Different from TQ1 however, the evaluations in TQ2 become more negative, not more positive. This could be explained by the filler task respondents were given between the first overall evaluation and the second overall evaluation. This task is known to be perceived by respondents as annoying, which might bring them in a bad mood. This would mean that even mood influences these overall evaluations, which again shows how easily pseudo-opinions are changed and therefore how unreliable a prediction of future overall evaluations based on these overall evaluations would be.

Table 4.4.4: Mean first and second overall evaluation of technologies in TQ2

	First overall evaluation	Second overall evaluation
IGCC with CCS	5.59	5.62
SOFC with CCS	6.12	6.08
Hydrogen production via coal gasification with CCS	5.73	5.58
Hydrogen production via steam reforming with CCS	6.16	6.01
ECBM	5.58	5.63
Small scale reforming based on membrane technology with CCS	6.26	6.10

Notes:

1. *Overall evaluations are expressed as a grade between 1 and 10*
2. *In TQ 1 the second overall evaluation came after an introduction regarding the usefulness of the technologies and on average 12 minutes after the first overall evaluation. In TQ2 the second evaluation was on average 9 minutes after the first evaluation and without any extra information (that is after an irrelevant filler task)*
3. *At the second overall evaluation in TQ 2 a "no opinion" response category was available whereas in TQ1 it was not.*
4. *These technical labels for options were translated. However, these translations were restricted to the lay titles (boldface) in Table 2.2.4. So respondents in the TQ were not presented with full descriptions of CCS options in lay terms as depicted in Table 2.2.4*

4.4.5 Comparing knowledge of CCS related issues in ICQ and TQ

In the ICQ, TQ1 and TQ2 respondents received questions to test their knowledge of several basic concepts which one needs to understand to be able to form a stable and well-informed opinion about global warming and CCS. In the ICQ, respondents had already received general information about global warming, how our current energy use causes global warming, how carbondioxide emissions can be reduced and about CCS. In the more traditional questionnaires, respondents had received no information before they answered these questions. In the ICQ, these questions were mend not only to test respondents knowledge, but also to find out how much they had remembered from the information they had been reading before. Moreover, in the ICQ these questions helped respondents to process the information by letting them think about it again and by giving the respondents the correct answer after they had given their answer. In the traditional questionnaires, these questions were mend to assess respondents' knowledge and to compare the knowledge of respondents that had not been given information with the knowledge of the respondents that had been given information. Table 4.4.5 contains the questions and the percentages of respondents that answered them correctly, per questionnaire.

Table 4.4.5: Percentages of correct answers to knowledge questions in the ICQ, TQ1 and TQ2

Question……Correct answer	ICQ	TQ1	TQ2
CO_2, or carbondioxide is…. A greenhouse gas		62.1	64.7
CO_2, or carbondioxide is produced by… The burning of coal, gas or oil (among other things)		87.2	86.7
H_2, or hydrogen, is….A gas that produces energy when its burned		63.9	62.0
You get hydrogen…Out of other materials, but this takes energy		70.0	66.7
The greenhouse effect causes…Warming of the global climate		90.5	95.0
Is 95% of the current Dutch energy use produced with coal, gas and oil…Yes	86.6	51.1	49.3
With the current production of energy using coal in the Netherlands…CO_2 is emitted into the atmosphere	98.0	71.3	70.7
With the current production of energy using gas in the Netherlands…CO_2 is emitted into the atmosphere	95.6	57.2	58.0
Because of the CO_2 that is emitted by the current production of energy with coal and gas….the greenhouse effect is enhanced	97.7	75.8	72.3
When the greenhouse effect is enhanced…The average temperature on earth will rise	98.7	96.9	94.3
When the emissions of CO_2 will increase at the current rate, the average temperature on earth until 2050 will…Probably rise 1 to 5 degrees Celsius	78.4	65.1	63.3

Table 4.4.5 continued: Question…..Correct answer	ICQ	TQ1	TQ2
CO_2 that is stored underground, for instance in empty gas fields, does …Not contribute to the greenhouse effect	89.6	47.4	49.0
What is an important difference between the current way to use coal and gas and the six modern ways to use coal and gas for energy production? … The modern technologies capture CO_2 and store it underground.	84.0		
Each of the six modern technologies that this questionnaire is concerned with strives at a decrease of CO_2 emissions…..Of about 20 percent.	75.5		
To make sure that about 20 percent less CO_2 is emitted when one of the six "modern technologies with capture and storage of CO_2 " is used, at least one of these modern technologies has to be …implemented at a large scale	95.8		

Note: The respondents were asked to choose the correct answer out of 2 to 4 possible answers. In the more traditional questionnaires, an extra answering category was added, stating "I don't know". The percentages that are depicted in the table are the percentages of respondents that choose the answer that is depicted in the table after the question.

As can be seen in Table 4.4.5, most respondents in the ICQ answered questions correctly. In the more traditional questionnaires, two questions seemed to be easy to answer for most respondents; the questions addressing the greenhouse effect as a cause of global warming and the enhancement of the greenhouse effect as a cause of increasing temperatures on earth. More than 90% answers these questions correctly. However, the mediocre percentage of correct answers to other questions seems to show that many people still have little understanding about how our current use of energy causes global warming.

5. Conclusions

In the Information-Choice Questionnaire a representative sample of the Dutch population were asked to solve a policy problem that was defined by several experts from ECN, Ecofys, Leiden University, TNO-NITG and Utrecht University. The experts selected six different carbondioxide capture and storage (CCS) options ("ICGG with CCS", "SOFC with CCS", "Hydrogen production via coal gasification with CCS", "Hydrogen production via steam reforming with CCS", "ECBM", and "small scale reforming based on membrane technology with CCS")[10] that would each on its own reduce 20% CO_2 emissions (40 Mton) within 10 to 25 years if the technology was implemented on a large scale in the Netherlands, while storing the captured CO_2 in the Netherlands or the Dutch North Sea (see Paragraph 1.3). Respondents were asked to evaluate the aspects and consequences of six CCS technologies and to evaluate the technologies overall. They were then asked to choose one CCS technology to solve the policy problem. Before respondents made their choice, they were given information about the consequences and aspects of the different CCS options. This information was provided by energy experts, translated for lay people by psychologists, and the validity and balance of this information and the choice problem has been checked by another group of experts (see Paragraph 2.2*)*. The evaluations and choices of respondents in the Information-Choice Questionnaire give insight into the preferences for CCS options as they could be after processing information on relevant aspects of the choice problem. Another research question that is addressed by the ICQ is if and when people might reject certain CCS technologies. How respondents in the Information-Choice Questionnaire evaluate the aspects and consequences of the CCS options gives insight into how information, deemed important by experts, influences respondents overall evaluations of CCS options. Simultaneous to the ICQ, a more traditional questionnaire about the same choice problem was completed by another group of Dutch respondents. This survey and its follow-up shed light on the uninformed opinions respondents have concerning CCS options, and the quality and stability thereof. The most important conclusions of the studies that have been described in this report are summarized in the following paragraphs.

5.1 Evaluations

Before asking respondents about the CCS technologies, they were first explained how CO_2 emissions affect the climate. Respondents were given information to read and evaluate regarding consequences of a temperature rise caused by the greenhouse effect. Overall, the greenhouse effect is evaluated very negatively: on a scale of 1 (very bad) to 7 (very good), the mean overall evaluation is 2.29. Following their evaluation of the greenhouse effect, respondents were given information on CO_2 emission reduction plans and how those could be achieved. CO_2 capture and storage was suggested as a possible technology that could reduce CO_2 emissions.

After having read and evaluated five consequences of CO_2 capture, transport and storage, respondents were asked for their overall evaluation. Overall, CO_2 capture, transport and storage is evaluated positively. On a scale of 1 (very bad) to 7 (very good), the mean overall

[10] Obviously, these technical labels for the CCS options were translated for respondents. For a full description of the options in lay terms, see table 2.2.4

evaluation is 5.54. This means CO_2 capture, transport and storage is generally considered to be quite good.

To further investigate how people evaluate specific CCS technologies after reading and evaluating the technologies' aspects and consequences, respondents were asked to grade the six specific CCS technologies in the questionnaire. In the Dutch school system, grades are on a scale from 1 to 10, with 1 meaning the lowest score possible and 10 meaning a perfect score. A 6 is considered a just acceptable score ("adequate"). This means in the Dutch grading system you did just good enough to pass but not any better. 5 or lower means you failed the test.

In the ICQ, all technologies are evaluated as adequate on average. Only "ECBM" is evaluated very slightly lower than a 6 on average (5.94). The gas options are graded higher than the coal options, although "hydrogen production via steam reforming with CCS" is evaluated only very slightly higher than "hydrogen production via coal gasification with CCS" and "IGCC with CCS" are. Statistically, the mean overall evaluation of "IGCC with CCS" does not differ from that of "hydrogen production via coal gasification with CCS", and the latter does not differ from the mean overall evaluation of "hydrogen production via steam reforming with CCS". "SOFC with CCS" and "small scale reforming based on membrane technology with CCS" both receive a significantly higher mean overall evaluation after information than the other CCS technologies. "ECBM" receives a significantly lower mean overall evaluation than the other CCS technologies in the ICQ. Although the average overall evaluations of several CCS technologies are significantly different, the absolute differences are small. This does not mean that respondents all feel slightly positive about the CCS options and do not differentiate. Although on average the differences are small, the percentages of respondents with more extreme grades should not be neglected. Depending on the specific CCS option, 12% ("ECBM") to 24% ("SOFC with CCS" and "small scale reforming based on membrane technology with CCS") of respondents is very positive about the technology (grades 8, 9 or 10). Percentages of respondents that give extremely low grades (1 – 3) to the CCS options are restricted to 4% regarding five of the six options, and to 6% regarding "ECBM". These very low percentages of very low grades are in line with the very low percentages of respondents that consider specific CCS options unacceptable.

In the more traditional questionnaires, not all CCS technologies were evaluated as adequate. All coal options are graded below 6 on average. This is different from the average grades in the ICQ and shows respondents in the ICQ have been affected by the expert information they were given. In the more traditional questionnaires, respondents were asked to evaluate the CCS options again after a bit of information or no information. After a little bit of information, the grades mostly went slightly up, although they are mostly still different from the average grades in the ICQ. After no information, but an annoying irrelevant filler task, two of the grades remained equal, but four went down. Similar to what others (e.g Strack, Schwarz & Wänke, 1991) have found before this study, the uninformed opinions in the more traditional questionnaire were easily changed and very unstable. Large percentages of the respondents in the traditional questionnaire admitted not to have heard of the specific CCS options (between 60.0% and 91.4 depending on CCS option). Still, a substantial part of the respondents did not refrain from giving their overall evaluation (63.0-76.9%). This resulted in evaluations that were easily changed within 12 minutes. Only 9% of the variance of the second evaluation can be explained from the first evaluation. As these overall evaluations can hardly predict the exact same overall evaluations within 12 minutes, they are totally worthless for predicting future evaluations.

5.2 Choice

Earlier, we argued that it would be logical to assume that most respondents choose the technology they consider most preferable, given the choice options. Most of them did indeed do so, as 88.6% of respondents choose the technology they had given the highest grade or, in case a respondent gave their highest grade to more than one technology, chooses from these technologies.

The analyses of the overall evaluations in the ICQ show that the average overall evaluations of each of the CCS options vary between 5.9 and 6.5. This means that a substantial part of the respondents perceives only little difference in attractiveness between technologies. This makes the outcome of the choice task (pick one out of six) less informative than with big evaluative differences. However, we do find that the pattern of the evaluations is reflected in the choices respondents make. They seem to have a general preference for the gas options, which are chosen by more respondents than the coal options. Especially "SOFC with CCS" and "hydrogen production via steam reforming with CCS" are preferred by more respondents than the other technologies, by 23.2% and 23.0% of respondents, respectively. "IGCC with CCS" and "small scale reforming based on membrane technology" are preferred by a bit less respondents, by 16.7% and 19.4% respectively. Less than 10% of respondents prefer "hydrogen production via coal gasification with CCS" (9.5%) or "ECBM" (7.7%).

5.3 Acceptance

Only minute percentages (1.4 to 6.4%) of respondents stated to find specific CCS technologies so unacceptable, that they considered taking action when this technology were to be implemented on a large scale in the Netherlands. Of the six CCS technologies, "ECBM" was named most as unacceptable. Still, only 6.4% of all 995 respondents in the ICQ considered this technology unacceptable. "IGCC with CCS", "hydrogen production via coal gasification with CCS" and "small scale reforming based on membrane technology with CCS" were considered unacceptable by less than 5% of respondents. "Hydrogen production via steam reforming with CCS" and "SOFC with CCS" were considered to be unacceptable by less than 3% and less than 2% of respondents, respectively. It seems therefore unlikely that many Dutch residents would object to the implementation of any of these CCS technologies.

We analyzed whether respondents background variables influence overall evaluations, choices and acceptance of CCS options. Variables such as gender, education, involvement with the issue, donations to environmental NGO's or political preference seem to cause little to no difference in the overall evaluations of the technologies (see Paragraph 4.2.5 for more details).

5.4 Relationship between evaluations of aspects or consequences and CCS technology grades

Before respondents in the ICQ evaluated the CCS technologies overall, they were asked to evaluate the aspects and consequences of these technologies. By analyzing the relationship between the overall evaluations and the evaluations of the aspects and consequences, it becomes clear how respondents' evaluation of the aspects and consequences influences respondents' overall evaluation of a technology. The analyses have shown that what respondents' think of the aspects and consequences moderately influences how respondents evaluate the technologies overall (5 of 6 multiple regression coefficients above .50). In other words, although the respondents did base their judgment of the technologies for a reasonable part on the aspects and consequences of the technologies, part of their judgment is not explained by this. Although the aspects and consequences of the technologies in the ICQ were selected by experts as the most important aspects and consequences, it seems that either not all the arguments that are important to respondents are stated in the given information, or respondents had not quite made up their mind yet. An important conclusion that can be drawn from the low to moderate individual correlations between most of the aspects or consequences and the overall evaluations is that none of the overall evaluations seem to be based on one or a certain kind of aspect or consequence. This means that none of the aspects or consequences that are evaluated in the questionnaire can solely predict the overall evaluation of a technology in the questionnaire. This suggests that it will be very hard to influence the public overall evaluations of a technology by changing single aspects or consequences of a technology. On a more positive note, as all technologies are evaluated as adequate and as there seem to be no aspects or consequences that are such a negative influence that this could solely bring down the overall evaluations, there seems to be no reason to change single aspects or consequences.

5.5 General comments

In this study, it is clearly shown that the current public opinions on CCS options, assessed by traditional questionnaires, are mostly *pseudo-opinions*: they are unstable (change within twelve minutes) and are affected by tiny amounts of non-diagnostic information and by the mood of the respondent. These uninformed opinions are totally worthless for predicting future public opinions on CCS options
All in all, the results of the ICQ suggest that, after processing relevant information, people are likely to agree with large scale implementation of each of the six CCS options. Respondents find all CCS options on average "adequate", seldom find these options unacceptable and do not choose one of the options over the others with a majority of respondents.

One of the advantages of this study, which was restricted to six CCS options is that respondents could be informed on sometimes subtle differences and similarities between options. Another advantage is that we could measure if that information was also evaluated differently and how this affected the overall evaluations of the six options. Results showed that the six CCS options were evaluated moderately positive, without big differences between options. Now that we now this, it would be interesting to find out if these moderately positive evaluations of CCS options remain intact (or become more negative or positive) in another comparison. The evaluations and choices in the current study are made by the respondents within the context of the presented choice problem. This choice problem restricted the choice of respondents for energy options to CCS options. When the CCS options are compared with other energy options, such as renewables, nuclear energy or efficiency options, overall evaluations might change. As it would be valuable to study how CCS options would be evaluated when they are explicitly compared to other ways of energy production that reduce CO_2 emissions (e.g. renewables, nuclear energy, efficiency options), preparations are being made by the authors and experts from Ecofys, Greenpeace, Natuur en Milieu, Utrecht University, and WWF, to perform such a study within the CATO project.

This ICQ study aimed to assess informed opinions on CCS options of the general Dutch public. Some of the local consequences of these CCS options would become fact only for those who live in the vicinity of power stations or CO_2 storage locations (e.g., annoyance due to drilling rigs or during construction of pipelines or a local economic boost due to construction, monitoring and other activities). When one is interested in reactions of locals to CCS options other factors come into play. We know it is often not a simple “not under my backyard” response (cf. Hisschemoller & Midden, 1999). Depending on pros and cons of the planned local activities and on how these are introduced to the local community, responses may also be positive. Among other factors, trust in organizations involved in the decision to implement CCS activities is important (e.g., trust in the oil company or in the local environmental NGO). Within the CATO program, work is in progress to study the antecedents of trust in CCS organizations as well as its consequences for processing the information provided by these organizations (e.g. Ter Mors et al. 2006, and Terwel et al. 2006).

A reservation concerns the prediction the ICQ results can make for future opinions on CCS options. Respondents in the ICQ processed valid and balanced information on aspects and consequences of the CCS options. The evaluations that result from this are not as much an indication for current public opinions on CCS options, rather they are an indication for potential public support for CCS options after the public is fully informed about pros and cons of CCS options.

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Appendices

Appendix 1: Expert Information on the aspects and consequences of the six policy options (In Dutch)

The tables in this appendix contain the expert information in condensed form. They are mainly the result of a series of expert interviews (See Faaij et al., 2004).

Note: Every single table about one technology is divided over two pages. The first column, with the categories for the rows, is valid for the right page part of the table also.

Systeem I: De optie wordt verondersteld 40 Mton CO_2 emissie per jaar ter voorkomen.

Primary fuel	**Conversie technologie**
1. Kolen	Op kortere termijn grootschalige **IG/CC's** krachtcentrales (>1000 MWe) met CO_2 verwijdering (met ongeveer 50% elektrische efficientie) gerealiseerd binnen grote industriele complexen. Beschikbare technologie met enig optimalisatie potentieel

Systeem I: Ingeschatte impacts & gevolgen.

	Kosten energiedragers	**Ontwikkelings kosten**	**Efficientie gebruik fossiele Bronnen**	**Milieu gevolgen**	**Veiligheidsrisico's**
Primaire brandstof: Kolen	**Ca. 3-5 Euroct/kWh (20-70% duurder dan huidige elektriciteit).** **Bij aanvang bovenkant vd range: onzekerheid over opslagkosten** **Kosten monitoring van gedrag opslagmedia over langere tijd (30 tot mogelijk 100 jaar) dienen te worden verdisconteerd.** **Berekening NWS:** **Industrie 26-74% duurder, huishoudens 9-26% duurder**	**Beperkt**	**40 – 48% overall elektrisch rendement; hogere waarde voor langere termijn. Totaal rendement (incl, warmte)** **(60-70% wanneer afzet mogelijk is; niet gegarandeerd)**	**Van relatief schoon tot zeer vuil (of andersom); prominent onderdeel van het totale milieuprofiel. Onderscheid dagbouw/schachtbouw; duidelijk vuiler dan aardgasproduktie. (lokale/regionale effecten op grondwater, landschap, stofemissies)**	**Relatief veilig tot veel ongevallen**
Technologie: IG/CC		**Beperkt (0)**	**Baseline zonder CO_2-afvang ca. 10% efficienter (…)**	**- CO_2 < 10%; Na duizenden jaren verlies van enkele procenten van opgeslagen CO_2 in goede gevallen, maar kan veel hoger zijn.** **- Verzuring: niveau aardgas; naar nagenoeg nul-Emissies zware metalen mogelijk discussiepunt.** **- Vast afval: verglaasde as (veel minder schadelijk)** **-met name aan NOx moet nog wat gedaan worden.**	**(0) onveranderd**
Energie-infrastructuur: electriciteits net		**N.V.T.**			
CO_2-infrastructuur		**Grote velden beperkt.** **Kleine velden/ aquifers fors meer.**		**Putten slaan; overlast minimaal; vergelijkbaar met gaswinning. (verkeer; 3 mnd testperiode; geluid van compressor. Op zee veel minder overlast).**	**Nihil; zeker binnen industriele omgeving.**
CO_2-opslagmedium		**Beperkt, maar meer dan gasveld; bij kleinere velden veel meer putten, monitoring.** **Demonstratie-stadium moet nog worden doorlopen.**		**- Impacts naar verwachting nihil voor gasvelden met kleine onzekerheden; vragen over bestendigheid oude putten en oplossen caprock.** **- Aquifers zuurder, maar geen waarneembaar effect op beoogde diepte. Zeer langzame geochemische processen (vele eeuwen in Nederland); mogelijk release van zware metalen bij lekken. Impacts zijn lokatiespecifiek; leakage rate kritische grootheid.** **– Micro-seismische activiteit; bij nieuw 'zetten' van breuken kansen op bevingen & lichte schades; risico afhankelijk van lokatie; meer onzekerheden (+/-).** **- Diffusierisico minimaal.**	**Onzeker maar miniem tov kolenproduktie; binnen enkele eeuwen kans op langzame ontsnappingen;. Mogelijk 1 op de 50 velden minder goed.** **Blow outs boorputten kunnen technisch (helemaal) ingeperkt. Inperking risico door simpele monitoring en evt. gecontroleerde ontsnapping. Verstikking bij lekken (kelderruimtes).** **Risico's deels onbekend bij opslag onder overdruk**
Eindgebruik		**N.V.T.**			

Infrastructuur	CO_2 infrastructuur	CO_2 opslag medium	Eind gebruik
Elektriciteit, distributie via het normale net; evt. Benutting van restwarmte en syngas	Grote capaciteit, dedicated CO_2 transport naar off-shore locaties	Grote schaal; zoute aquifers en gasvelden	allerlei (elektriciteit)

Betrouw- baarheid energie-	**Totale potentieel van de optie**	**Infrastructuurveranderingen en mogelijke conflicten andere ontwikkelingen**	**Vereiste innovaties (+ onzeker heden)**	**Macro-economische gevolgen**
Stabiele aanvoer: vele leveranciers die geografisch gespreid zijn.	**Enkele eeuwen; afhankelijk van mondiale scenario's.**	**Nihil**		**(++) Verhoging stabiliteit energievoorziening vgl gas en olie.** **(effect bescheiden; ook sterk afhankelijk keuzen en ontwikkelingen buitenland)**
Vergelijkbaar huidige elektriciteits-voorziening. **Op kortere termijn verminderde beschikbaarheid.**		**Beperkt tot aanzienlijk (0/+); inpassing in industriele complexen: afzet warmte niet gegarandeerd; over langere tijd qua implementatie lastiger.**	**Beperkt; optie zeker toepasbaar**	**(0) Verwaarloosbaar tav technologie-export.**
		Nihil; mogelijk uitbreiding capaciteit hoofdnet.vereist.	**N.V.T.**	**(+) hogere betrouwbaarheid, minder kwetsbaar, betere concurrentie positie industrie; verhoogd diversiteit in energievoorziening; bijdrage aan gezond portfoliomanagement**
		Beperkt (off-shore leidingen) (0/+).	**Nihil – tot zekere hoogte**	**(+) investeringen nodig; (beperkt) extra banen**
	Worst case: (incl. Inperkingen door milieubeleid; zeker on-shore): ~100jr? Zeer onzeker. Ca. 200 –500 / 2000 jaar opslag. **Hoge kwaliteit gasvelden ca. 200 jr.** **(140 Mton nu beschikbaar; Annerveen). Potentieel sterk afhankelijk van gestelde eisen tav veiligheid/leakage.** **Berekeningen NWS: 25-114 jaar**	**Mogelijk competitie CO_2 opslag en gaswinning; pas na 2020 grootschalige import.** **Groninger veld pas na 2020- 2040 (of na 2050 afhankelijk van balansfunctie die in beleid wordt gekozen) bruikbaar voor opslag.** **Tot ca. 2025 blijft Slochteren een 'swing' (regel) functie houden.** **Vereiste nieuwe institutionele infrastructuur CO_2 beheer lange termijn.**	**Nihil; Monitoring en aanzienlijk onderzoek noodzakelijk. 30 jaar monitoring nodig, mogelijk langer.**	**Mogelijk concurrentie CO_2-opslag enkele gasvelden met waardevolle bufferfunctie voor gasdistributie;** **Nederland mogelijk internationaal leverancier van CO_2 opslagcapaciteit.**
		N.V.T.	**N.V.T.**	**Hogere elektriciteitsprijzen hebben (ook) nadelige macro-economische gevolgen.**

Systeem II De optie wordt verondersteld 40 Mton CO_2 emissie per jaar ter voorkomen.

Primary fuel	**Conversie technologie**	**Infrastructuur**	CO_2 **infrastructuur**
2. Aard gas	**SOFC** brandstof cellen; 10 - 50 Mwe capaciteits range, hoge electriciteits efficientie(~ elektrische 40 – 50%; Overall energie efficientie 60-70% inclusief warmte gebruik EN CO_2 opslag). Mogelijk commercieel beschikbaar tegen lage kosten rond 2020	Elektriciteit, toegepast bij bedrijven en stedelijke gebieden; alle in combinatie met warmte distributie	Kleinschalig niveau; vereist goed ontwikkelde CO_2 infrastructuur

Systeem II: Ingeschatte impacts & gevolgen.

	Kosten **energiedragers**	**Ontwik-kelings kosten**	**Efficientie gebruik van fossiele** **Bronnen**	**Milieu gevolgen**	**Veiligheids-** **risico's**
Primaire brandstof: aardgas	**3-10 Euroct (gelijk tot drie keer zo duur als huidige elektriciteit); grote onzekerheid;** **kan duurder blijven. En sterk afhankelijk aardgasprijzen.** **Berekening NWS:** **Industrie 49% duurder, huishoudens 17% duurder.**	**N.V.T.**	**Gelijk waardig tot verbetering van ca. 20% tov huidige warmte- en krachtvoorziening (overall energetisch rendement ca. 70%)**	**Winning en deels internationaal transport; lekkages nu daarbij tot 1-10% van de methaan (Siberie); verbetering op langere termijn.** **Indirect energiegebruik in Rusland…?** **In Nederland bodemdaling; schade bij Waddenzee; op land soms positief.**	**Onveranderd**
Technologie: SOFC met H2 produktie		**Significant (+); hoog bij behalen laag kostenniveau**		**GHG < 5% tov huidig, mits methaanlekkages minimaal zijn.** **Verzuring; nihil.** **Afval: N.V.T.**	**Vergelijkbaar met nu**
Energie-infrastructuur: electriciteitsnet + warmtebenutting		**N.V.T.**			
CO_2**-infrastructuuur**		**Beperkt**			**Zeer beperkt; fijnmazige structuur vereist**
CO_2**-opslagmedium**		**beperkt**		**(zie I)** **aquifers wat hogere kans op geleidelijke ontsnapping dan gasvelden.**	**Goeddeels onbekend**
Eindgebruik energiedrager		**N.V.T.**			

CO_2 **opslag medium**	**Eind gebruik**
Kleinschalige reservoirs haalbaar; kolenlagen, kleine gasvelden, of verbonden met grote reservoirs	Allerlei; toepassingen in industriele sectoren en in de gebouwde omgeving mogelijk in combinatie met warmte distributie.

Betrouwbaarheid energievoorziening	**Totale Potentieel van de optie**	**Infrastructuurveranderingen en mogelijke conflicten andere ontwikkelingen**	**Vereiste Innovaties (gerelateerde onzekerheden)**	**Macro-economische gevolgen**
Prijsfluctuaties mogelijk op langere termijn zeer beperkt. Liberalisering leidt waarschijnlijk tot structureel lagere prijzen. **Creeeren buffers nodig om betrouwbaarheid verhogen; heeft prijsopdrijvend effect na ca. 2020.**	**Eigen voorraad ~30-50 jr; Inclusief import halve tot enkele eeuwen (sterk afhankelijk type reserves). Op korte termijn belangrijke invloed goedkope reserves van bv. Noorwegen. Mogelijk verhoging gasproduktie door CO_2 injectie (ER), maar onzeker (0-15% extra).** **Gashydraten; paar 1000 jaar; pas op langere termijn mogelijk relevant; onzekere en risicovolle resource**	**Investeringen in exportlanden dienen voortgezet (huidige trend).**		**(+ tot -) gevolgen zijn positief bij genoeg binnenlandse reserves, negatief wanneer geimporteerd moet worden. Binnenlandse reserve-ontwikkeling kent onzekerheden: tussen 2020 – 2030 opstart structurele import uit Rusland, Algerije en LNG.**
Microniveau: iets slechter tot vergelijkbaar huidig technologie; totale voorziening verbeterd.		**Veel nieuwe kleine centrales geintegreerd in woonwijken; gecompliceerd (+/++); vervanging grote centrales.**	**Hoog (++), veel onzekerheden**	**(0/+)nauwelijks (import) tot redelijk ontwikkelings- en export-potentieel. Niet wezenlijk anders dan huidige situatie.**
Verbeterd (distributed generation), mits elektriciteitsnet aangepast. **Fluctuerende bronnen relatief makkelijk in te passen.**		**Realiseerbaar en inpasbaar; wel significant (+); warmte distributie.** **Deel fijnmazig aardgasnet overbodig; verlies flexibiliteit kleinschalige opties (koken op gas, micro-WKK).** **10-50 mW centrales zijn forse investeringen, typisch voor de langere termijn. Je legt hiervoor nl. een nieuwe infrastrcutuur aan. Hierdoor kunnen inversteringen op korte termijn geblokkerd worden. Sterke concurrentie met kleinschaliger efficientere systemen.**	**Beperkt/aanzienlijk door noodzaak ander elektriciteitsnet.**	**(+); relatief hoge investeringen infrastructuur, maar spreidbaar in de tijd.** **Ervaring systemen exporteerbaar.**
		(++); fijnmazig; kost veelvoud aardgasnetwerk (in 10-15 jr uitgevoerd); overlast beperkt	**Nihil**	
	400 – 4000 jr **Berekening NWS: 58-268 jr**	**Verkrijgen van vergunning voor het boren van putten kan zo'n twee jaar duren.**	**Beperkt (monitoring, onderzoek)**	
		Beperkt		**Duurdere elektriciteit leidt tot lager gebruik vs. Schonere energie is kleinere rem op gebruik.**

Systeem III De optie wordt verondersteld 40 Mton CO_2 emissie per jaar ter voorkomen.

Primary fuel	**Conversie technologie**	**Infrastructuur**
3. Kolen	Grootschalige waterstof productie (kolen vergassing); conventionele, beschikbare technologie; korte termijn optie, grootschalige centrales (>2000MWth) in industriele omgeving. Deze technologie kan goedkoper en efficienter worden door gebruik van geavanceerde kolenconversie via vergassing en keramische membraan technologie (welke mogelijk beschikbaar is rond 2020-2030)	Grootschalige waterstof gebruik. Twee key toepassingen welke geconcentreerd kunnen worden in bepaalde regios zoals de Rijnmond, IJmuiden –Amsterdam regio en andere. 1 Industriele gebruikers 2 Distributie tot en met medium schaal (bijv. Transport/ tankstations)

Systeem III: Ingeschatte impacts & gevolgen.

	Kosten **energiedragers**	**Ontwikkelings** **kosten**	**Efficientie gebruik van fossiele bronnen**	**Milieu gevolgen**	**Veiligheidsrisico's**
Primaire brandstof: Kolen	**Ca. 5 – 10 Euro/GJ waterstof aangeleverd bij de gebruiker.**	**N.V.T.**		**Van relatief schoon (0) tot zeer vuil (--)**	**Relatief veilig (0) tot veel ongevallen (--)**
Technologie: Grootschalige vergassing en waterstofprodukti e	**Tot 2 maal zo duur (kortere termijn) als benzine, diesel of gas.** **Berekeningen NWS:** **Industrie 85-135% duurder,** **Transport 26-33% duurder**	**Significant (+) voor lange termijn**	**Kolen -> waterstof: ca. 50-70%;** **(korte-lange termijn)**	**-Beperkt tot aanzienlijk beter tov raffinaderijen.** **-Minder gevaarlijk afval / vgl met raffinaderijen** -CO_2 **< 10%** **-restafval, verglaasde as**	**Ongewijzigd tot (++), toename risico's.**
Beperkt waterstofdistributi e tot 'medium' schaal H2-net & tankstations		**Beperkt (0/+)**		**Nihil**	**Deels onbekend; vermoedelijk vergelijkbaar (kritische kanttekening; vgl. met LPG) huidig, maar kans op meer ongevallen dan bij gas (explosies). Risico's zijn in te perken.**
CO_2- **infrastructuur**		**Nihil**		**Nihil**	**Nihil**
CO_2- **opslagmedium**		**Nihil**		**Nihil voor gasvelden; aquifers zuurder; risico nihil**	**Onzekerheden, maar iig zeer klein**
Eindgebruik energiedrager: industrieel & transportsector		**Beperkt (0/+)**	**Variabel; vergelijkbaar (0) tot aanmerkelijk beter (factor 1.5 -2)**	**Fors verlaagde emissies industrie en transport (tot 100%)**	**Vergelijkbaar huidig; maar met onzekerheden**

CO_2 **infrastructuur**	CO_2 **opslag medium**	**Eind gebruik**
Zeer grote schaal transport capaciteit en opslag vereist; enkele hoofdpijpleidingen (off-shore) zijn voldoende.	Grote schaal; zoals zoute aquifers en (grote) gasvelden. toegang tot (kleinere) gasvelden and kolenlagen zou kleinschaliger CO_2 infrastructuur vereisen	Niveau 1. Bedrijven. Niveau 2. Transport sector

Betrouwbaarheid **energievoorziening**	**Totale** **potentieel** **van de optie**	**Infrastructuurveranderingen en mogelijke conflicten andere ontwikkelingen**	**Vereiste innovaties (gerelateerde onzeker** **heden)**	**Macro-economische gevolgen**
Stabiele aanvoer; (++) tov olie	**Enkele (2) eeuwen**	**Beperkt**		**(++/+++) toename stabiliteit prijzen, betere concurrentieposisitie voor chemische industrie, (aanzienlijk) stabieler dan olie-import; lagere kosten**
Vergelijkbaar huidige produktie		**(++) Ingrijpend; vervanging raffinagecapaciteit en complexe inpassing in industrie.** **-Minder flexibel qua realisatie.**	**Beperkt tot significant voor lange termijn technologie**	**Beperkt (0/+) tav technologie-export.**
Verbeterd (+)		**(zeer) significante toename veranderingen (+/++); tankstations & in eerder stadium ombouwen gasinfrastructuur.**	**Beperkt (0/+)**	**Toename positieve gevolgen + (investeringen infrastructuur en eindgebruik)** **(++) tav diversificatie, risicospreiding en betrouwbare aanvoer**
		(0/+) Beperkt; hoofdleidingen	**Beperkt**	
	Grote gasvelden: 25 jr EU emissie; 40 jr NL emissie. Totaal enkele eeuwen – 2000 jr. **Berekeningen NWS: 21-101 jr**	**Verkrijgen van vergunningen kan zo'n twee jaar duren.**	**Beperkt**	
Verbeterd (+)		**(0) voor industrieel gebruik tot toename (+) infrastructuurveranderingen: aangepaste processen en voertuigen**	**Onzeker; mogelijk significant.**	

Systeem IV De optie wordt verondersteld 40 Mton CO_2 emissie per jaar ter voorkomen.

Primary fuel	**Conversie technologie**	**Infrastructuur**
4. Aardgas	Grootschalige waterstof productie (via verscheidene soorten reforming methoden); conventionele, beschikbare technologie welke toegepast kan worden op grote en kleinere schaal (300 – 2000 MWth). In de loop van de tijd zijn prestatieverbeteringen (lagere kosten, hogere efficientie) mogelijk.	Grootschalige waterstof gebruik vereist Drie niveau's: 1.Grote industriele gebruikers 2.Distributie tot medium schaal (bijv. transport/ tankstations) 3.Gebouwde omgeving.

Systeem IV: Ingeschatte impacts & gevolgen.

	Kosten **energiedragers**	**Ontwikkelings** **kosten**	**Efficientie gebruik van fossiele** **bronnen**	**Milieu gevolgen**	**Veiligheidsrisico's**
Primaire brandstof: aardgas	**Ca. 30% duurder dan aardgas of benzine** **(~ 7-9 Euro/GJ)**	**N.V.T.**		**Ongewijzigd tot kleiner of gelijk aan 10 %, misschien zelfs wel 5 %.**	
Technologie: Grootschalige reforming voor waterstofprodukti e	**Berekingen NWS:** **Industrie 73-105% duurder,** **Transport 24-28% duurder,** **Huishoudens 34-43% duurder**	**Nihil**	**70% korte termijn; ~85% langere termijn**	**GHG < 10%,** **Met huidige technologie mogelijk hogere NOx emissies** **Op termijn (FC) halvering tot 90%) voor verzuring en stof.**	
Energieinfrastructuur: waterstofdistributie 'medium' schaal als tankstations en Gebouwde omgeving		**Beperkt**			**Vergelijkbaar/verslechterd veiligheidsniveau als gas; met name hoge druk H2 in GO.**
CO_2- **infrastructuur**		**Nihil**			
CO_2- **opslagmedium**					
Eindgebruik energiedrager: industrieel, transportsector, GO		**Beperkt; tot significant wat betreft toepassing (GO).**	**-Gebouwde omgeving geen winst. Mogelijk zeer micro-WKK op niveau van woningen/woonblokken voor behalen efficiencyvoordeel.** **-Industrie; mogelijk daling efficiency ~15% (niet bevestigd).**		**Vergelijkbaar; deels onbekend en deels nieuwe risico's vgl met aardgas. Deels vgl. Met LNG.** **Bij gebruik GO; H2 lekt veel makkelijker dan aardgas. In huizen daardoor (mogelijk) hogere risico's. Meer veiligheidscontrole en uitgebreider maatregelen nodig.**

CO_2 infrastructuur	CO_2 opslag medium	Eind gebruik
Grote schaal transport capaciteit en opslag vereist; een groot aantal kleinere reforming installaties vereisen verder ontwikkelde CO_2 infrastructuur.	Grote schaal; zoute aquifers Toegang tot (kleinere) gas velden en kolenlagen zou kleinschaliger CO_2 infrastructuur vereisen	Gebouwde omgeving is de belangrijkste sector voor waterstof gebruik. Ook de industrie en transportsector kan gebruik maken van sophisticated, goed ontwikkelde H2-infrastructuur.

Betrouwbaarheid energievoorziening	**Totale potentieel van de optie**	**Infrastructuurveran-deringen en mogelijke conflicten andere ontwikkelingen**	**Vereiste innovaties (gerelateerde onzekerheden)**	**Macro-economische gevolgen**
(- tot 0) Vergelijkbaar huidige voorziening.	**Enkele eeuwen**			**+/- (positief binnenlandse reserves, negatief bij import). Na 2020 import uit Rusland.**
		Beperkt; deel aardgasinfrastructuur beperkter gebruikt	**Nihil**	**(+) aanzienlijke investeringen infrastructuur en eindgebruik; exportpotentieel beperkt.**
		(+++) zeer ingrijpend; bij fijnmazige H2 distributie	**Beperkt tot significant; nieuwe materialen en protocollen.**	
		Beperkt (alleen hoofdleidingen)	**Nihil**	
	200 – 3000jr (factor 2 meer dan kolen). **Berekening NWS: 58-280 jr**			
		(+++) vergaande consequenties voor huishoudens en industrie; andere of aangepaste apparatuur en processen.	**Significant (+); bv. tav veiligheid distributie GO**	

Systeem V De optie wordt verondersteld 40 Mton CO_2 emissie per jaar ter voorkomen.

Primary fuel	Conversie technologie	Infrastructuur
5. CBM	Dedicated projecten met weinig kostende beschikbare CO_2 en vervolgens productie van methaan. Methaangas conditioning on site noodzakelijk. Relatief duur maar toepasbaar op korte termijn (ca. 2010)	Gebruik van aardgasnet; ontwikkeling op de CBM locatie van gas verzamel netwerk en gas-upgrading

Systeem V: Ingeschatte impacts & gevolgen.

	Kosten Energie-dragers	Ontwikkelings kosten	Efficientie gebruik van fossiele bronnen	Milieugevolgen	Veiligheidsrisico's
Primaire brandstof: Coal Bed Methaan	**Tot 3x zo duur als aardgas (12 Euro/GJ)** **Berekeningen NWS: 38-300 % meer.**	**Nihil tot +**	**Vergelijkbaar huidige ketens; afhankelijk van situatie wat hoger of lager dan huidige ketens.**	**+ geen mijnbouw**	
Technologie: CO_2 injectie in kolenlagen en CH4 produktie		**Significant (+)**		**Afvalwater (0; oplosbaar).** **Landschapseffecten zijn zeker honderd bovengrondse boortorens, (lager dan 20 m), te plaatsen in beschermd landschap.** **GHG <10% (negatief; verhouding 1:2)**	
Energie-infrastructuur: aardgasnet + verzamelnetwerk		**Nihil**			**Nihil**
CO_2-infrastructuur		**Nihil tot +, gas moet eerst geconditioneerd worden voor het in het aardgasnetwerk gepompt kan worden.**			**Beperkt**
CO_2-opslagmedium; **Niet door normale mijnbouw exploiteerbare kolenlagen.**		**Beperkt tot zeer hoog (++) Monitoring, onderzoek, proefboringen**		**Risico verzuurd grondwater, meer onderzoek nodig, maar andere expert zegt dat hij nooit een serieuze referentie voor dit risico is tegengekomen.**	**Meningen verschillen van veiliger dan in gasvelden, even veilig als in gasveleden tot tussen gasveld en aquifer in.**
Eindgebruik vervanging aardgas.		**N.V.T.**			

CO_2 infrastructuur	CO_2 opslag medium	Eind gebruik
Dedicated CO_2 infrastructuur en CO_2 distributie op CBM locatie noodzakelijk	Kleinere schaal projecten; CO_2 opslag in kolenlagen	Allerlei (vervangt aardgas)

Betrouwbaarheid energievoorziening	Totale potentieel van de optie	Infrastructuur-veranderingen conflicten andere ontwikkelingen	Vereiste innovaties (gerelateerde onzekerheden)	Macro-economische gevolgen
Onzekerheden tav betrouwbare en mogelijkheden exploratie. Systeem zelf zeer betrouwbaar over kortere tijd (+) versus ervaring met ECBM is gering en betrouwbaarheid is daarom nog niet bewezen. Over langere tijd bij grootschalige toepassing onzekerheden tav aanvoer.	**Onzeker; 10-50 jr; mogelijk meer.**	**Nihil**		**(++) binnenlandse energiebron**
		(+ tot +++) zeer veel injectie- en winningsputten, tot 50 keer zoveel dan bij andere CO_2-opslag; regelgeving tav AWZI.	**Beperkt: Tests, onderzoek en monitoring**	**(++ tot +++), toename positieve gevolgen. Diversificatie, stabiliteit prijzen.** **Beperkte extra werkgelegenheid.**
		Nihil tot (++) inpassing in landschap potentieel grote (juridische) conflictbron.	**Nihil**	
		Beperkt (+ tot 0)	**Nihil**	
	Onzeker; 50-100jr bij goed ontwikkelde technieken. **Berekening NWS: 3,8 tot 33,8 jaar.**	**Mogelijk conflict met toekomstige kolenexploitatie technieken en concessiehouders**	**Significant (+); monitoring en onderzoek; produktietechnieken moeten nog bewezen.**	
		Nihil		

Systeem VI De optie wordt verondersteld 40 Mton CO_2 emissie per jaar ter voorkomen.

Primary fuel	**Conversie technologie**	**Infrastructuur**
6. Aard gas	Geavanceerde kleinere schaal reforming gebaseerd op membraan technologie voor waterstof productie 'op locatie'; energie efficientie van ~ 85% met CO_2 geproduceerd 'op transportdruk' kosten reductie and optimisatie gewenst; gewenste performance verwacht rond 2010	Maakt gebruik van bestaande aardgasnet. Aansluitend gebruik van geproduceerd waterstof direct bij de tankstations, hetgeen de noodzaak van een aparte waterstof infrastructuur goeddeels wegneemt.

Systeem VI: Ingeschatte impacts & gevolgen.

	Kosten energiedragers	**Ontwikkelings kosten**	**Efficientie gebruik van fossiele bronnen**	**Milieu gevolgen**	**Veiligheidsrisico's**
Primaire brandstof: aardgas	**20-100% duurder dan benzine (7-12 Euro/GJ)** **Efficiency voordeel zal leiden tot lagere kosten per gereden kilometer; ook belangrijke drijvende factor voor implementatie.** **. Beperkter voordeel bij inzet hybride motor (geen exacte schatting)** **Berekening NWS:** **41% duurder**	**-**	**20 – 100% beter dan huidige ketens. (well-to-wheel)** **Efficiency FCV's op korte termijn niet veel beter.**	**GHG <10%** **Verzuring en smog door verkeer <10% huidige niveau's**	
Technologie: kleinschalige reforming voor H2-produktie met CO_2 afvang 'op druk'		**(++) nieuwe techniek;**			**Nihil; Deels onbekend**
Energie-infrastructuur: aardgasnet + waterstoftankstations		**(0/+) beperkt**			**Laag; deels onbekend**
CO_2-infrastructuur: fijnmazig		**Beperkt/significant**			
CO_2-opslagmedium		**-**			
Eindgebruik: transport-sector (vervangt diesel en benzine)		**(+) Andere voertuigen**			**Laag; deels onbekend**

CO_2 infrastructuur	CO_2 opslag medium	Eind gebruik
Vereist kleinschalige CO_2 infrastructuur (verbonden met hoofd pijpleidingen)	Diverse, zowel klein schalige projecten (kolenlagen, gasvelden) en grootschalige opslag uitvoerbaar	Met name relevant voor de transport sector (waterstof aangedreven voertuigen).

Betrouwbaarheid energievoorziening	**Totale potentieel van de optie**	**Infrastructuur-veranderingen en mogelijke conflicten andere ontwikkelingen**	**Vereiste innovaties/gerelateerde onzekerheden**	**Macro-economische gevolgen**
Onveranderd tov huidige voorziening	**Eeuw -enkele eeuwen; (50-100 jaar) ook LNG import.**			**Toename positieve gevolgen bij vervanging import aardolie door binnenlands aardgas (+) vs. Gelijk bij import gas (0)**
		Vervanging raffinage capaciteit (0/+); veel kleine installaties (++) **Vrij snelle introduktie vereist; daardoor veel investeringen in korte tijd.**	**(++) hoog (deels onzeker)**	**(++) Hoge investeringen infrastructuur; mogelijk exportpotentieel**
		(++) vervanging tankstations; moeilijk geleidelijk in te voeren (wel qua ontwikkeling)	**Beperkt**	
		(++ tot +++) fijnmazig; moeilijk geleidelijk in te voeren.	**Aanzienlijk tot heel ingewikkeld (+/++ tot +++)**	
	Eeuwen – 4000 jr. (400 – 1000jr) **Berekening NWS: 54- 252 jr**			
		(++) vervanging transportvloot. **Produkiecapaciteit nieuwe voertuigen moet snel op gang komen; is nu (nog) niet zichtbaar en moeilijk op gang te brengen.**	**(++) FC-voertuigen & opslag; onzekerheden FCV nog steeds groot. ; grote behoefte edelmetaal per auto op dit moment. H2 Opslag auto's kritisch element; vloeibare opslag duur en boil-off verliezen. Nieuwe opties (bv. hybrides) nog zeer onzeker.**	**(+)**

Appendix 2: English translation of the information for lay people

This English translation encompasses all the information from the experts that was translated for lay people. However, it does not contain all information respondents received. A few explanations about current Dutch energy use and sources and how this can affect our climate have been omitted. Explanation concerning other ways to reduce carbondioxide emissions has also been omitted. Keep in mind that this English translation has not been tested for comprehensibility by lay people as the Dutch version has been. This means that this English version is not the equivalent of the Dutch version when it comes to comprehensibility.

Greenhouse effect

The average increase in temperature on the earth may have a number of consequences which could influence the lives of many people. The average increase in temperature does not mean that temperatures are increasing all over the world. The increase in temperature can influence the climate in such a way that in some regions the weather becomes colder, wetter or more windy. You will now receive information about the consequences of the increase in temperature caused by the greenhouse effect. How much the consequences mentioned below will occur depends on how much the temperature increases. Consequences of the temperature increase are not necessarily negative; some consequences may be positive.

Consequences of the increase in temperature caused by the greenhouse effect.

1 The expected increase in temperature has consequences for the climate of the entire world. Some regions of the world may experience extreme drought as a result of global warming. The chances are fair to high that global warming will lead to an increase of failed crops and famine, especially in regions where temperatures are already high.

2 Other regions may face heavy rainfall and snowfall, making the chance floods reasonably to highly likely.

3. All over the world storms will in all probability become more violent. Damages caused by storms will increase.

4. The increase in temperature will cause part of the polar cap to melt and the oceans to expand, which will cause the sea level to rise. This rise may go up to 25 centimetres by 2050, causing some of the lower lying regions in the world to be submerged. For example, countries that consist of groups of small islands are expected to be partially or completely submerged in the course of this century as a result of the rise in sea level. Nature will be affected all over the world, and natural habitats will disappear as a result of the increase in temperature and the rise in sea level. As a result, many species of plants and animals may face extinction

5. In the Netherlands, the increase in temperature on earth could mean that we are more often confronted with rivers flooding because of heavy rains, which will diminish the area available for living and working. Measures will have to be taken to protect the coastline from the rise in the sea level and the heavy storms. The coastal defences must be strengthened, for instance by increasing the height of the dykes. In addition, river dykes will need to be built up to prevent flooding. Implementing such measures is very costly, possibly so costly that the economy will suffer.

6. Not all countries have the possibility to spend so much money. The poorest countries of the world are probably least able to take adequate preventative measures and will therefore suffer most from the consequences of the increase in temperature. Floods, for example, already cause annually tens of thousands of deaths worldwide, and this number may increase exponentially over the course of the century. These deaths will, for the most part, occur in poorer countries.

7. In the Netherlands, the summers will be warmer and there will be more heat waves. People in poor health (for example the elderly) will more often be ill and die of heat and of the increase in germs. The warmer summers may cause an increased incidence of tropical diseases in the Netherlands.

8. The winters in The Netherlands will be less cold. There will be fewer cold fronts, so that less people will fall ill or die because of the cold.

9. If the temperature continues to rise during this century, it is possible that this will cause changes in the warm ocean currents. The Gulf Stream may shift considerably towards the south. This could lead to a dramatic cooling of the climate in the Northern Hemisphere. The cooling of the Northern Hemisphere could, according to still very tentative predictions, take place within a number of years. In contrast to the consequences discussed above, this change in climate is so abrupt, it is almost impossible to adjust by taking adequate measures.

Capture and underground storage of CO_2 in The Netherlands

How can we remove CO_2? Burning fuels such as coal and natural gas for energy produces CO_2. With special techniques, this CO_2 can be captured and transported through pipelines to underground storage areas. CO_2 can be stored in naturally sealed subterranean spaces or under the ocean floor. These spaces can be empty gas fields, such as underground spaces from which natural gas has been won. CO_2 can be pumped into these empty gas fields. CO_2 gas can also be stored in deep underground spaces covered by a gas-tight layer. These spaces can be found under the Netherlands as well as under the North sea. CO_2 can be pumped into these spaces through wells drilled into the ground or in the sea floor. Finally, CO_2 can be stored under The Netherlands in deep layers of coal which cannot be mined.

If we wish to reduce CO_2 emissions in The Netherlands by 20 percent with these methods, a great deal of CO_2 must be stored. The space available for CO_2 storage is limited. If a certain amount of CO_2 is stored annually, the available space will be filled within a number of years. How long the storing of CO_2 can go on, depends therefore on the amount of CO_2 stored and the amount of space available for CO_2 storage. Experts estimate that the amount of CO_2 that must be stored annually in the Netherlands will fill the storage space available for CO_2 under the ground and beneath the sea floor in the Netherlands within 25 to 250 years.

How long we can continue to store CO_2 on this scale depends on the answers to two questions:

1. Are the empty natural gas fields available for CO_2 storage, i.e., are they not being used for something else?
2. Does research show that CO_2 leakage will not occur in certain underground spaces, even in the long run?

If the answer to both questions is ‘yes’, then there is storage space for a maximum of 250 years. If the answer to both questions is ‘no’, then there is storage space for a minimum of 25 years.

In addition, the possible storage duration depends on the amount of CO_2 stored annually, which, in turn, depends on the technology used to generate energy. Some technologies produce greater amounts of CO_2 than others in the generation of the same amount of energy. Correspondingly, the use of some technologies will fill the available storage space sooner than others.

Consequences of CO_2 capture, transport and underground storage in the Netherlands

1. In the transportation of CO_2 through pipelines, leakages can occur, releasing CO_2 into the air. The chance of this happening is very small and comparable to the present chance of gas leakage in underground pipelines in The Netherlands. By ensuring that good systems are in

place to monitor the leakage of CO_2, major CO_2 leakages can be prevented. It is expected, that good monitoring systems make the risk of leakages occurring in CO_2 pipelines very small.

2. Too much CO_2 in the air is hazardous and can even be lethal. There may be too much CO_2 in the air if large amounts of CO_2 are quickly released and are not dispersed, such as in a mountain valley. This scenario is highly unlikely to occur in the Netherlands. In the first place, it is highly unlikely that such a large amount would be released at once. In the second place, the Netherlands are flat, so CO_2 is not likely to build up or remain undispersed.

3. Once CO_2 is stored in the underground storage space, it might leak away through poorly sealed wells, and tears and cracks in the sealing layer of the underground storage space. Although experts are not sure how much CO_2 would be released into the air, quantities are likely to be extremely small. Good systems monitoring CO_2 leakage would be able to prevent much leakage. Good monitoring of CO_2 pipelines would make the risk of leakage from underground storage space very small.

4. CO_2 leakage from pipelines or underground storage may entail various risks. There is a small chance that CO_2 leakage acidifies the surrounding groundwater. If this is used for drinking water, it will no longer be potable. CO_2 may also affect tree roots, worms or insects. In addition, there is a very small chance that the leaked CO_2 would accumulate in low lying closed spaces such as cellars. This would be hazardous and possibly lethal for humans, animals and plants occupying this type of space.

5. Subsoil storage of CO_2 can cause minor earthquakes similar to those caused by natural gas mining. This might cause small ruptures in buildings in the area.

6. CO_2 which is captured and stored underground will not enter the atmosphere, and will therefore not contribute to the increase in temperature caused by the greenhouse effect.

Large modern coal fired power stations (for private and commercial use) with CO_2 capture and storage.

In these plants, coal is converted into electricity. The CO_2 released in this process is captured and stored under the floor of the Dutch part of the North Sea. About 20 of these large plants would be needed to ensure an annual 20 percent reduction of CO_2 released into the air. These 20 plants would generate nearly all the electricity the Netherlands will need in the future. The electricity would be supplied to homes, businesses and organisations. All the plants would be built in the industrial zones near Amsterdam, Delfzijl, IJmuiden and Terneuzen, and in the Rijnmond region. Realization of this technology is envisaged in the near future, i.e. from 2010 onwards. The technical know-how for this is largely available.

1. New installations needed

The technology required involves the construction of large plants in existing industrial zones. The present electricity grid may have to be slightly extended.

2. Miners' safety

The extraction of coal may cause miners' fatalities. Coal needed for the 20 plants would be mined abroad and mining accidents occur in some countries more frequently than in others. It is reasonable to expect an annual increase of a few to dozens of deaths in the extraction of the additional fuel necessary for the 20 new plants, much depending on the countries from which the Netherlands imports the fuel.

3. Contribution to the greenhouse effect

The contribution to the greenhouse effect by the generation of electricity will be greatly decreased with this technology. The release of CO_2 into the air would be less than one tenth of current emissions from existing energy plants.

4. Contribution to acidification

The emissions from existing coal fuelled power plants contribute to acidification. Acidification leads to the extinction of plant and animal species, the death of trees, damage to agriculture, damage to monuments and property, the over-grassing of moors, and a lower quality of drinking water. Although the use of coal contributes more to acidification than the use of natural gas, the present technologies for the generation of electricity from coal ensure a greatly decreased contribution to acidification in comparison to twenty years ago. Generation of electricity with these 20 modern coal fuelled plants would lead to a lower contribution to acidification than is contributed by the existing coal fuelled power plants now.

5. Contribution to pollution in the areas surrounding the coal mines

The coal needed for the 20 plants will be mined abroad. The area around the coal mines is highly polluted in some countries, in others less polluted. The degree of pollution of the land, water, and air will vary from little to very high in the area surrounding the mines, depending on the countries from which the Netherlands imports the coal needed for the 20 plants.

6. The possible number of years this technology can be used.

There is enough fuel available to supply the plants in the foreseeable future; there is a coal supply for centuries of use. Experts, however, have calculated that the underground storage space for CO_2 under the Dutch part of the North Sea will last between 25 and 100 years.

7. Reliability of the energy supply

Experts place a great deal of importance on the reliability of the energy supply in that it is important that we will always be able to generate enough energy. Part of the fuels necessary for this must be imported from other countries. We do not wish to be dependant on the politics of only a few countries, such as the dependence on the Middle East for oil. Coal can be imported from several countries in several parts of the world. The chance that the coal needed for these 20 plants cannot be imported is thus very small. The reliability of the energy supply is, therefore, high.

8. Price

If electricity is generated in these modern coal fuelled plants, businesses will have to pay approximately three quarters more than they do now. Households will have to pay approximately one quarter more for electricity. In time (2030), these prices will drop, for example because of improvements made to the plants that convert coal to electricity increasing their cost-effectiveness and efficiency. Businesses will then pay approximately one quarter more than they pay now for electricity and households one tenth more.

Conversion of natural gas into electricity (for private and commercial use) with CO_2 capture and storage.

Natural gas is converted to electricity and heat in small fuel cells. Fuel cells are relatively cost-efficient, quiet and clean installations of various sizes in which fuel can be converted into electricity and heat. The CO_2 released through this process is captured and stored underground in the Netherlands. Hundreds of fuel cells would be necessary to ensure that 20 percent less CO_2 is released into the air annually. Nearly all of the electricity the Netherlands will need in the future is generated in these fuel cells. The electricity and heat are supplied to households, businesses and organisations. These fuel cells would be installed near businesses and within urban areas. This technology on such a large scale will probably not be possible to implement before 2020. The necessary technical advances are expected to have been realized by then, but this is not a complete certainty.

1. New installations needed
In order to implement this technology, the existing large electricity plants would have to be replaced by smaller fuel cells which convert natural gas into electricity and heat...

2. New lines needed
Many new electricity and warm water lines would have to be installed to supply users with the electricity and heat generated by the fuel cells. The necessary work would cause inconvenience.

3. New CO_2 pipelines needed
Many new pipelines would have to be installed to convey the CO_2 captured from fuel cells to storage. The necessary work would cause inconvenience because of groundwork.

4. Contribution to the greenhouse effect
The contribution to the greenhouse effect by generation of electricity would be greatly reduced though the use of this technology: The emission of CO_2 into the air would be less than one twentieth of the amount that is currently being emitted by existing electricity plants.

5. Contribution to acidification
Acidification may lead to the extinction of plant and animal species, the death of trees, damage to agriculture, damage to monuments and property, the over-grassing of moors, and a lower quality of drinking water. The existing gas-fuelled electricity plants contribute less to acidification than they did twenty years ago. The modern gas-fuelled electricity plans would hardly contribute any more to acidification.

6. The possible number of years this technology can be used
Including the gas supply from abroad, this technology could be used for a few centuries, but experts have calculated that the small-scale underground CO_2 storage space necessary for this technology is available in the Netherlands for at least 50 years, and possibly as long as 250 years.

7. Reliability of the energy supply
Experts place a great deal of importance on our being able to generate enough energy. The use of gas as a fuel is less reliable when this gas must be imported from abroad, which will be the case as from 2020. In order to ensure high reliability it is possible to store reserves of gas for later use, but this leads to a higher gas price.

8. Reliability of energy supply through fuel cells
By using fuel cells, the reliability of energy supply improves. In order to do so the electricity network must be adapted.

9. Price
If electricity and heat are generated by means of fuel cells, businesses will have to pay approximately half more than they do now. Households will have to pay approximately one fifth more.

Large modern coal fired hydrogen stations (for industrial use and for bus and freight transport) with CO_2 capture and storage.

In these plants, coal is converted into hydrogen through gasification. Hydrogen is a gas that releases energy in the process of combustion. This hydrogen is mainly used by large businesses in order to generate electricity. It can also be used to power trucks and buses, in which case it replaces petrol and especially diesel oil. The CO_2 released in the process of converting coal to hydrogen is captured and stored under the Dutch part of the North Sea. Approximately 10 of these large plants are required to ensure a 20% annual decrease in CO_2 emission in the Netherlands. The hydrogen supplied by these plants can generate all the electricity required by large-scale industry in the Netherlands. In addition, this hydrogen can be used to power bus and freight transport in the industrial areas. All plants would be built in the industrial zones around Amsterdam, IJmuiden, Delfzijl, Terneuzen and in the Rijnmond region.

This can be carried out in the near future (2010) because the technical know-how is already available. In the long run (2020-2030), technical advances are expected to make the plants cheaper and more efficient.

1. New installations and pipelines needed

In order to implement this technology, ten very large plants would have to be built to convert coal into hydrogen. These plants would be built in existing industrial zones. In these zones, while construction of the plant takes place, new pipelines should also be laid and businesses should switch to using hydrogen.

2. New vehicles needed

In the industrial zones, bus companies and freight carriers would have to acquire new vehicles powered by hydrogen. In these areas, a number of fuel stations should also supply hydrogen.

3. Miners' safety

The extraction of coal may cause miners' fatalities. Coal needed for the 20 plants would be mined abroad and mining accidents occur in some countries more frequently than in others. It is reasonable to expect an annual increase of a few to dozens of deaths in the extraction of the additional fuel necessary for the 20 new plants, much depending on the countries from which the Netherlands imports the fuel.

4. Plants' safety

Some experts think that the coal gasification and hydrogen release processes in the ten large plants can be made as safe as those in existing coal-fuelled electricity plants. Other experts think that more accidents will occur.

5. Hydrogen transport safety

Experts think that transporting hydrogen using pipelines can be made as safe as the existing transport of natural gas. Hydrogen use in fuel stations, buses and trucks can also be made as safe as the use of petrol is now. The switch would, however, entail a number of additional technical safety measures. This will increase costs. Accidents caused by asphyxiation, fire or explosion are not expected to occur more often than at present.

6. Contribution to the greenhouse effect
The contribution to the greenhouse effect is greatly decreased through this technology. The release of CO_2 into the air would be less than one tenth of the emissions currently resulting from generating the energy required to power industry, freight, and bus transport.

7. Contribution to acidification
Current use of coal and electricity in industry contributes to acidification, as. do exhaust fumes from busses and trucks. Acidification may lead to the extinction of plant and animal species, the death of trees, damage to agriculture, damage to monuments and property, the over-grassing of moors, and a lower quality of drinking water. This technology is expected in the long run (2030) to reduce the consequences of acidification to one tenth of current values (in comparison to what the technology replaces).

8. Contribution to air quality
The exhaust from buses and trucks running on hydrogen is much cleaner than in current diesel vehicles. As a result, this technology would make a modest contribution to the improvement of air quality and thus to the health of humans, animals and plants.

9. Contribution to pollution in the areas surrounding the coal mines
The coal needed for the 20 plants will be mined abroad. The area around the coal mines is highly polluted in some countries, in others less polluted. The degree of pollution of the land, water, and air will vary from little to very high in the area surrounding the mines, depending on the countries from which the Netherlands imports the coal needed for the 20 plants.

10. The possible number of years this technology can be used
There is enough fuel to supply the plants for the foreseeable future; there is a coal supply for centuries of use. Experts, however, have calculated that there is enough underground storage space to store CO_2 under the Dutch part of the North Sea for 25 to 100 years.

11. Reliability of energy supply
It is important that we are always able to generate enough energy. Part of the fuels necessary to ensure this must be imported from other countries. We do not wish to be dependant on the politics of only a few countries, such as the dependence on the Middle East for oil. Coal can be imported from several countries in several parts of the world. The chance that the coal needed for these 10 plants cannot be imported is thus very small and therefore the reliability of the energy supply is high.

12. Price
Electricity generated from hydrogen using this technology will cost the industry two and one third more than it does now. The fuel costs for buses and trucks will increase by approximately one third.
In the long run (2020-2030), these prices will drop, for example because of improvements made to the plants that convert coal to hydrogen increasing their cost-effectiveness and efficiency. Businesses will then pay approximately three quarters more than they pay now, and fuel costs for buses and freight lorries will be approximately one quarter more.

Conversion of natural gas into hydrogen in large plants (for private and industrial use and in bus and freight transport) with CO_2 capture and storage.

Natural gas is converted to hydrogen in large and small plants. Hydrogen is a gas that releases energy in the process of combustion. Hydrogen is mainly used to generate electricity and heat for households and businesses. This hydrogen will be used in a lesser amount to power trucks and busses, in which case it replaces petrol and especially diesel oil. In order to ensure a 20% annual decrease in CO_2 emissions in the Netherlands, the use of hydrogen would have to be used to generate approximately half of the present of electricity consumption, as well as one quarter of the current consumption of natural gas for heating homes and, finally, one quarter of the current of petrol and diesel fuel consumption. The CO_2 released in the conversion of natural gas to hydrogen would be captured and stored in underground spaces, both under land and under the Dutch part of the North Sea.
It is the intention to realize this technology in the near future (as from 2010) in urban areas. The technical knowledge is available. The use of this technology necessitates many new installations and very many new pipelines to supply the hydrogen to businesses, fuel stations and households.

1. New installations needed
In order to implement this technology, tens of installations that convert natural gas into hydrogen would have to be built in urban areas throughout the Netherlands.

2. New pipelines needed
The hydrogen would have to be transported to businesses and to hundreds of thousands of homes and buildings. This would necessitate a dense network of many underground pipelines. In order to realize this network, massive excavation would have to be done, which is both time-consuming and inconvenient. The inconvenience could be partially alleviated by switching to hydrogen mainly in new housing developments, and by building installations which supply electricity and hot water for entire residential areas.

3. New installations necessary in homes
In urban area, hundreds of thousands of homes would have to be supplied with installations that convert hydrogen into electricity and hot water. These installations replace, among other things, central-heating boilers, and are approximately the same size as central-heating boilers.

4. New vehicles needed
In urban areas, bus companies and freight carriers would have to purchase new vehicles that run on hydrogen. In these areas, a number of fuel stations would have to supply hydrogen.

5. Necessary technical breakthroughs
No major technical breakthroughs are needed, as existing knowledge is sufficient to begin implementing this technology in the near future. However, the best safety measures must still be determined for the use of hydrogen in the home.

6. Safety use of hydrogen in daily life
Experts believe that transporting hydrogen through pipelines and using hydrogen in homes can be made as safe as the existing transport and use of natural gas. Costs for technical safety measures are, however, probably higher. Accidents caused by asphyxiation, fire or explosion will not occur more often then, than at present. Safety measures would make the use of

hydrogen in fuel stations, buses and trucks as safe as the current use of petrol. It is not known how much these safety measures will cost.

7. Contribution to the greenhouse effect
The contribution to the greenhouse effect will be greatly decreased with this technology. The release of CO_2 into the air would be less than one tenth of the current emissions resulting from generating the same amount of energy required to power industry and freight and bus transport.

8. Contribution to acidification
Acidification may lead to the extinction of plants and animal species, the death of trees, damage to agriculture, damage to monuments and property, over-grassing of the moors, and a lower quality of drinking water. This technology is initially expected to possibly reduce the consequences of acidification by half compared to the technology it replaces, and in the long run (2030) to one tenth.

9. Contribution to air quality
The exhaust from buses and trucks running on hydrogen is much cleaner than in current diesel vehicles. As a result, this technology would make a modest contribution to the improvement of air quality and thus to general health. The installations that convert hydrogen to electricity and heat for industrial buildings and homes will probably contribute to an improvement in the quality of air.

10. The possible number of years this technology can be used
Including the gas supply from abroad, this technology could be used for a few centuries. Experts have calculated that the underground CO_2 storage space necessary for this technology is available in the Netherlands and under the Dutch part of the North Sea for 50 years to 300 years.

11. Reliability of the energy supply
Experts place a great deal of importance on our being able to generate enough energy. The use of gas as a fuel is less reliable when this gas must be imported from abroad, which will be the case starting in 2020. In order to ensure the supply reliability it is possible to store reserves of gas for later use, but this leads to a higher gas price.

12. Price
Electricity generated from hydrogen with this technology will cost the industry approximately twice as much as it does now. The fuel costs for buses and trucks will increase by approximately four tenth.
In the long run (2020-2030), these prices will drop, for example because of improvements made to the plants that convert coal to hydrogen increasing their cost-effectiveness and efficiency. Businesses will then pay approximately three quarters more than they pay now, and fuel costs for buses and trucks will be approximately one quarter more.

Retrieval of methane gas by storing captured CO_2 in coal beds

Methane gas is found in and between underground coal beds. In these deep-lying layers of coal that are unfit for mining, CO_2 can be stored. CO_2 that has been captured at installations or electricity plants is pumped into such a coal bed through a drill hole, and methane gas can be extracted through another drill hole. This methane gas would be used for the same purposes as natural gas, for example for generating electricity in plants and for heating and cooking. In order to ensure a 20 percent annual reduction of CO_2 emissions, methane gas would have to replace approximately one third of the current use of natural gas. There is little experience with the extraction of methane gas through the storage of captured CO_2 in coal beds. There is, however, enough technological know-how at present to realize this technology. The technology can probably be implemented within the near future (as early as 2010).

1. New drilling rigs needed

This technology necessitates many drilling rigs (up to 20 meters high) spread out over the Netherlands, which will be dismantled after some time, leaving behind wellheads approximately two meters high. At the time of drilling, the landscape will clearly change in appearance with the placement of a few drilling rigs. After a few years, the wellheads can also be removed.

2. New wells and pipelines needed

In order to implement this technology, many wells are necessary for pumping the CO_2 underground and extracting the methane gas. Up to 50 times more wells would be needed than for other methods of storing CO_2. Some experts expect a good deal of protest against the erection of the drilling rigs and other facilities necessary for the implementation of this method due to the effects on the landscape. This could delay permits and so delay the implementation of this technology on a large scale.

3. New knowledge and research needed

There is enough knowledge at this time to begin implementing this technology in the near future. No major technical breakthroughs are needed. However, we need to know more about the amount of CO_2 that can be absorbed by coal, so that better estimates can be made on how long this technology can be used.

4. Contribution to the greenhouse effect

The contribution to the greenhouse effect is greatly decreased with this technology. The total release of CO_2 into the air in the Netherlands would be one fifth less than 1990 emissions. This is comparable to the emissions reductions of the other technologies.

5. The possible number of years this technology can be used

Experts have calculated that the underground coal beds in the Netherlands are suitable for the storage of CO_2 and the extraction of gas on this scale will be enough for at least 5 to 50 years.

6. Reliability of the energy supply

Experts place a great deal of importance on the reliability of the energy supply; in other words, it is important that we are always able to generate enough energy. The U.S. and Canada have had favourable experiences with this technology, but if they will be as favourable in the Netherlands is as yet unknown. Still, some experts expect that this technology will be very reliable within the near future.

7. Economic consequences

The extraction of methane gas gives the Netherlands a domestic source of energy. Large scale implementation of this technology would mean that the Netherlands would not have to import as much energy from abroad. This is likely to benefit our economy.

8. Price

Methane gas extracted with this technology is approximately one and a half times as expensive as natural gas. This increase in price may initially be higher, up to almost three times as expensive as natural gas, but through improved techniques, the price might drop to approximately one third more expensive than natural gas. The current costs for natural gas for household use are due in part to a considerable tax premium. Because this tax would probably not be higher for the use of methane gas, the costs for households would probably increase, but distinctly less than for industry.

Conversion of natural gas into hydrogen (for motor vehicles), with CO_2 capture and storage.

Natural gas would be converted into hydrogen by small installations located at fuel stations. Hydrogen is a gas that releases energy in the process of combustion. This hydrogen would be used to power motor vehicles such as cars and trucks. In order to ensure a 20% annual decrease in CO_2 emission in the Netherlands, the use of hydrogen would need to replace nearly all current use of petrol and diesel fuels, necessitating new installations the size of a large caravan at all fuel stations. The CO_2 released in the process of converting natural gas to hydrogen is captured and stored in underground storage under the Netherlands and under the Dutch part of the North Sea. This method can probably be implemented on a large scale as from 2030. Technical advances are expected to be realized by then, but this is not certain. By approximately 2030, nearly all motor vehicles would have to be replaced with hydrogen-powered models

1. New installations needed
This technology necessitates replacing existing petrol stations with hydrogen fuel stations that have installations which convert natural gas into hydrogen. These changes would have to be made quickly on an international scale in order to ensure a successful implementation of this technology, as it must be possible for hydrogen-powered cars to refuel anywhere.

2. New pipelines needed
A great many new pipelines would need to be laid to transport the CO_2 produced by the hydrogen fuel stations to the underground storage spaces. The necessary excavation would cause inconvenience.

3. New vehicles needed
The implementation of this technology necessitates the replacement of all cars and other motor vehicles with hydrogen-powered vehicles.

4. Necessary technical breakthroughs
Technical breakthroughs are needed, for instance, to improve the efficiency of installations which convert natural gas into hydrogen. In addition, better methods of storing hydrogen in cars must be found. Technical breakthroughs such as these are expected, but this is not certain.

5. Safety use of hydrogen in daily life
Experts believe that the use of hydrogen can be made as safe as the existing use of petrol. Costs for technical safety measures are as yet unknown. Accidents caused by fire or explosion at fuel stations and in vehicles are not expected to occur more often than at present.

6. Contribution to the greenhouse effect
The contribution of Dutch motorized traffic to the greenhouse effect would be greatly decreased though this technology: the release of CO_2 into the air would be less than one tenth of the emissions now caused by traffic.

7. Contribution to acidification
The exhaust from present traffic with motors fuelled by diesel and petrol contributes greatly to acidification. Acidification may lead to the extinction of plants and animal species, the death of trees, damage to agriculture, damage to monuments and property, over-grassing of the moors, and a lower quality of drinking water. This technology with vehicles running on hydrogen is expected to reduce the consequences to less than one tenth of current values.

8. Contribution to air quality
Vehicles powered by hydrogen emit almost no poisonous substances, and improve the air quality in the cities greatly. In the Netherlands, approximately 5000 premature deaths are caused by poor air quality due to traffic exhaust. When this technology is realized on a large scale in the Netherlands around 2030, thousands of lives will be saved annually in the Netherlands because of the cleaner air.

9. The possible number of years for the use of technology
Including the gas supply from abroad, there is enough natural gas for one to a few centuries, but experts have calculated that the underground CO_2 storage space necessary for this technology will be available in the Netherlands and under the Dutch part of the North Sea for at least 50 to 250 years.

10. Reliability of the energy supply
Experts place a great deal of importance on our being able to generate enough energy. The use of gas as a fuel is less reliable when this gas must be imported from abroad, which will be the case starting in 2020. In order to ensure the supply reliability it is possible to store reserves of gas for later use, but this leads to a higher gas price.

11. Economic consequences
The Netherlands would have to invest a great deal of money in all of the changes necessary for the implementation of this technology, including new installations and vehicles, and numerous CO_2 pipelines. It is unknown what the effect of these investments would have on the economy.

12. Price
The production of hydrogen costs are approximately twice as much as the production of petrol. The fuel costs for vehicles will probably not increase as drastically, perhaps a tenth to four tenths more expensive than now, because, for example, fewer taxes will be levied on hydrogen than on petrol, or because hydrogen-powered cars are more cost-efficient.

Appendix 3:Information-Choice Questionnaire (in Dutch)

Notes:

This document does not show any tables that were visible for the respondents. See the procedure for a description of this table.

VRAAG 6000

In Nederland wordt veel energie gebruikt. Bijvoorbeeld verwarming, licht, elektrische apparaten en vervoer kosten allemaal energie. Naar verwachting gaan we in Nederland steeds meer energie gebruiken. Bijna alle manieren waarop we momenteel energie opwekken zijn schadelijk voor het milieu en beïnvloeden het klimaat. In de toekomst is het nodig meer vormen van energie te gaan gebruiken die minder schadelijk zijn voor milieu en het klimaat niet beïnvloeden.
Wat vinden Nederlanders er van?
Wat er precies moet gebeuren staat echter nog niet vast. De Universiteit van Leiden voert een onderzoek uit waarin de Nederlandse bevolking in de gelegenheid gesteld wordt haar mening te geven over enkele nieuwe mogelijkheden om energie op te wekken. De resultaten van dit onderzoek worden in een rapport verwerkt, dat bijvoorbeeld regering en parlement kan helpen beslissingen te nemen.

VRAAG 6001

Deze beslissingen zijn belangrijk, omdat de keuzes bepalend zijn voor de levensomstandigheden in Nederland in de nabije toekomst. Dit onderzoek biedt u de mogelijkheid uw mening te laten horen. Omdat we een volledig beeld van de in Nederland heersende meningen nastreven, is het belangrijk dat iedereen die wij benaderen, dus ook U, aan het onderzoek meedoet. Uw mening zal strikt vertrouwelijk verwerkt worden.

VRAAG 6002

In dit onderzoek kunt u uw oordeel geven over zes verschillende mogelijkheden om in de toekomst energie op te wekken in Nederland.
Al deze mogelijkheden hebben bepaalde kenmerken en brengen natuurlijk ook bepaalde gevolgen met zich mee. U krijgt informatie over die kenmerken en gevolgen. Ook krijgt u informatie over de kenmerken en gevolgen van de huidige manieren om energie op te wekken, en hoe deze het milieu en het klimaat beïnvloeden.
U kunt aangeven in welke mate u die kenmerken en gevolgen voordelig of nadelig vindt. Op die manier kunt u zich een beeld vormen van elk van de zes mogelijkheden voordat u uw totaaloordeel bepaalt over elke mogelijkheid. Bovendien kunt u zo uw mening over die kenmerken en gevolgen kenbaar maken.

VRAAG 6004

Er wordt u nu eerst verteld hoe u uw mening over die kenmerken en gevolgen kunt geven. Dit gebeurt aan de hand van een aantal voorbeelden. Deze voorbeelden hebben vaak niet met energie te maken.

VRAAG 6005

Maatregelen of activiteiten kunnen nadelen hebben. Op dit scherm staat een aantal mogelijke nadelen van willekeurige maatregelen.
Leest u ze eens door.
1. Een ongeluk met als gevolg enkele doden
2. Een ongeluk met als gevolg een paar duizend doden
3. Een zeer geringe kans op een ongeluk met als gevolg een paar duizend doden
4. Een zeer kleine kans op duizeligheid bij het gebruik van een pijnstiller

VRAAG 6006

Waarschijnlijk vindt u deze voorbeelden niet alle vijf een even groot nadeel. Het is de bedoeling dat u voor ieder gevolg aangeeft hoe groot U het nadeel vindt door een getal tussen 1 en 9 in te vullen.
Het getal 1 staat hierbij voor een zeer klein nadeel, het getal 9 staat voor een zeer groot nadeel. Hoe groter u een nadeel vindt, hoe hoger het getal dat u invult. Omgekeerd geldt: hoe kleiner u het nadeel vindt, hoe lager het getal dat u invult.
Op het volgende scherm kunt u achter ieder gevolg op het scherm invullen hoe groot of hoe klein u het nadeel vindt.

VRAAG 7011_1

Een ongeluk met als gevolg enkele doden.
U kunt hier aangeven hoe klein of groot u het nadeel vindt.

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7011_2

Een ongeluk met als gevolg een paar duizend doden.
U kunt hier aangeven hoe klein of groot u het nadeel vindt.

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7011_3

Een zeer geringe kans op een ongeluk met als gevolg een paar duizend doden.
U kunt hier aangeven hoe klein of groot u het nadeel vindt.

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7011_4

Een zeer kleine kans op duizeligheid bij het gebruik van een pijnstiller.
U kunt hier aangeven hoe klein of groot u het nadeel vindt.

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 6011

Er is wat voor te zeggen om een ongeluk met als gevolg een paar duizend doden als een groter nadeel te zien dan een ongeluk met als gevolg enkele doden. Dat kunt u in uw beoordeling aangeven door een hoger getal in te vullen achter een ongeluk met als gevolg een paar duizend doden. Probeert u in uw beoordeling rekening te houden met dergelijke verschillen.
Het zou kunnen dat u in de enquête kenmerken of gevolgen tegenkomt, die u als groter nadeel wil beoordelen dan vorige kenmerken of gevolgen die u als 'zeer groot nadeel' had beoordeeld. In dit geval kunt u altijd terugbladeren om uw eerdere antwoord te veranderen.

VRAAG 6012

Het is u waarschijnlijk wel opgevallen dat in sommige voorbeelden wordt gezegd dat iets zeker gebeurt, terwijl in andere voorbeelden wordt gezegd dat er bijvoorbeeld een zeer kleine kans is dat een nadeel optreedt.
Waarschijnlijk heeft u daar ook rekening mee gehouden in uw beoordeling. Het is immers erger wanneer het optreden van een nadeel zeker is dan wanneer de kans klein is dat het nadeel zal optreden.
Straks zult u ook dergelijke onzekere gevolgen tegenkomen.
Probeert u daar rekening mee te houden.

VRAAG 6013

U weet nu hoe u aan kunt geven hoe groot of hoe klein u nadelen van een maatregel vindt. In dit onderzoek krijgt u straks niet alleen nadelen maar ook voordelen te beoordelen.
Hoe dit in zijn werk gaat zullen we duidelijk proberen te maken aan de hand van voorbeeldvragen die niet met energievoorziening te maken hebben.

VRAAG 6014

De voorbeeldvragen gaan over een pijnstiller. Voordat u aangeeft wat u van deze pijnstiller vindt, krijgt u informatie over de pijnstiller.
We willen u vragen om deze informatie op de volgende manier te beoordelen:
Wanneer u een kenmerk of gevolg geheel onbelangrijk vindt, kunt u dit aangeven door op het vakje voor onbelangrijk te klikken. Het kan ook zijn dat u het kenmerk of gevolg een nadeel of voordeel vindt. Dan kunt op het vakje voor nadeel of voordeel klikken.
Als u het kenmerk of gevolg niet onbelangrijk, maar een nadeel of voordeel vindt, kunt u vervolgens aangeven in welke mate.
Eerder vertelden we dat u altijd kunt terugbladeren om uw eerdere antwoord te veranderen. Dit geldt niet voor de vraag of u iets onbelangrijk, een voordeel of nadeel vindt. Dat kunt u niet achteraf veranderen, omdat andere ingevulde antwoorden dan weer uitgewist worden.
De mate waarin u iets een voordeel of nadeel vindt kunt u wel veranderen.

VRAAG 7031_1

De pijnstiller van Merk X kost € 9,55 per 24 tabletten.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_1

INDIEN [Q7031_1 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_1

INDIEN [Q7031_1 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_1

Het gebruik van Merk X brengt een zeer kleine kans op duizeligheid met zich mee.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_1

INDIEN [Q7041_1 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_1

INDIEN [Q7041_1 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_2

Het gebruik van Merk X kan in combinatie met alcohol tot misselijkheid leiden.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_2

INDIEN [Q7041_2 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_2

INDIEN [Q7041_2 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_3

Veel pijnstillers zorgen ervoor dat mensen zich niet
goed kunnen concentreren en suf worden. De pijnstiller van Merk X
heeft deze bijwerking zeer veel minder.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_3

INDIEN [Q7041_3 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_3

INDIEN [Q7041_3 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 6019

U heeft één of meer van de gevolgen van Merk X als voordeel beoordeeld. Hoewel u daar natuurlijk vrij in bent, is er ook wat voor te zeggen om de mogelijke bijwerkingen van een pijnstiller als nadeel te zien.

VRAAG 6020

Het is u daarnet misschien opgevallen dat in het laatste gevolg van Merk X eerst een nadeel werd beschreven, en daarna werd aangegeven dat dit nadeel bij de pijnstiller van Merk X veel minder voorkomt. Dit gevolg van Merk X is dus minder nadelig dan na het lezen van de eerste zin lijkt. In het eigenlijke onderzoek zult u straks ook dergelijke gevolgen tegenkomen, waarbij een vroeger nadeel nu opgeheven of verminderd is. Hoewel een dergelijk gevolg dus eerst een nadeel lijkt, hoeft dat niet zo te zijn. Probeert u daar rekening mee te houden.

VRAAG 6021

U heeft waarschijnlijk wel gezien dat één van de voorbeeld-nadelen over een zeer kleine kans op duizeligheid ook in de voorbeeldvragen staan. We kunnen kijken wat u toen geantwoord heeft.

VRAAG 6022

De getallen zijn niet gelijk. U heeft wellicht uw redenen gehad om een andere beoordeling te geven. U kunt zich mogelijk ook voorstellen dat dezelfde gevolgen met het zelfde getal beoordeeld kunnen worden.

VRAAG 6023

U krijgt nu achtergrondinformatie over energiegebruik in Nederland en de gevolgen daarvan. U kunt altijd één of meer schermen terug gaan als u iets nog eens wil lezen of iets wat u heeft ingevuld wilt verbeteren. Door op het vakje 'Terug' te klikken kunt u een scherm teruggaan. Onthoudt u hierbij nog wel dat u niet kunt veranderen of u iets onbelangrijk, een nadeel of een voordeel vindt.

VRAAG 6024

Achtergrond informatie
De Universiteit Leiden heeft deze vragenlijst samengesteld onder begeleiding van een breed samengestelde groep van energiedeskundigen. De informatie die u krijgt over zes mogelijkheden om energie op te wekken is goedgekeurd door deze groep van deskundigen. Dat betekent dat deze deskundigen het er over eens zijn dat de informatie een betrouwbaar beeld geeft van de energieproblematiek en van de gevolgen van deze zes mogelijkheden om energie op te wekken.
Voordat we meer vertellen over deze zes mogelijkheden om in de toekomst energie op te wekken, vertellen we eerst iets over de huidige energieopwekking en de gevolgen daarvan voor het broeikaseffect.

VRAAG 6025

Waar komt onze energie vandaan?
Nederland gebruikt energie voor veel verschillende doeleinden. Energie is nodig voor huishoudens, organisaties, bedrijven, industrie en vervoer. Aardgas wordt onder andere gebruikt om te verwarmen en te koken. Olie (in de vorm van diesel of benzine) wordt voornamelijk gebruikt om voertuigen zoals auto’s en vrachtwagens op te laten rijden.
Zonne-energie wordt gebruikt voor onder andere verwarming.
We gebruiken elektriciteit voor licht en elektrische apparaten.
Elektriciteit wordt opgewekt met verschillende brandstoffen. In Nederland staan grote elektriciteitscentrales die werken op aardgas en op kolen. En er staat een kerncentrale die elektriciteit opwekt. Ook wordt elektriciteit opgewekt in een groter aantal kleinere installaties, praktisch altijd met aardgas. Deze installaties staan meestal bij bedrijven en de warmte die vrijkomt bij elektriciteitsopwekking wordt zo veel mogelijk benut voor verwarming van huizen en kantoren.
Daarnaast wordt er buiten centrales elektriciteit opgewekt met windmolens, waterkracht en zonnecellen. Ook wordt er elektriciteit opgewekt door de verbranding van biomassa, zoals bijvoorbeeld hout en groente-, fruit- en tuinafval.
Verder wordt elektriciteit ingevoerd uit het buitenland.

VRAAG 6026

Wat betekent energieopwekking met olie, gas en steenkool voor ons klimaat?
De lucht in de dampkring rond de aarde bestaat uit meer gassen, bijvoorbeeld zuurstof en kooldioxide. Kooldioxide of CO_2 wordt een broeikasgas genoemd. Broeikasgassen in onze dampkring zorgen ervoor dat de warmte die de aarde van de zon ontvangt behouden blijft en niet allemaal weer ontsnapt naar de ruimte. Dit natuurlijke broeikaseffect zorgt voor een leefbaar klimaat op aarde. Maar bij de opwekking van energie met brandstoffen als olie, aardgas en steenkool komt extra CO_2 vrij en in onze dampkring. Daardoor wordt het broeikaseffect versterkt. De versterking van het broeikaseffect leidt tot een stijging van de gemiddelde temperatuur op aarde. Het overgrote deel van de energie op aarde wordt momenteel opgewekt met brandstoffen als olie, aardgas en steenkool. In Nederland is dit bijvoorbeeld ongeveer 95 procent. De verwachting is dat ook de komende 50 jaar een groot deel van de energie uit olie, aardgas en/of steenkool komt. Experts verwachten dat wanneer de uitstoot van CO_2 blijft toenemen zoals nu het geval is, de gemiddelde temperatuur op aarde in het jaar 2050 met 1 tot 5 graden Celsius zal zijn gestegen vergeleken met de temperatuur in het jaar 1990.

VRAAG 6027

De gemiddelde temperatuurstijging op aarde kan allerlei gevolgen hebben die het leven van veel mensen kunnen beïnvloeden.
De gemiddelde temperatuurstijging betekent niet dat het overal op aarde warmer wordt. De temperatuurstijging kan het klimaat zodanig beïnvloeden dat het in sommige streken juist kouder wordt, of natter, of meer winderig. U krijgt nu informatie over de gevolgen van de temperatuurstijging door het broeikaseffect. De mate waarin de gevolgen hieronder zullen optreden, hangt af van hoeveel de temperatuur stijgt.
Gevolgen van de temperatuurstijging betekenen niet altijd automatisch

een verslechtering, sommige gevolgen van temperatuurstijging kunnen
positief zijn.

VRAAG 6028

We vragen u nu een aantal gevolgen van de temperatuurstijging door het broeikaseffect te beoordelen.

VRAAG 7041_4

Gevolg van de temperatuurstijging door het broeikaseffect
De verwachte temperatuurstijging heeft gevolgen voor het klimaat over de hele wereld. Sommige gebieden in de wereld kunnen door de opwarming van het klimaat te maken krijgen met grote droogte.
Er is een redelijke tot grote kans dat daardoor vaker dan nu oogsten verdorren en honger kan ontstaan. Vooral gebieden waar de temperatuur ook nu hoog is zullen hiermee te maken krijgen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

- 0 ❑ Onbelangrijk
- 1 ❑ Nadeel
- 2 ❑ Voordeel

VRAAG 7042_4

INDIEN [Q7041_4 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

- 1 ❑ Heel klein nadeel
- 2 ❑ 2
- 3 ❑ 3
- 4 ❑ 4
- 5 ❑ 5
- 6 ❑ 6
- 7 ❑ 7
- 8 ❑ 8
- 9 ❑ Heel groot nadeel

VRAAG 7044_4

INDIEN [Q7041_4 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

- 1 ❑ Heel klein voordeel
- 2 ❑ 2
- 3 ❑ 3
- 4 ❑ 4
- 5 ❑ 5
- 6 ❑ 6
- 7 ❑ 7
- 8 ❑ 8
- 9 ❑ Heel groot voordeel

VRAAG 7041_5

Gevolg van de temperatuurstijging door het broeikaseffect
Andere gebieden kunnen juist te maken krijgen met hevige regenval en sneeuwval.
De kans op overstromingen wordt daardoor redelijk tot zeer hoog.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

- 0 ❑ Onbelangrijk
- 1 ❑ Nadeel
- 2 ❑ Voordeel

VRAAG 7042_5

INDIEN [Q7041_5 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_5

INDIEN [Q7041_5 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_6

Gevolg van de temperatuurstijging door het broeikaseffect
Stormen over de hele aarde zullen zeer waarschijnlijk heviger worden.
Schade door storm zal toenemen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_6

INDIEN [Q7041_6 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_6

INDIEN [Q7041_6 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_7

Gevolg van de temperatuurstijging door het broeikaseffect
De temperatuurstijging zorgt ervoor dat een deel van het poolijs smelt en de oceanen uitdijen, waardoor de zeespiegel stijgt. Deze stijging kan oplopen tot 25 centimeter in 2050. Hierdoor komen sommige lager gelegen gebieden in de wereld onder water te liggen. Van bijvoorbeeld landen die bestaan uit groepen kleine eilanden, wordt verwacht dat ze, door de zeespiegelstijging, in de komende eeuw deels tot volledig onder water verdwijnen. Over de hele wereld zal de natuur aangetast worden en zullen natuurgebieden verdwijnen door de stijging van de temperatuur en van de zeespiegel. Hierdoor kunnen veel plantensoorten en diersoorten uitsterven.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_7

INDIEN [Q7041_7 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_7

INDIEN [Q7041_7 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_8

Gevolg van de temperatuurstijging door het broeikaseffect
Voor Nederland zou de temperatuurstijging op aarde kunnen betekenen dat

we vaker met overstromingen van rivieren te maken krijgen door heftige regenval. Dit verkleint het gebied waarop we kunnen wonen en werken. Er zullen maatregelen nodig zijn om de kustlijn te beschermen tegen de stijging van de zeespiegel en de hevigere stormen: De zeewering moet versterkt worden (bijvoorbeeld door de dijken op te hogen). Ook rivierdijken zullen opgehoogd moeten worden om overstromingen te voorkomen. Om dergelijke maatregelen te treffen is veel geld nodig. Mogelijk zoveel geld dat dit heel slecht is voor onze economie. Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_8

INDIEN [Q7041_8 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_8

INDIEN [Q7041_8 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_9

Gevolg van de temperatuurstijging door het broeikaseffect
Niet alle landen hebben de beschikking over zoveel geld. Daarom is het waarschijnlijk dat de landen in de wereld die nu het armst zijn, het minst in staat zijn om voldoende maatregelen voor te bereiden. Het is dan ook waarschijnlijk dat de armste landen het sterkst getroffen zullen worden door de gevolgen van de temperatuurstijging. Bijvoorbeeld overstromingen veroorzaken wereldwijd nu al enkele tienduizenden doden per jaar, dit kan in de komende eeuw oplopen tot een veelvoud daarvan. Deze doden zullen vooral in arme landen vallen. Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_9

INDIEN [Q7041_9 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_9

INDIEN [Q7041_9 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_10

Gevolg van de temperatuurstijging door het broeikaseffect
In Nederland zullen de zomers warmer zijn. Er zullen meer hittegolven zijn. Mensen met een zwakke gezondheid (bijvoorbeeld hoogbejaarden) zullen vaker ziek worden en sterven door de hitte en door de toename in ziektekiemen. Door de warmere zomers is het mogelijk dat tropische ziektes vaker in Nederland voorkomen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_10

INDIEN [Q7041_10 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_10

INDIEN [Q7041_10 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_11

Gevolg van de temperatuurstijging door het broeikaseffect
De winters zullen in Nederland minder koud zijn.
Er zullen minder koudegolven zijn waardoor minder mensen ziek worden of sterven door de kou.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_11

INDIEN [Q7041_11 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_11

INDIEN [Q7041_11 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_12

Gevolg van de temperatuurstijging door het broeikaseffect
Wanneer de huidige opwarming de komende eeuw door blijft gaan, is het mogelijk dat dit veranderingen in de warme oceaanstromingen veroorzaakt. De Warme Golfstroom zou aanzienlijk minder Noordelijk kunnen komen dan nu. Dit zou kunnen leiden tot een dramatische afkoeling van het klimaat op het Noordelijk Halfrond. Deze afkoeling van het Noordelijk Halfrond zou, volgens de nog zeer onzekere voorspellingen, zich voltrekken binnen een aantal jaren. Anders dan de gevolgen hiervoor is het bij zo’n snelle klimaatverandering bijna onmogelijk om ons aan te

passen door maatregelen te treffen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_12

INDIEN [Q7041_12 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_12

INDIEN [Q7041_12 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 11

Zojuist beoordeelde u negen gevolgen van de temperatuurstijging die ontstaat door het broeikaseffect. Nu willen we graag uw totaaloordeel over het broeikaseffect.
Wat vindt u al met al van dit broeikaseffect?

1 ❑ 1 Zeer slecht
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer goed

VRAAG 12

Noot van de programmeur: (Zelfde scherm)

1 ❑ 1 Heel nadelig
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Heel voordelig

VRAAG 6041

Internationale afspraken
Veel landen in de wereld wensen het broeikaseffect te verminderen.

Daarom zijn er internationale afspraken gemaakt om de uitstoot van CO_2 terug te dringen. Ook Nederland acht het van groot belang om de uitstoot van CO_2te verminderen.

Hoe kunnen we de uitstoot van CO_2 verminderen?

Er zijn drie manieren om CO_2 uitstoot te verminderen.

De eerste manier is door te besparen op energie. Dit kan door mensen aan te sporen minder energie te gebruiken, maar ook door de apparaten die energie gebruiken, zuiniger te maken.

VRAAG 6042

De tweede manier is door te zorgen dat er geen of veel minder CO_2 ontstaat bij het opwekken van energie. Dit is bijvoorbeeld zo bij zonne-energie, windenergie, waterenergie en kernenergie. Bij energieopwekking door verbranding en vergisting van biomassa (zoals hout en groente-, fruit-, tuin- en kweekafval) ontstaat wel CO_2, maar dit zou ook zijn ontstaan wanneer deze planten op natuurlijke wijze zouden zijn vergaan. De opwekking van energie door verbranding van plantenafval levert dus wel CO_2 uitstoot op, maar niet meer CO_2 uitstoot dan toch al zou zijn ontstaan. Deze vormen van energie leveren nu minder dan 5 procent van de energie die we in Nederland gebruiken. Sommige van deze vormen van energie zullen in de komende tientallen jaren meer ingezet worden dan nu het geval is. Maar het is onwaarschijnlijk dat, ook als er bespaard wordt op energie, deze vormen van energieopwekking de komende tientallen jaren voldoende energie leveren om in de Nederlandse behoefte te voorzien.
Omdat zon, wind, water, kernenergie en plantenafval vermoedelijk niet genoeg energie leveren, blijft het gebruik van brandstoffen als kolen en aardgas de komende tientallen jaren zeer waarschijnlijk.

VRAAG 6043

De derde manier om CO_2uitstoot te verminderen, is door te zorgen dat bij de energieopwekking met brandstoffen als kolen en aardgas minder CO_2in de lucht komt. Dit kan door de CO_2 die vrijkomt bij energieopwekking met aardgas en kolen af te vangen en ondergronds op te slaan, bijvoorbeeld in lege aardgasvelden. Deze methoden noemen we "technologieën voor gebruik van kolen of gas met verwijdering en ondergrondse opslag van CO_2". Doordat de CO_2 wordt opgeslagen, kan deze niet meer in de lucht komen en dus ook niet meer bijdragen aan het broeikaseffect.

VRAAG 6044

Deze vragenlijst gaat over zes "technologieën voor gebruik van kolen of aardgas met verwijdering en ondergrondse opslag van CO_2". We willen graag weten wat u van deze technologieën vindt. Deze technologieën zijn geselecteerd door een breed samengestelde groep energiedeskundigen.

VRAAG 6045

Deze zes technologieën zijn gelijk in vier belangrijke opzichten:
1. De zes technologieën voor energieopwekking maken gebruik van gas of kolen.
2. De verwachting van deskundigen is dat alle zes technologieën uiterlijk in 2030 inzetbaar zijn. Dat betekent dat alles wat nodig is voor grootschalige invoering van de technologie aanwezig is in 2030.
Vier van de zes technologieën zijn duidelijk eerder inzetbaar, bijvoorbeeld vanaf 2010.
3. Invoering van elk van de zes technologieën op zich zorgt er voor dat er in heel Nederland 20 procent minder CO_2in de lucht komt dan nu. In de vragenlijst wordt er vanuit gegaan dat maar één van de technologieën op grote schaal wordt ingezet. Met grote schaal bedoelen we een zodanige inzet dat er in heel Nederland 20 procent minder CO_2in de lucht komt.
4. Wanneer één of meer van deze zes technologieën wordt ingezet zal het waarschijnlijk zijn als overgangstechnologie. Dat wil zeggen dat deze technologieën ingezet worden om een periode van 20 tot 80 jaar te

overbruggen totdat we er in slagen helemaal schone energie op heel grote schaal op te wekken. Deskundigen verwachten dat dergelijke zogenaamde duurzame energietechnologieën het gebruik van aardgas, olie en steenkool dan geheel zullen vervangen. De zes technologieën waarover de vragenlijst gaat zullen dus waarschijnlijk hooguit 80 jaar gebruikt worden.

VRAAG 6046

Samengevat is er dus een duidelijk verschil tussen het huidige gebruik van gas en kolen en het gebruik van gas en kolen in de zes moderne technologieën. Het belangrijkste verschil is de uitstoot van CO_2.
Het huidige gebruik van gas en kolen leidt tot de uitstoot van CO_2.
Deze uitstoot van CO_2 leidt tot een versterking van het broeikaseffect.
Dit leidt weer tot een stijging van de temperatuur op aarde.
De inzet van elk van de zes technologieën zorgt ervoor dat er in heel Nederland 20 procent minder CO_2 in de lucht gebracht wordt. Op die manier wordt er door Nederland minder bijgedragen aan het broeikaseffect.
Een manier om minder CO_2 in de lucht te brengen is met behulp van technologieën voor gebruik van kolen of gas met verwijdering en ondergrondse opslag van CO_2. Doordat de CO_2 wordt opgeslagen, kan deze niet meer in de lucht komen en dus ook niet meer bijdragen aan het broeikaseffect. Alle zes nieuwe technologieën in de enquête hebben gemeenschappelijk dat CO_2 verwijderd wordt en ondergronds wordt opgeslagen.

VRAAG 6047

U heeft intussen behoorlijk wat informatie te lezen gekregen. Het is belangrijk dat u deze informatie goed in u heeft opgenomen voordat u de rest van de enquête invult. Om te zien of alles duidelijk uitgelegd is en u alles heeft begrepen, wordt nu een aantal vragen gesteld over de voorgaande informatie.

VRAAG 31

Wordt momenteel ongeveer 95 procent van de energie die gebruikt wordt in Nederland opgewekt met behulp van kolen, gas en olie?

1 ❑ Nee, het is ongeveer 50 procent
2 ❑ Ja
3 ❑ Nee, het is bijna 100 procent

VRAAG 6048

Inderdaad, dat is juist \ Dit antwoord is niet juist..
Momenteel wordt (inderdaad) ongeveer 95 procent van de energie die gebruikt wordt in Nederland opgewekt met behulp van kolen, gas en olie.

VRAAG 32

Bij de huidige opwekking van energie met behulp van kolen in Nederland ..

1 ❑ wordt er geen CO_2 uitgestoten naar de dampkring
2 ❑ wordt er wel CO_2 uitgestoten naar de dampkring

VRAAG 6049

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Bij de huidige opwekking van energie met behulp van kolen in Nederland wordt er wel CO_2 uitgestoten naar de dampkring.

VRAAG 33

Bij de huidige opwekking van energie met behulp van gas in Nederland ...

1 ❑ wordt er geen CO_2 uitgestoten naar de dampkring
2 ❑ wordt er wel CO_2 uitgestoten naar de dampkring

VRAAG 6050

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Bij de huidige opwekking van energie met behulp
van gas in Nederland wordt er wel CO_2uitgestoten naar de dampkring.

VRAAG 34

Door de uitstoot van CO_2bij de huidige opwekking van
energie met kolen en met gas .....

1 ❑ wordt het broeikaseffect versterkt
2 ❑ wordt het broeikaseffect verminderd
3 ❑ blijft het broeikaseffect gelijk

VRAAG 6051

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Door de uitstoot van CO_2bij de huidige
opwekking van energie met kolen en met gas wordt het broeikaseffect versterkt.

VRAAG 35

Wanneer het broeikaseffect versterkt wordt ...

1 ❑ gaat de gemiddelde temperatuur op aarde omhoog
2 ❑ gaat de gemiddelde temperatuur op aarde omlaag
3 ❑ blijft de gemiddelde temperatuur op aarde hetzelfde

VRAAG 6052

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Wanneer het broeikaseffect versterkt wordt
gaat de gemiddelde temperatuur omhoog.

VRAAG 36

Wanneer de uitstoot van CO_2blijft toenemen zoals nu,
zal de gemiddelde temperatuur op aarde tot 2050 ....

1 ❑ misschien 10 graden Celsius stijgen
2 ❑ waarschijnlijk 1 tot 5 graden Celsius stijgen
3 ❑ waarschijnlijk 1 tot 5 graden Celsius dalen
4 ❑ zeker 5 tot 10 graden stijgen

VRAAG 6053

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Wanneer de uitstoot van CO_2blijft toenemen
zoals nu, zal de gemiddelde temperatuur op aarde tot 2050 waarschijnlijk
1 tot 5 graden Celsius stijgen.

VRAAG 37

Wat is een belangrijk verschil tussen de huidige manieren om kolen en gas
te gebruiken en de zes moderne manieren om
kolen en gas te gebruiken voor energieopwekking?

1 ❑ De moderne technologieën zorgen ervoor dat er geen CO_2ontstaat
2 ❑ De moderne technologieën vangen CO_2af en slaan het ondergronds op
3 ❑ Vergeleken met de huidige technologieën zorgen de moderne technologieën voor meer CO_2uitstoting in de dampkring

VRAAG 6054

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Het verschil tussen de huidige manier en de zes
moderne manieren om kolen en gas te gebruiken is dat de moderne
technologieën CO_2afvangen en ondergronds opslaan, wat de huidige
technologieën niet doen.

VRAAG 38

CO_2die ondergronds wordt opgeslagen, bijvoorbeeld in
lege aardgasvelden, draagt ...

1 ❑ niet bij aan het broeikaseffect
2 ❑ nog steeds bij aan het broeikaseffect

VRAAG 6055

Inderdaad, dat is juist. \ Dit antwoord is niet juist. CO_2die ondergronds wordt opgeslagen, bijvoorbeeld in lege aardgasvelden, draagt niet bij aan het broeikaseffect.

VRAAG 39

Elk van de zes moderne technologieën waarover deze vragenlijst gaat
streeft naar een vermindering van CO_2uitstoot ...

1 ❑ van ongeveer 100 procent
2 ❑ van ongeveer 50 procent
3 ❑ van ongeveer 20 procent
4 ❑ deze technologieën streven niet naar een vermindering van CO_2uitstoot

VRAAG 6056

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Elk van de zes moderne technologieën waarover deze vragenlijst gaat streeft naar een vermindering van CO_2
uitstoot van ongeveer 20 procent.

VRAAG 40

Om te zorgen dat in Nederland ongeveer 20 procent minder CO_2uitgestoten wordt met behulp van één van de zes "moderne technologieën voor gebruik van gas en kolen met verwijdering en ondergrondse opslag van CO_2",
moet in ieder geval één van die moderne technologieën ....

1 ❑ op grote schaal ingezet worden
2 ❑ op kleine schaal ingezet worden
3 ❑ niet ingezet worden

VRAAG 6057

Inderdaad, dat is juist. \ Dit antwoord is niet juist. Om te zorgen dat in Nederland ongeveer
20
procent minder CO_2uitgestoten wordt, moet in ieder geval één van de zes moderne technologieën voor gebruik van gas en kolen met verwijdering en ondergrondse opslag van CO_2op grote schaal ingezet worden.

VRAAG 6058

Afvangen en ondergronds opslaan van CO_2in Nederland

Hoe gaat het verwijderen van CO_2in zijn werk? Bij het omzetten van brandstoffen zoals kolen en aardgas naar energie ontstaat CO_2. Met speciale technieken kan deze CO_2afgevangen worden. Vervolgens kan de CO_2via pijpleidingen vervoerd worden naar ondergrondse opslagruimtes. CO_2 kan opgeslagen worden in van nature afgesloten ruimtes onder land of onder de zeebodem. Dit kunnen lege gasvelden zijn, dat wil zeggen ondergrondse ruimtes waaruit al het aardgas is gewonnen.
In deze lege gasvelden kan CO_2 worden gepompt. Het CO_2gas kan ook worden opgeslagen in diep onder de grond liggende ruimtes met daarboven een gasdichte laag. Deze ruimtes kunnen zowel onder de Nederlandse bodem liggen als onder de bodem van de Nederlandse Noordzee. Door putten te slaan in de grond of de zeebodem kan de CO_2 in de opslagruimte gebracht worden. Tenslotte kan CO_2 opgeslagen worden in diepliggende koollagen onder Nederland waaruit geen kolen gehaald kunnen worden.

VRAAG 6059

Wanneer we in Nederland de CO_2uitstoot met deze methoden willen verminderen met 20 procent, dan moet er zeer veel CO_2 opgeslagen worden. De ruimte waarin CO_2 opgeslagen kan worden, is beperkt. Wanneer elk jaar een bepaalde hoeveelheid CO_2 opgeslagen wordt, is die ruimte na een aantal jaren vol. Hoe lang er CO_2 opgeslagen kan worden hangt dus af van de hoeveelheid CO_2 die opgeslagen wordt en de hoeveelheid ruimte die er is om CO_2 in op te slaan. Deskundigen schatten dat er elk jaar zoveel CO_2 opgeslagen moet worden, dat de ruimtes onder de grond en onder zeebodem van Nederland waar CO_2 in kan, binnen 25 tot 250 jaar vol zijn.

VRAAG 6060

Hoelang we voort kunnen met CO_2 opslag op deze schaal hangt vooral af van twee kwesties.

1. Zijn de lege aardgasvelden beschikbaar voor CO_2 opslag (en worden ze dus niet gebruikt voor iets anders)?
2. Blijkt uit onderzoek dat uit bepaalde ondergrondse ruimtes ook op de lange duur geen CO_2 kan ontsnappen?

Als het antwoord op beide vragen "ja" is, dan is er opslagruimte voor hoogstens 250 jaar. Is het antwoord op beide vragen "nee", dan is er ruimte voor minstens 25 jaar.

VRAAG 6061

Daarnaast hangt de mogelijke opslagduur af van de hoeveelheid CO_2 die per jaar opgeslagen wordt. Dit hangt weer af van de technologie die gebruikt wordt om energie op te wekken. Bij het opwekken van dezelfde hoeveelheid energie ontstaat bij sommige technologieën meer CO_2 dan bij andere technologieën. Daardoor is bij het gebruik van sommige technologieën de opslagruimte eerder op dan bij andere technologieën.

VRAAG 6062

We vragen u nu een aantal gevolgen en kenmerken van de opslag van CO_2 te beoordelen.

VRAAG 7041_13

Gevolg van CO_2afvang, transport en ondergrondse opslag in Nederland

Bij het transport van CO_2in pijpleidingen kan de leiding lek raken, waardoor CO_2 in de lucht komt. De kans hierop is zeer klein en vergelijkbaar met de kans op gaslekken in ondergrondse pijpleidingen nu in Nederland. Door goede systemen die op het lekken van CO_2 controleren, zal het lekken van veel CO_2 voorkomen kunnen worden. De verwachting is dat door goede controle het risico op een lek in de CO_2 -leidingen zeer gering is.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_13

INDIEN [Q7041_13 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_13

INDIEN [Q7041_13 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_14

Gevolg van CO_2 afvang, transport en ondergrondse opslag in Nederland
Lucht waar teveel CO_2 in zit is schadelijk en mogelijk zelfs dodelijk. Teveel CO_2 in de lucht kan vóórkomen wanneer een zeer grote hoeveelheid CO_2 met grote snelheid vrijkomt en blijft hangen, bijvoorbeeld in een bergdal. In ons land is dit zeer onwaarschijnlijk. Ten eerste is het zeer onwaarschijnlijk dat zo'n grote hoeveelheid in één keer vrijkomt. Ten tweede is Nederland vlak en kan CO_2 zich moeilijk ophopen of blijven hangen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_14

INDIEN [Q7041_14 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_14

INDIEN [Q7041_14 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_15

Gevolg van CO_2 afvang, transport en ondergrondse opslag in Nederland
Wanneer CO_2 eenmaal in de ondergrondse ruimte is opgeslagen, zou het kunnen weglekken door slecht afsluitende putten, scheuren en breuken in de afsluitende laag van de ondergrondse ruimte. Hoewel deskundigen niet precies weten hoeveel CO_2 hierbij in de lucht zou komen, gaat het vermoedelijk om heel kleine hoeveelheden. Door goede systemen die op het lekken van CO_2 controleren, zou het lekken van veel CO_2 voorkómen kunnen worden. De verwachting is dat door goede controle het risico op het lekken van CO_2 uit ondergrondse ruimtes zeer gering is.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_15

INDIEN [Q7041_15 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_15

INDIEN [Q7041_15 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_16

Gevolg van CO_2 afvang, transport en ondergrondse opslag in Nederland

Wanneer CO_2 weglekt uit pijpleidingen of ondergrondse opslag, kan dit verschillende risico's met zich mee brengen. Er is een kleine kans dat weggelekte CO_2 het grondwater in de omgeving verzuurd. Wanneer dit drinkwater is, is het niet drinkbaar meer. Ook is het mogelijk dat weggelekte CO_2 het leven in de grond aantast, zoals boomwortels, wormen of insecten. Daarnaast is er een zeer kleine kans dat weggelekte CO_2 zich ophoopt in laaggelegen, afgesloten ruimtes zoals kelders. Dit zou schadelijk en mogelijk dodelijk kunnen zijn voor mensen, dieren en planten die zich in dit soort ruimtes bevinden.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_16

INDIEN [Q7041_16 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_16

INDIEN [Q7041_16 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_17

Gevolg van CO_2 afvang, transport en ondergrondse opslag in Nederland

Net zoals bij het uit de grond halen van aardgas zou het in de grond brengen van CO_2 kleine aardbevingen kunnen veroorzaken. Hierdoor kunnen op land bijvoorbeeld scheurtjes in gebouwen in de omgeving ontstaan.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_17

INDIEN [Q7041_17 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_17

INDIEN [Q7041_17 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_2

Gevolg van CO_2 afvang, transport en ondergrondse opslag in Nederland
CO_2 die wordt afgevangen en ondergronds wordt
opgeslagen komt niet in de lucht van onze dampkring en draagt dus niet
bij aan de temperatuurstijging door het broeikaseffect.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_2

INDIEN [Q7031_2 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_2

INDIEN [Q7031_2 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 51

Zojuist beoordeelde u een aantal kenmerken en gevolgen van CO_2 afvang, transport en ondergrondse opslag in Nederland.
Nu willen we graag uw totaaloordeel hierover.
Wat vindt u al met al van CO_2 afvang, transport en ondergrondse opslag in Nederland?

1 ❑ 1 Zeer slecht
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer goed

VRAAG 52

Noot van de programmeur: (Zelfde scherm)

1 ❑ 1 Heel nadelig
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Heel voordelig

VRAAG 6070

Voordat we verder gaan, vatten we de hoofdzaken nog één keer samen voor U. Het is belangrijk de uitstoot van CO_2 terug te dringen.
In Nederland wordt er naar gestreefd de komende jaren minder CO_2 in de lucht te laten komen dan nu. Hiervoor zijn grootschalige veranderingen nodig. Zes nieuwe technologieën kunnen als overgang dienen naar volledig schone energie op heel grote schaal. Deze technologieën maken gebruik van kolen of gas met verwijdering van C02 en ondergrondse opslag van CO_2 . Doordat de CO_2 wordt opgeslagen, kan deze niet meer in de lucht komen en dus ook niet meer bijdragen aan het broeikaseffect.
Eén van de zes nieuwe technologieën moet dan wel op grote schaal ingezet worden. Bijvoorbeeld door alle auto's in Nederland gebruik te laten maken van een nieuwe technologie. Of door alle elektriciteit in Nederland met behulp van nieuwe technologie op te wekken. Om 20 procent minder CO_2 in de lucht te laten komen moeten er dus op zeer grote schaal aanpassingen gemaakt worden.

VRAAG 6071

U krijgt straks informatie over de kenmerken en gevolgen van zes technologieën.

De informatie is door deskundigen samengesteld. Dit betekent dat u kenmerken en gevolgen te zien krijgt die volgens deskundigen belangrijk zijn. Wat deskundigen echter niet kunnen bepalen is of u de kenmerken en gevolgen van belang vindt en hoe nadelig of voordelig u een bepaald kenmerk of gevolg vindt.

VRAAG 6072

Straks wordt u gevraagd de kenmerken en gevolgen van de verschillende technologieën te beoordelen. Daarna wordt u gevraagd een keuze te maken uit de verschillende technologieën. Hoe dit laatste in zijn werk gaat zullen we duidelijk maken aan de hand van de voorbeeldvragen die u eerder invulde.

VRAAG 6073

In de voorbeeldvragen heeft u de gevolgen van pijnstiller merk X beoordeeld. Stel, u wilt een pijnstiller kopen en u heeft de keuze uit twee merken, merk X en merk Y.
Beide merken werken even goed. Er zijn echter ook verschillen tussen beide merken. Voordat u kiest krijgt u informatie over die verschillen.
Over merk X heeft u reeds informatie gehad. U heeft de kenmerken en gevolgen van merk X ook reeds beoordeeld.

VRAAG 61

We laten uw oordelen over kenmerken en gevolgen van Merk X nog even zien:
Prijs <?> (voordeel, 1=heel klein, 9=heel groot)
Kans op duizeligheid <?> (voordeel, 1=heel klein, 9=heel groot)
Kans op misselijkheid <?> (voordeel, 1=heel klein, 9=heel groot)
Kans op sufheid <?> (voordeel, 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze pijnstiller denkt. Hierbij kunt u rekening houden met uw eigen beoordelingen van de kenmerken en gevolgen.
Wat is uw algemene waardering van de pijnstiller van Merk X?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 62

Noot van de programmeur: (Zelfde scherm)
Vul nu uw rapportcijfer (van 1 tot 10) voor deze pijnstiller in.
Hoe beter u de pijnstiller vindt, hoe hoger het rapportcijfer.

VRAAG 6200

Stelt u zich voor dat u merk Y op dezelfde manier kunt beoordelen.
U hebt dan van beide merken pijnstillers de gevolgen en kenmerken beoordeeld. U hebt beide merken pijnstillers een rapportcijfer gegeven.
Nu zou u een beslissing kunnen maken, welke pijnstiller u het beste vindt.
Dit was natuurlijk maar een voorbeeld. In dit voorbeeld ging het er niet om een werkelijk te maken keuze.
Bovendien kreeg u maar weinig informatie over de pijnstillers.
Hierdoor kwam de werkwijze van de enquête misschien wat omslachtig over.
Straks krijgt u echter informatie over meer keuzemogelijkheden en bovendien over meer gevolgen per keuzemogelijkheid.
U zult zien dat de werkwijze van de enquête u dan helpt om de gevolgen van de keuzemogelijkheden op een rijtje te zetten. De werkwijze is straks precies hetzelfde als in het voorbeeld.

VRAAG 6201

Straks zult u op de manier waarop u merk X beoordeelde, ook de zes technologieën kunnen beoordelen. Eerst krijgt u de gevolgen en kenmerken van een technologie te beoordelen. Daarna krijgt u een overzicht van uw beoordelingen en kunt u de technologie als geheel beoordelen. Op dezelfde manier kunt u ook de andere technologieën beoordelen.

Nadat u de zes technologieën op deze manier beoordeeld hebt, krijgt u aan het eind een overzicht van de rapportcijfers die u de zes technologieën gegeven hebt. Op dit punt kunt u straks, als u dat wilt, rapportcijfers veranderen. Daarbij kunt u, als u dat wilt, eerdere overzichten van beoordelingen van gevolgen en kenmerken nog eens bekijken.
Daarna kunt u kiezen welke technologie u het beste vindt.

VRAAG 6084

De informatie over de kenmerken en gevolgen van de verschillende technologieën is door deskundigen samengesteld. Dit betekent dat U gevolgen te zien krijgt die volgens deskundigen belangrijk zijn. Wat deskundigen echter niet kunnen bepalen is of u een bepaald gevolg belangrijk vindt. Daarom vragen we dat aan u.

VRAAG 6085

Niet alle gevolgen van de verschillende technologieën worden vermeld. U krijgt alleen informatie over punten waarop de technologieën verschillen. Zo geldt voor alle technologieën dat ze zorgen voor voldoende energie in Nederland. Hoewel dit belangrijk is, zult u deze informatie niet tegenkomen. Het is immers hetzelfde voor alle technologieën en het helpt u dus niet bij het maken van een keuze.
In de voorbeeldvragen over pijnstillers hebben we bijvoorbeeld ook niet vermeld dat het voordeel van beide pijnstillers is dat ze pijn stillen.
Dit geldt voor beide merken en helpt dus niet bij het maken van een keuze.

VRAAG 6086

Het zal u straks misschien opvallen dat veel van de kenmerken en gevolgen van de technologieën nadelen zijn. Dit komt voor een deel omdat de voordelen van de technologieën vaak voor alle zes technologieën gelden en dus niet vermeld zijn. Denk bijvoorbeeld aan het kenmerk dat we net noemden, de levering van voldoende energie.
Alle technologieën hebben dus ook belangrijke voordelen, ook al staan ze niet bij de kenmerken en gevolgen die we u vragen te beoordelen.

VRAAG 6087

Als u bij een van de technologieën informatie over een bepaald aspect tegenkomt, wil dat niet zeggen dat u bij alle technologieën informatie over dat aspect zult tegenkomen.
Bij sommige technologieën krijgt u bijvoorbeeld informatie over technische doorbraken die nodig zijn voordat de technologie in gebruik genomen kan worden. Bij andere technologieën niet, omdat voor deze technologieën geen technische doorbraken nodig zijn.

VRAAG 6088

Gevolgen van technologieën worden ook niet vermeld, wanneer ze niet verschillen van gevolgen die nu ook plaatsvinden. U krijgt alleen informatie over gevolgen die anders zijn dan de gevolgen van de huidige energiewinning.
Een voorbeeld zijn de veiligheidsgevolgen van een technologie.
Bij sommige technologieën staat hier niets over vermeld, omdat de veiligheidsgevolgen hetzelfde zijn als nu. Dat betekent dus niet dat er helemaal geen veiligheidsgevolgen zijn, slechts dat deze gevolgen hetzelfde zijn als nu.

VRAAG 6089

Wanneer een bepaald gevolg niet optreedt bij een technologie, terwijl dat in de huidige situatie wel zo is, staat dit in het gevolg vermeld. Wanneer er bijvoorbeeld door een technologie geen luchtvervuiling door uitlaatgassen optreedt, staat dit vermeld als een vermindering van uitlaatgassen ten opzichte van nu.

VRAAG 6090

Als u van alle zes de technologieën de kenmerken en gevolgen beoordeeld heeft, wordt u gevraagd één van de zes technologieën te kiezen. Met die keuze geeft u aan welke van de zes technologieën u beter vindt dan de andere vijf technologieën.

VRAAG 110

Noot van de programmeur:
- de volgende vragen (111 tm 165) worden in 3 mogelijke verschillende volgordes aan de respondenten voorgelegd:

.
111-115 - 121-125 - 131-135 - 141-145 - 151-155 - 161-165
.
161-165 - 151-155 - 141-145 - 131-135 - 121-125 - 111-115
.
131-135 - 121-125 - 111-115 - 161-165 - 151-155 - 141-145

VRAAG 111

Nu volgt een omschrijving van de eerste technologie. Daarna volgen de te beoordelen kenmerken en gevolgen.

VRAAG 112

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2.
In deze centrales worden kolen omgezet in elektriciteit. De CO_2 die bij dit proces vrijkomt wordt afgevangen en opgeslagen onder de bodem van het Nederlands deel van de Noordzee. Er zijn ongeveer 20 van deze grote centrales nodig om er voor te zorgen dat er jaarlijks in heel Nederland 20 procent minder CO_2 in de lucht komt. In deze 20 centrales wordt bijna alle elektriciteit opgewekt die Nederland in de toekomst nodig heeft. De elektriciteit wordt geleverd aan bijvoorbeeld huishoudens, bedrijven en organisaties. Al deze centrales zullen in de industriële gebieden bij Amsterdam, Delfzijl, IJmuiden en Terneuzen, en in de regio Rijnmond worden gebouwd. Het is de bedoeling om deze technologie op kortere termijn (vanaf ongeveer 2010) te verwezenlijken. De technische kennis daarvoor is grotendeels beschikbaar.

VRAAG 7031_3

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde nieuwe installaties
Voor deze technologie moeten grote centrales in bestaande industriegebieden gebouwd worden. Het is mogelijk dat het bestaande elektriciteitsnet iets uitgebreid moet worden.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_3

INDIEN [Q7031_3 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_3

INDIEN [Q7031_3 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_18

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Veiligheid mijnwerkers
Bij de winning van kolen kunnen mijnwerkers omkomen. De kolen die nodig zijn voor de 20 centrales worden in het buitenland gewonnen.
In sommige landen gebeuren veel ongelukken in de mijnen, in andere landen minder. Sterk afhankelijk van de landen waaruit Nederland de kolen invoert die nodig zijn voor deze twintig centrales, kunnen er enkele tot vele tientallen doden per jaar meer vallen dan nu vallen bij de winning van brandstof voor de huidige elektriciteitscentrales.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_18

INDIEN [Q7041_18 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_18

INDIEN [Q7041_18 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_19

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Bijdrage aan het broeikaseffect
De bijdrage aan het broeikaseffect door de opwekking van elektriciteit wordt sterk verminderd door deze technologie: de uitstoot van CO_2 naar de lucht wordt minder dan een tiende van de hoeveelheid die de huidige elektriciteitscentrales nu uitstoten.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_19

INDIEN [Q7041_19 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_19

INDIEN [Q7041_19 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_20

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2

Bijdrage aan verzuring
De uitstoot van de huidige kolengestookte elektriciteitscentrales draagt bij aan verzuring. Verzuring kan leiden tot het uitsterven van planten- en diersoorten, sterfte van bomen, schade aan de landbouw, schade aan monumenten en goederen, vergrassing van heide en verslechterde kwaliteit van drinkwaterbronnen. Hoewel het gebruik van kolen meer bijdraagt aan verzuring dan het gebruik van aardgas, dragen de huidige technologieën die elektriciteit opwekken uit kolen wel veel minder bij aan verzuring dan twintig jaar geleden. Opwekking van elektriciteit met deze 20 moderne kolengestookte centrales draagt nog minder bij aan verzuring dan bij de huidige kolengestookte elektriciteitscentrales.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_20

INDIEN [Q7041_20 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_20

INDIEN [Q7041_20 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_21

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Bijdrage aan vervuiling van omgeving van kolenmijnen
De kolen die nodig zijn voor 20 centrales worden in het buitenland gewonnen. In sommige landen is de directe omgeving van kolenmijnen vaak sterk vervuild, in andere landen minder. Sterk afhankelijk van de landen waaruit Nederland de kolen invoert die nodig zijn voor deze twintig centrales, kan het land, water en de lucht rondom de mijn weinig tot zeer vervuild raken.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_21

INDIEN [Q7041_21 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_21

INDIEN [Q7041_21 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_4

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Aantal jaren dat gebruik technologie mogelijk is
Er is voorlopig genoeg brandstof voor de centrales (er zijn kolenvoorraden voor eeuwen), maar deskundigen hebben berekend dat er ondergrondse opslagruimte voor CO_2 onder het Nederlandse deel van de Noordzee is om minstens ongeveer 25 jaar door te gaan en hoogstens ruim honderd jaar.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_4

INDIEN [Q7031_4 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_4

INDIEN [Q7031_4 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_22

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Betrouwbaarheid van de energievoorziening
Deskundigen vinden hoge betrouwbaarheid van de energievoorziening belangrijk, dat betekent dat we altijd voldoende energie kunnen opwekken. De brandstoffen daarvoor moeten we deels invoeren uit andere landen. We willen daarbij niet afhankelijk zijn van de politiek van slechts enkele landen (zoals bijvoorbeeld de afhankelijkheid van het Midden-Oosten voor olie). Kolen kunnen uit veel landen en verschillende werelddelen worden ingevoerd. De kans dat de kolen die nodig zijn voor deze twintig centrales niet ingevoerd kunnen worden is daarom zeer klein. De betrouwbaarheid van energieopwekking is daarom groot.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_22

INDIEN [Q7041_22 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_22

INDIEN [Q7041_22 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_5

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Prijs
Wanneer elektriciteit wordt opgewekt in deze moderne kolengestookte centrales, zullen bedrijven ongeveer driekwart meer moeten gaan betalen. Huishoudens zullen ongeveer een kwart meer moeten gaan betalen voor elektriciteit. Op termijn (2030) zullen deze kosten dalen, bijvoorbeeld omdat de centrales die kolen omzetten naar elektriciteit verbeterd worden en goedkoper en zuiniger gaan werken. Bedrijven zullen dan ongeveer een kwart meer moeten gaan betalen dan nu. Huishoudens zullen ongeveer een tiende meer moeten gaan betalen dan nu.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_5

INDIEN [Q7031_5 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_5

INDIEN [Q7031_5 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 113

Uw oordelen over grote moderne kolencentrales.
Benodigde nieuwe installaties <?>
Veiligheid mijnwerkers <?>
Bijdrage aan broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan vervuiling van omgeving van kolenmijnen <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze technologie denkt.
Hierbij kunt u rekening houden met uw eigen beoordelingen
van de kenmerken en gevolgen.
Wat is uw algemene waardering van grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2 ?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 115

Uw oordelen over grote moderne kolencentrales.
Benodigde nieuwe installaties <?>
Veiligheid mijnwerkers <?>
Bijdrage aan broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan vervuiling van omgeving van kolenmijnen <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Prijs <?>
Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 121

Nu volgt een omschrijving van de tweede technologie. Daarna volgen de te beoordelen kenmerken en gevolgen.

VRAAG 122

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2 .

In kleine brandstofcellen wordt aardgas omgezet in elektriciteit en warmte. Brandstofcellen zijn (relatief zuinige, stille en schone) installaties van verschillend formaat waarin brandstof omgezet kan worden in elektriciteit en warmte. De CO_2 die bij dit proces vrijkomt wordt afgevangen en opgeslagen onder de grond in Nederland. Er zullen honderden brandstofcellen nodig zijn om er voor te zorgen dat er jaarlijks 20 procent minder CO_2 in de lucht komt. In deze brandstofcellen wordt bijna alle elektriciteit opgewekt die Nederland in de toekomst nodig heeft. De elektriciteit en de warmte die vrij komen worden geleverd aan bijvoorbeeld huishoudens, bedrijven en organisaties. Deze brandstofcellen zullen geplaatst worden bij bedrijven en in stedelijke gebieden. Deze technologie is op deze grote schaal waarschijnlijk pas inzetbaar vanaf 2020. De verwachting is dat de vereiste technische vernieuwingen dan zijn verwezenlijkt, maar dat is niet helemaal zeker.

VRAAG 7031_6

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2 .

Benodigde nieuwe installaties
Voor deze technologie moeten de huidige grote elektriciteitscentrales vervangen worden door kleinere brandstofcellen die aardgas naar elektriciteit en warmte omzetten.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_6

INDIEN [Q7031_6 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_6

INDIEN [Q7031_6 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_23

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Benodigde nieuwe leidingen
Er moeten er veel nieuwe elektriciteitsleidingen en warmwaterleidingen aangelegd worden die de bij de brandstofcellen geproduceerde elektriciteit en warmte naar de gebruikers vervoeren.
Dit levert overlast door werkzaamheden op.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_23

INDIEN [Q7041_23 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_23

INDIEN [Q7041_23 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_24

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Benodigde nieuwe CO_2 leidingen
Er moeten veel nieuwe pijpleidingen aangelegd worden die de bij brandstofcellen afgevangen CO_2 afvoeren naar opslagruimtes. Dit levert overlast door graafwerkzaamheden op.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_24

INDIEN [Q7041_24 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_24

INDIEN [Q7041_24 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_25

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Bijdrage aan het broeikaseffect
De bijdrage aan het broeikaseffect door de opwekking van elektriciteit wordt sterk verminderd door deze technologie: de uitstoot van CO_2 naar de lucht wordt minder dan een twintigste van de hoeveelheid die nu wordt uitgestoten door de huidige elektriciteitscentrales.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_25

INDIEN [Q7041_25 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_25

INDIEN [Q7041_25 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_26

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Bijdrage aan verzuring
Verzuring kan leiden tot het uitsterven van planten- en diersoorten, sterfte van bomen, schade aan de landbouw, schade aan monumenten en

goederen, vergrassing van heide en verslechterde kwaliteit van drinkwaterbronnen. De huidige gasgestookte elektriciteitscentrales dragen al veel minder bij aan verzuring dan twintig jaar geleden. De moderne gasgestookte elektriciteitscentrales zullen bijna niets meer bijdragen aan verzuring.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_26

INDIEN [Q7041_26 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_26

INDIEN [Q7041_26 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_27

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Aantal jaren dat gebruik van de technologie mogelijk is
Wanneer buitenlandse gasvoorraden worden meegerekend kunnen we enkele eeuwen voort, maar deskundigen hebben berekend dat er in de (kleinschalige) ondergrondse ruimtes die nodig zijn voor deze technologie opslagruimte onder Nederland is voor CO_2 om tenminste ruim 50 jaar door te gaan en hoogstens bijna 250 jaar.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_27

INDIEN [Q7041_27 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_27

INDIEN [Q7041_27 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_7

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Betrouwbaarheid energievoorziening
Deskundigen vinden het belangrijk dat we altijd voldoende energie kunnen opwekken. Het gebruik van gas als brandstof is minder betrouwbaar wanneer gas moet worden ingevoerd uit andere landen. Dit is het geval vanaf ongeveer 2020. Om de betrouwbaarheid zo hoog mogelijk te houden is het mogelijk om gasreserves op te slaan voor later gebruik, maar dit leidt tot een hogere gasprijs.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_7

INDIEN [Q7031_7 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_7

INDIEN [Q7031_7 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_8

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven),
met verwijdering van CO_2en ondergrondse opslag van CO_2.
Betrouwbaarheid van energievoorziening door brandstofcellen
Door het gebruik van deze brandstofcellen verbetert de betrouwbaarheid van energievoorziening. Daarvoor moet wel ook het elektriciteitsnet aangepast worden.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_8

INDIEN [Q7031_8 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_8

INDIEN [Q7031_8 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_9

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven),
met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Prijs
Wanneer elektriciteit en warmte wordt opgewekt met behulp van deze

brandstofcellen zullen bedrijven ongeveer de helft meer moeten gaan betalen. Huishoudens zullen ongeveer een vijfde meer moeten gaan betalen.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_9

INDIEN [Q7031_9 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_9

INDIEN [Q7031_9 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 123

Uw oordelen over de omzetting van aardgas in elektriciteit
Benodigde nieuwe installaties <?>
Benodigde nieuwe leidingen <?>
Benodigde nieuwe CO_2 leidingen <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Betrouwbaarheid energievoorziening
door brandstofcellen <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze technologie denkt.
Hierbij kunt u rekening houden met uw eigen beoordelingen van de kenmerken en gevolgen.
Wat is uw algemene waardering van omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 125

Uw oordelen over de omzetting van aardgas in elektriciteit
Benodigde nieuwe installaties <?>
Benodigde nieuwe leidingen <?>
Benodigde nieuwe CO_2 leidingen <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Betrouwbaarheid energievoorziening
door brandstofcellen <?>
Prijs <?>
Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 131

Nu volgt een omschrijving van de derde technologie. Daarna volgen de te beoordelen kenmerken en gevolgen.

VRAAG 132

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
In deze centrales worden kolen door vergassing omgezet in waterstof. Waterstof is een gas dat bij verbranding energie oplevert. Deze waterstof wordt vooral in grote bedrijven gebruikt om elektriciteit mee op te wekken. Deze waterstof wordt in mindere mate ook gebruikt voor de aandrijving van bijvoorbeeld vrachtwagens en bussen (en vervangt dan benzine en vooral dieselolie). De CO_2 die bij de omzetting van kolen in waterstof vrijkomt wordt afgevangen en opgeslagen onder de bodem van het Nederlands deel van de Noordzee. Er zijn ongeveer 10 van deze grote centrales nodig om er voor te zorgen dat er in heel Nederland jaarlijks 20 procent minder CO_2 in de lucht komt. Met de waterstof die deze centrales leveren kan alle elektriciteit worden opgewekt die de grote industrie in Nederland nodig heeft. Daarnaast wordt deze waterstof gebruikt door de bus- en vrachtvervoerders in de industriegebieden. Al deze centrales zullen worden gebouwd in de industriële gebieden bij Amsterdam, IJmuiden, Delfzijl, Terneuzen en in de regio Rijnmond.
Dit kan op korte termijn (2010) omdat alle technische kennis volledig beschikbaar is. Op wat langere termijn (2020-2030) worden technische verbeteringen verwacht waardoor de centrales goedkoper en zuiniger worden.

VRAAG 7031_10

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Benodigde nieuwe installaties en pijpleidingen
Voor deze technologie moeten tien zeer grote centrales gebouwd worden die kolen omzetten in waterstof. Die centrales moeten worden gebouwd in bestaande industriegebieden. In deze gebieden moeten dan tegelijk met de bouw van een nieuwe centrale, ook nieuwe pijpleidingen aangelegd worden en moeten bedrijven over gaan op het gebruik van waterstof.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_10

INDIEN [Q7031_10 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_10

INDIEN [Q7031_10 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_28

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Benodigde nieuwe voertuigen
In de industriegebieden moeten busmaatschappijen en vrachtvervoerders nieuwe voertuigen aanschaffen die op waterstof lopen. In deze gebieden moet ook bij een aantal tankstations waterstof getankt kunnen worden.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_28

INDIEN [Q7041_28 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_28

INDIEN [Q7041_28 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_29

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Veiligheid mijnwerkers
Bij de winning van kolen kunnen mijnwerkers omkomen. De kolen die nodig zijn voor de centrales worden in het buitenland gewonnen. In sommige landen gebeuren veel ongelukken in de mijnen, in andere landen minder. Sterk afhankelijk van de landen waaruit Nederland de kolen invoert die nodig zijn voor deze tien centrales, kunnen er enkele tot vele tientallen doden per jaar meer vallen dan nu bij de winning van brandstof voor de elektriciteitsopwekking voor de grote bedrijven en van olie voor bussen en vrachtwagens.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_29

INDIEN [Q7041_29 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_29

INDIEN [Q7041_29 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_30

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.

Veiligheid centrales

Sommige deskundigen denken dat de processen in de tien grote centrales (kolenvergassing en het maken van waterstof) ongeveer even veilig te maken zijn als de processen in de huidige kolengestookte elektriciteitscentrales. Andere deskundigen denken dat er meer ongelukken zullen gebeuren.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

- 0 ❑ Onbelangrijk
- 1 ❑ Nadeel
- 2 ❑ Voordeel

VRAAG 7042_30

INDIEN [Q7041_30 , 1]

Noot van de programmeur: (Zelfde scherm)

Hoe klein of groot vindt u het nadeel?

- 1 ❑ Heel klein nadeel
- 2 ❑ 2
- 3 ❑ 3
- 4 ❑ 4
- 5 ❑ 5
- 6 ❑ 6
- 7 ❑ 7
- 8 ❑ 8
- 9 ❑ Heel groot nadeel

VRAAG 7044_30

INDIEN [Q7041_30 , 2]

Noot van de programmeur: (Zelfde scherm)

Hoe klein of groot vindt u het voordeel?

- 1 ❑ Heel klein voordeel
- 2 ❑ 2
- 3 ❑ 3
- 4 ❑ 4
- 5 ❑ 5
- 6 ❑ 6
- 7 ❑ 7
- 8 ❑ 8
- 9 ❑ Heel groot voordeel

VRAAG 7041_31

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.

Veiligheid vervoer waterstof

Deskundigen denken dat het vervoer van waterstof via pijpleidingen net zo veilig is te maken als het huidige vervoer van aardgas. Ook waterstofgebruik in tankstations, bussen en vrachtwagens kan even veilig worden gemaakt als benzinegebruik nu. Wel moeten er waarschijnlijk meer technische veiligheidsmaatregelen getroffen worden. Daardoor worden de kosten hoger. Ongevallen door verstikking, brand of ontploffing zullen dan niet vaker voorkomen dan nu.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_31

INDIEN [Q7041_31 , 1]

Noot van de programmeur: (Zelfde scherm)

Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_31

INDIEN [Q7041_31 , 2]

Noot van de programmeur: (Zelfde scherm)

Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_32

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.

Bijdrage aan het broeikaseffect

De bijdrage aan het broeikaseffect wordt sterk verminderd door deze technologie: de uitstoot van CO_2 naar de lucht wordt minder dan een tiende van de hoeveelheid die nu wordt uitgestoten om dezelfde hoeveelheid energie op te wekken voor industrie en vracht- en busvervoer.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_32

INDIEN [Q7041_32 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_32

INDIEN [Q7041_32 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_33

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Bijdrage aan verzuring
Het huidige gebruik van kolen en elektriciteit in de industrie draag bij aan verzuring. Ook uitlaatgassen van bussen en vrachtwagens doen dat. Verzuring kan leiden tot het uitsterven van planten- en diersoorten, sterfte van bomen, schade aan de landbouw, schade aan monumenten en goederen, vergrassing van heide en verslechterde kwaliteit van drinkwaterbronnen. De verwachting is dat door deze technologie (vergeleken bij wat het vervangt) de verzuringsgevolgen op termijn (rond 2030) tot een tiende worden teruggebracht.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_33

INDIEN [Q7041_33 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_33

INDIEN [Q7041_33 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_34

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Bijdrage aan de luchtkwaliteit
De uitlaatgassen van bussen en vrachtwagens die op waterstof rijden zijn veel schoner dan de huidige dieselvoertuigen. Daarmee levert deze technologie een bescheiden bijdrage aan het verbeteren van de luchtkwaliteit en daarmee aan de gezondheid van mensen, dieren en planten.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_34

INDIEN [Q7041_34 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_34

INDIEN [Q7041_34 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_35

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2

en ondergrondse opslag van CO_2.

Bijdrage aan vervuiling van omgeving van kolenmijnen
De kolen die nodig zijn voor de 10 grote centrales worden in het buitenland gewonnen. In sommige landen is de directe omgeving van kolenmijnen vaak sterk vervuild, in andere landen minder.
Sterk afhankelijk van de landen waaruit Nederland de kolen invoert die nodig zijn voor deze tien centrales, kan het land, water en de lucht rondom de mijn weinig tot zeer vervuild raken.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_35

INDIEN [Q7041_35 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_35

INDIEN [Q7041_35 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_11

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.

Aantal jaren dat gebruik technologie mogelijk is
Er is voorlopig genoeg brandstof voor de centrales (er zijn kolenvoorraden voor eeuwen) maar deskundigen hebben berekend dat er ondergrondse opslagruimte is voor CO_2 onder het Nederlandse deel van de Noordzee om minstens ongeveer 20 jaar door te gaan en hoogstens ongeveer 100 jaar.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_11

INDIEN [Q7031_11 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_11

INDIEN [Q7031_11 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_12

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Betrouwbaarheid energievoorziening
Het is belangrijk dat we altijd voldoende energie kunnen opwekken. De brandstoffen daarvoor moeten we deels invoeren uit andere landen. We willen daarbij niet afhankelijk zijn van de politiek van slechts enkele landen (zoals bijvoorbeeld de afhankelijkheid van het Midden-Oosten voor olie). Kolen kunnen uit veel landen en verschillende werelddelen worden ingevoerd. De kans dat de kolen die nodig zijn voor deze tien centrales niet ingevoerd kunnen worden is daarom zeer klein.
De betrouwbaarheid van energieopwekking met kolen is daarom groot.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_12

INDIEN [Q7031_12 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_12

INDIEN [Q7031_12 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_13

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Prijs
Elektriciteit uit waterstof zal bij deze technologie voor de industrie ongeveer twee en een derde keer zo duur worden als nu.
De brandstofkosten voor bussen en vrachtwagens zullen met ongeveer een derde toenemen.
Op termijn (2020-2030) zullen deze kosten dalen, bijvoorbeeld omdat de centrales die kolen omzetten naar waterstof verbeterd worden en goedkoper en zuiniger gaan werken. De industrie zal dan ongeveer driekwart meer moeten gaan betalen. De brandstofkosten voor bussen en vrachtwagens zullen dan ongeveer een kwart duurder zijn dan nu.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_13

INDIEN [Q7031_13 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_13

INDIEN [Q7031_13 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 133

Uw oordelen over grote kolencentrales voor waterstof
Benodigde nieuwe installaties en pijpleidingen <?>
Benodigde nieuwe voertuigen <?>
Veiligheid mijnwerkers <?>
Veiligheid centrales <?>
Veiligheid vervoer waterstof <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan de luchtkwaliteit <?>
Bijdrage aan de vervuiling van de omgeving van kolenmijnen <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze technologie denkt. Hierbij kunt u rekening houden met uw eigen beoordelingen van de kenmerken en gevolgen.
Wat is uw algemene waardering van grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 135

Uw oordelen over grote kolencentrales voor waterstof
Benodigde nieuwe installaties en pijpleidingen <?>
Benodigde nieuwe voertuigen <?>
Veiligheid mijnwerkers <?>
Veiligheid centrales <?>
Veiligheid vervoer waterstof <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan de luchtkwaliteit <?>
Bijdrage aan de vervuiling van de omgeving van kolenmijnen <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Prijs <?>
Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 141

Nu volgt een omschrijving van de vierde technologie. Daarna volgen de te beoordelen kenmerken en gevolgen.

VRAAG 142

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

In grote en kleine installaties wordt aardgas omgezet in waterstof. Waterstof is een gas dat bij verbranding energie oplevert.
De geproduceerde waterstof wordt vervolgens vooral gebruikt om elektriciteit en warmte op te wekken voor huishoudens en bedrijven. Deze waterstof wordt in mindere mate ook gebruikt voor de aandrijving van bijvoorbeeld vrachtwagens en bussen (en vervangt dan benzine en vooral dieselolie). Om te zorgen dat er in heel Nederland 20 procent minder CO_2 in de lucht komt, moet waterstofgebruik ongeveer de helft van de huidige elektriciteitsopwekking vervangen, daarnaast een kwart van het huidige gasgebruik voor verwarming van woonhuizen en tenslotte een kwart van het huidige gebruik van benzine en diesel.
De CO_2 die bij het omzetten van aardgas naar waterstof vrijkomt, wordt afgevangen en opgeslagen in ondergrondse ruimtes, zowel onder land als onder de bodem van de Nederlandse Noordzee.
Het is de bedoeling om deze technologie op kortere termijn (vanaf 2010) en in de stedelijke gebieden te verwezenlijken. De technische kennis daarvoor is beschikbaar. Voor deze technologie zijn in de stedelijke gebieden veel nieuwe installaties nodig en vooral heel veel nieuwe pijpleidingen om de waterstof naar bedrijven en tankstations en naar alle woningen te brengen.

VRAAG 7031_14

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

Benodigde nieuwe installaties
Voor deze technologie moeten in de stedelijke gebieden in Nederland tientallen installaties worden gebouwd waarin aardgas wordt omgezet in waterstof.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_14

INDIEN [Q7031_14 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_14

INDIEN [Q7031_14 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_36

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde nieuwe pijpleidingen
De waterstof moet worden vervoerd naar bedrijven en naar honderdduizenden huizen en gebouwen. Hiervoor is een fijnmazig net van heel veel ondergrondse pijpleidingen nodig. De aanleg van deze leidingen is ingrijpend en tijdrovend en levert overlast op door graafwerkzaamheden. Deze overlast kan voor een deel worden voorkomen door vooral in nieuwbouwwijken op waterstof over te schakelen en daarnaast door installaties te bouwen die elektrische stroom en warm water leveren voor een hele woonwijk.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_36

INDIEN [Q7041_36 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_36

INDIEN [Q7041_36 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_37

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

Benodigde nieuwe installaties (in huis)

In de stedelijke gebieden moeten in honderdduizenden woningen installaties worden geplaatst die waterstof omzetten in elektrische stroom en warmte voor het huishouden. Deze installaties vervangen dus onder andere cv-ketels en zijn ongeveer net zo groot.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_37

INDIEN [Q7041_37 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_37

INDIEN [Q7041_37 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_38

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

Benodigde nieuwe voertuigen

In de stedelijke gebieden moeten busmaatschappijen en vrachtvervoerders nieuwe voertuigen aanschaffen die op waterstof lopen.

In deze gebieden moet ook bij een aantal tankstations waterstof getankt kunnen worden.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_38

INDIEN [Q7041_38 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_38

INDIEN [Q7041_38 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_39

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde technische doorbraken
Er is al voldoende kennis om op kortere termijn te beginnen met invoering van deze technologie (er zijn geen grote technische doorbraken nodig). Wel moet nog uitgezocht worden wat de beste veiligheidsmaatregelen zijn voor waterstofgebruik in woningen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_39

INDIEN [Q7041_39 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_39

INDIEN [Q7041_39 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_40

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Veiligheid waterstof in dagelijks leven
Deskundigen denken dat het vervoer van waterstof via pijpleidingen en het gebruik van waterstof in huishoudens net zo veilig is te maken als het huidige vervoer en gebruik van aardgas. Wel zijn de kosten van de technische veiligheidsmaatregelen waarschijnlijk hoger. Ongevallen door verstikking, brand of ontploffing zullen dan niet vaker voorkomen dan nu. Ook waterstofgebruik in tankstations, bussen en vrachtwagens zal door maatregelen (tegen nog onbekende kosten) even veilig worden gemaakt als benzinegebruik nu.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_40

INDIEN [Q7041_40 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_40

INDIEN [Q7041_40 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_41

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

Bijdrage aan het broeikaseffect

De bijdrage aan het broeikaseffect wordt door deze technologie sterk verminderd: de uitstoot van CO_2 naar de lucht wordt minder dan een tiende van de hoeveelheid die nu wordt uitgestoten om dezelfde hoeveelheid energie op te wekken voor industrie, huishoudens en vracht- en busvervoer.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_41

INDIEN [Q7041_41 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_41

INDIEN [Q7041_41 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_42

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

Bijdrage aan verzuring

Verzuring kan leiden tot het uitsterven van planten- en diersoorten, sterfte van bomen, schade aan de landbouw, schade aan monumenten en goederen, vergrassing van heide en verslechterde kwaliteit van drinkwaterbronnen. De verwachting is dat door deze technologie (vergeleken bij wat het vervangt) de verzuringsgevolgen eerst worden gehalveerd en later (rond 2030) mogelijk tot een tiende teruggebracht.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_42

INDIEN [Q7041_42 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_42

INDIEN [Q7041_42 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_43

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Bijdrage aan de luchtkwaliteit
De uitlaatgassen van bussen en vrachtwagens die op waterstof rijden zijn veel schoner dan de huidige dieselvoertuigen. Daarmee levert deze technologie een bescheiden bijdrage aan het verbeteren van de luchtkwaliteit en daarmee aan de gezondheid. De installaties die waterstof omzetten in elektriciteit en warmte voor de industrie en huishoudens zullen op termijn waarschijnlijk ook bijdragen aan verbeterde luchtkwaliteit.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_43

INDIEN [Q7041_43 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_43

INDIEN [Q7041_43 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_44

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Aantal jaren dat gebruik technologie mogelijk is
Wanneer buitenlandse gasvoorraden worden meegerekend kunnen we enkele eeuwen voort, maar deskundigen hebben berekend dat er onder de bodem van Nederland en bijbehorende Noordzee opslagruimte is voor CO_2 om minstens ongeveer 50 jaar door te gaan met deze technologie en hoogstens ongeveer 300 jaar.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_44

INDIEN [Q7041_44 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_44

INDIEN [Q7041_44 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_45

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van

CO_2 en ondergrondse opslag van CO_2
Betrouwbaarheid van de energievoorziening
Deskundigen vinden het belangrijk dat we altijd voldoende energie kunnen opwekken. Het gebruik van gas als brandstof is minder betrouwbaar wanneer gas moet worden ingevoerd uit andere landen. Dit is het geval vanaf ongeveer 2020. Om de betrouwbaarheid zo hoog mogelijk te houden is het mogelijk om gasreserves op te slaan voor later gebruik,
maar dit leidt tot een hogere gasprijs.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_45

INDIEN [Q7041_45 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_45

INDIEN [Q7041_45 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_15

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Prijs
De brandstofkosten voor de industrie worden bij deze technologie ongeveer twee keer zo duur. De brandstofkosten voor huishoudens gaan met ongeveer viertiende omhoog. De brandstofkosten voor bussen en vrachtwagens worden ongeveer een derde duurder. Op termijn (2030) zullen deze kosten dalen, bijvoorbeeld omdat de installaties die aardgas omzetten in waterstof verbeterd worden en goedkoper en zuiniger gaan werken. De industrie zal dan ongeveer driekwart meer moeten gaan betalen. Huishoudens zullen dan ongeveer een derde meer moeten gaan betalen. De brandstofkosten voor bussen en vrachtwagens worden dan ongeveer een kwart duurder dan nu.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_15

INDIEN [Q7031_15 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_15

INDIEN [Q7031_15 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 143

Uw oordelen over de omzetting van aardgas in waterstof
Benodigde nieuwe installaties <?>
Benodigde nieuwe pijpleidingen <?>
Benodigde nieuwe installaties (in huis) <?>
Benodigde nieuwe voertuigen <?>
Benodigde technische doorbraken <?>
Veiligheid waterstof in het dagelijks leven <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan de luchtkwaliteit <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid van de energievoorziening <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze technologie denkt.
Hierbij kunt u rekening houden met uw eigen beoordelingen
van de kenmerken en gevolgen.
Wat is uw algemene waardering van de omzetting van aardgas in waterstof
(voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met
verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 145

Uw oordelen over de omzetting van aardgas in waterstof
Benodigde nieuwe installaties <?>
Benodigde nieuwe pijpleidingen <?>
Benodigde nieuwe installaties (in huis) <?>

Benodigde nieuwe voertuigen <?>
Benodigde technische doorbraken <?>
Veiligheid waterstof in het dagelijks leven <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan de luchtkwaliteit <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid van de energievoorziening <?>
Prijs <?>
Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 151

Nu volgt een omschrijving van de vijfde technologie. Daarna volgen de te beoordelen kenmerken en gevolgen.

VRAAG 152

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen

In en tussen ondergrondse steenkoollagen bevindt zich methaangas. In deze diepliggende koollagen, die ongeschikt zijn voor winning van kolen, kan CO_2 worden opgeslagen. Dat gaat door de CO_2, die eerder afgevangen is bij installaties of elektriciteitscentrales, via een boorgat in zo'n koollaag te pompen waarbij via een ander boorgat het methaangas wordt gewonnen. Dat methaangas zal gebruikt worden voor dezelfde doelen als aardgas bijvoorbeeld voor elektriciteitsopwekking in centrales en om te verwarmen of te koken. Om te zorgen dat er 20 procent minder CO_2 in de lucht komt, moet het methaangas uit koollagen ongeveer een derde van het huidige aardgasgebruik vervangen. Er is hier nog weinig ervaring met winning van methaangas door verwijderde CO_2 op te slaan in koollagen. Maar er is al wel voldoende technische kennis om deze technologie te verwezenlijken. Deze technologie kan in Nederland waarschijnlijk op korte termijn (al vanaf 2010) worden ingevoerd.

VRAAG 7031_16

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen

Benodigde nieuwe boortorens.
Voor deze technologie zijn over Nederland verspreid, veel boortorens nodig (tot 20 meter hoog) die na enige tijd weer worden afgebroken waarna ongeveer twee meter hoge puthoofden overblijven. Op een plek waar op dat moment geboord wordt ziet het landschap er dus tijdelijk duidelijk anders uit door één of enkele boortorens. Na een aantal jaren kunnen de puthoofden ook worden verwijderd.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_16

INDIEN [Q7031_16 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_16

INDIEN [Q7031_16 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_17

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Benodigde putten en pijpleidingen
Voor deze technologie zijn veel putten nodig voor het ondergronds brengen van de CO_2 en het bovengronds halen van het methaangas. Tot 50 keer meer putten dan bij andere methoden van CO_2 opslag. Sommige deskundigen verwachten dat er vanwege landschapseffecten vaak bezwaar gemaakt zal worden tegen de bouw van boortorens en andere voorzieningen. Dat kan afgifte van vergunningen vertragen en daarmee de toepassing van deze technologie op grote schaal vertragen.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_17

INDIEN [Q7031_17 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_17

INDIEN [Q7031_17 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_18

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Benodigde nieuwe kennis en onderzoek
Er is al voldoende kennis om deze technologie op kortere termijn te verwezenlijken (er zijn geen grote technische doorbraken nodig).
Wel is meer kennis nodig over hoeveel CO_2 opgenomen kan worden door kool, zodat beter ingeschat kan worden hoe lang we gebruik kunnen maken van deze technologie.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_18

INDIEN [Q7031_18 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_18

INDIEN [Q7031_18 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_46

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Bijdrage aan het broeikaseffect
De bijdrage aan het broeikaseffect wordt sterk verminderd door deze

technologie. De totale uitstoot van CO_2 naar de lucht wordt in heel Nederland een vijfde minder dan de uitstoot in 1990. Dit is ongeveer vergelijkbaar met de uitstootvermindering van de andere technologieën.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_46

INDIEN [Q7041_46 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_46

INDIEN [Q7041_46 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_19

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Aantal jaren dat gebruik technologie mogelijk is
Deskundigen hebben berekend dat er onder Nederland in de koollagen die geschikt zijn voor opslag van CO_2 (en winning van gas) ruimte is om minstens ongeveer 5 jaar door te gaan met deze technologie op deze schaal en hoogstens bijna 50 jaar.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_19

INDIEN [Q7031_19 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_19

INDIEN [Q7031_19 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_20

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen

Betrouwbaarheid energievoorziening

Deskundigen vinden hoge betrouwbaarheid van de energievoorziening belangrijk, dat wil zeggen dat we altijd voldoende energie kunnen opwekken. In de VS en Canada zijn goede ervaringen opgedaan met deze technologie maar of die even gunstig zullen zijn in Nederland is onbekend. Toch verwachten sommige deskundigen dat deze technologie op kortere termijn zeer betrouwbaar zal zijn.

Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_20

INDIEN [Q7031_20 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_20

INDIEN [Q7031_20 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_47

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Economische gevolgen
Winning van methaangas vormt een binnenlandse energiebron.
Door grootschalige toepassing van deze technologie hoeft Nederland minder energie uit het buitenland in te voeren. Dat is waarschijnlijk goed voor onze economie.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_47

INDIEN [Q7041_47 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_47

INDIEN [Q7041_47 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_21

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Prijs
Met deze technologie gewonnen methaangas is ongeveer anderhalf keer duurder dan aardgas. Deze prijsstijging kan eerst hoger uitvallen (tot

bijna drie keer zo duur als aardgas) maar door verbeterde technieken kan de prijsstijging op den duur misschien lager worden (ongeveer eenderde duurder dan aardgas). De huidige kosten van aardgas voor huishoudens bestaan voor een aanzienlijk deel uit belastingtoeslag. Omdat deze belasting waarschijnlijk niet hoger wordt bij methaangas gebruik, zullen de kosten voor huishoudens waarschijnlijk wel stijgen, maar beduidend minder stijgen dan voor industrie.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_21

INDIEN [Q7031_21 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_21

INDIEN [Q7031_21 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 153

Uw oordelen over winning van methaangas
Benodigde nieuwe boortorens <?>
Benodigde putten en pijpleidingen <?>
Benodigde nieuwe kennis en onderzoek <?>
Bijdrage aan het broeikaseffect <?>
Aantal jaren dat gebruik van de technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Econonomische gevolgen <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze technologie denkt.
Hierbij kunt u rekening houden met uw eigen beoordelingen
van de kenmerken en gevolgen.
Wat is uw algemene waardering van de winning van methaangas
door verwijderde CO_2 op te slaan in koollagen?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 155

Uw oordelen over winning van methaangas
Benodigde nieuwe boortorens <?>
Benodigde putten en pijpleidingen <?>
Benodigde nieuwe kennis en onderzoek <?>
Bijdrage aan het broeikaseffect <?>
Aantal jaren dat gebruik van de technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Econonomische gevolgen <?>
Prijs <?>
Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 161

Nu volgt een omschrijving van de laatste technologie. Daarna volgen de te beoordelen kenmerken en gevolgen.

VRAAG 162

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

In kleine installaties bij tankstations wordt aardgas omgezet in waterstof. Waterstof is een gas dat bij verbranding energie oplevert. Deze waterstof wordt gebruikt voor de aandrijving van auto’s bij zowel personen- als vrachtverkeer op de weg. Om te zorgen dat er in heel Nederland 20 procent minder CO_2 in de lucht komt, moet waterstof vrijwel al het gebruik van benzine en diesel vervangen. Daarvoor zijn installaties nodig die bij alle tankstations gebouwd zullen worden en ongeveer zo groot zijn als een flinke caravan. De CO_2 die bij het omzetten van aardgas naar waterstof vrijkomt, wordt afgevangen en opgeslagen in ondergrondse ruimtes, zowel onder land als onder de bodem van de Nederlandse Noordzee. Deze methode is op deze grote schaal waarschijnlijk pas inzetbaar vanaf 2030. De verwachting is dat de vereiste technische vernieuwingen dan zijn verwezenlijkt maar dat is niet zeker. Ook moeten rond 2030 vrijwel alle motorvoertuigen zijn vervangen en op waterstof lopen.

VRAAG 7031_22

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

Benodigde nieuwe installaties

Voor deze technologie is het nodig om de huidige tankstations te vervangen door waterstoftankstations met installaties die aardgas naar waterstof omzetten. Voor een succesvolle invoering van deze technologie moeten deze veranderingen snel worden doorgevoerd, ook in het buitenland (waterstofauto's moeten meteen overal kunnen tanken).

Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_22

INDIEN [Q7031_22 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_22

INDIEN [Q7031_22 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_48

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

Benodigde nieuwe pijpleidingen

Er moeten heel veel nieuwe pijpleidingen aangelegd worden die de bij waterstoftankstations geproduceerde CO_2 afvoeren naar de ondergrondse opslagruimtes. Dit levert overlast door graafwerkzaamheden op.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_48

INDIEN [Q7041_48 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_48

INDIEN [Q7041_48 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_49

Omzetting van aardgas in waterstof (voor motorvoertuigen) met
verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde nieuwe voertuigen
Ook moeten alle auto’s en andere motorvoertuigen
worden vervangen door voertuigen die op waterstof lopen.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_49

INDIEN [Q7041_49 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_49

INDIEN [Q7041_49 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_23

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde technische doorbraken
Er zijn technische vindingen nodig, bijvoorbeeld om zuinigere installaties te maken waarin het aardgas wordt omgezet in waterstof. Ook moeten er betere manieren worden uitgevonden om waterstof in auto’s op te slaan. Dergelijke technische doorbraken worden wel verwacht maar zijn niet zeker.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_23

INDIEN [Q7031_23 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_23

INDIEN [Q7031_23 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_50

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Veiligheid waterstof in dagelijks leven
Deskundigen denken dat het waterstofgebruik net zo veilig is te maken

als het huidige gebruik van benzine. De kosten van technische maatregelen hiervoor zijn nog niet precies bekend. Ongevallen door brand of ontploffing in tankstations en in voertuigen zullen dan niet vaker voorkomen dan nu.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_50

INDIEN [Q7041_50 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_50

INDIEN [Q7041_50 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_24

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Bijdrage aan het broeikaseffect
De bijdrage van het Nederlandse gemotoriseerde verkeer aan het broeikaseffect wordt sterk verminderd door deze technologie: de uitstoot van CO_2 naar de lucht wordt minder dan een tiende van de hoeveelheid die het verkeer nu uitstoot.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_24

INDIEN [Q7031_24 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_24

INDIEN [Q7031_24 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_51

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Bijdrage aan verzuring
De uitlaatgassen van het huidige verkeer met diesel- en benzinemotoren hebben een flink aandeel in de bijdrage aan verzuring. Verzuring kan leiden tot het uitsterven van planten- en diersoorten, sterfte van bomen, schade aan de landbouw, schade aan monumenten en goederen, vergrassing van heide en verslechterde kwaliteit van drinkwaterbronnen. Door deze technologie met voertuigen op waterstof wordt de bijdrage van het verkeer aan verzuring sterk verminderd tot minder dan een tiende teruggebracht.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_51

INDIEN [Q7041_51 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_51

INDIEN [Q7041_51 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_52

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Bijdrage aan de luchtkwaliteit
Voertuigen die op waterstof rijden stoten vrijwel geen giftige stoffen uit en zorgen voor een veel betere luchtkwaliteit in de steden dan nu.
In Nederland overlijden nu per jaar zo'n 5000 mensen vroegtijdig aan de gevolgen van slechte luchtkwaliteit door uitlaatgassen van het verkeer.
Wanneer deze technologie rond 2030 op grote schaal is verwezenlijkt worden in Nederland duizenden levens per jaar gespaard door schonere lucht.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_52

INDIEN [Q7041_52 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_52

INDIEN [Q7041_52 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_25

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

Aantal jaren dat gebruik van de technologie mogelijk is

Wanneer de buitenlandse gasvoorraden worden meegerekend, is er voorlopig voldoende aardgas voor een of enkele eeuwen. Deskundigen hebben berekend dat er onder de bodem van Nederland en bijbehorende Noordzee opslagruimte is voor CO_2 om minstens ongeveer 50 jaar door te gaan met deze technologie en hoogstens ongeveer 250 jaar.

Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_25

INDIEN [Q7031_25 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_25

INDIEN [Q7031_25 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_53

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

Betrouwbaarheid van energievoorziening

Deskundigen vinden het belangrijk dat we altijd voldoende energie kunnen opwekken. Het gebruik van gas als brandstof is minder betrouwbaar wanneer gas moet worden ingevoerd uit andere landen. Dit is het geval vanaf ongeveer 2020. Om de betrouwbaarheid zo hoog mogelijk te houden is het mogelijk om gasreserves op te slaan voor later gebruik, maar dit leidt tot een hogere gasprijs.

Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_53

INDIEN [Q7041_53 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_53

INDIEN [Q7041_53 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7041_54

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Economische gevolgen
Er moet in Nederland in korte tijd heel veel geld gestoken worden in alle veranderingen die noodzakelijk zijn voor deze technologie (nieuwe installaties en voertuigen, heel veel CO_2 pijpleidingen).
Het precieze effect van deze investeringen op onze economie is onbekend.
Vindt u dit gevolg onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7042_54

INDIEN [Q7041_54 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7044_54

INDIEN [Q7041_54 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 7031_26

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Prijs
De kosten voor het maken van waterstof zijn ongeveer twee keer zo hoog als voor benzine. Overigens zullen de brandstofkosten voor het wegverkeer waarschijnlijk duidelijk minder stijgen (misschien een tiende tot vier tiende meer dan nu) bijvoorbeeld omdat er minder belasting wordt geheven op waterstof (dan op benzine) of omdat waterstofauto's zuiniger worden.
Vindt u dit kenmerk onbelangrijk, een nadeel of een voordeel?

0 ❑ Onbelangrijk
1 ❑ Nadeel
2 ❑ Voordeel

VRAAG 7032_26

INDIEN [Q7031_26 , 1]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het nadeel?

1 ❑ Heel klein nadeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot nadeel

VRAAG 7034_26

INDIEN [Q7031_26 , 2]

Noot van de programmeur: (Zelfde scherm)
Hoe klein of groot vindt u het voordeel?

1 ❑ Heel klein voordeel
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ 8
9 ❑ Heel groot voordeel

VRAAG 163

Uw oordelen over de omzetting van aardgas in waterstof
Benodigde nieuwe installaties <?>

Benodigde nieuwe pijpleidingen <?>
Benodigde nieuwe voertuigen <?>
Benodigde technische doorbraken <?>
Veiligheid waterstof in het dagelijks leven <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan luchtkwaliteit <?>
Aantal jaren dat gebruik van de technologie mogelijk is <?>
Betrouwbaarheid van energievoorziening <?>
Economische gevolgen <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)
We vragen u nu hoe u al met al over deze technologie denkt.
Hierbij kunt u rekening houden met uw eigen beoordelingen
van de kenmerken en gevolgen.
Wat is uw algemene waardering van de omzetting van aardgas in waterstof
(voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag
van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 165

Uw oordelen over de omzetting van aardgas in waterstof
Benodigde nieuwe installaties <?>
Benodigde nieuwe pijpleidingen <?>
Benodigde nieuwe voertuigen <?>
Benodigde technische doorbraken <?>
Veiligheid waterstof in het dagelijks leven <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan luchtkwaliteit <?>
Aantal jaren dat gebruik van de technologie mogelijk is <?>
Betrouwbaarheid van energievoorziening <?>
Economische gevolgen <?>
Prijs <?>
Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 201

U hebt net zes technologieën beoordeeld. Op dit scherm en enkele volgende
schermen gaat u bepalen welke van de zes technologieën uw voorkeur heeft
om in de toekomst op grote schaal toegepast te worden.
De rapportcijfers die u gaf ziet u hier.
1. Grote moderne centrales waarin kolen worden omgezet in elektriciteit
(voor huishoudens en bedrijven) met verwijdering van
en ondergrondse opslag van CO_2 Rapportcijfer <Question 115>
2. Omzetting van aardgas in elektriciteit (voor huishoudens en
bedrijven), met verwijdering van CO_2
en ondergrondse opslag van CO_2 Rapportcijfer <Question 125>
3. Grote centrales waarin kolen worden omgezet in waterstof (voor
industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2
en ondergrondse opslag van CO_2 Rapportcijfer <Question 135>
4. Omzetting van aardgas in waterstof (voor industrie, voor huishoudens
en voor bus- en vrachtvervoer), met verwijdering van CO_2
en ondergrondse opslag van CO_2 Rapportcijfer <Question 145>
5. Winning van methaangas door verwijderde CO_2 op te slaan
in koollagen Rapportcijfer <Question 155>

6. Omzetting van aardgas in waterstof (voor motorvoertuigen)
met verwijdering van CO_2
en ondergrondse opslag van CO_2 Rapportcijfer <Question 165>

VRAAG 203

Het gaat nog steeds om het bepalen van uw voorkeur voor één van de zes technologieën als het gaat om grootschalige toepassing in de toekomst. Deze vragenlijst ging niet over alle mogelijkheden om energie op te wekken, maar alleen over zes technologieën voor gebruik van kolen en gas met afvang van CO_2 en verwijdering van CO_2.
We willen u vragen welke van deze zes technologieën uw voorkeur zou hebben om op grote schaal toegepast te worden.
Bij het bepalen van uw voorkeur voor een technologie, zou u gebruik kunnen maken van de rapportcijfers. Het zou kunnen dat u, nu u alle informatie over de technologieën hebt gelezen en kunt vergelijken, door deze vergelijking anders bent gaan denken over sommige technologieën. In dat geval kunt u in het volgende overzicht een nieuw rapportcijfer geven.

VRAAG 204

Noot van de programmeur: (Zelfde scherm)
Wilt u één of meer technologieën een nieuw rapportcijfer geven?

1 ❑ Ja
2 ❑ Nee
↳ *GA VERDER NAAR VRAAG 207*

VRAAG 2056

Hieronder staan de zes technologieën met uw oorspronkelijke rapportcijfer.
U kunt daar achter een nieuw rapportcijfer intikken. Wilt u het niet veranderen, druk dan op [ENTER]. Mocht u uw beoordeling van de kenmerken en gevolgen van een technologie nog eens willen zien, dan kan dit door '99' in te tikken.
1. Grote moderne centrales waarin kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2
en ondergrondse opslag van CO_2<Question 115> Nieuw rapportcijfer -
2. Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2
en ondergrondse opslag van CO_2<Question 125> Nieuw rapportcijfer -
3. Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2
en ondergrondse opslag van CO_2<Question 135> Nieuw rapportcijfer -
4. Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2
en ondergrondse opslag van CO_2<Question 145> Nieuw rapportcijfer -
5. Winning van methaangas door verwijderde CO_2 op te slaan
in koollagen <Question 155> Nieuw rapportcijfer -
6. Omzetting van aardgas in waterstof (voor motorvoertuigen)
met verwijdering van CO_2en ondergrondse opslag van CO_2 <Question 165> Nieuw rapportcijfer-

VRAAG 3001_1

Uw oordeel over:
Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde nieuwe installaties <?>
Veiligheid mijnwerkers <?>
Bijdrage aan broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan vervuiling van omgeving van kolenmijnen <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>

Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)

VRAAG 3002_1
Uw oordeel over:
Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Benodigde nieuwe installaties <?>
Benodigde nieuwe leidingen <?>
Benodigde nieuwe CO_2 leidingen <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Betrouwbaarheid energievoorziening door brandstofcellen <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)

VRAAG 3003_1
Uw oordeel over:
Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2.
Benodigde nieuwe installaties en pijpleidingen <?>
Benodigde nieuwe voertuigen <?>
Veiligheid mijnwerkers <?>
Veiligheid centrales <?>
Veiligheid vervoer waterstof <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan de luchtkwaliteit <?>
Bijdrage aan de vervuiling van de omgeving van kolenmijnen <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)

VRAAG 3004_1
Uw oordeel over:
Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde nieuwe installaties <?>
Benodigde nieuwe pijpleidingen <?>
Benodigde nieuwe installaties (in huis) <?>
Benodigde nieuwe voertuigen <?>
Benodigde technische doorbraken <?>
Veiligheid waterstof in het dagelijks leven <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan de luchtkwaliteit <?>
Aantal jaren dat gebruik technologie mogelijk is <?>
Betrouwbaarheid van de energievoorziening <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)

VRAAG 3005_1
Uw oordeel over:
Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
Benodigde nieuwe boortorens <?>
Benodigde putten en pijpleidingen <?>
Benodigde nieuwe kennis en onderzoek <?>

Bijdrage aan het broeikaseffect <?>
Aantal jaren dat gebruik van de technologie mogelijk is <?>
Betrouwbaarheid energievoorziening <?>
Econonomische gevolgen <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)

VRAAG 3006_1

Uw oordeel over:
Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2
Benodigde nieuwe installaties <?>
Benodigde nieuwe pijpleidingen <?>
Benodigde nieuwe voertuigen <?>
Benodigde technische doorbraken <?>
Veiligheid waterstof in het dagelijks leven <?>
Bijdrage aan het broeikaseffect <?>
Bijdrage aan verzuring <?>
Bijdrage aan luchtkwaliteit <?>
Aantal jaren dat gebruik van de technologie mogelijk is <?>
Betrouwbaarheid van energievoorziening <?>
Economische gevolgen <?>
Prijs <?>
(Nadeel: 1=heel klein, 9=heel groot. Voordeel: 1=heel klein, 9=heel groot)

GA VERDER NAAR VRAAG 2056

VRAAG 208

We willen u vragen welke van deze zes technologieën uw voorkeur zou hebben om op grote schaal toegepast te worden.
Bepaalt u nu uw keuze door het cijfer voor een technologie in te tikken of door op de technologie te klikken.
Als u wilt kunt u hierbij gebruik maken van de rapportcijfers.
Uiteraard kunt u (ook) andere overwegingen een rol laten spelen.

1 ❑ Grote moderne centrales waarin kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <Question 2051>
2 ❑ Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <Question 2052>
3 ❑ Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <Question 2053>
4 ❑ Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <Question 2054>
5 ❑ Winning van methaangas door verwijderde CO_2 op te slaan in koollagen Rapportcijfer <Question 2055>
6 ❑ Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <Question 2056>

VRAAG 210

Misschien vond u één of meer van de technologieën volstrekt onaanvaardbaar.
Is er bij de zes technologieën die u beoordeelde, één of meer voor u zo onaanvaardbaar, dat u denkt actie te ondernemen wanneer in Nederland overwogen wordt deze technologie grootschalig te gaan toepassen?

1 ❑ Ja
2 ❑ Nee

VRAAG 211

INDIEN [Q210 , 1]

Kunt u hier aangeven van welke technologieën u grootschalige toepassing echt onaanvaardbaar vindt?
(Meer antwoorden mogelijk)

1 ❑ Grote moderne centrales waarin kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
2 ❑ Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2
3 ❑ Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
4 ❑ Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
5 ❑ Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
6 ❑ Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

VRAAG 221

In deze enquête heeft u informatie gekregen over een aantal verschillende manieren om in de vraag naar energie te voorzien, over het broeikaseffect en de opslag van CO_2. Daar willen we u een paar vragen over stellen.

U kunt uw antwoord geven door een getal tussen 1 en 7 aan te klikken dat uw mening het best weergeeft.
In hoeverre vindt u dat u over voldoende informatie beschikt om een keuze te kunnen maken tussen de verschillende mogelijkheden om energie op te wekken?

1 ❑ 1 Onvoldoende
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Voldoende

VRAAG 222

In hoeverre had u meer informatie willen hebben voor u uw oordeel gaf over alle gevolgen en kenmerken in de enquête?
Minder/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 223
In hoeverre vindt u de informatie in de enquête partijdig of onpartijdig?
Partijdig/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 224
In hoeverre vindt u de informatie eenzijdig?
Eenzijdig/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 225
Hoe duidelijk vindt u de informatie?
Onduidelijk/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 226
In hoeverre vindt u de informatie volledig?
Onvolledig/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 227

In hoeverre vindt u de hoeveelheid informatie gepast?
Te weinig/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 228

In hoeverre vindt u het prettig dat de informatie en werkwijze soms herhaald werden?
Irritant/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 301

Was er een moment tijdens het beantwoorden van de vragen dat u iets onduidelijk vond of dat u niet begreep wat u moest doen?

1 ❑ Ja
2 ❑ Nee

VRAAG 302

INDIEN [Q301 , 1]

Kunt u hier in uw eigen woorden aangeven wat u onduidelijk of onbegrijpelijk vond?

VRAAG 229

In deze enquête werd een speciale werkwijze gevolgd. Voor u een keuze maakte, kreeg u eerst informatie en werd u gevraagd uw mening over die informatie te geven. Over deze werkwijze willen we u een paar vragen stellen. U kunt steeds antwoord geven door het getal tussen 1 en 7 te noemen dat uw mening het beste weergeeft.
In hoeverre heeft de werkwijze u geholpen bij het maken van een keuze?
Niet geholpen/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 230
In hoeverre vindt u de werkwijze begrijpelijk?
Niet begrijpelijk/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 231
In hoeverre vindt u de werkwijze eenvoudig of ingewikkeld?
Eenvoudig/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 232
De mogelijkheden waaruit u kon kiezen stonden vast. In hoeverre voelde u zich hierdoor beperkt in uw keuze?
Beperkt/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 7051_1
Mogelijk bent u door de informatie die u gekregen heeft anders gaan denken over de opwekking van energie en de kenmerken en gevolgen daarvan. Hierover wordt een vijftal vragen gesteld. U kunt antwoord geven door het getal tussen 1 en 7 te noemen dat uw mening het beste weergeeft.
In hoeverre is uw mening over de verschillende manieren om energie op te wekken veranderd?

1 ❑ Niet veranderd
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ Wel veranderd

VRAAG 7051_2

In hoeverre is uw mening over het broeikaseffect en de gevolgen daarvan veranderd?

1 ❑ Niet veranderd
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ Wel veranderd

VRAAG 7051_3

In hoeverre is uw mening over de opslag van CO_2 en de gevolgen daarvan veranderd?

1 ❑ Niet veranderd
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ Wel veranderd

VRAAG 241

In hoeverre heeft u door de informatie meer argumenten gekregen voor Uw keuze voor één van de mogelijkheden om energie op te wekken?
Geen extra/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 242

In hoeverre bent u door de informatie in het algemeen anders gaan denken over verschillende manieren om energie op te wekken?
Niet anders/

0 ❑
1 ❑
2 ❑
3 ❑
4 ❑
5 ❑
6 ❑
7 ❑

VRAAG 7061_1

Hier ziet u een aantal uitspraken over energie.
Wilt u voor elke uitspraak zeggen in welke mate u het met de uitspraak eens of oneens bent? U kunt uw antwoord geven door een van de zeven antwoordmogelijkheden aan te geven.
Op welke manier er energie opgewekt wordt maakt mij niet veel uit.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_2

Ik heb voor mezelf een duidelijke afweging gemaakt tussen de voor- en nadelen van verschillende manieren om energie op te wekken.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_3

Ik voel me niet betrokken bij energievoorziening.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_4

Als er een documentaire over energievoorziening op de televisie komt, zorg ik er voor dat ik daar naar kan kijken.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_5

Op welke manier er op grote schaal energie opgewekt wordt, heeft voor mijzelf belangrijke consequenties.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_6

Als er op televisie over het broeikaseffect wordt gesproken,
zoek ik een ander kanaal.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_7

Als er in de krant iets wordt geschreven over de energievoorziening,
dan sla ik dat over.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_8

Ik wil mijn mening over het broeikaseffect ook openlijk laten blijken
door bijvoorbeeld een affiche voor het raam, het dragen van een button
of een sticker op de auto.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 251

Ik heb de film "The day after tomorrow", die een plotselinge omslag
van het klimaat naar een nieuwe ijstijd uitbeeldde, gezien.

1 ❑ Ja
2 ❑ Nee

VRAAG 252

Ik ken de spotjes van Postbus 51 waarin weerman
Peter Timofeeff vertelt over Nederland en water.

1 ❑ Ja, ik heb de afgelopen maanden minstens drie spotjes gezien, waaronder het spotje over het stijgen van de zeespiegel
2 ❑ Ja, ik heb minstens één van de spotjes wel eens gezien, waaronder het spotje over het stijgen van de zeespiegel
3 ❑ Ja, ik heb minstens één van de spotjes wel eens gezien
4 ❑ Nee, ik heb deze nog nooit gezien

INDIEN [Q7071_15 , 0] GA VERDER NAAR VRAAG 7071_15

VRAAG 310

Tot slot een paar achtergrondvragen.
Op welke politieke partij zou u stemmen als er vandaag
Tweede Kamerverkiezingen zouden zijn?

3 ❑ CDA
4 ❑ PvdA
5 ❑ VVD
6 ❑ SP
7 ❑ LPF
8 ❑ Groen Links
9 ❑ D66
10 ❑ Christen Unie
11 ❑ SGP
12 ❑ Lijst Wilders
19 ❑ Andere partij namelijk...
20 ❑ Ik zou niet stemmen
21 ❑ Ik heb geen stemrecht
27 ❑ Ik zou blanco\ongeldig stemmen
28 ❑ Dat wil ik niet zeggen
29 ❑ Dat weet ik niet

VRAAG 320

Heeft u broers of zusters?

1 ❑ Ja
2 ❑ Nee

INDIEN [Q320 , 1]

VRAAG 322

INDIEN [Q320 , 1 & G01 + G02 + G03 + G04 = 0]

U gaf aan broers of zusters te hebben en tikt dan 4 keer een 0 in.
Ga terug en verbeter uw antwoord.

INDIEN [Q320 , 1 & G01 + G02 + G03 + G04 = 0] GA VERDER NAAR VRAAG 321

VRAAG 9901

Tot zover het invullen van de vragenlijst. Wilt u deze vragenlijst dan
nu beoordelen door een rapportcijfer (van 1 tot 10) te geven? Als u deze
vragenlijst erg vervelend vond, geeft u een 1. Vond u het uitermate
interessant, dan geeft u een 10.

VRAAG 9902

Heeft u verder nog op- of aanmerkingen over deze vragenlijst?

1 ❑ Ja
2 ❑ Nee

VRAAG 9903

INDIEN [Q9902 , 1]

U heeft de rest van het scherm voor uw op- en aanmerkingen!

Appendix 4:Questionnaire without information (TQ) (In Dutch)

Notes:

This document does not show any tables that were visible for the respondents. See the procedure for a description of this table.

This is the text of the questionnaire of TQ1. TQ2 was similar, but had a different order and an extra filler task. The introduction of the second TQ was similar to that of the first TQ, as was the first part of the questionnaire with the awareness questions ad the overall evaluation questions about global warming, CCS, and the six CCS options. In TQ2, the filler task then followed instead of the knowledge questions. After this, respondents in the TQ2 did not receive information, but instead were again asked the same overall evaluation questions they were asked in the first part of the TQ. After this, respondents were asked to choose between the six CCS options. This part of the procedure was the same again as in TQ1. At this point in TQ2, the knowledge questions were asked, and furthermore the same questions that came after choosing in TQ1 were also asked in TQ2. At the end of the document, the filler task of TQ2 is given.

VRAAG 7100

In Nederland wordt veel energie gebruikt. Bijvoorbeeld verwarming, licht, elektrische apparaten en vervoer kosten allemaal energie. Naar verwachting gaan we in Nederland steeds meer energie gebruiken. Bijna alle manieren waarop we momenteel energie opwekken zijn schadelijk voor het milieu en beïnvloeden het klimaat. In de toekomst is het nodig meer vormen van energie te gaan gebruiken die minder schadelijk zijn voor milieu en het klimaat niet beïnvloeden.
Wat vinden Nederlanders er van?
Wat er precies moet gebeuren staat echter nog niet vast. De Universiteit van Leiden voert een onderzoek uit waarin de Nederlandse bevolking in de gelegenheid gesteld wordt haar mening te geven over enkele nieuwe mogelijkheden om energie op te wekken. De resultaten van dit onderzoek worden in een rapport verwerkt, dat bijvoorbeeld regering en parlement kan helpen beslissingen te nemen.

VRAAG 7101

Deze beslissingen zijn belangrijk, omdat de keuzes bepalend zijn voor de levensomstandigheden in Nederland in de nabije toekomst. Dit onderzoek biedt u de mogelijkheid Uw mening te laten horen. Omdat we een volledig beeld van de in Nederland heersende meningen nastreven, is het belangrijk dat iedereen die wij benaderen, dus ook U, aan het onderzoek meedoet. Uw mening zal strikt vertrouwelijk verwerkt worden.

VRAAG 7102

De onderwerpen die in dit onderzoek aan bod komen, zijn voor de meeste mensen geen dagelijkse kost. De onderwerpen die aan bod komen zijn bijvoorbeeld het broeikaseffect en verschillende mogelijkheden voor energiegebruik in de toekomst. Een manier om mensen te helpen een mening te vormen over een onderwerp, is door informatie daarover aan te bieden. Een aantal mensen krijgt in dit onderzoek dan ook uitgebreide informatie over verschillende mogelijkheden voor energiegebruik in de toekomst en aanverwante onderwerpen.
Daarnaast is het echter ook noodzakelijk vast te stellen welke keuzes mensen maken wanneer zij deze informatie niet krijgen. Zo kan onderzocht worden welke mening mensen nu, zonder de informatie in deze enquête, al hebben over deze onderwerpen. Ook kan zo onderzocht worden, hoeveel mensen zelf al weten van deze onderwerpen.

VRAAG 7103

Een aantal mensen wordt daarom vragen gesteld over mogelijkheden voor energiegebruik zonder dat zij uitgebreide informatie hierover

krijgen. U bent één van de mensen die een enquête zonder uitgebreide informatie krijgt.
In de enquête zonder uitgebreide informatie staan veel dezelfde vragen als in de andere enquête. Omdat aan deze vragen dus geen informatie vooraf gaat, zou het kunnen dat deze vragen nogal vreemd overkomen. Van sommige onderwerpen in de enquête is het zelfs waarschijnlijk dat de meeste mensen er niets van weten, en er dus ook geen vragen over kunnen beantwoorden.

VRAAG 7104

Nu leggen we u een aantal onderwerpen voor, omdat we willen weten van welke onderwerpen u misschien toch wel eens gehoord hebt.
Veel hiervan is nog onbekend bij de meeste mensen, dus wees niet bang om aan te geven wanneer u weinig van een onderwerp weet.
U krijgt steeds eerst de vraag, of u van het onderwerp weet. U kunt dan kiezen uit de antwoorden "nee", "een beetje" of "ja". Daarna krijgt u steeds de vraag, wat u van het onderwerp vindt. U kunt daar uw antwoord geven door een getal tussen 1 en 7 aan te klikken dat uw mening het beste weergeeft. Ook vragen wij u rapportcijfers te geven.

VRAAG 501 **LIST "JANEE"**

Weet u, wat het broeikaseffect inhoudt?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 601

Wat vindt u van dit broeikaseffect?
(U kunt bij deze en een aantal van de volgende vragen de Button met 'Geen mening' gebruiken)

1 ❑ 1 Zeer slecht
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer goed
9 ❑ Geen mening

VRAAG 603

Noot van de programmeur: (Zelfde scherm)

1 ❑ 1 Heel nadelig
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Heel voordelig
9 ❑ Geen mening

INDIEN [Q603 , 0] GA VERDER NAAR VRAAG 603

VRAAG 502 **LIST "JANEE"**

Let op: Bij de komende vragen is het waarschijnlijk dat de meeste mensen er niets van weten. Wees dus niet bang in te vullen dat u ergens niets van weet, de kans is groot dat bijna niemand van de ondervraagden het weet!
Weet u, wat CO_2-afvang, transport en ondergrondse opslag in Nederland inhoudt?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 605

Wat vindt u al met al van CO_2 afvang, transport en ondergrondse opslag in Nederland?

1 ❑ 1 Zeer slecht
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer goed
9 ❑ Geen mening

VRAAG 607

Noot van de programmeur: (Zelfde scherm)

1 ❑ 1 Heel nadelig
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Heel voordelig
9 ❑ Geen mening

VRAAG 503 **LIST "JANEE"**

Weet u van grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 609

Wat is uw algemene waardering van grote moderne centrales waarin kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk
9 ❑ Geen mening

VRAAG 611

Kunt u deze technologie een rapportcijfer geven? Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 504 **LIST "JANEE"**

Weet u van de omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 612

Wat is uw algemene waardering van omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk
9 ❑ Geen mening

VRAAG 614

Noot van de programmeur: (Zelfde scherm)
Kunt u deze technologie een rapportcijfer geven?
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 505 **LIST "JANEE"**

Weet u van grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 615

Wat is uw algemene waardering van grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk
9 ❑ Geen mening

VRAAG 617

Noot van de programmeur: (Zelfde scherm)
Kunt u deze technologie een rapportcijfer geven?
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 506 **LIST "JANEE"**

Weet u van de omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 618

Wat is uw algemene waardering van de omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk
9 ❑ Geen mening

VRAAG 620

Noot van de programmeur: (Zelfde scherm)
Kunt u deze technologie een rapportcijfer geven?
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 507 **LIST "JANEE"**

Weet u van de winning van methaangas door verwijderde CO_2 op te slaan in koollagen?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 621

Wat is uw algemene waardering van de winning van methaangas door verwijderde CO_2 op te slaan in koollagen?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk
9 ❑ Geen mening

VRAAG 623

Noot van de programmeur: (Zelfde scherm)
Kunt u deze technologie een rapportcijfer geven?
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 508 **LIST "JANEE"**

Weet u van de omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ Nee
2 ❑ Een beetje
3 ❑ Ja

VRAAG 624

Wat is uw algemene waardering van de omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk
9 ❑ Geen mening

VRAAG 626

Noot van de programmeur: (Zelfde scherm)
Kunt u deze technologie een rapportcijfer geven?
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 7105

Nu volgt een aantal vragen over energie en milieu.
Ook hiervoor geldt, dat de meeste mensen veel van de vragen moeilijk te beantwoorden zullen vinden.
Wees dus ook bij deze vragen niet bang om aan te geven wanneer u een antwoord niet weet.

VRAAG 509

CO_2, of kooldioxide, is ...

1 ❑ een broeikasgas
2 ❑ de scheikundige naam voor alcohol
3 ❑ de scheikundige naam voor roet
4 ❑ een brandbaar gas
9 ❑ weet ik niet

VRAAG 510

CO_2 of kooldioxide ontstaat ....

1 ❑ door zure regen
2 ❑ door het slijten van de ozonlaag
3 ❑ door de verbranding van onder andere kolen, aardgas of benzine
9 ❑ weet ik niet

VRAAG 511

H2 of waterstof is ..

1 ❑ gewoon water
2 ❑ een gas dat bij verbranding energie oplevert
3 ❑ net zoiets als plutonium
9 ❑ weet ik niet

VRAAG 512

Waterstof haalt men ....

1 ❑ uit de kraan
2 ❑ uit andere grondstoffen, maar daar is energie voor nodig
3 ❑ uit ondergrondse waterstofreservoirs
9 ❑ weet ik niet

VRAAG 513

Het broeikaseffect zorgt voor ..

1 ❑ het lichter worden van Nederland door de vele kassen
2 ❑ de opwarming van het klimaat op aarde
3 ❑ te veel CO_2 of kooldioxide in de lucht
9 ❑ weet ik niet

VRAAG 31

Wordt momenteel ongeveer 95 procent van de energie die gebruikt wordt in Nederland opgewekt met behulp van kolen, gas en olie?

1 ❑ Nee, het is ongeveer 50 procent
2 ❑ Ja
3 ❑ Nee, het is bijna 100 procent
9 ❑ weet ik niet

VRAAG 32

Bij de huidige opwekking van energie met behulp van kolen in Nederland ..

1 ❑ wordt er geen CO_2 uitgestoten naar de dampkring
2 ❑ wordt er wel CO_2 uitgestoten naar de dampkring
9 ❑ weet ik niet

VRAAG 33

Bij de huidige opwekking van energie met behulp van gas in Nederland ...

1 ❑ wordt er geen CO_2 uitgestoten naar de dampkring
2 ❑ wordt er wel CO_2 uitgestoten naar de dampkring
9 ❑ weet ik niet

VRAAG 34

Door de uitstoot van CO_2 bij de huidige opwekking van energie met kolen en met gas .....

1 ❑ wordt het broeikaseffect versterkt
2 ❑ wordt het broeikaseffect verminderd
3 ❑ blijft het broeikaseffect gelijk
9 ❑ weet ik niet

VRAAG 35

Wanneer het broeikaseffect versterkt wordt ...

1 ❑ gaat de gemiddelde temperatuur op aarde omhoog
2 ❑ gaat de gemiddelde temperatuur op aarde omlaag
3 ❑ blijft de gemiddelde temperatuur op aarde hetzelfde
9 ❑ weet ik niet

VRAAG 36

Wanneer de uitstoot van CO_2 blijft toenemen zoals nu,
zal de gemiddelde temperatuur op aarde tot 2050 ....

1 ❑ misschien 10 graden Celsius stijgen
2 ❑ waarschijnlijk 1 tot 5 graden Celsius stijgen
3 ❑ waarschijnlijk 1 tot 5 graden Celsius dalen
4 ❑ zeker 5 tot 10 graden stijgen
9 ❑ weet ik niet

VRAAG 38

CO_2 die ondergronds wordt opgeslagen, bijvoorbeeld in
lege aardgasvelden, draagt ...

1 ❑ niet bij aan het broeikaseffect
2 ❑ nog steeds bij aan het broeikaseffect
9 ❑ weet ik niet

VRAAG 7106

U hebt nu een aantal vragen beantwoord, zonder dat u vooraf wat informatie kreeg. In het volgende deel van de enquête krijgt u wel wat informatie voordat u een vraag krijgt.
Voordat we meer vertellen over deze zes mogelijkheden om in de toekomst energie op te wekken, vertellen we eerst iets over het broeikaseffect en CO_2 opslag.

VRAAG 7107

De lucht in de dampkring rond de aarde bestaat uit meerdere gassen, bijvoorbeeld zuurstof en kooldioxide. Kooldioxide of CO_2 wordt een broeikasgas genoemd. Broeikasgassen in onze dampkring zorgen ervoor dat de warmte die de aarde van de zon ontvangt behouden blijft en niet allemaal weer ontsnapt naar de ruimte. Dit is het broeikaseffect.
Door de opwekking van energie met brandstoffen als olie, aardgas en steenkool komt extra CO_2 vrij en in onze dampkring.
Hierdoor wordt het broeikaseffect versterkt, waardoor de gemiddelde temperatuur op aarde stijgt.

VRAAG 11

Wat vindt u van dit broeikaseffect?

1 ❑ 1 Zeer slecht
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer goed

VRAAG 12

Noot van de programmeur: (Zelfde scherm)

1 ❑ 1 Heel nadelig
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Heel voordelig

VRAAG 7108

Veel landen in de wereld wensen het broeikaseffect te verminderen. Daarom hebben veel landen over de hele wereld, waaronder Nederland, afspraken gemaakt om de uitstoot van CO_2 terug te dringen.

Eén manier om CO_2 uitstoot te verminderen, is door te zorgen dat bij de energieopwekking met brandstoffen als kolen en aardgas minder CO_2 in de lucht komt. Dit kan door de CO_2 die vrijkomt bij energieopwekking met aardgas en kolen af te vangen en ondergronds op te slaan, bijvoorbeeld in lege aardgasvelden. Deze methoden noemen we "technologieën voor gebruik van kolen of gas met verwijdering en ondergrondse opslag van CO_2". Doordat de CO_2 wordt opgeslagen, kan deze niet meer in de lucht komen en dus ook niet meer bijdragen aan het broeikaseffect.

VRAAG 51

Wat vindt u van CO_2 afvang, transport en ondergrondse opslag in Nederland?

1 ❑ 1 Zeer slecht
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer goed

VRAAG 52

Noot van de programmeur: (Zelfde scherm)

1 ❑ 1 Heel nadelig
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Heel voordelig

VRAAG 7109

Nu krijgt u enige informatie over zes "technologieën voor gebruik van kolen of aardgas met verwijdering en ondergrondse opslag van CO_2".

Deze technologieën zijn geselecteerd door een breed samengestelde groep energiedeskundigen.

VRAAG 7110

Deze zes technologieën zijn gelijk in vier belangrijke opzichten:
1. De zes technologieën voor energieopwekking maken gebruik van gas of kolen.
2. De verwachting van deskundigen is dat alle zes technologieën uiterlijk in 2030 inzetbaar zijn.
3. Invoering van elk van de zes technologieën op zich zorgt er voor dat er in heel Nederland 20 procent minder CO_2 in de lucht komt dan nu.
Met grote schaal bedoelen we een zodanige inzet dat er door het gebruik van één technologie in heel Nederland 20 procent minder CO_2 in de lucht komt.
4. Wanneer één of meer van deze zes technologieën wordt ingezet zal het waarschijnlijk zijn als overgangstechnologie. Deze technologieën zullen waarschijnlijk hooguit 80 jaar gebruikt worden.

VRAAG 7111

Hierna krijgt u van alle zes technologieën een korte beschrijving. Na elke beschrijving vragen wij u om de technologie te beoordelen. Wanneer u alle zes technologieën beoordeeld heeft, wordt u gevraagd om één van de zes technologieën te kiezen. Met die keuze geeft u aan welke van de zes technologieën u beter vindt dan de andere vijf technologieën.

VRAAG 113

Grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
In deze centrales worden kolen omgezet in elektriciteit. De CO_2 die bij dit proces vrijkomt wordt afgevangen en opgeslagen onder de bodem van het Nederlands deel van de Noordzee. Er zijn ongeveer 20 van deze grote centrales nodig om er voor te zorgen dat er jaarlijks in heel Nederland 20 procent minder CO_2 in de lucht komt. In deze 20 centrales wordt bijna alle elektriciteit opgewekt die Nederland in de toekomst nodig heeft. De elektriciteit wordt geleverd aan bijvoorbeeld huishoudens, bedrijven en organisaties.
Wat is uw algemene waardering van grote moderne centrales waar kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 115

Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 123

Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2
In kleine brandstofcellen wordt aardgas omgezet in elektriciteit en warmte. De CO_2 die bij dit proces vrijkomt wordt afgevangen en opgeslagen onder de grond in Nederland. Er zullen honderden brandstofcellen nodig zijn om er voor te zorgen dat er jaarlijks 20 procent minder CO_2 in de lucht komt. In deze brandstofcellen wordt bijna alle elektriciteit opgewekt die Nederland in de toekomst nodig heeft. De elektriciteit en de warmte die vrij komen worden geleverd aan

bijvoorbeeld huishoudens, bedrijven en organisaties.
Wat is uw algemene waardering van omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 125

Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 133

Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
In deze centrales worden kolen door vergassing omgezet in waterstof. Waterstof is een gas dat bij verbranding energie oplevert. Deze waterstof wordt vooral in grote bedrijven gebruikt om elektriciteit mee op te wekken. Deze waterstof wordt in mindere mate ook gebruikt voor de aandrijving van bijvoorbeeld vrachtwagens en bussen (en vervangt dan benzine en vooral dieselolie). De CO_2 die bij de omzetting van kolen in waterstof vrijkomt wordt afgevangen en opgeslagen onder de bodem van het Nederlands deel van de Noordzee. Er zijn ongeveer 10 van deze grote centrales nodig om er voor te zorgen dat er in heel Nederland jaarlijks 20 procent minder CO_2 in de lucht komt. Met de waterstof die deze centrales leveren kan alle elektriciteit worden opgewekt die de grote industrie in Nederland nodig heeft. Daarnaast wordt deze waterstof gebruikt door de bus- en vrachtvervoerders in de industriegebieden.
Wat is uw algemene waardering van grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 135

Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 143

Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2

In grote en kleine installaties wordt aardgas omgezet in waterstof. Waterstof is een gas dat bij verbranding energie oplevert. De geproduceerde waterstof wordt vervolgens vooral gebruikt om elektriciteit en warmte op te wekken voor huishoudens en bedrijven. Deze waterstof wordt in mindere mate ook gebruikt voor de aandrijving van bijvoorbeeld vrachtwagens en bussen (en vervangt dan benzine en vooral dieselolie). Om te zorgen dat er in heel Nederland 20 procent minder CO_2 in de lucht komt, moet waterstofgebruik ongeveer de helft van de huidige elektriciteitsopwekking vervangen, daarnaast een kwart van het huidige gasgebruik voor verwarming van woonhuizen en tenslotte een kwart van het huidige gebruik van benzine en diesel. De CO_2 die bij het omzetten van aardgas naar waterstof vrijkomt, wordt afgevangen en opgeslagen in ondergrondse ruimtes, zowel onder land als onder de bodem van de Nederlandse Noordzee.

Wat is uw algemene waardering van de omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 145

Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 153

Winning van methaangas door verwijderde CO_2 op te slaan in koollagen

In en tussen ondergrondse steenkoollagen bevindt zich methaangas. In deze diepliggende koollagen, die ongeschikt zijn voor winning van kolen, kan CO_2 worden opgeslagen. Dat gaat door de CO_2, die eerder afgevangen is bij installaties of elektriciteitscentrales, via een boorgat in zo'n koollaag te pompen waarbij via een ander boorgat het methaangas wordt gewonnen. Dat methaangas zal gebruikt worden voor dezelfde doelen als aardgas bijvoorbeeld voor elektriciteitsopwekking in centrales en om te verwarmen of te koken. Om te zorgen dat er 20 procent minder CO_2 in de lucht komt, moet het methaangas uit koollagen ongeveer een derde van het huidige aardgasgebruik vervangen.

Wat is uw algemene waardering van de winning van methaangas door verwijderde CO_2 op te slaan in koollagen?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 155

Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 163

Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

In kleine installaties bij tankstations wordt aardgas omgezet in waterstof. Waterstof is een gas dat bij verbranding energie oplevert. Deze waterstof wordt gebruikt voor de aandrijving van auto's bij zowel personen- als vrachtverkeer op de weg. Om te zorgen dat er in heel Nederland 20 procent minder CO_2 in de lucht komt, moet waterstof vrijwel al het gebruik van benzine en diesel vervangen. Daarvoor zijn installaties nodig die bij alle tankstations gebouwd zullen worden en ongeveer zo groot zijn als een flinke caravan. Ook moeten alle personen- en vrachtauto's vervangen worden. De CO_2 die bij het omzetten van aardgas naar waterstof vrijkomt, wordt afgevangen en opgeslagen in ondergrondse ruimtes, zowel onder land als onder de bodem van de Nederlandse Noordzee.

Wat is uw algemene waardering van de omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2?

1 ❑ 1 Zeer onaantrekkelijk
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Zeer aantrekkelijk

VRAAG 165

Vul nu uw rapportcijfer (van 1 tot 10) voor deze technologie in.
Hoe beter u de technologie vindt, hoe hoger het rapportcijfer.

VRAAG 208

We willen u vragen welke van deze zes technologieën uw voorkeur zou hebben om op grote schaal toegepast te worden.
Bepaalt u nu uw keuze door het cijfer voor een technologie in te tikken of door op de technologie te klikken.
Als u wilt kunt u hierbij gebruik maken van de rapportcijfers.
Uiteraard kunt u (ook) andere overwegingen een rol laten spelen.

1 ❑ Grote moderne centrales waarin kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <?>
2 ❑ Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <?>
3 ❑ Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <?>
4 ❑ Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <?>
5 ❑ Winning van methaangas door verwijderde CO_2 op te slaan in koollagen Rapportcijfer <?>
6 ❑ Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2 Rapportcijfer <?>

VRAAG 210

Misschien vond u één of meer van de technologieën volstrekt onaanvaardbaar.
Is er bij de zes technologieën die u beoordeelde, één of meer voor u zo onaanvaardbaar, dat u denkt actie te ondernemen wanneer in Nederland overwogen wordt deze technologie grootschalig te gaan toepassen?

1 ❑ Ja
2 ❑ Nee

VRAAG 211 **MEERVOUDIGE VRAAG**

INDIEN [Q210 , 1]

Kunt u hier aangeven van welke technologieën u grootschalige toepassing echt onaanvaardbaar vindt?
(Meer antwoorden mogelijk)

1 ❑ Grote moderne centrales waarin kolen worden omgezet in elektriciteit (voor huishoudens en bedrijven) met verwijdering van CO_2 en ondergrondse opslag van CO_2
2 ❑ Omzetting van aardgas in elektriciteit (voor huishoudens en bedrijven), met verwijdering van CO_2 en ondergrondse opslag van CO_2
3 ❑ Grote centrales waarin kolen worden omgezet in waterstof (voor industrie en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
4 ❑ Omzetting van aardgas in waterstof (voor industrie, voor huishoudens en voor bus- en vrachtvervoer), met verwijdering van CO_2 en ondergrondse opslag van CO_2
5 ❑ Winning van methaangas door verwijderde CO_2 op te slaan in koollagen
6 ❑ Omzetting van aardgas in waterstof (voor motorvoertuigen) met verwijdering van CO_2 en ondergrondse opslag van CO_2

VRAAG 221

In deze enquête heeft u zeer beperkte informatie gekregen over een aantal verschillende manieren om in de vraag naar energie te voorzien, over het broeikaseffect en de opslag van CO_2.
Daar willen we u twee vragen over stellen.
U kunt uw antwoord geven door een getal tussen 1 en 7 aan te klikken dat uw mening het best weergeeft.
In hoeverre vindt u dat u over voldoende informatie beschikt om een keuze te kunnen maken tussen de verschillende mogelijkheden om energie op te wekken?

1 ❑ 1 Onvoldoende
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Voldoende

VRAAG 232

De mogelijkheden waaruit u kon kiezen stonden vast. In hoeverre voelde u zich hierdoor beperkt in uw keuze?

1 ❑ Beperkt
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7 Niet beperkt

VRAAG 7061_1

Hier ziet u een aantal uitspraken over energie.
Wilt u voor elke uitspraak zeggen in welke mate u het met de uitspraak eens of oneens bent? U kunt uw antwoord geven door een van de zeven antwoordmogelijkheden aan te geven.
Op welke manier er energie opgewekt wordt maakt mij niet veel uit.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_2

Ik heb voor mezelf een duidelijke afweging gemaakt tussen de voor- en nadelen van verschillende manieren om energie op te wekken.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_3

Ik voel me niet betrokken bij energievoorziening.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_4

Als er een documentaire over energievoorziening op de televisie komt, zorg ik er voor dat ik daar naar kan kijken.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_5

Op welke manier er op grote schaal energie opgewekt wordt,
heeft voor mijzelf belangrijke consequenties.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_6

Als er op televisie over het broeikaseffect wordt gesproken,
zoek ik een ander kanaal.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_7

Als er in de krant iets wordt geschreven over de energievoorziening,
dan sla ik dat over.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 7061_8

Ik wil mijn mening over het broeikaseffect ook openlijk laten blijken
door bijvoorbeeld een affiche voor het raam, het dragen van een button
of een sticker op de auto.

1 ❑ geheel mee oneens
2 ❑ tamelijk mee oneens
3 ❑ beetje mee oneens
4 ❑ noch mee eens, noch mee oneens
5 ❑ beetje mee eens
6 ❑ tamelijk mee eens
7 ❑ geheel mee eens

VRAAG 251

Ik heb de film "The day after tomorrow", die een plotselinge omslag
van het klimaat naar een nieuwe ijstijd uitbeeldde, gezien.

1 ❑ Ja
2 ❑ Nee

VRAAG 252

Ik ken de spotjes van Postbus 51 waarin weerman
Peter Timofeeff vertelt over Nederland en water.

1 ❑ Ja, ik heb de afgelopen maanden minstens drie spotjes gezien, waaronder het spotje over het stijgen van de zeespiegel
2 ❑ Ja, ik heb minstens één van de spotjes wel eens gezien, waaronder het spotje over het stijgen van de zeespiegel
3 ❑ Ja, ik heb minstens één van de spotjes wel eens gezien
4 ❑ Nee, ik heb deze nog nooit gezien

VRAAG 310

Tot slot een paar achtergrondvragen.
Op welke politieke partij zou u stemmen als er vandaag
Tweede Kamerverkiezingen zouden zijn?

3 ❑ CDA
4 ❑ PvdA
5 ❑ VVD
6 ❑ SP
7 ❑ LPF
8 ❑ Groen Links
9 ❑ D66
10 ❑ Christen Unie
11 ❑ SGP
12 ❑ Lijst Wilders
19 ❑ Andere partij
20 ❑ Ik zou niet stemmen
21 ❑ Ik heb geen stemrecht
27 ❑ Ik zou blanco\ongeldig stemmen
28 ❑ Dat wil ik niet zeggen
29 ❑ Dat weet ik niet

VRAAG 320

Heeft u broers of zusters?

1 ❑ Ja
2 ❑ Nee

VRAAG 321

INDIEN [Q320 , 1]

VRAAG 9901

Tot zover het invullen van de vragenlijst. Wilt u deze vragenlijst dan
nu beoordelen door een rapportcijfer (van 1 tot 10) te geven? Als u deze
vragenlijst erg vervelend vond, geeft u een 1. Vond u het uitermate
interessant, dan geeft u een 10.

VRAAG 9902

Heeft u verder nog op- of aanmerkingen over deze vragenlijst?

1 ❑ Ja
2 ❑ Nee

VRAAG 9903 **OPEN VRAAG**

INDIEN [Q9902 , 1]

U heeft de rest van het scherm voor uw op- en aanmerkingen!

VRAAG 9300

Fillertask TQ2:

VRAAG 7081_1

In het volgende onderdeel van de enquête willen we u nog een paar vragen stellen over de manier waarop u in het dagelijks leven over bepaalde situaties denkt.
Ik prefereer complexe problemen boven simpele problemen.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_2

Nadenken is niet mijn idee van plezier hebben.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_3

Ik heb graag de verantwoordelijkheid over het aanpakken van situaties die veel nadenkwerk vereisen.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_4

Ik doe liever iets dat weinig nadenken vereist dan iets dat mijn denkvermogen op de proef stelt.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_5
Hard en lang nadenken over iets ervaar ik als plezierig.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_6
Situaties waarbij ik diep moet nadenken probeer ik liever te mijden.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_7
Het idee om mijn denkvermogen in te zetten om de top te bereiken, spreekt me zeer aan.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_8
Ik denk niet dieper na dan strikt noodzakelijk is.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_9
Een taak die tot nieuwe oplossingen voor problemen leidt, ervaar ik als plezierig.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_10

Ik denk liever na over eenvoudige, dagelijkse dingen dan over lange termijn dingen.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_11

Ik vind het leuk wanneer mijn leven gevuld is met puzzels die ik moet oplossen.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_12

Ik hou van taken die weinig nadenkwerk vergen wanneer ik ze eenmaal heb geleerd.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_13

Het idee van abstract nadenken past goed bij mij.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_14

Het leren van nieuwe manieren van nadenken windt me niet echt op.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_15

Ik heb liever een intellectuele, moeilijke en belangrijke taak dan één die belangrijk is, maar niet veel denkwerk vereist.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_16

Na het oplossen van een taak die veel mentale inspanningen vergt, ben ik eerder opgelucht dan bevredigd.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_17

Ik denk gewoonlijk veel na over zaken, ook al raken ze me niet persoonlijk.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7081_18

Ik vind het voldoende als er een oplossing komt voor een probleem; het interesseert me niet zo hoe of waarom het werkt.

1 ❑ Sterk mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ 5
6 ❑ 6
7 ❑ 7
8 ❑ Sterk mee eens

VRAAG 7071_1

Let u er op dat de schaal vanaf nu veranderd is?
Zelfs nadat ik er al eerder een mening over heb gevormd, wil ik altijd nog graag een andere mening in overweging nemen.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_1 , 0] GA VERDER NAAR VRAAG 7071_1

VRAAG 7071_2
Ik houd niet van onzekere situaties.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_2 , 0] GA VERDER NAAR VRAAG 7071_2

VRAAG 7001_242
Seconden sinds vorige vraag

VRAAG 7002_242
Totaal verstreken seconden

VRAAG 7071_3
Ik heb een hekel aan vragen die op veel verschillende manieren kunnen worden beantwoord.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_3 , 0] GA VERDER NAAR VRAAG 7071_3

VRAAG 7001_243
Seconden sinds vorige vraag

VRAAG 7002_243
Totaal verstreken seconden

VRAAG 7071_4
Ik voel me onprettig als ik niet begrijp waarom een gebeurtenis in mijn leven heeft plaatsgevonden.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_4 , 0] GA VERDER NAAR VRAAG 7071_4

VRAAG 7001_244
Seconden sinds vorige vraag

VRAAG 7002_244
Totaal verstreken seconden

VRAAG 7071_5
Ik erger me wanneer iemand het oneens is met wat alle andere leden van een groep vinden.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_5 , 0] GA VERDER NAAR VRAAG 7071_5

VRAAG 7001_245
Seconden sinds vorige vraag

VRAAG 7002_245
Totaal verstreken seconden

VRAAG 7071_6
Als ik in verwarring ben over een belangrijk onderwerp, raak ik erg van streek.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_6 , 0] GA VERDER NAAR VRAAG 7071_6

VRAAG 7001_246
Seconden sinds vorige vraag

VRAAG 7002_246
Totaal verstreken seconden

VRAAG 7071_7
Wanneer ik nadenk over de meeste conflict-situaties, dan kan ik me meestal wel voorstellen dat beide partijen gelijk zouden kunnen hebben.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_7 , 0] GA VERDER NAAR VRAAG 7071_7

VRAAG 7001_247
Seconden sinds vorige vraag

VRAAG 7002_247
Totaal verstreken seconden

VRAAG 7071_8
Als ik over een probleem nadenk, dan overweeg ik zoveel mogelijk verschillende meningen over het onderwerp.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_8 , 0] GA VERDER NAAR VRAAG 7071_8

VRAAG 7001_248
Seconden sinds vorige vraag

VRAAG 7002_248
Totaal verstreken seconden

VRAAG 7071_9
Ik wil graag altijd weten wat mensen denken.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_9 , 0] GA VERDER NAAR VRAAG 7071_9

VRAAG 7001_249
Seconden sinds vorige vraag

VRAAG 7002_249
Totaal verstreken seconden

VRAAG 7071_10
Ik houd er niet van als een uitspraak van een persoon op veel verschillende manieren uitgelegd kan worden.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_10 , 0] GA VERDER NAAR VRAAG 7071_10

VRAAG 7001_250
Seconden sinds vorige vraag

VRAAG 7002_250
Totaal verstreken seconden

VRAAG 7071_11
Het is ergerlijk om naar iemand te luisteren die die maar niet lijkt te kunnen beslissen.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_11 , 0] GA VERDER NAAR VRAAG 7071_11

VRAAG 7001_251
Seconden sinds vorige vraag

VRAAG 7002_251
Totaal verstreken seconden

VRAAG 7071_12
Ik voel me onprettig wanneer iemands mening of bedoeling me niet duidelijk is.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_12 , 0] GA VERDER NAAR VRAAG 7071_12

VRAAG 7001_252
Seconden sinds vorige vraag

VRAAG 7002_252
Totaal verstreken seconden

VRAAG 7071_13
Ik zie altijd veel mogelijke oplossingen voor problemen die ik tegenkom.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_13 , 0] GA VERDER NAAR VRAAG 7071_13

VRAAG 7001_253
Seconden sinds vorige vraag

VRAAG 7002_253
Totaal verstreken seconden

VRAAG 7071_14
Ik hoor liever slecht nieuws dan dat ik erover in onzekerheid blijf verkeren.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

INDIEN [Q7071_14 , 0] GA VERDER NAAR VRAAG 7071_14
VRAAG 7001_254
Seconden sinds vorige vraag

VRAAG 7002_254
Totaal verstreken seconden

VRAAG 7071_15
Gewoonlijk overweeg ik niet veel verschillende meningen voordat ik mijn eigen opinie vorm.

1 ❑ Mee oneens
2 ❑ 2
3 ❑ 3
4 ❑ 4
5 ❑ Mee eens

Appendix 5: Distribution of sample on some demographic variables

Note 1: TNS-NIPO sampled adult respondents (> 18 years)
Note 2: Distribution data of Dutch population by CBS

Dutch population			**Sample ICQ and TQ1**			
Sexe		*2004*	**ICQ**		**TQ1**	
	n	%	n	%	n	%
Male	8,045,914	49.5%	489	49.1%	148	45.3%
Female	8,212,118	50.5%	506	50.9%	179	54.7%
total	**16,258,032**	**100.0%**				

Age		*2004*	**ICQ**		**TQ1**	
	n	%	n	%	n	%
<20	3,983,218	24.5%	30	2.3%	5	1.5%
20-40	4,552,249	28.0%	459	34.7%	108	33.0%
40-65	5,462,699	33.6%	598	45.2%	157	48.0%
65-80	1,690,835	10.4%	211	16.0%	52	15.9%
80+	552,773	3.4%	24	1.8%	5	1.5%
total	**16,258,032**	**99.9%**				

Education		*2004*	**ICQ**		**TQ1**	
	N	%	n	%	n	%
bo	664,000	12.1%	-	-	-	-
mavo	461,000	8.4%	130	13.1%	45	13.8%
vbo	799,000	14.5%	319	32.1%	102	31.2%
havo/vwo	338,000	6.2%	77	7.7%	23	7.0%
mbo	1,850,000	33.7%	244	24.5%	82	25.1%
hbo	892,000	16.2%	180	18.1%	54	16.5%
wo	491,000	8.9%	45	4.5%	21	6.4%
total	**5,495,000**	**100.0%**				

Province		*2004*	**ICQ**		**TQ1**	
	N	%	n	%	n	%
groningen	574,384	3.5%	39	4.0%	13	4.0%
friesland	642,066	3.9%	43	4.4%	11	3.4%
drenthe	482,415	3.0%	32	3.2%	7	2.1%
overijssel	1,105,512	6.8%	56	5.7%	28	8.6%
flevoland	359,904	2.2%	23	2.3%	8	2.4%
gelderland	1,966,929	12.1%	125	12.7%	42	12.8%
utrecht	1,162,258	7.1%	64	6.5%	17	5.2%
noord-holland	2,587,265	15.9%	163	16.5%	55	16.8%
zuid-holland	3,451,942	21.2%	208	21.1%	72	22.0%
zeeland	379,028	2.3%	26	2.6%	5	1.5%
noord-brabant	2,406,994	14.8%	145	14.7%	46	14.1%
limburg	1,139,335	7.0%	62	6.3%	23	7.0%
total	**16,258,032**	**100.0%**				

Appendix 6: Effects of different orders of technologies

Table Appendix 6: Mean overall evaluation of technologies expressed in a grade in the ICQ, depending on position in the questionnaire

	1	2	3	4	5	6	*p*	Partial eta square
IGCC with CCS	6.31		6.14			6.24	.29	.003
SOFC with CCS		6.51/ 6.39			6.62		.13	.004
Hydrogen production via coal gasification with CCS	6.46		6.21	6.12			.005	.011
Hydrogen production via steam reforming with CCS			6.52	6.28		6.25	.037	.007
ECBM		6.23			5.81/ 5.79		.01	.018
Small scale reforming based on membrane technology with CCS	6.9			6.37		6.15	.001	.039

To avoid the possible influence of order effects on the overall evaluations, the order in which respondents received the information on aspects and consequences of the six CCS options was not the same for all respondents. Three versions of the ICQ were made with different orders. The order of the first version was t1 ("IGCC with CCS"), t2 ("SOFC with CCS"), t3 ("Hydrogen production via coal gasification with CCS"), t4 ("Hydrogen production via steam reforming with CCS"), t5 ("ECBM"), t6 ("Small scale reforming based on membrane technology with CCS"). The order of the first version was reversed for the second version, t6-t5-t4-t3-t2-t1. The order of the third version was t3-t2-t1-t6-t5-t4. By varying the order in which respondents evaluated the technologies, the chance that a technology receives higher or lower evaluations than the other technologies purely based on its position in the questionnaire becomes very small. To completely rule out this possibility, we analyzed the effect of order on the average overall evaluations of the technology. Although the average evaluations of some technologies did differ depending on their position in the questionnaire, the effect sizes (partial eta square) of these differences were not higher than .039, which is considered a small effect size by definition of Cohen (Cohen, 1973, 1988). Cohen defines" partial eta square around .01 as a "small" effectsize, around .058 as a "medium" effect size, and around .137 as a "big" effect size. As the overall evaluations that are further used in the analyses are an average of overall evaluations from three different order versions, the very minor effect of position is averaged out and it is not considered to be a factor in the analyses.