

climate changes spatial planning

Integration

PRObing a method to Facilitate the Interactive Linking of Expert knowledge to Stakeholder assessment PROFILES

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Summary in Dutch

Dit onderzoek betreft het ontwikkelen en toetsen van een methode voor participatieve verkenningen op het gebeid van klimaat en energie, waarbij partijen met een verschillende expertise zijn betrokken. De methode die het onderzoek heeft opgeleverd is Constructive Conflict Methodology genoemd. Uitgangspunt is dat een open dialoog primair tot doel heeft om conflicterende perspectieven helder naar voren te brengen en bespreekbaar te maken, waarbij de meer marginale (nieuwe) gezichtspunten evenveel aandacht verdienen als de meer gangbare perspectieven. Het verkennen van concurrerende denkbeelden en scenarios is een noodzakelijke voorwaarde voor beleidsgericht leren. Een cruciaal probleem hierbij is het identificeren van partijen die tezamen de meest onderscheiden perspectieven vertegenwoordigen. Constructive Conflict Methodology vestigt daarom in het bijzonder de aandacht op de identificatie van partijen en de articulatie van perspectieven aan het begin van de dialoog. Een tweede cruciaal probleem betreft de vraag hoe het leren in een dialoog kan worden gemeten. Aan beide vragen wordt in dit rapport ruime aandacht besteed. Tot slot wordt in dit rapport stilgestaan bij de epistemologische consequentie van de stakeholderdialoog als beleidswetenschappelijke methode, namelijk de verschuiving van een afstandelijke, observerende en reflexieve beleidswetenschap naar een interventionistisch, (quasi) experimenteel perspectief.

Extended Summary

This study concentrates on developing and testing a method for participatory assessments for climate and energy related issues. Such assessments require the active involvement of stakeholders and scientists with different background as regards knowledge and expertise. The method is called Constructive Conflict Methodology. Constructive Conflict Methodology CCM aims at an open dialopgue. The value of a dialogue is not so much that it delivers consensus but that it is able to articulate and reflect upon conflicting perspectives, thereby identifying and where possible developing novel viewpoints. The methodological challenge is to give equal opportunity to different perspectives, including mainstream discourse and marginal viewpoints. The exploration of competing perspectives and scenarios, including the knowledge claims they are based upon, is considered a necessary condition for policy oriented learning. A critical issue is the identification of parties that together cover the broadest range of perspectives possible. This is why Constructive Conflict Methodology gives much attention to stakeholder sampling and the articulation of perspectives before starting the actual dialogue.

The report discusses the conceptual and methodological issues in connection with stakeholder sampling and the articulation of perspectives. CCM argues for using a combination of qualitative and quantitative social science methods in this respect. Two cases are presented and discussed. The first case is the application of repertory grid technique in preparing the so-called H_2 Dialogue, on prospects for hydrogen options in the transition to a sustainable energy system for the Netherlands. The second case is the application of Q-methodology in preparation of the Biomass Dialogue, which focused on exploring sustainable bio-energy options for the Dutch energy transition. Both repertory grid technique and Q- methodology belong to a 'family' of methods that aims at identifying the actual range of contrasting perspectives, views and knowledge claims with respect to a certain

issue rather than measuring the amount of support for specific viewpoints as survey-methodology does. Both have in common that they enable respondents to articulate their vision in a bottom-up fashion, which means that respondents are not, or hardly, led by questioning. Both methods are different with respect to the interview and the statistical analysis of interview data. Both cases of the H_2 and Biomass Dialogues show the combination of qualitative as quantitative analysis helps to realize two important objectives in establishing the dialogue settings: they help to identify and articulate competing perspectives and knowledge claims and they help to make a balanced selection of stakeholders who, together, cover the full range of perspectives. Hence, both methods were critical for the formation of dialogue groups, which included stakeholders who, at least in part, did not know one another.

Another critical issue raised in the study relates to the evaluation of a stakeholder dialogue and, especially, how learning in a dialogue can be measured. Most of the stakeholder dialogues facilitated so far have been evaluated by, on the one hand, brief qualitative evaluations by dialogue participants and, on the other, critical reflection by the project team. For the Biomass Dialogue, a different approach was taken. Upon closure of the actual dialogue, the Q-methodology was repeated for a sample of dialogue participants and a control group of stakeholders who had participated in the Q-interviews before the dialogue but who had not taken part in the actual dialogue process. This means that dialogue evaluation was carried out taking a quasi-experimental approach, measuring differences over time between participants and a control group. The results of this measurement are both valid and reliable. They show that among dialogue participants a learning process had taken place, which had resulted in a higher level of knowledge with respect to different perspectives and knowledge claims as well as a higher valuation of the different viewpoints. In contrast, those who had not participated in the dialogue but only received the dialogue report had not experienced such a better understanding.

The study gives rise to some observations with respect to the epistemology of stakeholder dialogue methodology in the context of environmental policy science. In our work, we actually observe a shift from a traditionally distant, observational and reflexive policy science to an interventionist, quasi-experimental approach. The dialogue-approach that we have developed and applied for the last decade, is based on the notion of dialogue as a conversation between persons who would otherwise be unlikely to meet. As to create such a context requires active interventions rather than distant facilitation, because it means cutting across network boundaries and treating different perspectives equally, in short, changing the dominance of existing relationships and discourses with respect to climate and energy. Stakeholder dialogue using Constructive Construct Methodology becomes a social experiment, aimed at bringing about real change rather than mere reflection.

1. Research problem and approach

For the last decades, there has been a growing attention for participatory approaches in integrated environmental assessment. Recent work which involved both partners in this project (VU and WUR) has shown that there is still much work to do on improving the quality of participatory assessments, especially the ability of stakeholder assessments to articulate and reflect upon *conflicting knowledge claims*. The articulation of knowledge claims is certainly not the exclusive domain of scientific expertise, since stakeholders may very well surpass scientists by their expertise

in specific knowledge domains. Scientists are however supposed to possess specific methodological qualities which makes them capable of putting competing knowledge claims to an 'objectified' and 'impartial' test. The basic assumption underlying the concept of Integrated Assessment is that the outcomes of scientific tests may help stakeholders to make choices with respect to preferred course of action.

Yet, we have faced difficulties in structuring stakeholder assessments in such a way that there is sufficient time and opportunity to in depth explore and evaluate *conflicting* claims and arguments. Stakeholders with different views and interests tend to look for consensus and avoid the evaluation of conflicting knowledge claims. Moreover, experts too tend to blur the existence of conflicting knowledge claims within or among disciplines. We have also faced difficulties in communicating expert knowledge to stakeholders in such a way that this knowledge was used to strengthen the debate. Whereas stakeholders tend to focus on the feasibility of options, scientific experts tend to discuss options in the context of models or scenarios, thereby stressing uncertainty if it comes to practical implementation. Whereas stakeholders tend to make judgments, scientific information is often presented in a way unfit to facilitate policy choice.

Hence, this project's primary aim is to address the need for methods and tools that may, in a structured and transparent way, assist in the articulation and assessment of conflicting lines of argument, thereby using the available scientific information. Therefore, the general research problem of this project can be phrased as follows:

> *What method is most fit to structure the interaction between experts and stakeholders in such a way that their integrated assessment focuses on learning through the articulation and evaluation of conflicting knowledge claims?*

The main objective of the project is to develop a method that is apt to assist stakeholder assessments in mapping out the *argumentation patterns* of the different actors involved in a specific issue, stakeholders and scientists in particular. The method will focus on the articulation and assessment of *conflicting knowledge claims*. We want this method to be (1) robust, in that it is resistant against contingencies characteristic for an integrated assessment process, (2) elegant, in that it stimulates stakeholders and commits them to a learning process, (3) feasible, in that it does not take too much of an effort to apply the method in participatory assessments, and (4) efficient, in that the costs involved in the application are reasonable.

Specific objectives are

1) To find a way for improving the critical reflection and use of scientific knowledge in stakeholder assessments through defining a process which may bridge the gap between different argumentation patterns,
2) To help experts to (1) reflect upon the potential and the limitations of expert models and scenarios used to support integrated assessments, (2) recognise and understand specific knowledge claims from stakeholders and ways to incorporate these into models and scenarios, hence, to provide a tool for effectively designing and managing two-way communication strategies for integrated environmental assessments.

We admit that the critics of participatory approaches in IEA have a point when they assert that the claims with respect to the learning potential of participation have not been validated in practice. There seem to be two critical issues in this respect. First, there is a lack of conceptual clarity about what learning through participation is. This project considers participation as a form of knowledge production. Learning is defined as a deliberative process of problem structuring, i.e. the articulation and assessment of *conflicting lines of argument* with respect to a specific issue (Hisschemöller, 1993).

Pivotal in our view on participation is the relevance of *conflicting* claims and hypotheses for learning. This view is supported by the observation that the information content of a hypothesis tends to be negatively related to its relative frequency, or probability of occurrence. Hypotheses that are mentioned more frequently – those on which there is substantial consensus – have less probative value than rarely mentioned hypotheses, because highly probable or predictable hypotheses do not challenge accepted knowledge claims. (Dunn, 2001: 425 -6). Hence, as a quality indicator, really good assessments produce counter-intuitive results.

Second, what lacks is a shared notion on the methodological vehicles to foster and facilitate learning processes. Comparative analyses of different so-called participatory methods reveals that many of these are neither apt nor meant to facilitate the interactive articulation and exploration of *conflicting* lines of argument. Even if such approaches are built around a discourse which favors learning through participation, their practical application may fall short in full filling their discursive promise. Examples are cited in e.g. Van de Kerkhof, 2004; Hisschemöller, 2009 and Cuppen, 2010). As we see it, a main shortcoming of quite some participatory methods is that they artificially distinguish between two groups of participants; those discussing values (non-experts) and scientific facts (experts). The methods thereby incorrectly assume that values can be debated but that 'the facts are given'. A related problem is that value issues are often abstract, whereas successful interventions as to address climate change require specific actions that have to take into account local conditions.

So there is good reason to for developing a new methodology, based on current experience and selecting techniques from methods already in use.

This report focuses on the main findings in the project. Chapter 2 unfolds the method, Constructive Conflict Methodology, thereby giving due attention to what is broadly considered to be the main barriers to a dialogue. Chapter 3 focuses on the first steps of the method, which we consider most pivotal for successful dialogue, the identification and articulation of different stakeholder perspectives. Chapter 4 focuses on the evaluation of dialogues, especially on the question of measuring stakeholder learning. Chapter 5 discusses some epistemological implications of Constructive Conflict Methodology for the policy sciences, e.g. the epistemological shift from a more distant and reflexive approach in policy research to a more interventionist, (quasi)experimental perspective.

2. The method: Constructive Conflict Methodology

The overall goal of our dialogue approach, referred to as Constructive Conflict Methodology, is to enhance problem structuring in the sense that participants (and the project team as well) learn about the diversity of perspectives. Hisschemöller (2005) defines problem structuring as "the articulation, confrontation, comparison and, where possible, integration of as many contradictory arguments as possible".

Diversity and conflict in stakeholder dialogue: opportunities and barriers

Stakeholder dialogues should be *open*, in the sense that divergent viewpoints can enter the dialogue and that all viewpoints have an equal opportunity to play a role in the dialogue. This means that

participants articulate and assess different, potentially competing views and knowledge claims. Although a stakeholder dialogue may result in consensus, stakeholder dialogues should not be geared at reaching a consensus as this may put impediments to the creation of useful insights (Janis, 1972; Mason & Mitroff, 1981; Gregory, MacDaniels, & Fields, 2001; Stasser & Titus, 1985; Hisschemöller, Hoppe, Dunn & Ravetz, 2001; Coglianese, 1999, cited in Van de Kerkhof, 2006a and b). According to Mitroff and Emshoff (1979: p10) "the danger is not in reaching compromise, but in reaching it too soon and for the wrong reasons, e.g. because of the inability to tolerate conflict as a sometimes necessary and valuable tool for policy making".

A stakeholder dialogue that does justice to the diversity of stakeholder perspectives should result in an improved understanding of the diversity of perspectives and, in the ideal case, to an integration or synthesis of divergent perspectives. This problem structuring process requires an atmosphere of *constructive conflict*; an open exploration and evaluation of competing ideas and knowledge claims in order to achieve new ideas, insights and options for problem solving (Cuppen, 2010). Constructive conflict is brought about by a process in which participants confront each other's claims with their own claims, unravel argumentations, make (implicit) assumptions explicit, and jointly develop new ideas.

Although dissent and conflict are very powerful tools for structuring problems in stakeholder dialogue, an atmosphere of constructive conflict does not easily arise. On the contrary, groups in general avoid conflict and tend to focus on issues of agreement rather than on dissenting viewpoints or unique information (Schweiger, Sandberg & Ragan, 1986; Stasser and Titus, 1985; Stasser and Stewart, 1992). From the literature, four biases can be identified that hamper an open exploration of divergent viewpoints in stakeholder dialogues (Cuppen, forthcoming, based on Stasser and Titus, 1985 and Cuppen, Hisschemöller & Midden, 2009): 1) the bias of shared information, 2) the bias of source, 3) the bias of attitude and 4) the bias of phrasing.

The *bias of shared information* (Gigone & Hastie, 1993; Stasser, Taylor & Hanna, 1989; Brodbeck, Kerschreiter, Mojzisch, Frey & Schulz-Hardt, 2002) means that groups tend to focus on the information that they share, rather than unique information that is owned by only one of them. The *bias of source* means that the information of a specific source is (not) acknowledged, because of perceived characteristics of that source rather than the contents of the information. The bias of source can be observed for instance when the input of a high-status person is used and the information put forward by a lower-status person is ignored. The *bias of attitude* means that an item of information is more likely to enter the discussion if it favors rather than contradicts the prevailing perspective, preference or attitude of participants. The *bias of phrasing* means that an item of information is more likely to enter the discussion if it is phrased in a way that a participant is familiar with. Stakeholders may be accustomed to communicate in different ways and through different types of language, e.g. jargon.

How to stimulate constructive conflict?

Given these barriers to constructive conflict, stakeholder dialogues require a structured approach to ensure that each viewpoint has an equal opportunity to play a role in the dialogue in that all unique information can be put on the table. Five issues appear to be important for enhancing constructive conflict.

Firstly, as regards the diversity of viewpoints, special attention should be paid to the identification of marginal viewpoints. According to Dunn (2001), marginal viewpoints, or rarely mentioned hypotheses, have more probative value than hypotheses mentioned more frequently – those on which there is substantial consensus. Highly probable or predictable hypotheses do not challenge

accepted knowledge claims. Hence, the more different an idea is, the larger its learning effect will be. Brodbeck et al. (2002) show for example that the likelihood that a group identifies new and qualitatively superior decision alternatives increases as a result of 'minority-induced divergent thinking'. Marginality refers to the *newness* of viewpoints and claims for stakeholders: a marginal viewpoint is a viewpoint that is not often heard in the dominant debate about the issue. As such, stakeholder dialogues are about bringing together stakeholders who are unfamiliar with each other, and who do not or rarely meet in their daily practice.

Secondly, stakeholder dialogues should include each perspective on an equal footing. It appears that groups in which variety is balanced are more likely to disseminate unshared information than unbalanced groups (Brodbeck et al., 2002). Furthermore, it has been argued that the balanced inclusion of perspectives reduces groupthink (Janis, 1972; Dryzek & Niemeyer, 2008). This means that each perspective should be represented by an equal number of participants in the dialogue, regardless how dominant or marginal the perspective is.

Thirdly, in order for conflict to be constructive, it needs to be authentic. So, rather than creating artificial conflict, for instance by role-playing, conflict in stakeholder dialogues should revolve around authentic viewpoints. It appears for instance that the mere fact that someone is assigned the role of devil's advocate makes groups less productive in the sense that these groups produce fewer solutions and fewer good solutions to a specific problem than groups in which the DA is not role-playing (Nemeth, Brown, & Rogers, 2001; Nemeth, Personnaz, Personnaz, & Goncalo, 2004).

Fourthly, conflict is only constructive when it is manageable; participants should not feel overwhelmed by it (Jehn, 1995). In that sense, it is important that conflict is not 'too big' and that it is issue-related (or cognitive) rather than personal (or affective) (Jehn, 1997; Amason, Hochwarter, Thompson & Harrison, 1995). Cognitive conflict "pertains to conflict about ideas in the group and disagreement about the contents and issues of the task" (Jehn, 1997), whereas affective conflict "exists when personal and relationship components within the group are characterized by friction, frustration and personality clashes within the group" (Jehn, 1997).

Fifthly, and related to the fourth issue, constructive conflict benefits more from discussions that revolve around specific objects, artifacts or (policy) options than from discussions on abstract and personal values. A discussion on a specific object has more informational richness than a discussion on abstract policy values. As such, conflicts that arise because people talk about different things without realizing it (e.g. because of different interpretations) can be more easily prevented or resolved. Furthermore, in searching for an integration or synthesis of divergent perspectives, the challenge is to find a ***congruent*** definition rather than a shared definition of the problem. Congruency means that a policy option that incorporates different viewpoints can be envisaged and it is "to be discovered not through abstract, generic discussions (...), but through specific debates about the shared object of action, the artefact" (Grin & Van de Graaf, 1996).

Stakeholder identification & selection

The stakeholder identification and selection phase can make or break a dialogue. It was argued above that constructive conflict requires the balanced inclusion of divergent perspectives, paying special attention to marginal perspectives. Two issues need further attention in this regard.

Firstly, an open approach to studying knowledge systems implies no presupposed assumptions on loci of expertise and/or perspectives. Finding out who owns relevant expertise is a result rather than a starting point of stakeholder dialogue. Treating 'lay people' as experts with respect to their own problems (Mitroff, Mason & Barabba, 1983) paradoxically implies that distinctions between 'experts'

and 'laypeople' are not helpful. This distinction neglects the notion that expertise is not necessarily technical or scientific but can also be experience-based or rooted in practice. It also neglects the critical observation that an expert-lay people distinction is part of the socio-political construction of the problem under investigation. An example in this respect is the idea underlying innovation policies in various countries that knowledge for innovations is available because of research at academic institutions and in the labs of major private companies, thereby overlooking the value of small entrepreneurs in this respect.
Stakeholder selection should therefore be based on an empirical, bottom-up analysis of perspectives rather than on assumed categorizations, such as in case of selecting stakeholders according to their organization or actor type. So, in a conventional way, we might be satisfied inviting representatives from environmental or consumer NGOs, academia, business, farmers unions etc, thereby assuming that this will provide us with a sufficient variety of viewpoints. Instead, constructive conflict methodology proposes an extended preparatory stage, which focuses on identifying the actors putting forward a sufficiently salient diversity of views and knowledge claims. This is not often done for two, understandable reasons. First, as both research managers and funding agencies want to work towards results in a cost-effective way, there is a tendency or even pressure to focus on the actual dialogue process as 'the real thing', thereby keeping the preparatory stage as limited as possible. Second, our approach requires much more from the project team than to perform as a 'process manager'. Instead, it must get acquainted as much as possible with the contents of the issue under investigation. This means that the preparation stage may have to take over 50% of the project budget.

Secondly, the issue of representation needs further attention. Stakeholder dialogues should reflect the broad range of viewpoints. By including each perspective on an equal footing, stakeholder dialogues are representative in terms of the variety of perspectives. They are not necessarily representative in terms of the balance of perspectives. That is, a minority and a majority viewpoint are represented by an equal number of stakeholders in the dialogue and, as a result, the statistical distribution of perspectives within the larger stakeholder field is not necessarily reflected in the dialogue. This has been referred to as 'discursive representation' (Dryzek & Niemeyer, 2008).

Constructive Conflict Methodology

Constructive Conflict Methodology has been developed as an overarching approach to the design of stakeholder dialogues, aiming to stimulate learning about the diversity of perspectives, viewpoints and knowledge claims with regard to the issue under consideration (Cuppen 2010). Constructive Conflict Methodology comprises four steps: It is important to note that each step relates to a specific kind of intervention in, or as we may put it, a manipulation of the 'normal' social condition, that creates a dialogue process that is deliberately different from the status quo socio-political process.

1) Stakeholder identification & selection: this must lead to a situation in which the dialogue becomes a meeting between persons reasoning from different perspectives, who would, at least for a considerable part, be unlikely to meet otherwise. Simultaneously, this would assure the articulation of divergent, even contrasting perspectives,
2) Articulation of divergent perspectives: participants must have the opportunity to express their genuine viewpoints, arguments in support and their concerns in front of others in such a way that they are heard and can be confronted with input by others in an open way,
3) Confrontation of divergent views and knowledge claims: this requires an atmosphere in which participants are, to at least some extent, willing to explore different lines of argument and to learn as to whether they agree or disagree with one another,
4) Synthesis: this requires a way of reporting that, on the one hand, does justice to the different claims and arguments and, on the other, highlights elements from the discussion that can be considered new.

These steps are not necessarily taken in complete linear order or one by one (see Figure 1). Multiple steps can take place at the same time or in an iterative fashion (indicated with the feedback arrows). Articulation of divergent perspectives feeds back to stakeholder selection, as stakeholder selection should be based on an identification of the diversity of perspectives. Confrontation of claims feeds back to articulation of divergent perspectives as confrontation leads to a further articulation of perspectives, for instance by surfacing assumptions. Synthesis feeds back to both the articulation and confrontation step. This is because synthesis can be used as an intermediate step in a dialogue, for instance when a dialogue consists of multiple workshops or meetings. Each workshop can have its own synthesis, which is then used as input for the next workshop in which further articulation and confrontation can take place.

Constructive Conflict Methodology may rely on the use of specific social science methods in support of four steps. Especially relevant are those methods that facilitate stakeholder selection on the basis of an empirical analysis of perspectives. Examples are for instance Q methodology (Stephenson, 1935; Brown, 1980) and Repertory grid technique (Kelly, 1991). Furthermore, methods are needed that facilitate the elicitation of the implicit, or taken-for-granted dimensions of perspectives. This concerns for instance implicit assumptions. These taken-for-granted elements need to be explicit in order to clarify knowledge claims and presumptions. Examples are Policy Delphi (Turoff, 1970), Cognitive mapping (Axelrod, 1976; Kitchin, 1994) and Toulmin model of argument (Toulmin, Rieke, & Janik, 1979; Toulmin, 2003).

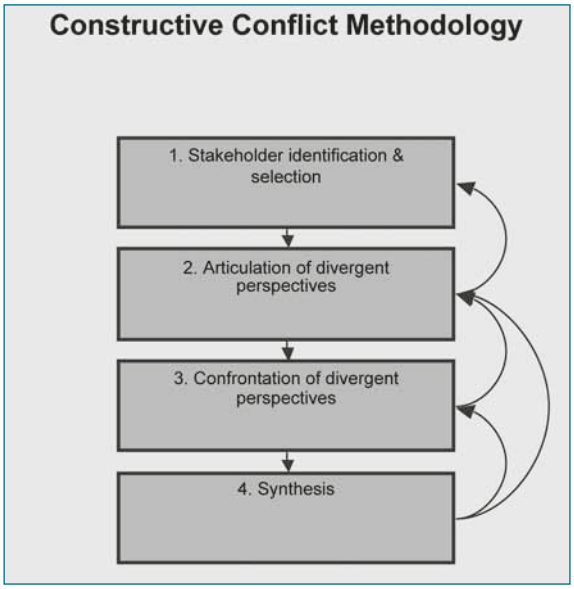


Figure 1.
Constructive Conflict Methodology in four steps.

3. Application of the method: putting perspectives into participation

Constructive Conflict Methodology was applied in two stakeholder dialogue projects, the Hydrogen (H_2) Dialogue (2004 - 2008) and the Biomass Dialogue (2007 - 2009). This chapter focuses on the implementation of step 1 and 2, stakeholder identification and the articulation of stakeholder perspectives, as these steps are considered critical for a dialogue that aims at learning from competing perspectives. The H_2 Dialogue used repertory grid technique, the Biomass dialogue used Q-sort analysis.

3.1 The H_2 Dialogue

Repertory Grid Technique

The H_2 Dialogue used repertory grid technique as to identify stakeholders with the most different perspectives on Hydrogen for a future suistainable energy system in the Netherlands (Van de Kerkhof, Cuppen and Hisschemöller, 2009).

Repertory grid originates from construct psychology and has mainly been used in clinical settings to increase the psychologist's understanding of how an individual (a patient) views the world (Kelly, 1991Fransella & Bannister, 2003). Since its introduction the method has been applied in the fields of artificial intelligence, education, human l earning and, more recently, also in the field of policy analysis (Van de Kerkhof, 2006b; Van der Sluijs, Hisschemöller, De Boer, & Kloprogge, 2001; Dunn, 2001). The basic idea of the method is that the minds of people are composed of 'construct systems', which reflect their constant efforts to make sense of the world. According to Kelly (1991, p9) "man creates his own ways of seeing the world in which he lives; the world does not create them for him". Construct systems are similar to the notion of 'perspectives' that is central in the *Creative Conflict Methodology*. Referred to as 'constructive alternativism' (Kelly, 1991), different people use different construct systems to make sense of reality. Hence, construct systems are highly individual in nature. People observe, draw conclusions about patterns of cause and effect, and behave according to those conclusions. People's construct systems are not static but are continuously confirmed or challenged. Hence, they change through experience. Moreover, although the systematization of elements within a construct system should help a person to avoid contradictory predictions (Kelly, 1991), construct systems are not internally consistent. People can (and do) live with a degree of internal inconsistency within their construct system. Repertory grid aims to unfold systemizations by articulating the individual construct systems of people. This helps to better understand the meaning that people give to the world around them and to specific problems or issues that affect them.

Repertory grid focuses on elements and constructs. In the case of the H_2 Dialogue, the elements are ten different hydrogen visions, and the constructs are the qualities that stakeholders use to distinguish between the hydrogen visions, for instance 'sustainable' versus 'not sustainable'. *Rating* concerns an evaluation of the elements on the basis of the construct. As constructs are bipolar, a construct can be represented as a scale, e.g. from 'sustainable' to 'unsustainable'. The elements can then be rated on that scale, resulting e.g. in an evaluation of the sustainability of the hydrogen visions.

The repertory grid procedure is best characterized as a structured interview in which the respondent is confronted with a triad of elements and is then asked to specify some important way in which two of the elements are similar and different from the third (Fransella & Bannister, 2003). The bipolar

construct, reflecting the similarity and difference, is then presented on a scale (e.g. a five-point scale, with one pole of the construct at score 1 and the other pole at score 5). The respondent is asked to rate the elements (that are possible/desirable to rate) on the scale that represents the construct, and to indicate which pole of the construct he or she prefers. After this, the interviewer moves on to a next triad of elements. Typically, these steps are repeated until the respondent mentions no new constructs anymore. In any case, the interview lasts for an hour at most.[1]

Repertory grid is a participatory method when it is used as a tool to facilitate a stakeholder dialogue on a societal issue. It appears a suitable method for the *Creative Conflict Methodology*, as it is able to make explicit the taken-for-granted elements of construct systems. In addition, it is characterized by a very open way of questioning and the interviewer, due to his or her minimal role, does not steer the respondents through questioning (Van der Sluijs et al., 2001)[2]. Hence, the requirement of *Creative Conflict Methodology* that diversity is articulated in a bottom-up fashion can also be met with RGT. Respondents can use their own words to talk about a topic. The elements, constructs and ratings provide the researcher with "a kind of mental map: a precise statement of the way in which the individual thinks of, gives meaning to, construes, the topic in question" (Jankowicz, 2004, p14). The method's claim is furthermore that it is efficient in that it manages - with only 15 to 25 RGT interviews- to identify the full range of constructs that people use for evaluating an issue in a particular context (Dunn, 2001).

RGT elements in the H_2 Dialogue: Ten visions

On the basis of sixty interviews that were conducted in the preparation phase of the dialogue, together with information from the first Conference of the Dutch National Sustainable Hydrogen Research program, ten hydrogen visions were identified. These visions are:

1. All H_2 - Centrally produced from clean fossil: *"A brand new network! Let's do it again":*
   H_2 in the Netherlands is centrally produced from fossil sources (natural gas) with carbon capture and storage (CCS). H_2 is distributed through a heavy H_2-infrastructure. On site (in buildings) it is converted into heat and power through micro-combined-heat-power (CHP). The national electricity and natural gas infrastructure have become redundant.
2. Central all electric: *"H_2 from fossil sources: it's electrifying!":*
   Electricity in Europe is centrally produced from fossil sources (natural gas, in combination with CCS) and to some extent from nuclear and renewables. Electricity distribution uses an extended grid. Electricity surplus is converted into H_2 as reserve. The natural gas grid has become redundant.
3. All Electric: Decentralized and renewable: *"Many a little makes a mickle":*
   Electricity is produced at the level of dwellings or neighborhoods from renewable sources, e.g. advanced solar PV with heath/cold storage, and advanced heat exchange systems. The surplus of electricity is converted into H_2. This is used for private car transport. If there is H_2 left, it is stored in a 'light' H_2-network.

1 Although not developed as such, RGT can also be used on the group level. We (Van de Kerkhof, M., Cuppen, E., & Hisschemöler, M.) experimented with this in an interactive session on repertory grid that we organized during the scientific conference 'Participatory Approaches to Science & Technology' (PATH, 4-6 June in Edinburgh). In that session, we used different types of fruit as elements. We showed a group of about 25 participants a series of three pictures of different pieces of fruits and asked them to compare these and to mention constructs. Doing the elicitation of constructs on the group level triggered the creativity of participants. Apparently the participants had a large associative network on the issue of fruit in their minds as, after six triads of fruits, we had already generated 85 constructs (and our frequency analysis showed that saturation point had not even been reached yet).

2 ??

4. Adding H_2 to the natural gas grid: *"The Dutch do it their own way":*
   H_2 is added to the national natural gas grid and is distributed to the households through the existing gas infrastructure. H_2 from biomass and coal is imported. Because of the mix with natural gas, H_2 is not necessarily of high quality. As the amount of H_2 in the grid increases, the household appliances and infrastructure are gradually adjusted.
5. Global H_2 from non-fossil sources: *"CO_2 is the problem and the solution must be large scale":*
   Electricity is produced at large scale in Northern Africa and Europe from non-fossil sources (large-scale solar in the Sahara, offshore wind in the Atlantic Ocean, hydro and nuclear). Where a heavy infrastructure for electricity is not available, H_2 is transported through pipelines and tankers. H_2 is then locally converted into electricity or delivered for transport or micro-CHP.
6. H_2 for the mobile sector: *"It's mobility, you fool!":*
   Transport uses H_2 combined with fuel cells. H_2 is carried trough pipelines and tankers to fuel stations or is produced on site. There, it is delivered to the consumers. Cars are fully electric and light in weight.
7. H_2 without fuel cell: *"H_2 makes it, fuel cells won't..":*
   H_2 is used in stationary and mobile applications but without a fuel cell. Instead, H_2 is converted into useful energy through conventional combustion technologies. Hence, quality requirements for H_2 are less, which enables a greater variety of sources for the production of H_2.
8. H_2 Cartridge system: *"Clique-claque, over the counter":*
   H_2 is stored in portable cartridges that can easily be refilled. Small end users, such as households and small companies use them for stationary and mobile applications. The cartridges are filled at industrial sites or at fuel stations, which enables the use of the heat while refilling. Empty cartridges are exchanged.
9. Recycling of industrial H_2: *"From what we now blow into the air, industries can be energized!":*
   H_2 from industrial activities is used as a secondary source of energy or as raw material for industrial processes. The H_2-infrastructure is located on industrial sites. The surplus is delivered to other users.
10. Gasification without H_2: *"We do not need H_2 to solve the problems!":*
    The focus is on natural gas and biogas, as well as biofuels for the entire energy system. For the production of electricity also renewables and nuclear are used. Innovations in renewable technologies are developed and used at an increasing scale. Through CCS and biofuels the major problems for the energy system, climate change and security of supply, are solved without a major role for hydrogen as an energy carrier.

These visions reflect a diversity of perspectives; their scope is much larger than would be expected according to the mainstream view of hydrogen (i.e. hydrogen as a fuel for transportation). Vision 3, for instance, assumes an important role for hydrogen in the housing sector on the basis of small-scale renewables. The visions also differ with regard to the future energy infrastructure, the level of hydrogen production, and the energy sources that are used to produce hydrogen. For instance, vision 1 assumes central production of hydrogen from fossil sources and a brand new hydrogen infrastructure, whereas vision 4 assumes the use of the existing natural gas infrastructure to distribute hydrogen to the households. In vision 9 hydrogen is produced and used at industrial sites and distributed by means of a local, industrial, hydrogen infrastructure. In vision 3, only renewable energy sources are used and hydrogen serves as a buffer to store the surplus of electricity. The hydrogen dialogue also included a non-hydrogen vision (vision 10 above), which served as a reference vision to compare hydrogen options with competing (non-hydrogen) options.

RGT construct elicitation in the H_2 Dialogue

Repertory grid technique was applied in the kick-off workshop to systematically compare the hydrogen visions and to structure stakeholders' ideas about these visions. Twenty-four participants were involved in the kick-off workshop, representing industry, government, NGOs and knowledge institutions. During this workshop a self-developed software application of repertory grid was used. It was planned initially to use an existing application[3], but although all are quite advanced, none of these existing software packages met the requirements of the H_2 Dialogue. The first requirement was that the software needed to be an interface for the respondent rather than an aid for the interviewer. The software also needed to enable the respondent to indicate a preference to one of the construct's poles and to rank the elements according to this preference. To have a software program that includes these features, existing software packages were used as inspiration for the development of a new software tool.

During the workshop, each participant conducted a repertory grid exercise on a computer. The participants compared the elements (i.e. ten hydrogen visions) and formulated characteristics (constructs), which they used to distinguish the elements in several rounds. In each round the software tool 'quasi-randomly' generated three hydrogen visions. Quasi-randomly means that in the first round vision 1 was presented with two random other visions, in the second round vision 2 was presented with two random other visions, etcetera. This was done to make sure that the ten visions were presented in a balanced way. The participants followed the instructions that appeared on the screen in front of them, the project team was present to support the participants where needed.

For every triad, the participants were posed the following questions:

1. 'Please compare the three visions. In what respect are two of these visions similar and do they differ from the third? Please click with your mouse on the two visions that you think are similar.' This automatically moved the two similar visions to the left side of a five-point scale and the other vision to the right side of that scale visualized on the screen, the scale representing the bipolar construct.
2. A pop-up screen appeared, in which the question was asked: 'What kind of characteristic do the two visions share, and what is the characteristic of the third vision? Please make sure that the characteristic is bipolar.'
3. Then, the participant was asked to: 'Assign all visions a value on the five-point scale by dragging them with your mouse to a certain position on the scale. The three initial visions can also be moved to other positions. The visions that you think are not possible or desirable to place on the scale can be left aside.'
4. When this part was completed another pop-up screen appeared, asking: 'Which of the two characteristics (left side or right side of the scale) would you prefer for the long term?'
5. The last question was: 'Would you like to draw another comparison on the same three visions, or would you like to continue with the next triad?' If the participant chose to continue with a new triad, the software tool quasi-randomly generated a new triad.

Traditionally, the elicitation of constructs takes as long as necessary. It stops when the respondent does not come up with new constructs anymore, assuming that the complete construct system has by then been covered. Due to the group setting, and the computerized way of interviewing, this procedure was not possible for this repertory grid exercise. Therefore, the project team planned one hour for the elicitation of constructs. Participants who were finished before the end of the hour were allowed to stop. This turned out to be sufficient, all participants finished within the hour.

3 Such as GridSuite (see: http://www.uni-stuttgart.de/pae/gridsuite), Omnigrid (see: http://www.psyctc.org/grids/omnigrid.htm) or Enquire Within (see: http://www.enquirewithin.co.nz/)

Findings: Identifying three disparate hydrogen visions

The analysis facilitated the identification of the relevant themes in the hydrogen discourse and, in that way, helped to shape the agenda for the dialogue. In order to identify what are, according to the participants, the most disparate visions a HOMALS analysis was conducted. The analysis was conducted by means of the statistical software package SPSS.

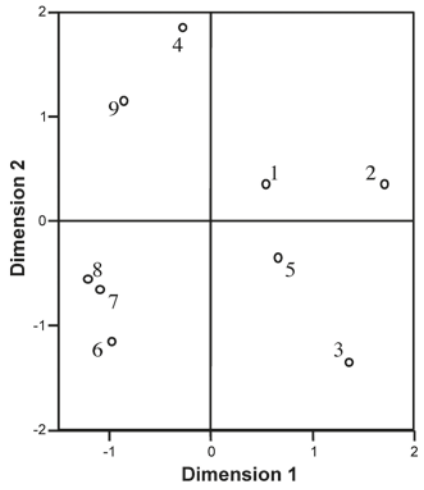
HOMALS is an acronym for 'HOMogeneity Analysis by means of Alternating Least Squares'. HOMALS reduces the dimensionality of data, without ignoring underlying relations (see a.o. De Leeuw & Van Rijckevorsel, 1980). In the HOMALS analysis, hydrogen visions that are evaluated by participants as being similar with regard to specific constructs are placed close to each other, while visions that are evaluated as being different are placed far apart. In order to do this, HOMALS divides the visions in homogeneous subsets for every variable. The variables are the participants' ratings of the visions on the constructs. For instance, variable 1 is the rating of the visions by participant 1 on construct 1; variable 2 is the rating of the visions by participant 2 on construct 1; variable 3 is the rating of the visions by participant 3 on construct 1, etcetera[4]. Based on these homogeneous subsets per variable, the relations between the visions can be represented in a two-dimensional plot.

The matrix that was used for the HOMALS analysis contains 251 variables. Furthermore, the matrix contains nine hydrogen visions; vision 10 (the non-H_2 vision) was not included in the analysis. First, a HOMALS analysis was conducted that included all ten visions but in the plot that resulted from this, vision 10 was an outlier and the plot was very difficult to interpret. Repeating the analysis without the outlier resulted in a new plot that was easier to interpret. The fact that vision 10 was an outlier indicates that the participants evaluated vision 10 differently from the rest of the visions. Therefore, it was decided to use vision 10 as a reference vision (i.e. no H_2) for each of the three dialogue groups later on in the dialogue.

Figure 2 shows the resulting two-dimensional plot for the HOMALS analysis on the nine hydrogen visions.[5] To correctly understand the figure, most important is the distances between the points (hydrogen visions) as well as between the different points and the center where the two axes cross. The axes themselves are not very relevant. They are multidimensional and can be understood as 'meta-constructs' or 'higher-level constructs', overarching the constructs mentioned by the participants. Figure 2 shows that the visions are fairly equally distributed over the four quadrants. Visions 6, 7 and 8 form a cluster, as well as visions 4 and 9. For the other visions the clustering is less clear.

4 Construct 1' means 'first mentioned construct' (note that the first construct mentioned by participant 1 is not likely to be the same as the first construct mentioned by participant 2). Since each variable is a participant's rating of the ten visions on a construct, each variable consists of 10 levels.

5 Eigenvalue dimension 1: .485; Eigenvalue dimension 2: .411



1. All H_2 - Centrally produced from clean fossil
2. Central all electric
3. All electric: Decentralized and renewable
4. Adding H_2 to the natural gas grid
5. Global H_2 from non-fossil sources
6. H_2 for the mobile sector
7. H_2 without the fuel cell
8. H_2 cartridge system
9. Recycling of industrial H_2

Figure 2.
Result of the HOMALS analysis: vision 1 to 9 in a two-dimensional space (object scores).

To interpret the plot, two things are important. Firstly, the axes can be rotated around the origin. This means that examining the distances between the visions is an additional or sometimes even a better way to interpret the results than examining the distances between a vision and the x-axis and y-axis. Secondly, visions that are far from the origin are considered most salient as they have a high level of a certain characteristic.

A common way to interpret a HOMALS plot is to find out the meaning of the two axes[6]. However, in this study another way was used to interpret the plot. Since the goal of the HOMALS analysis was to find out possible clusters of elements (visions) and to identify three disparate visions to be explored further in the dialogue process, it was more interesting to investigate which visions were considered to be most disparate and in what way. Disparity translates visually in the HOMALS plot into distances between visions: the further two visions are apart, the more disparate these visions are.

Figure 2 shows that vision 4 (adding hydrogen to the natural gas grid) and vision 3 (decentralized and renewable) are most disparate. The constructs that the participants used show that these differences concern among other things the infrastructure. Vision 3 is seen as a long-term solution and is associated with a new infrastructure and a new system at the local level, with non-fossil energy sources. Vision 4, on the other hand, is associated with the short term, with the existing infrastructure and the existing system, at the central level and with fossil energy sources. The fact that the participants see visions 3 and 4 as very different makes these visions interesting starting points to be explored further in the dialogue process. Since vision 4 is positioned close to vision 9 (recycling of industrial hydrogen) and since these two visions can go well together (e.g. by taking the surplus of industrial hydrogen and add this to the natural gas grid) it was decided to cluster these two visions.

6 The x-axis (dimension 2) can be interpreted by comparing the visions that are at the right side of the y-axis (dimension 1) to the visions that are at the left side of the y-axis, as the visions at the right side of the y-axis have something in common which distinguishes them from the visions at the left side of the y-axis and vice versa. The y-axis can be interpreted in a similar way.

To decide on a third vision for the dialogue, the HOMALS plot was studied again. Note that visions 4 and 3 are not only far away from each other, but also from the cluster of visions 6 (hydrogen for the transport sector), 7 (hydrogen without the fuel cell) and 8 (hydrogen cartridge system), which are all positioned in the lower left quadrant. The results of the frequency analysis were used to decide which of these three visions to take as the third starting point for the dialogue process. Five out of six participants prefer the use of fuel cells, which supports vision 6 instead of 7. Eight out of ten participants do not prefer a batch infrastructure (cartridges), but a flow infrastructure, which favors vision 6 instead of 8. In addition to this, vision 6, on hydrogen as a fuel for transportation, reflects the mainstream pro-hydrogen position that is held by the major stakeholders (both in Europe and in the world). It was considered important to include the transport vision (vision 6) in the dialogue, as it would allow to confront this vision with other, less mainstream, views on hydrogen[7]. Also, it would be interesting to explore if and how the internationally organized transport sector (vision 6), compared with e.g. the nationally organized housing sector (vision 3), can be governed at the national level.

So, based on the HOMALS analysis, visions 3 (decentralized, small-scale renewables), 4/9 (adding hydrogen to the natural gas grid and use of industrial hydrogen) and 6 (hydrogen for the transportation sector) were taken as starting points for the dialogue process and for the formation of three dialogue groups that would further work out the three visions.

3.2 The Biomass Dialogue: Q methodology

Q Methodology was developed originally in the 1930s as an innovative way to study people's subjectivity (Stephenson, 1935; Brown, 1980). Since then, it has been applied in various fields of social science, in attempts to uncover patterns of perspectives that are situated within people's subjectivity. For instance, it has been employed to identify views regarding citizenship, the public interest, environmental policy, and the quality of participation processes (Webler et al., 2001; Wolsink, 2004; Davies & Hodge, 2007; Barry & Proops, 1999). Recently, it has also been used in studies that particularly address policy and planning of renewable energy sources (Ellis et al., 2007; Cuppen, 2010).

Q Methodology can uncover perspectives or positions in a debate, without imposing predefined categories. The merit of Q methodology is that "by allowing the categories of the analysis to be manipulated by respondents, the researcher loses the exclusive power to signify the reality of the researched" (Robbins & Krueger, 2000: 645). Q methodology differs from R methodology (surveys and questionnaires) in that the latter asks respondents to express views on isolated statements, while Q methodology identifies respondents' statements in the context of their valuation of all statements presented (see e.g. Dryzek & Berejikian, 1993). Furthermore, as opposed to R methodology, Q Methodology traditionally intends to give a picture of the perspectives that exist (the *variety* of perspectives) within the population, rather than measuring the distribution of those perspectives in the population (the *balance* of perspectives). This implies that the procedure for sampling respondents is usually different from that in R methodology. Rather than random sampling (and large sample sizes), Q methodology relies on purposive sampling (and smaller sample sizes): the

7 The HOMALS analysis makes clear that vision 2 (all-electric) appears to be almost as salient as transport (vision 6). However, since the project could manage three dialogue groups only, and since application of hydrogen in transport is usually considered, it was decided to leave the all-electric option out. In addition, a more practical argument was that, in case of the Netherlands with its natural gas infrastructure, the all-electric option would be less likely than for a country that heavily relies on an electricity infrastructure, such as France. There, electricity is the primary national energy carrier and the availability of nuclear would justify a connection between electricity and hydrogen. These were all considerations made in advance of the dialogue.

fact that there is a person who is assumed to have a different point of view is for instance enough reason to include him/her in the sample.

Q methodology comprises six stages (Davies et al., 2007). The first stage is the definition of the 'concourse'. The concourse is the full breadth of discussions and discourses on the particular issue under study. Defining the concourse means identifying sources, either written or spoken, which contain ideas, opinions, values, preferences and knowledge claims on the issue under study. From the concourse, a large set of statements is derived in the second stage of Q methodology. These statements reflect the breadth of the concourse, and hence include a diversity of viewpoints, claims and opinions. This set has to be reduced to a more manageable number (usually no more than sixty), while still reflecting the diversity of viewpoints, claims and ideas. Preferably, the wording of the statements stays as close as possible to the original wording (and thus the original meaning) of that idea or opinion as found in the concourse. The set of statements is referred to as the Q set. The third stage concerns the identification of a group of respondents, referred to as the P sample. The P sample needs to comprise as many different ideas, preferences and opinions on the issue under study as possible. In the fourth stage, respondents do the Q sort, which involves ranking the statements on a scale that represents significance or salience for respondents (Brown, 1980: p198), such as 'most agree' to 'most disagree' (usually normally distributed). Importantly, as noted above respondents evaluate and rank the statements all together, and hence in relation to each other, rather than in isolation. Data from the Q sorts are factor analyzed in the fifth stage, resulting in clusters of Q sorts that are highly similar in their rankings of the statements (high correlation). These clusters can be interpreted as perspectives or discourses in the final (sixth) stage. The typical way to interpret a factor in Q methodology is to look at the statements that receive the highest and the lowest scores respectively (strongest agreement and disagreement) for that factor. In addition, the statements that distinguish most between one factor and the other factors are useful in interpreting a factor because these indicate how a factor is different from the other factors. Furthermore, the Q sorting task is often accompanied by an interview, in which respondents are asked to explain their sort. These explanations can help to interpret the factors.

Concourse definition and selection of Q statements

In an attempt to reflect the wide range of ideas and opinions about biomass, we collected about two hundred statements. These statements were taken from transcripts from discussions in another stakeholder dialogue on biomass in which one of the authors was involved and that was organized one year earlier. Furthermore, we used reports, newspaper articles, etcetera. Definition of the concourse was a relatively easy task, as the issue of biomass was heavily discussed in the media at the time of setting up this study. As a consequence, the breadth of ideas and opinions was relatively well articulated. The transcripts from the stakeholder dialogue were furthermore very useful for identifying marginal perspectives, as this stakeholder dialogue included people and ideas that were not all very well represented in the dominant debate on biomass. As sufficient material was available, interviews (another technique for concourse definition) would probably not have added to this breadth of statements.

In order to reduce the Q set to a more manageable number, three members of the project team individually categorized the statements, and then identified unique statements within categories. The three categorizations and sets of unique statements were compared and discussed, and iteratively, this process continued until sixty-two statements remained. The large size of the Q set points to the wide variety of ideas and opinions that exists with regard to biomass in the Netherlands. The Q statements were piloted with five people (who were all well acquainted with the biomass debate) to check whether we didn't miss relevant statements. This resulted in a definite list of sixty statements. Furthermore, to check the representativeness of the statements, we asked

during the Q interview whether the respondent thought important statements were missing. This did not result in adjustments; in the rare cases that respondents wanted to add a statement, it mostly concerned a repetition or a refinement of a statement that was already included, as an emphasis of the importance of that statement.

Identification of the P sample

Respondents for the Q sorting task were all potential participants in the Biomass Dialogue. Hence, they were all stakeholders. A stakeholder was defined as an actor involved in, affected by, knowledgeable of, or having relevant expertise or experience on the issue at stake. In chapter 3 it was argued that stakeholder selection should include a diversity of perspectives and cut across networks in order to increase the chance that people meet other people with unfamiliar, or new ideas.

We used newspaper articles, and news-websites to identify stakeholders. As noted above, the biomass issue received much (media) attention at the time of this study, which made it relatively easy to identify stakeholders. In addition, from previous work on sustainable energy issues, we were already familiar with a broad scope of stakeholders. We furthermore used the snowball-sampling technique to identify stakeholders: after each interview we asked the respondent to mention someone with a different, and someone with a similar perspective on biomass. This resulted in a group of seventy-five respondents, from different sectors and organizations, such as government (local, regional, national), NGOs, entrepreneurs (working on cultivation or treatment of biomass, or on energy/heat/fuel production), industry (idem), end-users of biofuels (companies), sector organizations (e.g. sector organization for oil and fat), science and knowledge institutes, consultancy, and investors. But more importantly, these seventy-five stakeholders were identified as representing diversity in knowledge, expertise, values and perspectives.

Q interview

The interviews took place from August 2007 until October 2007. Interviews typically lasted 60-90 minutes. The central task in the interviews was the Q sort, added upon by a number of open questions that were used to gather qualitative data for interpretation of the factors. Before the sort we asked: "Can you explain shortly what your ideas on biomass are in relation to a sustainable energy supply for the Netherlands?". After the sort we asked three questions: "Why are these statements at the extremes of the distribution?" and "Do you miss specific statements?" and "Would you like to come back to, or add something to your answer on my earlier question about your ideas on biomass?".

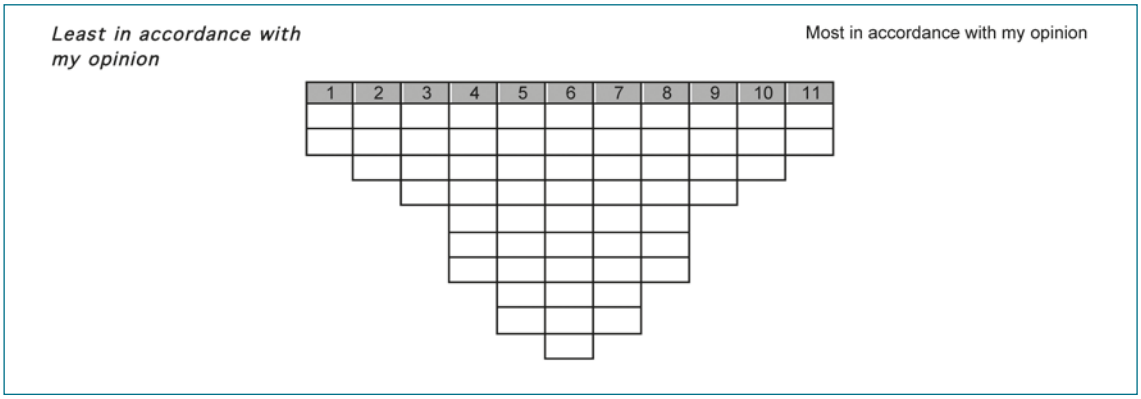


Figure 3.
Q distribution used for the Q sorting task.

In the interview, the sixty statements were presented to the respondents. Respondents were asked to rank-order the statements according to a forced normal distribution with eleven positions from most to least 'according to my point of view' (see Figure 6.2). The statements were printed on small cards. Respondents put the cards on the normal distribution that was printed on a sheet of paper.

Q analysis

When all interviews were finalized, the analysis of the Q sorts was done with help of PQMETHOD 2.11 (Schmolck, 2002). The correlations between the Q sorts of all seventy-five respondents were calculated, creating a 75 by 75 correlation matrix. The average correlation between Q sorts is .22, which indicates that the seventy-five respondents are rather heterogeneous in terms of their ideas and opinions about biomass. Due to the high variation in Q sorts, factor analysis of the correlation matrix was not straightforward. In order to be able to identify meaningful factors, we took an iterative approach. Going back and forth from different types of factor extraction and rotation to the qualitative interview data, meaningful factors were eventually identified using the Centroid analysis method (with Q sorts/respondents as variables and the statements as cases), and rotated using Varimax (which are both standard procedures in Q methodology). We concluded that six factors could clearly be identified and explained with help of the qualitative interview data. Of the seventy-five respondents, forty-two loaded significantly[8] on one factor and not on others. Of these forty-two respondents, seven respondents loaded significantly on factor 1, fourteen on factor 2, three on factor 3, seven on factor 4, seven on factor 5 and four on factor 6. One respondent did not load significantly on any of the factors, and all the remaining respondents loaded significantly on more than one factor.

The number of factors extracted is quite high for a Q study (usually two to four factors are extracted). This is due to the high variation in respondents' Q sorts. Total variance explained of the 6 factors is 46%. Although variance explained is not considered a relevant measure in Q methodology[9], the relatively low variance explained variance also points to the high variation of ideas and viewpoints with regard to biomass, which underlines the complexity and uncertainty with regard to the issue.

Q methodology: Results

The six factors that resulted from the factor analysis were interpreted as six different perspectives on biomass. The typical way to interpret a factor in Q methodology is to look at the statements that receive the highest and the lowest scores respectively (strongest agreement and disagreement) for that factor. In addition, the statements that distinguish most between one factor and the other factors are useful in interpreting a factor because these indicate how a factor is different from the other factors. The meaning of a factor can only be understood by analyzing the factor in relation to the other factors. In addition, we identified the respondents that loaded significantly on a factor, i.e. that define a factor. The qualitative interview data of these respondents were also used to interpret the factor. We used quotes from the interviews to describe and explain the factors. We will shortly discuss each perspective.

8 Factor loadings above 0.34 were accepted as statistically significant at the 0.01 level (calculated as: 2,58 * standard error (SE); SE=1/√(number of statements)) (see McKeown & Thomas, 1988).

9 In regular R (not Q) factor analysis a total variance explained of 46% is considered low. The relatively low total variance explained is probably a consequence of the large number of respondents (75 compared to usually about 30 in Q studies), as this means that there are more Q sorts (75) than statements (60). In Q methodology however, variance explained is not considered a relevant measure, since one is not interested in the question what the percentage of a perspective in the population is, but Q methodology is developed to show that various factors exist, and what the similarities and differences between these factors are. If the variance explained of factor A is higher than that of factor B, that only means that there are more people of factor A in the sample. Contrary to R methodology, the sample is not randomly selected. The 6 perspectives are salient perspectives that can be recognized in the discourse. They can be interpreted as ideal types. Reality is of course more nuanced. Furthermore, the relatively low total variance explained is probably also a consequence of the large number of respondents (75 compared to usually about 30 in Q studies), as this means that there are more Q sorts (75) than statements (60).

Perspective 1: Keep all options open
This perspective focuses on knowledge development. Generic claims about the sustainability of biomass applications are not possible, because the sustainability of an application is very much dependent on the specific situation. Therefore, it does not make sense to exclude specific options in advance, or to embrace others. Biorefinery (refining biomass in order to use all valuable elements within the biomass) is seen as a promising development.

Perspective 2: Hit the brakes
This perspective is very skeptical about the possibilities of sustainable biomass applications and calls for a pause. A growing international biomass-market increases the risks for developing countries, with regard to environment, social-economic situation, human rights and food supply. At the moment, there is no biomass that is sustainable for people, planet and profit. As long as we cannot guarantee sustainable biomass, we should halt the development of new applications.

Perspective 3: Support small-scaled innovative initiatives
The third perspective focuses mainly on small-scaled and decentralized applications in the Netherlands. Initiatives by small innovative entrepreneurs are hard to get off the ground, because the Dutch government mainly has an eye for the large companies. However, we should not expect innovations from these companies, because they benefit from maintaining the existing fossil fuel-based system. We should not keep putting money in research, but in implementation.

Perspective 4: Security of supply with global, certified, 2nd generation biomass
This perspective has a strong market orientation. The most important incentive for the development of biomass applications is the replacement of fossil fuels (security of supply). This perspective is optimistic about the potential of biomass, especially the 2nd generation biomass[10], and states as a condition that the sustainability of biomass should be guaranteed by means of a certification system.

Perspective 5: Efficiency the goal, biomass a means?
According to this perspective, we should not overestimate the potential of biomass. In the future, other renewable sources (e.g. solar, wind) will be better suited for our energy supply, because the availability of those sources is larger. We should be critical about the sustainability of biomass applications: the whole chain should be taken into account when determining whether there is a positive energy balance. Energy-efficiency is key. Technology and market have not sufficiently been developed.

Perspective 6: Just do it, step by step
This perspective is pragmatic. It underlines that we cannot know at this moment what will be the best option in the future. This means that we should act now with the knowledge that we have, instead of postponing actions. All options should be kept open; there should be a broad range of applications. The role of entrepreneurs is very important in this perspective.

10 There is no commonly shared definition of 2nd generation biomass. An often-used definition in the Netherlands originates from the Dutch GAVE programme (support for technological development of 2nd generation technologies) is based on the amount of CO_2 emission reduction: 1st generation biofuels achieve CO_2 emission reductions of around 30-50% compared to fossil fuels and 2nd generation biofuels achieve a CO_2 reduction of 80% or more. However, others define 2nd generation on the basis of the biomass source that is being used: 2nd generation biofuels are made from residuals, and 1st generation from cultivated biomass. Others define 2nd generation biomass as lignocellulose (e.g. woody material), whether or not combined with a specific type of technology to convert the biomass into a fuel.

An important finding from the Q analysis presented in this chapter is that a stakeholder selection based on perspectives results in a different group composition than a selection based on type of organization. Organization-types are rather heterogeneous in terms of their perspectives on biomass. This implies that organization is not a good proxy for perspective. However, the analysis also showed that some organization-types are more heterogeneous than others. Environmental NGOs appeared to be rather homogeneous in terms of their perspective; stakeholders from these NGOs predominantly loaded on perspective 2 ('Hit the brakes'). Of course, there may be cases in which there is a requirement to involve stakeholders from specific organizations. If one aims to involve both a diversity of perspectives and a diversity of organizations, it is important to realize that the distribution of organizations on particular perspectives differs. Some perspectives (in particular perspective 2) are dominated by specific types of organizations (environmental NGOs). The finding that particular organization-types are over-represented on particular perspectives, and under-represented on others might indicate that these actors are unfamiliar with some of the perspectives. This underlines the importance of organizing stakeholder dialogues that facilitate mutual learning, i.e. the interaction between stakeholders with different perspectives and from different organizational networks.

Q methodology proved a useful tool to gain insight into the different perspectives on energy from biomass in the Netherlands, in a more nuanced way than only mapping pro- and con viewpoints. It enabled a bottom-up identification of the variety of perspectives on energy from biomass in the Netherlands that exist among Dutch stakeholders. In addition, it enabled an analysis of the disparity of perspectives by giving insight into the similarities and differences between these perspectives. The value of Q methodology for giving insight in the different positions and opinions that different actors may have on a complex policy issue, is underlined by other studies that used Q Methodology for this purpose (see e.g. Van Eeten, 2001; Ellis et al., 2007).

Importantly, in addition to the identification of the diversity of perspective, Q methodology proved to be a useful method for identifying and selecting stakeholders with salient perspectives, i.e. a high loading on one of the six perspectives. This enabled a balanced representation of the variety of perspectives in the Biomass Dialogue. The perspectives that resulted from the Q analysis were used to select participants in the dialogue. From the group of seventy-five respondents, we could have only thirty people taking part in the Biomass Dialogue. The second step in our approach (after the Q sort analysis) was to select forty out of seventy-five people (taking about ten cancellations into account). For this second step we used the results of Q Methodology. We calculated factor loadings for each respondent. The higher the factor loading of a person on a factor (perspective), the more that person's Q sort resembles the archetypal sort for that factor, and hence, the more that person agrees with the perspective. This resulted in an overview of the respondents and the perspectives they most and least adhered to. Then, for each perspective, we identified the persons that loaded most strongly on that perspective. Furthermore, we identified the respondents that showed large similarities with each of the perspectives, on the basis of the interview data. This resulted in a list of forty people who represented the six perspectives in a balanced way. These were the persons that we invited to take part in the Biomass Dialogue[11].

Three dialogue (sub)groups were formed. For this, we merged participants supporting perspectives with most similarities. The first dialogue group was a merger of Perspective 1, 4 and 5, i.e. Keep all options open with certified biomass and efficiency. The second group covered perspective 2, Hit the brakes. The third group included adherents of the two entrepreneurial perspectives 3 and 6.

11 In the interviews we asked the respondents if they would be willing to take part in the Biomass Dialogue. Self-evidently, their answer on this question was taken into account.

Stakeholder selection should not only include a diversity of perspectives, but also cut across networks in order to increase the chance that people meet other people with unfamiliar, or new ideas. To check whether the stakeholder selection procedure for the Biomass Dialogue succeeded in this, participants were asked in the evaluation form after workshop 1 whether they had met people at the workshop with whom they had never discussed about the biomass issue before. All respondents affirmed to this question. They were furthermore asked with the ideas of whom of the other participants they were already familiar. There was one participant (a local entrepreneur in pure vegetable oil) with whose ideas eight of twelve respondents[12] were familiar. In general the picture was very mixed, and most respondents were familiar with some of the other participants and their ideas and unfamiliar with some of others. Hence, it seems that stakeholder selection in the Biomass Dialogue was successful in cutting across networks.

4. Confrontation of perspectives and synthesis

This chapter addresses the third and fourth step in CCM, the confrontation between different perspectives and dialogue closure, where some form of synthesis can be realized. This chapter will first discuss the design of the dialogue process for both the Hydrogen and Biomass Dialogues. In terms of their design, both dialogues show quite some similarities but there were also critical differences. Next, the actual dialogues are analyzed, thereby focusing on relevant discussions and on how dialogue participants have dealt with conflicting interests and views. At this point, the implications of different design become apparent, especially where the relation between scientific experts and non scientists (practitioners) is concerned. Finally, this chapter will draw some conclusions, reflecting upon both the opportunities and threats for open dialogue in social systems characterized by institutional constraints.

Dialogue process design

In the H_2 dialogue, three dialogue groups were formed around the three visions that came out as most salient from repertory grid workshop.[13] The groups focused on:

1) Hydrogen for transport
2) Local renewables for the built environment
3) Hydrogen into the existing natural gas infrastructure

The groups had about 20 members each. There were stakeholders from energy companies, small innovative firms, universities and other research institutes, potential customers of H_2 technology, such as lease and public transport companies, environmental and development NGOs and an association of home owners considering to establish a H_2 based energy system in their neighborhood. Since participants attached much value to the dissemination and utilization of policy relevant results, the project team committed three former members of Dutch parliament to become independent chairs of the dialogue groups. As to safeguard a dialogue process sufficiently open, transparent and confidential, participants agreed on a "Dialogue Schedule and Rules of the Game".

12 Not all participants filled in the evaluation form; there were fifteen participants in workshop 1.
13 A full description and analysis of this dialogue process can be found in Hisschemoller and Bode (2011).

The steps 3 and 4 were organized as a competitive process. First, the groups were asked to elaborate their respective hydrogen visions in 'creative competition' (Klijn and Teisman 2000), building the strongest arguments for each case. They hereby used backcasting to explore ambitious visions and the trajectories to be taken, reasoning backwards from an end state 'as if it were already obtained'. Backcasting is appealing as it encourages 'out of the box thinking', thereby avoiding the conservatism inherent in scenario building approaches known as 'forecasting' (Lovins 1976; Van de Kerkhof, Spanjersberg and Hisschemöller 2003). Critical is the identification of barriers and opportunities along the way. The project team encouraged the groups to compare their hydrogen trajectories to non-H_2 alternatives, that can be considered as potential barriers.

Halfway the dialogue, the groups exchanged their ideas at a so-called Confrontation Workshop. Two experts from abroad and a Dutch external expert panel reviewed the work. One of them was a high profile hydrogen protagonist, the other a high profile hydrogen skeptic. Following the Confrontation Workshop, the groups met in order to reflect upon the comments received and to explore the need for adjustments. The dialogue concluded with a so-called Integration Workshop, aimed at synthesis and recommendations for policy. For this workshop, four external speakers were invited including two speakers from abroad.

In summary, the dialogue process was designed as to get all possibly relevant information on the table through a process meant to encourage competition between views and knowledge claims. Competition was stimulated by:

- inviting stakeholders from different policy, science and business networks,
- articulating competing hydrogen trajectories,
- comparing H_2 and non-H_2 alternatives within the dialogue groups,
- discussing the outputs at two points in time among the groups
- involving external experts with a critical perspective,
- committing international experts to reflect upon dialogue outputs.

The next section will clarify the implications of the spirit of competition in dialogue design for the actual dialogue process.

For the Biomass Dialogue, following the Q sort analysis and after consultation with the dialogue participants, three dialogue groups were formed with stakeholders sharing the most convergent perspectives.[14]

Group 1 related most to the perspective Keep All Options Open. Furthermore, an international orientation is needed as to provide guarantees for sustainability by the adoption of global certification schemes. A third focal point within this group was that sustainability considerations need to strongly take into account energy efficiency. This group included many stakeholders from academia, some environmental NGOs, major companies on both the supply and demand side for energy as well as some government officials. They took a reflexive stand rather than an activist position, avoiding strong claims arguing that much is yet uncertain.

Group 2 reflected the most critical perspective, claiming that large scale biomass applications will harm the environment, especially in developing countries. Immediate and indirect impacts on nature and local agriculture are already there. Therefore, government must not support biomass applications at this stage. Supporters for this perspective are found among stakeholders working

14 A full description and analysis of this dialogue process can be found in Hisschemoller, Breukers, Cuppen and Suurs (2009) and Cuppen, E. (2010).

with environmental and development NGOs, as well as among academics, some small entrepreneurs and government actors.

Group 3 reflected the two perspectives especially found among small and medium sized business. Their major claim is that innovative initiatives meet with bureaucratic slack and opposition from large energy companies. Advanced biomass applications are expected to make a big contribution to sustainability in the Netherlands and abroad, especially (but not merely) when they are small-scale.

For each perspective an equal number of participants was invited to take part in the dialogue. In total, of the 40 participants invited 30 took actually part. For encouraging the articulation of different perspectives, workshop discussions took partly place in like-minded groups. For encouraging the confrontation and evaluation of different arguments, part of workshop discussions took place in heterogeneous groups or in plenary sessions, representing the different perspectives.

The biomass dialogue was designed in such a way that the entire dialogue concentrated on the pros and cons of specific biomass chains and applications. Stakeholders presented 'their own biomass chain' or their 'own idea' about feasible and sustainable biomass options (technologies). Presentations were followed by questions and discussion on clarifying their technical, environmental and institutional aspects. Textbox 1 gives an overview of the biomass-to-energy options discussed in the dialogue.

Textbox 1: Biomass chains presented in the Biomass Dialogue.

Present biomass chains presented in workshop 1:

1) A small biomass installation using municipal trimmings,
2) A demo-plant for the production of biodiesel from waste-fats (from restaurants)
3) A manure co-fermentation plant on a pig farm
4) Production of Pure Vegetable Oil from rape seed and a service to adapt diesel engines for use of this oil
5) A large global-scale bio-ethanol chain for the blending with petrol

Possible (future) biomass chains presented in workshop 2:

1) Algae: production of biodiesel, heat and electricity
2) Biofuels through large scale Fischer-Tropsch synthesis
3) Innovative ethanol-chains based on sugar beets
4) P4+ or the Oily-way-to-go concept (Small-scale pyrolysis of biomass, combined with underground carbon storage for food production and electricity production)
5) Pressed oil for production of heat, cold, food and feed
6) Recycling paper? (this presentation was mainly intended to clarify the dilemmas when opting for CO_2 or energy efficiency in situations where they cannot be accomplished both)

In order to integrate specific options into a vision on sustainable biomass for the Netherlands, the dialogue was structured into a three-step backcasting approach. The first workshop analyzed the current situation. Five specific biomass chains (textbox 1) were presented and discussed in this workshop. The second workshop discussed ingredients of a vision on the future contribution of biomass to the Dutch energy system. Here, experts presented six biomass chains (textbox 1) with a future potential (2025). As to enable a lively imagination of the biomass chains and technologies among participants with a diverse background, all options discussed were visualized in cartoon-like

schematic drawings, accompanied by a short text (Figue 4). Then, the third workshop meeting carried out the actual backcasting as to identify opportunities and barriers for future implementation of biomass options. At a fourth workshop, dialogue participants discussed the draft dialogue report (Hisschemoller, Breukers, Cuppen and Suurs (2009).

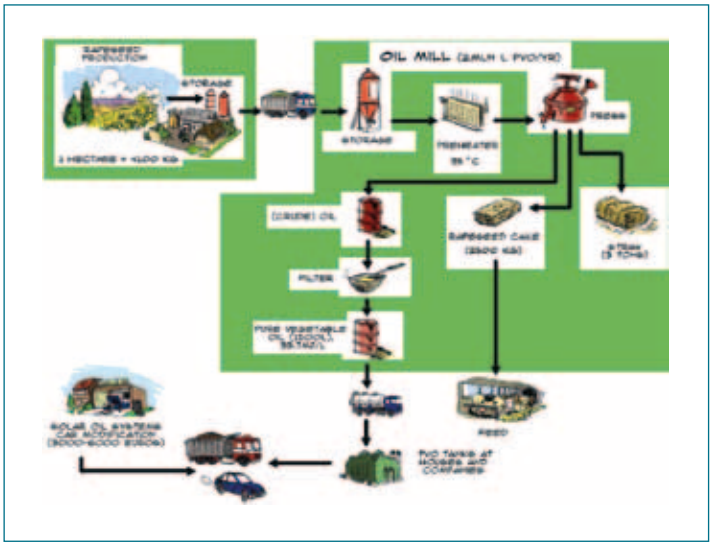


Figure 4.
The Pure Vegetable Oil chain in a cartoon-like drawing.

In terms of design the Biomass Dialogue was in some ways similar but in other ways different from the Hydrogen Dialogue. Both dialogues included the most divergent perspectives and focused on specific options and (future) trajectories. Both dialogues used backcasting in order to identify specific opportunities and barriers. Also, both processes were designed as to provide insights for Dutch (climate and energy) policy-making. However, some differences are striking. First, whereas the H_2 Dialogue was designed as to encourage competition among views and knowledge claims, the Biomass Dialogue was more designed as a process which can be best described as aimed at enlightenment. Each dialogue workshop included both meetings for homogeneous subgroups (the three perspectives) and heterogeneous subgroups as well as plenaries, where all perspectives were represented. Instead, in the H_2 Dialogue the three dialogue groups separately explored options and cases relevant for 'their' trajectories only. The met only twice for information exchange and discussion, at the so-called Confrontation and Integration workshops. Second, the H_2 Dialogue was a bigger project than the Biomass Dialogue in terms of number of participants, number of meetings, and there was more time between the several workshops.

The actual dialogue process: managing conflict

Hydrogen Dialogue

The design of the H_2 Dialogue was to a large extent based on repeated observations on the Dutch and international hydrogen debate. Obviously, there are quite some H_2 sceptics. However, among the H_2 communities consensus appeared to prevail with respect to the future potential of H_2 for a sustainable economy, whereas in fact different stakeholders hold diverging expectations related to how this future would look like. Hence, the project team considered it necessary to challenge the stakeholders to put forward different ideas with respect to concrete issues instead of making consensual statements on a distant and rather abstract future hydrogen economy.

To some extent, this dialogue approach was a success. The dialogue revealed big differences of opinion between the proponents of the three trajectories, H_2 for Transport, H_2 and non- H_2 options for the built environment and H_2 in the Dutch natural gas infrastructure. The discussions at the Confrontation workshop and afterwards clarified conflicting knowledge claims and visions not only with respect to H_2 options, but with respect to strategies for renewable energy in general (Hisschemoller and Bode 2011). The dialogue touched upon a huge amount of knowledge from national and international academic and business experts. Within and across at least two of the groups learning took place, which became apparent when they adjusted their trajectories in reaction to the Confrontation workshop. However, during this final stage the various standpoints became polarized. This was possibly further stimulated when after the fall of the Dutch conservative government national elections paved the way for a coalition that fulfilled many environmentally oriented people with hope that change was in the air (2006). Would the H_2 Dialogue be able to develop some useful advice for the new government? The main conflict was about adding H_2 into the natural gas grid, especially about the concept proposed by participants from this dialogue group of a 'flexible national gas infrastructure'. Such an infrastructure would enable the transportation of different gasses at one time, including natural gas, hydrogen, biogas but also other including CO 2, that could be added or extracted from the grid upon demand. Two international speakers at the Integration workshop addressed advanced technologies that can enable the introduction of a flexible gas infrastructure, one of these being catalytic dissociation of hydrocarbons (Muradov and Veziroglu 2008). One member of the external expert panel proposed an experiment with a flexible gas infrastructure for an industrial area (Eemsmond area).

The dialogue became less successful and also less pleasant for many participants including the project team, when the conflict turned out unmanageable at the so-called Integration workshop. In the draft final report, the project team, which had taken good notice of the resistance against the 'flexible gas infrastructure', proposed to address this concept as a research option, which it already was given the current research activities of Gasunie, the national natural gas infrastructure company, at that time. Unfortunately, a group of participants, mobilized by stakeholders from the Dutch National Energy Research Centre (ECN), rejected the concept even as a research option. For this reason, these stakeholders eventually rejected the entire final report. The criticism by ECN researchers, various of which had actively contributed to the dialogue, was of a fundamental nature. In their view, the dialogue process had made insufficient distinction between the input from stakeholders with "*an opinion on hydrogen and the input by real hydrogen experts*" (cited in Hisschemoller and others 2007).[15] This criticism relates to the dialogue method, which aimed at articulating different and competing perspectives on hydrogen energy on an equal footing. Although in reality the division of opinion cut across both academics and practitioners, what makes this case special is that it was framed in the end as a controversy between experts and non-experts.

Biomass Dialogue

The design of the Biomass Dialogue was to a large extent based on the observation the negative impacts of large scale biomass to energy options had provoked controversy and debate (although it had not yet reached its peak by that time). What also played a role was the experience with the H_2 dialogue, where an atmosphere of consensus suddenly had turned into an atmosphere of conflict. Hence, the project team communicated the message to the dialogue that it was necessary to exchange arguments and explore options, but there was absolutely no need for trying to reach consensus as this was considered highly unlikely.

15 The environmental NGO Greenpeace refused to subscribe the report, because this organization interpreted the exploration of a flexible gas infrastructure as a vehicle to facilitate new large-scale coal fired electricity plants.

The participants appreciated this message. By times the dialogue amongst subgroups with different views was really open. Experts from academia were interested in the knowledge put forward by entrepreneurs. One example was related to the fact that after conversion into pure plant oil, the residue, about 2/3 of total substance, is a cake used as animal feed. This insight led, for the case of pure vegetable oil, to some nuance in statements regarding competition between energy and food production. In a similar vein, the dialogue addressed differences between pure vegetable oil and biodiesel.

Another example of constructive interaction between experts and practitioners relate to the presentation of the concept Poor Peoples Profit for Planet, 4P+ or the Oily Way to Go.[16] Basically, this concept tries to reconcile biomass for energy and food production for local communities in developing countries. Biomass residues from the forest are collected and pyrolyzed (burning with no or little oxygen), which means that the hydro carbons are split into on the one hand carbon and, on the other, oil and some gas. The carbon (charcoal) is stored underground, improving the general soil condition and thereby increasing agricultural production. The oil can be used for electricity production or converted into a transport fuel. As this process leads to a negative carbon balance, the locals can be awarded with CO_2 credits, e.g. by western energy companies. Among some participants this concept provoked critical reactions. One climate scientist, however, clarified that the process introduced largely resembles what archeologists have found for large regions in e.g. Amazonia (-5000 - 1500 aC), carbon storage resulting in very black earth, also known as Terra Preta.[17]

Not only were there constructive interactions between experts and practitioners. The first dialogue session showed that, in spite of the project team's expectations, participants were in large agreement with respect to the criteria for sustainable biomass to energy projects. In some instances, small business stakeholders took an even more stringent approach than academics or stakeholders from the ministry, e.g. in their rejection of biomass imports or combustion in electricity plants.

However, the biomass dialogue did not result in proposals for action that could reckon with unanimous support. A large groups of participants was hesitant to switch from research to action.

Conclusions: opportunities and threats for open dialogue

Both the H_2 and Biomass dialogues showed a lively interaction between stakeholders, experts and practitioners, where the elaboration of and confrontation between different views and knowledge claims is concerned. Provided that steps 1 and 2 in the CCM, the identification and articulation of rival perspectives, are successfully completed, it is vital for a dialogue that step 3, the confrontation of views, is organized in a transparent and fair way. This means that every perspective has about equal opportunity to make itself heard in the dialogue. Both dialogues have, in a rather condensed way, produced and disseminated a great amount of knowledge available among participants. More than once, individual participants and groups were stimulated to develop concepts and ideas that can be considered new. From this angle, CCM has shown capable of enhancing a lively interaction and even to produce new ideas. If we look into the contents of both dialogues, at several occasions persons and groups have reconsidered their position in response to input by others.

16 This concept was invented by Boudewijn Klaversteijn (WinWays Innovation) and is based on the notion of catalytic dissociation of hydrocarbons presented at the Hydrogen Dialogue Integration Workshop. There, Klaversteijn introduced the notion of a flexible gas infra for the industrial area Eemsmond, but here this notion is related to fossil, as in the concept originally launched by Nazim Muradov (see above).

17 See for a case study on the feasibility of this concept for a region in Cameroon, Oben (2011).

However, we also find from both dialogues that stakeholders, once organized around different perspectives, are unlikely to change their core thinking about the topic. When it comes to step 4, the synthesis of results, especially where policy recommendations are concerned, participants have a hard time in reaching some sort of agreement or at least some common ground with respect to actions that can be taken. The H_2 Dialogue shows that, when the backcasting is about to finish with plans for action or policy in the here and now, people may have difficulties with recognizing the legitimacy of other opinions.[18] Although not that straightforward, also in the Biomass Dialogue, we observed a withdrawal into the core positions, when it came to finalization of the report. CCM does not require to reach consensus. Yet, it is fair to say that this method, because of the articulation of differences of opinion, would not really help a process that is aimed at obtaining full consensus among those involved. Full consensus in the case of unstructured problems can only be obtained, if one either accepts the exclusion of stakeholders that are in the margin of the dominant knowledge and policy network, or artificial consensus , i.e. consensus at an abstract and distant level.

In spite of the differences of opinion, reporting needs to give a fair and balanced picture of the variety of options discussed and the arguments pro and con. The bottom line would be that each group of stakeholders (perspective) sufficiently recognizes its own input. If stakeholders would like to go further than enacting influence on the reporting of their own input, e.g. by denying the legitimacy of other viewpoints, we have reached the limits of CCM as a genuine approach in the analysis of unstructured problems.

5. Measuring learning through dialogue

We have evaluated the dialogue processes. Evaluation can typically take place along two tracks. On the one hand, the project team evaluates each step in a dialogue according to its own observations. On the other hand, upon the closure of each meeting participants are asked to fill out a short evaluation form. Questions relate to the relevance of the topics under discussion, as to whether participants have made their point in a satisfactory manner and as to whether they have heard something new. In some cases, dialogues have been evaluated afterwards through interviews with a number of active participants.

One of the most challenging issues relates to the question as to whether participants learn through dialogue. This is not very easy to measure, partly because the concept of learning has different meanings for different persons. In a qualitative sense, a question such as "Have you heard something new?" can be used to register the learning impact of dialogue. In two instances, learning has been measured in a quantitative way. For the Groningen Costa Due project, Hollaender and Stokman (2007) have conducted surveys at several points in time during the dialogue. These surveys show that, in the course of the dialogue, participants tend to converge with respect to the relevance of the issues under consideration. This does not mean that they agree with respect to the steps to be taken. It means that dialogue shapes a joint awareness as regards issues relevant for decision-making (both at public and private level).

18 This observation has also been made for other dialogue projects, e.g. Climate Options for the Long Term (COOL) (Van de Kerkhof 2004).

For the Biomass Dialogue, Cuppen (2010) evaluated in both a qualitative and a quantitative way to what extent the application of *Constructive Conflict Methodology* resulted in an improved understanding of a participant's own and others' perspectives.

The evaluation was done by means of a repeated Q sort analysis. For this project, stakeholders and their different perspectives with respect to energy from biomass had been identified ex ante by a Q sort analysis. The ex ante Q sort analysis resulted in the identification of six perspectives on energy from biomass in the Netherlands. Part of the respondents who were involved in the ex ante Q interviews participated in the Biomass Dialogue. Ex post Q interviews were conducted with a group of participants as well as with a group of non-participants (the control group). The control group participated in the ex ante Q interviews but not in the dialogue itself.
Ex ante and ex post agreement with the six perspectives was compared for the dialogue and the control group. A multivariate analysis of variance showed that there is a significant difference between the dialogue group and the control group as regards the relation between their ex ante and ex post agreement with the six perspectives. Figure 5 shows the average Fisher's z score of the dialogue group (dark blue line) and the control group (pink line) on Q1 and Q2. The Y-axis represents the mean normalized factor loading on the six perspectives. This value is calculated as the mean of the six normalized factor loadings, averaged on the level of groups (dialogue and control). On the X-axis are the two measurements: before (Q1) and after (Q2) the dialogue.

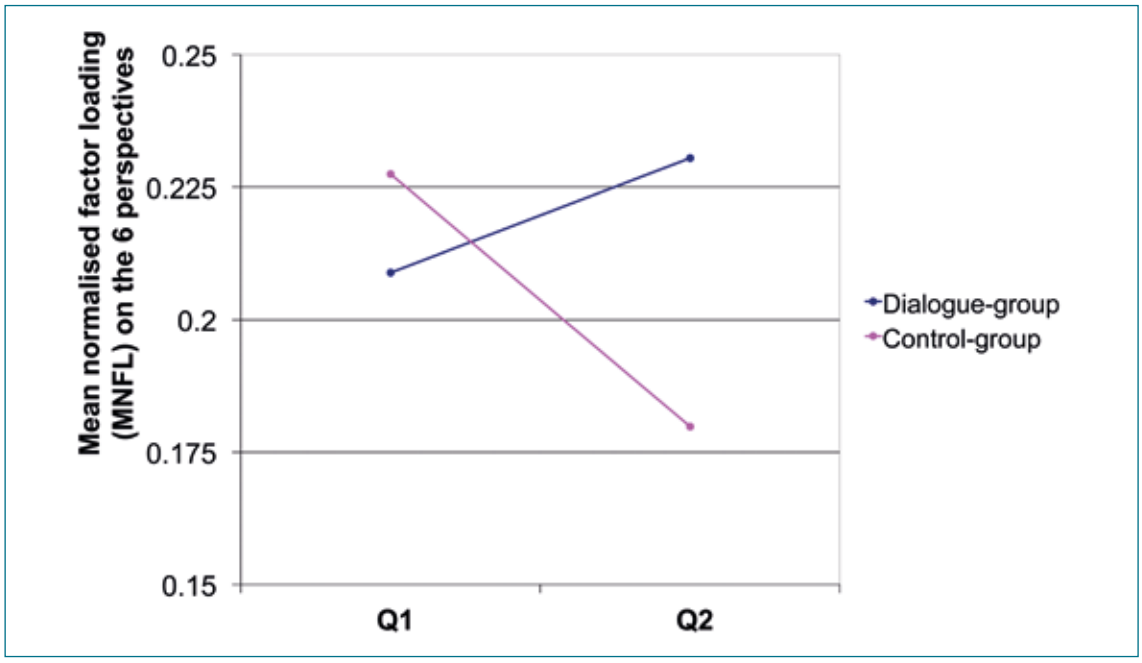


Figure 5.
Significant interaction effect (p< .01): the mean normalized factor loading (Fisher's z-score) increases for the dialogue group, whereas it decreases for the control group.

On average, the agreement with the six perspectives increased for the dialogue group, whereas it decreased for the control group. Follow-up tests with MANOVA showed that the dialogue group and the control group were, before the dialogue, comparable in terms of their agreement with the six perspectives but that they differ significantly afterwards: the agreement for the dialogue group is higher than that for the control group. This means that the intervention, taking part in the Biomass Dialogue, had an impact: an increased agreement with the six perspectives. The analyses shows that the dialogue had a problem structuring effect in the sense that participants learned about the diversity of perspectives. Hisschemöller (2005) defines problem structuring as "the articulation,

confrontation, comparison and, where possible, integration of as many contradictory arguments as possible". Taking on this definition for the process of problem structuring, the analyses presented here gives deeper insight into the question what learning in stakeholder dialogues actually entails. For the Biomass Dialogue, learning means that participants show in general more agreement with the beforehand-identified perspectives after the dialogue than before. Hence, learning does not imply that people drastically change their perspective, but rather that they better understand and acknowledge the diversity of perspectives.

6. Conclusions and discussion

The introduction presented the study's general research problem:

> *What method is most fit to structure the interaction between experts and stakeholders in such a way that their integrated assessment focuses on learning through the articulation and evaluation of conflicting knowledge claims?*

The fitness of the method is defined by its ability to deal with biases that under normal daily conditions tend to undermine dialogue and the learning capacity of dialogue participants in particular. The method should be able to identify and address four biases that hamper an open exploration of divergent viewpoints in stakeholder dialogues: 1) the bias of shared information, 2) the bias of source, 3) the bias of attitude and 4) the bias of phrasing. Constructive Conflict Methodology may help in creating an atmosphere in which these biases can, at least in part, be avoided. CCM considers a dialogue between scientists and other stakeholders as an encounter between persons who would otherwise be unlikely to meet. Much attention is given to the identification of stakeholders with very different perspectives on the issue, thereby not a priori assuming that stakeholders who belong to a similar category or type of organization share a similar perspective. By giving different voices about equal opportunity to make themselves heard, CCM can be effective in addressing the bias of shared information and the bias of attitude. To reassure a plurality of views within stakeholder categories and types of organization (including the diversity of views among scientists) may address the bias of source. Finally, bringing together practitioners from different fields and focusing the dialogue on concrete matters rather than abstract knowledge or distant values may help to address the bias of phrasing.

Obviously, a dialogue methodology cannot be applied in a 'push the button' fashion. There is no guarantee that the biases will be sufficiently avoided as to enable productive dialogue. We are confident, though, that even in situations where the dialogue lacks openness CCM enables to better identify the problems than methods and techniques, which lack the CCM analytical framework. This trickles down to asking the right questions at the right moment.

The evaluation of the biomass dialogue, using repeated Q sort analysis has shown that, firstly, we are very well able to measure learning in a dialogue and, secondly, that the dialogue had indeed provided a learning environment for its participants. This means that CCM provides an affirmative answer to the general research question of this project.

The Hydrogen and Biomass Dialogues have made us aware of some other critical issues for an environmental science practice that is not only geared at the acquisition of academic knowledge but

simultaneously at a better environment. The Netherlands is a small country. Although it is generally considered an open economy and international cooperation in the field of academic knowledge production is considered a normal case, it is likely that the knowledge system as regards climate change and energy is restricted by national boundaries caused by some typical determinants of the present Dutch national environmental policy system. In the case of climate change policy-making, this system is shaped by the availability of large natural gas reserves and a nation-wide natural gas infrastructure. Interestingly, even social scientists may lack the capacities to identify the biases of the system they themselves are part of. Social science has many techniques to collect information on stakeholder views, but –given their limited knowledge and expertise with respect to climate and energy, social scientists are unable to get to a full understanding on their own. They need to be informed by other disciplines and practitioners. Multidisciplinary research has not provided a solution, because in this type of research each discipline researches an issue from its own disciplinary perspective. The dialogue approach shows the value of crossing boundaries between academics within academia and stakeholders with an academic background who are found among small entrepreneurs, fighting against the inertia of boundary institutions. There is a compelling argument for stakeholder dialogue as a transdisciplinary project, if it brings together both scientists and practitioners. This is, because no-one in person, no discipline, no political interest group or political power is able to solve the complex issues on its own.

This study also shows that stakeholder dialogue is a social experiment, because we intervene in and disrupt normal social conditions, if only by bringing persons together who would otherwise be unlikely to meet. New solutions identified and discussed in stakeholder dialogue can be compared to the solutions debated in the reference situation , the environment of real climate and energy policy-making. which was, unfortunately, not very actively involved in the H_2 and Biomass dialogues. Interestingly and surprisingly, the actors that have so far most actively used outcomes from our dialogue projects are small and medium sized business people who work on technological innovations. They apparently saw the dialogues as opportunity to identify and explore opportunities for application.

Constructive conflict methodology is therefore not only interesting for stakeholder dialogue as such, but probably also in case we want to thinking to action.

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Climate changes Spatial Planning

Climate change is one of the major environmental issues of this century. The Netherlands are expected to face climate change impacts on all land- and water related sectors. Therefore water management and spatial planning have to take climate change into account. The research programme 'Climate changes Spatial Planning', that ran from 2004 to 2011, aimed to create applied knowledge to support society to take the right decisions and measures to reduce the adverse impacts of climate change. It focused on enhancing joint learning between scientists and practitioners in the fields of spatial planning, nature, agriculture, and water- and flood risk management. Under the programme five themes were developed: climate scenarios; mitigation; adaptation; integration and communication. Of all scientific research projects synthesis reports were produced. This report is part of the Integration series.

Integration

The question is how to increase the 'adaptive capacity' of our society. Analysis of the adaptive capacity is related to the physical component (the feasibility of physical spatial adaptation) and to the existing institutional structures. Areas Climate changes Spatial Planning dealt with are: uncertainties and perceptions of risk; institutional capacity to deal with climate change; the use of policy instruments; and cost benefit analysis. Adaptation strategies must be in line with the current institutional structures of a policy area. For a proper decision process we developed decision support tools, such as socio-economic scenarios, the Climate Effect Atlas and other assessment frameworks.

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