Articulating Divergent Perspectives: Q Methodology in a Participatory Integrated Assessment on Energy Options from Biomass in The Netherlands.

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1. Introduction

Complex environmental problems are usually characterized by controversies, uncertainties and ambiguities with regard to both the definition of the problem and the most appropriate solutions to the problem. Participatory Integrated Assessment (PIA) is an approach in which (scientific) knowledge, (practical) expertise, values and interests are integrated in an assessment in order to deal with this type of problems. In the recent decades, attention for stakeholder participation in the assessment of complex ecological or environmental problems has increased considerably. There are different rationales for stakeholder participation in this regard. From a policy-making perspective, there is a risk that policy gets stalled early in the implementation phase if the points of view of stakeholders are not integrated (Kasemir, Jaeger, & Jäger, 2003). The acceptance of, and compliance with, decisions might increase as they take into account the different views and interests of stakeholders. Second, participation of stakeholders in decision-making might increase the legitimacy and accountability, both of the decision-making process as well as of the outcomes (Van Kersbergen & Van Waarden, 2004). This refers to participation as a political right for citizens and as a prerequisite for democracy (Laird, 1993; Bohman, 1996; Fischer, 2000). Thirdly, participation can contribute to capacity building and the formation of networks. Furthermore, in the specific context of PIA, an important rationale for stakeholder participation refers to knowledge production. It is the notion of knowledge production that is taken as a theoretical starting point in this paper. The idea of knowledge production has been developed in political philosophy (Pateman, 1979; Held, 1987; Fischer, 1990), policy science (Hisschemöller, Hoppe, Dunn, & Ravetz, 2001; Hisschemöller, 2003), social psychology (Webler, 1995), and, more recently, in the field of studies on interdisciplinarity (Gibbons et al., 1994; Funtowicz & Ravetz, 1993). There is a legitimate need to 'integrate' and 'assess' complex and uncertain expert knowledge (Gough et al., 2003). Funtowicz and Ravetz (1993) argue that 'post-normal' problems cannot be solved by scientists alone because of the high uncertainties and high stakes. Participation by stakeholders and citizens is needed to improve the quality of knowledge. This perspective underlies the notion that lay persons are experts with respect to their own problems (Mitroff, Mason, & Barabba, 1983). In a PIA process stakeholders deliberate on a specific issue, in order to produce new insights, knowledge and ideas. Knowledge production hence involves a process in which mutual learning is enhanced by generating and evaluating divergent knowledge claims and viewpoints. PIA processes therefore facilitate the articulation and evaluation of divergent perspectives and knowledge claims. This requires 1) a method to facilitate stakeholder selection, in such a way that stakeholders with sufficiently divergent perspectives are invited to participate, and 2) a method to structure stakeholder interaction, in such a way that the available divergent perspectives are articulated in the PIA process, and argumentations are explicated.

Usually, stakeholder selection is largely based on representation of different types of actors. Participants need to reflect the actor field in such a way that participants from government, industry, NGOs, etcetera, are involved. If one aims for knowledge production, however, one aims to articulate and evaluate different perspectives. Hence, the variable that should be guiding stakeholder selection is 'type of perspective' (and not 'type of actor'). Although these two might often overlap, this study shows that this is not entirely the case. We present Q Methodology here as a method to select participants on the basis of the perspective a person adheres to. We want to share our experience with the use of Q Methodology in a PIA process on energy options from biomass in the Netherlands, the Biomass Dialogue. Q Methodology was used to map the divergent stakeholder perspectives on energy-options from biomass for the Netherlands. This served three goals.

First, we wanted to gain an in-depth understanding of the various perspectives that exist in the discourse on biomass in the Netherlands. This understanding should go further than being able to map stakeholders with a pro- and con-perspective; it should entail structuring the discourse by gaining an overview of salient perspectives and similarities and differences between these perspectives. Second, we used the results of the Q Methodology in order to be able to select participants for the Biomass Dialogue who reflect the various perspectives. Third, we used the results to structure the dialogue in such a way that there was discussion between 'similar-minded' participants (articulation of perspectives) and 'different-minded' participants (confrontation and evaluation of different perspectives). The paper discusses how useful Q Methodology was in pursuing these functions and reflects on Q Methodology as a tool for PIA.

We start this paper with explaining the aim and design of the Biomass Dialogue (Section 2). In Section 2 we explain how interviewees were identified in the preparation phase of the dialogue. In Section 3 we explain what Q Methodology is, and how we used it in the Biomass Dialogue. In Section 4 we report the results of the Q Methodology: six stakeholder-perspectives on energy-options from biomass in the Netherlands. In Section 5 we explain how we used these results to select participants for the Biomass Dialogue, and in Section 6 how we used the results for the organisation and structure of the first workshop. We wrap up in Section 7 with some conclusions, and we discuss the use of methods such as Q Methodology for PIA processes.

2. Biomass Dialogue

In scenarios for mitigating climate change, energy from biomass is usually given an important role. At the moment, (sustainable) biomass is subject to political and public debate in the Netherlands. Biomass is all organic material. When converted to energy, it can mitigate climate change, because in principle it is CO_2-neutral. A simple example: a tree takes CO_2 from the air to grow, and an equal amount of CO_2 is emitted when the tree is burned. So the net CO_2 emission is zero. Biomass as an option to mitigate climate change can be interpreted as a complex issue. Firstly, because there are many different elements and options within a biomass-system. Energy can be made from all different sources of biomass, e.g. waist, or energy crops. Energy crops can be oily, woody, or sugary. Biomass can be converted to biofuels (bio-ethanol or biodiesel), or it can be used to make electricity or heat. It can be applied on a large scale (e.g. import of energy crops), but it can also be applied on a small scale (a village). It can involve centralized energy production, or decentralized energy production. Secondly, even if there is agreement on the CO_2-balance of a biomass option, it is not the only aspect that impacts the sustainability of that option. Usually other aspects, such as (socio-) economic impacts and impacts on biodiversity, are taken into account as well. Many uncertainties exist with regard to the impacts on the sustainability of biomass options. Thirdly, there are many different actors involved, with many different stakes and interests. They often have divergent perspectives on which aspects and impacts of biomass options should be considered important.

The Biomass Dialogue[1] is a PIA project that aims to develop concrete ideas about sustainable biomass-chains for the Netherlands, and to identify what is needed in order to

[1] The project is funded by BSIK Climate Changes Spatial Planning as part of the project "*An integrated framework to assess spatial and related implications of increased implementation of biomass delivery chains*" lead by Prof. Johan Sanders (Wageningen University) in which is cooperated by Wageningen University, University Utrecht, ECN, KEMA en Vrije Universiteit Amsterdam. It is also part of the project "*Strategies for implementing sustainable transition trajectories in the transport sector"* lead by Prof. Ruud Smits (University Utrecht).

realise the sustainable biomass-chains. The dialogue is structured according to the back-casting methodology (Robinson, 2003): the first workshop is aimed at analyzing the current situation, in the second workshop a desirable future situation is developed, and in the third workshop the future situation is taken as a starting point to analyze the implementation trajectory that is needed in order to get there.
The Biomass Dialogue runs from May 2007 until May 2008. It consists of an extensive preparation phase, three workshops and an evaluation phase. The first workshop took place on December 13th 2007, the second workshop takes place on February 14th 2008, and the third workshop will be held in March 2008.

3. Preparation phase: Interviews

In total, the project team interviewed 75 stakeholders, from August 2007 until October 2007. A stakeholder is defined as an actor who can affect, or is affected by the issue. In accordance with the notion that the Biomass Dialogue is a PIA project that aims to stimulate knowledge production and learning among participants, participants should reflect diversity in perspectives, knowledge and expertise. Based on a stakeholder-typology we selected a large group of stakeholders representing different types of stakeholders:

- Government (local, regional, national)
- NGOs
- Entrepreneurs (cultivation, treatment, energy/heat/fuel production)
- Industry
- End-users (companies)
- Sector organizations
- Science & knowledge institutes
- Consultancy
- Investors

We used newspaper articles, and newswebsites to identify stakeholders. We also used the snowball-sampling technique to identify stakeholders: after each interview we asked the respondent to mention someone with a different perspective on biomass. The typology above was not a strict typology; we used it to ensure that we balanced the different types of stakeholders, and it actually grew in the process of identifying stakeholders. Also within the categories we balanced different types of actors (e.g. scientists with a positive attitude and scientists with a negative attitude with regard to biomass). This resulted in a group of 75 interviewees, representing diversity in knowledge, expertise, values and perspectives. Interviews typically lasted 60-90 minutes. The central task in the interviews was the Q sort, added upon by some open questions. In the following section Q methodology and the Q sort task are explained.

4. Q Methodology: Method

Q Methodology is a method that 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, including policy analysis. Van Eeten (2001) for example, applied the Q Methodology as part of a recasting exercise applied to the highly intractable controversy of the Netherlands Civil Aviation.

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 and Krueger, 2000: 645). Q methodology differs from R methodology (surveys) in that the later 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 & Berejikijan, 1993). The following steps were part of the Q methodology. First, we developed a sample of statements. In an attempt to reflect the wide range of perspectives on biomass, we collected about 200 statements from transcripts from discussions between stakeholders in other PIA projects on biomass, reports, newspaper articles, etcetera. From these, we selected 62 statements to represent the broad range of perspectives (see appendix A). The Q statements were piloted with a number of people to check whether we didn't miss relevant statements. This resulted in a definite list of 60 statements. Furthermore, to check the representativeness of the statements, we asked during the interview whether the respondent thought that there were important statements missing. Next, these statements were presented to the respondents during the interview. Respondents were asked to rank-order the statements according to a forced normal distribution with 11 positions from most to least 'according to my point of view' (Q sort; see figure 1). They were asked to sort the statements in relation tot each other.

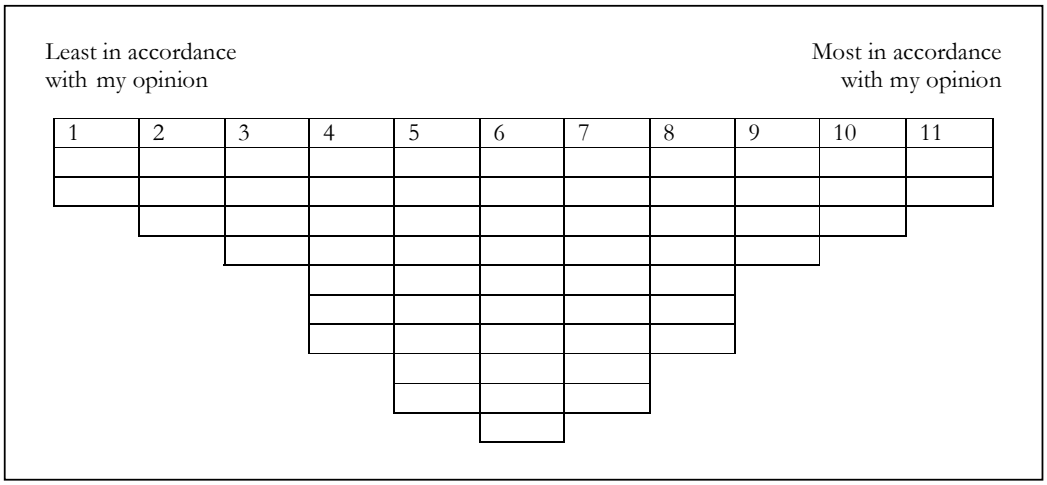

Figure 1: Q sort distribution

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 75 respondents were calculated, creating a 75 by 75 correlation matrix. The correlation matrix was factor analyzed using the centroid analysis method (with Q sorts/respondents as variables and the statements as cases), and rotated using Varimax. After examination of the initial results, we concluded that 6 factors could clearly be identified and explained[2].

[2] Total variance explained of these 6 factors is 46%. In regular R (not Q) factor analysis this is considered low. 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. A total variance explained of 46% is one the one hand a consequence of the large sample (75 compared to usually about 30 in Q studies), and on the other it underlines the diversity of ideas and view-

Of the 75 respondents, 42 loaded significantly[3] on one factor and not on others. Of these 42 respondents, 7 respondents loaded significantly on factor 1, 14 respondents on factor 2, 3 respondents on factor 3, 7 respondents on factor 4, 7 respondents on factor 5 and 4 respondents 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 results of this factor analysis are described in section 5.

5. Q methodology: Results

The 6 factors that resulted from the factor analysis were interpreted as 6 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, and to look at the statements that distinguish most between that factor and the other factors. In addition to this, we used the open questions in the interviews, and the explanations that respondents gave about their Q sorts. We show for each factor a table that lists the 10 statements that score highest and lowest on that factor. Most distinguishing statements are printed in italics[4]. Then we will shortly discuss each perspective. The section wraps up with a short conclusion.

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 is not useful to exclude specific options in advance, or to embrace others. Table 1 shows the statements with the highest positive and negative scores for this perspective.

Table 1 Statements that received the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for perspective 1. Most distinguishing statements printed in italics.

Agree (11):	60: We should concentrate on the use of residuals for biofuel production.
	34: The distinction between 1st and 2nd generation is not as black-and-white as is often posed.
Agree (10):	53: First, try to make high-quality products from a biomass source, and make energy from what is left.
	44: The Netherlands is strong in knowledge development in the area of biomass technology.
	20: The issue of unsustainable land-use, for example in South America, Africa and South-east Asia also exist without biomass production.
Disagree (1):	*7: Biomass is a temporary solution; in the end, solar and wind should be the main energy sources.*
	2: If biofuels are being stimulated in the EU, this will definitively have negative impacts on environment, social-economic impacts, human rights and food shortages in developing countries.
Disagree (2):	23: The cultivation of energy crops in the Netherlands will make the landscape monotonous, attract harmful insects and spread a dirty smell.
	22: The production of biomass should be restricted to within the EU to be able to control sustainable preconditions with regard to society, economy and the environment.

points with regard to biomass. 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.

[3] 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)

[4] Arrays of differences between z-scores of statements on factors above |2.5| were accepted as most distinguishing.

	27: Cultivation of energy crops is not favourable because manure and irrigation are needed.
Disagree: Other distinguishing statements	*17: The Dutch government mainly has an eye for large companies; there is not enough attention and support for small, innovative players.*

Perspective 2: Hit the brakes

This perspective is very sceptical 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. Table 2 shows the statements with the highest positive and negative scores for this perspective.

Table 2 Statements that received the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for perspective 2. Most distinguishing statements printed in italics.

Agree (11):	40: In the formulation of criteria for certification of biomass also stakeholders from the South should be involved.
	2: If biofuels are being stimulated in the EU, this will definitively have negative impacts on environment, social-economic impacts, human rights and food shortages in developing countries.
Agree (10):	*1: If the complete lifecycle is taken into account in the analysis, biofuels do not reduce as much greenhouse gas emissions as was hoped for.*
	29: There is a need for generic policy aimed at all clean and efficient vehicles, instead of a policy that is aimed specifically on biofuels.
	21: The production of biomass is only sustainable if it contributes to the social-economic development of the local community.
Agree: Other distinguishing statements	*7: Biomass is a temporary solution; in the end, solar and wind should be the main energysources.*
Disagree (1):	4: If we want, we can drive clean and fly clean now with biofuels.
	5: Within the Netherlands and the EU, the production of rapeseed oil should be taken seriously.
Disagree (2):	*18: The Dutch government should give tax dispensation for biofuels.*
	35: There is no use to develop niche markets; in the end we need large-scale biomass applications, and that niche won't help to reach that.
	24: The cultivation of energy crops contributes to a colourful landscape and to the bee-population.
Disagree: Other distinguishing statements	*31: Too much money goes to research, and too little to implementation in the market.*
	19: The potential of degraded and marginal grounds is so large that it can mean an economic impulse in rural areas.
	32: Biomass delivers an important contribution to the security of supply, namely less dependency on geopolitical sensitive areas, and a higher degree of self-support for the EU.
	51: In the long run, biofuels will compete on the world market with fossil fuels.
	3: If there are no entrepreneurs who want to experiment with biofuel applications, nothing will happen.

Perspective 3: Support innovative initiatives

The third perspective focuses mainly on small-scale, 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 don't need to expect innovations from them, because large companies profit from maintaining the existing system. We shouldn't keep putting money in research, but in imple-

mentation. Table 3 shows the statements with the highest positive and negative scores for this perspective.

Table 3 Statements that received the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for perspective 3. Most distinguishing statements printed in italics.

Agree (11):	*17: The Dutch government mainly has an eye for large companies; there is not enough attention and support for small, innovative players.*
	31: Too much money goes to research, and too little to implementation in the market.
Agree (10):	42: Small-scale energy production with biomass can give a huge impulse to security of supply in developing countries.
	18: The Dutch government should give tax dispensation for biofuels.
	60: We should concentrate on the use of residuals for biofuel production.
Disagree (1):	*35: There is no use to develop niche markets; in the end we need large-scale biomass applications, and that niche won't help to reach that.*
	33: Given the pace of the development towards more efficient cars, maybe we don't need biofuels for transport.
Disagree (2):	23: The cultivation of energy crops in the Netherlands will make the landscape monotonous, attract harmful insects and spread a dirty smell.
	49: Because, as a small country with limited means, we are forced to make choices, the government should support only the most favourable trajectories.
	55: Technology development is the key to large-scale use of biomass, not an active subsidy policy.
Disagree: Other distinguishing statements	*1: If the complete lifecycle is taken into account in the analysis, biofuels do not reduce as much greenhouse gas emissions as was hoped for.*
	7: Biomass is a temporary solution; in the end, solar and wind should be the main energy sources.

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 (woody material), and puts as a condition that the sustainability of biomass is guaranteed through means of a certification system. Table 4 shows the statements with the highest positive and negative scores for this perspective.

Table 4 Statements that received the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for perspective 4. Most distinguishing statements printed in italics.

Agree (11):	*52: Over the whole biomass chain, there should be a positive score as regards economic profit, energy- and CO_2-balance.*
	32: Biomass delivers an important contribution to the security of supply, namely less dependency on geopolitical sensitive areas, and a higher degree of self-support for the EU.
Agree (10):	46: Political pressure, at minimum on the EU level, is needed to make sustainability criteria function.
	51: In the long run, biofuels will compete on the world market with fossil fuels.
	15: The competition between food, feed, and fuel will have a negative financial impact on people
Agree: Other distinguishing statements	*35: There is no use to develop niche markets; in the end we need large-scale biomass applications, and that niche won't help to reach that.*
Disagree (1):	33: Given the pace of the development towards more efficient cars, maybe we don't need biofuels for transport.
	38: Biofuels can only succeed if the government subsidizes until the end of times.
Disagree (2):	45: Dutch farmers will not benefit from a growing use of biomass.
	18: The Dutch government should give tax dispensation for biofuels.
	5: Within the Netherlands and the EU, the production of rapeseed oil should be taken seriously.

Disagree: Other distinguishing statements	*56: 2nd generation biofuels profit from stimulating the 1st generation (E85 and diesel variant E95) now.*
	2: If biofuels are being stimulated in the EU, this will definitively have negative impacts on environment, social-economic impacts, human rights and food shortages in developing countries.
	11: Criteria will not prevent that in the future there will be a number of large agro companies, that supply biomass without taking social and environmental interests sufficiently into account.

Perspective 5: Efficiency the goal, biomass a means?

According to this perspective, we shouldn't 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. Table 5 shows the statements with the highest positive and negative scores for this perspective.

Table 5 Statements that received the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for perspective 5. Most distinguishing statements printed in italics.

Agree (11):	*52: Over the whole biomass chain, there should be a positive score as regards economic profit, energy- and CO_2-balance.*
	7: Biomass is a temporary solution; in the end, solar and wind should be the main energy sources.
Agree (10):	*51: In the long run, biofuels will compete on the world market with fossil fuels.*
	60: We should concentrate on the use of residuals for biofuel production.
	37: The precarious Dutch energy policy has lead to stagnation of the market development concerning biomass.
Agree: Other distinguishing statements	*55: Technology development is the key to large scale use of biomass, not an active subsidy policy.*
Disagree (1):	9: Biomass should be used only for electricity production and heat supply, not for transport fuels.
	54: Public resistance is an obstacle for local biomass applications.
Disagree (2):	33: Given the pace of the development towards more efficient cars, maybe we don't need biofuels for transport.
	23: The cultivation of energy crops in the Netherlands will make the landscape monotonous, attract harmful insects and spread a dirty smell.
	45: Dutch farmers will not benefit from a growing use of biomass.
Disagree: Other distinguishing statements	*2: If biofuels are being stimulated in the EU, this will definitively have negative impacts on environment, social-economic impacts, human rights and food shortages in developing countries.*
	31: Too much money goes to research, and too little to implementation in the market.

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. Table 6 shows the statements with the highest positive and negative scores for this perspective.

Table 6 Statements that received the highest positive (agree score (11) and (10)) and highest negative scores (disagree score (1) and (2)) for perspective 6. Most distinguishing statements printed in italics.

Agree (11):	*3: If there are no entrepreneurs who want to experiment with biofuel applications, nothing will happen.*
	57: 2nd generation biofuels are for the time being not ready for large-scale application.
Agree (10):	34: The distinction between 1st and 2nd generation is not as black-and-white as is often posed.
	51: In the long run, biofuels will compete on the world market with fossil fuels.
	41: In the Netherlands, biofuels are discriminated compared to fossil fuels when it concerns the calculation of CO_2-emissions.
Agree: Other distinguishing statements	*19: The potential of degraded and marginal grounds is so large that it can mean an economic impulse in rural areas.*
	56: 2nd generation biofuels profit from stimulating the 1st generation (E85 and diesel variant E95) now.
Disagree (1):	23: The cultivation of energy crops in the Netherlands will make the landscape monotonous, attract harmful insects and spread a dirty smell.
	22: The production of biomass should be restricted to within the EU to be able to control sustainable preconditions with regard to society, economy and the environment.
Disagree (2):	*35: There is no use to develop niche markets; in the end we need large-scale biomass applications, and that niche won't help to reach that.*
	33: Given the pace of the development towards more efficient cars, maybe we don't need biofuels for transport.
	9: Biomass should be used only for electricity production and heat supply, not for transport fuels.
Disagree: Other distinguishing statements	*44: The Netherlands are strong in knowledge development in the area of biomass technology.*
	2: If biofuels are being stimulated in the EU, this will definitively have negative impacts on environment, social-economic impacts, human rights and food shortages in developing countries
	52: Over the whole biomass chain, there should be a positive score as regards economic profit, energy- and CO2-balance.

Conclusion

The six perspectives describes above can be interpreted as six salient perspectives in the discourse on bio-energy (energy from biomass). Respondents Q sorts correlate to a greater or lesser extent with these perspectives. An important finding is that stakeholders from the same actor-group adhere to different perspectives. For example, there are scientists loading on perspectives 1, 2, 4 and 6, stakeholders from national government loading on perspectives 1 and 2, stakeholders from local and regional government loading on perspectives 2, 3 and 5, stakeholders from NGOs on perspectives 2 and 4, and entrepreneurs and stakeholders from industry on perspectives 1, 3, 4, 5 and 6. This implies that stakeholder selection based on diversity of perspectives is not equal to stakeholder selection based on actor-type.

6. Use of results to select participants

From the group of 75 respondents, we could have only 30 people taking part in the Biomass Dialogue. The second step in our approach was to select 40 out of 75 people (taking about 10 cancellations into account that should result in 30 participants). For this second step we used the results of Q Methodology. We calculated factor loadings for each interviewee (see appendix B). The higher the factor loading of a person on a factor (perspective), the more that person's resembles 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, based on the interviews, we identified the respondents that showed large similarities with each of the perspectives. This resulted in a list of 40 people (with a bal-

ance between the 6 perspectives). These were the persons that we invited to take part in the Biomass Dialogue[5].

7. Use of results to structure the dialogue

At the time of writing this paper the first workshop has taken place, the second and third workshop not yet. Hence, the focus here will be on the first workshop. The aim of the first workshop (13 December '07) was to develop shared insights into different perspectives on the sustainability of biomass options. Methodologically, the workshop was divided in three steps: 1) articulation of perspectives, 2) confrontation of perspectives, 3) evaluation/synthesis of perspectives. The first step entailed breaking up the group in subgroups of participants with similar perspectives. Participants in these 'homogeneous' subgroups evaluated the sustainability of 5 existing biomass chains. They explained the criteria that they think are important when evaluating the sustainability of biomass chains, and why. The rationale behind the 'homogeneous' subgroups is that, when working in small subgroups with people with a similar perspective, it is easier to work out an argumentation for a specific claim or idea than when working in large heterogeneous groups. The second step entailed mixing up the homogeneous subgroups into new, heterogeneous subgroups. These subgroups consisted of participants with different perspectives, in order to confront the former evaluations with different, maybe even conflicting evaluations. The third step entailed a plenary session, in which the results of the two rounds of subgroups were discussed.

Q methodology can be used to identify the persons with similar perspectives. Hence, the Q results were used to form the first round of ('homogeneous') subgroups. Due to practical reasons, we could form only three subgroups (and not six, according to the perspectives). In order to this in such a way that the perspectives most alike were combined in one group, we calculated correlations between the factor scores (see appendix C). The higher the correlation between two factor scores, the more similarities between two perspectives. Based on these correlations we identified which perspectives are most similar, and we interpreted the similarities based on the descriptions of the perspectives (see section 4). The correlations show that perspectives 4 ('Efficiency the goal, biomass a means?') and 5 ('Security of supply with global, certified, 2nd generation biomass') are most alike (r=0.55). Both see biomass as a commodity in a market in which it will eventually compete with fossil fuels, but on the condition that biomass-applications have a positive energy-balance. Perspective 4 is however more positive about the question whether this is feasible. This perspective sees the solution in 2nd generation, certified biomass. Perspective 5 doubts the feasibility of a positive energy balance, as well as the potential availability of biomass. According to perspective 5, technology and market have not been sufficiently developed, which has negative implications on the efficiency of biomass-applications. Both perspectives correlate with perspective 1 ('Keep all options open'). Perspective 1 and 4 are both optimistic about the potential of biomass to contribute to a sustainable energy-system (perspective 5 is more critical about this), but perspective 1 is more knowledge-oriented, and perspective 4 more market-oriented. Another difference is that perspective 1 calls for keeping all options open, while perspective 4 focuses only on 2nd generation, certified biomass. Perspective 1 and 5 share a focus on residuals as a biomass-source and the attention for technology development. However, perspective 5 is more critical about the efficiency of biomass applications and focuses

[5] 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.

mainly on knowledge development in the market (and not e.g. in science). Perspective 2 ('Hit the brakes') shows the lowest correlations with all other perspectives. It is the most critical perspective. Lastly, perspective 3 ('Support innovative initiatives') and 6 ('Just do it, step by step') are correlated. These perspectives are similar in that they focus on entrepreneurship, and putting things into practice *now*. Perspective 6 takes a more pragmatic, and less ideological stance than perspective 3. Perspective 3 focuses on small scale, decentralized applications in the Netherlands, whereas perspective 6 doesn't want to choose for a specific scale and type of application. Besides that, perspective 3 is very critical about the role of the Dutch government and policy; this does not seem to play a very important role for perspective 6.

Based on the correlations, and our interpretations of the similarities between the perspectives, we formed subgroups in which we combined perspectives that show substantial similarities. During the workshop, we presented the perspectives and our suggestion for subgroup formation to the participants. Generally, the participants recognized the different perspectives and agreed with the suggested subgroup formation. The three subgroups were formed as follows:

- Group 1: Perspective 1, 4 and 5
- Group 2: Perspective 2
- Group 3: Perspective 3 and 6.

These subgroups were used in workshop 1 to articulate the argumentations for the evaluation of the sustainability of the existing biomass chains. The subgroups will be used in the second and third workshop to discuss new, sustainable biomass chains, and their implementation trajectories. Based on our observations of the first workshop we can say that within subgroups participants managed to reach a consensus on the sustainability of the biomass chains. We might say that this shows that the participants in the subgroups have similar perspectives, i.e. have similar ideas on which criteria are important when evaluating the sustainability of biomass chains, and on whether the biomass chains live up to these criteria. Furthermore, we found a difference in the style of evaluating between the three subgroups. The subgroup that was formed around perspectives 1, 4 and 5 was mainly asking questions, adding nuances, and was reluctant in judging the sustainability of the presented biomass chains. Perspectives 1, 4 and 5 are more reflective and abstract than the other perspectives; the style of evaluation seems to be in line with the perspectives. The subgroup formed around perspective 2 brought up objections, formulated requirements and was rather critical about socio-economic impacts of the biomass options. This is in line with the sceptical character of perspective 2. The subgroup formed around perspectives 3 and 6 took a very practical stance when evaluating the biomass chains, and identified the elements on which the chain could be improved in terms of sustainability. Opposed to subgroup 1, this subgroup was not reluctant to make judgments about the sustainability of the presented biomass chains. Their style of evaluation is in line with the practical and pragmatic character of the perspectives. Apparently, not only is there similarity within subgroups, but also are there differences between subgroups.

8. Conclusion & discussion

Others have written already on the use of Q Methodology for policy analysis, i.e. giving insight in the different positions and opinions that different actors may have in a debate (see e.g. van Eeten, 2001). In line with this type of Q research, we have found it useful to map the different perspectives on energy from biomass in the Netherlands, in a more

nuanced way than only mapping pro- and con viewpoints. The six perspectives provide structure and improved understanding of the discourse. In addition, we have shown how Q Methodology can be used, not only to map divergent perspectives, but also to facilitate participant selection and the structuring of a PIA project. As mentioned above, at the time of writing this paper only one of three workshops has taken place yet, so our discussions are based on the results of the pre-phase of the dialogue and the first workshop.

With regard to participant selection we can conclude that Q Methodology helped us to identify the stakeholders with salient perspectives, i.e. a high loading on or identification with one of the six perspectives. A familiar and usual way to identify stakeholders is to use a stakeholder typology (like we did as a first step), often combined with the snowball sampling technique. It may seem logical to assume that a specific type of actor corresponds to a specific type of perspective (e.g. scientists focus on knowledge development). However, we found in our analysis that this is not always the case. Apparently, type of actor is not a good proxy for the perspective someone adheres to. For PIA projects, this is an important finding. Besides the snowball sampling technique, we are not familiar with any methods or tools to facilitate participant selection for PIA. Methods and tools for participant selection for PIA projects, such as Q Methodology, are therefore very welcome. Our results also show that an extensive preparation phase preceding the actual dialogue is truly worthwhile, and actually even required for a successful dialogue.

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10. Appendix A: Q statements

1	If the complete lifecycle is taken into account in the analysis, biofuels do not reduce as much greenhouse-gas emissions as was hoped for.
2	If biofuels are being stimulated in the EU, this will definitively have negative impacts on environment, social-economic impacts, human rights and food shortages in developing countries.
3	If there are no entrepreneurs who want to experiment with biofuel applications, nothing will happen.
4	If we want, we can drive clean and fly clean now with biofuels.
5	Within the Netherlands and the EU, the production of rapeseed oil should be taken seriously.
6	Bio-ethanol is more promising the bio-diesel, because there are more possibilities for improving the process and the efficiency with ethanol.
7	Biomass is a temporary solution; in the end, solar and wind should be the main energy sources.
8	Algae are the biomass source of the future.
9	Biomass should be used only for electricity production and heat supply, not for transport fuels.
10	Bio-refinery offers huge opportunities for small-scale and regional sustainable developments.
11	Criteria will not prevent that in the future there will be a number of large agro-companies, that supply biomass without taking social and environmental interests sufficiently into account.
12	Tax on fossil fuels should be increased.
13	The most important obstacle for biofuels is not the conversion, but the uncertainty in the future supply of biomass.
14	The availability of private capital is at the moment not a limiting factor for the development of a large-scale bio-based energy-supply.
15	The competition between food, feed, and fuel will have a negative financial impact on people
16	The European blending-targets, such as 5,75% in 2010 and 10% in 2020, require significant import volumes from countries outside the EU.
17	The Dutch government mainly has an eye for large companies; there is not enough attention and support for small, innovative players.
18	The Dutch government should give tax dispensation for biofuels.
19	The potential of degraded and marginal grounds is so large that it can mean an economic impulse in rural areas.
20	The issue of unsustainable land-use, for example in South America, Africa and South-east Asia also exist without biomass production.
21	The production of biomass is only sustainable if it contributes to the social-economic development of the local community.
22	The production of biomass should be restricted to within the EU to be able to control sustainable preconditions with regard to society, economy and the environment.
23	The cultivation of energy crops in the Netherlands will make the landscape monotonous, attract harmful insects and spread a dirty smell.
24	The cultivation of energy crops contributes to a colourful landscape and to the bee-population.
25	The time of large-scale is over; we need flexible, decentralized energy systems.

26	Every form of subsidy on imported biomass should be stopped.
27	Cultivation of energy crops is not favourable because manure and irrigation are needed.
28	Cultivation of energy crops for the 2nd generation biofuels will cause much less problems in developing countries than for the 1st generation crops.
29	There is a need for generic policy aimed at all clean and efficient vehicles, instead of a policy that is aimed specifically on biofuels.
30	If the European fuel has to meet higher standards than the American, this results in unfair competition.
31	Too much money goes to research, and too little to implementation in the market.
32	Biomass delivers an important contribution to the security of supply, namely less dependency on geopolitical sensitive areas, and a higher degree of self-support for the EU.
33	Given the pace of the development towards more efficient cars, maybe we don't need biofuels for transport.
34	The distinction between 1st and 2nd generation is not as black-and-white as is often posed.
35	There is no use to develop niche-markets; in the end we need large-scale biomass applications, and that niche won't help to reach that.
36	Stimulating biofuels has more to do with agricultural policy than with environmental policy.
37	The precarious Dutch energy policy has lead to stagnation of the market development concerning biomass.
38	Biofuels can only succeed if the government subsidizes until the end of times.
39	Import of end- or half products is preferable to import raw biomass.
40	In the formulation of criteria for certification of biomass also stakeholders from the South should be involved.
41	In the Netherlands, biofuels are discriminated compared to fossil fuels when it concerns the calculation of CO2-emissions.
42	Small-scale energy production with biomass can give a huge impulse to security of supply in developing countries.
43	The Netherlands can supply an important part of the houses with sustainable energy by means of local residuals.
44	The Netherlands is strong in knowledge development in the area of biomass technology.
45	Dutch farmers will not benefit from a growing use of biomass.
46	Political pressure, at minimum on the EU level, is needed to make sustainability criteria function.
47	Because stakeholders did not succeed in forming a successful lobby, there is insufficient support for the development of biomass technologies.
48	Because the CO2-reduction potential of 1st generation biofuels is limited, we should not invest in 1st generation, but in 2nd generation.
49	Because, as a small country with limited means, we are forced to make choices, the government should support only the most favourable trajectories.
50	Entrepreneurs are not only competitors: cooperation is required to learn from, and support each other.
51	In the long run, biofuels will compete on the world market with fossil fuels.
52	Over the whole biomass chain, there should be a positive score as regards economic profit, energy- and CO2-balance.

53	First, try to make high-quality products from a biomass source, and make energy from what is left.
54	Public resistance is an obstacle for local biomass applications.
55	Technology development is the key to large-scale use of biomass, not an active subsidy policy.
56	2nd generation biofuels profit from stimulating the 1st generation (E85 and diesel-variant E95) now.
57	2nd generation biofuels are for the time being not ready for large-scale application.
58	Consumers and end-users are increasingly interested in biofuels.
59	We can never compete on price with biofuel that are made in developing countries.
60	We should concentrate on the use of residuals for biofuel production.

11. Appendix B: Factor loadings

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
Respondent						
1	0.1467	-0.1500	0.4096	0.1608	0.3613	0.3611
2	0.5391X	-0.2616	0.2272	-0.0563	0.2176	-0.0077
3	0.3518	0.1695	0.0595	0.4068	0.0578	0.4908
4	0.3278	0.2132	-0.0572	0.2227	0.4539	0.2652
5	-0.0291	0.2869	0.3332	-0.0196	0.4142	-0.0648
6	0.0999	0.1052	0.1822	0.1010	0.3409	0.4336X
7	0.4525	0.2700	0.2185	0.1702	0.3909	0.1201
8	0.1487	0.1434	0.1761	0.2628	0.4331X	-0.0068
9	0.4590	0.1828	0.4092	0.2208	0.1230	0.1158
10	-0.1299	0.6709X	-0.0275	-0.0724	-0.0710	-0.2441
11	0.3919	-0.0463	0.1476	0.3646	0.1430	0.1202
12	0.2746	0.0901	0.4310	0.1185	0.3275	0.1488
13	0.2467	0.5376X	0.0415	0.3020	0.2094	0.1137
14	0.1792	0.3672	0.3461	0.3014	0.1328	-0.0853
15	0.1467	0.0638	0.3408	0.3606	0.0869	0.2333
16	0.4841	0.0419	-0.0286	-0.0485	0.2798	0.5028
17	0.0658	0.2253	0.0076	0.6016X	-0.0693	0.0148
18	0.2715	0.6125X	0.0264	0.1658	0.3347	0.0376
19	0.2540	0.3589	-0.0769	0.3343	0.4382	0.0417
20	0.2099	0.7868X	0.2398	-0.0819	0.0286	0.0741
21	0.4881X	0.0704	0.1035	0.2350	0.2200	0.2354
22	-0.1531	0.6708X	-0.0441	-0.0280	0.3170	0.0150
23	0.2593	0.5706X	0.1285	0.0595	0.0786	0.0335
24	0.1611	-0.1928	0.5347	0.3862	0.3214	-0.0101
25	0.0394	0.6257X	-0.0230	0.2854	0.2636	-0.0222
26	0.3823	-0.0048	0.3504	0.2163	0.2268	0.4216
27	0.0352	0.1057	0.5362X	0.1004	0.1339	0.0308
28	0.4760X	0.2048	0.0761	0.0843	0.2940	0.2237
29	0.6812X	-0.1732	0.0802	0.2331	0.0347	0.2309
30	0.1032	-0.1285	0.3186	-0.0325	-0.0707	0.4598X

31	0.3311	0.0448	0.4478	0.0358	0.2834	0.1595
32	0.2975	0.1104	-0.0461	0.5120X	0.2305	0.2114
33	0.2242	0.1292	0.0164	0.1338	0.1558	0.4538X
34	0.3135	-0.1892	0.2512	0.1025	0.1877	0.5785X
35	0.0857	-0.1270	0.6028X	0.1640	0.1776	0.1153
36	0.0869	0.4592X	0.0154	0.2353	0.0522	-0.2110
37	0.0569	0.2332	0.2447	0.0570	0.4982X	0.2652
38	0.3542	0.1108	0.5091	0.0512	0.1573	0.4452
39	0.0531	0.3537	0.0042	0.2766	0.4695X	0.1221
40	0.6249X	0.0529	0.1445	0.1971	0.1711	0.0019
41	0.2931	0.1087	0.3054	-0.0401	-0.0448	0.1050
42	-0.0286	0.5056	0.3924	0.3494	0.1451	0.1371
43	0.3238	-0.0226	0.3188	0.2952	0.3247	0.2052
44	0.3020	0.0063	0.3607	0.3143	0.4526	0.0348
45	0.5666X	0.2184	0.0486	0.2316	0.0529	0.0987
46	0.1998	0.2342	0.6324X	-0.0249	0.0514	0.1211
47	0.0045	0.3917X	-0.2363	0.2747	-0.0103	0.0595
48	0.2489	0.2000	0.0930	0.1241	0.4384X	0.2475
49	-0.0189	0.6047X	-0.1947	-0.1686	-0.0885	-0.0286
50	0.2395	-0.2329	0.1551	0.4674X	0.1040	0.0039
51	0.4968	-0.2235	-0.0289	0.0918	0.1810	0.5807
52	0.0265	-0.3441	0.4684	0.1926	-0.1277	0.3684
53	0.4415	0.0930	0.1553	0.3005	0.5535	-0.0638
54	0.1571	0.0734	0.0939	0.5903X	0.2596	-0.1264
55	0.1676	0.3103	0.3785	0.3377	0.1618	0.1033
56	0.5073	0.0075	0.3149	0.4541	0.1744	-0.0203
57	0.4390	0.1066	0.3241	0.1859	0.4601	-0.0240
58	0.1996	-0.0826	0.2385	-0.0727	0.5132X	0.1612
59	0.1080	0.1217	-0.0837	0.2254	0.0528	-0.4089X
60	0.5769X	0.0432	0.2796	0.1386	0.0182	0.2379
61	0.1937	0.0860	0.1878	0.4048X	0.0588	0.1443
62	-0.0741	0.6204X	0.1865	0.1001	0.0975	-0.1328
63	0.1019	0.2474	0.2086	0.5511X	0.2076	-0.0143
64	-0.0608	0.2036	-0.0286	0.3578	0.4330X	0.0328
65	0.4408	0.0921	0.1582	0.3113	0.5300	0.0219
66	0.1244	0.0812	0.3491	0.6105X	0.4114	0.2254
67	0.1955	0.0402	0.2865	0.1168	0.5063X	0.3218
68	0.0146	0.7959X	0.0133	0.0024	-0.1169	0.1477
69	0.1219	-0.0773	0.0817	0.4516	0.2279	0.3531
70	-0.2136	0.5615X	0.0258	0.1790	0.1208	-0.1877
71	0.4757	-0.0308	0.3443	0.1728	0.2299	0.3367
72	0.1262	0.6143X	0.2400	0.0387	0.2520	0.0314
73	0.2095	0.1179	0.2692	0.0729	0.2695	-0.0657
74	0.3654	0.4077	0.0378	0.2169	0.2091	0.1950
75	0.2759	0.2245	0.0798	0.3913	0.0393	-0.2543

Factor Matrix with an X Indicating a Defining Sort

12. Appendix C: Correlations between factor scores

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
Factor 1	1.0000	0.1136	0.3697	0.5018	0.4564	0.4284
Factor 2	0.1136	1.0000	0.1733	0.2595	0.3861	-0.0242
Factor 3	0.3697	0.1733	1.0000	0.3404	0.4016	0.4456
Factor 4	0.5018	0.2595	0.3404	1.0000	0.5473	0.2641
Factor 5	0.4564	0.3861	0.4016	0.5473	1.0000	0.4434
Factor 6	0.4284	-0.0242	0.4456	0.2641	0.4434	1.0000