Low Carbon Societies Network

Social Acceptance in Quantitative Low Carbon Scenarios

Project: ENCI-LowCarb

Engaging Civil Society in Low-carbon Scenarios

Social Acceptance in Quantitative Low Carbon Scenarios

Project: ENCI-LowCarb

Engaging Civil Society in Low-carbon Scenarios

<u>February 2012</u>

This paper was presented at the International Conference: Connecting Civil Society and Science:
« A Key Challenge for Change towards Sustainable Development »,
Stuttgart, Germany, Oct 20-21, 2011

Authors:
Eva Schmid (Potsdam Institute for Climate Impact Research, Germany)[1]
Brigitte Knopf (Potsdam Institute for Climate Impact Research, Germany)
Stéphane La Branche (Grenoble Institute of Political Studies, France)
Meike Fink (Climate Action Network, France)

---

[1] Corresponding Author, E-mail: eva.schmid@pik-potsdam.de, Telephone: +(49) 331-2674, Fax: +(49) 331 299-2570, Mail: P.O. Box 60 12 03, 14412 Potsdam, Germany

7th Framework Programme for Research and Technological Development
The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement N° *213106 . The contents of this report are the sole responsibility of the ENCI-Lowcarb project Consortium and can in no way be taken to reflect the views of the European Union.*

Social Acceptance in Quantitative Low Carbon Scenarios

International Conference: Connecting Civil Society and Science -
A Key Challenge for Change towards Sustainable Development,
Stuttgart, Germany, Oct 20-21, 2011

Eva Schmid (Potsdam Institute for Climate Impact Research, Germany)[1]

Brigitte Knopf (Potsdam Institute for Climate Impact Research, Germany)

Stéphane La Branche (Grenoble Institute of Political Studies, France)

Meike Fink (Climate Action Network, France)

Abstract

Significant mitigation of greenhouse gas emissions in developed countries constitutes one important pillar for addressing the problem of dangerous anthropogenic climate change. Quantitative energy system models are widely employed to calculate scenarios for assessing optimal deployment pathways of sectoral mitigation options. These energy system models are based on engineering and economic methodology, and yield low carbon scenarios that are technically feasible, but not necessarily socially acceptable. One means to integrate sociological dimensions into quantitative low carbon scenarios is to enable researchers and civil society to collaborate during the scenario definition process. Such a process calls for an extension of the quantitative toolbox towards truly interdisciplinary approaches, drawing on methodology from the social sciences. However, the successful execution of such a collaborative process, with project partners from distinct professional culture backgrounds, is potentially subject to impeding cross-cultural miscommunications. This paper proposes a conceptual innovative project design, intended to foster collaboration between civil society and science in the field of introducing social acceptance in mitigation scenarios. It is based on the experience from the EU project ENCI LowCarb[2]. The blueprint project design enables quantitative modelers, social scientists, and non-governmental organization members to jointly develop project-specific interdisciplinary research methods for addressing technological and sociological dimensions at once.

---

[1] Corresponding Author, E-mail: eva.schmid@pik-potsdam.de, Telephone: +(49) 331-2674, Fax: +(49) 331 299-2570, Mail: P.O. Box 60 12 03, 14412 Potsdam, Germany

[2] ENCI LowCarb (Engaging Civil Society in Low Carbon Scenarios, http://www.lowcarbon-societies.eu) is financed by the 7th Framework Programme for Research of the European Commission. The project partners are: RAC-France, Germanwatch, INFORSE-Europe, CIRED, and PIK. For further information please visit the project website: www.lowcarbon-societies.eu.

1) Introduction

Significant reductions of global greenhouse gas emissions play a key role in addressing the problem of dangerous anthropogenic climate change. In order to achieve low-stabilization targets, emissions have to peak before 2020 (UNEP 2010). Yet, greenhouse gas mitigation is a challenge for which no simple and single recipe exists, as exemplified by the abortive developments of international negotiations and limited mitigation success since the ratification of the Kyoto protocol. The dominant source of greenhouse gas emissions, especially CO_2, is the anthropogenic use of fossil resources for energy supply. Consequently, mitigation requires a long-term transformation towards low carbon energy systems. To date, the majority of research efforts on how to achieve this have concentrated on identifying innovative technological solutions and assessing optimal deployment pathways, as well as suitable policies in the different sectors of the energy system. This tendency manifests itself in the predominantly model-based low carbon energy roadmaps published recently, e.g. the "Lead Study" in Germany (Nitsch et al. 2010) or on the European level the EU Roadmap 2050 (European Commission 2011a). Central topics are aggregate assumptions on the developments of energy demand, energy efficiency, investment costs of future technologies, technical potentials, demographic structures, etc., that serve as an input or are an output of the respective quantitative energy system model frameworks. However, sociological dimensions, in particular the social acceptance of implications of the suggested energy futures, are rarely addressed. This is a serious shortcoming, as the transformation of national energy systems represents a profound and long-term change process involving society as a whole. Moreover, a high level of unacceptability could result in group's refusal of climate measures or in avoidance strategies that would then decrease its potential efficiency; the question of "social acceptability" is also one of relative unacceptability and its consequences.

In the context of energy system strategies, social acceptance has three dimensions (Wüstenhagen 2007): (i) socio-political acceptance, referring to the acceptance of technologies and policies by the public, key stakeholders and policy makers, (ii) community acceptance of site-specific local projects and (iii) market acceptance, referring to the process of consumers' and investors' adoption of innovative low-emission products. For addressing these dimensions in the context of energy system transformation scenarios, it is necessary to extend the engineering/economics toolbox of research methods towards truly interdisciplinary approaches by combining them with methodology developed in other strands of social science and the humanities. One implication is to not only rely on quantitative methods, but also on qualitative methods, that are useful when the specific individual perspective of the research subject is focused upon, the research subject has been poorly investigated so far and verbal data is to be interpreted (Bortz & Döring 1995); all of these issues apply in the present context.

One approach to address social acceptance in low carbon scenarios to is to include well-managed and repetitive stakeholder consultations as an integrative part of an energy system model scenario definition process. The parameters and input variables of the aggregated model are carefully translated into tangible, real-life, implications for the public and then evaluated by civil society representatives with respect to their social acceptance. The considerations emerging from these stakeholder consultations are translated back into configurations of technical model parameters, i.e. political framework conditions, and result in different low carbon energy system scenarios. These integrated scenarios are calculated by the quantitative models and the results are again translated into tangible meaning and presented to the civil society stakeholders, emphasizing at least the first of the three dimensions of social acceptance in energy system strategies. Such a collaborative scenario definition process has been undertaken together by non-governmental organizations (NGOs) and research institutes within the EU-project ENCI LowCarb (Engaging Civil Society in Low Carbon Scenarios) for France and Germany. Based on the ENCI LowCarb experience, this paper proposes an innovative project design blueprint, intending to foster repetitive collaboration between civil society and science for introducing dimensions of social acceptance into model-based, low carbon energy system scenarios.

Section 2 presents the existing barriers to interdisciplinary research and collaboration processes between science and civil society in the context of energy system scenarios. Section 3 introduces a conceptual project design blueprint intended to overcome these difficulties. It describes four distinct phases of a collaborative scenario definition process. Section 4 elaborates on the specific experiences from the ENCI LowCarb project and problems encountered during the process. Section 5 reflects on limitations and compares to other scenario projects involving stakeholders. Section 6 concludes.

2) Barriers to Collaboration

In order to derive a project design that encourages collaboration between engineering, economics and other strands of social science as well as civil society, it is worthwhile to step back and analyze why comprehensive collaborative projects between scientific disciplines and civil society are to date rare, especially in the field of energy system scenarios. Three general observations are helpful. First, one has to acknowledge that “science” and “civil society” are umbrella terms for communities that again consist of a large variety of distinct sub-communities. Second, these communities and sub-communities are distinct with respect to their raison d’être, objectives and culture, i.e. values, norms and language. Third, they have a tendency to coexist, in the sense that there are few institutional intersections per se; collaborative projects across communities are often preceded by proactive, innovative, and open-minded individuals.

Civil Society and Non-Governmental Organizations

Civil society is a rather vague umbrella term, Reverter-Bañón (2006) argues that her understanding of civil society is three-fold: as associational life (Putnam, cited in Reverter-Bañón 2006), as good society, and as public sphere (Habermas, cited in Reverter-Bañón 2006). In more concrete terms, the World Bank (2004) defines the notion as follows: “The term civil society refers to the wide array of non-governmental and not-for-profit organizations that have a presence in public life, expressing the interests and values of their members or others, based on ethical, cultural, political, scientific, religious or philanthropic considerations. Civil society organizations (CSOs) therefore refer to a wide array of organizations: community groups, non-governmental organizations (NGOs), labor unions, indigenous groups, charitable organizations, faith-based organizations, professional associations, and foundations”. CSOs are formed as people with similar interests organize themselves and represent a certain set of claims, beliefs, norms and values. Often, the term CSO and NGO are conflated. Willets (2002) defines the term NGO as an independent voluntary association of people acting together on a continuous basis and for some common purpose. In this paper, CSO is used as the umbrella term and NGOs are considered as a subset of CSOs.

Many CSOs intend to change the status quo of a certain affair; environmental NGOs lobby for reducing pollution, churches preach humanitarian values and citizens’ initiatives fight for local projects. Often, CSO activists operate at the grass-roots level and are ideal-driven. In terms of climate change mitigation, environmental NGOs have played a visible role with projects focused on greenhouse gas emission reduction involving lobbying, campaigning or protesting against specific local affairs. With the intention to scientifically back up their lobbying work, NGOs have increasingly been seeking contact to the scientific communities. Moreover, many environmental NGOs have shifted from constituting an activist movement towards more mature organizations employing scientists that did not want to continue a purely academic career. NGOs have published comprehensive scientific studies to underpin their claims and objectives with research results, e.g. WWF (2008; 2009) and Greenpeace (2007). However, these studies were largely commissioned to research institutions and prepared in principal-agent relationships more than in structured collaboration processes. In sum, it appears natural to foster collaboration between NGOs, rooted in the civil society community, and scientists as a *starting point* for incorporating social acceptance into energy system scenarios. In later steps, CSO representatives are included in the collaboration process.

Scientific Cultures and Mitigation

In terms of public attention and academic outreach visibility, the mitigation problem has mainly spurred natural scientists and engineers to develop and assess low-emission technologies, system scientists to perform integrated analyses of optimal deployment paths, and economists to analyze energy market forces and suitable policies. Politically prominent theoretical research results on long-term mitigation strategies have been obtained by engineering or economic methods: mathematical modeling, optimization, game theory, statistics and econometrics, i.e. quantitative methods. Maybe this is due to the seductive charm of hard numbers and associated “scientific facts”. Yet, a recent publication of the German Academies of Sciences strongly encourages collaborations between engineers, natural and cultural scientists, as they consider this a prerequisite for achieving ambitious climate policy targets in Germany (Renn 2011). Within the social science literature, the refusal, acceptance, or avoidance strategies of actors regarding mitigation measures is less investigated. There are efforts to understand the public and local acceptance of renewable energies by means of specific case studies, e.g. Zoellner, Schweizer-Ries and Wemheuer (2008), Musall and Kuik (2011) and Nadaï (2007), involving qualitative interviews and questionnaire-based survey analysis. However, there are to date no visible efforts to combining these findings with purely quantitative energy/economics models. One possible explanation is the coexistence of the different scientific sub-communities.

Even within different scientific disciplines, there are many coexisting and often conflicting strands of research. Many of the conflicts root from methodological issues. Albeit scholars of both the quantitative and the qualitative tradition share the overarching goal of producing valid descriptive and causal inferences (Brady & Collier, cited in Mahoney & Goertz 2006), there are substantial discrepancies in basic assumptions and practices. Schrodt (cited in Mahoney & Goertz

2006) observes that the dynamics of the debate between quantitative and qualitative scholars on the validity of their methods are best understood by comparing it to one about religion, with deep cleavages between the two. Mahoney and Goertz (2006) provide an excellent discussion on how the two research traditions are to be understood as alternative cultures with proprietary values, beliefs, norms and language that may lead to severe "cross-cultural" communication problems when "forced" to work with each other. Thinking of different research traditions in terms of ethnocentric, coexisting and potentially conflicting cultures helps for explaining and mastering the challenges of collaborative research projects. One can draw on the large body of literature on culture in other academic disciplines, e.g. organizational behavior and cultural studies. Clearly, parallels exist between methodological, organizational and ethnological culture. Considering the effective cultural barriers to collaboration even within science, it is not surprising that the barriers towards collaboration between science and NGOs or CSOs are even higher.

3) The Collaborative Scenario Definition Process

The collaborative scenario definition process proposed in the following[3] is an interdisciplinary approach that aims at producing quantitative engineering/economics model scenarios with underlying political framework conditions defined by civil society stakeholders. It is organized in four distinct phases. Phase 1 is concerned with establishing a fully functional project team and Phase 2 with establishing the technological framework conditions for the scenarios. The political framework conditions are elaborated with civil society stakeholders during Phase 3, resulting in scenarios that differ with respect to their degree of social acceptance. Phase 4 synthesizes.

Core Project Partners

It is advantageous to include at least one core project partner from each the scientific and the civil society communities. From the latter, NGOs constitute good candidates, as they form a continuously working formal entity, which cannot necessarily be generalized to all CSOs. Additionally, one can expect that NGOs are well embedded within the CSO landscape and constitute a facilitator between scientists and other CSOs. From the scientific communities, it is on the one hand necessary to have project partners from one or more research institutions that operate a engineering/economic type of quantitative model (here an energy system model),

[3] It is based on the experience from ENCI LowCarb, but presented on a meta level. It is applicable to projects involving the definition of scenarios with both technological and political framework conditions.

termed quantitative modelers, hereafter. On the other hand it is necessary to have project partners from the social sciences or humanities that are proficient in both quantitative and qualitative research methods of their discipline, termed social scientists hereafter[4]. Due to the distinct professional cultures of the project partners, it is decisive to stimulate their awareness for cultural issues in general and cultural differences in particular. A trivial, but effective means to achieve this is to define a core project team with each a research institution and NGO from at least two countries that do not share the same language. There are several practical advantages of combining the three different *professional cultures* with two or more different *national cultures*. Project partners communicate in a non-mother language, which fosters the awareness for unfamiliar terms and alleviates barriers to clarification requests during conversations. Furthermore, as the problem of climate change mitigation presents itself and is addressed very differently in individual countries, the trans-national perspective helps to reframe and to challenge the purely domestic perspective.

Phase 1: Intra-Group Development

Albeit the intra-group development of project teams is a fairly standard procedure, a conscious group-formation process is of particular importance for collaboration across project partners from different communities. A suitable organizational structure is proposed in Figure 1. It resembles a matrix structure and enables vigorous communication flows between all project partners; the color codes visualize the different communities and countries. Tuckman (1965) observed that groups generally develop by passing through four distinct stages: forming, storming, norming and performing. Given project partners from different communities with their respective cultural backgrounds, the first three stages need special attention for being successful in the fourth.

The forming stage of group development is characterized by uncertainty: project partners from the different communities are "testing the waters" and get acquainted to each other by exchanging ideas, expectations and world views. One gathers information and impressions of each other, but avoids open controversies or conflicts (Tuckman 1965). It is very likely that during this stage, many of the others' positions are not immediately obvious and even beyond clear assessment to the individual project partner. During the storming phase of group development, which is

[4] In the following, it is assumed that both modelers and social scientists are from one research institution and the representative terms research institution, quantitative modeler, social scientist and NGO will be used in singular for simplicity; more then one project partner may be included from each community.

characterized by intra-group conflict and requires tolerance and patience, project partners express opinions and views more openly, including criticism (Tuckman 1965). One can expect that substantial cultural distance (Triandis 1994) exists between each the social scientist, the quantitative modeler and the NGO member. To overcome these, and enable the group to develop novel interdisciplinary approaches with regard to the specific research question of the project, conscious intercultural communication is advantageous. McDaniel, Samovar and Porter (2009, p. 13) argue that five aspects of culture are especially relevant to intercultural communication: perception, cognitive thinking patterns, verbal behaviors, nonverbal behaviors and the influence of context.

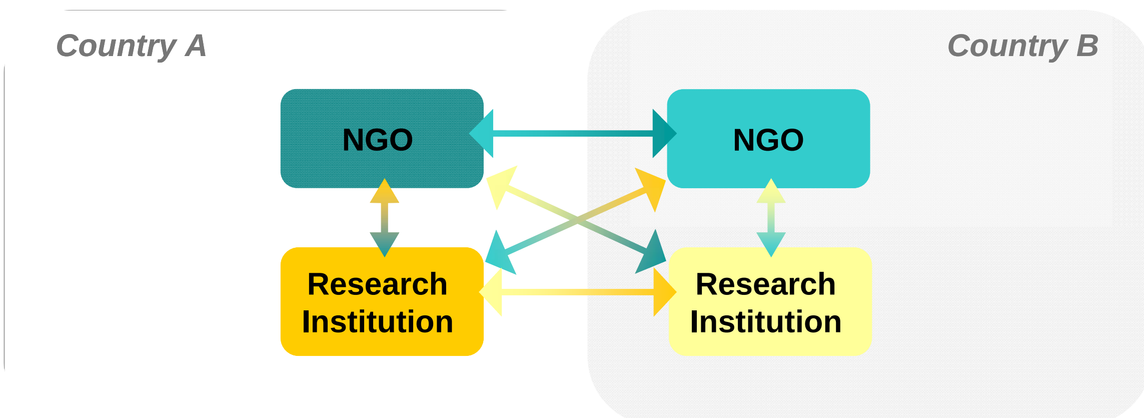

Figure 1. Organizational structure during Phase 1 of the collaborative scenario definition process.

A promising format to foster viable cross-cultural communication is to employ formal "wish-lists". The quantitative modeler receives model features that the others would like to see in the model and what kind of results they expect. The social scientist receives ideas on how social acceptance is defined and will be explored, interpreted and measured. The NGO member receives considerations on what kind of stakeholders to consult. Thereby, each project partner gets a good understanding on how the others *perceive* his/her discipline. Each project then presents what he/she originally planned to contribute in the project and relates this to the "wish-list" items. Such an exercise will reveal the *cognitive thinking patterns* of the project partners. After each presentation, some time is reserved for clarifying terms that were unclear or non-familiar to the audience. Here, project partners have a chance to realize potential *verbal* and *nonverbal* barriers to communication. Finally, in thematic sessions, the history and status quo of the domestic energy system can be presented, so one learns facts and *context* of the other country's challenges. During the "wish-list" process, the project partners have a chance to develop a common language and gain realistic expectations of the abilities of the quantitative model, the concept of social acceptance and the stakeholder landscape. In repetitive exchange, project partners develop a joint idea of the research methods they will employ. Finally, they pass the norming stage of group development, characterized by cohesiveness and in-group feeling, on to the performing stage, during which group energy is channeled into the task (Tuckman 1965).

Phase 2: Technological Framework Conditions

Phase 2 of the scenario definition process is concerned with model development and the technological framework conditions of the scenarios by involving external experts. The task is to refine the national quantitative models and bring them to a stage, in which they are applicable to stakeholder consultations, fulfilling as many "wish-list" items as feasible, driven by the overarching question of "What is technically possible in the future?". Thus, the social science issues regarding social acceptability do not yet enter the stage, they will be integrated in the next phase. Figure 2 proposes an organizational structure during Phase 2; with the core structure prevailing, but now the national sub-teams, indicated in green, have formed a tighter entity. This ideally results from the intense communication flows during Phase 1. The yellow shading of the consulted experts symbolizes the notion that they will most likely be closer to the researchers in terms of "professional culture" than to NGO members.

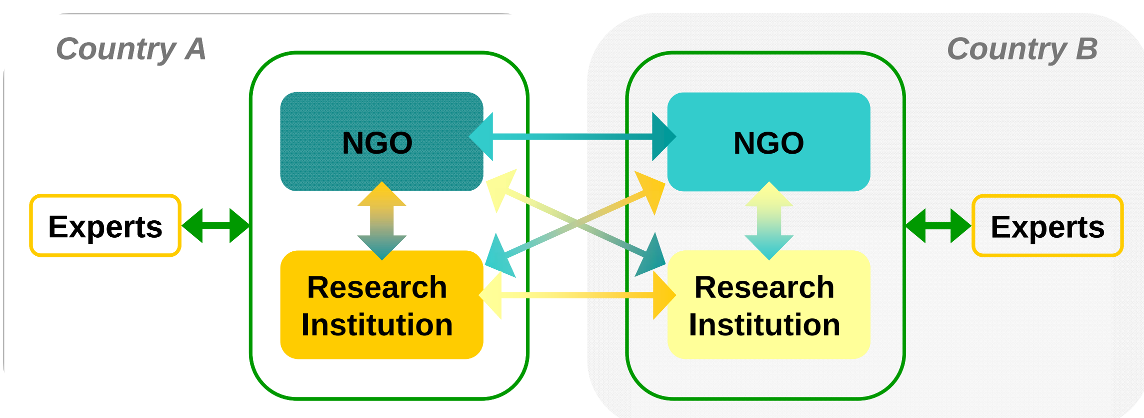

Figure 2. Organizational structure during Phase 2 of the collaborative scenario definition process.

Expert workshops are organized in each country, for giving the national sub-teams a chance to engage in focus group discussions with experts for obtaining state-of the art knowledge on technical details. Thereby, the experts can assess the validity of the quantitative model and have a control function on the scientific quality. In the end of Phase 2, a finalized version of the energy system model exists, along with a detailed documentation that is also understandable to the non-technical reader. It is necessary to provide such a document during the stakeholder consultations in order to create transparency and alleviate the frequent black-box accusation when it comes to quantitative scenario building. Central to the model description are detailed translation rules, from "model parameters" to "real-world implications" and vice versa, that serve as a basis for taking into account political framework conditions explicitly.

Phase 3: Political Framework Conditions and Corresponding Scenarios

A central issue in Phase 3 of the collaborative scenario definition process is to elaborate different and potentially controversial political framework conditions with relevant CSO stakeholders. The political framework conditions relate to the quantitative model by applying the aforementioned translation rules from model parameters to "real-world implications". Coherent sets of political framework conditions form one scenario, differing with respect to the articulated level of social (un-)acceptability of mitigation options. The integrated scenarios are again evaluated by the CSO stakeholders. Figure 3 proposes an organizational structure for Phase 3. The blue shading of the CSO Stakeholders indicate that they are culturally close to the NGO project members, these indeed serve as facilitators in a two-step interaction in workshop format.

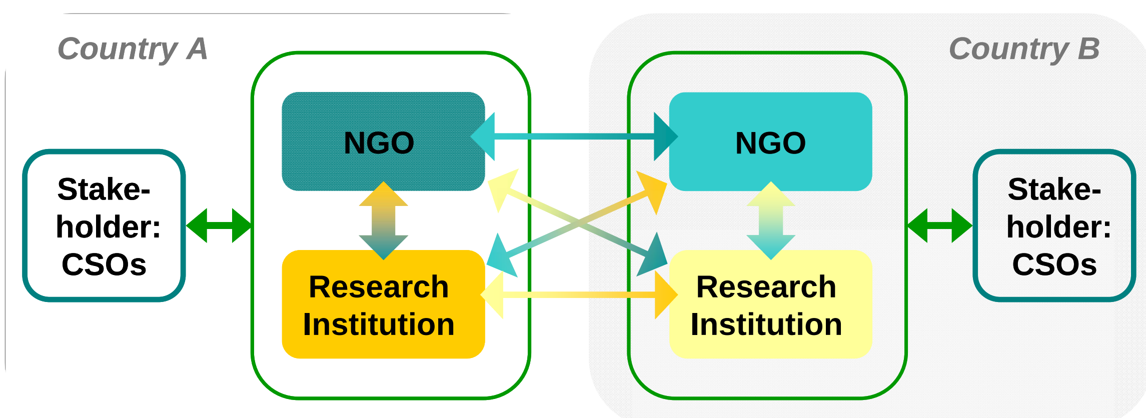

Figure 3. Organizational structure during Phase 3 of the collaborative scenario definition process.

Before inviting CSO stakeholders, the sub-national project teams identify sectors of the domestic energy system that are of particular interest or controversy regarding social acceptance. Together with a professional and neutral moderator, the national sub-teams develop concrete workshop agendas. The social scientist selects suitable methods for capturing stakeholder's assessments during the workshops. A practical format is a questionnaire with Likert scales (Likert 1932), measuring the level of agreement or disagreement of the respondent towards specific statements. The specific statements are the translated "real-world implications" and postulate particular and tangible developments[5]. Per item, two Likert scales are employed: Stakeholders are once asked to indicate whether they find the proposed development *realistic* and once whether they would *welcome* it from the point of view of their organization. Stakeholders are unlikely to express a uniform opinion, so several different sectoral "scenario building-bricks" in terms of political framework conditions will emerge from the workshops. The national sub-teams combine them into coherent scenarios for the fully integrated energy system, which serve as an input to the quantitative model. During the second sectoral stakeholder workshops, ideally attended by the same CSO representatives, the developed scenarios are presented, discussed, and evaluated. The feedback loop ensures that the social acceptance considerations are actually realized and gives the CSO representatives a chance to indicate their assessment of social (un-)acceptance of the integrated scenarios.

Phase 4: Synthesis

The last Phase is concerned with the synthesis of results obtained throughout the collaborative process. Ideally, the project ends with a workshop for communicating the scenarios to policy makers, stakeholders, and the wider public. Possibly valuable extensions for the collaborative process are to evaluate the political feasibility of the scenarios' political framework conditions and to elaborate the reasons for social (un-)acceptance of specific mitigation options in more detail. Here, one could extend the socio-political point of view adopted during the collaborative scenario definition process, and analyze market and community acceptance.

4) The ENCI LowCarb Experience

The ENCI LowCarb project is financed in the 7th Framework of the EU Commission and constitutes a rather novel format involving both research institutes and NGOs. The core project partners are the Potsdam Institute for Climate Impact Research (PIK), Germanwatch, the Centre International de Recherche sur l'Environnement et le Développement (CIRED), and Reseau Action Climat France; the project phases, identified ex post, are summarized in Table 1.

[5] An example from the transport sector workshop of the ENCI LowCarb project is "Cycling and Walking will contribute substantially to the Modal Split. Please indicate your perception whether this is *realistic* and, separately, *welcome*, from the point of view of your organization on a 7-point scale from Yes to No.".

Table 1. Overview of the phases in the collaborative scenario definition process within the ENCI LowCarb project.

	Phase 1	Phase 2	Phase 3	Phase 4
Objective	Intra-group development of the project team	Model building "What is technologically possible?"	Stakeholder workshops "What is socially desired?"	Synthesis, communication of scenarios
Leadership	Fragmented	Research Institution for sub-team in each country	NGO for sub-team in each country	Joint responsibility
Events	Kick-off meeting, Planning workshop	Expert workshops, Planning workshop	Repetitive CSO stakeholder workshops	Synthesis workshop, Communication Workshop
Deliverables / Output	"Wish-Lists" and feedback	Workshop summaries, model with description	Workshop summaries, national scenarios	Country reports, Comparative report
Time Horizon	6 months	12 months	12 months	6 months

ENCI LowCarb had two main project objectives: developing a reproducible methodology for engaging civil society, and preparing the German and French integrated energy system scenarios. The following reports on specific experiences made during the project on a more abstract level, with the intention to deliver beneficial input for future projects that involve a collaboration between science and civil society, additive to the blueprint outline in Section 3. The German and French domestic energy system scenarios are accessible on the project website[6] upon publication.

Attitudes and Politics

In the beginning of the project, the different professional cultures and different intrinsic objectives of NGO members and scientists became tangible. NGOs are generally interested in developing scientific (counter-) expertise that can be used for proper lobbying activities. Especially, if the NGO is a network composed by several NGOs (like RAC-France), with individual future energy visions, there can be a strong internal pressure for obtaining politically relevant outcomes. Scientists have an interest in producing coherent, technically sound and objective research and tend to care less about the politics. These potentially conflicting attitudes

[6] http://www.lowcarbon-societies.eu

were made explicit early in the project. In later stages, many conflicts could be avoided due to project partners pointing out that the argument or problem at hand actually had to do with our different attitudes and perceptions, resulting in more productive discussions. Raising awareness for such issues proved to be crucial, especially during the definition of the integrated scenarios, as these were based on the stakeholders' assessments of *political* framework conditions.

Joint Understanding of Quantitative Models

Large and complex quantitative models are a very powerful tool for pursuing integrated system analyses, however, the models and their output are often meaningful only to the expert or insider. Outsiders are not enabled to judge the quality and validity of model results, and either have to believe the modelers, or not. During the ENCI LowCarb project, it was very important for the NGO members to learn more about quantitative models in general, and the models of the project partners in particular, so that modeling results can be put into perspective. It was a rather time-intensive process for the quantitative modelers to explain the models and was perceived as a real cross-cultural communication effort. During this process, it was very enlightening for the modelers to learn about the requirements from an NGO perspective, which sometimes differs substantially from academic peer group discussions.

For the NGOs, it was important to distinguish between means and measures in the energy system models: technical solutions, e.g. offshore wind turbines, and political measures to foster them, e.g. feed-in-tariffs. Whereas energy system models contain a whole range of technical solutions, it is not possible to integrate the full impact of political measures. NGOs are interested in a mixture of both, so it is helpful to differentiate and focus on what is feasible in the model during the project. The joint effort of clarifying the capabilities of the energy system models turned out to be a crucial success factor for the ENCI LowCarb project. The "wish-lists" introduced earlier were invented during the explanation process and turned out to be an extremely useful tool. The modeling teams were forced to think about the "real-world implications" of the aggregate model results and develop concrete translation rules on how parameters and variables may be expressed in tangible meaning. During the preparation and post processing of the stakeholder workshops these translation rules served as a helpful structuring element for the quantitative modelers.

From the perspective of the quantitative modelers, the expert meetings in Phase 2 were very helpful and stimulating. The modeling teams learned a lot and sometimes revised the models according to the experts' opinions. Expert meetings are much more interactive than research conferences, where models are compared with other models, but not scrutinized in detail. For the NGOs, it was important to point out the sometimes double faced nature of experts, who are in fact also stakeholders, e.g. technical subjects like the necessary length of new transmission lines are a politically critical subject and even experts are not able to exclude this dimension from their opinions. For the NGOs, it was destabilizing sometimes that the modelers continuously improved their models, until the final scenarios were calculated. From the point of view of the researcher, this was natural to do, but it resulted in a situation in which the NGOs and became rather impatient as they wanted to see the model finished and ready to use. This should be anticipated and accompanied by setting and enforcing deadlines, sounding trivial, but proved to be a major source of conflict and dissatisfaction within the project team.

Stakeholder Workshops and Scenario Definition

The stakeholder workshops were the focal point toward which all efforts in the ENCI LowCarb projects were directed to. However, it was absolutely necessary to go hrough the first two phases of intra-group and model development for reaching a stage in which the project team was enabled to understand the stakeholders' requirements and translate them into coherent quantitative model scenarios. The preparation of the first stakeholder workshop was very demanding, as the agenda set here would determine the success of the collaborative procedure. The translation rules, from "the model" to "the real-world" and vice versa, had to be thematically summarized to determine those energy sectors (e.g. transport, electricity, heat) for which a feedback process was technically possible. It would not have been adequate to promise the stakeholders implications of low carbon scenarios that in the end cannot be represented in the quantitative model. For developing the agendas of the first sectoral CSO stakeholder workshops, the project team had to strike a balance between anticipating the areas in which social acceptance is problematic, and being prescriptive in the selection of topics. Furthermore, it was challenging to decide on how the stakeholder assessments would be collected, formalized, and grouped for constructing the integrated scenarios.

The stakeholder workshops on different energy sectors (transport and electricity) were attended by 12 CSO representatives each, and were stimulating and successful events. The instructions on the "scenario building bricks" in terms of political framework conditions were very valuable to the modelers. The workshops helped the project partners to understand which political scenario assumptions are socially more or less accepted, and specifically *why*. Due to the sector specific stakeholder workshops, particular attention had to be paid to assure inter-sectoral coherence without neglecting the statements of the stakeholders for defining the final scenarios. A basic problem is that regarding energy system futures, there are many problematic technologies or developments in terms of social acceptance. However, it is not possible to define one scenario for each issue. This implies that the different options have to be combined into “worlds” that are structurally different, but still coherently reflect the stakeholder’s assessments. Without the lengthy preparation of the translation rules from model to reality the project would have failed at this point. The synthesis phase can under certain circumstances be disappointing for the NGO partners. The final outcomes can be opposing to the principles of the NGO, which then hinders their communication on project results or even challenges the overall NGO strategy.

5) Limitations and Comparison

Limitations to the presented conceptual approach relate mainly to the reduction of complexity during the collaborative scenario definition process. One practical limit of the project’s intention to develop socially acceptable scenarios is the necessity to find a compromise concerning the representation of stakeholder opinions. The national sub-teams select and invite stakeholders, thereby consciously limiting the wide range of opinions to a manageable number. It is an important task for the social scientist to ensure the representativeness of stakeholders. Furthermore, stakeholders that are invited to express their assessment and opinions during the workshop are situated in an artificial situation with rules established by the project partners, which may bias the discussion.

The focus of the ENCI LowCarb project was on socio-political acceptance; a representation of market and community acceptance were beyond the scope. One could, however, extend this in future projects and include more case-studies or field research for the social scientists to investigate and elaborate on these issues. It would also be interesting to include more than one model of each country, to overcome the risk of model bias. Another aspiration could be to include also industry and policy makers in the collaborative procedure, or, in an supplementary phase, one that would try to take into account the political feasibility of the measures generated by the previous process. Generally speaking, one should be careful about including too many core project partners, as this may be detrimental to Phase 1 of the process.

For putting these limitations into context, it is helpful to consider the methods and setup of other scenario processes that involved civil society and/or stakeholder assessments and how they compare to ENCI LowCarb. However, there is to our knowledge no comparable project that was as transparent about the civil society stakeholders' roles. For example, Friends of the Earth Europe (FOEE) and the Stockholm Environment Institute (SEI) formally describe themselves as partners in a project aiming at developing an ambitious European mitigation scenario. The roles between FOEE and the SEI, however, were close to a traditional client agent relationship. FOEE fixed in advance technical assumptions on the availability of certain technologies in line with their internal strategy and SEI delivered the technical modeling knowledge. Nevertheless, several national FOEE associations were included in the initiative and a continuous exchange was established. It is interesting that the project partners decided to publish one publication each, supporting different communication strategies: FOEE (2009) and Heaps et al. (2009).

Another example is the European Climate Foundation (ECF) "Roadmap 2050" (ECF 2010), that outlines technically feasible pathways to achieve an 80% emission reduction target in 2050. Representatives of the EU institutions have been consulted periodically throughout the course of the project and a wide range of stakeholders (companies, consultancy firms, research centers and NGOs) have counseled ECF in the preparation of this report. Their names are mentioned, but not the method of how opinions were weighted, neither the rhythm of meetings. The hierarchy varied between project partners (a group of consultancies and research centers), core working group participants (European utilities, transmission system operators, clean tech manufacturers and CSOs) and further outreach (40 more companies, NGOs and research institutes). ECF tried to follow the recommendations in the scenarios, but claims to be solely responsible for the choices.

Then, the "Roadmap 2050" for a low carbon economy published in March 2011 by the European Commission (EC) (European Commission 2011a) comes with an impact assessment (European Commission 2011b) of three DGs, evaluating a set of possible future decarbonization scenarios. The EC consulted individuals and stakeholders on their vision and opinion regarding an EU low carbon economy by 2050 through an online questionnaire "Roadmap for a low carbon economy by 2050"; 281 responses have been submitted. In its impact assessment, the EC declares that the wide range of views on how the EU can decarbonize its economy have been taken into account. However, the robustness of such an online questionnaire may be questioned. The core difference between these scenario processes and the ENCI LowCarb project is that here, domestic mitigation scenarios are one outcome, embedded in a project foster cooperation between science and CSOs.

6) Conclusion

Quantitative low carbon scenarios, developed in response to the problem of climate change, clearly benefit from an introduction of sociological dimensions, in particular social acceptance. Addressing the social acceptance of mitigation options can by definition not be a one-way process from science to the public. In this paper, we propose a project design intending to foster collaboration between science and civil society for that purpose. One distinct feature is a conscious emphasis on intra-group development, accounting for the issue that collaboration partners come from significantly different and potentially conflicting professional cultures; a situation that may give rise to severe communication barriers. NGOs and researchers can learn substantially of each other and create a mutual understanding of appropriate methods and perspectives. This enables the development of interdisciplinary research methodologies, intertwining both qualitative and quantitative tools of the different scientific disciplines.

In order to structure a collaborative scenario definition process, it is helpful to differentiate between technological and political framework conditions that serve as an input to the quantitative models. Experts are invited to define the technological framework conditions. The configurations of political framework decisions are guided and evaluated by relevant CSO stakeholders. A necessary prerequisite is that aggregate model input and output data are translated into tangible meaning. However, the methodology and organization of such a process is to date not well studied and should be developed formally for empowering more collaborative scenario definition processes in the future. In the end, this process can lead to the conceptualization of innovative low carbon scenarios that take into account social dimensions, in particular the social (un-)acceptance of mitigation options.

Meaningful energy system scenarios and policy roadmaps can only be developed if such organizational setups become more mainstream. Civil society has to be involved in solutions of climate change mitigation; purely academic solutions will not be successful. Climate change is not an isolated environmental problem like the ozone-hole, where there is one clear cause and one clear solution, but it is a problem whose solution will affect the entire economy and therefore the whole global society.

Acknowledgements

This research was funded by the project ENCI LowCarb (213106) within the 7th Framework Programme for Research of the European Commission. We thank the tree anonymous reviewers from the International Conference "Connecting Civil Society and Science - A Key Challenge for Change towards Sustainable Development" in Stuttgart, Germany on 20/21 October 2011 for valuable suggestions and Jan Burck, Sandrine Mathy, Oliver Tietjen and Michael Pahle for challenging remarks and fruitful discussions.

References

CAT, Centre for Alternative Technologies 2010, *‘ZERO CARBON BRITAIN 2030 A new energy strategy’*, Available from: http://www.zerocarbonbritain.com/zcb-home/downloads [4 April 2011]

ECF, European Climate Foundation 2010, *‘Roadmap 2050 A practical guide to a prosporous, low carbon Europe’*, Study commissioned by the European Climate Foundation (ECF), Contractors: McKinsey & Company, KEMA, Energy Futures Lab at Imperial College London, Oxford Economics, E3G, Energy Research Centre of the Netherlands, Regulatory Assistance Project and the Office for Metropolitan Architecture, Available from: http://www.roadmap2050.eu/ [14 July 2011]

European Commission 2011a,*’A Roadmap for moving to a competitive low carbon economy in 2050’*, Communication of the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Available from: http://ec.europa.eu/clima/documentation/roadmap/docs/com_2011_112_en.pdf [8 August 2011]

European Commission 2011b, *‘Impact Assessment’*, Accompanying document to European Commission 2011a, Available from: http://ec.europa.eu/clima/documentation/roadmap/docs/sec_2011_288_en.pdf [8 August 2011]

FOEE, Friends of the Earth Europe 2009, *‘The 40% Study. Mobilizing Europe to achieve Climate Justice’*, Available from: http://www.climateshareeurope.org/Studysummary.pdf [8 August 2011]

Greenpeace 2007,*’Klimaschutz: Plan B Nationales Energiekonzept bis 2020’*, Study commissioned by Greenpeace Germany, Contractor: EUtech Energie und Management, Authors: Barzantny, K, Achner, S, Böhling, A, Schuring, S, Available from http://www.greenpeace.de/fileadmin/gpd/user_upload/themen/klima/Klimaschutz_PlanB.pdf [8 August 2011]

Heaps, C, Erickson, S, Kartha, S & Kemp-Benedict, E 2009, *‘Europe’s Share of the Climate Challenge. Domestic Actions and International Obligations to Protect the Planet’*, Stockholm Environment Institute, Available from: http://www.climateshareeurope.org/EU27%20LowRes.pdf [8 August 2011]

Likert, R 1932, ‘A Technique for the Measurement of Attitudes’, *Archives of Psychology*, vol. 140, pp. 1–55.

Mahoney, J & Goertz, G 2006, ‘A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research’, *Political Analysis*, vol. 14, no.3; pp. 227–249.

McDaniel, ER, Samovar, LA & Porter,RE 2009, ‘Using Intercultural Communication: The Building Blocks’ in *Intercultural Communication, A Reader*, (eds.) Samovar, LA, Porter,RE & McDaniel, ER, Wadsworth, Boston.

Musall, FD & Kuik, O 2011, ‘Local acceptance of renewable energy – A case study from southeast Germany’, *Energy Policy*, vol. 39, no. 6, pp. 3252-3260.

Nadaï, N 2007, '"Planning", "siting" and the local acceptance of wind power: Some lessons from the French case ', *Energy Policy*, vol. 35, no. 5, pp. 2715-2726.

Nitsch, J, Pregger, T, Scholz, Y, Naegler, T, Sterner, M, Gerhardt, N, von Oehsen, A, Pape, C, Saint-Drenan, Y-M & Wenzel, B 2010, *'Langfristszenarien und Strategien für den Ausbau der erneuerbaren Energien in Deutschland bei Berücksichtigung der Entwicklung in Europa und global „Leitstudie 2010"'*, Federal Ministry for the Environment, Nature Conservation and Reactor Safety, German Government, Avilable from: http://www.bmu.de/files/pdfs/allgemein/application/pdf/leitstudie2010_bf.pdf [5 March 2011]

Renn, O (ed.) 2011, '*Die Bedeutung der Gesellschafts- und Kulturwissenschaften für eine integrierte und systemisch ausgerichtete Energieforschung'*, Available from: http://www.pik-potsdam.de/members/edenh/publications-1/Rennetal.2011DieBedeutung derGesellschaftsundKulturwissenschaftenfreineintegrierteundsystemischausgerichteteEnergieforschung.pdf [1 August 2011]

Triandis, HC 1994, *Culture and social behavior*, McGraw-Hill, New York.

Tuckman, B 1965, 'Developmental sequence in small groups', *Psychological Bulletin*, vol. 63, no. 6, p. 384–99. doi:10.1037/h0022100

UNEP, United Nation Environment Environment Program 2010, '*The Emissions Gap Report. Are the Copenhagen Plegdes Sufficient to Limit Global Warming to 2°C or 1.5°C? A Preliminary Assessmen'*, Available from: ttp://www.unep.org/publications/ebooks/emissionsgapreport/pdfs/EMISSIONS_GAP_TECHNICAL_SUMMARY.pdf [8 August 2011]

Wüstenhagen R, Wolsink & M, Bürer, MJ 2007, 'Social acceptance of renewable energy innovation: An introduction to the concept', *Energy Policy*, vol. 35, no. 5, pp. 2683-2691.

Willets, P 2002, '*What is a Non-Governmental Organization? Article 1.44.3.7: Non-Governmental Organizations'*, UNESCO Encyclopedia of Life Support Systems, Available from: http://www.staff.city.ac.uk/p.willetts/CS-NTWKS/NGO-ART.HTM#Part11 [1 August 2011]

World Bank 2004, *'Defining Civil Society'*, Available from: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/CSO/0,,contentMDK:20101499~menuPK:244752~pagePK:220503~piPK:220476~theSitePK:228717,00.html [1 August 2011]

World Wildlife Fund (WWF) 2008, *'-30% de CO2 = +684000 emplois L'équation gagnante pour la France'*, Study comissioned by WWF France, Contractor: CIRED/CNRS, Authors : Philippe, Q & Demailly, D, Available from http://www.wwf.fr/pdf/Rapport_WWF_REDUCTION_GES.pdf [8 August 2011]

World Wildlife Fund (WWF) 2009, *'Modell Deutschland Klimaschutz bis 2050: Vom Ziel her denken'*, Study comissioned by WWF Germany, Contractors: PrognosAG & Öko-Institut, Authors : Kirchner, A , Matthes, F C & Ziesing, H-J, Available from : http://www.wwf.de/fileadmin/fm-wwf/pdf_neu/WWF_Modell_Dutschland_Endbericht.pdf [8 August 2011]

Zoellner, J, Schweizer-Ries, P & Wemheuer, C 2008, 'Public acceptance of renewable energies: results from case studies in Germany', *Energy Policy*, vol. 36, no. 11, pp. 4136–4141.

Project Partners

CIRED GERMANWATCH INFORSE-EUROPE International Network for Sustainable Energy PIK réseau action climat france

www.enci-lowcarb.eu