Empirical Study of the Formation Processes of Energy Scenarios

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Abstract

Energy scenarios are an important element in the discussion about the future of energy supply. In describing possible future developments and their dependence on specific constraints they make a contribution to decision-making processes in the field of energy policies. The demand for objective assessment in this field is an expectation which energy scenarios have to satisfy. However, due to several reasons it is unclear to which extent energy scenarios can meet these expectations, especially because they generally depend on assumptions that are based on scientific knowledge as well as on energy-political arguments. Another difficulty in terms of objectiveness results from the fact that these studies are typically conducted on behalf of political institutions. Therefore not only the author, but also the client has a designing impact on the scenario.

The paper at hand presents a research project which approaches the problem of objectiveness of energy scenarios mainly in an empirical manner. It focuses on the formation processes of scenarios and thereby spotlights on the actors involved. The underlying assumption is that for an analysis of energy scenarios in terms of objectiveness profound knowledge of the formation conditions and their influence on the results is crucial. As major parts of this process, the direct designing impact of the author in modelling the energy system and the indirect impact of the client is examined.

The analysis will take place from two different perspectives: To achieve a profound comprehension of the underlying model und to identify the actual "formation spaces" of the actors, the process is at first investigated from the perspective of a noninvolved observer. Secondly, the involved actors are questioned about their perception of the whole process. Finally, a comparison of both perspectives will allow for conclusions about the implicitly and explicitly performed design contributions of the actors involved.

Introduction

The form of the future energy system is debated in the area of conflict of what is conceived as socially desired, economically demanded and technically possible. The basis for this discussion is the present energy system which is, depending on the context, understood as a technical system, a determinant of the national economy or as a source of threats to the environment and climate. From this present energy system the future system, more precisely: images of how the system will, can or should look like are "derived". Thus the derivation is both based on knowledge about the present system and on desires, expectations, fears or generally on subjective or normative images about the future system. Furthermore, a profound discussion on the energy system requires highly specialized technical and economical knowledge, which the participants of the public discussion as well as the political and economical decision-makers in general do not possess.

Need in Energy-political Advice

To satisfy the resulting need in advice, scientific institutes are consulted by political institutions and, besides the verbal forms of consultation, are typically commissioned to provide a scientific study. In this the consultant, in the following synonymously called author, is expected to possess the necessary knowledge of the present energy system to enable the decision-maker to participate in a profound discussion. However, by performing the derivation explained before, he is also the one who makes statements about the future system, thus processing subjective or normative images about the future. The source of these images is hard to identify, but generally both the client and the consultant must be considered. If it is assumed that the consultant is also expected to be scientifically independent or objective, a conflict can accrue from this situation. Indicators for this conflict can be found in different places. For example the Study Commission of the German Bundestag *Sustainable Energy Supplies in View of Globalization and Liberalization* [1] gives reason for the competing commission of two institutes by the following statement: "To achieve the most sturdy results the Commission referred to two institutes in the awarding of contracts (…) that use different simulation methods and have positioned themselves differently in the energy-political discussion." (Deutscher Bundestag, Referat Öffentlichkeitsarbeit (Ed.) 2002. p. 645; Translation by author)

Future Knowledge as an Epistemological Problem

As mentioned before, a typical result of a consultation is the provision of a scientific report. In general this study is published and becomes a source of reference for other studies, thus as a scientific work, it claims a validity that exceeds the concrete situation of advice. This extension suggests that also the question of objectiveness should be tackled from an extended perspective.

If the claim of those studies is generalised in the way that they make statements about the present or future world at all, it must be asked to what significance such a study can come. The epistemological problem of recognizing a complex system in the (perceived) world is intensified by the fact that these studies explicitly make statements about the future. If statements concerning the future can only be made based on subjective or normative assumptions, as outlined before, the question about the objectiveness of

[1] In the following abbreviated as "Study Commission *Sustainable Energy Supplies*".

the consultation process can be exceeded to the epistemological question of objectiveness of assumptions about the future in general.

Herein the conceptual investigation of "objectiveness/ subjectiveness" in the context of future knowledge is central and is a major topic of the later presented research group and the embedded graduate project.

Scenarios

Today the scenario technique is a standard approach for energy-political consultations. The basic idea is to explicate a small number of possible future development paths without explicitly stating their probability of occurrence. Typically a study describes three to four single scenarios. "To mark out an area of future possibilities" (Häfele & Schrattenholzer 1980. p. 24; Translation by author), each of them attempts to explicate one specific development in consideration of characteristic assumptions. One of the scenarios typically describes the path of development when no special action is taken. This case is normally called "reference-", "base-case-"or "business-as-usual"-scenario. In the other scenarios this assumption is changed by implementing distinct actions into the future path.

The consequences of these actions are - at least partly - quantified by the studies. For example, the scenario study for the formerly cited Study Commission *Sustainable Energy Supplies* (Institut für Energiewirtschaft und Rationelle Energieanwendung, Wuppertal Institut & Prognos AG 2002) compares the increase or reduction of costs that result from the varying use of renewable, fossil and nuclear energy sources relatively to the reference case.

The Client as a Part of the Formation Process

In the previous sections the client and the author have been identified as the two main actors in the formation process of energy scenarios. The interdependencies of the actors can be summarised in an idealised way as follows:

The client commissions the author to provide a scientific study in the context of an energy-political question. From this context different specifications arise that he communicates to the author. For example a methodical specification could read to explicitly not provide a forecast, but a scenario analysis.

Because the core of the scenario method is to explicate future developments in consideration of special assumptions, part of the specifications define those assumptions and thus describe the futures to be analysed. At the same time they allow the comparison of the distinct futures. A typical case would be providing one scenario that assumes an intense expansion of renewable sources, while a second one is based on the use of fossil energy sources. The question of how explicitly these specifications are verbalized, especially whether quantitative statements are made, is part of the graduation work that will be described later. Unlike these "characterising" specifications, in an idealized formation process the client also gives "basic" specifications to the author on which all scenarios will be based or – in other words – which become characteristic for the reference scenario. An example would be the assumed population growth. In great clarity this distinction can be found in the scenario study for the Study Commission *Sustainable Energy Supplies* (Institut für Energiewirtschaft und Rationelle Energieanwendung, Wuppertal Institut & Prognos AG 2002).

The client's specifications are understood as an indirect designing impact in the formation process, where the client makes use of a "designing space". Hence, he reduces at least partly the author's designing space,

what must be taken into consideration when investigating the objectiveness of the formation process or its results.

The Author as a Part of the Formation Process

The direct design of the study is conducted by the author, who not only composes the final report, but also does the underlying modelling. Even if this part of the formation process has not been mentioned yet, it is of great importance from different points of view.

For the advising institutes the model is the most important distinguishing feature, because in the model their specific view on the energy system is expressed. As a result different sections or aspects of reality are replicated, for example power plants and electrical nets or fuel markets and customers. In this context Labys distinguishes between a technical (or engineering) and an economic approach (Labys 1990). Furthermore, different variables and characteristic parameters are used to represent these sections, such as thermic efficiencies or cost elasticities. Other distinguishing features are the implemented mathematical methods or the represented geographical regions. That the distinction between the modelling procedures is also visible to the client and therefore is relevant for his choice of the author can be seen in the citation that was presented in the first section of this paper. Here the Study Commission *Sustainable Energy Supplies* gives reasons for commissioning two institutes with the instance that both are using different "simulation methods" (Deutscher Bundestag, Referat Öffentlichkeitsarbeit (Ed.) 2002. p. 645; Translation by author).

When investigating the modelling process in terms if objectiveness it is an important instance that the different modellers or institutes not only appear as competitors but also as members of an international scientific community which discusses and reflects its methods and results. Even if the conceptual clarification of "objectiveness" in the context of future knowledge is outstanding, it can be assumed that for the objectiveness of the modelling this scientific reflection and in a way "quality assurance" is central. A result could be that certain aspects of modelling are well discussed, reasoned and maybe can be seen as scientific standards for energy models. These aspects then could be interpreted as (more) objective or intersubjective, whilst other aspects might be more intuitively designed by the modeller and be – due to an preliminary understanding of objectiveness – be more subjective. That "objectiveness" of modelling is a topic inside the community itself can be found at (Lipinski 1990) for example.

Research Project

In the graduation project that is outlined in the paper at hand the problem of objectiveness of future assumptions is investigated. The work will concentrate on energy scenarios and thereby spotlight on their formation processes and the involved actors. The underlying assumption is that for an analysis in terms of objectiveness a profound knowledge of the formation conditions and their influence on the results are crucial.

On the one hand, the process will be examined from the perspective of a noninvolved observer to achieve an in-depth understanding of the models. With this approach the actual designing spaces of the actors and their use are identified as well. On the other hand, the involved actors are interviewed about their perception of the process and their role in it. By comparing both perspectives the designing spaces are identified where design contributions were performed either implicitly or explicitly.

Because these methodical conditions cannot be examined under exception of the epistemological background, the graduation project is embedded into a research group with the title "Potentials of

Objectifying Future Assumptions: The Example of Energy Futures". The term "futures" that includes different concepts of future assumptions, especially forecasts and scenarios, indicates the necessity of achieving conceptual and terminological clearance in this field. One question to be answered is in what sense a future assumption can be either objective or subjective at all and how "objectiveness" is related to terms such as "neutrality" or "intersubjectivity". Based on this knowledge it further can be asked, what potentials to objectify concrete future assumptions or studies exist. Finally the results of the research group will be used in the graduation project to analyse the objectiveness of the formation process of energy scenarios.

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