Sustainability Foresight as a means for participatory transformation management

Truffer, B. [1*], Voss J.-P. [2], Konrad, K [1]
[1] *Cirus/Eawag, Switzerland;* [2] *Oekoinstitute, Germany;*

* Eawag, Überlandstrasse 133, CH-8600 Dübedorf, Bernhard.Truffer@eawag.ch

Abstract

Utility sectors are currently characterized by a sharply increasing amount of uncertainty regarding their long term perspectives. Substantial transformation pressures are currently building up with regard to market regulation, basic technologies, customer expectations and environmental conditions. Given that infrastructure bound technological systems depend on long term stability of societal consensus and other border conditions, this increased uncertainty calls for new approaches of planning, evaluation of alternative trajectories and strategy formulation. Sustainablility Foresight has been developed as a participatory method for developing sustainability strategies of entire industry sectors. It encompasses three analytical steps (i) the reconstruction of visions about future sector structures, (ii) sustainability implications that are entailed by these visions, (iii) conjoint strategy development for actor groups participating in the endeavour.

1. Introduction

Utility systems play a key role in a broader project of transforming industrial society for sustainable development.[1] At the same time, these sectors are particularly resistant to change. This is due to strong interlinkages between technological systems, natural resources, institutions and value orientations which stabilise consumption, production and governance patterns and make up a so-called socio-technical regime (Kemp 1994; Rip, Kemp 1998). The interconnectedness of the mentioned elements and the dependency of modern societies on the provision of utility services make it hard to introduce radically new production and consumption patterns – such as energy provision based on renewable sources, recycling of drinking water or provision contracts based on demand-side management. The high complexity implies that it is difficult to predict the consequences from exchanging parts of the prevailing socio-technical regime. The large scale introduction of intermittent renewable energy sources such as offshore wind energy in electricity systems is a case in point. Some research work and political effort has been put into strategies to transform prevailing socio-technical regimes (Kemp et al. 1998; Summerton 1992; Mayntz, Schneider 1995).

Utility systems have often been chosen as a field of application (Voß 2000; Kubicek 1994; Schneider 2001; Mez 1997; Arentsen, Künnecke 2003). Utility regimes are currently undergoing accelerated and fundamental changes linked to liberalisation and privatisation policies which have started in the 1990ies. These comprise corporate organisation, political institutions, technology, cultural values and theoretical concepts of utility provision. The current phase of transformation succeeds a long period of relative structural stability which has lasted from the

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Second World War until the beginning of the 1990ies. During this phase utility systems were characterized by a socio-technical regime made of public or semi-public monopolies and organised around the principle of central control of large scale generation and integrated distribution networks. During the 70ies and 80ies, pressures on the regime had built up. They include the reduced effectiveness of rate-of-return regulation of monopolies at a point where great investments for the extension of network infrastructures are not needed anymore because domestic markets are saturated; and a growing perception of environmental problems connected with the established regime structure; and the advance of new technologies which create opportunities for more decentralised and competitive modes of service provision. In combination with neo-liberal ideas these changes culminated in the adoption of liberalisation and privatisation policies in the nineties (Midttun 1997; Arentsen, Künnecke 2003; Schneider 2001). In parallel and supported by some of these changes, a shift towards decentralised technology could be observed in most industrialized countries (Patterson 1999). Furthermore, a new understanding and evaluation of utility system performance begun to take shape over the past couple of years. The society-wide shared goal of 'public service' is fading, giving way to values like efficiency, entrepreneurial spirit and consumer sovereignty. These changes trigger further adaptive changes which build up momentum, opening spaces for a spectrum of new socio-technical configurations ranging from highly decentralised generation of electricity, heat and water in the context of 'intelligent' buildings to centralised renewable electricity generation. The future structure of utility provision is being shaped by a myriad of individual actions and decisions: companies sketching market or investment strategies, consumers purchasing appliances or signing-up for supply contracts, policy makers negotiating subsidies or drafting rules for network access.

Given this high complexity of transformation pressures, how could a transformation process be shaped that assures more respect to the principles of sustainability, i.e. long-term viability of society? In the following we present and discuss an approach to deal with the specific challenges that are linked to the shaping of ongoing socio-technical transformation. The approach is entitled Sustainability Foresight and comprises the following three steps:

(A) Exploration of transformation dynamics: Construction of alternative paths of transformation in participatory scenario workshops, identification of highly dynamic fields of innovation.

(B) Sustainability assessment: Elicitation of evaluation criteria held by different stakeholders and discursive assessment of transformation paths with respect to sustainability impacts.

(C) Development of strategies: Analysis of options and constraints for actors to shape transformation, development of measures to modulate innovation processes with respect to sustainability.

The Sustainability Foresight method was developed in the German utility system (provision of electricity, natural gas, water and telecommunications).[2] Building on and extending established foresight methodology it aims at providing a platform for

[2] The work is supported through the programme on socio-ecological research by the German Federal Ministry for Education and Research (www.sozial-oekologische-forschung.org). The project title is „Integrated microsystems of supply. Dynamics, sustainability, and the shaping of transformation processes in network-bound infrastructures [*Integrierte Mikrosysteme der Versorgung. Dynamik, Nachhaltigkeit und Gestaltung von Transformationsprozessen in netzgebundenen Versorgungssystemen*]" (www.mikrosysteme.org).

collective, future oriented learning across the four utility sectors and the action domains of production, consumption and regulation.

Using the Sustainability Foresight method, we want to explore alternatives to conventional problem-solving with a view to assess their practical potential for implementing reflexive governance for sustainability. We expect Sustainability Foresight to work complementary to conventional problem-solving by increasing the reflexivity in 'wicked' problem areas which do not lend themselves to straightforward problem-solving (Hisschemöller, Hoppe 2001). We first explain the conceptual background behind the method. We then give a more detailed description of the Sustainability Foresight approach with examples from the application in the German utility system. This will be the basis for discussing the results which are hitherto available and putting the approach in relation to the concept of reflexive governance as worked out in the introduction. In a concluding section we reflect on the practical potential of the reflexive governance in general and Sustainability Foresight in particular to shape processes of socio-ecological transformation in a sustainable way.

2. Sustainability Foresight and participatory technology assessment

Since the 1960s there is a systematic engagement from the side of businesses as well as public policy with foresight methods to explore the embedding of strategies in dynamic contexts (Godet 1987; Ringland 1998). The approach has become popular through the Shell oil company which used it to deal with the uncertainties of their business environment that cropped up with the oil crises in the 1970ies. Foresight is about anticipating possible future developments in a certain domain of interest. Foresight conceptualises the future as open, not determined by natural necessities, but contingent and influenced by human action. The future is therefore seen as malleable and apt to strategic shaping, not to fatalistic adaptation. "Foresight is not a process of forecasting the future but rather an attempt to explore the space for human actions and interventions to shape the future. Foresight is aimed at producing orientations rather than predictions; it provides guidance to all actors and reduces uncertainty" (Renn 2002 cited in Borup 2003, p.3). Practically, foresight is not about finding out about one most probable path of development but it entails the construction of a range of different, equally plausible paths of future development. Foresight exercises seek to make use of the distributed knowledge, expectations and understanding which are contained in the diverse perspectives of present-day actors on developments of common concern.

By putting these expectations in form of scenarios they feed back on present-day actions. The actual results of foresight activities are therefore not the fictitious stories about alternative futures on their own, but the repercussions which they have in social interaction processes in the present (Truffer et al. 2003). These may be that expected opportunities enhance actions which in turn support developments which spur their actual realisation (self-fulfilling prophecy) or, vice versa, that expected risks call for preventive action, which makes them less likely to occur (self-defeating prophecy). Foresight processes thus potentially shape the developments which they set out to explore. As such they become a strategic device in shaping socio-technical transformation. As such foresight can prepare decision makers for alternative courses of development and prevent premature lock-in to specific trajectories.

The Sustainability Foresight approach has been developed for the task of shaping processes of socio-technical transformation. It is designed in order to integrate a broad range of interacting factors from heterogeneous domains. In the following we

first give an overview on the concrete procedural set-up of the Sustainability Foresight as it is currently applied in German utility systems.

3. The Sustainability Foresight Methodology

The Sustainability Foresight comprises a three step process in which a selection of diverse actors from the utility systems addresses the problem of sustainable transformation. The challenges of system analysis, goal formulation and strategy development are dealt with in sequence.[3] The specific methods which have been devised for each step take account of the inherent complexity and ambivalence:

1. uncertainties of system dynamics are taken up in explorative scenario analysis
2. ambiguity of sustainability goals is taken up in a discursive sustainability assessment procedure
3. distributed control capacities are reflected in strategies to shape critical innovation processes.

The process is described in detail in the remainder of this chapter. For an overview on the phases, process steps and actors involved see.

Table 1: Overview on the Sustainability Forsight process

Phase	Process steps	Actors
Adaptation to problem area	Scanning of future discourse and visions discussed in problem area	Project team
	Development of heuristic conceptual framework of the transformation process	Project team
Phase I: Explorative scenarios	Collection of factors which influence transformation	Stakeholders
	Selection by uncertainty and impact, elaboration of alternative projections for 30 factors	Stakeholders
	Cross-impact analysis, construction of scenarios as combinations of factor projections, composition of narrative storylines for selected scenarios	Stakeholders
Phase II: Discursive Sustainability Assessment	Elicitation of criteria for sustainability assessment held by stakeholders	Stakeholders
	Development of impact profile of scenarios with respect to identified criteria	Experts
	Discursive assessment of risks and opportunities connected to scenarios	Stakeholders and experts
Phase III: Shaping innovation processes	Identification of critical innovation processes (contingent across scenarios and high sustainability impact)	Project team
	In-depth analyses of actor networks and context conditions of critical innovations, identification of ‚loci of influence'	Project team and stakeholders
	Development of integrated strategy for shaping interdependent institutional, cultural and technological innovation	Project team and stakeholders

An important first element of sustainability foresight is a thorough adaptation of the general method to a specific field of application. This includes an empirical study of the structure and dynamics and future expectations that are put forward by actors. As a starting point we chose to take expectations on future developments of the utility system which are discussed in the practice of electricity, gas, water, and

[3] The three steps are related to the distinction of system knowledge, goal knowledge and transformation knowledge as elements of sustainability research (cf. Mogalle 2001).

telecommunications provision. These expectations are not articulated in form of full-fledged scenarios but are more often appearing as expectations about prices, technologies, market structure and so on. If carefully analysed, however, they do link up to form a more encompassing picture. In our case we identified three central features of the future utility system which appeared frequently in professional discussion:

a) System structures are going to be more decentralised than today (e.g. renewable energy, fuel cells, biogas, membrane technology for drinking water processing, mobile telecommunication).

b) Utility provision will be oriented towards services, not commodities, with the boundary between supply and demand dissolving (e.g. customer generation in small combined heat and power units, contracting, facility management).

c) Organisational and technical linkages between electricity, gas, water and telecommunications will become more intensive (e.g. integrated service contracts, intelligent networking of infrastructure and appliances in smart buildings).

These three 'dimensions of change', as they are referred to in the project, provide an exploration space in which 'Integrated Microsystems of Supply' is a hypothetical extreme scenario in which decentralisation, service orientation and interlinkage between sectors is fully fledged. This vision serves as a background foil for contrasting alternative possible developments

A second step for problem structuring, besides the empirical study of future expectations of actors, is the development of a heuristic concept for the particular transformation process under study. This is necessary to guide the detailed set-up of the Sustainability Foresight process. The concept shall give a comprehensive account of the action arenas and types of factors of influence which are important for the course of transformation and its impacts. Such a heuristic is useful in order to ask the right questions, include the right actors and not 'overlook' any influential processes. For the utility systems we have differentiated the following categories which we considered important to give a comprehensive image of transformation. Most of them may be relevant also for other areas of transformation. In principle, however, important categories should be derived from an empirical study of the specific transformation which is in focus of the Sustainability Foresight:

The conceptual framework is useful for a systematic structuring of issues and selection of stakeholders. Especially the latter is important since the participants have a very strong role in defining the substantial contents and results of the Sustainability Foresight whereas the organisers (in our case an interdisciplinary research team) act to a large extent as facilitator, moderator and service provider in gathering and structuring information. Problem structuring thus includes the development of a participation concept which should clearly define the functions of stakeholders within specific steps in the procedure and derive respective criteria with respect to recruitment. We distinguished 'diversity of perspectives, 'affectedness', and 'influence on transformation' as specific recruitment criteria for the process steps of scenario analysis, sustainability assessment, and strategy development, respectively. These criteria have been translated into respective quota for groups of stakeholders to be part of the process.

3.1 Explorative Scenarios Development

The objective of the first phase of the process is to re-construct alternative visions of future utility systems out of the specific expectations hold by different stakeholder groups. This has been carried out in a series of scenario workshops with 20 participants. The participants represented the variety of perspectives from production, consumption and political regulation in the four sectors.

In a first step various factors which influence the transformation of utility systems were collected. This took place in form of a moderated process, initiated by the following question: “How does the future of utility provision (electricity, gas, water, telecommunication) look like (…) and on which factors does it depend?” The first rather large sample of factors was clustered and selected according to the uncertainty of their future value and their potential impact in shaping future structures of utility provision. For a selection of the 30 most relevant factors detailed descriptions were worked out which provided alternative projections of their value at the end of the exploration period (2025 in our case). Different combinations of factor values formed different scenario frameworks. These were based on a cross-impact analysis supported by a software tool. Consistent and particularly interesting scenario frameworks with respect to the three features of decentralisation, service orientation and sector integration were selected and fleshed out with narrative storylines.

The result of this first phase are four elaborated scenarios representing alternative future structures of utility provision as well as a set of detailed descriptions of highly relevant factors influencing the transformation process. Both resulted from the interaction of heterogeneous perspectives on utility provision. By this procedure it is possible to overcome some limitations often set by particular institutional perspectives like, for example, the one of technology development, business or consumer protection. This yields a trans-disciplinary and trans-professional view on the system in which processes become central which are – under every day conditions – often externalised (e.g. societal acceptance for new technologies). Another effect of the collective scenario construction is the ‘creative destruction’ of expectations and visions of future development which were taken for granted by participants. Routine-thinking about how things unfold and what will come next could be replaced with a fan of contingent alternatives which would each require specific strategic responses. This pluralization of the future can work as a particular kind of ‘steering through visions’ (Canzler, Dierkes 2001; Brand 2002). In this case it is not the coordinating force of visions which become embraced as commonly held expectations and translated into agendas (van Lente 1993; Konrad 2004), but the ambiguity of multiple expectations that may influence general action orientations towards experimenting, adaptivity and cooperation.

We have so far given a brief account of the Sustainability Foresight method. The method was developed based on general considerations about the role of foresight for the shaping of socio-technical transformation. The scenario workshops have brought up four different scenarios which represent alternative future structures of utility systems and which chart a spectrum of possible developments until 2025 (see Table 2). One interesting aspect, to only mention an example, is the scope of alternative developments in terms of decentralisation of technologies and concentration of markets. Here, the four scenarios represent all possible combinations, including technological decentralisation combined with high market concentration.

Table 2: Overview on selected aspects of scenarios of utility transformation

Scenario A	Scenario B	Scenario C	Scenario D
„Technological competition in a cooperative society“	„Development along the lines of ‚conservative ecology'“	„Broadening technology mix by competition of transnational corporations“	„The old Rome“
Decentral technology Low market concentration Utility sectors tightly coupled Visions generated in societal discourse become decentrally implemented State as moderator Competition stimulates technology development	Central technology Low market concentration Utility sectors separated Active innovation policy (R&D) State regulates utility markets and technology development	Central and decentral technology High market concentration (international oligopoly) Utility sectors separated Innovation policy concentrated on national champions Strong market regulation	Central technology High market concentration Utility sectors separated Economic stagnation No active innovation policy Weak market regulation

Scenarios tell stories which make one think in new ways and draw attention to factors and their ways of interacting which go beyond the beaten paths of future discourse in the utility system. Apart from these substantial results, also the process in which the scenarios have been created proved effective. Participants affirmed that they learned about the utility system as a whole, about long-term dynamics, interdependencies and about the different perspectives and capacities of other actors. Many of them particularly emphasised the special opportunity to stand aside, take some time to reflect and look at the larger picture of sectoral transformation – a quality of thinking and communicating which they miss in their daily practice.

3.2 Discursive sustainability assessment

The second phase moves from exploration to assessment. The focus is on the production of knowledge about goals, i.e. criteria for sustainable utility development and respective opportunities and threats in ongoing developments. It is not possible to determine sustainability criteria objectively. We do not know the exact conditions for the long-term viability of coupled societal and ecological systems. Trade-offs between goals rest on differences in normative values and cannot be resolved scientifically. Moreover, values are endogenous to transformation and may change over its course. Sustainability goals will therefore always remain ambivalent. What counts is to keep the balance between equally legitimate but potentially conflicting values and develop problem specific practical judgements (Loeber 2003: 20). This can only be achieved in societal discourse among those who ‘own’ these values (cf. Stirling, Zwanenberg 2002). Such discourses may change views of actors and allow for consensus or help to identify areas of unresolvable conflict which need careful political attention.

The sustainability foresight method envisages a systematically structured process in which stakeholders articulate their values, experts assess possible future developments with respect to their effect on these values and a broad range of affected actors engages in a discursive assessment of opportunities and threats

which have to be taken special care of in future transformation.[4] The result of the assessment phase is the explication of threats and opportunities of transformation from the perspective of the various actors who are potentially affected by them. By this way can critical aspects be identified, which form starting points for the development of adequate strategies. Such an open-ended approach to sustainability assessment allows for a concretisation of the abstract notion of sustainability without passing over inherent ambiguities. It yields a map of the societal value landscape with respect to the transformation of electricity, gas, water, and telecommunications provision. Societal goal formulation can be supported by differentiating between facts and values and making them accessible for differentiated modes of conflict resolution such as discourse about problem framing and bargaining over distributional aspects (cf. Saretzki 1996).

3.3 Shaping innovation processes

The focus of the third phase is on the development of strategies. It addresses 'critical innovation processes' to shape broader transformation patterns. Critical innovations are identified on the basis of the foregoing scenario analysis and sustainability assessment: Factors which have a central role in the transformation of utility systems as a whole and are linked to outstanding threats, opportunities or areas of conflict with respect to sustainability are candidates for a closer investigation into the innovation processes which determine future characteristics of this factor. If, for example, "service orientation", "demand side management" and "market development for smart building technology" are identified as important factors and discursive assessment shows consensus on the desirability of user involvement in the utility systems, but at the same time divergent evaluations with respect to smart building technology, the latter would qualify as a critical innovation process and should be special attention in strategies for sustainably shaping utility transformation. Critical innovation processes thus refer to the emergence of new technological, institutional or cultural patterns in utility provision. Institutional innovations, related to economic, political or cultural contexts are treated symmetrically with technological innovations in this context. Besides smart building technology or small combined heat and power generation also network regulation, performance contracting schemes or cultural practices to switch providers or engage in self-supply of utility services could earn special attention as critical innovations processes.

The strategic approach of the third phase of Sustainability Foresight thus is to foster the contextualisation of critical innovation processes. This happens on two levels. On the level of the interactions which are relevant for critical innovations new arrangements are created which couple rationalities of developers, investors, users, interest groups, regulators and other stakeholders who represent the socio-ecological context in which innovations are to take effect. Such arrangements can take the form of R&D consortia, focussed impact assessments, collective experiments etc. On the level of expectations about changing sector structures new visions are constructed which can serve to orient the search for sustainable transformation paths. Such visions are based on the scenarios and evaluation of sustainability impacts. Concrete arrangements for the contextualisation of innovation processes need to be based on in-depth empirical analysis. This is oriented towards specific actor constellations and relevant context conditions which have historically contributed to shaping the innovation path and those which are likely to play a role in future development. On this basis possible courses of the 'innovation journey' in relation to contingent actor strategies and context

[4] The procedure resembles the method of participatory policy analysis developed by Ortwin Renn and others (1993).

developments are mapped. Turning points can be anticipated which represent windows of opportunity for influence.

4. Conclusions

Sustainability Foresight it represents a new form of governance, or societal problem treatment more generally, which developed out of learning experiences in a concrete area of practice. In the case of Sustainability Foresight it is the elaboration of technology assessment methods which moved from single technologies towards socio-technical systems as the object of study and from expert assessments to citizen participation and stakeholder interaction as the ways of producing knowledge and evaluative judgements. The concept of sustainable development played an important role for this process in demanding to take into account long-term effects of technologies in larger socio-ecological system contexts (e.g. including social impacts and global effects) and to face diverse and not easily reconcilable criteria for assessment (e.g. social, ecological and economic) (Grunwald 2002). In this respect the concept of sustainable development has effectively induced changes in social practice. Up to now, one cannot speak of a full regime change which has taken place in technology assessment, but it is clearly visible that new and more reflexive forms of governing technological change are developed and become institutionalised (Simonis 2001).

We had to learn that interactive research involving a diverse set of heterogeneous actors is a precarious endeavour. It opens the research process towards ongoing dynamics in the field of study, and makes it more vulnerable to the influence of interests and conflicts. This requires a high level of attention to current political processes, relations between actors, and possible tensions which will have repercussions within the process. A great deal of flexibility in the management of the process is necessary in order to navigate through the currents of the real world stream of action. The Sustainability Foresight method as described here should thus not be understood as a toolkit for straightforward application, but rather as an ideal-type process arrangement which may inspire similar processes elsewhere.

This means that the project team, i.e. researchers, public officials, or whoever else is initiating and conducting Sustainability Foresight, has strong influence on the process and indirectly on its results. A clear example is the selection of stakeholders which is an important factor in shaping the processes of problem analysis, goal formulation and strategy development. Yet, there is no standard method available by which relevant stakeholders for a particular problem can be identified. The project team therefore has important discretionary powers which go beyond the role of a facilitator of stakeholder interaction. Also the specific set-up and moderation does, of course, shape the results of Sustainability Foresight. This central role of the project team should be reflected by providing good documentation of the specific process set-up and the reasoning behind it. It also underlines the importance to have interdisciplinary competences and process management skills represented in the project team.

Another proviso with respect to the capabilities of reflexive governance to bring about sustainable development is the basic dilemma of (critical) discursive communication about problem-solving on the one hand and (affirmative) realism towards interests and power in actual institutional contexts on the other hand. Whereas it is necessary to promote an argumentative orientation of the participating stakeholders in order to produce integrated problem definitions and cooperative strategies, it is questionable if knowledge and strategies which were produced under these conditions will actually prove to be robust in real world policy

processes where institutional inertia, competitive struggle and opportunistic behaviour are prevalent. It is necessary to strike a balance between detached observation and strategic role playing. Sustainability Foresight cannot overcome this dilemma, it can only help to find a good way to deal with it. This means that the social processes that take place when working with the method are not free from particular interests, asymmetrical power relations and strategic interaction. Neither is guaranteed that the results which are produced in the 'laboratory' of Sustainability Foresight can and will be implemented in the real world contexts to which they refer, because the specific institutional embedding constrains what actors think, value and what they can do. In this respect, Sustainability Foresight, and perhaps reflexive Governance more generally, can not be regarded as a *solution* to the problems which are linked to established institutional patterns in modern societies. In providing space for collective, problem-oriented learning it can be regarded as a means to *create opportunities* for making use of institutional slack to establish more adequate practices for dealing with uncertainty and ambivalence in the shaping of sustainable transformation.

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