# POLICY INTEGRATION THROUGH FORESIGHT

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## Introduction

The quest for integration is older than the problem of environmental policy or sustainability. It is the unbeloved downside of modernisation which rests on instrumental rationalisation and functional differentiation as organising principles. The more specialised professional perspectives become, the larger grow the gaps and blind angles between them. This refers not only to the departmentalisation of policy-making and disciplinary blind folders in science, but also to the separation of e.g. policy making on the one hand and science and technology development on the other hand. The difficulties of integration are not only cognitive, but also include institutionalised competition between the specialised competences, worldviews and resource needs. Concerns for integration, especially in the domain of policy-making have made it to much public recognition in the fairway of problems such as environmental protection or sustainable development. These problems sprout in the blind angles and start to grow over into realms of institutionalised concerns like the economy, politics or science. As such they are considered severe enough to touch on the institutional principles of modern society.

The pathology is quite clear and has been analysed over and over in the framework of different theories and with respect to different empirical problem areas. Beck diagnoses contemporary societies to be fundamentally shaped by the ubiquity of unintended consequences as a repercussion of from modernisation (Beck 1993). Mayntz and Willke (on the Basis of Luhmann) have worked out concrete difficulties of governing against the background of dynamics of differentiation (Mayntz et al. 1988; Willke 1992). Integration has been put forward as the central concern of institutional reforms for sustainability policy (Minsch et al. 1998) and for adequate knowledge production (Gallopín et al. 2001; Funtowicz et al. 1998).

On the programmatic level, environmental policy integration has been formulated as a primary concern already in the 1970s (Müller 2002). With respect to possible cures, however, knowledge is limited. The same refers to practical success in terms of producing integrated policy outputs (Lenschow 2002). Against the background of a shift from government towards governance which comprises a broader and more heterogeneous range of actors, it is questionable, if the classical framing of policy integration as referring to policy departments and public policies is still valid. In the governance perspective policy integration would not be confined to intra-state relations but include (informal) governing activities that take place throughout society. Strategies of large companies or influential interest groups have a similar potential to foil sustainable development as counter-running departmental policies.

Against this background it may be valuable to think about policy integration in different ways. Rather than creating couplings between differentiated action domains by changing existing rules and procedures (such as the application of common criteria and indicators, institutional

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prescriptions for consultation or co-decision or common reporting guidelines) it could be useful to consider integration in a sphere which is much more fluid and amenable to mutual adaptation, but not less very important for guiding action: the expectations which actors hold about the future. Foresighting exercises systematically develop such expectations. This article therefore presents the sustainability foresight approach as a method of policy integration which is particularly apt to cope with long-term and large scale problems such as sustainable development.

The sustainability foresight approach as presented here was developed in course of a project dealing with transformation and sustainable development in the utility system.[2] The problem setting of utility transformation after liberalisation will therefore briefly be described following this introduction. I then give an overview on recent developments in research on technological innovation, governance and knowledge production which all emphasise the emergence of 'reflexive arrangements'. I then relate these to the working of foresight processes. After that I give a more detailed description of the Sustainability Foresight approach with examples from the application in the German utility system. In a concluding section I give a brief outlook on results that are hitherto available and discuss the potential of the approach for policy integration.

## Shaping sustainable transformation

Utility systems are of great importance for the sustainability of industrial society. Yet, they are particularly difficult to shape. This is due to close interlinkages between natural resources, technology, institutions, concepts and values which make up a functioning configuration of entwined production and consumption patterns. Interdependencies between the various elements and reliance of society on the provision of utility services make it hard to find ways to introduce radically new and supposedly more sustainable patterns – such as energy provision based on renewable sources and increased efficiency instead of fossil and nuclear based supply. Furthermore, it is difficult to predict what will happen to the system if parts are substituted and what exactly is needed for a new system to function. Incumbent interests make use of these uncertainties typical for complex socio-technical systems by emphasising the security of supply as an argument against changes in the structure of the system. According to these reasons utility regimes have resisted any deliberate attempt to modify their basic structure for decades – be it attempts to introduce competition for more efficiency and lower prices or more sustainable forms of utility provision such as decentral combined heat and power production or demand side management. In the 1990s, however, utility systems entered into a process of accelerating structural change. This change has been the accumulated result of various pressures on the established regimes, culminating in liberalisation and privatisation of the formerly semi-public monopolistic industry. This new phase of structural dynamics creates opportunities for more sustainable configurations but also risks of new path dependencies with adverse ecological, social or economic impacts.

Conventional problem-solving routines which are based on a mechanistic steering paradigm cannot be applied in this case, because the central underlying presumptions do not hold. Whereas conventional problem-solving requires

($A_{conv}$) system analysis for the prediction of consequences of alternative actions,

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($B_{conv}$) a clear definition of goals in order to rank alternatives, and

($C_{conv}$) a powerful steering centre able to implement specific instruments,

we face different conditions in all three points in the case of long-term transformation of electricity systems:

($A_{trans}$) Potential transformation paths and effects of intervention are highly uncertain, because they are rooted in complex interactions between social, technical and ecological processes which cannot be fully analysed and predicted.

($B_{trans}$) Sustainability goals remain ambivalent, because they are endogeneous to transformation itself and cannot be resolved scientifically or politically.

($C_{trans}$) The power to shape transformation is distributed among many autonomous actors without anyone having the power to control all others.

In the following we present Sustainability Foresight as an approach to deal with the specific challenges that are linked to ongoing socio-technical transformation, path-dependency and sustainability. It takes up the challenge that is given by uncertainty, ambivalence and distributed power in three steps:

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

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

(C) Shaping strategies for critical innovations: In-depth analysis of selected technological and institutional innovation processes and interactive strategy development with stakeholders.

The Sustainability Foresight method aims at providing a platform for collective, future oriented learning across the sectors and different action domains of production, consumption and regulation. The method systematically introduces reflexivity and cautiousness when it comes to ‘unstructured problems ‘(Hisschemöller, Hoppe 2001). As such it can play an important role for the shaping of transformation by taking care that emerging directions take shape in the interaction of actors representing different perspectives and in anticipatory confrontation with its long-term consequences.

## Emergence of ‘reflexive arrangements’

The Sustainability foresight method builds on practical learning and conceptual developments in the area of technological innovation, governance and knowledge production. Remarkably, it is possible to observe a parallel development of issues across these areas which may be characterised by keywords such as ‘dissolution of boundaries’, ‘heterogeneous cooperation’, ‘interaction in networks’ and ‘reflexivity’. The dissolution of boundaries also holds for the areas themselves, in practice as well as in theoretical research. Increasingly, power aspects in technological innovation, knowledge dimension of governance or market orientation of knowledge production come into view. And problem-solving processes like sustainability strategies, technology discourses or participatory foresight become established for which it becomes difficult to tell, if it is innovation, governance or knowledge production that is happening there. The sustainability foresight method aims explicitly at constituting such a hybrid-process which combines experience and concepts from all three. These are briefly pointed at in the following paragraphs.

## Bridging the gap between technology and society

Over the last decades the focus of innovation studies has moved from the technical development of artefacts to the social interaction processes that give shape to the development of technology (Bijker et al. 1987). These interactions are not confined to technical design work in the laboratory but include wider organisational and societal contexts as important components of the innovation process. Sustainability oriented innovation studies build on these conceptual orientations and pose specific questions about the possibilities to induce and shape radical innovations with superior performance as regards eco-efficiency, risk and social integration. These questions have shown two major problems in studying sustainable innovation: How can the sustainability impact of technological innovation be anticipated and integrated into the design at an early stage? And how can sustainable technologies with radically different designs be introduced in the context of established socio-technical regimes? The second question has led into an emergent research programme on sustainable system innovation where possibilities for deliberate change of regime structures are investigated (Kemp 1994; Kemp, Rotmans 2004).

In innovation studies in general and for sustainable innovation in particular, evolutionary concepts have proven fruitful for understanding the interlinked dynamics that give shape to innovations and socio-technical patterns on a larger scale such as systems for energy provision, transport etc. For this purpose a multi-level concept of socio-technical change has been developed which places particular innovation activities in the context of broader regime structures which include a mutually stabilising configuration of e.g. cultural meaning of technologies, regulation, maintenance networks, financing opportunities etc. Socio-technical regimes are themselves embedded in a so-called socio-technical landscape made up of general political and economic structures, cultural values etc. Socio-technical change is conceived as interacting processes on all three levels (Rip, Kemp 1998).

A central proposition from this stream of research is that innovation cannot be planned or controlled since it is subject to contingent influence from many parallel processes with their own dynamics. This holds for single technologies and not the less for innovation on the level of socio-technical systems. However, innovation and technological development can be shaped by introducing reflexivity to co-evolutionary processes, i.e. by increasing the capability of actors to anticipate on interference and selection pressures through larger processes in which their actions are embedded. A number of approaches have been developed in this direction: the ‘contextualisation’ of technology development in ‘nexus-arrangements’ has been studied where variation and selection become institutionally linked allowing for the interaction between technology promoters and adopters at an early stage, as e.g. in test laboratories (van den Belt, Rip 1987). Programmatically, this has been translated into the concept of Constructive Technology Assessment which proposes to constitute a nexus not only between promoters and users of technology, but also to include actors from the wider societal contexts on which technology may have an impact, e.g. environmental protection, administration and regulation or social welfare. Thereby the articulation of user requirements and societal concerns at an early stage of the innovation process is possible when they may still be integrated into the design process and that way produce adapted or socially robust innovations (Rip et al. 1995).

A related programmatic concept is ‘strategic niche management’ which puts emphasis on the promotion of specific technologies through the creation of protected learning spaces in which mutual adaptation of technologies, user practices, maintenance infrastructure etc. can occur before novel configurations have to prove themselves in real world selection environments (Kemp et al. 1998).

Studies of technological innovations today, those concerned with impact assessment as well as those in support of technology development, jointly point to a gap between science and technology development on the one hand, and society including users, operators and impactees on the other hand. This gap has to be bridged in order to allow for technology development to become sustainable, i.e. better adapted to societal and ecological requirements (Rip 2002).

Another recent development in innovation studies is a turn towards the role of expectations and visions of the future for orienting and coordinating innovation activity. It is increasingly acknowledged that they play an important role for strategy building and formation of collective action and thereby shape the emergence of de facto socio-technical patterns, however fictitious they are in the first place (van Lente 1993; Konrad 2004). This has also drawn attention to future socio-technical scenarios as a means of influencing innovation processes. Systematic foresight processes are therefore a strategy for more reflexively dealing with these expectations.

## Governance networks

Besides innovation studies governance studies are highly relevant for understanding and shaping transformation. Research here has followed a similar widening of perspective as described for innovation studies. What is now governance research started from studies of government and public policy. Over several empirical and theoretical steps, however, concepts have changed quite radically in order to account for real world complexities of governance (Mayntz 1995; 1998). The shift from the term government to governance is a symptom of changes in the way societal order and self-steering are understood. Government or the political system conceptualised as an entity apart from society have lost their exclusive stance as the subject of political steering. Different processes take place at the same time: The image of the state as the steering actor is giving way to a view on a highly differentiated set of institutions with particular and often contradicting interests and strategies (Lindblom, Woodhouse 1993, pp 57-72). National boundaries which constituted practically closed political entities dissolve into entangled multi-level governance structures (Kohler-Koch, Eising 1999). And society itself becomes recognised as a highly organised and institutionally differentiated web of interaction domains which to a large extend govern themselves, without ‘help’ from professional policy making – but with strengthening reflexive interests and power to act for them, even against ‘official’ policy (Schimank 1996, pp 241-266).

The actual shape of institutional structures that underlie the performance of various domains such as education, legal justice or energy provision is no longer seen as the making of government but as an emergent result of political struggle between various public and private actors which takes place across these former boundaries (Czada, Schimank 2000; Jessop 1997).

For empirical as well as normative reasons policy networks gain attention against this background as the new subjects of political steering (Marin, Mayntz 1991). They comprise relevant actors from various domains who have stakes in a certain policy issue and are powerful enough to make themselves heard. These actors make use of their specific resources (e.g. democratic legitimation, employment opportunities, knowledge, legal rights) in order to contribute to and shape collective problem solving strategies according to their own interests.

Governance studies now take account of the importance of policy networks for the governance of complex societies with functionally differentiated institutions. Their informal mode of negotiation allows for the articulation of problems which transcend particular perspectives and for the organisation of collective action making use of a broad spectrum of different resources (Willke 1998, 109-141; Schneider, Kenis 1996). As such they are

important for problem formulation and agenda setting as well as decision making and implementation and evaluation of policies.

Hence, policy networks also come into view for strategic approaches to sustainable development. Especially the emphasis on integrated problem treatment which is linked to sustainability resonates well with the specific qualities of governance through network interaction. Strategies for sustainable governance therefore focus on initiating and moderating interactive problem-solving across differentiated spheres of concern and competence (Minsch et al. 1998). Since the results of network interactions are strongly influenced by the actors who take part results can be shaped by influencing their composition (Dunsire 1993).

As a specific approach with relation to problem formulation and agenda setting in policy networks methods of deliberative policy analysis have been proposed which intend to break up in-groups of policy-makers and experts in favour of broader participatory processes for policy analysis in which also lay persons and critical experts take part (Fischer 1993).

## Transdisciplinary knowledge production

A similar pattern as in innovation and governance studies is visible in science studies. Scientific disciplines as specialised institutions of knowledge production which are differentiated from societal contexts lose ground in favour of knowledge production in heterogeneous networks. This has been supported by a de-mystification of scientific method as the foundation for its monopoly status in producing legitimate knowledge, 'telling truth to society'. Sociological studies of science have 'revealed' that science is a product of normal social interaction, being influenced by factors such as subjective values, self-interest and institutional contexts (Latour, Woolgar 1979; Knorr-Cetina, Mulkay 1983). On the other hand, with advent of the 'risk society' it becomes recognised that scientific 'progress' does not necessarily solve problems but as well produces new and wicked ones which disciplinary science itself cannot deal with anymore. Sustainability and other more concrete ecological or health issues are examples of this (Beck 1991).

Desillusioning with scientific knowledge production opened the eyes of science studies for different forms of knowledge production beyond and across the specialised institutions of the science system. This led to the recognition that knowledge which orients practical social action and problem treatment processes is indeed being produced in many distributed localities outside of the science system in networks of actors from different domains such as public administration, industry, consulting firms and think tanks, NGOs, citizen initiatives etc. (Gibbons et al. 1994; Nowotny et al. 2001). Also in normative respects this new 'mode 2' of knowledge production is awarded potential for increasing societal capabilities for dealing with 'post-normal' problem settings as sustainable development (Funtowicz, Ravetz 1993; Ravetz, Funtowicz 1999).

In connection with this emerge concepts and methods which deliberately aim at developing the potential of 'transdisciplinary' sustainability research. They focus on the productive organisation of research processes, in which scientists from diverse disciplines and actors from relevant fields of practice cooperate in producing problem oriented knowledge (Hirsch Hadorn et al. ; Hollaender et al. ). Knowledge produced in these settings is regarded as more relevant to the problems of society and more 'robust' in the sense that it is useful for orienting action in real world contexts, not only viable in virtual worlds of laboratories and theories. Especially for sustainability problems that cut across social, technical and ecological dimensions of the world and concern various particular perspectives of actors and societal domains at once, it is deemed necessary to follow such an integrated approach in order to be able to create an understanding of the system of a whole – even it is messier than a theory about an analytically constructed slice of the world (Gallopín et al. 2001).

This movement in the study of knowledge production shows, similar to innovation and governance, a turn from universal principles towards processes of social interaction from which technological, institutional or cognitive structures emerge and by which they are shaped.

## Foresight as macro-nexus

Foresight is about the systematic development of expectations about an uncertain future. As such it is a hybrid process of innovation, governance and knowledge production. Foresight generates knowledge about future developments within a focal area, coordinates the strategies of actors and shapes socio-technological innovation processes by providing orientation. Foresight is thus a hybrid of or at least maintains linkages to all the three research domains mentioned above.

Foresight methodology differs from forecasting by recognising the impossibility to predict the future, especially when it concerns long-term developments of complex systems. The openness of the future substantiates its malleability and aptness towards strategy. “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 about the construction of a range of alternative paths of future development from the contingent interaction of various factors. This type of foresight is also being referred to as the ‘scenario approach’ to system analysis (Gallopín 2002; Berkhout, Hertin 2002). The actual results of foresighting activities, however, are not the fictitious stories about alternative futures as such but the repercussions they have in present interaction processes. This is where it can gain relevance for policy integration. Foresight processes have a reflexive side to them. They shape the developments they are about. As such they can become a strategic device for the governance of socio-technical transformations. The expectation of certain chances may motivate actions which work towards their realisation (self-fulfilling prophecy); expected risks may support preventive actions (self-defeating prophecy). In this sense, the effect of foresight exercises which generate alternative images of the future which contradict each other may be interpreted as a „self-reflecting prophecy“ which points up the contingency of transformation processes and prevents actors from getting locked in strategies which are based on deterministic assumptions.

In Foresight, like in innovation, governance and knowledge production, there is a tendency towards the involvement of actors from heterogeneous fields of expertise and competence. This is important for policy integration on three levels. It can enhance ‘integrativeness’

- of constructed system images and scenarios by integrating theoretical and practical viewpoints from various perspectives.
- of sustainability indicators, assessments and goals for actions strategies
- of strategies to cope with transformation.

At the same time the process itself is already an integrated practice of future exploration through which participating actors learn about their interdependence, worldviews, interests etc. By moving from an emphasis on ‘knowing’ the future to an emphasis on ‘shaping’ through collective anticipation and coordination of actor strategies, foresight actually comes close to what has been articulated as a ‘nexus-arrangement’ in evolutionary innovation studies (van den Belt, Rip 1987). The notion signifies an interaction space where innovation processes (variation) become linked to their wider societal environment and the conditions and requirements for the innovation to become effective (selection environment). These

arrangements allow for selection pressures to be anticipated and incorporated into the design of the innovation before it is probed in direct confrontation with its environment. For both sides, innovators and affected societal actors, it can be beneficial to search for robust designs right from the outset rather than risking failed investments or adverse impacts at the point of implementation. This is the basic rationale for Constructive Technology Assessment and several approaches to 'bridge the gap' between technology promotion and control that have become wide spread in the nineties (Rip et al. 1995; Rip 2002; Simonis 2001).

If foresight is organised in a way to foster interaction of actors influencing transformation processes in order to learn about interdependencies and possible resulting macro-dynamics, it can well be understood as a 'macro-nexus' which provides an institutionalised link between interacting processes of evolution. The sustainability foresight method is explicitly based on such an understanding of the working of foresight processes. In order to exploit the full potential to deal with the peculiar sustainability problems of uncertainty, ambivalence and distributed control, some specifications and upgrading of conventional foresight methods are necessary. These are based on recent developments in innovation, governance and knowledge production as mentioned above. They are briefly listed here and will be described in concrete terms by the following presentation of the sustainability foresight process.

- The focus on sustainability issues requires taking into account empirical, normative and strategic dimensions of transformation. Besides explorative analysis of system dynamics, a systematic account for evaluative issues and practical conclusions in terms of strategies is necessary.
- The focus on sustainability requires also a comprehensive picture of the problem area, including social, technical and ecological dimensions in the action fields of production, consumption and regulation. These should be respected conceptually and in terms of participation of stakeholders.
- Transformation on a sectoral level is embedded in multi-level dynamics including the emergence and linking-up of niche developments as well as developments in the social, technical and ecological landscape in which transformations of sectoral regimes are embedded. These different levels have to be reflected in the development of strategy options.

# The Sustainability Foresight Process

Against the background of the foregoing conceptual considerations we have developed the Sustainability Foresight method for application to the problem of transformation in utility systems. The intended effect is twofold: The first is the production of knowledge about system dynamics, sustainability goals and strategy options which can be used in a broader (political) context to devise collective strategies in dealing with transformation. The second effect are learning processes on the side of the involved actors who come to gain a better understanding of their embedding in dynamic socio-technical contexts and may adapt their strategies accordingly. This includes individual learning as well as 'systemic learning' in the sense of altered discourses and cooperative relations. The second effect is more immediate in so far as it directly affects the actors who 'do transformation' in their daily activities whereas the first is mediated through political discourse and the uptake of project results within it. For the second effect a higher reflexivity of individual strategies can be expected. This may result, on the one hand, in new possibilities through cooperation, and, on the other hand, in avoiding repercussions from narrow problem definitions and respective strategies. For the first effect, knowledge is co-produced from a broad base of distributed expertise and sophisticated procedures of exploration and strategic focusing. It can therefore be expected to deliver a

better understanding of the relevant aspects for shaping transformation than it could be generated by a specialised perspective alone.

The starting points for the process are implicit expectations about the future which are held by different actors. If not reflected in a systematic foresight process, these expectations may translate into agendas and actual socio-technical development without being consciously assessed with respect to their conditions and impacts. These expectations are an input to the process and become critically assessed in systematic scrutiny and group interaction (cf. Grin, Grunwald 2000). For example, expectations about macro-developments are scrutinised by testing the consistency with expectations about the development of certain factors and their interaction. Sustainability is discussed on the basis of a broad array of values that is held by different stakeholder groups participating in the process and estimated impacts of alternative development paths. The long-term perspective strengthens a communicative orientation of the participating actors over a strategic orientation.[3]

Strategically, Sustainability Foresight focuses on the possibilities to shape emerging structures rather than the re-arrangement of structures which already exist. This facilitates to get involved with more radical alternatives as innovation is better able to gain societal support than straight forward attacks on given societal configurations. At the same time the shaping of emerging structures can have strong and long lasting effects. If considerations about certain performances and impacts become successfully incorporated into the design of structures, they work for themselves (Rip, Schot 1999).

## Problem structuring

An important element of sustainability foresight is a thorough adaptation of the general method to a specific field of application. This includes empirical study of structure and dynamics and future expectations that are put forward by actors. In close connection to the empirical study a heuristic concept needs to be developed which can guide the detailed set-up of the process. It shall give a comprehensive account of the various areas that are important in influencing change and impacts of transformation in order not to 'overlook' relevant processes. For the utility systems we have differentiated the following categories which we considered important to give a comprehensive image of transformation:

- Multiple *Sectors* for provision of electricity, natural gas, water and telecommunications, which parallely undergo transformation
- *Action fields* of production, consumption and political regulation whose inherent dynamics as well as their interaction drive transformation
- *Structural dimensions* of values, knowledge, institutions, technology and ecology which in combination enable and constrain patterns of utility provision
- *Levels* of socio-technical organisation like sectoral regimes, niche developments within the regime and changes in the socio-technical landscape in which regimes are embedded.

As a general concept to understand the interaction of patterns within and across these different overlapping categories we resort to "co-evolution" (Konrad et al. 2003; Voß 2004). The heuristic framework made up of the conceptual ground work is useful for a systematic structuring of issues, design of work packages and selection of stakeholders. Especially the

[3] In the long-term uncertainty about one's own position within the discussed field increases. The ‚veil of indifference' supports a construction of future knowledge that is less biased towards individual benefits (cf. Rawls).

latter is important since the participants have a very strong role in defining the substantial contents and results of the Sustainability Foresight whereas the scientific research team takes on the role of a facilitator, moderator and service provider in gathering and structuring information which can be taken up in the process but doesn't have to.

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 such as 'broad variety of perspectives, 'affected by transformation', 'influence on course of transformation'. These criteria are then operationalised by allocating quotas to actors representing the above mentioned categories. Since a lot depends on productive interaction processes recruitment criteria should also include social and communication skills of the persons involved.

In order to be able to link up the topics and images which are discussed in the respective field of practice, sustainability foresight takes societal expectations about the future as a starting point from where actors can be approached and alternatives explored. For the German utility systems we came up with three dominant features of future utility provision that have been discussed in professional communication: a) decentralisation of system structures, b) service orientation up to blurring of the boundary between supply and demand by self-generation, and c) interconnections between or even integration of sectors via products and social and technical organisation. These three features, or 'dimensions of change' as they are referred to in the project, provide an exploration space with 'integrated Microsystems of supply' as a hypothetical extreme where decentralisation, service orientation and interconnection is fully fledged. This vision serves as a background foil for contrasting alternative possible developments.

## Phase I: Explorative scenarios

The objective of the first phase of the process is to develop an integrated image of the utility systems and explore alternative future developments. This has been carried out in a series of scenario workshops with about 20 participants. The participants represented the variety of perspectives from the production, consumption and political regulation in the four sectors. In principle, the specific method applied for the scenario-building process may be adapted to the research question, the resources or other conditions of a specific sustainability foresight exercise. In the following we will briefly sketch the method applied in the project.

As a first step influencing factors along a guiding question were collected in a moderated process. The first rather large sample of factors was clustered and selected according to the principles of uncertainty of their future value and 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 scenario frameworks. These were produced following 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 very heterogeneous perspectives on utility provision.

The ‘creative destruction’ of deterministic visions of future developments in favour of a fan of contingent alternatives 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, but the ambiguity of multiple expectations that may influence general action orientations towards experimenting, adaptivity and cooperation.

## Phase II: 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. When it comes to fundamental questions about the persistence of human life also the legitimacy of democratic political decision making may be called in question. Sustainability goals will therefore always remain ambivalent. What counts is to keep the balance between equally legitimate but potentially conflicting values. 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 and help to identify areas of conflict which need special 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 risks and chances of transformation from the perspective of various actors. Critical aspects can be identified for the development of adequate strategies. This approach to sustainability assessment allows for an operationalisation of the abstract notion of sustainability without passing over inherent ambivalences. 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 and bargaining (cf. Saretzki 1996).

## Phase III: Shaping innovation processes

The focus of the third phase is on the development of strategies to shape transformation. It is impossible to actually steer long-term transformation processes. Too many factors play together in too many combinations. General features of complexity and co-ecolutionary dynamics apply which means that interventions do not have determined effects (Axelrod, Cohen 2000). Through the design of processes from which innovations emerge, however, it is possible to open possibilities or restrict certain unwanted developments. A general approach which increases the chances of sustainable results to emerge from them is to couple innovation into contextual developments at an early stage. This prevents a too narrow

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

perspective which neglects important conditions and effects of innovations and therefore is more likely to cause harmful side-effects. Another approach would be to support innovations which promise to be useful for probing possibly sustainable development paths. Through the shaping of innovation processes it can thus become possible to 'modulate' transformation, i.e. to take up and influence ongoing dynamics without trying to control them (Rip 1998).

The third phase addresses innovations in technology, institutions, and cultural practices which may lead to new configurations in the future structures of utility systems. Concrete strategy options are worked out for critical innovation processes (such as smart building, new schemes of network regulation, self-production of electricity). For these, in-depth analyses of the innovation context and possible dynamics are carried out with the aim to identify possible breaking or branching points in the future and actors who can influence the conditions at these points. This will be done with the help of innovation scenarios which are embedded in the in scenarios for the utility system as a whole. Strategy options are further elaborated in interaction with the actors who are to adopt them.

# Conclusions

I have presented Sustainability Foresight as a method that has specifically been designed for dealing with uncertainty, ambivalence and distributed control in sustainable transformation processes. The method was developed for experimental application in the German utility systems for electricity, gas, water and telecommunications in order to shape ongoing transformation processes. This process has, by now, gone through two thirds of its way. It is therefore too early for a concluding evaluation. Nevertheless, I can discuss some results and come back to the potential of sustainability foresight for achieving policy integration.

The scenario workshops have brought up four alternative scenarios of future utility systems. These peg out the spectrum of possible developments until 2025. One interesting aspect of the scenarios is the breadth of different developments with respect to decentralisation. First, it was soon agreed by the various participants that decentralisation had to be differentiated in a technological dimension and an organisational one. Second, the four scenarios showed all possible combinations of technical and organisational degrees of decentralisation which were worked out as projections of the respective scenario factors. In contrast to an undifferentiated trend towards decentralisation, the process has put in perspective that decentralisation can actually look very differently in the technical and organisational sphere and that both can link up in various forms, i.e. centralised organisation with decentralised technology and vice versa.

We have experienced that participating actors value the opportunity to take part in the process. Many of them claimed that they have gained new insights through looking at the larger picture of long-term sectoral developments in interaction with people from various domains and very different viewpoints. Interactive research with participation of many heterogeneous actors, however, is always a precarious endeavour. It opens the research process towards ongoing dynamics in the field of study, including interest and conflicts. This requires a great deal of flexible and pragmatic adaptation of methods in order to keep the linkages with the 'real world' on the one hand and reduce complexity and balance various views for an integrated picture on the other hand. The Sustainability Foresight method as described here can thus not be taken as a toolkit for straightforward application to any kind of problem domain, but rather as an ideal-typical process arrangement which may inspire and partly orientate the interactive conceptualisation and management of similar processes elsewhere.

In the introduction I have referred to sustainability foresight as an approach of policy integration. Towards the end of section two of this paper this was conceptually specified by reference to the concept of a "nexus" in co-evolutionary development. Through collective

deconstruction and reconstruction of expectations, sustainability assessments and strategy implications foresight provides a common frame of reference for actors who are involved in utility transformation. This frame does not need to be consensual. It is rather expected that it portrays the diversity in viewpoints and assessments of the participating actors. It therefore allows for a high degree of heterogeneity among actors. The general effect is that it enhances strategies which are able to deal with the uncertainty of future developments. And it sensitises actors for mutual interdependence. It does not press heterogeneous actors into an integrative framework but provides a learning space in which co-evolution between interdependent actors – which happens anyway - can be made more reflexive. Shaping expectations about the future in this way, sustainability foresight, can contribute to the consideration of broader developments and indirect impacts in the strategies of governance actors.

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