Facing the dynamics of institutional change – An analysis of socio-technical transformations of municipal utilities

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Abstract

Combining established approaches derived from socio-technical, (neo-)institutional and organizational studies, the paper seeks out for the construction of an integrated mechanism of socio-technical change on the level of the firm. The paper also analyses specific socio-technical transformations of municipal utilities based on an empirical study among all German utilities engaged in the provision of electricity. Therefore, it discusses a basis for actual studies measuring change activities in the utility sector and presents first empirical data concerning the course of its socio-technical change under the influence of macro- and meso-level transformations.

1 Introduction: The German utility sector in a process of dynamic change

The German energy market is subject to a far reaching change. No doubt the sector-specific institutional re-arrangements and new technologies in the energy system have brought municipal utilities under pressure to alter their long-lasting structures. Profound regulatory changes like the European liberalisation directive are pushing new forms of market competition while established guidelines of municipal business activities are challenged by the New Public Management paradigm. At the same time, new technologies achieved their readiness for marketing and are now diffusing in the market rapidly. These enfold energy-efficient and climate-friendly forms of energy generation (e.g. gas and steam cogeneration plant, renewables) as well as advanced IT systems offering profound opportunities in data monitoring or energy provision on the stock market. In order to defend market shares and ensure the survival of the firm, municipal utilities will have to alter established guiding principles and management paradigms as well as organisational structures, operational activities and nonetheless the technologies for generating and distributing energy. This raises the question which aspects in particular are subject to change, how and to which extent utilities are living up to these tasks and how successful these changes are with reference to efficiency measures.

To deal with those tasks, the paper aims at different aspects of socio-technical transformation with a special regard to institutional change. It addresses four research questions:

1. **How can socio-technical change be analyzed integrating macro-, meso- and micro-level of institutional settings?**
2. **Which transformation dimensions are relevant for municipal utilities coping with the institutional change and structural constants of the sector?**
3. **To what extend do utilities already compete in socio-technical change processes and where are synergies between the elements?**
4. **How can we measure the efficiency of structural transformation with regard to new institutional arrangements on the sector level?**

In a first step, I develop a functional mechanism of socio-technical change in regulated sectors integrating different theoretical approaches. Focussing on the analytical level of the firm, both where often studied in separated research steps in the past. Organisational structure, the technology in-use and institutional aspects like norms are closely intertwined. This leaves a gap for a new approach of combing these factors. Instead of studying them separately, I strive for a synthesis in an approach focussing on socio-technical change under the constraints of institutional impacts of the sector level and on integrating institutional aspects into specific socio-technical trajectories. Therefore, I combine established approaches from socio-technical and (neo-) institutionalism research as well as organizational studies. In a second step, I define and discuss three categories of sector transformation most critical to the German utilities. The paper presents sets of indicators for an analysis of the posited socio-technical transformations. These include strategic diversification strategies, forced service orientation and especially greening strategies of utilities. Descriptive data are presented in a third step to show if and where socio-technical change has already taken place. In a fourth step, I focus on efficiency measures with regard to distinct transformation strategies in the market. As this is still subject to ongoing research, this part contains a brief outlook on sector-specific measuring problems and solutions.

2 Theoretical background: Socio-technical transformation as multi-level change

(Neo-) institutionalism as background for sector-based and organizational change

Stressing the regulative frame of the energy sector as well as the definition of functions municipal utilities commit to, institutional theory is a promising starting point for a socio-technical analysis. Defining institutions in the sense of routines, norms and rules (Jansen 1996), they become a guiding principle for motivated action. Institutions therefore organize and constrain the opportunities of individual and collective actors (Nelson/Nelson 2002). Talking about the modes of institutional change, Thelen and Steinmo propose that there are four possible causes for its dynamics: Changing socio-economic frames, the entrance of new market actors, institutional transformations provoked by external changes and the adoption of individual strategies with regard to broad-based institutional change (Thelen/Steinmo 1992). Taking a closer look to the intertwining of institution and action, it seems obvious that in the analysis of both aspects institutions might serve as an independent as well as a dependent variable (Schulze 1997). This differentiation can be found especially in contrasting the different levels of institutions.

On a macro- and meso-level, the organization is subject to national or sector-based structures enabling and constraining their ability to behave innovative and change existing modes of organizational action (Carlsson 1994, Edquist 1997, Lundvall 1992, Soskice 1999). These approaches build a framework for regulative theory positing that macro- and meso-level redirection pursues the relevant actors to adapt to new tasks or even enables them to implement strategies of permanent organizational and technological renewal. Even if the starting point of transformations is often on a local level, it needs state actors taking binding decisions followed by legislation to spread a transformation like the usage of innovative technologies or new modes of governance among a whole sector. (Berkhout 2003). With regard to the municipal utilities in Germany, we found that the revision of the regulative framework indeed had a significant effect on the technology-in-use as well as on different operative areas (Barnekow/Jansen 2006).

On the micro-level of the organization, I follow neo-institutionalism to explain the function of explicit and even implicit rules and norms as an integrative part of subjects altered by regulative change. Here, institutions are individual guiding principles or "myths" for actions of an organization (Meyer/Rowan 1991). By adapting to sector-specific rules, organizational actors gain legitimacy for their actions. In addition, the Actor-Centered approach of Institutionalism gives insight into institutional arrangements and their impact on actors by focussing on different adoption strategies of the actors involved. It shows that institutional arrangements and their impact on actors can be analysed by focussing on the coping strategies of the actors themselves. For example, organisational actors search for rational profit-maximising outcomes within the boundaries set up by institutional arrangements (March 1991, Siggelkow/Levinthal 2003). In this view, interactions within the system are conscious decisions and taken for granted routines of individual actors committed to norms. Exposed to national and sector-based regulatory dynamics, organisations struggle to achieve consistency between the new overall norms and the norms and identity of the organization (Brunsson/Olsen 1997).

Socio-technical practice: Multi-level-matching and the impact of persistence

To understand how socio-technical transformations proceed on the level of the organization under the influence of macro-institutional and technical change, we first need to take a look at organizational theory. According to contingency theory, the precondition of the survival of organizations is its ability to adopt its structures to changing environments to achieve efficiency gains (Kieser 2002). Therefore, organizations define their "situation" and develop strategies to adoption in accordance to their formal structure. Typical subjects to change in the environment are universal and sector-specific technological changes which provoke the change of the organization (Hatch 1997, Kitschelt 1991). Searching for a match with environmental change, organizations have to alter their operative strategies as well as the technology-in-use. If and how organizations are able to react to changing conditions then depends on their abilities to identify the need for change and to put change into practice which is described under the terms of "slack" (Jansen 1996) or "absorptive capacities" (Cohen/Levinthal 1990). To match the environment to their structure, organizations will have to use specific strategies of change which depend on the allocation of resources within a sector. As these are normally allocated asymmetric in markets, we can expect to find different strategies of coping and different combinations of established structures and new elements.

While traditional contingency theory marks a rather deterministic path of explaining the intertwining of macro- and meso-level changes with organizational patterns, I plead for a more open conceptualization considering the active engagement of organizations forming distinctive strategies. Following the idea of strategic choice (Child 1972), external factors do not determine strategic decisions, but build contextual backgrounds for organizational decisions which also affect the environment. The "social shaping" of contingencies in the environment gives the organization a more active part. For example, if we understand the key contingency technology as a social project shaped by its human stakeholders like organizations using specific machines or operations (McLoughlin 1999, Rammert 2000), the outcome partly follows their own quality factors and strategies instead of determining their actions.

If we combine these findings with the notion of macro- and micro-level approaches to (neo-) institutionalism mentioned above, we can state that institutions are an integrative part of socio-technical transformations as well as technology and operative patterns. In a macro-perspective, together with the development of universal or sector-specific technologies, institutions in the form of regulative policies force the socio-technical change of the organization, e.g. by setting incentives to invest into specific technologies (Monstadt/Naumann 2005). In a micro-perspective, institutions in the form of norms and rules are themselves part of the socio-technical transformation (Dolata 2007).

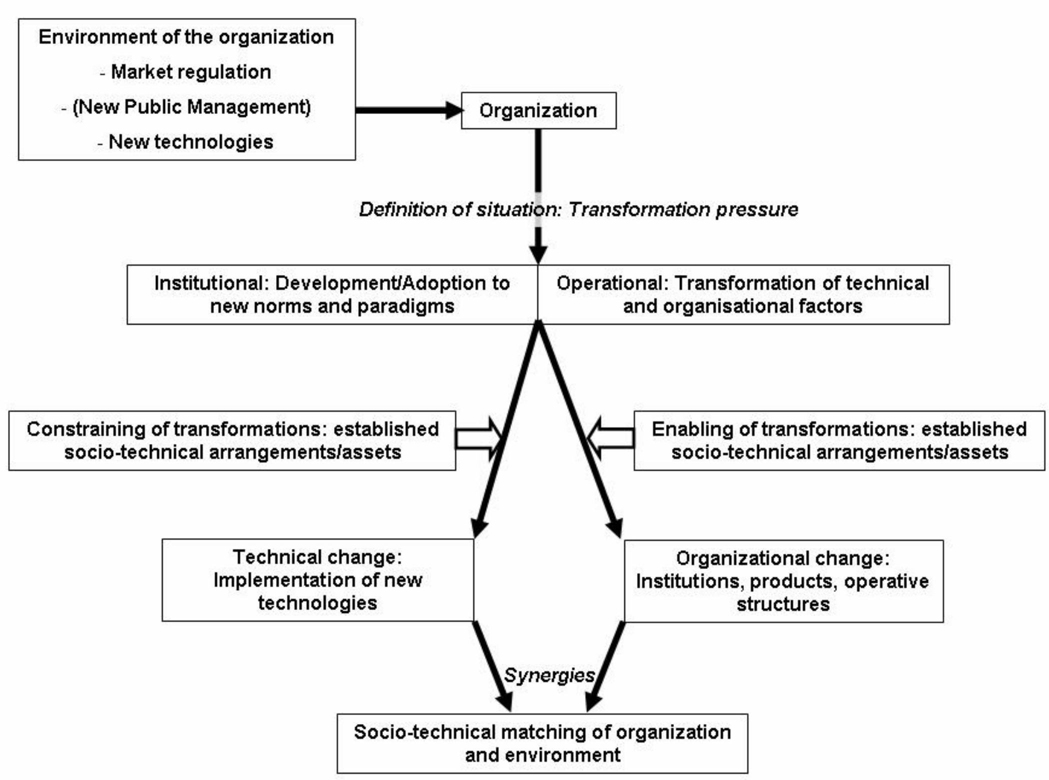
Altering established configurations, the myths as integral part of the organizational structure have to change as well and provide the fit with technology and operative aspects. To sum it up, I state that technology, institutions and organizational patterns might follow the concept of co-variation here (Kitschelt 1991). Instead of regarding their transformation as individual processes, this perspective assumes a synchronous adjustment of elements which might be indicated by homogeneous adoption rates in each dimensional partition.

Nevertheless, with a close look on the different matching strategies we might find that sometimes no linear or simultaneous change takes place, but that established structures in dimensional partition resist against technological or institutional transformation pressure coming from the outside of the organisation. As this paper focuses on municipal utilities, the particularities of net-bound supply systems must be taken into account. Large Technical Systems-theory (LTS) provides us with the insight that transformational paths are bound by established structures (Hughes 1987). The LTS impacts especially vertically integrated firms like utilities (Teece 1990). This can be characterised by the interdependency of technical and non-technical systemic components which is responsible for both positive and negative reactions facing transformation pressure. Transformations are hindered as the coupling is setting up inertia to paradigmatic changes. But transformations get also fostered by established components in a tight coupling that especially spur the advancement of prevailing organizational elements due to the clear-cut specifications. Exploiting the incorporated knowledge of an organisation leads to the same ambivalent outcomes. Organizations use established search routines, frames of references and core competencies to generate new knowledge or operative solutions (Bijker 1997, Malerba 2002). This might help a firm to develop tested and reliable solutions at a manageable amount of transaction costs, but following traditional search strategies might blur the vision towards more radical innovations.

Synopsis: Functional mechanism of socio-technical change

Recapitulating the profound importance for operative structures and implemented technologies, we can state that institutional variables are an integrative part of socio-technical change. The following *figure 1* shows the functional mechanism of the interplay of technology, operative aspects and institutions in transformation processes of organizations. A central trigger effect for change lies in the environment of the organization. New macro- and meso-specific regulations and technologies developed outside the organization put the utility under pressure to refine its own situation and to develop coping strategies. On an institutional level, the organization reacts with the adaptation of new norms and paradigms extracted from external changes. On an operational level, it affects the technology-in-use and structures of the organization. Both transformation levels are influenced by established socio-technical arrangements like networks which represent sunk costs enabling specific change processes while restricting others. As outcome, the concrete technical change contains the implementation of new technologies. On the other side, changed institutions, operative structures and a revised product portfolio build the organizational change which might occur in co-evolution. Both finally implemented, their internal matching forms synergies like cost efficiencies. In a last step, the fitting of the new socio-technical arrangements can be rated by efficiency- (e.g. is the organization working more cost- or environmentally efficient than before?) and normative measures (e.g. to which amount did the organization adopt to the politically predetermined goals?).

Figure 1: Functional mechanism of socio-technical change with regard to external and internal institutional factors



3 The energy market on the move: New market regulation

Before getting into the description of sector specifics, I give a broad overview of the most influencing regulations in the market.

German municipal utilities got exposed to market pressure for the first time with the new Energy act in 1998 which followed the guidelines of the EU electricity directive. The central key issue was the accommodation to open former monopolistic supply structures to establish end-user eligibility. The act contained free entry for electricity generation, free entry to the end user market, management unbundling and separate accounting as well as regulations of third party access to the grid. Market liberalisation also fostered the privatisation of utilities while also offering them more opportunities in the provision of energy.

The regulatory impact was again increased by the amendment of the energy act (EnWG) in 2005. It set profound regulations for unbundling and price caps for net annuities. With the advent of ex-ante regulation of net fees, a pressure to alter priorities arose which even changed the existing value chains (Walz 2001).

Talking about changing operational routines and norms under the light of the market regulation, the consequences of implementing the New Public Management (NPM) must be taken into account. Even if it does not function as a direct regulative instrument, it impacts the transformation of utilities. The term marks the new paradigm in the public sector towards managerial governance patterns (Elsner 2004). These partly displace established security-of-supply-myths as utilities get under pressure by cost-reduction strategies in the municipal sector. It therefore may force utilities to act more in accordance with economic efficiency and organisational streamlining than in the past. Another important element of NPM is the enforcement of customer orientation that forces municipal utilities to reconsider their service strategies.

On the other hand, regulated feed-in fees for renewable energy sources (RES) and combined heat- and power-production (CHP) constitute supply-side regulation. Regarding RES, the new Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz EEG) of 2000 and its amendment in 2003 forced the electricity suppliers to pay a fee for the electricity produced by renewable energy sources above the market price. Every kWh gets a refund ranging from 3,70 ct for hydroelectric power plants with capacities above 50MW up to 62,4 ct for small solar power stations. Concerning CHP, a new CHP act (Kraft-Wärme-Kopplungsgesetz KWKG) was enacted in April 2002. Its principal aims are to avoid the shut-down of existing plants, support the construction of new plants, and promote innovative energy technologies. This is to be achieved by a bonus granted for co-generated electricity similar to the practices regulated in the EEG.

4 Identifying transformation dimensions in the energy market: From absorptive capacities to absorptive action

After describing the theoretical matching of technology, organization and institutions in section 2, this section focuses on an analytical framework of socio-technical change of utilities containing all three aspects. In recent years, a few studies already went in for the analysis of transformations in the energy sector (Bauknecht/Bürger

2003, Konrad et al. 2004, Truffer et al. 2004). Although these studies already offer valuable insights for constructing relevant transformation dimensions, the emphasis of concrete organizational specifics instead of a sector-based focus demands for a careful revision of relevant dimensions and indicators.

With regard to the existing sector-specific studies and the assumptions extracted from market regulation mechanisms and NPM theory, I discuss three dimensions centred on the actual transformation opportunities of municipal utilities.

Overall trends

I define two overall trends putting the utilities under transformation pressure in different aspects. First, decentralization marks an important strategy of utilities affecting nearly all kinds of operative action. With increasing market competition, a former homogeneous supply area is strategically divided by means of customer groups or areas with different load profiles and needs (Moss 1998). It gets support from NPM in which decentralization is part of the new governance paradigm for public administrations and companies (Elsner 2004). With respect to the energy sector, Truffer et al. identify changes on the level of centralization for technical and organisational aspects which are closely intertwined (Truffer et al. 2004). They also analyse a close adjustment between centralized and decentralized aspects in the sector which militates in favour of integration between established elements of the net-bound industry with new decentralized elements. For an operationalization stressing organization-specific aspects, these findings will be taken into account.

Second, cooperation and pooling of knowledge or assets become a must in a market with increasing uncertainties to implement new elements (Jansen 2006, Malerba 2002, Nyblom et al. 2003). They allow especially smaller municipal utilities to deal with the tasks of market liberalisation and the regulative framework of the Energiewirtschaftsgesetz (EnWG). Two main aspects of these new networks in the form of bilateral cooperation, local consortia of utilities or shares of regional- or transmission net operators help to cope with these tasks. Market liberalisation sets incentives for investments, e.g. own generation capacities which might be not affordable for sole municipal utilities. Cooperation networks allow for the needed new economic resources (Coombs et al. 1996). Sharing the investments, municipal utilities achieve economies of scale even for larger generation or network projects.

Apart from financial resources, a motive for cooperation is the search for know how (Edelmann/Nickel 2003). Relevant informational exchange of utilities concerns investments as well as best practice in distribution or the obligations to report to the Federal Network Agency (Bundesnetzagentur BNetzA). They account for an important crossing between a meso-level of sector governance and the micro-level of the organization (Jansen 1996) which make them a central aspect for analyzing transformation influences.

In compiling the different transformation dimensions, each of these two factors must be now formulated as part of the set of indicators.

Strategic diversification

In a liberalized market, utilities are not bound to distribution of energy anymore. Emancipating from less transparent full supply contracts with transmission network operators (Rosen 2004) and given the opportunity to trade energy outside the own supply area, the value chain is changing (Walz 2001). Municipal utilities might therefore seek for new opportunities in the market for broadening the portfolio and the employment of technologies.

- The implementation of fossile-fueled generation capacities like traditional coal-fired- and energy-efficient CHP plants is part of the technology-specific part of this dimension, because these forms of energy generation offer large-scale capacities which allow using it for selling energy and therefore exploiting a new path in a diversifying product range. For a large number of utilities these generation projects are a main future task, especially the sharing of new large-scale facilities (Ernst&Young/VDEW 2006).
- New balancing power systems allow a more efficient load adjustment. Cooperative utilities connect their generation capacities to balance peaks and drains on a regional level. Furthermore, utilities can now use the advanced technical systems to appear as a balancing power seller. This will be a profitable investment as balancing power is expected to grow in the next years (Blesl/Fahl 2005).
- As utilities tended to behave passively dealing with questions of energy provision before the market liberalisation, new opportunities alter the utilities` strategies towards diversification. Instead of using full supply contracts of upstream providers, the usage of the advanced energy trading instruments has become a critical factor for success (Ellersdorfer/Kemfert 2001). The European Energy Exchange stock offers the possibility of day-to-day and future trading of energy. Over-the-counter-activities with free traders also enhance the chance to diversify the portfolio. Diversification may also take place in the selling of energy. Due to market liberalisation, utilities are relatively free to sell their energy outside of their traditional service area.
- As part of a diversification strategy, the extension of sources of information is highly relevant in a competitive market. Therefore, strategic decisions might be discussed in broader circles of energy market-related actors. Apart from informational cooperation, the operative teamwork is gaining importance as well. Especially shared-service strategies in network operation function as part of a diversification. New common and specialised network companies adduce the services for their affiliates reducing costs. The utility owns part of it while being the customer of its services.
- Two factors might be used as indicator for the institutional implementation of a socio-technical diversification strategy. With the market liberalisation and formal privatization of utilities comes the possibility to adapt to private sector rules in defining tasks and goals of the utility. This might leave room to identify new opportunities in the market enhancing the portfolio and areas of activity. Second, a commitment to a higher risk assumption concerning the future investment areas might be seen as a precondition for new more widespread activities in a fast and volatile market.

Greening

There are two trigger effects in the market pushing greening strategies. Conceptualized as economic-technical and institutional-cultural aspects, they are both part of this dimension (Mol/Spargaaren 2000). On the one hand, municipal utilities are trying to gain financial profit by using the feed-in-fees which are part of the incentive-based market regulation forcing renewable energies. On the other hand, they often have to commit to an environmental policy forced by municipal shareholders, e.g. as part of the Agenda 21 strategy.

- The feed-in-fees for RES catalyzed the diffusion of new forms of energy production. Apart from zero-emission-technologies like wind, water or photovoltaic, biomass- and biogas facilities offer high potentials especially in the utility sector. These plants use CHP operation which is a core competence of utilities. But there also might be difficulties for the diffusion of biomass- and biogas plants especially due to uncertainties in combustible supply (Thrän 2004). The utilities operating mainly on a local level need long-lasting contracts e.g. with farmers to ensure the security of supply. This accounts for regional differences in exploiting this new technology.
- Environmental management systems serve as a kind of "script" for the engagement of a utility in greening strategies. Committed to defined standards (e.g. ISO 14001, Öko-Audit), they comprise the whole planning-, accomplishing- and optimization process of environmental activities which makes them an important part of this dimension.
- Together with new technologies and energy efficient practices organizations arose concerned with the diffusion of climate friendly solutions (e.g. Bundesverband Windenergie BWE, Arbeitsgemeinschaft für sparsame Energie- und Wasserverwendung ASEW). Utilities interested in their employment could use the membership to gain best-practice guidelines and to ensure its representation of interests in the political sphere.
- In order to differentiate the commodity energy, the offering of green energy is an option promoting carbon-free energy production and in some cases even regionalism. Additionally, the overall activities in offering climate friendly products will be taken into account.
- With a view to the institutional factor, a self-assessment of the relevance of climate protection activities for the utility gives insight to the prominence of this theme.

Service orientation

Owning a potential volume of 2 billions Euro a year (Trend Research 2003), services in the energy market play a profound role. Utilities might tend to search for enhanced customer orientation and cost efficiencies and at the same time confront external institutional change. Services are combining both by providing operative synergies and tailor-made solutions. In the past, utilities were not able to match some important socio-technical aspects. Investments in IT-based customer relationship management after 1998 could not enfold a significant influence for gaining new customers as institutional factors as a strategic customer orientation did not evolve at the same time (Steria Mummert/F.A.Z. Institute 2005). Today, utilities possess differentiated possibilities to get an enhanced service orientation into action.

- Looking at core technologies relevant in this field, the usage of IT- or energy data management systems respectively is indicating an enhanced service orientation of the utility. They build the starting point for innovative services in measuring, accounting or controlling customer's facilities. Municipal utilities engaged in energy efficiency depend on a reliable and detailed database of load profiles to optimize its structures (Geißler 2005).
- These energy systems often get combined with decentralized energy production facilities, mainly Micro-CHP for single housing blocks or factories. In this technical field, there has been much improvement in recent years allowing its widespread use. With closeness to Contracting services, its users are often special contract customers which buy full-service solutions combining the delivery of energy with value-added services like maintenance. In the light of reduced net fees, Micro-CHP offers the potential to build up own generation projects while reducing net costs at the same time (Leprich 2004). On the other hand, limited economies of scale could hinder the engagement if the building up of know how is inefficient with a view to a limited number of possible local projects.
- The distribution of energy remains highly relevant to municipal utilities even after the market liberalisation. But to some extend, the possibilities are limited due to a bordered area of supply or high costs of developing new distribution strategies. At the same time there is a lack of know-how, e.g. in the field of Contracting. Cooperation between single utilities or as part of a regional network can help to overcome this persistence. Networking helps to achieve economies of scale and even economies of scope by sharing best-practice and costs for new service offers. This engagement can even lead to common products: an example is a regional umbrella brand labelling energy services of the participants.
- We have to differentiate the group of customers to get to know more about the service orientation of a utility. Different from private households, business clients or major customers in general use the option of changing energy suppliers and contracts more often as energy is a more relevant cost factor for them. Besides, they possess a better leverage for bargaining offers. Apart from that, business clients are a target group for enhanced services as they nowadays focus more and more on their core activities by using outsourcing solutions (Bauknecht/Bürger 2003). If utilities possess a low share of private household customers, it shows that they took much effort in a service-driven customer group and in producing individually fitted solutions.
- Apart from a general broadening of the service portfolio, Contracting activities as part of an enhanced product range indicate a serious position of this socio-technical dimension. With respect to core competencies utilities can build on, Contracting seems a favourable option for utilities to enhance their service portfolio as it merely grounds on the traditional know-how of CHP plant-operation as well as on a long-lasting customer relation. Contracting normally comprises the bundling of technology and services. Within a framework of a Contracting agreement, utilities install small-scale plants, ensure the supply of electricity and heat and attend the energy production with services like load measuring and facility management. These new services got a potential to enhance customer loyalty by constituting this combination of physical assets and services (Voß et al. 2003). On the other side, sunk costs found in the net infrastructure can also obstruct investments in this new form of

energy distribution (Barnekow/Jansen 2006).

- A stronger commitment to consumer orientation serves as the institutional indicator in this dimension. We must consider the special qualities of bonding customers. As customers tend to differentiate and create a diversified demand around the core product of energy, customer orientation gets one of the most relevant aspects of service orientation.

Table 1 shows all three transformation dimensions together with their indicator sets. As the indicators touch operative activities and the usage of technologies, it relies on statements concerning the activities within the next years. For a more precise differentiation of operative indicators, these are split into "internal structures" and "product range".

Table 1: Actual transformation dimensions of municipal utilities

Transformation dimensions	*Indicators*	
Strategic diversification	*Technology*	*1. New coal fired plants/CHP (stand alone/shares)* *2. Balancing power systems*
	Operative: internal structures	*1. Diversification in energy procurement* *2. Informational exchange: Regional utility groups, other utilities etc.*
	Operative: product range	*1. Energy sales outside of the own network area* *2. Shared service/cooperation in network service*
	Institutional change/norms	*1. Adoption to private sector rules* *2. Commitment to risk assumption concerning the utilization of innovations*
Greening	*Technology*	*1. Renewable energies (wind, photovoltaic, biogas etc.)*
	Operative: internal structures	*1. Environmental management systems* *2. Organization affiliation (RES, energy efficiency)*
	Operative: product range	*1. Green energy sales* *2. Activities in offering climate friendly products*
	Institutional change/norms	*1. Rating of climate protection activities*
Service orientation	*Technology*	*1. Energy data management systems* *2. Micro-CHP*
	Operative: internal structures	*1. Cooperation in distribution* *2. Small share of private customers*
	Operative: product range	*1. Build-up of Contracting solutions* *2. Enhancement of service portfolio in general*
	Institutional change/norms	*1. Stronger commitment to consumer*

5 Data Collection

The design is based on a survey of all local municipal utilities active in the electricity supply which were selected for a mailed questionnaire. It assembles data of legal forms, organisational integration and size of German firms. These were identified using two databases:

a) A DVD provided by the German business intelligence firm Creditreform (Markus DVD).

b) These data were compared to the members of several associations of municipal utilities. This resulted in the addition of some smaller utilities which are often not legally independent firms. All in all, 623 local utilities that are active in the supply of electricity were identified.

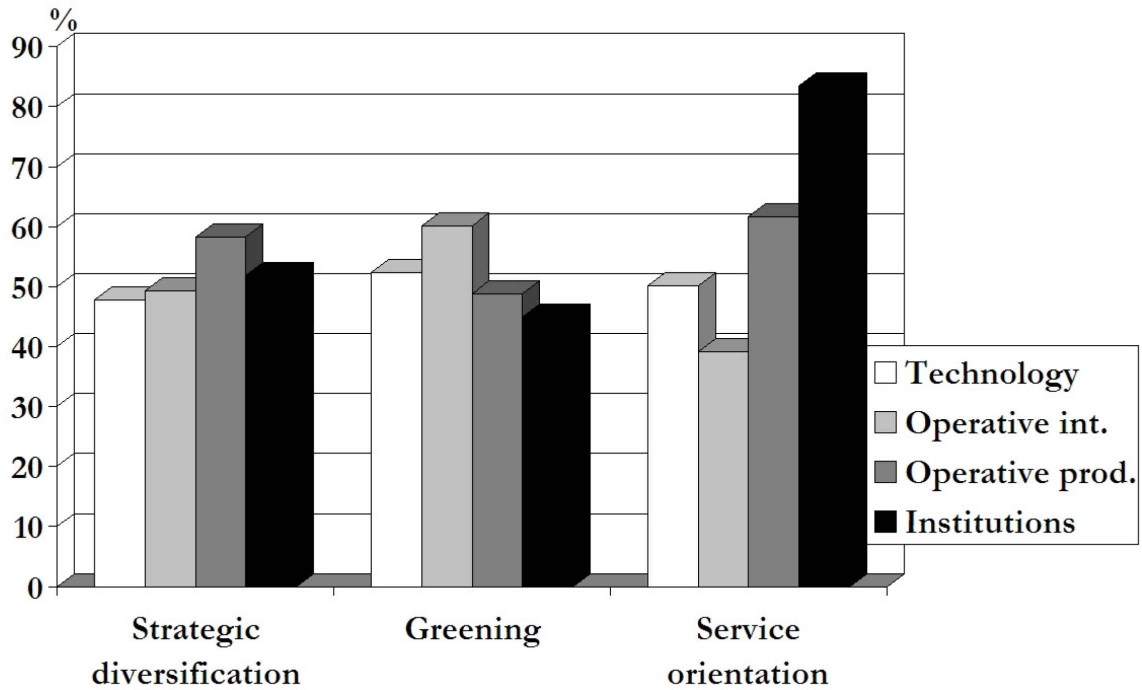
These utilities were approached with the mailed questionnaire addressed to the management director. The survey was conducted between March and April 2006. Rate of return is approx. 21% (n=129). There is a small bias in the sample concerning the size of the municipal utility which favours larger utilities (> 200 employees, area of supply > 100.000 persons). The sample represents all regions in Germany.

6 Transformation in practice: Reverse salient and synergies

First I use basic descriptive analysis to gain insights into the state of transformations. Before starting the analysis, some new dummy variables were coded to avoid bias[1]. Especially according to the different databases, the population differs between n=103 and n=638. In a second step the arithmetic mean was built for each sub dimension to picture the state of transformation on the level of municipal utilities.

Figure 2 shows the different characteristics of the subsets comparing all three dimensions.

Figure 2: State of transformations



In general, we can state that the average rate of transformation on each dimension is about 50%.

There is a relatively symmetrical picture of the state of transformation between the dimensions. The theoretically assumed co-variation of different dimensions in adapting to macro- and meso-level institutional change therefore seems obvious. Concerning the dimension of strategic diversification, the values differ within a range of about 10% with technology (47.85%) and operative aspects on the level of products (58.27%) at its ends. For the greening dimension, the difference between 44.88% for the institutional transformation and 60.10% for the transformation of operative structures on the internal level is also quite small. But with a closer look on the dimension of service orientation, there are obviously specific persistences which might work as reverse salient. While technology and operative structures got values amongst 39.20%

[1]For instance, as the original data contains variables concerning the different forms of RES – which will be used in detail in further analysis – these got reduced to a binary coded variable discriminating between an active engagement in exploiting RES technologies and no engagement in this field. By doing so, I avoided an incomparable low rate for the technology dimension as the engagement is highly selective here.

and 61.70%, the institutional sub dimension reaches up to 83.46%. A differentiation between "talk" and "action" (Brunsson/Olsen 1997) of municipal utilities exist here. Municipal utilities commit to norms more than living up to it. The new set of norms by NPM therefore seems to be more effective in this transformation dimension than the pressures of competition on operative business forced by market liberalisation.

Using a factor analysis in a second step, we can identify the theoretically assumed synergies between the four dimensional elements. For instance, the implementation of balancing power systems, diversification in energy procurement, energy sales outside the own network area and the adoption to private sector rules load on one factor. A second factor contains the engagement in fossile-fueled generation capacities, informational exchange with other municipal utilities and formal cooperation in generation projects. It approves the assumption of the impact of networking for engagement in large-scale generation technologies which depends on economies of scale and knowledge exchange between the municipal utilities.

7 Outlook: New efficiency measures under the light of meso-institutional change

With a view to contingency theory, matching of technology and operative structures takes place to increase the overall performance of organizations facing changing structures. The determination of the organizational efficiency[2] therefore becomes a must to benchmark states of socio-technical transformations. To determine the impact of these transformations, we need to consider reliable measures. Here, together with the institutional change of the sector by setting up new regulations, come new possibilities.

Measuring efficiency of municipal utilities is quite more difficult than analyzing firms in completely private sectors. Following a municipal commitment and the directives of its municipal shareholders, utilities usually have to engage in non-profit activities as the build-up and operation of public baths. This marks a difficulty in choosing standard efficiency measures like company results. Relying on the comparison of energy pricing, there is also a difficulty due to the net-bound infrastructure. It highly differs between the municipal utilities e.g. regarding the length of networks and number of transformers in use. End user prices reflect these aspects which permits the usage of energy pricing as significant indicator.

The informational duties referring to the EnWG offers new possibilities. To determine allowances for future ex-ante regulation, the Federal Network Agency and the ministries of economics in the federal states already started to control network charges in 2006. The individual amount of their reduction might now be used for an indicator. As it only allows conclusions concerning the efficiency of the net infrastructure it needs to be combined with additional indicators referring to energy generation or -distribution activities.

A better "overall indicator" for efficiency evolves due to the onward deregulation of energy prices. As part of market liberalisation, the energy pricing traditions of the German energy sector break up. With the decontrol

[2] I refer to economic efficiency here as it is a key variable to indicate the survival of the municipal utility for the future.

of standard tariffs legal from August 2007, municipal utilities are freed from formal price maintenance. With a look at the changing rates which are already published, a bigger spread can be expected for the future (Verivox 2007). A relative stability of standard tariffs for electricity could mark efficiency gains in adapting to institutional change as the utility found solutions to cope with decreasing network charges and raised energy provision costs. This allows for more detailed insights into efficiency levels of the municipal utilities.

These indicators will be used for more detailed analysis in my further research to socio-technical transformations.

8 References

Barnekow, S. and D. Jansen (2006), "Local utilities coping with the transformation of the energy market and their role fort the diffusion of climate friendly technologies." *FÖV Discussion Papers* 36.

Bauknecht, D. and V. Bürger (2003), „Report zur Entwicklung des Versorgungssektors Strom." *Report of the joint project "Integrierte Mikrosysteme der Versorgung" as part of the research programme "Sozial-ökologische Forschung" des Bundesministeriums für Bildung und Forschung BMBF.*

http://www.sozial-oekologische-forschung.org/_media/Mikrosysteme-Report_Strom.pdf

Berkhout, F., A. Smith and A. Stirling (2003), "Socio-technical Regimes and Transition Contexts." *SPRU Electronic Working Paper* 2003/3.

Bijker, W. (1997), *Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change*, Cambridge, Mass.: MIT Press.

Blesl, M. and U. Fahl (2005), "Der europäische Strommarkt im Spannungsfeld zwischen Klimaschutz und Liberalisierung." *Zeitschrift für Energiewirtschaft* 29(4): 289-300.

Brunsson, N. and J. P. Olsen (1997), *The Reforming Organization*, Bergen: Fakbokforlaget.

Carlsson, B. (1994), "Technological Systems and Economic Performance." in M. Dodgson and R. Rothwell (Ed.), *The Handbook of Industrial Innovation*, Aldershot and Brookfield, VT: Edward Elgar, 13-24.

Cohen, W. M./Levinthal, D.A. (1990), „Absorptive Capacity: A New Perspective on Learning and Innovation." *Administration Science Quarterly* 35 (1): 128-152.

Coombs, R., A. Richards, P. P. Saviotti and V. Walsh (1996), "Introduction: Technological Collaboration and Networks of Alliances in the Innovation Process", in R. Coombs, A. Richards, P. P. Saviotti and V. Walsh (Ed.), *Technological collaboration: The dynamics of cooperation in industrial innovation*, Cheltenham: Edward Elgar, 1-17.

Dolata, U. (2007), "Technik und sektoraler Wandel. Technologische Eingriffstiefe, sektorale Adaptionsfähigkeit und soziotechnische Transformationsmuster." *MPIfG Discussion Paper* 07/3.

Edquist, C. (1997), *Systems of Innovation. Technologies, Institutions and Organizations*, London: Pinter.

Edelmann, H. and M. Nickel (2003), "Erfolgreiche Strategien für Stadtwerke und regionale Versorger." *Energiewirtschaftliche Tagesfragen*. 53 (7): 460-464.

Ellersdorfer, I. and C. Kemfert (2001), "Strategieoptionen von EVU im liberalisierten deutschen Elektrizitätsmarkt." *Wirtschaftswissenschaftliche Diskussionsbeiträge der Universität Oldenburg* 231-01.

Elsner, M. (2004), "Vom regel- und verfahrensorientierten Staatsdiener zum ergebnisorientierten Public Manager." *Wissenschaftliche Diskussionspapiere des Bundesinstituts für Berufsbildung Bonn.*

Ernst&Young/VDEW (2006), „*Stadtwerkestudie 2006. Erste Erfahrungen mit der Regulierung und aktuelle Themen der Energiewirtschaft*", Düsseldorf.

Geißler, M. (2005), "Energiedienstleistungen im Lichte des EU-Richtlinienvorschlags zur Endenergieeffizienz." in *Energie effizient nutzen: Klima schützen, Kosten senken, Wettbewerbsfähigkeit steigern*, Sonderpublikation der Volkswirtschaftlichen Abteilung, KfW-Bankengruppe.

Hughes, T. P. (1987), "The Evolution of Large Technological Systems", in W. E. Bijker, T. P. Hughes and T. J. Pinch (Ed.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, Cambridge, Mass.: MIT Press, 51-82.

Jansen, D. (1996), "Nationale Innovationssysteme, soziales Kapital und Innovationsstrategien von Unternehmen." *Soziale Welt* 45 (4): 411-434.

Jansen, D. (2006), „*Organisationssoziologische Theorien. Traditionen und aktuelle Diskussionen.*" FernUniversität Hagen, S. 135-158.

Kieser, A. (2006), „Der situative Ansatz", in A. Kieser and M. Ebers (Ed.), *Organisationstheorien*, Stuttgart: Kohlhammer, 215-264.

Kitschelt, H. (1991), "Industrial Governance Structures, Innovation Strategies, and the Case of Japan: Sectoral or cross-national Comparative Analysis." *International Organization* 45(4): 453-493.

Konrad, K., J.-P. Voß, B. Truffer and D. Bauknecht (2004), „Transformationsprozesse in netzgebundenen Versorgungssystemen. Ein integratives Analysekonzept auf Basis der Theorie technologischer Transitionen."

Report of the joint project "Integrierte Mikrosysteme der Versorgung" as part of the research programme "Sozial-ökologische Forschung" des Bundesministeriums für Bildung und Forschung BMBF. http://www.sozial-oekologische-forschung.org/_media/Mikrosysteme-Transformation_dynamics.pdf

Lundvall, B.-A. (1992), *National Systems of Innovation - Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

Malerba, F. (2002), "Sectoral Systems of Innovation and Production." *Research Policy* 31: 247-264.

March, J. G. (1991), "Exploration and Exploitation in Organizational Learning." *Organization Science* 2(1): 1-13.

McLoughlin, I. (1999), *Creative Technological Change. The Shaping of Technology and Organisations,* London, Routledge.

Meyer, J. W. and B. Rowan (1991): "Institutionalized Organizations: Formal Structure as Myth and Ceremony", in Powell, W. W. and P. J. DiMaggio (Ed.), *The New Institutionalism in Organizational Analysis*, Chicago: University of Chicago Press, 41-62.

Mol, A. P. J. and G. Spargaaren (2000), "Ecological Modernization Theory in Debate: A Review", in A. P. J. Mol and D. A. Sonnenfeld (Ed.), *Ecological Modernization around the World*, London/Portland, OR: Frank Cass**,** 17-49.

Monstadt, J. and M. Naumann (2005), "Neue Räume technischer Infrastruktursysteme. Forschungsstand und Perspektiven des Wandels der Strom- und Wasserversorgung in Deutschland." *Forschungsverbund netWORKS Papers* No. 10.

Moss, T. (1998), "Neue Managementstrategien in der Ver- und Entsorgung europäischer Stadtregionen. Perspektiven für den Umweltschutz im Zuge der Kommerzialisierung und Neuregulierung", in H.-J. Kujath, T. Moss and T. Weith (Ed.), *Räumliche Umweltvorsorge. Wege zu einer Ökologisierung der Stadt- und Regionalentwicklung*., edition sigma**:** Berlin, 211-240.

Steria Mummert Consulting/F.A.Z. Institute (2005), „*Branchenkompass Energie 2005*", Hamburg/Frankfurt M.

Nelson, R. R. and Nelson, K. (2002), "Technology, Institutions, and Innovation Systems." *Research Policy* 31 (2): 265-272.

Nyblom, J. S. Borgatti, J. Roslakka and M. A. Salo (2003), "Statistical Analysis of Network Data - an Application to Diffusion of Innovation." *Social Network* 25: 175-195.

Rammert, W. (2000), *Technik aus soziologischer Perspektive 2*, Wiesbaden, Westdeutscher Verlag.

Rosen, U. and A. Michels (2004), "Von der Vollversorgung zur strukturierten Beschaffung." *Zeitschrift für Energiewirtschaft* (2004, 3): 217-224.

Schulze, H. (1997), „Neo-Institutionalismus. Ein analytisches Instrument zur Erklärung gesellschaftlicher Transformationsprozesse." *Arbeitspapiere des Bereichs Politik und Gesellschaft der FU Berlin.*

Siggelkow, N. and D. A. Levinthal (2003), "Temporarily Divide to Conquer: Centralized, Decentralized, and Reintegrated Organizational Approaches to Exploration and Adaptation." *Organization Science* 14 (6): 650-669.

Soskice, D. (1997), "German Technology Policy, Innovation and National Institutional Frameworks." *Industry and Innovation* 4 (1): 75-96.

Teece, D. J. (1990), "Technological change and the nature of the firm." in G. Dosi, C. Freeman, R. Nelson, G. Silverberg and L. Soete (Ed.), *Technical Change and Economic Theory*, London/New York: Pinter Publishers.

Thelen, K. and S. Steinmo (1992), "Historical Institutionalism in Comparative Politics", in S. Steinmo, K. Thelen and F. Lonstreth (Ed.), *Structuring Politics. Historical Institutionalism in Comparative Analysis*, Cambridge University Press: Cambridge, 1-32.

Thrän, D. (2004), "Hemmnisse bei der energetischen Nutzung biogener Festbrennstoffe." *Zeitschrift für Energiewirtschaft* (2004, 1): 35-44.

Trend Research (2004), "Der Markt für Contracting in Deutschland bis 2010."

http://www.energiecontracting.de/01_contracting/05_infocenter/literatur/pdf/2.pdf.

Truffer, B., Bauknecht, D. and T. Jäger (2004), "Die Wandlungsdimensionen als zentrale Beschreibungsfaktoren künftiger Entwicklungspotenziale von Versorgungssektoren." *Report of the joint project "Integrierte Mikrosysteme der Versorgung" as part of the research programme "Sozial-ökologische Forschung" des Bundesministeriums für Bildung und Forschung BMBF.*

http://www.sozial-oekologische-forschung.org/_media/Mikrosysteme-Report_Wandlungsdimensionen.pdf

Verivox (2007), "Preiserhöhungen in der Grundversorgung Strom. "
http://www.verivox.de/presse/media/Erhoehungen_Grundversorgung_August_2007.pdf

Voß, J.-P., C. Fischer, K. Schumacher, M. Cames, M. Pehnt, B. Praetorius and Lambert Schneider, (2003), "Innovation. An integrated concept fort the study of transformation in electricity systems." *TIPS Discussion Paper* 3.

Walz, R. (2001), "Organisation and Regulation of the Electricity Supply Industry in Germany", in de Paoli, L. (Ed.), *The Electricity in Transition: Organisation, Regulation and Ownership in EU Member States*, Milano: Franco Angeli, 265-316.