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Sven Barnekow / Dorothea Jansen

Local utilities coping with the transformation of the energy market and their role for the diffusion of climate friendly technologies

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1. Introduction

No doubt the question of energy supply for the future is of utmost importance regarding the ongoing pollution of the atmosphere and exhaustible resources. Supply traditions and new sector specific paradigms are challenged by new demands for performance and cost efficiency. Up to now, there is no clear answer how we will cope with environmental and economic challenges in the energy market and how innovations will be put into practice comprehensively. Searching for solutions the public sector and its organisational and institutional modes of action seem to be the most relevant starting point. Whether and how local utilities will be able to trigger a change of the German energy system towards climate change mitigation is the key question of this article[1]. It stresses the interaction of market regulation and soft institutional factors as well as the strategies of local utilities regarding new technologies. In addition, it takes a closer look at new modes of service implementation strategies and their effect on the diffusion of technical innovations. In a further step, the article points out the relevance and strategic options of cooperation networking of utilities as competitive advantage.

2. Design of the study: Local utilities as key actors and selected innovation domains

The specific solutions for the future's energy supply point at two different sides of public tasks. On the one hand, the strategies for containment of pollution are subject to the action of political institutions

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1 Empirical evidence is mainly provided by results of the research project "*Diffusion of innovations in energy efficiency and in climate change mitigation in the public and private sector*" conducted at the German Research Institute for Public Administration (FÖV) in collaboration with the Fraunhofer Institute for Systems and Innovation Research (ISI). An earlier version of this paper was presented at the workshop "Markets, Institutions and Innovation-Related Services" held by the Centre of Globalisation and Governance/University of Hamburg in cooperation with the Institute of Sociology/University of Lucerne, Hamburg, 28th-29th of June 2006. We thank the participants of the workshop for valueable comments.

using legal instruments. On the other hand, energy suppliers have to accomplish the public contract to guarantee the security of supply[2]. Being subject to both aspects, the strategies of action of local utilities are expected to play a key role in the diffusion of innovations especially in energy efficiency and climate change mitigation. We chose them as key actors in the market because of their function as "gatekeeper": Municipal utilities still own the "last mile" in the net infrastructure, posses a supply tradition for a local area and are often used to operate generation facilities within their area of supply. Therefore, we claim them to be important enabling agents to overcome structural barriers and to enforce a change in energy production. Changes in market structure and customer orientation in interaction with regulatory changes may have a profound impact on local utilities' strategies to act and so on the diffusion process of energy supply innovations.

Before entering the theoretical backround and innovation-related assumptions concerning the German energy market, we present the innovation domains chosen for our study. We include climate friendly generation technologies as well as energy efficiency enhancing technologies and services.

Talking about climate change mitigation technologies, renewable energy sources (RES) need to be considered. The term encompasses all kinds of electricity- and heat production based on RES ranging from wind and photovoltaic plants to biogas facilities. RES are still growing in Germany, especially in the field of biogas plants (BMWi 2006). Their stable growth rates and their high profile in environmental benefits make them an interesting object of research concerning diffusion patterns.

As innovation domain mainly committed to energy efficiency we chose Combined Heat- and Power Production (CHP). Although these facilities are mainly fired by coal or gas, they lower emissions by producing electricity and heat simultaneously. Even if the technology itself might be known for decades, there are good reasons to take a closer look on CHP as innovation. This energy efficient technology came under pressure with the market deregulation and was nearly abandoned in the end of the nineties especially by municipal utilities (Seeliger 2002). Today, we can state that this climate-friendly form of

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2 In Germany, the term "Daseinsvorsorge" is in use to describe this arrangement.

energy production experiences a renaissance in the market. Special key factors for the second diffusion in the sector can be expected. Next, CHP in the form of micro CHP delivering energy to a small district, a firm or a single household has the potential to pave the way for a profound sector specific paradigm change towards decentralisation.

As a third domain we chose Contracting. "Contracting" labels activities in the field of energy supply focussing on the specific needs of a customer ranging from sole residential buildings to complex enterprises with a large number of locations. These activities are related to the energy-efficient renewal of facilities or the installation of new generation capacities based mainly on CHP which makes them interesting for our research topic. Experts expect energy services and especially Contracting to be the most relevant factor in the field of operational tasks in the next years (Czotscher 2005). Combining physical assets and innovative services this domain is of high interest concerning possible synergies between these two elements promoting their diffusion.

3. Between institutional regulation and sector dynamics: Organisations as promoters of social innovations and cooperative action

Building on sociological research results on the development and distribution of innovations we conceptualise innovations as product of the intentional negotiation of its stakeholders which are bound by established technological paths or institutions (Disco/v.d. Meulen 1998). This chapter gives insight to the theoretical backround and key thesis used in the study and relates it to our empirical approach.

Insights into the mechanisms of socio-economical and socio-technical change with a focus on institutional structures can be derived from the transition management approach which has become a prominent starting point to analyse paths of innovations recently (Rotmans et al. 2001, Rip/Schot 2002, Geels 2002). According to transition management theory, the options possible and directions of trajectory change – e.g. from large-scale, fossil-fueled and centralised energy-production to decentralised production based on RES and innovative energy services in our case – are moulded by so-called (socio-) technical regimes. These regimes consist of all kind of practices, technological characteristics and knowledge related to a specific trajectory embedded into sets of institutions and infrastructures. While the overall landscape provides the environmental 'backround' concerning material or social aspects, innovation dynamics are driven by niche activities below the regime level (Kemp et al. 2001). Here, experimental technological projects protected from market pressure grow until they are sufficiently developed to challenge the former established socio-technical structures. The regime transformation is co-determined by adaptability, efficiency of niche protection or even the intrinsic motivations of actors to engage in innovative product development (Weber et al. 1999).

Two main insights for our empirical research can be drawn from this theoretical approach to the diffusion of innovations. Bottom-up, we have to identify the specific niche processes concerning the development and diffusion of energy supply solutions. We also need a closer look at actors' strategies to alter traditional regime structures in generation and innovative energy services. Concerning the structural framework around the socio-technical regime, we search for expertise about institutional arrangements defining and altering the operational tasks of utilities. Secondly, in the development of energy-efficient technologies, energy law, different modes of subsidies and forms of institutionalised knowledge exchange have to be taken into account. To follow these two paths of investigation, different approaches dealing with the impact of institutions offer expertise for the analysis of diffusion patterns.

The central question arising from the bottom-up perspective is if and how the strategies of utilities concerning the usage of innovations are altered under the changing regulation regime. We focus on decision-making-processes at the micro-level which may change the existing paradigms of producing and distributing energy. There is need for a theoretical approach dealing with individual action at the level of an organisation in the sector. As the energy market can be characterized by complex systemic structures, we need to take a close look at the non-technical and especially organisational dynamics within feasible technical and institutional options to identify the drivers of technical innovations (Tushman/Rosenkopf 1992). The Actor-Centered approach of Institutionalism 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 (Mayntz/Scharpf 1995). In this view, interactions within the system are conscious decisions and taken for granted routines of individual actors committed to norms. To analyse the diffusion of environmental innovations and the mechanisms of utilities' decision-making, we take this bottom-up perspective into account to explain the transformation of the sector level. Coleman (1990) shows that macro phenomenon can be explained by individual behaviour at the micro level. Facing the institutional change of the sector which implies the building-up of new trading opportunities or public funding, corporate actors may try to take individual advantage by putting innovations into action. The sector structure is thus altered by the cumulative effect of individual decisions. As actors usually follow more or less rational myths in their strategies (Meyer/Rowan 1991) in order to secure approval of their customers, regulators or even their profession, new myths of economic efficiency might then gain importance due to market deregulation. The market deregulation itself promotes new ways of profit maximising by altering the value chain towards energy generation[3]. Out of these considerations, we frame our first thesis: *Deregulation sets a premium on cost efficiency. According to this, local utilities will change their self image and be more prone to energy generation.*

Concerning the role of myths for operational action we also ask for the specific role of environmental values. These are often linked to local municipal values[4]. As second thesis, we therefore claim that *local utilities who retain municipal values are more prone to follow an innovative environmental generation strategy.*

Taking a top-down-perspective, we search for an answer if and how institutional arrangements in the energy sector will gear the individual utility towards climate-friendly investments. To explain evolutionary dynamics and effort taken in developing innovative technologies and practices at a systemic and even national level, the building of institutions and the incentives set by them must be taken into account (Edquist 1997, Lundvall et al. 2002). Innovations are bound by the interplay of different actors and their strategies or positions regarding economic goals of engagement or communication structures. The performance of the innovation system therefore gets affected by the

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3 The following paragraph gives a detailed description of these regulatory mechanics.

4 As an example for this analogy, we point at the local Agenda21-processes combining goals of sustainable development and municipal commitment (Forum Umwelt und Entwicklung 1996).

degree of "matching" between actors involved in the innovation project and institutions. In the energy market, e.g. suppliers and technology producers are dealing with instances of regulation which might facilitate engagement in a specific innovation domain while it retards the engagement in another field. We match these aspects with insights taken from transition management mentioned above to state our third thesis: *Environmental regulation will create innovative niches which offer leeway for climate-friendly innovations in energy generation.*

Apart from analysing the impact of regulatory patterns, we raise the issue of assets influencing the diffusion of innovations. Shedding light on the sector specific idiosyncrasies relating to innovative strategies structural variables are of high importance, too. The production and distribution of energy is a traditional net-bound area described by the term of a Large Technical System LTS (Hughes 1987, Mayntz/ Hughes 1988). The configuration of an LTS may have strong impacts especially on vertically integrated firms like utilities (Teece 1990). This can be characterised by the interdependency of technical and non-technical systemic components. On the one hand, a tight coupling of components may fasten the development of incremental innovations due to clear-cut specifications. On the other hand, the coupling is setting up inertia to paradigmatic changes which do not seem compatible with other established systemic elements. As Nelson and Nelson (2002) pointed out, organisational behaviour can be constrained by institutional arrangements as well as by prevailing physical technologies. Thus the physical network structure and plants as well as the former monopolistic institutional structures of the energy sector promote supply solutions on the base of technological excellence and large-scale-projecting. These structures and routines obviously set up inertia.

The main barriers for environmental innovations such as renewable energy generation or decentralized supply systems follow from these institutions and structures. New technologies have to compete with established know-how in generation, power plant fleet and grid infrastructures. This lowers their chance to become a widely used alternative. This is why we need to consider the traditional assets of local utilities. These are their fixed areas of supply, their client base and their infrastructural assets. All will have an impact on the diffusion of next-generation supply technologies. To sum it up, we can state as our fourth thesis *that due to high asset specificity established sector-*

specific structures can constrain the decision to invest into climate-friendly solutions at the level of the utility.

Furthermore, we want to focus on specific implementation strategies of utilities to bring environmental innovations to the market. Two main enabling trends can be presented here which are expected to have a significant impact on the diffusion of innovations, the role of synergies between physical assets and value-added services and the role of network strategies of local utilities.

After we set institutional and organisational factors as main drivers for sector change, we also have to deal with the question on how these changes are put into practice at the level of the utility with regard to environmental innovations. In accordance with processes of individualisation (Beck 1986) an increase in service and customer orientation has already become a main task for firms. To promote new technologies, value-added services are expected to play a key role (Wengenroth 2001). In our research, we therefore put emphasis on the interplay of organisational service orientation and strategies in innovation domains. Here, we especially emphasise contracting in combination with CHP facilities to point at synergies and other enabling factors related to the combination of our innovation domains. As our fifth thesis, we state that *value-added services work as enabling structures for the diffusion of innovations. Synergies based on the traditional assets of utilities will enforce the change management in specific utilities*.

As a second strategy we refer to networking of organisational actors. Recent studies of innovation systems show that nowadays the formation of networks and the cooperation of actors play a key role for innovation processes (Malerba 2002, Nyblom et al. 2003, Jansen 2006). Horizontal networks might allow independent actors to pool resources in order to deal with interdependency and economies of scale (Jansen 2002). Here, we assume an enabling effect of different kinds of cooperative modes. With an additional regard to transaction cost economics, it can be claimed that the exchange of complex information and flexible organisational adaptation may be organized more efficiently in horizontal networks than in markets (Jansen 1996). This leads to our sixth thesis to be examined*: Cooperation in the form of networking eases innovative behaviour of utilities. Here, especially horizontal networks have high performance rates.*

4. Liberalisation and environmental regulation modes in the energy market: Utilities under transformation pressure

To analyse the impacts of regulation modes on utilities' strategies, the mechanisms need to be further described. The recent change of regulatory policy triggered much effect on the utilities' goals and innovation-based investment strategies. Market liberalisation and incentives for environmental generation strategies are particularly important here. The following paragraph deals with the different aspects of liberalisation and environmental regulation in a first step and relates them to aspects of entrepreneurial action of utilities in a second one.

Municipal utilities in Germany came under increased market pressure with the liberalisation of the electricity market by the new Energy act of 1998 following the guidelines of the EU electricity directive of 1997. Key issues included the opening of former monopolistic supply structures to establish end-user eligibility. In practice, this act established 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. Albeit most utilities are still owned by their municipality, private legal forms replaced the public form of an "own" establishment within the administration of the municipality ("Eigenbetrieb") in the past eight years (Edeling 2004). Market liberalisation gave rise to the privatisation of utilities[5] while at the same time offering them more opportunities in the provision of energy.

After the formal deregulation of the German energy market, many experts expected the utilities to disappear under the new regulation regime (Leonhardt 2000, Lieske 2001). Instead, the municipal utilities and so their public contract to supply the essential good of energy on a local base survived. Albeit the national market became subject to a concentration process. Their traditional assets make local utilities a relevant partner for other energy suppliers (Forthmann/Czoscher 2002). Therefore, concentration due to vertical integration can be observed. The carriers of the integrated network, the "big four" transmission net operators (TNO), have paid much effort to buy shares of utili-

5 Referring to our own data, about 84% of the German utilities operated under a private legal form (e.G. Gmbh, AG) in 2006 (*App.: Table 1*).

ties to influence decisions in their supervisory boards especially concerning supply contracts (Schlemmermeier/Schorsch 2003).

In addition, the regulatory impact was increased by the recent amendment of the energy act (EnWG) in 2005 and its turn to ex-ante regulation of third party access to the grid. Until then, especially the small utilities could deal with increased competition in production efficiency by charging high net fees (Brunekreeft 2004). With the advent of ex-ante regulation of net fees, a pressure to alter priorities arises. This will touch the core business of local utilities. Even if utilities partly owned and operated generation facilities in the past, the distribution of energy has been their most relevant operative task (Walz 2001).

The amendment of the energy act set profound regulations for unbundling and price caps for net annuities. This new step changes the value-added chain and promotes own generation projects. While net fees are reduced for all suppliers at every step of the value chain, municipal utilities which are not engaged in own energy production additionally suffer from rising wholesale prices for electricity.

Talking about changing operational routines and norms, we take the New-Public Management (NPM) into account. The term marks a new paradigm in the public sector towards managerial governance patterns (Elsner 2004). The implementation of NPM-strategies may force utilities to act more in accordance with economic efficiency and organisational streamlining than in the past. Managerial governance patterns partly displace established myths and are implemented broad-based as utilities are put under pressure by cost-reduction strategies in the municipal sector. Up until the liberalisation, local utilities were dominated by values such as supply security, cost orientation, and sometimes environmentalism. Market de-regulation and the increased market pressure lead to a change of these myths. Our data confirm our first hypothesis fully. Utilities altered their position towards a more cost-efficient management: Nearly all (99%) of the utilities claim to follow the strategies of private firms in operative business (*App.: Table 2*). This is true for those utilities, which are vertically integrated into large TNO as well as for municipally owned utilities.

Changing priorities and strategies are also obvious in regarding the operation of own plants. Investments in own facilities were an obstacle to utilities in the recent past of regulated markets. By now, new market structures emerge and open new opportunities. In the utility sector, actors claim own generation projects to be a more profitable task than a few years ago, even in comparison with the energy trading opportunities (Czotscher 2005). A close look on the investments in generation indicates the central role of local utilities. About 50% of the actors investing into generation facilities in Germany are new players in this operational field (VDEW/Ernest&Young 2006). A big share contains utilities and new investment companies set up by several utilities. More than 25% of all utilities are already investing or are planning to invest into own facilities and shareholdings of large scale projects (ibid.).This points to the fact that some utilities have found a way to deal with transaction costs in generation projects. Here, core competencies of an organisation can be characterised as important co-determinants of transaction costs (Foss 1993)[6].

Concerning our first thesis, we can affirm our assumptions. Deregulation clearly pushed nearly all utilities towards a new self-image grounded on efficiency standards. On the one hand, low prices become the main objective of local utilities' decisions and actions. On a first sight, this could prevent them from investing in relatively cost-intensive renewable energies as well as energy efficient technologies. On the other hand, municipal utilities are challenged by new options and threats opened by the liberalisation. Local suppliers invest in new technologies and services in order to get a competitive advantage over other suppliers. The generation and distribution portfolio of municipal utilities is therefore broadening in quantity and quality. Here, even if cost structures may hinder their diffusion in some cases, a chance for energy-efficient and climate-friendly innovations to find its way into the market seems to be a viable option in accordance with these more managerial operational goals.

These new goals only partly superseded traditional values of the municipal sectors. In the past two decades, an environmental mission statement became institutionalised as a code of conduct for municipal actors. This can affect investments into climate-friendly innovations. For instance, the commitment to municipal values of utilities affects the extent of innovative behaviour concerning renewable energy solutions (*Table 1*). This confirms our second thesis.

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6 We deal with this aspect more deeply in chapter 5.

Municipal orientation	RES				Total	
	Not operative		Operative			
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Fully disagree	5	8.33	2	3.17	7	5,69
Partly disagree	20	33.33	12	19.05	32	26.02
Partly agree	20	33.33	25	39.68	45	36.59
Fully agree	15	25.00	24	38.10	39	31.71
Total	60	100	63	100	**123**	**100**
Cramer's V = 0,2181						

Table 1: Appraisal "Municipal orientation of the utility" by activity in renewable energy generation

The investments into climate-friendly innovations are also promoted by regulated feed-in fees. Environmental regulation in Germany comprises a set of measures, which explicitly set incentives to invest in new technologies. Technologies attractive from this point of view are energy efficient innovations such as CHP, new products such as "green power" (from renewable energies), and energy generation using RES. Regarding RES, the new Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz EEG) of 2000 and its amendment in 2003 oblige the electricity suppliers to pay a fee for the electricity produced by renewable energy sources above the market price. Every kWh which is produced under the use of RES and fed into the grid 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 below 30 MW.

Concerning CHP, the regulatory framework has undergone numerous changes in recent years (Madlener/Schmid 2003). The new CHP act (Kraft-Wärme-Kopplungsgesetz KWKG) which was enacted in April 2002 had an important influence on municipal utilities. 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 fed into the public grid similar to the practices regulated in the EEG. Regulation thereby sets incentives to invest in decentralised renewable energy plants by removing the pressure of liberalisation from RES and

CHP through guaranteed fixed feed-in prices. With the guaranteed feed-in fees, the usage of renewable energies for generation projects can offer planning reliability lost by the deregulation directives (Ragwitz et al. 2005).

We can clearly state that the regulated subsidies of climate-friendly innovations via feed-in fees had an effect on the utilities' strategies and respectively on their prospensity to invest in these fields (*Figure 1*). Environmental regulation is successful in creating innovative niches for climate friendly technologies, which are indeed used by local utilities.

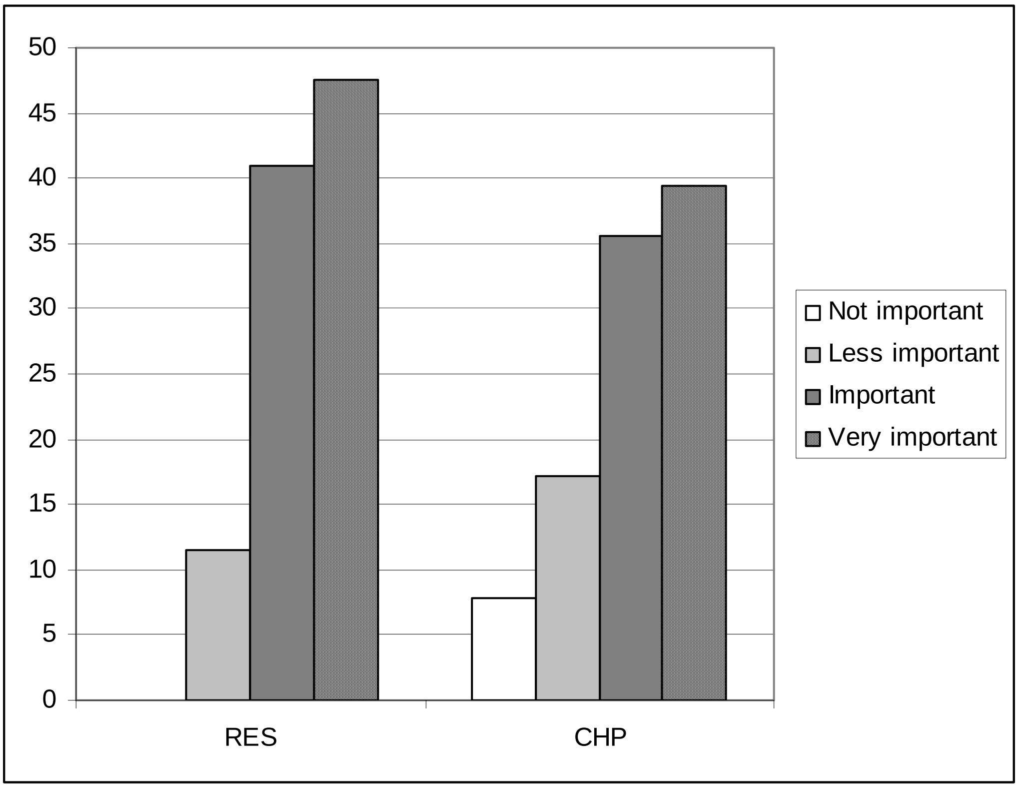

Figure 1: Relevance of feed-in-fees for investment decision for local utilities in % (n_{RES}=61, n_{CHP}=76)

Nearly 90% of all utilities engaged in generation using RES ranked the subsidies relevant or highly relevant for their engagement. In the field of CHP, 75% ranked the subsidies relevant or highly relevant. Regulatory framing thus indeed has a positive effect on local action of the organisational actors concerning climate-friendly behaviour and the promotion of innovations. The legal guarantee of purchasing reduces the entrepreneurial risk for the utilities and arranges for planning reliability. This favours especially the technology of CHP[7].

The engagement in one of the fields can also be self-enforcing. In the selected innovation domains, synergies in provision and operation can be expected to enhance and broaden the engagement in climate-friendly and energy-efficient solutions. High correlations show that if a utility is active in one of the selected innovation domains, there is a high likelihood that it engages in the other two as well (App: *Table 3a and 3b*).

Coming back to our third thesis, we can state that subsidies for climate-friendly innovations have a positive effect on their diffusion. Renewable energies profit even more from these regulations than CHP.

To sum up, the modes of regulation offer potentials to enforce the diffusion of environmental innovations. Facing the institutional change of the sector, utilities may be forced to search for innovative strategies in energy generation. Economic and environmental (de-)regulation display an ambivalent effect on the diffusion of innovations. On the one hand, they might increase economic insecurity and devalue the traditional assets of municipal utilities (last mile, multi-utility, stable customer relationship, large amount of customers). On the other hand, regulation can provide for legal security and foster the generation of new markets and the investment in new technologies or product solutions. Market deregulation and re-regulation concerning environmental innovations change the value-added chain and the perception of organisational priorities for utilities. So albeit there might also be hindering effects, we can approve our first three thesis with reservations. The changing regulatory structure definitely stimulated the commitment to an organisational culture searching for new market niches. The new regulation regime fosters the change of self-images towards economic and competitive behaviour and at the same time promotes the broadening of the generation portfolio. This opens a window of opportunity for the diffusion of climate-friendly, mainly energy-efficient

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7 In addition to the legal bonus, running the "last mile" and thus having access to customer data makes it interesting to invest into CHP. Utilities' knowledge of the detailed consumption profile of their clients and their location on the spot reduce transaction cost and yield them a competitive advantage over other suppliers. On the other hand, the low asset specificity of specific new technologies and services may make them less suitable for the established governance structures in the sector.

technologies which are privileged by feed-in fees and environmental commitments of the municipality.

After analysing the regulatory impacts, we now focus on asset specificities influencing the diffusion of innovations into the market.

Next to dealing with enabling structures, we also take hindering effects into account. Here we claim that the diffusion of environmental technologies and a service-based small-scale generation paradigm is bound by the infrastructural ideosyncrasies of the established energy system.

Technical rationality cannot be neglected in a service-driven future of utilities. As LTS theory posits, existing physical assets can limit the transformation of the utility into a service-based organisation. Utilities traditionally raised high funds for the maintenance and extension of grid infrastructures. But high past expenditures e.g. for district heating can influence the readiness to offer services „next to the customer“ in the future. The path-dependencies of LTS which are grounded in past investments in the grid infrastructure can reduce the marginal utility of investments in innovative projects (*Table 2*).

Competition with existing gas-/district heating structures	**Freq.**	**Percent**	**Total**
Fully disagree	10	19,6	19,6
Partly disagree	21	41,2	60,8
Partly agree	14	27,5	88,2
Fully agree	6	11,8	100
Total	51	100	

Table 2: Persistences concerning the investment decision

If there has been much effort in recent years to extend the natural gas grid, the potential for the extension of the district heating grid providing decentralised capacities is low. About 39% of the utilities claim that the potential competition with own gas- and district heating-infrastructures has an influence on their decision whether or not to engage in contracting projects. High asset specificities of the old technologies and path dependencies can be a barrier to innovative behaviour of the municipal utilities.

There are even more problems for utilities who follow innovative paths. Generation costs of energy are subject to economies of scale, but building up e.g. energy-efficient large-scale CHP-capacities is not affordable for most utilities especially with regard to the increasing market risks (Monstadt 2005). Another problem is lack of know-how especially in smaller utilities without strong connections to large suppliers. Expertise in Contracting projects might be low and this lack might lead to competitive disadvantages in the market.

In sum, sector persistences can be observed as we assumed in our fourth thesis. Infrastructural preinstallations and lack of know-how in innovative operational fields clearly set up inertia as well as unavailable economies of scale. How utilities can partly cope with these problems to take the futures' tasks beyond pure generating and selling electricity will be described in the following paragraphs.

5. Driver for innovations: Service orientation and networks

Energy services are expected to be a future driver of growth in the sector with a potential volume of 2 billion Euro a year (Trend Research 2003). In this field, especially additional functional services offer high potential for more engagement (Konrad et al. 2004). As utilities are a focal actor in this sector-specific change, we took a closer look at their motivations and modes of operation towards the transformation into a service provider.

The change management dealing with a stronger service orientation of utilities is constituted by sector specifics where changes in the value-added chain and forced market regulation trigger the utilities to enrich their product portfolio (Figure 2).

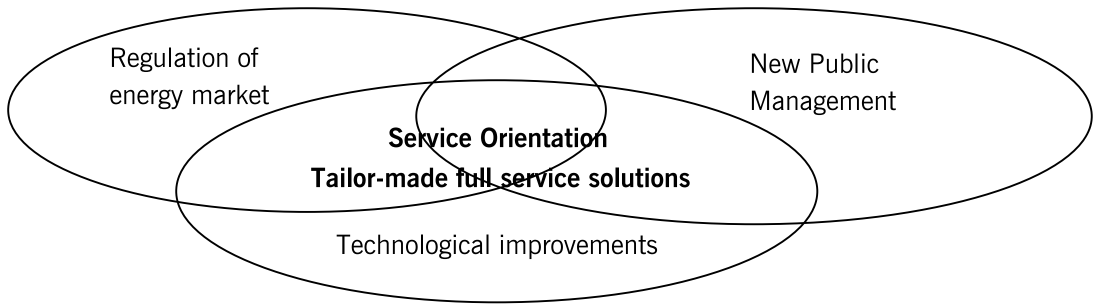

Figure 2: Determinants of utilities' service orientation

First, as mentioned above, market liberalisation and growing competition affect the strategies of utilities. Guaranteed feed-in fees for CHP and RES and the enabling of operational synergies can catalyse this service-driven transformation. Secondly, the implementation of NPM-routines leads the municipal enterprises to enforce their customer orientation and to search for cost-cutting synergies. With changing myths towards a stronger commitment to economic efficiency and customer orientation in mind, the strengthening of a service-based product range becomes an evident strategy for them. Thirdly, technological improvements (e.g. IT-systems, small-scale capacities) facilitate the construction of full-service-solutions concerning the energy supply. Special attention must be paid to the nature of the relationship between technology and services. The future innovation is focussed on the service itself while technology takes a back seat for customers (Voß et al. 2003, Wengenroth 2001). This is why utilities pay highest attention to evolving services instead of promoting 'pure' technological improvements.

Our data confirm these assumed changes as specific services are developing very fast. *Figure 3* shows the commitment to the diversification of the product range with respect to the engagement in additional services in a timeline.

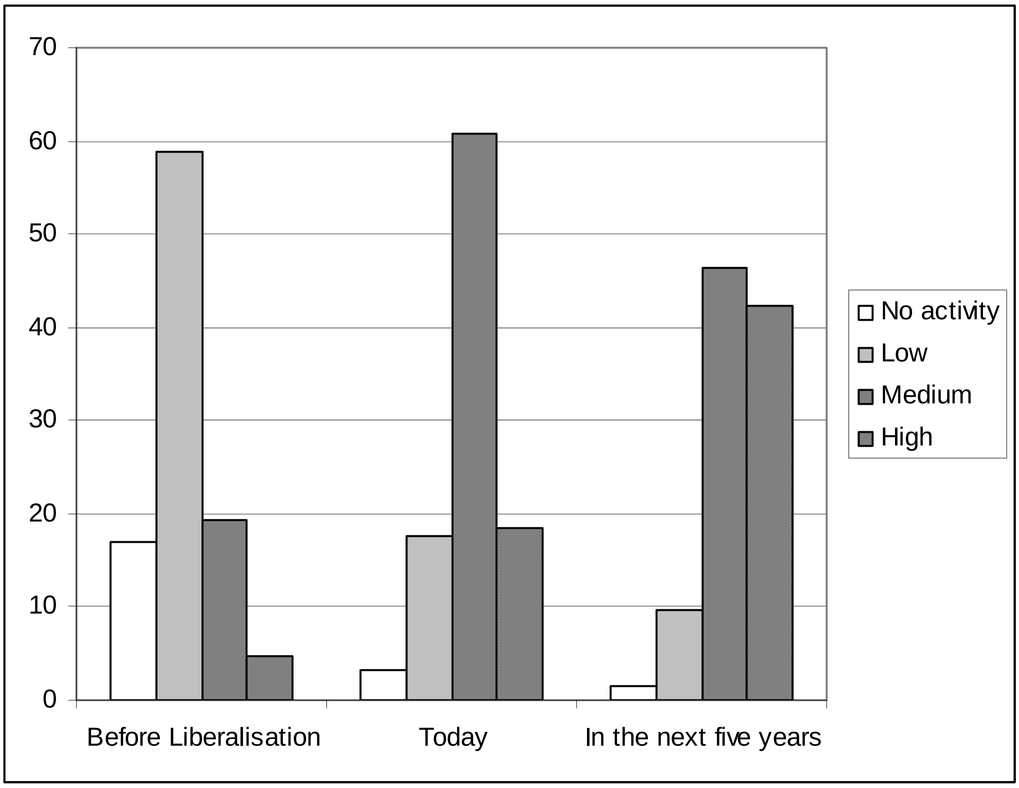

Figure 3: Engagement of local utilities in enhancing the service portfolio in % (n=125)

Before the liberalisation of the market, performance in developing service solutions was low. About 75% of the utilities stated that there was no or little engagement at that time. Nowadays, about 80% rank their activity as average or even high. Asked for their future engagement, the table shows that the transformation process goes on and that service orientation is still increasing.

There is evidence that regulation guidelines can have an additional direct influence combined with technical improvements and organisational change. Based on a highly specialised infrastructure, value-added services are created as spin-offs with regard to regulation requirements. For instance, the strong effort taken in building up energy data management is driven by two factors. First, new technological possibilities in IT-infrastructures allow for real-time measuring, reporting and controlling. Since the energy act sets regulatory duties new technical opportunities might be used for more efficient management strategies. *Table 4* in the appendix displays this development in a timeline. Systemic energy data management is also offered to the customers to gain efficiency benefits. Thus, technology and regulation are driving the service by forming service-driven strategies building on internal and external factors of the utility.

The area of energy supply is subject to a strategic diversification: Instead of perceiving it as a homogenous space with the need for the commodity of energy, different customer groups and regional areas with specific needs concerning load capacities or energy services can become the target of strategies (Moss 1998). In accordance to their new self image and the growing impact of economies of scope, utilities tend to search for this kind of enhanced customer orientation and cost efficiencies at the same time. Services are combining these needs by providing operative synergies and tailor-made solutions. Much effort is paid to the enrichment of the portfolio by the building-up of integrated facility management, maintenance and controlling of generation units. These full-service-strategies also foster the usage of energy-efficient generation like CHP. Here, especially in small-scale CHP-projects, a self-enforcing interplay of the promotion of climate-friendly innovations in generation based on physical assets and services based on the know-how of the utility can be found. They offer the opportunity of enhanced customer loyalty by constituting a concerted mix of physical assets and services (Voß et al. 2003). Using their closeness to the customers municipal utilities are able to build up technical innovations enhanced by integrated services like mentioned above. The costs can be reduced since provision of this type of energy does not depend on cost-intensive grids[8]. At the same time CHP and RES such as biogas can be combined. They fit into the decentralized distribution paradigm which might diffuse into market niches and start to compete with the centralised paradigm.

Innovative small-scale CHP offering complementary services and environmental performance is therefore expected to grow in the next years. This process will enforce the self-image of local utilities as service provider. More than 50% of the utilities who are already engaged in micro-CHP tend to upgrade this field (*App.: Table* 5).

The utilities offer even services by combining their traditional assets and their know-how. According to Whitley (2000) the implementation of innovations depends on the confidence of an organisation

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8 An example might be mid-scale projects in which energy is produced for a new residential quarter or an industrial facility with a local heat and energy supply.

that it can handle it in an effective way. To estimate the innovative potential of municipal utilities specific assets have hence to be taken into account which have an influence on operative efficiency. As organisational decision making tends to be incremental and is normally based on former decisions and competences (Lindblom 1959/1979, Nelson/Winter 1977). Engagement in innovative generation technologies thus depends on activities in established generation technologies (App: *Table 6*). With respect to the design of new service-based products, it can be also shown that utilities rely on their existing physical assets and know-how as complementary resources (Teece et al. 1994) as well as on the customers' trust in their competence (*Figure 4*).

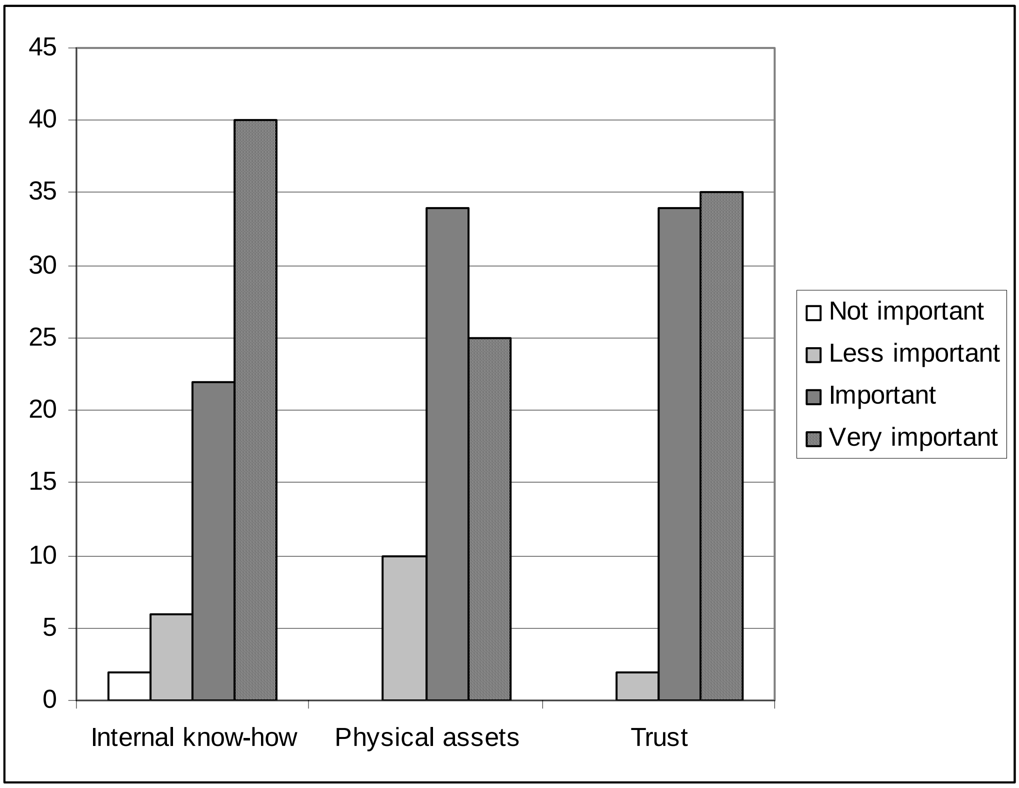

Figure 4: Relevance of aspects concerning the investment decision of local utilities in % (n=71)

While trust relates to the "on-site-factor" of long-lasting supply traditions in a defined region, physical assets and know-how are based on the high expenditures in the past to provide for "Daseinsvorsorge". This is why CHP and equipment contracting are two main trends to be found in the utility sector.

Coming back to our fifth thesis, we can state that the engagement in climate-friendly and especially energy-efficient innovations can be pushed by value-added services. We can also affirm our hypothesis on the effect of synergies. While inertia in infrastructures influences the engagement in a negative way as shown in the last paragraph, utilities can use synergies building on the established know-how of the organisation to integrate generation and service solutions.

Nevertheless, entry barriers and bounded expertise constitute important problems for municipal utilities who want to enrich their operational fields and to get innovations into action. Thus, utilities need a strategy to overcome these barriers. Here, we analyse the informational and operational networking between municipal utilities.

Forced by the informational duties and unbundling directives of the recent energy act, consultancy networking became a must for municipal utilities and a pre-condition for entrepreneurship (Monstadt 2005). As an answer to hitherto unknown regulatory and investment tasks and to enhanced opportunities to enrich service and generation portfolios municipal utilities started to build up strategic networks. By enabling informational and infrastructural services for their members, networks facilitate innovative changes in the energy system. They support collective action in energy trading and a coordinated exchange of information concerning regulatory tasks and innovations. Additionally, they might be the answer to infrastructural barriers hindering the diffusion of climate-friendly innovations. Nearly all utilities (98%) are engaged in information networks today (App: *Table 7*) which shows that networking already became a widely used option. Utilities may follow two main strategic paths of cooperation in networks[9], either a path of horizontal cooperation or a path of vertical cooperation with large suppliers.

Large suppliers such as the “big four” (RWE, E.on, EnBW, Vattenfall) are interested in buying shares of utilities to gain a long-time dis-

9 In addition to the partly contradictory two types described below, cooperative relationships with regional grid operators are a third option. These enterprises are mostly distributing energy in larger rural areas and often operate larger generation plants. Up to now, many of them are controlled by the large suppliers (e.g. E.on Hanse, edis). Nonetheless, smaller utilities and regional suppliers can cooperate as peers. Thus, this type of network cannot be easily characterised as either horizontal or vertical cooperation. Therefore, we reduce our focus to the large suppliers and networks of smaller utilities.

tribution channel while municipal utilities need more capital to cope with ongoing net investments and resources of know-how to deal with the new regulation directives. These interests of both parties can be served by an integration of the municipal utility via shareholdings and membership in the supervisory board. We found explicit evidence that these kinds of shareholdings affect the general activities in innovative generation (*Table 3*).

Activities in innovative generation projects	**Shareholdings**				**Total**	
	No		**Yes**			
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Not active	16	27,59	27	62,79	43	42,57
Active	42	72,41	16	37,21	58	57,43
Total	58	100	43	100	101	100
Cramer's V = - 0,352						

Table 3: Activities of local utilities in innovative generation projects by shareholdings of other companies

While about 72% of the utilities without shareholdings claim to be active in innovative generation projects, only 37% of those with shareholdings are active in these domains. There is even less engagement concerning investments into generation in the future at those utilities which reported shareholdings by other firms (*App.: Table 8)*. 63% of the "free" utilities without shareholdings will engage in generation projects on an average or high level. Of those with shareholdings only 47% report on future generation projects. To sum up, these findings show that environmental performance and the diffusion in innovation domains of utilities attached to a TNO are lower compared to independent municipal utilities.

To preserve their autonomy in strategic decisions (Sydow 1992), municipal utilities also seek for other forms of cooperation. Regional horizontal networks of utilities mostly started as informal energy trading communities (so called "Arbeitsgemeinschaften") in the late nineties. Today they offer a wide range of services for their members. They take an intermediary position for nearly all operative activities and promote the adoption of innovations. Apart from economic interests factors such as the commitment to the municipality and coequal concerted action play a role. Thus, horizontal regional networks are an important object for investigation. Our results show that partners from horizontal regional networks are much more attractive for the exchange of knowledge (*App.: Table 7*). This is why these networks will be highlighted in the following.

Horizontal networks in the utility sector are mostly organised at the level of regions with an emphasis on strategic action. Strategic networks can be characterized by building up an own identity leading the inter-coordinated action of its participants (Sydow 1992). As firm networks are intended to support the realisation of competitive advantages in business, the driving interest of pooling resources is most important. A closer look at the constitution of these regional networks shows that it is not regional closeness that constitutes the networks' identity but the need to build a counterbalance to the "big four" in the German energy market and their affiliates. Even if information about the operational tasks of generation, contracting or other energy services are marketable goods, cooperation networks can offer advantages in facing similar tasks. These networks constitute a functional equivalent to services enabling independent and even innovative behaviour of its network members in the market. With regard to enabling structures for environmental innovations, the consultancy function of networks is of utmost importance. Up to now, already 98 % of the utilities are using these networks to gain information[10]. Facing a fast-changing environment with new regulatory directives, new generation technologies and differentiated modes of sales and distribution, knowledge exchange becomes a must to maintain in the market. By pooling specific knowledge and resources in generation and distribution, these multi-centred networks offer advice for the operational activities of their members. By evaluating best-practice among the network, utilities can be able to change their frames of reference and to invest in new environmental projects.

Apart from offering informational advantages, new modes of governance in the operative areas drive the formation of networks (*App.: Table 9a to 9c*). The pooling of knowledge leads to best-practice-consultancy concerning services for their members which can even

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10 This number also includes those utilities with shareholdings which can take part in these regional information networks, but they normally are not part of operative networks as both groups have conflicting interests.

become a commercialized activity[11]. Cooperation in accounting, marketing or legal consulting especially in the business segment of contracting might then become a main task for these networks[12]. Concerning the grid, we find just 8% of the utilities cooperating with other utilities. We expect that their number will grow fast in the next years since horizontal networks offer a chance to build up scale effects by enabling service pooling and the profiting from synergies of assets.

To sum up, generation of energy is gaining importance rapidly for utilities. Here, horizontal networks offer special opportunities. Regional cooperation networks in this sector work as enabling structures for investments in innovative energy technologies and more efficient energy management. To deal with the economies of scale utilities are sharing the costs for large-scale generation projects. About 22% of the German utilities are using this option, partly by building a planning company as a joint venture. The sharing of expenses for large-scale projects such as CHP plants, the joint production of energy and the joint maintenance of assets are important elements in innovative strategies. They lower entry barriers and transaction costs and affect the propensity of local utilities to invest.

The diffusion pattern of these strategic approaches confirms the thesis of institutional isomorphism (DiMaggio/Powell 1983). Diffusion is driven by regulating authorities and horizontal sector networks. Nevertheless, the independence and the capacity to act at the local level remains relevant for the participants of the network. But in a market dominated by high structural dynamics in regulation, price formation and technology, any actor has to adopt to it to stay in business. So the dynamic capabilities (Montgomery 1995, Konrad et al. 2004) of an organisation cannot be explained without taking into account the support of social networks, be it built upon horizontal or vertical structures.

In conclusion, our sixth thesis is corroborated by our empirical evidence. Utility networking embeds the traditional logic of "make or buy" and pushes operational change towards innovative behaviour and climate-friendly innovations. The second part of our thesis stating that

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11 Examples in the German market are Trianel or the Südweststrom.

12 For instance, cooperation networks which developed regional green labelling programmes, may offer the starting point for common contracting standards.

utilities' innovative performance is enforced by participation in horizontal networks is proved by our data on the engagement in innovative generation projects (*Table 2*) and Contracting (App.: *Table 10*). The forms of networking have an impact on the engagement in generation activities and innovative energy supply solutions. While engagement in vertical networks under the leadership of big suppliers lowers activities, utilities in horizontal networks promote next-generation facilities and supply solutions.

6. Conclusions

The framework of analysis developed in chapter 3 of this article proved to be a useful approach. In chapter 4, we were able to show that regulation modes in the energy market had a profound effect on the utilities'self-images and strategies. Liberalisation and NPM drive them towards customer-oriented action in a competitive market. In addition, regulatory subsidies affect positively the engagement of utilities in climate-friendly or energy efficient generation and distribution solutions.

On the other hand sector persistences due to lack of financial backing, internal competition with net infrastructures and lack of information concerning modes of operation or contracting are hindering factors for the diffusion of innovative technologies and services.

In chapter 5 we dealt with the change of the traditional paradigm of energy supply towards services at the level of utilities: Decentralised, service-based supply strategies offer advantages for utilities in competition, push the diffusion of environmental innovations and transform utilities into service providers. Tailor-made- and full service offers are shown to provide the link to the diffusion of energy efficient innovations. In spite of the inertia described above, existing infrastructures and supply traditions even offer advantages in a service-driven market.

Therefore and with a special regard to the regulation-based dynamics in the energy market, horizontal networks became a central precondition for utilities to achieve a market position. Regulatory duties promote the establishment of information exchange and operative networks, as is shown in the second part of this chapter. The arrangement of efficient operative networks seems to be a main task for municipal utilities who want to participate actively in the German energy market.

Networks can push the diffusion of contracting solutions by offering best practice or joint operational experience. In particular, horizontal networks play a central role in building up grid-based services and help to cope with economies of scale concerning large-scale capacities. Local utilities increasingly conceive themselves to be partners in horizontal networks rather than being a self-sufficient municipal firm or a subsidiary of a TNO.

In sum, we can state that German utilities are more alive than it was estimated a few years ago. They use the newly gained opportunities to build up more efficient management structures, customer relations and innovative product or generation solutions. Albeit, new opportunities create new risks. This forces utilities to take part in larger network structures and to strive for market consolidation. Nevertheless, due to the ongoing regulative changes in the market, there is a high potential for more organisational and technical dynamics affecting climate friendly innovations in the next years. Future research will show how effective the evolving different forms of networking will be in dealing with socio-technical and environmental change in the long run. The different strategies of action of grid operators and local utilities will interact and it remains to be seen whether the niches for environmental solutions in energy generation and energy services will grow larger.

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8. Appendix: Data collection and tables

I 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:

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

(2) 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 who 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.

II Tables

Table 1: Legal form of German utilities

Legal form	Freq.	Percent	Cum.
Own establishment	16	12.50	12.50
Sole proprietorship	3	2.34	14.84
GmbH	94	73.44	88.28
GmbH & Co KG	5	3.91	92.19
AG	10	7.81	100.00
Total	128	100.00	

Table 2: Private sector orientation of the utility – Appraisal of the statement „Utilities must be geared to strategies of private firms”

Appraisal “Private sector orientation”	Freq.	Percent	Cum.
Fully disagree	1	0.79	0.79
Partly disagree	1	0.79	1.59
Partly agree	29	23.02	24.60
Fully agree	95	75.40	100.00
Total	126	100.00	

Table 3a: Activities in innovation domains

Innovation domains	Freq.	Percent
RES + CHP + Contracting	45	35.16
RES + CHP	13	10.16
RES + Contracting	4	3.13
CHP + Contracting	17	13.28
RES	3	2.34
CHP	21	16.41
Contracting	7	5.47
No activity in any innovation domain	17	13.28
Total	100.00	

Table 3b: Activity in renewable energy generation*Activity in CHP

RES	CHP		
	Not operative	Operative	Total
Not operative	24	38	62
operative	7	59	66
Total	31	97	128

Phi = <u>0.3278</u>
d% = <u>38,24%</u>

Table 3c: Activity in renewable energy generation*Activity in Contracting

RES	Contracting: Not operative	Contracting: Operative	Total
Not operative	38	24	62
operative	16	49	65
Total	54	73	127

Phi = 0.3708
d% = 37,49%

Table 4a: Activities in Energy Data Management: before 1998

Activities before 1998	Freq.	Percent	Cum.
No engagement	65	52.00	52.00
Low engagement	43	34.40	86.40
Medium engagement	14	11.20	97.60
High engagement	3	2.40	100.00
Total	125	100.00	

Table 4b: Activities in Energy Data Management: today

Activities today	Freq.	Percent	Cum.
No engagement	2	1.59	1.59
Low engagement	17	13.49	15.08
Medium engagement	58	46.03	61.11
High engagement	49	38.89	100.00
Total	126	100.00	

Table 4c: Activities in Energy Data Management: within the next five years

Activities within the next five years	Freq.	Percent	Cum.
Low engagement	7	5.56	5.56
Medium engagement	37	29.37	34.92
High engagement	82	65.08	100.00
Total	126	100.00	

Table 5: Utilities engaged in micro-CHP: future planning

Future planning: Micro-CHP	Freq	Percent	Cum.
No scaling-up	15	42.86	42.86
Scaling-up	20	57.14	100.00
Total	35	100.00	

Table 6: Crosstabulation of activities in innovative generation projects by experiences in managing conventional generation technologies

Activities in innovative generation projects	Experiences with conventional generation		
	No	Yes	Total
Not active	35	9	44
	51.47	26.47	43.14
Active	33	25	58
	48.53	73.53	56.86
Total	68	34	102
	100.00	100.00	100.00

Cramér's V = 0.2380

Table 7a: Informational exchange with consortium of utilities/horizontal cooperation networks

Consortium of utilities /Horizontal networks	Freq.	Percent	Cum.
No exchange	2	1.57	1.57
Exchange	125	98.43	100.00
Total	127	100.00	

Table 7b: Informational exchange with TNO/"Verbundnetzbetreiber" and affiliates

TNO/"Verbund-netzbetreiber"	Freq.	Percent	Cum.
No exchange	46	38.33	38.33
Exchange	74	61.67	100.00
Total	120	100.00	

Table 8: Crosstabulation of engagement in building up own generation capacities within the next five years by shareholdings of other companies

Own capacities within the next five years	Shareholdings		
	no	yes	Total
No engagement	10	14	24
	15.38	23.73	19.35
Low engagement	14	17	31
	21.54	8.81	25.00
Medium engagement	22	16	38
	33.85	27.12	30.65
High engagement	19	12	31
	29.23	20.34	25.00
Total	65	59	124
	100.00	100.00	100.00

Cramér's V = 0.1607

Table 9a: Cooperation in generation projects: with consortium of utilities/horizontal cooperation networks

Consortium of utilities/ Horizontal networks	Freq.	Percent	Cum.
No cooperation	99	77.95	77.95
Cooperation	28	22.05	100.00
Total	127	100.00	

Table 9b: Cooperation in generation projects: with TNO/"Verbund-netzbetreiber" and affiliates

TNO/"Verbund-netzbetreiber"	Freq.	Percent	Cum.
No cooperation	115	90.55	90.55
Cooperation	12	9.45	100.00
Total	127	100.00	

Table 9c: Cooperation in grid services: with with consortium of utilities/horizontal cooperation networks

Consortium of utilities/ Horizontal networks	Freq.	Percent	Cum.
No cooperation	117	92.13	92.13
Cooperation	10	7.87	100.00
Total	127	100.00	

Table 9d: Cooperation in grid services: with TNO/"Verbundnetz-betreiber" and affiliates

TNO/"Verbund-netzbetreiber"	Freq.	Percent	Cum.
No cooperation	119	93.70	93.70
Cooperation	8	6.30	100.00
Total	127	100.00	

Table 9e: Cooperation in distribution: with with consortium of utilities/horizontal cooperation networks

Consortium of utilities/ Horizontal networks	Freq.	Percent	Cum.
No cooperation	93	73.20	92.13
Cooperation	34	26.80	100.00
Total	127	100.00	

Table 9f: Cooperation in distribution: with TNO/"Verbundnetzbetreiber" and affiliates

TNO/"Verbund- netzbetreiber"	Freq.	Percent	Cum.
No cooperation	119	93.70	93.70
Cooperation	8	6.30	100.00
Total	127	100.00	

Table 10: Crosstabulation of cooperation with consortium of utilities/horizontal networks in generation projects by activity in Contracting

Cooperation with consortium/ horizontal networks in generation projects	Contracting		
	No	Yes	Total
No	51	47	98
Yes	3	25	28
Total	54	72	126

Phi = 0.3472
d% = 29,16%