Energy efficiency in public buildings – local transition strategies

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Abstract

The Public building sector is a major field of action in local energy strategies. The influence of local authorities is significant, as they can act directly. Furthermore, increase of energy efficiency in these buildings saves public money, thus making it very attractive. The paper focuses on the role of local authorities as "consumer and model", analyzing local strategies for energy efficiency in public buildings. It discusses the importance of local social innovations like the creation of intermediaries, defined by their mediating role between different major actors. The idea is that the local level is not only the key level for implementation but also for developing and testing new approaches. Three case studies in major German urban areas (Berlin, Frankfurt/Main, Ruhr Metropolis) confirm this hypothesis. They have been realized in 2010–12 in the framework of an interdisciplinary research group on urban infrastructures. Results of two of them, Frankfurt/Main and Berlin, are presented in the paper.

Urban energy infrastructure faces major transformations concerning the technical structures of energy provision and consumption as well as its social organization. The core question is what role cities can play in the process of transforming the energy system, what specific local approaches for this exist and how these differ according to different local contexts. The research refers to the multi-level perspective in transition research (Geels 2002, Konrad et al.2004) as well as to literature on large technical infrastructures (LTI) as socio-technical systems (Hughes 1989) and on social innovations (Zapf 1989, Gillwald 2000). The paper presents examples of innovative local strategies, e.g. a model for financing energy efficiency in public buildings developed in Berlin, and the energy management in Frankfurt with its monitoring strategies and guidelines for the construction and refurbishment of public buildings. These examples have been analyzed on the basis of documents as well as of qualitative interviews with local key actors. Both cities have locally developed and applied successfully new approaches and tools for problem solving. They demonstrate the feasibility and trustworthiness of potential innovations, thus also playing an important role for a wider diffusion. They are "primary actors" (Geels 2011: 25) as well as "seedbeds and locations for radical innovations" (Ibid: 25).

Introduction

In recent years, the local level, especially cities, has come to the forefront of public debate on climate mitigation action and energy transition strategies (Aall et al 2005, Betsill and Bulkeley 2007; Brunnengräber et al 2008, Bulkeley and Kern 2004 and 2006; Bulkeley et al. 2011, EEA 2009, Geels 2011, Hodson and Marvin 2010, Schönberger 2013). Local communities do more than merely implement strategies designed at other levels of governance; they have a wide range of initiatives and strategies adapted to their particular local context and needs. The Council of European Cities and Municipalities[1] has delegated local authorities two major roles in climate protection: As a consumer and a promoter of sustainable practices via planning and public education (CEMR 2009). The Climate Alliance of European Cities identifies four categories: 1) consumer and model, 2) planner and regulator, 3) advisor and promoter, 4) provider

and supplier[2]. Bulkeley and Kern relate these categories to different modes of local governance: "Self-governing", "governing by authority," "governing through enabling" and "governing by provision" (Bulkeley and Kern 2006: 2242).

The role of "consumer and model" is particularly in the focus of the present paper. Concerning their own building stock, municipalities have direct influence as well as self-interest to act. Renovations and energy management in public buildings do not only directly lower emissions and costs, but can also have an important "model effect". They can demonstrate to private actors possibilities to act and encourage them to choose efficient solutions. To act in its own premises also gives additional credibility to the whole local energy policy/climate change strategy. As part of a "green public procurement strategy" it also sets incentives for local companies to invest in energy efficiency business models, technologies and competences (EU Commission 2005).

The paper presents case studies on two local approaches for energy efficiency in public buildings. They are a part of larger case studies realized in 2010/12 in the framework of an interdisciplinary research group on urban infrastructures. Starting point of this research is that urban energy infrastructure faces major transformations concerning the technical structures of energy provision and consumption as well as its social organization. The principal question is what role cities can have in the process of transforming the energy system and what specific local approaches for this exist. The research refers to the multi-level perspective in transition research (Geels2002 and 2007, Konrad et al. 2004) as well as to literature on Large Technical Infrastructures (Hughes 1989) defining them as socio-technical systems, and to concepts of social innovations (Zapf 1989, Gillwald 1997).

The concept of a socio-technical regime describes "semi-coherent sets of rules carried out by different social groups" (Geels 2002: 1260) and explains the stability of socio-technical configurations. The regime is part of a multi-level concept (Geels 2002) and is situated between the landscape (external factors) and the niche on which new elements are developed and tested. Such new elements, new technological solutions or social innovations, can be optimized in a niche and adapted to the needs of the users. Niches also serve for network, trust and rule building around these new approaches.

In this paper, niches are defined as socio-technical niches according to Kornelia Konrad et al., representing the testing of a "specific local combination of structural elements" (own translation, Konrad et al. 2004: 64). This concept stresses the experimentation of a whole socio-technical configuration of institutional, knowledge, technical, ecological as well as goal and value structures for function fulfilment (Ibid.). The focus is on this functional aspect and on the way to achieve it, less on specific technical innovations. They are only one possible way of changing existing configurations and are analyzed in a whole set of structural elements. In the case studies, examples for such niches were chosen on the basis of interviews. Selection criteria were attributed meaning (of the interviewed stakeholders), deviation of the traditional way of function fulfilment, the potential to achieve changes of the energy regime. This paper presents two of the examples focusing on energy efficiency in public buildings. It shows how at the local level, niches are set up by different stakeholders for changing the local socio-technical system of energy with the goal of enhancing energy efficiency. It also demonstrates that this is realized quite differently according to different local contexts, reflecting the importance of contextual aspects like local energy system history and infrastructure as well as local political, economical and social constellations.

First, buildings as major field for local energy transition strategies will be introduced, and then different strategies will be exemplified on the case studies. The examples presented here have been analyzed on the basis of documents as well as of 24 qualitative interviews with local key actors. The interviews have been analyzed according to qualitative content analysis (Gläser, Laudel 2010 and Mayring). This procedure of extracting and structuring material by categories allows to analyze it rule based and systematically. The set of categories has first been designed on the basis of the research questions and hypothesis and further developed in the course of the coding procedure.

Buildings as major field for local energy transition strategies

Buildings account for 40 % of the final energy consumption in the European Union (EU 2012), thus representing a major field for energy efficiency actions. But the rate of building renovation still has to be increased considerably. In the directive on energy efficiency of the European Parliament and the Council, public buildings are identified as important lever for achieving the goal of more energy efficiency (EU 2012). Besides accounting for a considerable share of the existing building stock, they also have a high visibility and can have an exemplary function.

In Germany, municipalities own more than 170,000 municipal properties[3] (DIFU 2011). With around 2.6 billion euro, energy in public buildings is at the 4th place in local public spending (DIFU 2011). It also accounts for about two thirds of 23.5 Mt CO_2-emissions by energy usage in public buildings per year (Ibid.).

The status and strategies of energy efficiency actions in municipal premises varies strongly. While some forerunner cities like Frankfurt have already a long established energy management and considerable achievements, others lack behind. Often, the financial situation makes investments in energy efficiency difficult, even though they would pay for themselves in a significant extent and would save money in the long term. Here, private investments e.g. from energy service companies or citizens can be a solution as it will be demonstrated in one of the case studies below.

Municipalities act quite differently, strategies are strongly linked to the respective local context with its energy policy and institutional traditions, local actors and interests, local economy, structure of population, infrastructures and ecology. This is exemplified in this paper on two case studies regarding local energy efficiency policies in two German cities. Berlin represents a privatized approach, enhancing energy efficiency by ways of partnerships and private investments. Frankfurt represents a more traditional regulative and supportive way of governance with a long established energy management and regulations concerning public buildings and buildings used by the municipality.

Example 1: "Energy Saving Partnerships" in Berlin

ENERGY POLICY AND LOCAL GOALS IN BERLIN

Berlin is a monocentral metropolitan area with the status of a federal land. Since 1990, Berlin has an explicit energy and climate policy (SenGUV 2011). Basis is the Energy saving act (BenSpG) from 1990, concretized in 1994 by the first energy concept as well as in further concepts and a working programme (2008). Twelve districts constitute the level of implementation of the energy policy. They do not have the same status as municipalities[4], but their cooperation is nevertheless necessary e.g. for programmes concerning energy efficiency in public buildings. The level of activities of these districts concerning energy efficiency varies quite strongly. All are supposed to appoint an energy manager (BenSpG §20). These energy managers evaluate the buildings of their district, propose possibilities for energy savings, implement measures and supervise their realization (Berliner Energieagentur 2011a). They are mainly focused on cost reductions while district climate managers focus on local measures for CO_2-reductions.

In its climate policy working programme of 2008 and the "energy concept 2020" (Berliner Energieagentur 2011a), Berlin sets a target of 40 % CO_2 reduction (17.6 Mt/a) until 2020 and 85 % until 2050 (in comparison to 1990, Berliner Energieagentur 2011a). Besides administration and utilities, the Berlin Energy Agency plays an important role as an energy service company and local intermediary. This is an institution created by the federal Land as a Public Private Partnership with the big energy utilities Vattenfall and Gasag and the KfW Bank (Kreditanstalt für Wiederaufbau):[5] The federal Land of Berlin, the Vattenfall Europe Wärme AG, the GASAG Berliner Gaswerke Aktiengesellschaft and the KfW Bankengruppe hold an equal share of 25 percentage of the BEA[6].

A central strategy of Berlin consists of integrating local economic actors "as active climate protection partners" (SenGUV 2011: 24) acting according to the motto "cooperation instead of confrontation" (Strieder 2001 as well as several interview partners). Examples for this strategy are the "Berlin Climate Alliance (Berliner Klimabündnis)" bringing together the largest local CO_2 emitters in a voluntary agreement to contribute to a lowering of CO_2 emissions. There are also individual "contracts" with local companies like Vattenfall[7]. The approach for energy efficiency in public buildings presented here, the so-called "Energy Saving Partnerships" (ESP), can be seen as part of this strategy of cooperation, integrating private partners into the striving for energy efficiency. Berlin has a strong tradition of privatisation of urban infrastructures (see Monstadt 2004).

In the following, the approach of the "Energy Saving Partnerships" will be analysed as example for a local niche development and local social innovation.

BACKGROUND AND CONCEPT OF THE "ENERGY SAVING PARTNERSHIPS"

Background of the emergence of the concept was the high financial strain of the local budget of energy costs (in 1994 accounting €23 M, about 1 % of the local budget (Monstadt 2004: 351) as well as important potentials for energy savings in public buildings. At the same time, several barriers became obvious to the implementation of the Energy saving act (BenSpG) concerning energy savings in public buildings. On the one hand, the critical financial situation of Berlin made investments difficult, on the other hand there were obstacles concerning fiscal accounting (e.g. principles of cameralistics), organizational deficits and lack of information and of personnel resources (Monstadt 2004). In the middle of the 90es, the innovation gap was aggravated by the deteriorating financial situation of the city (Ibid.). The goal of saving at least 25 to 30 % of energy in public buildings by 2010 (energy concept 1990–2010) seemed not achievable by public financial investments. The investments needed were estimated at up to two billion euros (SenGuv 2011: 59).

Against this background, representatives of the administration came up with the idea of achieving energy saving goals by involving private capital. They created the approach of the "Energy Saving Partnerships", working it out in collaboration with the Berlin Energy Agency and CommunalConsult (Kist and Brüne 2001, SenGuv 2011). "The financial difficulties of the capital made inventive" (Berliner Zeitung, 31.05.2006[8], own translation).

When discussing the concept of "Energy Saving Partnerships" with local stakeholders, this point of necessity to find an alternative strategy for being able to act under the given circumstances was stressed. But there is also pride and the perception of "a Berlin invention", something new they had developed and that has drawn attention to them and been diffused to other contexts in and outside of Germany.

The implementation of the idea was decided by the Senat on the 4th of April 1995. The first model projects with about 50 properties each were started in 1996.

The concept includes both operation as well as performance contracting. The local authority runs a tendering process to transfer the financing, planning, implementation, and monitoring of energy saving measures to a private contractor, the "Energy Saving Partner". This contractor signs an "energy saving guarantee contract" (SenGuv 2006: 7)[9] to guarantee a minimum level of energy savings, clarity on duties and responsibilities as well as to ensure long-term quality. The investments are refinanced by the savings made. Remaining savings are shared by the partners until the end of the contract (SenGuv 2006). During the period of the contract (between 10 and 14 years), the contractor is responsible for the performance of the technical systems. The energy suppliers are not directly affected by the project.

In order to avoid cherry picking, pools of buildings are put together leading to a profitable cross calculation and ensuring that less profitable properties are integrated (Kist 2006, Monstadt 2004, SenGuv 2006). The buildings in the pools have different levels of energy consumption, construction material, fixtures and fittings (SenGuv 2006). Figures 1 and 2 illustrate the concept of the "Energy Saving Partnerships".

In May 2011, the status was 26 pools including between 1 and 73 premises (519 premises in total, mostly schools, followed by office buildings)[10]. The average energy savings were 26 %, the guaranteed financial savings for the public budget amounted to €2,708,192 per year (6 %), the CO_2 reduction 69,663 t/a (Berliner Energieagentur 2011).

LOCAL PERCEPTION OF THE "ENERGY SAVING PARTNERSHIPS"

Having in mind the often controversial discussions on public private partnerships, the "Energy Saving Partnerships" in Berlin seem astonishingly non-controversial. According to the

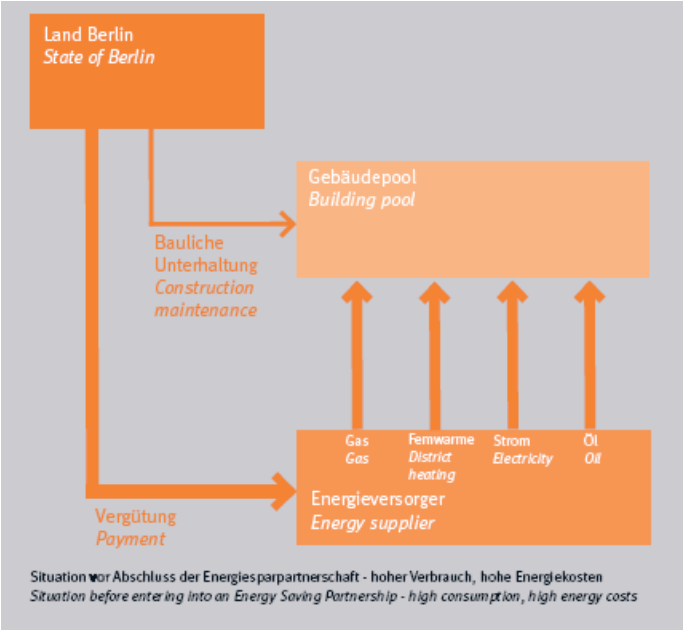

Figure 1. Situation before an "Energy Saving Partnership" (SenGuv 2006).

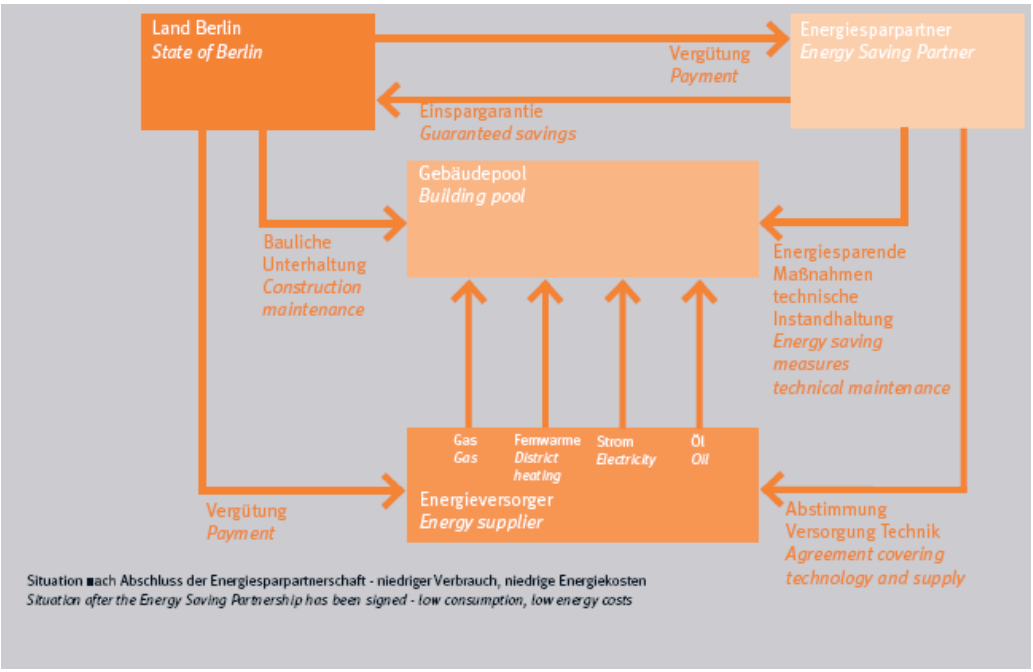

Figure 2. Situation after the Energy Saving Partnership has been signed (SenGuv 2006).

interviewees, the implementation did not face major acceptance problems. It seemed clear that private investments were necessary. Still, when digging deeper and when looking at media coverage, there are also concerns. An interviewee (private sector) described it as a sort of "shadow budget". "Somebody has to take loans for it, why it's not the city itself?"

A representative of a district told that the project was eyed critically because of fear of a reduction in staff in the premises. According to him and to other interview partners, the reduction of staff was taking place independently from the "Energy Saving Partnerships" in all districts, imposed at the city level for financial reasons. "But those, who do not have "Energy Saving Partnerships" are worse off. I don't know what they do. Perhaps they hire engineering offices, that's very expensive" (representative of a district using the ESP). The aspect of privatisation was eyed critically as well as the question of long-term contracts without experience how they would really work out (political actor).

Some protest arised concerning conflicts between the goal of maximal savings and the needs for comfort of the users of the buildings as well as their perception of not being integrated. Media coverage is mostly positive, citing happy facility managers telling about their new gas boiler for example (Berliner Zeitung, 31.5.2006), labelling it as "ideal model for

the poor Berlin" (Tagesspiegel, 20.3.2009) and rejoicing about Berlin being a forerunner in Energy Efficiency for public buildings (Tagesspiegel, 20.3.2006). But they also cite a member of the parents' council telling about "complaints from all schools" ("Saving until the children freeze", title for an article of the Berliner Zeitung, 8.12.2005). According to her statement and some remarks in interviews, the user integration seems to be improvable. As shown in several studies, this aspect is important for acceptance and compliance of the users of the buildings (Fink et al. 2012, Hacke and Lohmann 2007), also in view of possible rebound effects. User integration is intended but seems not always to be realized as it could be appropriate. The representative of a district as well as one from politics explains in the interviews difficulties, for example arising from the permanent change of users especially in schools. Awareness raising should ideally take place at a regular basis, not as one time action. In some districts, the "Energy Saving Partnerships" even tend to go at the expense of user and behaviour oriented approaches (statements from two interviewed stakeholders).

In a review on "10 years of Energy Saving Partnerships", Klaus Kist, responsible at the Berlin environmental administration, mentions enormous reserves and the necessity of sensitivity for winning over the district administrations (Kist 2006). The status of implementation on the level of the districts varies strongly (Berliner Energieagentur 2011a).

Some other difficulties concern conflicts around the distribution of the benefits and consequences of changes in use, vending or closing of premises (Kist 2006, Berliner Zeitung 27.9.2005). But overall, the assessment of the experiences with the "Energy Saving Partnerships" seems very positive. Plans exist to apply it to other sectors such as housing companies and other measures (e.g. building envelop) and to renew such contracts when finished.

As contrast to the approach of Berlin, a strategy of the city of Frankfurt/Main is shortly introduced here.

Example 2: Frankfurt: Policies for local building standards

ENERGY POLICY AND LOCAL GOALS IN FRANKFURT

Frankfurt/Main is with around 700,000 inhabitants at the 5th place of German cities. It is at the centre of the Frankfurt/Rhine-Main metropolis region, a polycentric region with around 2.2 million inhabitants[11].

Frankfurt was one of the founding members of the Climate Alliance (1990), setting the goal of 10 % CO_2 reductions every 5 years[12]. In 1989, a local energy agency, the "Energiereferat" was founded as a part of the city's environmental department[13] with the mission to develop and implement climate protection in Frankfurt. It concentrates on the fields of electricity saving, energy planning and combined heat and power supply as well as residential buildings and renewable energies. It "promotes climate protection aims"[14] involving different partners.

Energy efficiency in buildings is an important field of the energy policy in Frankfurt. Its goal of being a "Passive House Capital" has led to several resolutions. On the one hand, requirements have been installed concerning buildings realized on ground bought from the municipality and for communal buildings as well as the prerequisite of following the passive house standard[15] or at least staying 30 % below the Energy Saving Regulation standard (EnEV – 30 %) for getting public subsidies. On the other hand there are subsidies for renovations and the realization of buildings in passive house standard (Energiereferat 2009).

Since June 2012, a "Master Plan for 100 % Climate Protection" is being discussed in a public 4 year participatory process financially promoted by the Federal Ministry of the Environment. The goal is to update the climate protection concept of 1998 with the goal of 100 % renewable energies in 2050, covering half of the current energy consumption by energy savings. The commune sees itself as "laboratory for solutions for a broad implementation of climate protection, energy savings and renewable energies" (www.frankfurt.de)[16].

Local governance structures for energy provision are quite different from those in Berlin. In contrast to the strong privatisation policy in Berlin, Frankfurt holds a major part (75 %) of the local energy utility Mainova. The approaches in climate and energy policy are quite different as well, even though the focal points, energy efficiency and CHP (combined heat and power) converge. An important aspect is the much better financial situation of Frankfurt in comparison to Berlin.

The Energy Agency is complemented by an energy management unit with 10 employees, founded in 1991 in the context of joining the Climate Alliance (with a small precursor established in 1983). Its task is to lower the public spendings on water and energy and to "exemplary implement" (Linder 2012:1) the climate protection goals of the municipality. This institution is mainly responsible for the approaches for energy efficiency in public buildings presented in the following.

ENERGY EFFICIENCY FOR PUBLIC BUILDINGS IN FRANKFURT

Frankfurt has 1,047 properties and 2,450 buildings with public usage. The annual energy costs amount to €32 M per year, including €13 M per year for heating (Energiemanagment 2011[17]).

Since 1990, important energy savings have been realized (-31 % heat energy, -26 % CO_2 emissions; Linder 2012). They have mainly been achieved through controlling, optimising operations and investment measures (Ibid.). The ratio between financial effort of the energy management unit and the financial gains is about 1:3 (Linder 2012).

An instrument presented exemplary here, are the guidelines for cost-efficient building (Leitlinien wirtschaftliches Bauen, Hochbauamt 2012). Basis is the decision of the city council assembly of 2007 that the passive house standard has to be adopted for new public/publicly used buildings and in case of their renovation[18]. These guidelines have been proposed in some interviews as one example for local innovative action. They are updated yearly by the energy management in a process of involving a range of different actors around the administration of the premises. These guidelines have been developed based on a tool for cost-efficiency, including environmental costs and regarding the whole life cycle of the building. The aim was to get objective values for different variants proposed. "So we have developed a procedure and we were astonished that such thing did not exist on the market" (interviewee of the administration). Nowadays, a lot of other municipalities use the tool developed in Frankfurt as well.

By applying the tool, they could show already in 2003 that adopting passive house standard was cost-efficient for 90–95 % of communal building projects (Ibid.)[19]. This emphasis of cost-efficiency is perceived as a major factor of success by local interviewees, especially representatives of the administration.

Goal of the guidelines is to minimize the annual total costs over the whole life cycle (planning, construction, operating costs, demolition and disposal), estimated with 40 years, including environmental costs and based on given quality standards. These include standards for example regarding health and comfort, the contribution to climate protection and the consideration of climate change, local identity (Hochbauamt 2012). The guidelines include milestones and detailed check lists.

The "Guidelines for cost-efficient building" represent a different rule setting, at the same time regarding the outcome (including new goal and value elements) as well as the process (integration of different actors of the administration of public buildings in a yearly process). Knowledge structures are changed by the systematic compilation and processing of data, technical structures by the application of the passive house building standard.

Niche Developments and Social Innovations

Niches are defined here according to Kornelia Konrad as specific local combination of structural elements in which a whole socio-technical configuration is tested (own translation, Konrad et al.: 64). For the presented case studies, the examples are chosen as representing the development and testing of a local new approach, a deviation from how the fulfilment of a function was organized before. The structural elements explicated on the example of the "Energy Saving Partnerships" can be seen in Table 1[20].

When asking the interview partners in Berlin to name examples for local innovation niches, the approach of the "Energy saving Partnerships" was clearly in the foreground, named by almost everyone. They see it as "Berlin invention". It was first experimented with in model pools and now it can be perceived as local social innovation. It has also been diffused more widely. Representatives from other cities (German and international) as well as institutions on the federal and national level have come to learn about the experiences and to implement it in other contexts. The Land of Hesse has edited a guideline based on the Berlin experiences[21].

The approach of forming pools was named as the most special aspect. On the one hand to avoid cherry picking, on the other hand for combining measures with long and ones with shorter time frames of amortization to create cost effectiveness for the whole period.

An important characteristic of niches are unstable rules "in the making" (Geels 2007: 402). The process of rule creation constituted a major challenge and important part of the model phase (interviews with representatives of the administration and Kist 2006). Two lawyer's offices were involved and especially the phase of the two model pools was one of "learning by doing" (Kist 2006:3). A model contract and the guideline[22] have been written, later complemented by handbooks of the national energy agency dena (2005, 2007, 2008) and the federal environmental agency (Umweltbundesamt 2000) as well as by a DIN-Standard[23], creating the basis for a standardized application. Learning and rule creation are part of the process from niche experimentation to social innovation. Regulative rules are developed by the stakeholders as it can be well observed on the example of the "Energy Saving Partnerships", but there are also normative and cognitive rules developing in the process of experimentation and stabilization of the new approach (Geels 2007).

While in Berlin the character of the niche is based on the experimental pools with a rule creation phase and the important role of a semi-private intermediary (the Berlin Energy Agency), in Frankfurt, the new approach for enhancing energy efficiency represents an approach of self-governing (Bulkeley and Kern 2006) realized within the administration of the city (and integrating energy responsibles in the buildings) in order to dem-

Table 1. "Energy Saving Partnerships" according to structural elements.

Technical Structures	Development /adaption of monitoring systems and other energy management tools for public buildings ; new technical equipment
Ecological Structures	Less consumption and emissions
Institutional Structures	Focus of the niche: Changes in governance and actor structure;new rules; partial privatisation of energy management and maintenance
Knowledge Structures	Data Management; Information of the users of the buildings; Experiences with the new institutional form of management
Value- and Goals Structures	Privatisation vs. Traditional public management; Social norms of energy usages; change in goal

onstrate the feasibility of energy efficiency standards and cost effectiveness and for inciting other local actors to follow their example. Both use their scope of action as public bodies with some (restricted) regulative power for realizing new ways of problem solving and for setting an example. Both have been replicated in other contexts as well and present their solutions with pride.

In Berlin as well as in Frankfurt, the current status isn't the one of niche experimentation any more. They are widely applied and institutionalized and can be seen as social innovation according to the definition of Zapf (1989): a new way to reach goals, by the mean of which problems can be solved better than with former practices and that are worth imitating and for institutionalisation. Social innovations "can be preconditions, circumstances or outcome of technical innovations" (Zapf 1989: 177. own translation). Like Rogers, he stresses the criteria of constituting something new in the perception of individuals (Zapf 1989). But "worth imitating" implies also a social judgement as well as being tested, not just a new idea but something that is being implemented (also in the concept of Schumpeter 1947). While technical innovations are generally supposed to be really new in the sense of unknown before, social innovations can also be approaches that are re-decovered (see also Gillwald 2000). This relative concept is also expressed in the notion of 'new in the perception of individuals' (Zapf 1989).

Local niche creation can foster the creation of social innovations. Gillwald (1997) stresses the importance of niches for social innovations because of the necessary constitution of trust. But social innovations can also constitute a niche for the experimentation of new approaches. Examples are new intermediary organizations, bringing together different stakeholders and/or finding synergies between different sectors like housing and energy or energy and transport. The two concepts are closely interlinked and overlap. Local niche experiments can be defined as a mean to create and experiment potential social innovations. They are at the starting point of social innovations that are, following the definitions of Zapf (1989) and Schumpeter (1947) to be tested and accepted to be defined as such. But social innovations can also enable local stakeholders to develop new approaches of problem solving, they can be the "incubation rooms" (Geels 2007 citing Schot 1998, Kemp et al. 1998). This fits to the close interlinkage of social innovations with technical innovations, described by Zapf (1989).

Conclusion

Two quite different local contexts with differing approaches for achieving an increase in energy efficiency in public buildings have been presented. Both underline the importance of quite pragmatic considerations as typical starting points (Gillwald 1997). They also show that the driving forces for transformations are mainly political and economical, as stated by Renate Mayntz (2009), while technologies can define "corridors" (Ibid.: 128) and can act as barriers or enable changes (Ibid.). They also illustrate that cities have a strong interest in energy efficiency in their premises. This is for saving money as well as for their contribution to climate protection in terms of self-governing (Bulkeley and Kern 2006: 2242). It renders them more credible when acting as a good example. They can create show cases for encouraging private actors to follow this example. This role of a model is a motive often cited as motivation in local documents as well as in interviews with local stakeholders. In Frankfurt, the realization of the passive house standard in public buildings is supposed to show that this is a realistic and cost-effective option. And there are some successes in convincing private actors to follow this example. The striving for the title of "Passive House Capital" is also playing a role as local vision and incentive. The "Guidelines for cost-efficient building" represent a different rule setting in itself and its implementation. At the same time regarding the outcome (including new goal and value elements) as well as the process (integration of different actors of the administration of public buildings in a yearly process). In Berlin, out of the lack of resources for public energy efficiency investments and representing a context with a tradition of privatisation of infrastructures and favouring a cooperative approach to a regulative one, a form of energy performance contract has been tested and rules have been developed in a "learning by doing" process. This was basis of guidelines on the level of another Land as well as on the national level.

Both cities have locally developed and tested successfully new approaches and tools for problem solving that were diffused to other locations as well as integrated into national policies. They demonstrate the feasibility and trustworthiness of potential innovations, thus playing an important role for a wider diffusion. They are "primary actors" (Geels 2011: 25) as well as "seedbeds and locations for radical innovations" (Ibid.: 25).

Therefore we conclude that in cities and towns, new approaches for energy provision and usages and visions of changes in the energy regime can be successfully experimented with and the results of this can be transferred or can have influence on the currently dominant socio-technical regime on different governance levels (see also Späth and Rohracher 2010). They are ideal context for niche developments. This regards especially the domain of public buildings as they are mainly administrated at the local level and can serve as "show rooms" for energy efficiency innovations.

It will be interesting to further compare local strategies and niche innovations, especially regarding their link to the respective context and to differing modes of governance as they can be observed when looking at Berlin and Frankfurt. Another step will then be to analyse how these innovations are diffused and what impacts they have on the energy regime.

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Endnotes

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3. Municipal buildings/properties: http://www.leitfaden.kommunaler-klimaschutz.de/leitfaden/c2-handlungsfeld-energie.html: all energy consuming facilities ownd by the commune like administration buildings, public schools, hospitals, swimming baths, gymnasia, libraries and others.
4. They are "Selbstverwaltungseinheiten without Rechtspersönlichkeit" (FES 2003) Administrative units without legal personality.
5. http://www.berliner-e-agentur.de/sites/default/files/uploads/pdf/unternehmensbroschuerebeaeng.pdf (accessed 07.01.2013).
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19. The rest are mainly buildings with an only temporary usage like morning halls.
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