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# Berlin's electricity distribution grid: an urban energy transition in a national regulatory context

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## ABSTRACT

Germany has set ambitious targets to transform its energy system from being based on fossil fuels and nuclear to renewable energies, requiring electricity grids to be upgraded. As a result there is significant public pressure in some German cities to exert greater local control over electricity distribution infrastructure. A case study approach was used to investigate contestations around ownership and governance of Berlin's electricity distribution grid. Actors at the local level perceive the national institutional framework supporting liberalised energy markets as not designed to adapt electricity distribution grids to the challenges of the *Energiewende* (energy turn) and to be instead hampering investment, innovation and the involvement of local actors. By analysing politics of grid ownership and governance, and emerging tensions between a national regulatory framework and more locally bounded energy system visions, our study contributes to the emerging academic debate on urban energy transitions.

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## Highlights

- Politics of electricity grid ownership and governance in Berlin.
- Identifies difficulties in regulating electricity distribution grids in Germany.
- Tensions between national regulation and urban energy transition processes.

## 1. Introduction

Germany has set ambitious targets to change its energy system from fossil fuels to renewable energies and promote energy efficiency in order to reduce GHG emissions. By 2050 GHG emissions should be reduced by at least 80% compared to 1990 levels, renewable energy generation should contribute 60% of gross final consumption of energy and 80% of electricity supply should be produced by renewable energies (Federal Government 2010). The latter is especially challenging as the electricity demand in Germany may increase considerably if more electricity is used for transport and heating in the future (SRU 2011). Germany intends to implement this *Energiewende* (energy turn) while maintaining economic growth and prosperity (BMW 2012). After the catastrophe in Fukushima in 2011 the government decided to decommission all nuclear power plants by 2022, which means that measures to transform the energy supply have to be implemented more quickly. As a result the

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electricity transmission and distribution grids urgently need to be adapted to cope with an increasing share of renewable energies (BMW 2012).

A particular feature of the German case is that local distribution grids for energy (electricity and gas) operate on the basis of concession contracts – the holder has the right to use public ground for laying and operating the infrastructure, typically for a period of 15–20 years. Many of these contracts were taken up by private operators when public utilities were privatised in the late 1990s/early 2000s and many will terminate in 2015 and 2016 (VKU 2013). The key drivers of the *Energiewende* targets and processes to award concessions in some cities have encouraged new forms of local action to change the way energy systems are governed and operated. This has been the case in Berlin, Germany's capital city which is also one of the 16 federal states (*Länder*), with 3.4 million inhabitants and an electricity grid of 35.831 kilometres in length (Vattenfall 2011). The aim of this paper is to use the Berlin case to address the following research question: What is the relationship between local debates about the future governance and ownership of urban electricity distribution grids and the national level regulatory framework supporting liberalised energy markets?

The paper is structured as follows. In the next section the socio-technical conceptual approach which guided the research will be introduced. Here we argue that exploring the changing relationships between national and local energy actors, institutions and infrastructures can provide insights on key societal and political factors shaping socio-technical change, particularly in a German context. Section 3 outlines our qualitative, case study methodological approach. Section 4 describes the results of the case study of socio-technical transition processes in Berlin's electricity distribution grid and analyses the development of the national market and regulatory framework in Germany which underpins the *Energiewende*. We examine how local action to transform the energy system in Berlin is embedded in this institutional framework and we discuss emerging tensions. In the final section we discuss our findings in relation to the literature on urban energy transitions, and stress the need for more analytical focus on the politics of grids and network regulation.

## 2. A socio-technical systems conceptual approach

This paper adopts a socio-technical systems approach to the analysis of contemporary debates around energy systems and distribution grids in Germany (Hughes 1983; Bolton and Foxon 2015). Drawing from the history and sociology of technology, this approach views large technical systems as both shaping society as well as being shaped by society, its culture, politics, economic system and the geographical conditions (Williams and Edge 1996). In the section below we engage with socio-technical approaches which are seeking to understand the contemporary processes of energy system lock-in and how incumbent systems can be changed and re-directed towards more sustainable long term trajectories.

### 2.1. Sustainable and urban energy transitions

In the literature on sustainability transitions incumbent, or established, systems are conceptualised as socio-technical regimes – alignments of actors, infrastructures and institutions which provide system stability (Geels 2002). Incremental innovations in line with regime rules and practices are likely to be adopted whereas radical innovations which require structural changes to the systems themselves in order to be more widely adopted are typically marginalised. As a strategy to overcome such lock-in, Kemp, Schot, and Hoogma (1998) argue for the purposive creation of niche spaces protected from the day-to-day operation of markets within which learning about sustainable technologies and associated organisational and institutions innovations can take place. Developing these ideas, Geels and Schot (2007) articulate a number of transition pathways based on dynamic interactions between regimes, innovation niches and macro level landscapes which are largely beyond the control of system actors.

Alongside these largely stylised accounts of sustainability transitions in the literature authors have stressed the contextual and contingent nature of sustainable socio-technical change. Geels, Hekkert, and Jacobsson (2008) view such changes as ‘innovation journeys’, stressing the ‘open and uncertain nature of radical technological change, which is full of search and exploration processes, twists and turns, etc.’ (524). In their discussion of energy system transitions Schreuer, Rohracher, and Späth (2010) argue for a greater focus on institutional contexts and situated actors with differing interests and ideas.

Recent contributions to this body of literature have argued for more attention to be paid to how sustainability transitions play out in urban contexts (Coutard and Rutherford 2010). Rather than merely being sites where niche experiments can be conducted, cities themselves, it is argued, are increasingly important actors in shaping socio-technical change (Bulkeley, Broto, and Maassen 2011). The emerging role of cities is due to a confluence of factors; including the increasing availability of decentralised energy technologies, the liberalisation and unbundling of previously state controlled integrated utility monopolies, and an emphasis on urban and local scale action to address environmental issues. Not only are cities beginning to exert influence over national energy transitions, but through their involvement in transnational networks of large cities and municipalities, they are influencing change at a global level and potentially circumventing established regime structures (Bulkeley et al. 2012). Cities, Rutherford and Jaglin (2015) argue, are not merely homogenous, ‘passive contexts’ where energy decisions made at other scales are implemented, rather they are active arenas where ‘the nature, form and implications of the urban do have a very concrete impact on what is and is not done in the governing of (urban) energy’ (174).

## **2.2. Multi-level energy system governance**

While the urban dimension of sustainability transitions is rightly emphasised in this literature, it is important to keep in mind the complexity and diversity of multi-level interactions between cities, regions, national and global organisations and institutions in shaping system change. Large technical systems such as electricity infrastructure do not neatly align with spatial scales. Historical studies, for example, illustrate how ‘system builders’, in seeking to expand infrastructures and achieve techno-economic efficiency, often came into tension with locally embedded actors and interests who were reluctant to cede control of systems which were originally organised at an urban scale (Hughes 1983).

These tensions have played out in different ways across contexts. Russell, for example, identifies a strong production side bias in UK energy system governance throughout the twentieth century (1993). This, he argues, has led to the marginalisation of end use energy efficiency and decentralised technologies such as combined heat and power. Russell argues for more research on how structural biases inscribed into the seemingly mundane aspects of systems, for example, regulatory rules and market designs, inhibit or enable the development of energy efficiency and decentralised technologies. Drawing on such a structural perspective, Hawkey and Webb (2014) compare the UK, Norway and the Netherlands and argue that variations in the political economies of these countries go some way to explaining the different ways in which urban heating systems have developed. In a German context Monstadt’s study of energy and environmental policy in Berlin exemplifies the changing relationship between institutions embedded at the national level and urban energy transitions (2007). Following the privatisation and liberalisation of energy and other utility networks, the role of cities has changed dramatically: ‘... under the new framework ... crucial regulatory functions have shifted to the national or European policy level ... [and as a result] ... regional and local policies can at best make a marginal contribution to the regulation of economic efficiency and the security of supply’ (Monstadt 2007, 335).

### **2.2.1. National-urban dynamics and the governance of distribution grids**

Drawing on the above studies, the focus of this paper is on new relationships and tensions between national and urban actors and institutions viewed through the lens of contemporary debates around

ownership and governance of electricity distribution grids. Although initially designed only to deliver power to end customers in a one-way flow, in countries such as Germany, where levels of decentralised generation are expanding rapidly, distribution grids are increasingly seen as more active components of the energy system which facilitate the connection and integration of renewables. Unlike transmission networks, which span regions and nations, lower voltage distribution systems are local. However, as part of an integrated energy chain from generation through to end use, they typically operate according to rules and regulations devised and implemented by national actors which are designed to grant competing generators and suppliers access to the networks.

Research on the UK distribution grids has identified significant tensions between a regulatory logic which seeks to govern distribution grids uniformly at a national scale and efforts to systematically develop low carbon energy solutions in cities. The main priority of private distribution system operators (DSOs) has been to achieve short-term cost efficiencies in the day-to-day operation of their networks in compliance with national regulation. As a result there has been little incentive to engage with city-level actors and develop innovative solutions for specific urban contexts (Bolton and Foxon 2013, 2015).

In a German context the debate about the future role and governance of electricity (and other) distribution networks has revolved around ownership. Germany has in recent decades developed significant capacity in decentralised generation which is primarily owned by non-incumbent actors such as cooperatives and private individuals, unlike the UK where the majority of generation remains centralised and incumbent owned (Hall, Foxon, and Bolton, 2016). Also, unlike the UK, private network operators in Germany operate local grids on a concession basis, with periodic renewals of the contract. In this context of uncertainty about system ownership and control, academic studies have begun to analyse the politics of grid remunicipalisation, particularly in Germany. Hall, Lobina, and Terhorst (2013), for example, investigate the current trend in remunicipalisation in Germany's electricity sector and France's water services and discuss the political and economic reasons behind the policy change towards public sector provision. A number of studies have focused on the energy politics of Berlin and the surrounding region, focusing in particular on the role of civil society environmental groups in campaigning for local ownership of grids (Moss, Becker, and Naumann 2014; Becker, Beveridge, and Naumann 2015; Blanchet 2015).

We contribute to this emerging literature by highlighting how structural features of the electricity system, in particular national level processes of energy market liberalisation and grid regulation, are intertwined with city-scale contestations around grid ownership. As such our approach is more rooted in the socio-technical systems approaches discussed above (in particular: Hughes 1983; Russel 1993; Bolton and Foxon 2013). This analytical approach is further reflected upon in the final section of the paper.

### 3. Methods

The methodological approach is an interpretive style where we use the perceptions, opinions and beliefs of different actors to present socio-technical change as a complex and contingent process, as opposed to being determined by a particular variable, for example, economic or technical efficiency. In line with the wider literature on science and technology studies (STS), energy system change is not linear and predictable, but shaped by actors embedded in particular localities and by a range of contextual factors. A potential limitation of such an interpretive approach and case study method is that it is difficult to formalise and we cannot claim that our findings are generalisable to all cities. However, through our engagement with theories of socio-technical change we can claim to inform the wider debates about urban and sustainability transitions, which can be drawn upon to inform further empirical studies.

The study is primarily based on fifteen semi-structured interviews with experts involved in Berlin's electricity sector which were conducted in June and July 2014 (see Table 1). The aim here was to understand how they perceive and experience the current institutional framework and how these

**Table 1.** List of interviewees by type.

Organisation	No. of interviewees	Code attached to quotation
Independent think tank on energy regulation	1	R01
Energy providers	3	E01–E03
Lobby group for independent energy providers	1	E04
Distribution system operator	2	DSO
Berlin senate administration	6	S01–S03 Department for Urban Development and the Environment, special unit for climate and energy; Department for Finance; Department for the Economy, Technology and Research
Political parties, <i>Land</i> Berlin	4	CDU (Conservatives), SPD (Social Democrats); Green party; Left-wing party
Citizen initiatives	2	BEB – <i>BürgerEnergie Berlin</i> (Citizen Energy Berlin); BET – <i>Berliner Energietisch</i> (Berlin Energy Roundtable)
Total	19	15 interviews

perceptions and experiences might shape the future development path of Berlin's electricity distribution grid. The format of the interviews was not uniform but a range of topics were discussed which were common to all. Most interview questions were developed from the literature review. Yet, some more detailed questions, which served to verify or put into relation the statements of other participants, were added during the course of conducting the interviews. Questions focused on four main thematic areas. First, we asked about the interviewee's involvement in the governance of Berlin's electricity grid, their motivation and cooperation with other stakeholders. Then questions concerning their perspective on the model of grid regulation in Germany and the history of Berlin's energy supply followed. We further asked about the potential for change in terms of incentives for investment and innovation, municipal control and the process of awarding the grid concession. The interviews were concluded with questions on next steps and solutions regarding technical and institutional challenges and demands on policy-makers.

As a means of source triangulation a variety of stakeholders involved in the governance of Berlin's electricity distribution grid were interviewed including an independent think tank on energy regulation, several departments of Berlin's Senate Administration, the spokespersons for energy policy of the different parties represented in the Berlin Parliament, two citizen initiatives, the current DSO *Stromnetz Berlin GmbH* (called Vattenfall Europe Distribution Berlin GmbH until 01/04/2013) and independent energy providers and their lobby group. The interview transcripts were manually coded and grouped into the main categories which were used to form the basic structure of the empirical section.

#### 4. Berlin: contested grid ownership in a liberalised context

This section focuses on the Berlin case. We begin by outlining the national regulatory framework for electricity networks, and following this we discuss how these structural features of the socio-technical system are playing an important role in the specific urban debate around grid governance and ownership.

##### 4.1. Implementing the liberalisation of the German electricity market

In Germany the liberalisation of the electricity market has not been implemented systematically since the country began opening up its energy systems to competition in order to comply with European directives in 1998. Unbundling<sup>1</sup> of the electricity sector was implemented in such a way that only two of the four transmission grids and none of the nearly 900 distribution grids are completely separated from energy generation and supply. This is because ownership unbundling is not required in Germany, partly because the political establishment has been opposed to it in the past. As a result an oligopoly of four big energy companies (*EnBW*, *E.on*, *RWE* and *Vattenfall Europe*) was created

which used anti-competitive behaviour to drive new energy suppliers out of the market (E01, R01; Kemfert 2013, 45). In the quote below one interviewee compares the German and UK approaches to liberalisation and explains how this reluctance to implement market reforms has created a degree of uncertainty and ambiguity around grid governance:

In contrast to the UK ... Germany had set only vague guidelines under which energy networks actually were to be used. Network tariffs were missing. These were left to industry associations to agree on among themselves [called Associations' Agreement on Electricity or *Verbändevereinbarung Strom*]. And conditions on how to use the grids were lacking. And there was no regulatory authority. (E04)

Germany finally established the Federal Network Agency (FNA) after it had received several warnings from the EU because the 'big four' and the approach to market governance were hampering competition. The FNA monitors compliance with existing legal provisions and regulations, regulates network tariffs and carries out abuse proceedings in case an energy supplier feels treated unfairly by the network operator. The regulation which governs network tariffs and puts in place revenue caps for the grid operator has become more and more complex in the course of implementing the liberalisation and incorporating EU legislation into national law. The regulator calculates the relative cost efficiency of each grid operator by using an efficient operator as a benchmark and the regulator then sets an individual revenue cap. The cost check to determine the baseline for the revenue cap is only undertaken every five years which leads to a situation in which costs and revenues are decoupled, a problem called CAPEX time shift (cf. Eurelectric 2014).

As illustrated in the quotations below, a number of stakeholders we interviewed in Berlin are critical of this regulatory model. In the first a representative of the DSO states that if a grid operator has a growing need to invest the revenue may not cover costs, and in the second a spokesperson of the citizen initiative BEB argues that the regulatory regime is hampering the *Energiewende*.

That is a massive investment barrier. I am rewarded for not investing because if I don't invest my costs will be lower than my revenue and I will realise efficiency gains. (DSO)

The incentive regulation is more like a crutch in terms of realising the *Energiewende* ... It only assesses how efficiently the current infrastructure is used. And within this system there is no incentive to upgrade the current infrastructure in order to use it sustainably and sensibly in the future. ... This results in a certain direction in which the system develops because every grid operator has to comply with the regulation ... and will have the incentive to maximise the return on equity and will not be interested in promoting the development of renewable energies if that is not incentivised. (BEB)

Also, several interviewees were concerned that in the process of liberalising the energy market and tightening the regulation, integrated energy companies shifted their focus from network operation to energy generation because it delivered higher returns. An interviewee expressed frustration that 'very little has been invested into the network during the last decade' (R01) because even though the regulatory authority monitors efficiencies there are 'grey areas' (S03) where the FNA cannot intervene if the grid is being run down.

Debates and political tensions around grid regulation and governance form the backdrop to the Berlin case. It is apparent from the interviews that from the perspective of certain actors in Berlin the national regulation is not facilitating an urban energy transition in line with their vision of a more decentralised future. However, there are significant political constraints to a more investment led regulatory model because if the FNA accepts more investment costs to be passed on to the consumer 'the result would be that electricity prices would rise ... and it seems that policy-makers are not willing to increase electricity prices further' (S02).

## 4.2. Berlin's electricity distribution grid

### 4.2.1. History of Berlin's grid and contemporary challenges

In Germany the structure of the distribution grids is highly heterogeneous, ranging from very small grids to extensive grids to very densely structured ones like Berlin's distribution grid with one of the



highest number of connected customers. The history of the grid goes back to the 1880s when Berlin was, alongside Chicago and New York, at the vanguard of developing urban electricity systems (Hughes 1983). The city's electricity company, *Berliner Elektrizitäts-Werke* (BEW), by 1895, was the largest electricity utility in Germany, in large part due to the influence of major electrotechnical manufacturing companies located in the region – notably *Siemens & Halske* and *Allgemeine Elektrizitäts-Gesellschaft* (AEG) – which used the city's system as a platform to trial innovative technologies which were subsequently sold on to the burgeoning global market. Despite this, in the early years many within the city were calling for greater state control and eventually in 1915 the utility was taken into public ownership and subsequently renamed *Berliner Städtische Elektrizitätswerke Aktiengesellschaft* (BEWAG).

By 1920, with the creation of Greater Berlin, BEWAG was responsible for 90% of electricity demand (Moss 2014). Following the Second World War, as tensions between the east and west grew, Soviet East Berlin segmented the previously unified network by halting any electricity or fuel trading with the West in 1952 and West Berlin became an electricity island at this stage. After the German reunification in 1989/1990 two independent energy providers had to be merged and significant investments needed to be made to raise the standards of the eastern grid. As a consequence the two grids 'are at a completely different point in their investment cycle' (DSO) because West German energy companies, in contrast, had invested heavily in the 1970s. With reunification Berlin's grid eventually became interconnected with the wider regional and national electricity system, but remained under public ownership. This changed in 1997 when BEWAG was privatised. The municipality sold a majority share to private investors, largely to raise revenues because the city's economy was in decline and public budgets were squeezed (Monstadt 2007). Following the liberalisation of the wider German electricity market *Vattenfall*, a Swedish company, moved into the German market by buying the former BEWAG, along with the grid in Hamburg and two large grids in East Germany. These changes have meant that 'the close relationship between the Berlin Senate and BEWAG has been loosening significantly' (Monstadt 2007, 333).

Currently Berlin ranks last in terms of renewable energy development in comparison to all 15 other federal states in Germany of which two others are city states (Diekmann et al. 2014). Berlin only has one wind turbine and the development of solar power on Berlin's roofs is hampered by structural problems of the roofs and issues of insurance and ownership. Thus, a major issue in Berlin seems to be that climate and energy concepts are developed but not put into action (Monstadt 2007; Suck et al. 2011; Rocholl 2014). An interviewee from the Green Party explains the lack of implementation in the following way:

Climate policy works well where the Mayor takes up the cause of climate protection. But the Mayor here is not interested in it at all ... There is no political will to put in place staff responsible for monitoring whether at least what has been decided will be implemented. (Green party)

Even though the implementation of a special unit for climate protection and energy in 2013 seems to be a step in the right direction, in other Senate Departments only a few members of staff are concerned with energy policy issues. According to a representative of the Senate Administration 'this means that although Berlin thinks energy is important, it does not want to pay for it' (S03). There is also no strategic coordination between the different Senate Departments when it comes to climate and energy policy.

#### 4.2.2. Whose grid?

The electricity distribution grid has come to the centre of attention in Berlin's political arena because the electricity concession is currently being newly awarded. The concession contract with the current grid operator *Stromnetz Berlin GmbH* terminated at the end of 2014. All interviewees named the concession contract to be the major, perhaps the only, way in which the local government, the Berlin Senate, can influence the governance of Berlin's electricity distribution grid. Since the government of Berlin negotiated the last concession contract with the former public electricity provider it has

had practically no influence on the governance of Berlin's electricity distribution grid for more than a decade after it privatised BEWAG in 1997.

The expiry of the concession contract prompted the formation of two citizen initiatives which promote local involvement in energy governance. Especially in the run up to a referendum in 2013, the Senate as well as the political parties took a position on the question of grid governance. The referendum was organised by the Berlin Energy Roundtable (BET) and aimed at legally requiring the local government to buy back the electricity distribution grid, introduce democratic participation in energy governance and create a public utility for the generation and distribution of renewable energy. Eighty-three per cent of voters, or 600,000 people, voted for BET's draft law. However, only 24.1% of the required 25% of Berlin's electorate voted; some have linked this low turnout to a decision to move the election date to November rather than let it coincide with the general elections (cf. Blanchet 2015). However, who will be awarded the grid concession is a decision still pending in November 2015 and might be followed by legal proceedings.

A number of actors and groups are currently in the running to operate the energy system:

- The State of Berlin has founded *Berlin Energie* in March 2012 to apply for the gas and electricity grid concessions. *Berlin Energie* is located within the Department for Urban Development and the Environment and the special unit for climate protection and energy within this department is supporting its efforts.
- *Stromnetz Berlin GmbH*, a company owned by *Vattenfall*, which currently holds the concession and is applying to retain it.
- The cooperative *BürgerEnergie Berlin* (BEB, Citizen Energy Berlin) was founded with the aim of applying for the electricity grid concession and promoting sustainable and democratic energy supply. Nearly 2500 people are already involved in the cooperative and together they have raised more than 10 million euros. Their idea is to manage the grid in cooperation with the State of Berlin in order to ensure that all citizens have a say in the management of Berlin's electricity grid, either by raising five shares at one hundred euros each to become a member of the cooperative and benefit from a moderate dividend payout, or through parliamentary control of the municipally owned company.

The first two are applying for a 100% share in public or private hands, respectively. *Stromnetz Berlin GmbH* has submitted a second offer applying for cooperation with the State of Berlin. *BürgerEnergie Berlin* (BEB) made an offer to buy a minority share and cooperate with the State of Berlin. Such cooperation would be organised in an institutionalised public-private-partnership (IPPP).

Apart from the Senate Department for Finance as the contracting authority and the three applicants, the political parties represented in Berlin's parliament are important actors in the process of awarding the grid concession. The Social Democrats and the Conservatives form the local government, the Senate, for the legislative period from 2011 to 2016. While the Social Democrats, the Left-wing and the Pirate Party<sup>2</sup> are in support of transferring the electricity grid back to the public sector, the Conservatives are opposed because they 'see the need for more private capital in order to implement the *Energiewende*' (Conservative Party). However, in the coalition treaty they agreed that the State of Berlin would apply for the grid concession. The Green party did not clearly declare itself in favour of recomunalising the electricity grid but rather agreed that they do not want the grid to be managed by Berlin's biggest electricity supplier, *Vattenfall*. Their representative stated that they 'sympathise very much with *BürgerEnergie Berlin*, a non-governmental way of local involvement' (Green party). Both the Social Democrats and the Left-wing party said they are open for the cooperation with BEB. Thus, if the Senate Department for Finance decides that the best offer was made by BEB, it is likely that the parliament will agree.

The Department for Finance evaluates the tenders based on criteria<sup>3</sup> which follow the principles set out in Section 1 of the Energy Management Act.<sup>4</sup> Security of network operations receives the

highest weighting with 60 points. Consumer-friendly, environmentally friendly and cost-effective/efficient network operation follow with 45 points each. Other categories such as construction measures, tariffs for usage of public ground, network transfer and termination rights receive between 25 and 40 points. However, there have been contestations around the weighting of the criteria and sub-criteria. As a result the Finance Department is revising and adding detail to its weighting system.<sup>5</sup> Even though this increases transparency, BEB argues that a more detailed weighting system decreases the political leeway of the Berlin Senate. It is more difficult to award points for innovative ideas if the catalogue of criteria does not ask for those, they argue.<sup>6</sup>

### 4.3. An uncertain outcome

Despite the recent emphasis on grid ownership, it is by no means certain what form local control of the electricity grid in Berlin will take and to what extent this will have a transformational effect on Berlin's energy system.

From the perspective of many of our interviewees national legislation on awarding concessions forms an obstacle to a transition towards a low carbon urban energy system since it involves many legal uncertainties and restricts the political leeway of municipalities to exercise their right to provide public services. For example, in the following two quotes local political actors express their concern about the legal uncertainties of the process:

I find the requirements of the Energy Management Act concerning the procedure of awarding concessions extremely questionable ... It is really very difficult for a municipality, even for Berlin, but all the more for smaller municipalities to carry out the procedure in a legally watertight way. (Green party)

In this field [concession process] many questions remain which have not yet been answered in a uniform way and still need to be clarified by the highest court ... which will take some time. Of course, that doesn't make the process easier. (Conservative Party)

Following EU public procurement law, and in line with the regulatory regime discussed in Section 4.1, the Energy Management Act (*EnWG §46*) stipulates that the concession process has to be transparent and non-discriminatory. Thus, when a concession contract expires the municipality is not allowed to decide to take over the management of the grid and the concession can only be awarded to the municipality if it wins the call for tenders. A representative of the Left-wing party in the locality stated the following: 'I find that problematic because it contradicts the law on local government which is anchored in the constitution [*Grundgesetz §28.2*]'. Several of our interviewees pointed to court rulings which, in their view, have limited the municipal leeway in recent years. A representative of the Berlin Energy Roundtable explains that 'if you consider the case of Schönau [small municipality in the black forest] where the grid concession was transferred to the citizen initiative after the initiative had won a referendum, this is absolutely impossible today' (BET). The national government has stipulated in its coalition treaty that it intends to amend the law governing the process of awarding grid concessions, but has not yet acted on it.

Actors seeking to exert greater local control over the grid will of course be subject to the same institutional and regulatory framework as the current private operator. It is therefore questionable whether local ownership would make a material difference. BEB, whilst recognising the legislative and regulatory constraints, argues that local ownership would change the organisational culture of the network operator and enable the utilisation of profits which are generated through network operation for re-investment in the *Energiewende*. In order to achieve this BEB is proposing a collaboration with the State of Berlin. The leverage of an IPPP between the State of Berlin and *BürgerEnergie Berlin* would arguably be greater than that of *Berlin Energie* because BEB would finance the buyback of the grid with the equity capital they have raised, while the State of Berlin would depend solely on debt capital and would have to use the revenue from grid operation mainly to service interest and principal payments. BEB's argument is that there will be potential for radical innovation in the long run

since a cooperation of a public company and a private citizen cooperative would introduce completely new organisational structures.

It remains to be seen however whether such an alliance can be formed: At the time of writing the most recent significant development has been negotiations between the Berlin Senate and *Vattenfall*, which are being conducted in parallel to the official process of awarding the grid concession.<sup>7</sup>

## 5. Discussion and conclusions

In the context of Berlin two social groups can be identified which allocate different meanings to the electricity distribution grid (Pinch and Bijker 2012). The first group emphasises that the grid operator has to be neutral and is required to distribute any electricity. As it is unbundled from energy production and supply according to the rules of liberalised electricity markets, the grid operator has no significant influence on CO<sub>2</sub> emissions. Thus, they argue that public ownership would not change much and investment and innovation should concentrate on supply or demand side measures. Energy suppliers and members of mainstream political parties were found to belong to this first group. The second group argues that the electricity grid provides a public service and should therefore be managed by a public company which facilitates democratic participation of Berlin's citizens. This view is supported by some politicians (predominantly Green and left-wing), the citizen initiative *Berliner Energietisch* and a range of environmental NGOs and citizen groups. In the view of these city-scale actors the distribution grid is a strategic asset and a facilitator of urban energy transitions, however, the national regulatory and legislative framework is not designed to adapt electricity distribution grids to the challenges of the *Energiewende* and is instead hampering investment, innovation and democratic participation. The rules and routines of this incumbent system are thus guided by a focus on large scale supply instead of providing options for distributed energy generation.

The Berlin case illustrates the politics shaping energy transitions which is increasingly prevalent in many European countries. At the European and national levels markets are seen as the most effective means of achieving a least cost low carbon transition. 'Natural monopoly' networks are separated from generation and supply functions of the energy chain to enable non-discriminatory access and competitive processes. In the Berlin case however we see that there is a competing system vision where energy grids are foregrounded and seen as strategic assets which need to be controlled by system builders at the local level. The emergence of this alternative view is partly due to weak implementation of liberalisation reforms at the national level which has created uncertainty and ambiguity in the formulation, execution and amendment of relevant laws and regulations, but also a lack of trust in the process itself, in particular a view that it serves the interests of incumbent utility actors. The Berlin case therefore exemplifies the struggle between the established regime and new organisational forms of energy governance which are more embedded at the local level.

The political struggle over the role of distribution grids in Berlin, we argue, provides insights for the wider academic debates about energy transitions, in particular the literature on urban energy transitions discussed in section two. We suggest that as the energy transition progresses, grid governance is likely to become increasingly politicised, which introduces new challenges for analysis of urban energy transitions. Studies of urban energy transitions have tended to foreground city-level dynamics, but the Berlin study suggests that more attention will need to be paid to structural aspects of energy systems such as complex rules and regulations governing energy networks, an aspect which to date has received little attention in case study work. Tensions and synergies between local policy and political processes and the dynamics of socio-technical systems, we argue, will greatly influence the future energy pathways. Grids have particular material features which influence energy politics, such as natural monopoly and capital intensity, but this is often hidden from view and embedded in the day-to-day operation of the energy system, rather than part of the more visible politics of energy transitions. In the German case it is increasingly apparent that there is a strong interdependency between urban energy transition processes and the operation and implementation of regulatory rules for liberalised energy markets. The socio-technical analytical

tradition which emphasises these system characteristics can be drawn upon to uncover the complex interrelation between society, politics, economic aspects and the development of the technical system. Further empirical work could explore how tensions and synergies between innovative local energy initiatives and grid governance regimes are playing out in different contexts and examine how this influences the differential development of sustainable energy systems across cities and regions.

## Notes

1. Unbundling describes the separation of network services (transmission and distribution) from other business units (energy generation and supply) in order to ensure non-discriminatory network access in liberalised energy markets. There are three levels to what extent unbundling is implemented. These are accounting, legal and ownership unbundling.
2. The Pirate Party has not been interviewed as part of this study but their position can be found on their website: <https://www.piratenfraktion-berlin.de/fraktion/themen/wirtschaft-netz-und-infrastruktur/> (Accessed 18/11/2015).
3. The selection criteria are available at [http://www.berlin.de/sen/finanzen/vermoegen/downloads/konzessionsverfahren-strom/zweiter\\_verfahrensbrief\\_strom.pdf](http://www.berlin.de/sen/finanzen/vermoegen/downloads/konzessionsverfahren-strom/zweiter_verfahrensbrief_strom.pdf) (Accessed 18/11/2015).
4. §1(1) EnWG – The purpose of the law is to ensure a secure, cost-effective, consumer friendly, efficient and environmentally friendly grid-based electricity and gas provision for the general public which is increasingly based on renewable energies.
5. Source: <http://www.rbb-online.de/politik/beitrag/2014/10/stromnetzvergabe-jetzt-auch-offiziell-verschoben.html> (Accessed 06/10/2015).
6. Source: <http://www.buerger-energie-berlin.de/blog/aktuell-rolle-rueckwaerts-im-strom-verfahren> (Accessed 06/10/2015).
7. Source: <http://www.berlin.de/rbmskzl/aktuelles/pressemitteilungen/2015/pressemitteilung.309318.php>; <https://www.berlin.de/rbmskzl/aktuelles/pressemitteilungen/2015/pressemitteilung.398639.php> (Accessed 15/11/2015).

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