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Special issue editorial: Urban energy transitions: Places, processes and politics of socio-technical change

Urban Energy Transitions: Places, Processes and Politics of Socio-technical Change

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1. Prologue

On the second anniversary of the meltdown at the Fukushima Dai-ichi nuclear power plant in Japan, some of the focus fell on the abandoned, radioactive ghost towns in and around the disaster exclusion zone from which remaining residents have been forced to evacuate. A series of poignant images shows the empty streets, collapsed houses, unused drinks and rice vending machines, school bags hanging outside a class in an abandoned school (*The Guardian*, 11 March 2013).[1] All are a reminder of the sudden, brutal collapse and absolute fragility of urban livelihoods and materials in the wake of an energy infrastructure failing to withstand an earthquake and tsunami.

Meanwhile, following the explosion in global oil prices in 2008, residents in Lomé in Togo and many other cities in Ghana, Benin and Burkina Faso have become ever more dependent for fuel on an illegal trafficking of subsidised petrol from Nigeria. Every morning at dawn, dozens of containers of petrol are washed up on the beaches of Togo and Benin, thrown overboard from boats on their way back from Nigeria. The containers are dragged out of the water and their contents transferred into plastic bottles and other receptacles, which are then transported to the streets of Lomé and other cities for sale to the local populations at prices up to 30 per cent lower than the normal market price. While this flow of petrol—from resource extraction in Nigerian oil fields, through an intricate transport network, to its burning and use for cooking in somebody's home—sustains whole livelihoods, cities and informal economies, it also financially benefits mostly local elites who employ the traffickers and represents a significant loss of income for these already-poor West African states (*Le Monde*, 23–24 September 2012).

Finally, in western Canada, Vancouver defines itself as "the most liveable city in the world", displaying "the smallest per capita carbon footprint of any city in North America" and "the greenest building code in North America" in its recently published environmental strategy in which the capital

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city of British Columbia aspires to become "the greenest city in the world by 2020" (City of Vancouver, 2012, pp. ii and 5). Vancouver is already

> set to bring … community-based greenhouse gas emissions [in 2012] down to 5% below 1990 levels, even as [the City's] population has grown by more than 27 per cent and jobs have increased by over 18% (City of Vancouver, 2012, p. 18).

Meanwhile, 1000 kilometres to the north-east, in many parts of the state of Alberta, mining companies are actively extracting as many fossil fuels as the domestic and international markets can bear from the huge provincial reserves of bituminous coal and oil sands, making the latter "the fastest growing source of greenhouse gas emissions in Canada" according to Greenpeace.[2] Hence, while more and more cities and regions around the world, like Vancouver, boast very ambitious low carbon strategies, pointing to hopeful "soft energy paths" of more sustainable and peaceful energy and urban futures, current global economic, geopolitical and indeed geological trends generate quite different tendencies towards a prioritising of industrial profits and national energy autonomy/self-sufficiency.

2. Introduction

It is a widely held view in industry, policy and academic circles alike that some form of 'energy transition', broadly defined as a radical, systemic and managed change towards 'more sustainable' or 'more effective' patterns of provision and use of energy, is one of the major global challenges facing contemporary societies (see AGECC, 2010; Rifkin, 2011; WWF International, 2011).[3] Cities, as entities within which an ever-larger share of energy is used, are seen as simultaneously constituting a key target of such an energy transition, as well as a key 'instrument' in delivering it. Taken as a whole, this Special Issue tells a very different story about (the study of) the intricate relations between energy and cities, and between transformations of energy systems and urban change.

Indeed, as the above vignettes illustrate, energy in a variety of guises is bound up technically, economically and politically with our societies, communities and livelihoods in very diverse ways. These vignettes tell stories of mutually recursive change—whether sudden or planned, radical or incremental, perpetual or one-off—of energy systems or infrastructures and particular spaces and places. They usefully underscore that not all radical change in patterns of provision or use of energy consists in, or spontaneously aligns with, a deliberate and managed transformation towards a 'more sustainable' configuration, however defined. They are also a reminder that, behind the current headline concerns and debates around peak oil, climate change, security of energy resources and affordability of energy, emerge a host of social and political issues and stakes for urban areas, societies and policies that are only at best partially captured by talk of "*the energy transition*", by narrow sectoral viewpoints and strategies (such as transport, housing, particular industries or activities) and by a predominant focus on national and/or transnational policy implementation.

Yet, the important notion that energy transition processes (and changes to energy systems more generally) constitute (or might constitute) a largely *urban* set of processes has received less attention than it arguably deserves. The main argument of this Special Issue—and the reason for its title—is that energy transitions always work at least partly through urban processes, urban practices and urban change, and that, concomitantly, the urban experience and

condition (in their inherent diversity) are constantly reconfigured by energy and by the evolving and contested ways in which they are connected.

On a national and transnational scale, transition to cleaner energy systems has 'stalled' according to the International Energy Agency (IEA).[4] Our societies are locked in to fossil fuels and the economic growth and lifestyles that they support (Clark, 2013)

> Despite much talk by world leaders, and a boom in renewable energy over the past decade, the average unit of energy produced today is basically as dirty as it was 20 years ago (IEA executive director; quoted in *The Guardian*, 17 April 2013).

Without wishing to denigrate this important point, it is clear that if we observe and measure 'transition' exclusively from this kind of global, 'average' and narrow (fossils vs renewables, clean vs dirty) viewpoint, then we run the risk of generalising and simplifying the changing, complex relationships between energy and our societies in all their diversity. This oversimplification would, in turn, be detrimental to those who wish to address such global concerns practically, and who are also dependent on a more refined and context-sensitive understanding of energy transition processes.

An urban focus can place the degree, types and implications of change in clearer perspective by highlighting different facets of the always shifting, but inextricable, interaction between urban change and the transformation of energy systems—urban energy transitions in short—on a daily basis. These concern, for example, the nature, functioning and implications of infrastructures of energy production and distribution; policy choices and decisions; political economies of resources; and everyday engagements with metabolic flows and fuels. In each case, urban residents are affected directly by, or bound up with, flows, exchanges, chains of events and decisions that seem to occur more widely (and/or elsewhere) than just in their immediate energy-fuelled livelihoods. Urban energy transitions thus seem to involve a diverse and discrete set of processes, practices and policies which come together differently and are differently interpreted, translated, experienced and grounded, at particular moments in specific places. Seen like this, energy transition processes can be more visible, more articulate with the diversity of people's lives and therefore with urban change (and its policies), and more open to politicised debate and to alternative, perhaps more progressive, possibilities.

It was with this hypothesis in mind that we convened an international roundtable workshop in Burgundy in June 2009 from which the papers in this Special Issue are drawn. The workshop was concerned with exploring the evolving relationship between urban change and energy systems and policies within a multidisciplinary and multi-temporal (past, present, future) scope. It produced an exciting variety of stories of the processes and practices around energy which make and remake cities world-wide and which at the same time constantly rework and push the boundaries of what constitutes the 'urban'. In the rest of this paper, we introduce the questions and areas of debate that this Special Issue engages with, first by tracing the lineage of analytical work on cities and energy, and then by outlining a set of reflections on further research which appear to us to be opened up by the papers that follow in this issue.

3. Re-energising Urban Studies

It is well known that modern urbanised societies are massively dependent on energy.

Ever since the first industrial revolution and based largely on the exploitation of fossil fuels (coal and coal gas, natural gas, oil), cities have been built and developed according to a paradigmatic assumption that energy use could (and indeed should) constantly expand. This energy has increasingly been produced remotely and simply imported into cities over highly complex, but 'invisible', infrastructure systems. Intensive energy use is almost literally embedded and encrusted in the global urban fabric as almost everything we do and consume as urban residents reproduces this dependence and addiction; but we rarely see or pay attention to it.[5] This banalisation and taken-for-granted nature of energy in the urban environment (and more broadly) has undoubtedly contributed to its relative invisibility in both urban policy and urban scholarship. Yet within the context of ongoing planetary urbanisation, the emerging normative need to formulate 'local' responses to 'unsustainable' energy systems highlights that the inherently co-evolutionary relationship between cities and energy must be a more central practical and analytical concern than has been the case to date. Indeed, local and urban authorities have frequently been endowed (by national states) with a statutory obligation to formulate relevant policy responses and have themselves looked to develop exemplar local projects, plans, strategies and policies in the energy/climate domain. Local/urban action on energy is increasingly seen by a variety of actors (including at the national and supranational levels) as more compatible with objectives for promoting societies of greater and 'smarter' resilience, sobriety and decarbonisation.

In the North, the spatial organisation of cities, their building stocks and the energy flows and infrastructures on which transitions reside are being questioned with regard to increasingly pre-eminent energy efficiency and carbon emissions concerns. The relations between cities, their sprawling hinterlands and their broader environments are being placed under close scrutiny. Embedded energy-intensive urban ways of life and everyday practices are increasingly contested. Taken together, these various forms of energy dependence have potentially disruptive economic, social and environmental consequences, which need to be taken into account. Local responses have included the promotion of more decentralised, renewables-based energy systems within cities and demand-side management measures aiming at improving the energy efficiency of the built environment and its residential and industrial users (Rydin *et al.*, 2013). At the same time, UN Habitat estimates that up to 1.6 billion people around the world do not have access to electricity and that around 2 billion people rely on biomass fuels for cooking.[6] Urban energy transition in the South thus clearly means something very different from the North, combining issues around governance, access to finance, trade and supply chains with everyday concerns of, amongst other things, very low basic household incomes, availability of cooking fuel and indoor air pollution (Barnes *et al.*, 2005; Prasad, 2011). The scale of any urban energy transition therefore appears monumental, in both the North and South, with pressure on energy resources from population and economic growth likely to be exacerbated in various ways in all urban contexts.

Nevertheless, it seems fair to suggest that existing scholarship has only just scratched the surface of the relations between cities and energy. This probably results in part from the profound ambivalence of this relationship.

Indeed, it is striking that, while nearly all aspects of urban functioning inherently depend on access to flows and circulations of energy, the production, organisation,

management and regulation of these flows are seldom central tasks or competencies of urban actors and local authorities.[7] Concomitantly, while cities are sites of tremendous levels of energy consumption, and therefore (would appear to) have a direct influence on the nature and form of energy systems as a whole, the actors responsible for these systems tend to neglect the urban dimension, seeing cities strictly as the end points of a supply chain to which one merely has to deliver the flows. This constrained vision is clear in the way that urban energy is usually[8] subsumed by major international organisations and policy institutions as merely part of wider challenges of climate change (DG-REGIO, 2009; OECD, 2010; World Bank, 2010a; UN-HABITAT, 2011), 'green growth' (World Bank, 2010b; Hammer *et al.*, 2011), or both combined (Kamal-Chaoui and Robert, 2009).

Given this relative lack of urban practitioner influence on energy systems, it is perhaps understandable that scholars in urban studies and adjunct disciplines have traditionally paid such scant attention to the mutually constitutive relations between the two. After all, if a city does not have its own energy policy, or if energy companies do not have a specific urban strategy, there would appear, on the whole, to be very little to see, to say or to analyse about how cities and their components shape, and are shaped by, energy systems.[9] Yet Paul Cheshire (2006, p. 1237) convincingly argues that urban sustainability policies are being implemented on the basis of an insufficiently robust research base about energy use and planning. And given the central contribution of energy production, distribution flows, management and use to nearly all aspects of urban functioning and urban metabolism, it remains highly surprising the extent to which this has, until recently, been under-researched in the urban studies field (see Box 1).[10]

Box 1. Publications on energy in urban studies journals and on cities in energy journals

A quick survey shows that only 26 papers published in *Urban Studies* over the past 50 years mention 'energy' or 'electricity' in their abstracts. Many of these papers are studies connecting transport-related energy consumption levels and patterns with urban forms and density (see, for example, Anderson *et al.*, 1996; Naess and Sandberg, 1996; Cooper *et al.*, 2001; Holden and Norland, 2005; Dodson and Sipe, 2007). IJURR (11 papers) and Environment and Planning A (10 papers) fare even worse.

By comparison, 316 papers published in *Energy Policy* since 1973 have had some kind of 'urban', 'cities' or 'city' focus as mentioned in their abstracts, although more than three-quarters of these papers have been published since 2005. Thus, we can say that, while cities have not been a long-standing focus of study for scholars in energy policy, there is evidence to show that cities are being taken increasingly seriously by them (albeit within a particular, policy-oriented form of analysis and not aimed at understanding the mutual shaping of cities and energy). Even taking into consideration the fact that *Energy Policy* publishes 12 issues a year totalling more than 8000 pages, it is perhaps time for urban studies scholars to return the compliment.

3.1 From Cities and Energy to Urban Energy Transitions

This situation of neglect is changing, however, and beyond sector-specific, normative and model-based studies, critical urban scholarship is emerging that can help to disentangle the diverse and contested processes and practices around energy that

recurrently make and remake contemporary cities and urban spaces.

There have been a handful of journal Special Issues on cities and energy in the past few years (*Annales de la Recherche Urbaine*, 2007; Perl, 2007; Beddington, 2008). However, these and other recent publications (for example, Droege, 2008; Troy, 2012) have tended either to address only specific aspects (sectors, technologies, national contexts) of their relationship or to adopt a particular, often normative, approach ('*the* city in *the* energy transition'), rather than studying the co-production of energy systems in transition and systemic urban change, the contested and political processes involved and their uneven socio-spatial outcomes across diverse global urban contexts. Similarly, a major proportion of research on cities and energy to date has been from modelling, scenario and/or quantitative analytical approaches as the prospective implications and future 'sustainability' of urban energy systems are simulated (for example, the papers in Dhakal and Shrestha, 2010) or imagined (for example, Atkinson, 2007) to 2050 or beyond. Whilst this work is crucial in exploring the potential forms and repercussions of various 'configurations that (might) work', it is not our concern here as it would be impossible to provide a useful overview in the space available and these usually normative[11] approaches lie beyond the scope of the papers in this Special Issue.

A focus on cities and energy must also be distinguished from the recent plethora of work on cities, climate change and low carbon transitions (see Bulkeley and Betsill, 2003; Bulkeley *et al*., 2011; Hoornweg *et al*., 2011; While and Whitehead, 2013). Energy infrastructure and systems can be an instrument (among others) for local climate policy and carbon management, such that energy transitions and low carbon transitions might appear to be largely synonymous (see for example, Bridge *et al*., 2013). There have been an increasing number of studies of the different forms of local governance of climate change, as local and urban authorities re-appropriate energy/climate issues and integrate them into their land use planning and sustainable development strategies (Collier and Löfstedt, 1997; Bulkeley and Kern, 2006; Rutland and Aylett, 2008; Lovell *et al*., 2009). Much low carbon urban transition analysis is framed as a challenge for governance and institutional configurations. However, a more direct engagement with urban energy requires seeing it as more than a governance tool or one of the means to address and implement a particular wide-ranging policy, and taking seriously both the materiality of its flows and its socio-technical characteristics, and the varied, contrasting, sometimes competing, political projects for which it works.

Work in human geography, environmental sociology, political science and science and technology studies (STS) has perhaps addressed more directly some of the links between energy, societal change and their associated socio-political implications, albeit without a specifically urban entry point (for overviews, see Rosa *et al*., 1988; Guy and Shove, 2000; Mol and Spaargaren, 2006; Haas *et al*., 2008; Bradshaw, 2010; Bridge, 2010; Schreuer *et al*., 2010; Cherp *et al*., 2011; Zimmerer, 2011; Bridge *et al*., 2013; Foxon *et al*., 2013). Other more disparate work around energy and urban change adopts a variety of approaches (quantitative/qualitative, utopian/dystopian, sectoral/transversal, policy analysis/theoretical, etc.) and can be situated according to a number of distinct strands of focus (see Table 1).

This summary table is not meant to be exhaustive, but it does show that, although a consistent and substantive focus on energy is far from a major concern for urban studies in general, there has been a variety of

Table 1. A synthesis of major strands of work on energy and urban change

Strand	*Focus*	*Representative works*	*Conceptualisation of energy*	*Conceptualisation of the urban*	*Approach to transition*
Mobility and urban form	Sectoral: transport-location–energy nexus	Owens (1986), Newman and Kenworthy (1989), Breheny (1995)	Quantities consumed by mobility and residential decisions and choices	Spatial analysis of centre–periphery relations and locational characteristics	Policy-oriented focus on urban compactness, polycentricity, increasing use of public transport, etc.
Technology and low energy buildings and neighbourhoods	Sectoral: potential of new technologies for delivering urban sustainability	Capello *et al.* (1999), various issues of *Building Research & Information*	Technologies, low consumption buildings	Parts of urban fabric	Technology-driven
Tracing urban energy flows and metabolisms (material flow analysis, territorial ecology)	Methodological: material resource inputs and waste outputs of territories	Barles (2010)	Quantitative flows and materials	Bounded territorial administrative unit interacting with 'external' sites	Metabolic change (inputs and outputs) over time
Energy, society, practices	Demand-side: individual, household and social behaviours and practices associated with energy consumption	Rosa *et al.* (1988), Chappells and Shove (2005)	Mutual constitution of forms and levels of energy use and wider everyday practices	Context for forms/levels of energy consumption and social practices	Changes in society and/or in everyday practices (over time) through engagement with energy
Cities in large technical systems (LTS)	Supply-side: large centralised infrastructure systems	Hughes (1983), Summerton (1994), Coutard (1999)	Infrastructure deployment and management	Territories and administrative units within national infrastructure systems	Change to socio-technical components of systems over time

(continued)

Table 1. (Continued)

Strand	*Focus*	*Representative works*	*Conceptualisation of energy*	*Conceptualisation of the urban*	*Approach to transition*
The urban consequences of policy reforms	Political economies: 'splintering' outcomes of neoliberal reforms	Guy *et al.* (1997), Graham and Marvin (2001)	Sector subject to reforms of privatisation, liberalisation, etc.	'Multiplex', multi-actor urbanism, socio-spatial differentiation within and between cities	Shifts from public to private management, monopoly to market, sectoral unbundling, resulting urban change (fragmentation)
Low carbon transitions in cities	Urban governing/politics of carbon	Bulkeley *et al.* (2011), Hodson and Marvin (2009b), Jonas *et al.* (2011)	Energy infrastructure as an instrument of low carbon policy	Cities as urban policy actors within multilevel climate governance	Socio-technical change through which low carbon is rolled out
Community energy, post-oil communities	Local energy systems, local communities constructed around low energy development and lifestyles	Walker *et al.* (2007), North (2010), Bailey *et al.* (2010)	Energy as a tool for local autonomy, development of alternative approaches	Bottom–up collective organisations	Local, inclusive, democratic socio-technical change

innovative research which has broadened and deepened our knowledge of particular aspects, sectors and dimensions of city–energy relations. These strands also, crucially, conceive of energy, cities/the urban and change/transition in quite different ways

— Energy refers to different things: a quantity consumed in mobility and residential decisions, a set of flow inputs and outputs of particular places, an infrastructure system through which electricity and heat are produced, transported, distributed, commercialised and consumed, a policy sector, an instrument for the delivery of climate change mitigation strategies, etc.
— Cities/the urban are more or less territorially constituted and bounded, cover different scales from bits of the built environment to global urban relations, include a narrow or wide set of actors beyond official policy-makers and elected politicians, etc.
— Transition is more or less sectorally/spatially/socially focused, more or less open and diverse, more or less political, etc.

Taken together, these strands of research have contributed to recognition of, in particular

— the mutual influence between energy provision and urbanisation; and the weight of urban regions, activities and populations in the energy metabolism of contemporary societies;
— the importance of space (both in terms of transformation of the built environment and in terms of urban/territorial structures) in (transitions in) the supply and use of energy within urban regions;
— the rising capacity of urban actors to govern or influence energy-related change; and the importance of cities as sites of energy-related innovations;
— the importance of infrastructures as powerful instruments for energy or low carbon policies.

Nevertheless, most strands of research addressing energy and urban change tend to perpetuate

— an artificial divide between the 'social' and the 'technical', by focusing either on the technological innovations (allegedly) required in order to (presumably) attain predetermined energy-related targets while disregarding the broader social conditions within which these innovations become meaningful (or not) and are enacted in/through social practices; or on the study of the sociopolitical resources for and forms of collective action, while ignoring the materiality of the socio-technical systems and infrastructures that are both shaping collective action and shaped by it;

and/or

— a vision of nested, largely autonomous spatial scales (from the local/micro to the global/macro), by privileging either a national or supranational ('Europe', 'Asia', etc.) focus concomitant with an instrumental or 'black-boxed' vision of cities and the urban; or a city-level focus conceptualising the urban as a bounded spatial or institutional form/container within which change happens to happen, whereas, we argue, acknowledging the relational nature of the urban is central to studying and understanding contemporary urban change.

The papers in this Special Issue build on these identified strands of existing research, but we argue that, taken collectively, they also advance us towards a more direct focus on urban energy transitions by combining

and adding to particular elements from different strands: a focus on energy materialities through a transversal view of energy systems as articulating contexts, infrastructures, flows and practices of production and consumption; a relational view of 'the urban' which is cognisant of the links between near and far places through which urban energy systems work; and a concern for socio-technical change as always contested and thoroughly political. Through this focus, the Special Issue unpacks and analyses diverse urban processes and practices of energy transition in contexts of the North and South, and shows how energy shapes and reshapes our comprehension and experience of urban politics and the urban condition.

3.2 Five Areas of Reflection on Emerging Urban Energy Transitions

In reading the papers in this Special Issue and reflecting on their positioning with regard to existing work and ongoing scientific debates, we see five overlapping areas of reflection, points of discussion and/or potential pathways for further research on emerging urban energy transitions. These are meant neither to constitute an exhaustive, all-encompassing agenda, nor to foreclose debate, but they offer a number of open and evolving thoughts on what strikes us as being useful avenues to explore conceptually and empirically in this important research area.

I. Materialities of urban energy. Given that energy systems are usually defined, planned, operationalised and conceptualised mainly on national and supranational levels, we can justifiably ask what is specific and/or specifically urban about energy. One response comes from intensifying global urbanisation through which an ever-increasing proportion of the world's population consumes energy in cities, thus necessitating ever-increasing expansion of urban infrastructure and growth in energy production flows to satiate this demand. Another concerns the recent, emerging and uneven ways in which urban practitioners are developing or rediscovering competences in energy production, distribution and management as they seek to or are tasked with formulating and implementing local energy policies to complement or replace strategic action at the national level, within a context facilitating a degree of (re)localisation of energy governance due to a combination of interdependent political, economic and technical decentralisation trends. A third element relates to a change of perception of urban areas from pure environmental nuisances or hazards to resources available for a more environmentally-benign functioning of modern societies, in particular: as energy sources (urban mining); as ecosystems conducive to ('green') innovation, whether technological, organisational or social (North, 2010); and as places of concentration of financial resources allowing large scale infrastructural change and hence step changes in the energy metabolism of contemporary societies.

All the papers have things to say about these points, but there is something more here about the urban materiality of energy and the differing ways in which (and the uneven consequences of how) energy flows connect up (and disconnect) different groups, artefacts, logics and practices as they seep through the urban fabric and interlink across global space urban localities, territories and the processes and practices within them (see Bennett, 2005).

Importantly, part of the specificity of 'the urban' within energy systems as a whole derives from the varied materialities of energy flows as they appear and evolve in urban contexts. This obviously concerns the

infrastructures over which energy is supplied, but also the everyday ways in which people encounter energy through plugs and radiators, bills and tariff structures, smoke and pollution, crises and controversies, etc. and the manners in which energy flows and energy-dependent equipments are integrated into the practices, routines, cultures and affects of urban lives. In this way, it is less a question of placing the urban within ('non-urban' or supra-urban) energy systems than in understanding how the materialities of energy intrinsically create, reinforce and work through particular (relational) urban processes.

To this end, the papers explore a diversity of technologies and infrastructures (for electricity, heating, cooling, etc.) through/over which energy flows into, across and around cities of the North and South, illustrating how urban infrastructure can be a major instrument in testing and implementing pathways of energy transition, whether low carbon transitions (Coutard and Rutherford, 2011; Bulkeley *et al.*, forthcoming; Rutherford, forthcoming) or fossil-fuel oriented ones in which security and supply logics dominate environmentalism and moderation of demand and consumption (Moss, forthcoming; Verdeil, forthcoming). Studying the case of Berlin, Moss (forthcoming) observes the generic dominance of supply-side logics over time but links these to changing concerns for energy efficiency, while Verdeil (forthcoming) focuses on energy supply faced with growing consumption and new energy practices in Amman, Jordan. The papers thus avoid analysis of a straight production–consumption dialectic, and contribute to reconnecting contexts of production and consumption by focusing systemically on both the infrastructures and the social norms and values (for example, comfort, suburbia) through which energy transitions are socio-technically constructed (Walker and Cass, 2007; Dodson, forthcoming; Shove *et al.*, forthcoming), in contexts in which the boundaries between producer and consumer are becoming blurred or problematised by, for example, 'smart', increasingly sophisticated (and intrusive) demand-side management techniques or local household energy production (van Vliet *et al.*, 2005).

The paper by Shove *et al.* (forthcoming) in particular extends the focus to the rapid rise of the 'resource-intensive monoculture' of cooling by air conditioning and the potential for disrupting its further extension. By focusing on the global connections of disparate local practices, they show how energy transition is not (just) about simple diffusions of technologies or replacement of one set of technologies/systems by another, but more about "transitions in practice" involving "the intersection of materiality, meaning and knowledge" and "figuring out how the varied practices, into which such technologies fit, themselves evolve". Dodson (forthcoming) also pleads for a focus on the distinctive social practices and individual experiences and affects associated with the ways in which energy transitions (might) play out materially in suburbs.

A comprehensive approach to the materiality of urban energy (transitions) would imply 'following' not just actors and technologies (see sub-section II below), but also flows (of resources, of energy, of money) which sustain (and are sustained by) the relations between these entities and, on a more aggregate level, between urban societies or areas and their broader environment (see Bridge, 2011). This combination of sociotechnical and 'metabolic' approaches would entail diverse theoretical and methodological consequences, which merit further reflection.

II. Relational energy urbanism. A second set of reflections revolves around how

urban energy transitions are shaped differently by contingent and context-specific processes in the multiple 'urbans' of the North and South and how concomitantly these urban contexts for socio-technical change are constructed and maintained relationally across space by the flows and circulations of energy, of knowledge and expertise, of models and notions of best practice, of norms and conventions of energy supply and consumption, etc.

While it is notable that much of the recent work promoting more systemic understandings of energy transitions has been explicitly focused on change at, or from the perspective of, the urban/regional level (Bulkeley and Betsill, 2005; Monstadt, 2007; Hodson and Marvin, 2009a; Coutard and Rutherford, 2010), the papers collectively offer a revealingly very diverse set of case studies of different forms of 'energy transition' in cities around the world. They locate their analyses in both large and small cities, North and South contexts, central and peri-urban spaces, and the variety of forms of demand for energy which permeate these highly distinct social/socio-spatial fabrics. They focus on major metropolitan areas (London, Berlin, Stockholm, Cape Town), more 'ordinary' cities (Amman, Graz, Freiburg), as well as the 'generic' spaces of everyday (sub)urban lives (Dodson, forthcoming; Shove *et al.*, forthcoming). Some focus on pioneer cities or cities of 'best practice' in Europe, which highlight the factors and drivers both behind 'success' like (bottom–up) environmentalism and political will (Emelianoff, forthcoming), or which debunk, constrain or problematise this 'success' (Rohracher and Späth, forthcoming; Rutherford, forthcoming). Others focus on the particular constraints, tensions and outcomes of local energy policies and actions in the South (Jaglin, forthcoming; Verdeil, forthcoming). However, all move beyond an identification of the now well-recognised ways in which many city and regional governments are strategically positioning themselves, or being positioned, as major actors in 'energy transitions' to focus on the tensions, conflicts and limits of this urban positioning.

One of the central contributions of the Special Issue is its underscoring of how the diverse challenges of and responses to energy issues may turn out to be central components in broader, ongoing (energy-related) *urban* transitions. Moss (forthcoming) explicitly offers an 'extreme' case of socio-technical change over time in the very particular context of 20th century Berlin. His paper is thus not just about the urban consequences of energy transitions or how energy transitions change 'the urban', but also about the impact of urban transitions (political economic shifts) on energy transitions (the conditions within which urban energy supply and consumption must change). Dodson (forthcoming) conceptualises suburbia as a distinctive "complex 'assemblage' that is configured through socio-material relations of land use, transport technology, energy and money-credit", such that suburbs become a productive scale/space for analysis of where/how change occurs. While the title of his paper suggests important suburban implications/outcomes of change which occurs elsewhere, his mobilisation of a notion of socio-technical assemblage also implies a consideration of the specificities of an urban energy transition in which the drivers and media of change are (also) present *in* the less dense, automobility-dependent spaces of the peripheries of Australian and North American cities.

The circulation and transfer of knowledge, ideas and 'best practice' policy between contexts (with their associated indicators and benchmarks, but also 'good' technologies) has also been highlighted, particularly the role of new intermediary actors

(consultants, think-tanks, operators, international organisations, interurban networks) in facilitating this exchange. While there is now a whole policy literature offering examples of best practice in urban energy and low carbon transition (see Newman *et al.*, 2009; Fitzgerald, 2010; Tumber, 2011; Troy, 2012), Emelianoff (forthcoming) considers the question of the transfer and replicability of models/best practice, which involves the constant displacement of actors between/across scales of action. This multilevel view means that urban dynamics, capacities to act and concrete action are not just dependent on, but also sometimes themselves lead to, changes and policy shifts at national and supranational levels (Emelianoff, forthcoming; Rohracher and Späth, forthcoming).

The papers by Jaglin (forthcoming) and Verdeil (forthcoming) also analyse the multiscalar challenges and interactions of urban energy policies in Cape Town and Amman respectively. They identify the limited capacities and weaknesses of local actors/coalitions to do or manage things in a sector in which state actors and national energy companies remain very dominant, and the urban implications of this 'deterritorialised' energy governance. Jaglin in particular challenges both the analytical value of the notion of multilevel governance (which serves to designate very diverse political regulation patterns) and its effectiveness in practice (i.e. the capacity of multilevel governance schemes to provide a solution to important co-operation or control issues). Quoting Horak, she notes that it is

> necessary to examine where the interactions [within multilevel governance situations] take place and which form they take: proliferation of unco-ordinated initiatives, attempts to organise a multilevel agenda, mutual neutralisation, etc. Also, the density and the variety of interactions do not fit in well with the concept of multilevel governance as "nested layers of authority, each with its own separate sphere of policy concerns" (Jaglin, forthcoming).

These case studies are thus useful in affirming the pertinence of, but also the limits of, multilevel governance perspectives whereby environmental/energy governance is being consistently rescaled, downwards as well as upwards (Bulkeley, 2005; Bulkeley and Betsill, 2005), which leads to a general importance of national support/context or particular national–local relations for local climate action (Emelianoff, forthcoming) and energy governance (Jaglin, forthcoming; Verdeil, forthcoming). The focus on the urban level recognises that policies, processes and practices at work in cities are inherently intertwined with broader patterns in the spatial, economic and sociopolitical organisation of societies. Yet they also collectively go beyond this and foreground energy transitions as spatially constituted processes (Bridge *et al.*, 2013), by opening up notions of urban space to include the 'distant' sites and 'external' relational processes through which, in this case, urban energy transitions are shaped (see Amin and Thrift, 2002; Massey, 2007).

In seeing cooling as an outcome of multisited processes which normalise it within particular social practices (cooling remakes practices and the places of those practices), Shove *et al.*'s (forthcoming) contribution to a more relational understanding of space and 'the urban' is twofold: first, they are concerned by a connected, multilocal space of cooling constituted by a combination of shared technologies, norms and conventions, and more discrete and diverse practices; second, both this relational space and the urban spaces which are interconnected are profoundly reconfigured by practices which go on within them. It is therefore not the mere diffusion across space of a technology like air conditioning which is

central, but how it is integrated in and alters local practices (which may circulate), and therefore places, by shifting social expectations and norms of comfort, luxury, work environment, etc.

The papers thus make a significant contribution to understanding the different 'urbans' of energy policymakers and public actors, energy companies, energy users and consumers, etc, and the knowledge and expertise which they rely on, construct, use and circulate (Guy and Shove, 2000; Guy, 2006), but also the differentiated and contested ways in which urban energy is assembled relationally through a set of socio-technical connections between local and multilocal actors, technologies, systems, policies, practices, etc.

III. The diversity of transition processes and their outcomes. The papers take an open, nuanced, pluralistic and politically sensitive stance to normative notions of transition. The papers all speak in a critical way, for example, to notions and practices of sustainable urban development, the opportunities and instruments available for policy-makers and other institutions and groups to promote technological innovation and 'behavioural change', and the conceivable urban strategies and policies that may promote more sustainable directions for energy production and use. Instead, they are all concerned with understanding the nature and implications of *processes* of transition in context. The diversity of societal contexts in which transitions may emerge and may be shaped implies that we cannot view transition processes as singular, universal and linear pathways to the 'zero-' or 'post-carbon' city (see Theys and Vidalenc, 2013). Energy transitions, if they actually occur, may result in deep changes in the spatial organisation, economic performance and social cohesion of societies, but the precise nature of these changes will differ between places and also over time.

As a result of this pluralistic approach, the papers in this themed issue make several valuable contributions to the transitions literature.

First, they demonstrate that it is important that the nature, form and outcomes of urban energy transitions are not seen to be restricted to formal policy-making arenas, as the stakes, contexts and practices of change clearly extend well beyond the traditional remit of urban/energy (planning) policy. Transitions are tightly bound up in systems of wider urban practices involving a diverse set of actors, from local suppliers and market intermediaries to households and the ways in which their incredibly varied energy-related practices are both the source and outcome of the complexity and specificity of particular energy systems and their reconfigurations. More understanding of the systemic nature of these practices (see also Shove, 2010) helps to problematise misleading ideas that the social dimension of energy transitions resides in homogeneously inciting consumers to use less energy and expecting them to (simply) 'change behaviours'.

Second, while they follow influential theories of socio-technical change (for an overview, see Moss, forthcoming) in studying "how different components of a socio-technical system change at different speeds and different times" (Moss, forthcoming), the papers depart from these theories by their emphasis on the fact that processes of change and their outcomes are highly contingent, relative, debatable and reversible; and by their punctilious study of these variations and, to some extent, of the factors that explain them. Moss, for example, argues for a view of change which goes beyond linear path dependency and socio-technical transitions perspectives and is

sensitive to non-linear trends, political contestation and crisis discourses (as disruptive of pathways of change). He illustrates the very contrasting rationales and interests for similar energy efficiency programmes at different periods in 20th century Berlin or for similar objectives of 'energy security' (Moss, forthcoming). And Dodson (forthcoming), having defined suburbia as a socio-technical assemblage (see earlier), emphasises the "uneven suburban socio-technical geographies", the fact that "suburbia is socio-technically and spatially heterogeneous" and, hence, "the need to understand the differential social effects on places generated by the energy transition".

Third, some of the papers illustrate how hype and expectations of 'energy transition' were only partially translated into effective implementation, policy and socio-technical change (Jaglin, forthcoming; Rohracher and Späth, forthcoming). Rohracher and Späth (forthcoming) note the "tedious and unspectacular work of getting measures implemented". Others show how even apparently 'effective' change can be contested (Rutherford, forthcoming). It is therefore crucial to reach a better understanding of the underlying processes of (nascent) energy transitions; the key factors that drive or hinder change in a given direction; the different pathways along which change is initiated and sustained (Walker and Cass, 2007; Rydin *et al.*, 2013); the mechanisms by which transition processes acquire momentum (Hughes, 1983), experiments scale up or practices and their material and infrastructural environment mutually reinforce each other; or, conversely, the mechanisms that undermine these processes.

Fourth, they offer a further spatialisation of transitions (see Truffer and Coenen, 2012; Bridge *et al.*, 2013), focusing on the spatial elements through which urban energy systems evolve (Moss, forthcoming; Rohracher and Späth, forthcoming) and the spatial consequences of transition (Dodson, forthcoming). Rohracher and Späth call for further study of

> the ways in which socio-political processes at different levels of spatial reach (or at 'scaled' governance levels) can shape the building up of momentum for change between the three levels of socio-technical structuration: niche, regime and landscape (Rohracher and Späth, forthcoming).

Shove *et al.* (forthcoming) assess the usefulness of theories of transition as a means of capturing the emergence and global diffusion of a particular energy-intensive socio-technical system. As they do so, they too reflect on the scalar and spatial implications of transitions theory in discussing the limits of the nationally framed multi level perspective (MLP) in accounting for innovation diffusion on a transnational scale. They come to focus on the importance of practices within spaces (see also Shove and Walker, 2010) and consequently shift the emphasis away from global technology expansion to the ways in which a common technology works in helping practices to be accomplished, thus reconnecting 'multisited' locally divergent ways of doing with global circulations of norms and technologies: "what looks like diffusion is better understood as an outcome of multiple, multiply sited, integrations in practice".

Altogether, the papers thus offer a critical reflection on influential work on socio-technical transitions and 'transition management' (see, for example, Rotmans *et al.*, 2001; Geels, 2002; Elzen *et al.*, 2004; Smith *et al.*, 2005). They contribute to an emerging 'urbanisation' of this work (see also Hodson and Marvin, 2009a; Bulkeley *et al.*, 2011), illustrating the diversity of roles which urban actors play in systemic socio-technical

change and the purposeful transformation of energy systems (see, in particular, Bulkeley et al., forthcoming; Rohracher and Späth, forthcoming; Shove *et al.*, forthcoming) and emphasising how, under certain circumstances, cities

> can provide a specific and potentially powerful social context for the partial reconfiguration of dominant socio-technical regimes … [by allowing] systems of provision … [to] deviate substantially from dominant regime characteristics (Rohracher and Späth, forthcoming).

Hence they offer a conceptualisation of the urban in socio-technical transitions that does not boil down to the niche–regime–landscape triumvirate. In sum, the papers forming this Special Issue deflect any notion of an urban energy transition as a clear, homogeneous, singular, consensual pathway of socio-technical change toward a (more) sustainable urban energy configuration.

IV. Temporalities and rhythms of change. It is also clear from the papers that we need to be interested in the particular histories, temporalities and rhythms of socio-technical change, or where, why and how change occurs at particular moments in particular places (see also Coutard and Rutherford, 2010). To this end, it is useful to relate past, present and prospective analyses of urban energy transitions. Although only Moss (forthcoming) offers an in-depth historical perspective, most papers are concerned to place their studies within a contextualised timeline of change which is conscious of the weight and path dependencies of past choices, trajectories, practices, etc. in shaping contemporary dynamics. Rohracher and Späth (forthcoming) indeed offer a retrospective view of recent socio-technical transition processes in Graz and Freiburg that seem to have reached some state of closure (without reaching the desired outcomes). As this paper and that of Moss illustrate, it is important to understand what history and its processes imply for contemporary/forthcoming transitions and choices in terms of continuities, discontinuities, socio-political shifts, diffusion and use of technology, etc. (Moss, forthcoming). Both papers show something of the limits to and often undulatory nature of transition processes—i.e. why momentum slows or disappears (and then reappears) at particular points in time (Moss, forthcoming; Rohracher and Späth, forthcoming). They advance our knowledge of how current urban energy policies, trajectories and, in some cases, crises are historically founded or configured, and how past configurations can provide insights on contemporary processes (see also Hughes, 1983; Tarr and Dupuy, 1988; Nye, 1990; Melosi and Pratt, 2007; Fouquet and Pearson, 2012; Kim and Barles, 2012). They also help to distinguish the perspective developed here on urban energy transitions (based on co-evolutionary interactions between energy systems and the urban and a view of energy transitions as inherently urban processes) from the study of past transitions in urban energy systems (based largely on technological innovation and viewing cities as mere contexts of change) (see Rutter and Keirstead, 2012).

The papers also reveal changing cultures and social expectations of energy in cities, as ideas of 'transition' become (slowly, partially, diversely) embedded in social, political and media consciences. Just as previous work uncovered the role of energy (light and power) in constituting and maintaining urban capitalist modernities and cultures in the late 19th and early 20th centuries (Mumford, 1961; Nye, 1990; Thrift, 1996; Kaika and Swyngedouw, 2000; Huber, 2008), so the papers here (Dodson, forthcoming; Shove *et al.*, forthcoming)

contribute to the exploration of emerging or prospective (more sustainable?) infrastructural-urban configurations, and the as-yet-hypothetical advent of a new infrastructural modernity between universally and uniformly (green infrastructure) networked spaces and the juxtaposition of (re)localised metabolism enclaves in a utopian/dystopian post-networked city (Coutard and Rutherford, 2011).

V. The urban politics of energy transitions. It arises from these considerations that the urban processes and implications of energy transitions are, finally, inherently of a political nature, simultaneously reflecting, reinforcing and transforming existing institutional and governance arrangements, consensual or conflictual relationships between different actors and the unequal distribution of power within and among social groups and interests (see MacLeod and Jones, 2011, for a recent reflection on the shifting contours of urban politics). Technical innovation, spatial organisation and social practices related to energy in cities are all always shaped by, even dependent on, persistent, dynamic and contested political negotiations defining urban energy provision and use (Summerton, 2004; McFarlane and Rutherford, 2008; Meadowcroft, 2009).

More or less established strands of research point to interesting ways forward here. For example, work on the governance and geopolitics of energy resources follows how political power goes hand-in-hand with the flows of oil and other resources (Watts, 2004; Klare, 2008; Florini and Sovacool, 2009; Bridge, 2011; Mitchell, 2011)

> Oil may indeed be a curse but its violent history—and its ability to generate conflict—can only be decoded if we are attentive to the unique qualities of oil itself, to the powerful corporate and state institutions for which it becomes a bearer, and not least to the ways in which oil becomes an idiom for doing politics as it is inserted into an already existing political landscape of forces, identities, and forms of power (Watts, 2004, p. 76).

Research on landscapes and energy examines in particular the negotiations over, oppositions to, impacts of and compensations from the visible materiality of particular energy infrastructures—for example, wind turbines (Pasqualetti, 2000; Chataignier and Jobert, 2003; Nadai and van der Horst, 2010; Cowell *et al.*, 2011) or electricity transmission lines (Sims and Dent, 2005; Cotton and Devine-Wright, 2012): this opens up questions of how energy affects particular collective and individual values and the responses and engagements of various 'publics' with energy infrastructure (Walker and Cass, 2007; Cotton and Devine-Wright, 2012). And work on the politics of climate change (Mason, 2013; Wainwright and Mann, 2013) and indeed the post-politics of some climate and wider ecological discourses (Swyngedouw, 2007) provides useful directions which have been taken up by some researchers in studies of the urban politics of low carbon transitions (While *et al.*, 2009; Jonas *et al.*, 2011).

These strands illustrate the pertinence and relevance of a shift in focus from urban energy policies to exploring the contours and outcomes[12] of a metabolic politics of urban energy transitions and diverse urban political economies of energy.[13] The papers in this Special Issue collectively engage us on this track.

They do so, for example, by suggesting that cities may have a window of opportunity for action on energy transitions because of their distinctive, even deviant, political and/or socio-technical contexts compared with those at national level which may be more dominated by the inertias of government and party politics, policy lobbying, the needs of big centralised (state) infrastructure

providers, etc. (Emelianoff, forthcoming; Jaglin, forthcoming; Rohracher and Späth, forthcoming)

> Not least due to the inconsistencies, frictions and malleability of existing regime structures, there is often significant room for manoeuvring to stabilise and embed such deviations by local action (Rohracher and Späth, forthcoming).

The risk though is of policy dispersion (Jaglin, forthcoming) or the loss of transition momentum and de-alignment from socio-political dynamics (Rohracher and Späth, forthcoming) which underscores the need for energy policy to be in sync with a host of other policies and aims; pointing to the interesting and still underinvestigated issue of multiregime interactions.

Jaglin focuses on the complex and unstable power relations and compromises, not stable co-operation, which take into account "the reality of conflicting views" and diverging interests across scales (Jaglin, forthcoming). Similarly, Verdeil is concerned by the socio-political combinations of diverging social interests (including within business-driven coalitions) and politics/geopolitics

> Energy transitions are deeply inscribed in, and dependent upon, a given geography of energy circuits and the geopolitical relationships that shape and reshape them (Verdeil, forthcoming).

Energy supply is thus a heavily political issue and subject to lock-in not only due to sunk costs, materiality of infrastructure etc but also to the lobbying and hegemony of major actors of supply (Moss, forthcoming). Moss tracks the shifting ideologies and discourses for change (from Nazi nationalism to market liberalisation and climate change) in Berlin, underscoring how energy systems become instruments of particular political projects (Moss, forthcoming).

Energy reflects a politics of urban materiality, involving struggles over defining what matters (Rutherford, forthcoming), over hegemonic policy discourses (Rohracher and Späth, forthcoming) and over urban transitions as a whole

> While a degree of consensus pervades the logic of low-carbon energy systems emerging in London, this apparent unity belies the diverse rationales at work, conflicts over how and by whom new forms of urban energy should be generated, and the practical and material ways in which low carbon is enacted and disrupted (Bulkeley *et al*., forthcoming).

Energy can be at once an instrument for engaging radical systemic change and an accumulation strategy or medium for the reproduction of capitalist social relations (Huber, 2008; Hess, 2011). Bulkeley *et al*. (forthcoming) sum up this ambivalence of energy transition when they show how there is at one and the same time both potential for (testing) change but also for reproducing the *status quo* of existing dominant elites.

The papers show how different socio-technical elements of energy systems become politicised in different, context-specific ways and at particular times: tariffs (Verdeil, forthcoming), infrastructure such as heating plants (Rutherford, forthcoming), discourses and green objectives (Emelianoff, forthcoming; Rohracher and Späth, forthcoming), particular organisations and actors (Bulkeley *et al*., forthcoming), demand-side management techniques (Jaglin, forthcoming; Moss, forthcoming), ways of life and social norms (Dodson, forthcoming; Shove *et al*., forthcoming), crises and risks (of blackouts, etc.) (Jaglin, forthcoming; Moss, forthcoming). The diversity and systemic nature of these political elements offers another way of following energy flows as they come to matter

in urban environments to different social interests (Rutherford, forthcoming). We can, in this way, begin to perceive some of the limits to urban energy transitions, the possible alternatives, the varying winners and losers in energy transitions and thus, crucially, how we might work towards more socially just and politically inclusive transitions (Heynen *et al.*, 2006; Monstadt, 2009).

4. Conclusion

The evolving mutual interactions between cities and energy systems are not just, or even mainly, the product of narrow (predominantly technical/technocratic) processes of energy production, distribution and consumption, but they are primarily concerned with the 'urban'—i.e. with how infrastructures, buildings, industries, institutions, as well as individuals and social groups, their practices and values both shape and are shaped by context-specific, conflicting energy needs, uses, forms of management, etc. In short, the energy question is inherently an urban question, and vice versa: the intricate relations between cities and energy are (once again) revealed by the current processes and strategies of urban energy transition and by the ways in which the various technologies, systems, regulations and forms of management/governance and of consumption associated with energy are mobilised in the contradictory and conflictual processes and practices of urbanisation in the North and South; the choices, trade-offs and compromises involved; and the inevitable tensions, struggles and conflicts which result.

The organisation and functioning of urban systems, spaces and societies are being deeply challenged by emerging energy transition processes. That they are being challenged in very different ways worldwide debunks the myth of one unique and generic energy transition scenario towards which all groups, societies and territories might or should converge. The global circulation and transfer of best practice models, knowledge and expertise on energy issues should not shroud the everyday reality of the sheer diversity of urban contexts around the world and of peoples within those cities, which reminds us that we always need to talk about energy transitions in a plural and heterogeneous sense. Cities are not secondary entities expected to contribute to one unique national, let alone global, energy transition; they are the communities, spaces and political arenas through which change is invented, implemented, enacted and experienced in always specific and different ways. For the promises of urban energy transitions (affordability, security, sustainability, autonomy, etc.) to become reality, a deeper understanding is required of the context-specific conditions and the 'nuts and bolts' of sociotechnical change, the inevitable inertias, pitfalls and barriers involved in implementing such change, and the resulting winners and losers.

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Notes

1. See: www.guardian.co.uk/environment/gallery/2013/mar/11/fukushima-abandoned-towns-in-pictures.
2. See: www.greenpeace.org/canada/en/campaigns/Energy/tarsands.
3. The new Socialist government of France made a national debate on 'the energy transition' one of its priorities on entering office in mid 2012, while the question of how to ensure the energy futures of the UK and the US has rarely been far from political agendas in recent years. In the South, 'energy transition' usually means something different, as national governments work to shift whole swathes of their countries and populations onto allegedly more dependable electricity-based (often fossil fuel-driven) energy systems.
4. Global financial investors are also still clearly betting on a carbon-intensive energy future, given the embedded market power of fossil fuel companies, and in spite of all the talk of increasing investment in green energy (DiMuzio, 2012).
5. This has been the case even in times of global energy crisis such as that of the 1970s when there were quite widespread, but usually ignored, calls for urgent and radical change to energy system configurations (see, for example, Lovins, 1977).
6. See: http://www.unhabitat.org/content.asp?cid=2884&catid=356&typeid=24&subMenuId=0.
7. Exceptions to this include the Stadtwerke model in Germany and similar organisation systems in Nordic cities.
8. But see, for example, International Energy Agency (2009); Bose (2010).
9. Of course, an urban perspective on energy needs to take into account the relational, multilevel dimension of the problem at stake. For example, the International Energy Agency (IEA) estimated in 2008 that cities and urban regions were responsible for more than two-thirds of global energy consumption (International Energy Agency, 2008). While such figures have powerful symbolic value, it would be misleading to think of cities as autonomous 'sources' or 'causes' of ever-increasing global energy use, as urban activities are framed by policies instigated at national and supranational levels (and urban policies can themselves sometimes induce changes to national and supranational policies), and are closely related to 'global' issues (agricultural transformations, demographic evolutions, climate change, etc.).
10. In recent years at least, there has been a greater research focus and a larger number of journal Special Issues on water, another crucial urban resource.
11. In the sense that they present what are held to be desirable pathways and visions of the future and how these collectively might be achieved.
12. Walker and Devine-Wright (2008) usefully discuss the process and outcome dimensions of energy projects, distinguishing thus between political questions of who a project is developed and run by and who a project is for.
13. Recent work on urban energy governance and financing of local energy initiatives begins to point to a fruitful avenue of exploration (Webb, 2012).

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