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Governance of energy in a data-driven city – reflections on a roadmap for energy efficient neighbourhoods

Abstract

This paper presents reflections on a case study of Greater Manchester, UK, undertaken as part of a European project for an ICT roadmap for energy efficient neighbourhoods. The paper has two aims; to reveal emerging local carbon governance practices, and to highlight the promise and problems of data-driven approaches for energy governance. By contrasting with international examples, the paper illustrates how state regime and the political economy of the energy market have a strong bearing on energy governance locally. Greater Manchester offers an atypical case study being a late comer to the climate change agenda, but a forerunner in terms of multi-level governance. The paper argues that while data-driven practices hold potential for local energy innovation, a lack of capacity in local energy governance, emerging conflicts around data ownership, regulation which privileges incumbent providers, and an erosion of local government capacity combined with top-down governance experiments, pose considerable challenges for harnessing the benefits. The commercialization of data appears to have become widespread, despite the multitude of purposes open data would serve in local innovation. The paper concludes with setting out an agenda that empowers local actors previously excluded from energy governance, and highlights the role for local government as data hubs.

Introduction

Increasingly, energy plays a role in local governance and strategic decisions about the future sustainability of cities and neighbourhoods. The tide is turning after domination from the 1940s by the utility industries on the one hand and state regulation on the other. Local actors have taken an interest in energy, not only because of anthropogenic climate change but because of the spatial implications of the low carbon economy (Bridge et al, 2013). In terms of the spatiality of energy governance, this paper focuses on local and neighbourhood perspectives, which are closely related to the role for community in carbon governance, seen as positive and productive in the social embedding of carbon reduction, as opposed to an individual consumer-focused framework traditionally led by the energy retailers (Heiskanen ,2010; Walker, 2011).

Connecting with the literature in 'eco-state restructuring' and 'carbon control' (While et al 2010) we incorporate into this research the notion that there has been a shift from "*discursively strong but materially weak trade-off between economic and environmental goals, to a harder-edged instrumental concern with reducing carbon emissions as a first order policy concern"* (ibid: 88-9). Eco-state restructuring as a political process involves a 'downscaling' of state responsibilities in climate protection onto lower tiers of government in order to "*mobilize strategic interests and actors to undertake specific projects and activities*" (ibid: 80), and is increasingly concerned with controlling territorially accounted carbon emissions. Whilst the territorial logic of carbon governance has given rise to international perspectives on e.g. carbon trading and carbon budgets, local and neighbourhood perspectives are increasingly relevant, especially from the perspective of enabling local actors to formulate alternative visions for low carbon futures.

Despite the global awareness and acceptance of the risks of climate change and energy security, energy efficiency is not a straightforward condition that can easily be achieved through the existing systems of urban governance. In the space of two decades a consensus has emerged that "*there is a discernible move towards local solutions to conflicts between environmental protection, urban growth, and economic development*" (Gibbs and Jonas 2000: 299). The question about local government's capacity to address the 'sustainability challenge' is addressed in literature on climate change governance (e.g. Bulkeley and Betsill, 2005; Betsill and Bulkeley, 2007). Bulkeley and Castan Broto (2013) make the case that there has been a proliferation of 'governance experiments' at the local level, but that they are often characterized by top-down and purposive agendas, which underline the importance of the inclusion of previously excluded or marginalized local actors. In terms of local agency, we deploy regime theory in the case study to understand emerging low carbon activities, especially, as to whether recent developments in sub-national carbon governance

have re-purposed "*pre-existing 'development' regimes that have operated locally to promote economic development*" (Gibbs and Jonas, 2000: 308-9) or whether new local or extralocal stakeholders have been included.

We put forward the hypothesis that in the field of energy, data governance and a growing presence of Information and Communication Technologies (ICTs) are an intrinsic part of the emerging 'carbon control' agenda, and consequently, have a prominent role in local and neighbourhood level energy governance. ICT infrastructures and solutions are central to the low carbon visions both materially and discursively. From an empirical perspective, the rhetoric surrounding 'high tech' and 'low carbon' cities is riddled with contradictions. Indeed, the debate around ICTs and sustainability contains "hopes, dreams and myths" (Fuchs, 2008: 292). ICTs are widely perceived to contribute to energy efficiency in many different domains while the increasing demand for and *dependency on* digital will continue to inflate the direct contribution of ICTs and related data infrastructure to global carbon emissions. See Viitanen and Kingston (2013) for a critique of the way in which ICTs has been co-opted with the green economy agenda as a consumption-led strategy in 'smart cities' leading to a socio-geographic displacement of carbon emissions and environmental and social risks.

The point of departure for this paper is that while ICTs present a growing environmental problem, they are also part of the solution. As Floridi (2009: 155) argues: "*It seems beyond doubt that a successful marriage between physis and techne is vital and hence worth our effort. Information societies increasingly depend upon technology to thrive, but they equally need a healthy, natural environment to flourish*". Since the processes related to urban governance are supported by and dependent on various informational resources, the challenge then is to enhance the capabilities inherent in these resources. Energy governance has been the domain of private utility industries and national policy elites, but a decentralising trend focuses on the micro-local or neighbourhood scale and seeks to connect communities with the governance of energy (Walker, 2011). Regarding the direction of travel of the carbon agenda in cities, Chatterton (2013: 1656) asserts:

> "*The post-carbon agenda addresses the need for governance structures that are not over reliant on just the market or state, but which increase empowerment, local self-management, accountability and neighbourhood level participation".*

Due to the pressures of climate change and downscaling of responsibilities in environmental protection, regional and local energy governance has been argued to be going through a 'transformation' (Monstadt, 2007). Efforts therefore to empower currently excluded groups and bring energy governance closer to the communities affected by it, seem timely.

The link that we make between empowerment and energy governance relates to Walker's (2010) analysis about environmental justice and the way in which evidence, and therefore the basis of the assessment of justice or injustice, is produced and determined. This is a useful perspective in assessing programmes of 'eco state restructuring' (While et al, 2010), such as in residential energy efficiency, where local authorities are charged with a leading role. The neighbourhood perspective adds a 'community lens' to the analysis of otherwise individual consumer focussed energy efficiency which has previously been found wanting (Heiskanen et al, 2010). Walker (2011: 780) argues that community can take many meanings in carbon governance (e.g. actor, place, process) and that "*working through and with community mechanisms is expected to be productive for achieving carbon reduction*". Taking the notion of governance, Walker suggests that community capacities need to be understood in relation to the capacities of other governance actors, together with enabling resources that they can control. We suggest that data is an increasingly important enabler in the governance of energy. To illustrate this, the rollout of smart meters through energy suppliers has been criticized as a fragmented consumer-driven approach where the opportunity for collective local action has been missed. Data generated by smart meters is available to the individual household, their electricity supplier, network operator and third parties where the household have given specific consent (DECC,2012a). The present model of smart meter deployment does not enable community- or neighbourhood based energy governance, however, alternative approaches enabled by high resolution digital monitors and a local utility cooperative are being pursued by innovative 'low carbon communities' in English cities (Connell *et al*, 2013).

The paper is divided into four main sections. First, the methodology is discussed with a critical reflection on the 'roadmapping' approach to European research and policy. Second, international examples are used to highlight the importance of the state regime and political economy in the governance of energy. This section also reviews the main UK policies and legislation nationally and locally that influence the current approach to governing and mobilizing energy efficiency policies in Greater Manchester. This section serves to link the wider literature and theoretical insights on energy governance and carbon control with the empirical findings from the case study. The third section is dedicated to a more detailed discussion about the role of data in the planning and realisation of energy efficient neighbourhoods. The fourth and concluding section offers a discussion on the possible pathways towards data-driven local energy governance which rests on inclusive foundations.

Methodology

This research was conducted as part of a European FP7 coordination action, ICT Innovation Roadmap for Energy Efficient Neighbourhoods (IREEN). The purpose of IREEN is to "*produce a roadmap for the roadmap for European-scale innovation and take-up of ICT supporting energy efficient urban and rural neighbourhoods.*" Across the consortium, IREEN has engaged with approximately 200 experts in six seminars or roundtables, and undertaken 33 city interviews, where Manchester's contribution stands as the main basis for this paper. The empirical research for the Greater Manchester case took place in 2012-2013, involving a series of interviews with local practitioners in the field of "energy", "climate change", "sustainability", "planning" and "ICT/data governance", as well as a workshop with international and local experts in Manchester in autumn 2012. In total, 10 expert interviews were carried out, supported by a review of local and national policies on carbon reduction and energy efficiency. In this paper, the interviewees' identities are not disclosed, due to the political sensitivities as well as the ramifications of local government budget cuts on local workforce at the time of writing.

Roadmapping as a method is supported by a vision, in this case for energy-efficient neighbourhoods enabled by data-driven approaches. From an epistemological perspective, the method renders a strong directionality to the research findings with clear implications for the limitations of the findings. The purpose is to make recommendations for how ICTs can contribute to energy efficient neighbourhoods rather than for example, arriving at alternative interpretations of how to achieve energy efficiency. The roadmap methodology assumes that the dependencies on informational assets in the economy render non-ICT based future energy governance scenarios unlikely. As the purpose of the IREEN project is to inform European research policy, it is useful to be reminded that "linear assumptions" about the relationship between innovation and technology policy have been found wanting (Henry et al, 1995), due to lack of understanding of contextual social, political and economic forces. This paper attempts to take account of at least some of the contextual factors in Greater Manchester.

The limitations of this research mean that we do not address in detail the complexities associated with the spatial and social unevenness of energy infrastructure and energy policy. These hypotheses "*focus on the aggravation of spatial disparities and not so much on governance issues*" as argued by Monstadt (2007: 328). Other studies within the social sciences have developed advanced understandings of 'energy justice' from procedural and distributional perspective which arguably have relevance for energy governance too (Walker, 2010). We will use the concluding section to reflect on the relationship between energy justice, energy governance and data.

Energy governance and local government in the UK and internationally

> "*Local government in the UK didn't have duties, powers and accountabilities related to energy – so this is a huge challenge. Because of that, there isn't capacity, no energy staff [...] it is even more challenging in the current financial circumstances. There has been a shift in understanding this low carbon challenge in relation to local government."* (interview, February 2013)

English local government has no formal powers or duties relating to energy at present. However, this was not always so. In pre-war Britain nearly two thirds of the electricity supply industry and one third of gas supply used to be in the hands of large municipalities, the rest in private ownership (Robson 1950: 302). Immediately after the war, alongside many important industries, electricity supply was nationalized according to the global zeitgeist: "*The trend towards public ownership or control of certain basic industries and services, particularly those relating to fuel, power, transport and banking, is a secular movement of world-wide dimensions*" (ibid: 299). The subsequent wave of privatization and deregulation of nationalized industries during the 1980s and 1990s, pioneered by the consecutive conservative administrations of the UK, also became internationally fashionable. The UK's privatization programme is said to have been the most significant in the Organisation for Economic Co-operation and Development (OECD) (Pollit, 2004). In the late 1990s, the EC too adopted a policy of electricity market liberalization, requiring member states to open their electricity markets to competition in stages, a move which was not welcomed with equal enthusiasm by all member states (Green, 2006). The reforms were aimed at creating ideal market conditions for competition, increased efficiency and lower prices by reducing state involvement. In some respects the reforms met the objectives, certainly the UK enjoyed low energy prices for many decades, although this was counter effective in an energy efficiency sense. Research shows that deregulated energy markets have fundamental barriers to energy efficiency (Eyre, 1998; Meyer, 2003). Therefore further (re-)regulation has been necessary to 'stimulate utility involvement in energy efficiency', especially through 'demand side management' which otherwise would not have happened (Eyre 1998: 965).

The purpose of this overview is to provide a backdrop against which we can assess in more detail the current regulatory approach to energy efficiency, particularly through a local government lens. The regulatory approach and the political economy of the energy market have a strong bearing on the local energy landscape in the UK, but this is true also elsewhere in Europe. Local government in

Sweden was required by law to deliver energy plans and reduce dependency on imported fossil fuel in local energy systems in the wake of the 1970s oil crisis (Nilsson and Mårtenson, 2003). To further illustrate the role of national policy and the Nordic welfare state model, in what is internationally regarded as a successful energy transition to renewables, Westholm and Beland Lindahl (2012) analyse the Swedish heating and cooling sector from 1980 to 2010. Their analysis shows that the changes led by municipalities were underpinned by a strong national welfare state regime, which made local government resourceful. The welfare state model developed in the 1950s and 1960s had not been designed in any way to govern energy systems, but it had established "*a relatively uniform, standardized administrative structure with local authorities and county councils that raised their own taxes and operated and powerful implementation agents for the state*" (ibid, 329). By contrast, in the UK, neoliberal state regulatory reforms have had a deep impact on the local state stripping away resources and powers through policies such as Competitive Compulsory Tendering, which has "*undermined the contribution of local public services to the maintenance of inter-regional economic stability and to regional development"* (Patterson and Pinch, 2000: 265). Peck and Tickell (2002: 385) argue that whereas the national state used to be "the principal anchoring point for institutions" under the Fordist-Keynesian model, inter-urban competition became necessary "*cutting social and environmental regulatory standards and eroding the political and institutional collectivities upon which more progressive settlements had been constructed in the past*". If the Scandinavian welfare state regime provided a progressive and locally anchored approach to energy governance, at the other end of the spectrum lie the neoliberal 'roll back' state regimes faced with the problems of 'after-Fordist' local environmental regulation (Gibbs and Jonas, 2000) and the creation of winners and losers . Utility privatization forms a central part of the 1980's 'roll-back' strategies. The 'roll-back' regimes of the 1980s turned to 'roll-out' neoliberalism characterized by active re-regulation and state intervention, "extending and bolstering market logic" while apparently repairing the failings of earlier policies (Peck and Tickell, 2002; 389). This is clearly evidenced in energy policy by Eyre's (1998) observations about the need to re-regulate the liberalized utility sector to encourage energy efficiency. The present-day policy concern of 'carbon control' (While et al 2010) can also be understood as symptomatic of 'roll-out' neoliberalism via the involvement of the energy sector using mechanisms such as Energy Company Obligation (ECO) on the one hand, and the increasing pressure on local government to manage the low carbon transition on the other.

Compared with municipalities who still own local energy companies and local distribution networks, the scope for urban energy strategies is constrained in areas of fully privatized energy markets. However, as mentioned above, the trend in Europe is increasingly towards less public ownership of energy generation and distribution, due to 'pro-market' reforms which are enabling multi-national

energy firms to buy municipally owned energy companies. Consequently, municipalities have less scope than they used to, and there is a pan-European convergence towards more reliance on external partnerships and 'enabling governance', as revealed in direct comparison between UK and German local authorities by Bulkeley and Kern (2006).

Mondstadt (2007) argues that a transformation is underway in regional governance and energy planning as a result of the energy market reforms as well as the public policy pressures on climate protection in Europe. His observations from North Eastern Germany reveal that political efforts of ecological modernization had largely failed because the regional energy companies protected their economic interests and showed 'innovational lethargy' (p. 333), and that under these circumstances the local state had proven weak. The nature of the energy sector is such that it privileges large utility operators: *"These utilities have privileged power, financial resources, information, knowledge and skills to influence economic growth, socio-technical innovation and ecological modernization".* Given the stalemate between public authority and the regional energy companies, the role of innovative ecological entrepreneurs in the energy sector, or 'ecopreneurs', as agents of change and innovation is highlighted: *"The growing economic and ecological importance of ecopreneurs has challenged traditional forms of governance in Berlin. The rise of the ecopreneurs indicates a step towards private self-regulation in climate protection and technological innovation."* (Monstadt, 2007: 334-35). This marks a double movement in the field of local energy governance; on the one hand local state institutions and actors have less direct influence over energy via for example regulation, but on the other hand they are needed to foster the necessary conditions for innovation: "*The argument is that within the multi-level system of energy-related policies the regional and urban level still has an indispensable function, as the conditions for enhancing socio-technological innovation cannot be planned and implemented solely by the nation state or the EU"* (ibid 335-36).

The abolishing of the regional tier in England has left a gap in spatial energy policy coordination and accountability as the regional development agencies used to sign off District Network Operators' asset management plans. Therefore, Greater Manchester's efforts in energy governance are important, especially as the urban tier in energy governance has been characterized as having an "institutional void" (Monstadt, 2007). In terms of the territorial implications of local responses to energy governance, While et al (2010) predict that 'eco-state restructuring', could lead to two opposite kinds of 'experiments in reterritorialisation of governance' at the sub-national scale. One is an increasing importance of city-regions where local authorities form collaborative strategies, alternatively, local authorities could "*resist incorporation into wider city-regional or regional*

networks ". The case study of Greater Manchester (GM) illustrates how the reterritorialisation of energy governance has been brought about in the government's 'localism agenda' under the so-called 'City Deal'[1]. The City Deal for GM includes a "Low Carbon Demonstrator**"** which comes with some privileges for the city region in terms of government support and resources (GMCA 2012). Indeed local government stakeholders interviewed in the IREEN research posited that "*Whitehall have finally realised that they cannot reach their carbon reduction targets without local government*", but simultaneously the view was expressed that carbon reduction policies, such as the strategic framework for low carbon heat (DECC, 2012b), had been designed without input from local government. Many felt that the involvement of local government in the low carbon strategic agenda had been "an afterthought" in the UK.

Greater Manchester

Since the industrial revolution, Manchester's political and business communities have seen the management of natural resources as part of the economic development agenda, manifested e.g. through public health interventions in the city's air and water quality to keep the city an attractive place to do business (MacKillop, 2012). In early 21st century, we argue that *energy* is at the heart of the environmental 'pro-growth' agenda in the city region. While the 'low carbon economy' is ubiquitous in local economic strategies, there is a new vernacular emerging around 'energy'. To illustrate this, the GM Energy Strategy states that GM spent over £5bn, or 11% of the region's GVA, on energy in 2010 (AGMA, 2013). The strategy has an aspiration to control and benefit from the volume of economic activity in energy: "*The energy market is highly complex, partitioned and regulated, and GM does not fully control its energy system. Achieving a low carbon, secure and affordable energy system in GM will require a concerted effort. No single player can act alone. For the private sector, the challenge will be delivering long term investment. For the public sector, this is a test of multi-level governance"* (AGMA 2013: 2). Indeed the local stakeholders rejected the idea of the 'deregulated' energy market in the UK, instead, they emphasized that current regulation protects the interests of existing utility companies and prevents local authorities from challenging the status quo in the energy market.

'Multi-level governance' refers to the Low Carbon Hub Board, set up as part of the City Deal for GM. It is chaired by Manchester City Council's leader Sir Richard Leese and incorporates members from private and public sectors including Siemens, Arup, Manchester Airport Group, the Cooperative Group, as well as education and housing sectors. The Energy Group which reports to the Low Carbon Hub Board also has a cross-sectoral membership and is chaired by an elected member of

Manchester City Council Neil Swannick, the chief executive of Electricity Northwest is the vice chair and "for all intents and purposes the co-chair of the Energy Group" (interview, February 2013).

The reputation of Manchester's boosterist urban regime promoting a city of uncompromised economic development (McKillop, 2012) gives the local agenda for 'low carbon' an interesting backdrop. While et al (2004) describe the how implementation of the Agenda 21 in the 1990s in Manchester led to bitter relations between the environmental stakeholders and the urban regime who consequently sought to isolate themselves from environmental activists. The GM interviews suggest that local stakeholders, including business leaders, officers of the city council, and especially the now disbanded NWDA played a significant a role in "winning the hearts and minds" of the city region's leaders about cities' role in climate change, particularly those at the helm of Manchester City Council and the city region, Sir Richard Leese and Sir Howard Bernstein whose perceptions were influenced by the Agenda 21 experience.

Figure 1 provides a timeline of low carbon policies from the point when GM is described to have "come together" as a low carbon city region:

Figure 1: GM carbon policy timeline

[insert figure 1]

It should be noted that the Manchester city region has a history of over 25 years (Deas, 2013) but that prior to 2007, the interviewees argued that there was "*a total absence at city region level*" of coordinated carbon reduction policy, and at local authority level such policies used to be "*completely vague or disconnected*". The Greater Manchester Strategy (AGMA 2009) set out "to a*chieve a rapid transformation to a low carbon economy*". Around the same time, a 'bottom-up' partnership for climate change action in the city of Manchester was launched "Manchester – A Certain Future (MAFC), which is seen as a community-owned campaign (Heiskanen et al, 2010). Some of the interviewees expressed concern about MACF's lack of progress to date. Perhaps this is partly due to the historic lack of tethering within the 'Greater Manchester family'; a term which refers to the local policy and economic elite who oversaw Manchester's policy development since the 1990s (see Quilley, 1999). However, carbon control has crept up the policy agenda and now is a concern for the elite too. Following the Climate Change Act 2008, the "Mini Stern review" was commissioned locally to assess the economic impact of climate change legislation for Manchester City Region (Deloitte, 2008). Consequently, the GM Climate Change Strategy (2011) sets out the target for carbon emissions reduction of 48% by 2020. After the City Deal was announced**,** GM's 'Low Carbon Hub' has

assumed responsibility for the GM Climate Change Strategy which leaves some unanswered questions about the role of existing partnerships, such as MACF. To set up the Hub, GM actors were in direct negotiation with Whitehall, having created 'memoranda of understanding' under the City Deal with government departments, including Departments for Energy and Climate Change (DECC), Environment Food and Rural Affairs (DEFRA), Transport (DfT), Communities and Local Government (DCLG) and Business Innovation and Skills (BIS) who have a representative each on the board of the Low Carbon Hub. The City Deal allows GM access to government 'low carbon pathfinders', which practically means revenue for projects prioritized by the government. Although GM has its' unique combined authority status, the Low Carbon Hub is not entirely unique as other City Deals, including the one in Leeds City Region, has a prominent low carbon component aiming to "deliver the UK's leading low carbon city region" through renewable energy and retrofit investment programmes (Leeds City Region, 2012).

The GM energy stakeholders maintain that the 'city region model' is beneficial for neighbourhoods, too, from a strategic resource and policy coordination perspective. In their view the Hub is "a partnership of local government" which gives the Hub access to neighbourhood managers "working on the ground". This centralized city-regional coordination of energy policy makes it easier to develop "*consistent neighbourhood characterisation, identify strategic opportunities and housing stock profiling*". At this juncture, the role of data begins to emerge through the importance that is given to 'central coordination' of data at the city-region level. Data in other words enables strategy.

According to Low Carbon Hub stakeholders, "*we are a formally designated test bed for testing out urban ideas for low carbon and climate change".* The city region advocates posit that the large energy companies and network operators find it more manageable to work with a group of ten local authorities rather than with each local authority individually. However, there are dissenting voices too. One interviewee criticized GM activities as serving (the city of) Manchester's strategic aims disproportionately – indeed the inter-city rivalry in the GM area is a long standing feature of its metropolitan governance (Deas, 2013). These ongoing frictions make the city region model "highly politicized" and this, some interviewees argued, causes inertia.

The actors, private and public members of the GM Low Carbon Hub, include the 'Greater Manchester family' – which carries in itself discursive power of persuasion and implies cohesiveness and belonging. The argument is advanced here that the City Deals have characteristics of 'governance by experiment', being geographically selective and purposive in their aims (Bulkeley and Castan Broto 2013). This does not leave much room for bottom up experimentation and thus fits in with the observations (ibid, 2013: 373) *"Rather than operating as open-ended, learning processes,*

we find that experiments are often vested with particular interests and strategic purpose in the governing of the city." We propose that the strategic purposes of GM Low Carbon Hub harness carbon control and local energy governance as important instruments of inter-urban competition. This explains why tensions between the ten GM local authorities persist around the low carbon agenda. The territorial implications of the GM City Deal support the scenario sketched by While et al (2010) where the city-region approach takes precedence, even if in practice this means some dissatisfaction and political compromise. The 'eco-state restructuring' via the City Deal gives city-region elites resources and scope to bring forward low carbon energy investment programmes: "*for example DEFRA put in place £15m for community led initiatives but we probably get a top slice from that to take forward community led energy initiatives in GM (rather than individual LAs applying)*" (interview February 2013). The corollary of the urban regime theory is too obvious not to mention in this context – this theory may explain how GM's elites garner support as the City Deal furnishes them with resources to distribute locally: "*Regimes over-come problems of collective action and secure participation in the governing coalition through the distribution of selective incentives such as contracts, jobs, facilities for a particular neighborhood, and so on*" (Mossberger and Stoker 2001: 812). With reference to Gibbs and Jonas (2000), there has been a discernible 'coming together' of policy elites around the energy decentralization agenda in GM, and the agenda has largely been appropriated by the pre-existing 'pro-growth' regime, our findings thus also supporting the observations by McKillop (2012). The extent to which the Low Carbon Hub enables a bottom-up approach in GM is less certain. While local expression and 'control' over energy policy is pursued as a strategic goal, it is not at all clear how this is achieved – instead, the energy domain appears largely rooted in extralocal powers.

There remains a lack of powers for local authorities to achieve the benefits of 'neighbourhood' or 'community' approach to energy governance. The interviews with GM practitioners suggest that various energy interventions, such as smart meter rollout, domestic retrofit and collective energy switching schemes, could have higher rate of success if there was 'spatial co-delivery of activity' – referring to a more holistic delivery model recognizing the role of communities at the neighbourhood scale: "*Under market transformation and this techy field there is no funding stream to recognise the importance of user enablement in the introduction and deployment, yet it is a critical part*". The practitioners drew attention to the multicultural communities, and the lack of experience within energy companies to engage place-based communities. The unfulfilled potential of 'spatially coordinated' delivery at the neighbourhood scale would combine different interventions to optimize the performance of technologies that are being delivered, also beyond the household level, for

example in network support and innovation. However, carbon control programmes involving the energy sector and roll-out neoliberal regulatory approach is void of the benefits that local energy governance could bring to bear – a link that was lost in successive reforms after WW2. We conclude that the 'governance experiments' rooted in eco-state restructuring remain disconnected in GM's neighbourhoods. This is a set back from the perspective of community-based energy governance which could unlock social and technical innovation in carbon governance and energy efficiency (Heiskanen et al 2010, Walker 2011, Karvonen 2013).

Where bottom-up experimentation exists, Bulkeley and Castan Broto (2013) stress that "*the ability of otherwise marginal actors to use experiments as a means of advancing an alternative politics of climate change"* is important. This is a central question that can be appraised using the energy justice framework as set out by Walker (2010) about procedural justice, i.e. access to decision making processes, and distributional justice, or the judgement made of 'winners and losers'. Another insight that we draw on from Walker's (2010: 317) research relates to environmental justice and expert mode of knowledge production which "can be problematic and open to challenge" from a community perspective. This conflict between experts and lay people applied to the carbon control agenda is salient. Empowered actors, experts and professionals, validate their decisions about energy interventions based on data defined within the governance processes set by economically and politically resourceful groups. Our argument about the data-driven city is that, as a basic requirement the data relating to energy governance must be open. The vision, which underpins also the IREEN roadmap for energy efficient neighbourhoods, is that energy and carbon data are a key governance resource, and should be made visible and accessible at the neighbourhood level, as will be demonstrated in the following section.

To discuss the role of data in more detail, conceptually we draw on the political economy of open-source software (Weber, 2000) which by definition is participatory and works towards public good, rather than private gain (as with proprietary software). To illustrate how we apply the open source philosophy to the data-driven city, we borrow the 'cathedrals and bazaars' analogy (Raymond 1999). The example serves to highlight the main characteristics of 'proprietary' versus 'open' solutions. The 'cathedral' is "built by coordinated teams who are tasked by and answer to a central authority" who also benefit from economic rents through intellectual copyrights (Weber 2000). The 'bazaar' now seems self-explanatory in contrast to the 'cathedral'. We draw on this analogy to refer to a city's data environment, which will be examined further in the section below in relation to energy data. The basic thesis of the bazaar-like data environment is that it should be non-hierarchical and

accessible to a wide spectrum of contributors, users and innovators. This type of data environment could enhance conditions where bottom-up experimentations could emerge in local carbon and energy governance.

The role of data in energy governance

The purpose of this section is to present evidence of data governance and practices in relation to the energy efficiency agenda pursued by local government. This debate is informed by the energy justice framework described above, and the basic notion that access to and ownership of data may be a significant enabler to advance alternative, progressive energy practices and politics. We also refer to the neoliberal state regime where policy development in strategically critical fields is the reserve of "technocratic elites, think tanks, opinion formers, consultants and policy networks" (Peck and Tickell, 2002: 398). We suggest that carbon control has become one such strategically critical field, which shines light on energy data, especially as urban areas are subject to more advanced infrastructure-based controls, inter alia smart grid networks.

Debates in academia as well as practice tend not to be focused on the underlying data for low carbon schemes, or how power relations may be expressed in the construction and governance of data. However, a closer look reveals that data are fundamental to the process of carbon control and energy governance. The availability and granularity of data was raised as a bottle neck in many application areas for technological innovation, e.g. virtual power plants (IREEN 2013).Consider the running of a state of the art district heating scheme as an example. These systems incorporate advanced ICTs and live data. Biomass-fuelled district heating solutions often have a gas alternative or back up, outside of the UK or in off grid locations, other backup fuels would be more appropriate of course. The fluctuations of fuel consumption are centrally monitored and controlled by computers. The data about the amount of biomass consumed builds up intelligence about, for example, eligibility for payments under the UK's Renewable Heating Incentive, giving a revenue stream for the local authority (or whoever owns the scheme), and providing grounds for strategic decisions about the prospects of biomass supply from local woodlands. This illustrates how data is intrinsic to creating and financing energy systems at a local and neighbourhood scale. It also helps to move the argument towards the importance of data being available openly to assist in local energy innovations and the creation of local ecosystems.

Turning our attention to domestic retrofit schemes reveals further data-dependent pathways. In GM alone, the target is 15,000 'Green Deal' measures in 2013-2015, as per the Home Energy

Conservation Act report of 2013 (MCC, 2013). The governance capacity to deploy such schemes depends heavily on data. To qualify for retrofit funding, the government has set specific requirements on targeting neighbourhoods or households with certain characteristics. Typically, a level of intelligence about socio-economic data such as fuel poverty is required, but also advanced information about the housing stock condition, accounting for previous energy interventions (HCA, 2012). The government placed responsibilities on local government to report on energy efficiency data almost two decades ago under the Home Energy Conservation Act 1995 (HECA). This triggered a first wave of local authority involvement as 'strategic enablers' in energy efficiency in the built environment, as observed by McEvoy et al (2001). We argue that a significant strand of local government involvement in data-driven energy governance was set in motion then, as many authorities embarked on extensive surveys and energy audits as part of the effort to monitor and reduce residential carbon emissions. As part of this trend, many local authorities built detailed databases on the energy performance of their housing stock. The updated HECA responsibilities began in 2013, under guidance from DECC (2012c) to bring HECA in line with the Climate Change Act 2008 and other relevant legislation. While there is much emphasis on 'targets and ambitions' for local authorities under the renewed guidance, an important trend could easily go undetected in terms of the data implications. It is apparent that local authorities are no longer the hub of data and intelligence that they were when HECA 1995 was introduced. Local authorities used to collect data from a variety of sources, such as take up of insulation schemes or boiler upgrades by private households, as well as in the social housing stock. This has resulted in what was described as a "meaty database" by one interviewee – indeed such databases are still seen as an important asset for local government strategic planning, but abilities across local government vary and capacity has been lost which means that many databases are no longer updated. In Manchester, resulting from the financial pressures from the funding cuts to local authority budgets as part of the UK's austerity programme, data governance capacity has been eroded:

> *"A lot of people used to have databases but it was one of the things that were cut due to the funding cuts. However, the new type of funding that is coming in [Green Deal and ECO] requires local authorities to have the data on stock to back up and justify schemes and expenditure. People really need the data to target it, so there's more interest now in collecting and using detailed data and analysis. The problem is they haven't got the data.*" (interview, January 2013)

Specifically relating the cost and availability data, the interviews revealed how some relevant data was no longer available to local government, and other data such as the Energy Performance Certificates (EPC) were subject to a charge, as highlighted in the quote below:

> *"… local authorities are supposed to be leading, but other people have the data. And even having to buy the EPC, it would cost £10k this year, and next year you'd need it again. Then there's other data that we haven't even got access to at all. They're building something else, "HEED", which is not available on an address basis to local authorities, and it makes it hard to target things on some vague ward based information, for example."*
> (interview, January 2013)

The HEED database relates to a commercial data service from the Energy Saving Trust which combines EPC data with commercially derived consumer data from Experian. Additional concerns arise when new datasets made available centrally tend not to integrate with the local systems held by individual local authorities, each using alternative non-interoperable commercially procured systems. The UK has experienced a trend in the commercialization of data required as evidence for public policy making, which has been highlighted by Viitanen and Kingston (2013) as a concern with regard to future smart cities. Private industries, such as in the utility sector, often have superior data directly from customers, and 'public data' are increasingly held by central agencies who charge for its use. There are yet unresolved questions about the sustainability of data business models, specifically, who should pay for the use, maintenance and governance of data relating to urban areas.

Data is a central currency in the business of carbon control and is intrinsic in governance decisions, for example, justifying energy efficiency schemes as required by a combination of environmental regulation and state controlled policy instruments, but also in the all-important economic planning and operation required as part of energy governance. Those who demonstrate 'banking carbon' as a result of energy interventions will benefit from the associated incentives (or, avoid penalties from non-compliance) under the Energy Companies Obligation (ECO) scheme, where large UK energy retailers are required to fund energy interventions to customers who are 'vulnerable' or in 'heard to treat' properties (Ofgem, 2013). For this purpose, DECC have opened an anonymous auction site where certified Green Deal/ ECO providers can sell 'lots' of eligible ECO interventions to energy companies in return for ECO subsidy (DECC, 2013), based on assumptions about carbon being saved under each 'lot'.

In summary, we found that the capacity and skills to govern data is a central feature of carbon governance. In relation to energy, the challenge is even greater due to the historic lack of local government responsibility since WW2. The business models which emerge around data governance reflect dominant political and economic interests in the energy sector, whose interests are protected by the current regulatory regime.

Reflections on the roadmap and concluding thoughts

> "*Energy efficiency and low carbon are an exercise in economic management. Getting the skills in local government to manage this process is key, e.g. estimations on return on investment, deciding what is best use of resources. There is currently a gap in these skills." (interview, March 2013)*

It is clear from the GM case study that carbon control is 'big business', with considerable advantage for actors who possess accurate data about households and neighbourhoods. This concluding section illustrates how the carbon control agenda is played out in data-driven urban energy governance. As While at al (2010: 82) posit, "*the idea of control also draws attention to the distinctive political economy associated with climate mitigation in which discourses of climate change both open up, and necessitate an extension of, state intervention in the spheres of production and consumption*". We have explored the city-region model favoured under the localism agenda of the UK coalition government, against the backdrop of the energy market reforms since WW2 that have marginalized local government in the governance of energy. This paper has highlighted how energy has returned to local government agendas, but that this return has not been matched with formal duties or powers at least in the UK. Any local developments in the field of energy are experimental and largely reliant on private industries on the one hand, and the central government sponsorship on the other, exacerbated by the UK austerity programme which has eroded local government capacities.

Previous research on climate change and energy governance explains how most European cities are affected by the cross-border trends of energy market liberalization, decentralization and carbon control agendas advocated by national and supranational bodies. Bulkeley and Castan Broto (2013) argue for the need to understand how governance experiments could empower marginalized groups and actors, and how governance could enable open-ended learning processes, rather than imposing top down agendas on communities. Some argue that the momentum of the climate change agenda has given scope for locally distinctive and politically astute campaigns led by local government (Gibbs and Jonas 2000). However, the evidence from this research suggests that at least the energy sector does not seem as open to local government influence, and that incumbent energy providers' position is bolstered by the neoliberal regulatory regime.

The Greater Manchester case study illustrates how emerging local and sub-regional energy governance is characterized by complexity with different spatial, political and administrative boundaries and bodies advancing low carbon activities in the overlapping territories. Investigating the residential carbon agenda, individual local authorities have been tasked under the HECA to set

carbon targets and report on them, and at the same time, a metropolitan form of governance, the Low Carbon Hub, carries out pathfinders and acts as a test bed for low carbon policies of Whitehall departments. The Low Carbon Hub is the new face of the pre-existing urban regime in the Manchester city-region, engages with both local and extralocal actors in programmes of eco-state restructuring through the City Deal mechanism. Parallel to this, the community-owned MAFC partnership has aspirations of its own for the city. However, an actual *obligation* of reducing residential carbon emissions has been placed on large energy companies under the ECO scheme. The funding for the retrofit interventions comes from energy customers through their energy bills. Furthermore, Green Deal/ECO delivery is disconnected from energy innovation, for example, in the field of smart grid developments or renewable energy.

We argue that communities and neighbourhoods are excluded from the procedures of decision making and governance of energy which reflects the fragmented and complex picture emerging around the residential carbon agenda. An end consumer who decides to have a Green Deal retrofit plan delivered by certified installers and paid for via an agreement between their certified installer and their energy company, creates an assumed carbon saving that becomes an intangible tradable asset. A recipient of an ECO intervention in a neighbourhood classed as deprived could create the same intangible asset without taking any part in the decision. This shows how carbon control has become a first order policy concern (While at al, 2010), superseding previous focus on 'sustainability'. It also shows how governance decisions relating to energy efficiency are based on various data-driven assumptions and transactions relating to carbon, mostly invisible to the communities they relate to. We advance the argument that making energy and related financial transactions more visible by means of data could help communities to connect with the energy and carbon efficiency agenda. The International Energy Agency (IEA, 2012: 3) states: "*Energy efficiency needs to be made clearly visible, by strengthening the measurement and disclosure of its economic gains."* The IEA also stresses the need for investment in energy efficiency governance and administrative capacity, this need is acutely felt in UK local government after the radically reduced budgets since 2010.

We have shown the central role that data play in how the funding conditions and delivery mechanisms are determined in energy efficiency interventions. These energy and carbon data are highly professionalized, and despite local authorities' role in coordinating energy data under the HECA, many databases are out of their remit, commercially run, or incompatible with pre-existing local systems. Furthermore, energy production and consumption, although subject to significant forces of decentralization, still appear to be dominated by the consumer-provider relations which

have a centralizing effect, with some exceptions under 'community energy' and 'microgeneration' initiatives.

The argument pursued here is that data has an enabling role in local energy governance practices, perhaps previously overlooked. Increasingly, energy infrastructures are infused with sensors and monitors which enable the creation of data and infrastructure-based controls, using advanced ICT systems. Communities and individual households are the unit whose carbon reduction is being traded, or whose characteristics qualify for one type of energy intervention or another. Currently, this information is strongly rooted in professional discourses and assessments that are largely inaccessible to the general public. From an energy justice perspective, it is vital that communities have more ownership of the data environment. To imagine 'bottom up' energy innovations in neighbourhoods, the governance of energy data appears to be among the first things that need to change.

It would be unrealistic to suggest that with access to data about their energy and carbon, communities would suddenly be empowered become more self-determining. However, without this data, they appear to have less opportunity. This is noteworthy in the context of the lessons from Berlin (Monstadt, 2007) where local 'ecopreneurs' had played a fundamental role changing the dynamics of local and regional energy governance, that energy data should be available for innovative practices by those who are not part of the status quo, for example energy service companies.

The technologically driven agenda for energy efficiency will result in more data-based controls on how and where energy is produced, consumed and saved; those with access to data determine distributive outcomes also. The neoliberal state regime has produced an environment where policy development is the reserve of "*technocratic elites, think tanks, opinion formers, consultants and policy networks*" (Peck and Tickell 2002: 398), which is further exacerbated by exclusive data governance practices in the field of energy. There is a political and normative duty to ensure that decisions remain open and transparent, and that the underpinning protocols are open, too.

This paper set out to make recommendations for the inclusion of previously marginalized actors in local energy governance. We conclude that this includes local government actors; their position has been weakened by not only by the 'roll-out' neoliberal approach to energy market regulation, but also by unprecedented cuts to their budgets since 2010. For local authorities to remain relevant in the increasingly technocratic energy governance process, they should bolster their role as local energy data hubs and provide open 'bazaars' of energy data. Just as renewables, community energy

and microgeneration decentralize the energy landscape, the data landscape too, should decentralize. The availability, quality, reusability and interoperability of energy data within and between neighbourhoods support local innovation. The vision advocated by the innovation roadmap (IREEN, 2013) aims to create data environments that allow for bottom-up experimentation. It seems non-conducive to innovation to 'back winners' by making recommendations about specific technologies or solutions, rather it appears more appropriate to make recommendations that allow for local self-determination in how energy data should be governed. This will need strategic input from regulators. The complex relationship between data protection, privacy and ownership needs to be resolved in conjunction with the industry and consumers. In terms of energy data governance, a movement away from proprietary and bespoke closed systems is a likely direction of travel, towards openly accessible data and web-based solutions, supported by open standards. Open data business models have not been resolved in many cities, and here lies the challenge that requires significant efforts between governments, energy industries, local government, 'eco-preneurs' and consumers. We argue that the existing data business models are rooted in the top-down governance of energy in the UK. To counter this trend, an open data environment is a significant factor to ensure energy justice from both procedural and distributive perspective, as well as building local competences to find progressive alternatives.

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[1]According to the Deputy Prime Minister's office, the City Deals are agreements between central government and the main cities in England. According to the government, power is transferred to local governance bodies to decide what it best to benefit the local economy. For more information see https://www.gov.uk/government/policies/giving-more-power-back-to-cities-through-city-deals

Figure 1: GM carbon policy timeline