Enabling Urban Energy:

Governance of Innovation in Two UK Cities

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Abstract

In the context of a Europe-wide policy focus on low carbon energy, city authorities are being charged with significant responsibility for innovation and energy saving, but weak public finances and constrained circumstances raise questions about their capacities to respond. The paper examines case study evidence from two UK cities which have developed combined heat and power generation with district heating (CHP/DH), under contrasting business and governance models. Aberdeen Council focused on social objectives for affordable warmth, resulting in setting up of a not-for-profit company. Birmingham Council prioritised economic regeneration and opted for a long-term concession contract with a private sector district energy utility. In order to proceed, actors had to assemble an alternative socio-economic calculus with sufficient legitimacy to contest, and reframe, dominant short-term least-cost evaluation practices. Capacity to achieve this depended on actors mobilising social capital, through intersecting urban energy knowledge networks. A public funding component was also critical. The longer term implications of the different business models are considered. In conclusion it is argued that accelerated development of the full potential for urban energy requires a new policy framework, giving due recognition to its public value.

1. Introduction

In the context of a Europe-wide policy focus on low carbon energy, city authorities are being charged with significant responsibility for innovation and energy saving, but constrained public finances and the dominant neo-liberal political economic context raise questions about their capacities to respond. This paper explores the potential for UK city authorities to innovate in low carbon energy infrastructure, in the context of centralised markets and enabling (rather than service providing) roles for local government. It compares strategies in Birmingham and Aberdeen, where actors have assembled innovative formations of social, financial and technological knowledge in order to justify the development of combined heat and power and district heating (CHP/DH) infrastructures. Both cities are unusual in going beyond more common municipal incremental energy saving measures, and their locally mediated responses to neo-liberal political economy produced contrasting business models and trajectories. The circumstances prompting these different solutions are discussed, and the implications for municipal energy are considered.

Behind the policy focus on low carbon energy is urban dependence on abundant, affordable supplies of energy, when climate science has demonstrated the major risks of continued reliance on fossil fuels. Energy policy, politics and governance have consequently returned to prominence across Europe, with the ambition to create a low carbon, resilient and efficient energy system (EC *Energy Roadmap, 2050*). One component of such a system is the production of a greater proportion of energy close to its point of use, particularly in densely populated urban areas, where the potential for energy and carbon saving, and local democratic participation, is greatest. The concept of 'smart cities', or 'eco-cities', with sustainable energy systems, has become the short-hand symbol of such ambition, but it is a concept which is politically contested and which remains predominantly aspirational (Hollands, 2012; Joss, 2011). In the UK the focus of government proposals for electricity market reform is on top down measures to incentivise investment by international utilities. The value of 'distributed energy' generation in urban areas is nevertheless acknowledged:

> 'We recognise that integrated, local-level distributed energy systems could be an important step towards a more coordinated approach that includes, for example, transport and waste' (UK DECC, 2011, p.104).

Decentralised energy, particularly CHP/DH, has considerable long-term social, environmental and economic benefits, but initial infrastructure costs are high (Kelly and Pollitt, 2010). The UK government's market reform white paper notes benefits of reduced financial costs (by reducing the need for transmission network reinforcement and reducing demand on the electricity system by local generation of heat), more local control through community involvement and investment, and a more resilient, affordable and secure energy infrastructure (p.104). At the end of November 2011, the UK Government's Infrastructure Plan highlighted an increasing role for urban heat networks, with urban authorities[i] in a key role. Similarly the Scottish Government 2020 Roadmap for Renewable Energy identifies district heating as important, and has established an expert commission to increase development. Most recently, UK government Heat Strategy (DECC, 2012) signalled the contribution of cities to developing heat networks as part of a resilient low carbon energy system. Energy policies are therefore noting the public benefits of municipal energy, particularly for heat supply, even though the major policy instruments focus on price support mechanisms for large-scale electricity generation in centralised markets.

2. Urban Energy Governance in the Context of Neo-Liberal Political Economy

Municipal energy has had a varied history across Europe, but the past thirty years of neo-liberal political economic principles, in global centres and institutions of the OECD (Crouch, 2011), are associated with declining direct provision. EU member states, motivated by (short-term) cost saving and risk transfer, have pursued the principle of privatisation of supply in a single market for energy. In the UK successive governments have shifted the balance of ownership and finance of infrastructure towards the private sector, thus reducing domestic capital expenditure (Helm, 2010), and the role of the state has correspondingly shifted towards enabling through regulatory instruments. The disappearance of municipal energy in the UK long predates privatisation however, with municipal control ended by the 1940s creation of nationalised regional electricity boards. Further centralisation took place with the 1957 creation of the Central Electricity Generating Board (CEGB). Privatisation commenced in the 1990s, with an energy regulator (OFGEM) governing a centralised market. Mergers and takeovers of regional electricity companies have since resulted in domination of supply by six large-scale utilities.

Across Europe decreased municipal ownership and control of energy has not, however, resulted in convergence on one particular market formation. In the past, where a social-democratic consensus supported integrated, and in some instances cross-subsidised, public services including energy (notably in Sweden, Denmark and Germany), municipal authorities had significant regulatory and operational control over local energy services. Regional variety and historical differences persist, but with increased private ownership, greater concentration of ownership, more fragmentation of local services and public private partnerships and franchises (Helm, 2010; Monstadt, 2007; Rutherford, 2008). Despite the regional differences, energy infrastructure and services are increasingly subject to the logic of global financial market flows of capital, technology and fuel supplies (Winskel, 2002). Where municipalities continue to hold a minority share in privatised utilities, these are likely to be managed according to commercial criteria[ii], rather than as a means of balancing social and environmental objectives with profit-making goals. Infrastructure is likely to be constituted as a globally-tradable asset, whose value is determined through the

application of de-contextualised, standardised, risk instruments (Torrance, 2008). The object is to produce replicable investment propositions, with predictable rates of return, insulated from particularities, and uncertainties, of place-based history, politics and culture. The political-economic context for municipal energy innovation is hence extremely challenging, and as yet there is limited research on the scope for local agency, in the face of such globalised finance and energy markets.

3. Positioning Cities as Practitioners of Low Carbon Energy

Historically, municipal leadership has been highly significant in progressive change: in late 19th and early 20th century UK cities, for example, municipal governments were critical to infrastructure investments in clean water, sewage, transport, energy and communications. These improvements were not the inevitable rational-economic outcome of technological advance and wealth creation, but required political will and direction, and political movements driven by urban poverty were critical to steering investment into public goods (Szreter, 2004). In today's context of states seeking competitive economic advantage by attracting mobile transnational capital (Jessop, 2002), ambitious policies for low carbon innovation confront governments with complex collective action problems. Municipal leadership, supposedly 'unencumbered with the "paralysis" afflicting national governments in responding to resource security and climate change issues' (Hodson and Marvin, 2009: 196), has returned to the fore as part of the solution. The anticipated role of cities is indicated by successive EU initiatives[iii], which are presented as functioning in a depoliticised, technocratic sphere: 'routemaps', 'tool kits' and scenarios are expected to offer a standardised framework for instrumentally rational problem solving and knowledge-sharing. The skills expected of urban authorities are those entailed in building strategic partnerships, coordinating between levels of governance, joining up policy across functions, and acting as standard bearer for best practice in relation to transparency, probity, inclusivity and accountability (Betsill and Bulkeley, 2006). These are high expectations in at least two senses: first in the context of a globalising energy system with very little incentive to attend to regional and local interests, and which is at best only weakly oriented to environmental objectives; second in the context of managerialist models of local governance informed by market-driven, short-term cost reduction criteria, where initiatives beyond statutory duties are unlikely to command resources.

4. The Enabling Model of Local Governance

In the conventions of neo-liberal political economy, an enabling model of local governance, using competitive contracting, outsourcing and public-private partnerships (PPPs), rather than direct service provision, is equated with efficiency and effectiveness (Osborne and Gaebler, 1992). In combination with reduced budgets, and a short-term cost focus, however, the evidence suggests that the enabling model fragments services and tends to reduce quality of provision, inclusivity and equity (Bulkeley and Kern, 2006; Coutard and Rutherford, 2010; Monstadt, 2007; 2009; Rutherford, 2008). When authorities pursue innovation in low carbon infrastructure through private finance they also risk co-optation as a showcase for mobile capital (Hodson and Marvin, 2009), without necessarily securing long-term local benefits. In the context of low carbon energy, the short-term 'least cost/highest return' calculus of energy market actors is juxtaposed against local social, economic and ecological goals. Under pressure, municipal authorities may, or may not, seek to ensure support for locally-determined interests and equitable outcomes.

The potential to shape privatised energy interests and finance to local projects is limited. Rather than statutory control over directly managed services, authorities face new governance roles, which require skills in energy contracting, negotiation of quality standards, energy efficiency management, and auditing of contractor performance. Monstadt (2007) argues that privatisation of municipal energy does not preclude alignment of short-term cost with local innovation potentials in order to address environmental problems, but notes that authorities struggle to identify and/or develop the necessary capacities: 'urban governance of energy systems in Berlin is characterised by… an institutional void: a lack of generally accepted rules, procedural norms and organisational capacities guiding policy-making to protect the public interest' (Monstadt, 2007: 340). In contrast, Hodson and Marvin (2009) conclude that the London Hydrogen Partnership (LHP) did mediate competing objectives of social equity and profitability. Local actors facilitated flows of knowledge, bridging conflicting expectations and managing conflict between a local progressive/inclusive politics and a business-led 'exogenous' model of the city as a showcase. Potentially therefore private-public partnerships may work as a vehicle for combining a democratic agenda with trans-national technical expertise and capital, and modulating

the tensions between them. The transaction costs for city authorities are however likely to be high: Coutard and Rutherford (2010) document the struggles of the Ile de France regional authority in strategic planning for sustainable energy and local economic resilience, in the face of established commitments to high-carbon economic growth, embedded in state governance and international markets. As Hodson and Marvin also note, much of city activity in sustainable energy transitions remains aspirational. The question to be asked, then, is whether, and how, city authorities in the neo-liberal UK can innovate in low carbon energy provision.

5. Prospects for City Governance of Low Carbon Energy in England and Scotland

UK local authorities have limited financial autonomy, are governed by the *ultra vires* principle, which restricts activities to those permitted by statute, and are increasingly constrained to work via market contracting rather than direct provision. Recent budget reductions add to the difficulties. Authorities do however have prudential borrowing powers, which create access to low interest loans without consent from other levels of government. In addition, climate change legislation, and its powers and incentives for low carbon energy, plus penalties for emissions (notably the UK CRC 'tax' on energy use in large organisations, and EU waste to landfill taxes), have created impetus for municipal investment in energy saving, and, more ambitiously, low-carbon energy services. In their comparison of local governance of climate protection in the UK and Germany, Bulkeley and Kern (2006) identified four modes of governing. In the UK most effort was concentrated on energy saving for the local authority estate; secondly some provision of energy efficient insulation for social housing has developed; thirdly 'enabling' has typically been translated as promotional and advisory activities, and lastly urban authorities have made use of planning powers to raise building-level standards of energy efficiency. Governance has therefore focused on incremental adjustments to energy use, rather than more radical innovation.

Under devolved UK governance arrangements, control over energy market regulation and taxation remains in the hands of the UK Department of Energy and Climate Change, which limits capacity and authority at devolved levels. Structures and responsibilities of local authorities have remained very similar, but in Scotland the establishment of the Parliament has resulted in a higher degree of (perhaps necessary) interdependence in local-central government relations. More collaborative and

pragmatic decision processes have emerged, with greater density of institutional links between civil society and policy networks (McGarvey, 2011). In contrast English central-local government relations are marked by more use of market mechanisms and competitive measures for performance management (Downe et al, 2010). Similar institutional structures are therefore coloured by the different 'processes and power dynamics through which governing is orchestrated' (Bulkeley and Kern, 2006: 2242), resulting in policy networks, relationships and reform strategies being somewhat differentiated between the two countries. These differences do not translate straightforwardly into overall differences in capacity for municipal energy innovation, although they provide somewhat different contexts for action. It makes sense therefore to examine two municipalities, one in Scotland and the other in England, not as archetypes deriving directly from devolved governance, but as exemplars of how local authorities operating in multi-level governance frameworks, create capacity to innovate within a tightly controlled system.

6. The Potential Role of Social Capital

In the context of very limited local structural powers for energy service provision, limited financial control and little energy systems expertise, the governance capacities of city officials and politicians are highly constrained. Those officers and politicians who recognise and accept responsibility to act are likely to have to rely on mobilising forms of social capital. As a long-established concept in sociology, social capital describes the potential of societies to learn, improvise and innovate through the indeterminate dynamics of interaction (Portes, 1998) represented in 'the networks … norms, values and understandings that facilitate co-operation within or among groups' (OECD, 2001, p.41). This entails risk of tautology: it may act as a catch-all 'residual' category to characterise the contributions of social interaction to otherwise unexplained elements of substantive innovation. It is also a contested concept, criticised for undervaluing, or degrading, social interaction, by equating it to a form of calculative monetary exchange. This is however a criticism which perhaps coincidentally gives too much ground to a neo-liberal economic concept of 'capital' as a limited resource, to be efficiently deployed through market exchange for private gain. Instead activities such as those concerned with discovery of ways to solve local problems are 'like muscles that develop and grow stronger with exercise' (Sandel, 2012: 130). In this sense, social capital is a concept giving explicit recognition, and

value, to non-monetarised sources of power and action capabilities (Tura and Harmaakorpi, 2005). It is useful, because it has facilitated dialogue and stimulated debate between disparate interests who would not otherwise engage (Woolcock, 2010). Community governance activity, or social capital, is then likely to be significant in identifying and capturing public benefits which would otherwise be marginalised or lost (Bowles and Gintis, 2002). It remains in circumstances marked by uncertainty over resources, capacity and the legitimacy of acting, when governance through formal, codified technique, rules and contracts is lacking.

A distinction has been made between *bridging* social capital, which connects different groups of actors, with potentially competing or conflicting objectives, through weak ties (Granovetter, 1973), and *bonding* social capital, which sustains relationships within a group (Putnam, 2000). Social capital of the bridging variety has been shown to be important for more radical or 'disruptive' innovation (Christensen, 1997; Ehrnberg and Jacobsson, 1997; Lundvall et al., 2002; Maskell, 2004; Tura and Harmaakorpi, 2005) and is regarded as a contributor to regional innovation capacity (Cooke et al. 2000). It is a form of social capital concerned with developing understanding of potential action, resources and options, apart from those already known, and is akin to Sennett's (2012) characterisation of dialogic interaction concerned with improvised discovery of solutions to problems. There are therefore questions about the mobilisation of social capital by municipal actors as a contributory factor to innovation, and whether this results in constructive articulation and negotiation of local interests.

7. Assembling Innovation in Municipal Energy: Aberdeen and Birmingham

Despite the uncertainties of reduced budgets and uneven policy support, some city authorities have developed new energy infrastructure. Case studies of Aberdeen and Birmingham, based on semi-structured interviews and documentary analysis[iv], are used here to explore the routes to local innovation, when neo-liberal political economy significantly constrains the landscape. What is the role of the city authority in each case, and to what extent do local interests and commitments shape the governance and organisation structures which emerge? Aberdeen and Birmingham have long histories of industrialisation, relative decline and post-industrial reconstruction. Aberdeen is a small city (pop 217,000) in the north east of Scotland,

with a long history in merchant shipping, food processing and fishing industries, now much reduced in significance. Since the exploitation of North Sea oil and gas in the 1970s, Aberdeen harbour has been redeveloped as an offshore oil industry supply and service location, and the city has become known as the 'oil capital of Europe'. The oil and gas industries have brought investment in urban infrastructure, jobs and low unemployment. The benefits have not however been evenly distributed, with 15% of households in relative poverty, and the highest income inequality in Scotland. The city of Birmingham, in the west midlands of England, has a population of just over one million, and a history as a major centre of the industrial revolution, technological innovation and manufacturing, again much reduced in significance and scale. Main economic activities are now public, retail, leisure and professional services, and there are high levels of inequality, inner urban poverty, and above average unemployment.

Each city has recently invested in provision for combined heat and power generation and urban heat networks, but with different primary objectives and governance structures. Aberdeen developments stemmed from the city's housing team, and prioritised social objectives for affordable warmth in electrically-heated multi-storey flats. In 2003, the city council established an independent non-profit company, limited by guarantee, with a volunteer Board, Aberdeen Heat and Power (AH&P). Under a fifty year framework agreement with the council, and governed by a Teckal exemption[v] from EU competitive procurement rules, AH&P has developed three gas-fired CHP energy centres, supplying heating and hot water to around 1500 flats in 15 of the city's 59 multi-storey housing blocks, as well as a school and community facilities. Some of the co-generated electricity is sold via a private wire to the school; the remainder is sold into the public network via a consolidator. Domestic users receive unmetered heat and hot water at a fixed tariff (paid with rent) reflective of costs. In Birmingham, energy innovation was a component of economic regeneration strategy and was led by urban design and engineering. Establishing the legitimacy of urban energy systems required long-term intra-Council negotiation over conventional accounting and risk assessment rules, short-term cost criteria, legal requirements, and EU procurement and state aid. Seeking to minimise exposure to financial risk, the city sought a solution through procurement of a private contractor to manage risks of business losses or system failure. In 2006, the council signed a 25 year concession contract with Utilicom, to build, own and operate gas-fired combined heat, cooling

and power networks, for supply to the city authority and other large heat and power users in commercial and public services. This resulted in establishment of Birmingham District Energy Company (BDEC), a wholly owned special purpose (SPV) subsidiary of the parent company. Utilicom was subsequently acquired by GDF-Suez and restructured as energy services company, Cofely. BDEC directors are employees of Cofely, but there is a partnership board, structured by a profit share for large subscribers, in the form of an energy rebate.

Table 1. Key dimensions of organisation and governance for UK urban energy

	Aberdeen Heat and Power Ltd	Birmingham District Energy Company Ltd
City council lead objective	Affordable warmth for social housing	Urban regeneration in city centre commercial and public services district
Organisation structure	Community interest company under local ownership and control	SPV wholly-owned and operated by Cofely District Energy, a subsidiary of GDF-Suez
Business model	Non-profit ESCo; any surplus reinvested	For profit ESCo
Governance structure	Volunteer board of directors including councillors, community and business organisations and former council officers	Directors from parent company, plus partnership board with profit share, in form of energy rebate, for founder subscribers
Heat tariffs	Cost-based	Market-based, indexed against gas prices
Main customers	Tenants in public housing	Leisure and entertainment, retail, commercial and public services
Other customers	Sport, leisure and entertainment facilities	Tenants in public housing
Finance	UK and Scottish government grants, city housing regeneration capital, prudential borrowing, bank loan and overdraft	UK government grants, parent company internal finance plus borrowing
Risk mitigation	Loans guaranteed by city council; council long term contract for purchase of energy	Loans guaranteed by parent company; council, NHS and University long term contracts for purchase of energy

How can the different trajectory of urban energy innovation and governance in each city be explained? In neither case were energy infrastructure and services perceived as core council business, and there was little confidence in municipal energy governance capacity. Project development was marked by internal dissent and dynamics of opposition, doubt, anxiety and risk aversion. In these circumstances, three key social and political processes were central to eventual development of governance competence and confidence: first, the foundations laid by civil society anti-poverty movements; second, local actors' mobilisation of social capital through multi-level, intersecting knowledge networks; and finally the translation of social capital into an alternative, locally-contextualised formulation of social, environmental and economic value of CHP/DH sufficiently powerful to contest short-term least cost decision criteria, and to justify investment. Each is examined in turn.

a. Civil Society Political Processes

Formal and informal political processes in the two cities proved to be critical as a foundation for action, as a means of activation of social capital, as a conduit for state legislative power, and as legitimating municipal investment in low carbon energy. In each city different types of actors were shaped by anti-poverty campaigns, and contributed in different spheres to local innovation. In Birmingham the actors were social housing tenants. In the 1980s, Tenants and Residents Association fuel poverty campaigners brought a series of court cases against the Council, resulting in orders for improvements in the energy performance of its housing stock. The outcomes of the court cases intersected with pre-existing commitment among city engineers to CHP/DH as an affordable energy measure for social housing. Local authority short-term, least-cost decision criteria prevailed, however, resulting in refurbishment of electric heating and improved insulation in the worst multi-storey housing. Engineers nevertheless used the opportunity to gain support for a pilot CHP/DH scheme serving a community leisure centre and three multi-storey housing blocks. Heating proved very affordable for tenants and the scheme brought favourable publicity and political capital. In this case, anti-poverty action through the local courts catalysed changes in local authority practice and created scope for energy services experimentation.

Anti-poverty campaigns were also instrumental in innovation in Aberdeen, but this

time through the force of UK legislation, which created local government resources for appointment of local housing energy conservation officers. Earlier fuel poverty campaigns had built momentum for UK home energy conservation legislation in the 1990s, when climate protection and carbon saving also appeared on policy agendas. An unexpected by-election in England created the political opportunity: the UK Home Energy Conservation Act (HECA) (1995) 'was established due to Diana Maddock, who was elected lib dem MP for Christchurch at a by-election in 1993. There was a Conservative Government plan to introduce VAT on fuel at 17.5%. Her Christchurch constituency had a high percentage of pensioners' (community energy consultant and member of AH&P Board). The Act required local authorities to identify cost effective measures for a reduction of 30% in home energy consumption and carbon emissions between 1997 and 2007. In Aberdeen, the legislation resulted in appointment of an experienced anti-poverty campaigner, and her commitment, combined with knowledge derived from intersecting community and district energy networks, created momentum and legitimacy for investment in CHP/DH as a solution to fuel poverty.

In Birmingham, despite historical experience of addressing fuel poverty through CHP/DH, it was not HECA legislation which provided subsequent impetus. This came instead from economic regeneration strategies, in the context of a ruling local Liberal Democrat-Conservative coalition. A combination of engineers committed to CHP technology and local Liberal Democrat manifesto promises of sustainable development created a route to legitimating investment in low carbon urban energy, as a component of regeneration. The Liberal Democrat deputy council leader became the project's political champion, maintaining his support throughout internally-contested negotiation, and ensuring eventual agreement. Similarly in Aberdeen, critical decisions about whether to proceed required local political, as well as officer, leadership. A commitment to tackling fuel poverty was consistent with the ruling Labour-Liberal Democrat coalition policies. Even so, there was considerable internal doubt and dissent about investment in CHP/DH. Notably, the Council was required to consider legal advice, which was against the proposal. The deputy leader, a Labour councillor and incomer who had moved north for the oil industry, chaired the committee which considered the recommendation to create a non-profit community energy services company: 'At the founding meeting he said that the advice of the

council solicitors was “not to proceed, but we are not obliged to take their advice”. So he put their report down and said “it is noted”. So he had the political courage’ (community energy consultant and member of AH&P Board).

Political processes were not therefore expressed in the same ways in each city, but worked dynamically through the practical projects of complex actors to shape distinctive innovation priorities and trajectories. Such processes worked through multiple levels of governance, civil society and markets: longstanding UK anti-poverty social movements and campaigns against fuel poverty were given form and traction by different kinds of actors, through different channels in each city, with different consequences, and impacts on the direction and outcomes of national and local actions.

b. Social Capital and Intersecting Knowledge Networks

In the absence of codified techniques, contracts and standard energy governance instruments, the second set of factors shaping the trajectory of urban energy stemmed from local actors mobilising forms of social capital which supported and legitimated the development of viable CHP/DH projects. In each city, forms of bridging social capital, represented in intersecting community and energy market knowledge networks, were most evident in actors’ accounts. ‘Local’ innovation was not taking place in a separate sphere from multi-level state, civil society and energy market actors, but was moulded through constantly evolving interaction ‘where the positions and practices of local, regional and national actors are always interdependent and mutually constituted’ (Coutard and Rutherford, 2010: 722-3).

To initiate municipal re-engagement with energy services provision, after a century of absence of responsibility, and limited policy instruments, requires committed actors who can conceive of the public value of such projects, and who are willing and able to discover and harness any available resources. HECA established local authority provision of dedicated resources, and created some additional funding support for officer networks which enabled sharing of knowledge and mutual learning. This motivated those appointed, and created further connections to government agencies and community energy knowledge networks. Each of these networks opened up further links to technical, legal and financial expertise and energy market knowledge.

The Aberdeen officer encountered the vice chair of the committee set up to distribute HECA support funds. His biography included anti-poverty campaigning, as well as commercial expertise, and the complementarity of their values and experience contributed to the articulation and justification of project priorities for affordable warmth, combined with local control over energy assets. Engagement in energy knowledge networks, established through bodies such as the Energy Saving Trust (EST), in turn produced links to technical and commercial expertise. The Aberdeen engineering design consultant, for example, was selected through a competitive process restricted to EST-approved companies. The interactions between city officers, politicians and non-local formal and informal energy expertise networks thus created local technical and financial capacity over successive stages of the project.

In Birmingham the mobilisation of social capital took a different form, stemming from the technical knowledge of city engineers, and their commitment to CHP/DH as an energy and cost saving 'building block' in regeneration strategy. The earlier success of the pilot CHP/DH scheme in social housing was insufficient to overcome political aversion to public borrowing for direct investment, and (as in all UK councils) commitment to short-term least cost criteria for capital projects dominated decision-making. Regeneration strategy, combined with the stimulus of UK government funding for low carbon energy, however, presented an opportunity for engineers to re-introduce the case for investment in urban energy, as a long-term means to a low carbon, efficient supply. Forms of bridging social capital were mobilised through intersecting public and private district energy practitioner networks. The earlier pilot CHP/DH scheme had brought engineers and other officers and politicians into contact with like-minded local authorities, but a critical turning point was interaction with politicians and officers from a mix of specialisms in another city with an established private sector district energy company. Birmingham politicians and officers were less averse to a business model which located the main financial risk of project failure with a private sector owner. Discussions produced council agreement to proceed to competitive tender for technical evaluation. This resulted in a contract between the city authority and a consultancy subsidiary of the company whose business model had impressed the council.

In the context of contentious and consequential investment decisions, Birmingham officers viewed their reputational credibility as dependent on using knowledge networks to scrutinise and evaluate different categories of expertise very carefully. Critical distinctions were drawn between 'useful knowledge' and its negatively-tagged counterpart 'theoretical knowledge'. The former, was regarded as deriving value from the practice-based knowledge of 'dirty hands merchants' (city engineer), while over-reliance on the latter was regarded as risking unnecessarily higher costs. 'Theoretical knowledge' was characterised as stemming from both public and private consultancy services, which were perceived as potentially over-engineering systems through technical feasibility metrics which factored-in costs of protection against claims on professional indemnity. Mobilisation of social capital focused on discovery of sources of practice-based 'useful knowledge' as a means of identifying effective commercial and financial expertise in network development, operation and supply. Interaction with such knowledge networks was in turn seen as instrumental in progressive development of council capacity in energy contracting, across planning, legal, finance, procurement, and engineering specialisms. In this case, the political make up of the council and the focus on economic regeneration resulted in interaction with other municipal politicians and officers, and private sector technical and commercial experts, with existing urban energy systems, rather than anti-poverty community knowledge networks.

Although UK policy, political and energy market structures limit the financial resources and capacities of municipal authorities to engage in local energy services, scope for innovation was created by the mobilisation of different forms of bridging social capital. This worked to bring locally-committed actors into interaction with community and energy market knowledge networks, to discover solutions to locally-defined problems.

c. Constructing an Alternative Formulation of Social, Environmental and Economic Value

'It was my Saturday job for a long time'

(City of Aberdeen Energy Conservation Officer)

In both cities, identifying and discriminating between sources of trustworthy, usable knowledge, suited to local circumstances and objectives, and accessing all available

resources, was extremely challenging. Processes of project development required complex multi-party negotiations, which were prone to recurring crises. Much painstaking negotiation centred on securing the translation of social capital into material change in energy provision. This required construction of an alternative, locally-contextualised calculus of social, environmental and economic value, which had to be sufficiently powerful to contest dominant short-term least cost decision criteria and justify investment. In Aberdeen, the key to such an alternative calculus was officer development, of an Affordable Warmth Strategy, and its political adoption by the ruling Labour-Liberal Democrat coalition. 'Cost in use' of heating to residents, rather than 'least short-term cost' to the housing regeneration budget, was specified as the primary criterion for decisions, and a technical options appraisal identified gas CHP/DH as the best means of meeting the goal. In Birmingham, where a Conservative-Liberal Democrat coalition was in charge, the key was establishing the legitimacy of a new economic evaluation formula using 'whole-life cost' (WLC) appraisal of energy investments as a component of regeneration strategy. Despite the scepticism of council finance specialists, UK government private finance policies were supportive of such techniques, coincidentally resulting in government-required officer training. Despite continuing internal dissent over the validity of WLC formulae, local discussion of the potential to improve financial control of unplanned plant failure gained a foothold with accountants. This led to the framing of unplanned breakdown of energy plant as a risk which could be formally costed, and potentially 'sold' to a private partner, in exchange for a long-term energy supply contract. Forecast energy price rises were also a central factor in cost comparisons between centralised and localised supply. When the economic calculus of future energy costs was assembled in WLC format, with component costs of network connection, future heat, cooling and power supplies, and maintenance embedded, this proved sufficient to frame a legitimate case for long-term investment, despite higher short-term costs.

In both cities, an element of public funding was critical in enabling the decision to be made materially consequential. Limited funding became available, following the 1997 UK election of a Labour government, as a result of emerging low carbon energy policy. The Community Energy Programme (CEP) provided £50m grant finance to promote community heating infrastructure. The Programme was bounded by complex technocratic application and spending criteria, with specified carbon saving targets

and tight timetables, governed by political cycles and financial years. CEP funding could not be drawn down until a system was commissioned, requiring authorities to meet the full initial investment costs. In Aberdeen the pre-existing energy saving options appraisal meant that the city was able to proceed immediately to apply. Housing regeneration capital was committed, in combination with three successive successful CEP grant applications, plus funding from energy utilities obliged by government to reduce energy demand. A Co-operative bank loan to AH&P, guaranteed by the council, provided the balance of finance for the first phase, which increased council confidence sufficiently for subsequent investments to draw on prudential borrowing. While every phase was challenging for politicians and officers unaccustomed to managing strategic planning for urban heat networks, the third phase proved the most demanding: receipt of the CEP grant depended on meeting specified carbon saving targets through heat network connection of a fixed number of multi-storey housing blocks. Poor building fabric condition resulted in some of the planned blocks being withdrawn, threatening loss of the finance for the whole project. Fixed CEP timescales meant that a revised calculus for meeting the carbon target had to be devised quickly. The engineering consultant proposed, and the Council agreed to, the connection of a nearby municipal leisure complex with a significant heat demand. There was however additional cost for pipework, without additional benefit to housing tenants. The AH&P Board agreed to the plan, but lacked understanding of its financial significance. For a relatively inexperienced Board, with little commercial expertise, this caused considerable tension. The Chair of the Board proposed recourse to external accounting expertise, rather than continued reliance on municipal accountants. The new accountant reframed the cash flow position, negotiated an agreed overdraft facility with the existing lender, again crucially underwritten by the council, and thus enabled a solution to the crisis.

In Birmingham, the pressures created by internal dissent combined with time-limited CEP funds caused tense intra-Council and inter-party negotiations. The WLC formula, in combination with the short-term stimulus of public finance, and learning from other public and commercial practitioners, proved sufficient to gain initial agreement on procurement of a CHP/DH system for the city centre regeneration area. The public tender was followed by a lengthy qualification process assessing financial and technical credibility of bidders, which resulted in selection of Utilicom as

preferred contractor. A further extended period of negotiation ensued, while differences between council specialisms over the risks of proceeding, and doubts of city centre businesses over the merits of a long-term heat supply contract, were debated. A 25-year energy services contract with a private provider creates effective monopoly, with the risk of such a supplier charging excessive prices. Lack of in-house council experience in governing energy services, and scepticism of businesses expected to connect to the heat and cooling network, interacted with EU regulations for procurement and state aid rules, and unfamiliarity of district heating in the UK, resulting in a high degree of caution. Agreement to proceed and the associated CEP application were pushed to the last moment, with legal teams working under pressure and 'phones open to London with 15 minute calls to update' (city officer). The CEP application was faxed at midnight to UK government, 'all the way to the wire', said the officer, and with continuing scepticism by sections of the council.

8. Governing Municipal Energy in the UK

What can we learn from the two cases in different UK political-legal jurisdictions? In the context of centralised energy markets and uncertain policy support, UK urban energy innovations place considerable demands on local actors with limited energy governance powers, and few technical and financial resources. Developments in Aberdeen and Birmingham suggest that only where local actors' biographies and skills intersect with appropriate political opportunity structures, such as those created by the HECA or the CEP, will innovation result. Such locally committed actors were willing to compensate for limited formal resources and capacities by mobilising bridging forms of social capital, embodied in formal and informal urban energy knowledge networks. The resulting socio-technical network of actors customised to each locality was instrumental in formation of local knowledge about urban energy infrastructure planning, project finance and systems development. This is however a slow and uneven route to realising the public benefits of district energy, and it has high costs for local project developers managing the largely uncodified, coordination of different interests, resources, timescales and priorities. It also has higher overall public costs, because each municipal authority pays separately for specialist consultancy services.

Both cities interacted with UK and devolved government policies for economic competitiveness, but local actors perceived themselves as having limited access to UK and European energy policy-making spheres. They acted therefore within their sphere of control over energy saving, using whatever cultural, political and economic resources were available to them. It might seem predictable that a Conservative-Liberal Democrat coalition in Birmingham, committed to market-oriented local governance and competition, would result in a profit-making venture, operating as a subsidiary of a large business, while a Labour-Liberal Democrat coalition in Aberdeen would result in a non-profit organisation pursuing social goals. It is however unlikely that political composition was determining, even though it was influential. In both cases innovation was inter-dependent with different levels, and political make up, of government. HECA legislation was enacted by a UK Conservative government, while funding for district energy projects came from subsequent UK Labour administrations. In Aberdeen a local Labour councillor played a key role, but he was an incomer not deeply embedded in Aberdeen politics, and perhaps did not share local assumptions about what was or was not possible. Although ostensibly fitting the competitive model of enabling governance, developments in Birmingham have not excluded social/equity objectives, which include plans to connect 20% of Birmingham social housing to DH by 2020. This target is challenging, however, given that BDEC's profit-making business model limits commitment to affordable warmth for social housing, because of high capital costs relative to financial returns. In practice, connection of a small number of multi-storey housing blocks to the network has relied on grants from government funding for low carbon infrastructure in housing. Some of this work has been managed directly by the council, and proposals under the UK government 'Green Deal' are being examined as a basis for further municipal investment. The concession contract between the council and the private utility thus failed to ensure secure benefits for poorer households.

The different initial objectives of each city have shown a degree of convergence over time in ambitions to combine local economic resilience, affordable warmth and climate protection goals via aspirations to extended low carbon energy infrastructure. In Birmingham, urban energy planning has been further integrated into economic strategy, to some extent reversing its framing from financial risk to financial

opportunity for municipal revenues, local employment and skills, and reducing exposure to rising costs from volatile international energy markets. Such ambitions are associated with consideration of EU loan finance, with internal responsibility for risk. The city's Climate Change Strategy and Action Plan 2010 aspires to energy self-sufficiency, with targets to cut carbon emissions by 60% by 2026. Plans include a city-wide heat network, building on city centre schemes and pilots from school building programmes. In principle secondary schools would act as local heat network hubs, using Council estate biomass (now re-imagined as resource rather than waste), and the old industrial infrastructure of the canal network for low-impact transport, alongside investment in energy from waste, and waste heat recovery. BDEC's network infrastructure is currently controlled by Cofely, but development of the network for distributing heat from a variety of sources will require shared access, which is likely to be challenging. Creating a common framework for technical, legal and commercial standards and a degree of transparency over the distribution of costs and benefits will require careful multi-party negotiations between the Council, property developers, district energy and energy-from-waste contractors, and the electricity distribution network operator.

In Aberdeen, innovation has also contributed to further ambitions to integrate low carbon energy development across council services via economic competitiveness strategy. This is demonstrated in the integration of energy services into Enterprise, Planning & Infrastructure. Development has been led by social objectives of poverty alleviation, and learning has proceeded without the demands of external heat market development. CHP/DH investment has resulted in the most significant reduction in carbon emissions (approximately 31%) achieved in the city. The council has now set a target for carbon neutrality by 2020 (*Carbon Management Plan* 2010-15) for the council estate and public housing. Plans are structured to integrate with Scottish government combined goals for sustainable development, service efficiencies and cost reductions. The longer-term aim is to create a heat main, referred to informally as 'the ring of fire' around the city, connecting other heat sources and CHP systems already in place, including NHS and university sites. Scottish government investment has allowed new network extension to the city centre, with potential for connection of private sector housing and commercial buildings. Extension to commercial contracting would however invalidate the terms of the current Teckal exemption, and

management of bad debt risk is also challenging, because of municipal liability. Private sector contracting requires negotiation with building owners or developers who operate through property portfolios traded in global markets and who typically have no connection to local economies. Business development will therefore require a revised organisational structure, new skills and new forms of governance.

In both cities the formation of customised, place-specific socio-technical networks, meshing locally-embedded knowledge with non-local expertise, was critical to viable innovation. With different initial objectives, and through encountering, and learning from, different problems, each city managed to assemble the necessary socio-technical actors for innovation. The private SPV in one city and non-profit company in another represent contrasting embryonic forms for wider systemic transformation in urban energy systems, but the different forms are likely to be consequential for the longer term distribution of costs and benefits.

Conclusions

This paper has examined the potential for UK urban energy innovation, in the context of European policies looking to cities for leadership in collective action problems stemming from climate change and the need for resilient low carbon energy infrastructure. The local government 'enabling' model, combined with limited financial powers, and a centralised energy market dominated by transnational corporations, do not provide supportive circumstances. Nevertheless the case studies show that the neo-liberal model is not impervious to municipal agency and innovation, and locally mediated responses to circumstances produced contrasting business models and trajectories. Aberdeen Council married social objectives for affordable warmth with carbon saving requirements and prioritised these over short-term cost, while Birmingham Council prioritised local economic regeneration and carbon saving. In Aberdeen this resulted in creation of a not-for-profit company to build, own and operate CHP/DH mainly supplying social housing, while in Birmingham it resulted in creation of a for-profit company (SPV) owned and operated by a private sector district energy utility, mainly supplying large heat and power users in public and commercial sectors. Despite recurring difficulties, municipal capacities for energy governance have been enhanced in both cities, resulting in ambitions to integrate low carbon energy services across council functions. The same centralised

regime has been shown to be susceptible to alternative translations, through the locally-inflected political strategies of different urban authorities. The models for energy governance developed in Aberdeen and Birmingham are by no means exhaustive; other UK authorities have for example created joint public-private ventures, with a negotiated division of responsibility for different components of local energy services.

Regulatory complexity and political uncertainty mean that there is no settled means of governing such innovation, and it is unclear whether UK energy policy aspirations to an increased contribution from municipal government will be made to work. Energy market reform and price support mechanisms are geared to centralised electricity generation, and lack of UK familiarity with CHP/DH, high initial infrastructure costs and long-term payback periods make finance very demanding. Repeated evidence of the public benefits of CHP/DH (Kelly and Pollitt, 2010) has not yet been met with concerted government action to mobilise the investment needed in new infrastructure. There is uncertainty about whether further devolution of government, alongside different qualitative relationships between Scottish and English central-local government, will follow through into divergence in policy instruments or investment. Questions remain about whether any such divergence would mobilise local civic identity, leadership, and socio-economic capabilities, to produce differential change.

Municipal innovation currently requires enterprising constitution of the financial means to act, through demonstration of local benefits and reduced costs. Social, local economic and climate protection benefits of municipal energy investment are however typically difficult to establish as legitimate factors, given the prevailing short-term least cost decision calculus, and are consequently undervalued and under-recognised in the UK political-economic settlement. Locally-committed actors, with capacity for mobilising social capital, are bridging the gap between decontextualised financial markets and local interests, in an attempt to establish the validity of different 'orders of worth' (Boltanski and Thevenot, 2007). Municipal capacities could be far more effectively enabled through a supportive and self-consistent policy framework, counterbalancing short-term financial market metrics with measures which recognise the public value of decentralised urban energy. Such policy measures are used in other northern European countries; examples are directive use of planning powers for

low carbon heat supply, resources to map heat demand accurately and zone urban areas suitable for district heating, forms of licensing to support provision which demonstrates integrated social, economic and carbon benefits, requirements for heat retailers to be non-profit making, and provision for municipal ownership of heat networks.

Energy infrastructures are a material expression of political processes and power relations. They offer insight into the qualities of cities as meeting points between locally-committed actors and global trade in finance, legal and business expertise. The resulting contestation over values and resources is consequential for the shape of energy services and how the distribution of costs and benefits operates. In turn this creates create new circumstances for future action (McFarlane and Rutherford, 2008; Monstadt, 2009). The current mix of competitive and collaborative 'smart city' plans and tools for energy planning offer some scope for local capture of resources, but with indeterminate consequences for a progressive political agenda. The case studies show that such plans and tools are anything but politically neutral. They are themselves the embodiment of political processes: the values inscribed in their parameters and variables are the outcome of political contest.

The current cost-benefit equation for urban energy investment is driven by economic short-termism which disguises the full social and environmental costs of the status quo. It works against collaboration between cities, and between local, devolved and UK governments, but coordinated planning and procurement would reduce costs of project development, and potentially improve local economic welfare while sustaining an affordable, resilient energy system. The resources to use local powers for planning and regulation in land use, transport and waste infrastructures for low carbon energy investments would thus be enabled, and social capital given more concerted expression. The research reported here gives grounds for optimism. While other European countries are experiencing the fragmentation of local services, resulting from increased reliance on market mechanisms, the city authorities studied provide evidence of the potential for a creative re-assembly of local capacities and resources. A more cohesive, supportive policy framework, giving full recognition to the substantive value of socio-economic and environmental objectives, as counter-weight to short-term cost criteria, is however needed in order for full realisation of the

integrated public benefits of city governance in district energy infrastructure and investment.

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[i] See 3.88-3.90, p.64

[ii] A comparison of Swedish district heating companies shows that privatisation is associated with higher prices for heating, relative to those companies which have remained in municipal ownership (http://www.nilsholgersson.nu/). In the Report *Innehållsförteckning – Jubileumsutgåva av Avgiftsrapport Nils Holgersson 1996-2005*, the second point in the box on p.35 states 'There is a clear difference in behaviour in terms of pricing, depending on who is owner [of the DH system] and the directives which the company has to work from'. This is illustrated by the last graph on p.43 where the green line represents the (lower) average price in municipal systems and the red line the (higher) average price in privatised systems over a 5 year period (2001-2005).

[iii] Concerto; Covenant of Mayors; Cascade; Smart Cities, http://ec.europa.eu/energy/technology/initiatives/smart_cities_en.htm accessed 02/05/12

[iv] The paper draws on interviews with 3 local government officers, 3 financial advisers, 5 representatives of urban energy services companies, on-going discussion with four representatives of Aberdeen Heat and Power, and interaction with a network of around 20 UK urban authorities centred on three district energy workshops. Internal and public local government documents are also analysed. This data is part of comparative research on urban development of district heating, www.heatandthecity.org.uk.

[v] The *Teckal* exemption provides that, in certain circumstances, the award of a contract by one public body to another separate legal person will not fall within the definition of 'public contract', with the result that EU law will not require the contract to be put out to tender. The *Teckal* exemption comprises both a 'control test' and a 'function test'. (1) The local authority must exercise similar control over the contractor to that which it exercises over its own departments, and (2) the contractor must carry out the essential part of its activities with the controlling local authority or authorities.