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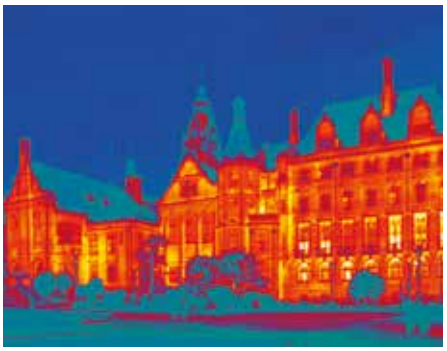


What We Know about Local Authority Engagement in UK Energy Systems

Ambitions, Activities, Business Structures & Ways Forward

Janette Webb, Margaret Tingey and David Hawkey **November 2017**

Preface

This report is based on the *Local Engagement in UK Energy Systems* research project (2014-2017), funded by UKERC/EPSRC and ETI.

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Executive Summary

"We have a big role to play in this [energy] agenda… There's obviously a big transformation of local government underway, and we must work differently - by assessing the linked agendas through which you can achieve your outcomes, helping people in fuel poverty… providing jobs and skills opportunities; we need to look at how you can do that as a systemic city approach. So we see the transformation of Birmingham's energy system and its interactions with other service areas, as a catalyst for delivering multiple outcomes."

Energy Officer, Birmingham City Council

This report examines UK Local Authority clean energy plans and investments. Local Authorities (LAs) are recognised across the governments of the UK, and by the UK Committee on Climate Change (2012), as critical to climate protection and clean energy commitments. Local strategies can contribute significantly to energy savings in public, commercial and residential buildings; statutory duties, planning and development powers are important in catalysing cross sector innovation for clean energy systems. Many leading edge LAs have made pledges to achieve 100% clean energy in their area by 2050. There are however, uncertainties about the future structure of local government services, powers and resources, and the local government role in energy systems is uncertain. In this context LAs are increasingly treating energy provision and demand management as a source of revenues and as an agent of transformation across the local social, economic and environmental landscape. Some cities and regions are making energy infrastructure and services central to capital investment and creating municipal energy companies to manage new business; others are asking how they can get started. Despite the unknowns, LAs are one of the very few organisations committed to the area for the long term and their democratic status is a route to engaging everyone in decision-making about the necessary shift to clean energy, giving them a stake in benefits as well as costs.

The research

Despite the groundswell of support for municipal action on energy, there is little empirical evidence about the actual capacity of 21st century UK LAs to engage, or about the suitability of central government policies and institutions for facilitating localised energy provision. Our research addresses some of the gaps by examining what is being done now, why and what could be achieved with more supportive policy and resources. It is the first systematic overview of energy initiatives across the entire population of UK LAs, and provides in-depth analysis of energy projects, business structures and local solutions to common problems in a cross section of 40 LAs; additional context is provided by a review of LA engagement in energy across Europe.

Key findings

In many northern European countries municipal governments have a strong role in energy provision; this is usually matched by significant local political and financial powers (see Section 2).

In the UK our systematic mapping of energy plans and projects across all 434 LAs found widely held ambition, but small scale and uneven investment (see Section 3).

- 82% had energy and carbon management plans and/or projects.
- A total of 458 energy projects were identified across 208 LAs.
- Three quarters of activity was in heat and energy efficiency for a low carbon, low energy building stock.
- Scotland, Greater London, Yorkshire & the Humber and the North East of England had the greatest proportion of LAs actively engaging with energy.

In general LAs with greater powers, larger budgets and political support were most likely to be able to mobilise investment in energy. Our findings also suggest that where LAs are particularly engaged, they are oriented more to heat and energy efficiency than to electricity, suggesting that this may be the most effective route to LA energy provision and engagement in managing use. Heat and energy efficiency require changes at building and distribution infrastructure scales, where LAs have competence to plan and coordinate action, and which are proving difficult areas of policy for central governments.

The UK political-economic context for LA action on energy remains uncertain, stemming from austerity in public finances, lack of statutory local powers over energy services and uncertainties in clean energy policies and subsidies (see Section 4). These are having some negative consequences for LA energy plans and investments, resulting in opportunistic, small projects, rather than strategic investment and long term capacity building. An increasing focus on financial performance indicators and short-term cost savings, as opposed to social welfare, climate protection and local prosperity, are also leading some LAs to question the legitimacy of their energy plans.

Findings from 40 cases studies of selected local authority energy initiatives

We interviewed officers from 40 LAs about their authority's approach to energy, and about one specific initiative. Energy initiatives, even within this restricted sample, were highly diverse with a range of business structures and delivery partners (see Section 5). There was no predictable trajectory and no single service or directorate initiating energy projects. Instead projects emerged where there was a commitment to clean energy as a valuable component of core services, and an opportunity to assemble the finance. Success often required a dedicated and enthusiastic champion, who persisted long term despite political change.

Focus of energy initiatives in our LA case studies: The largest proportion of initiatives concerned decentralised energy and energy efficiency for a low energy, low carbon building stock, hence tackling the difficult policy issues of low carbon heat and building retrofit. Projects included combined heat and power (CHP), renewable electricity generation from solar PV and small scale hydropower, and improvements to the corporate estate and domestic buildings. The sample also included a municipally owned licenced gas and electricity supply company, a smart grid pilot and a supply chain capacity building initiative.

Energy project objectives: Objectives were diverse. Carbon and energy saving were common goals, but projects were also expected to benefit economic development and to generate new income, cut energy bills for the council and/or households. Some LA projects prioritised local social and economic value; high rates of return on financial investment were not critical.

Energy project business structures: We compared projects directly managed by the LA, and those established as independent businesses. The majority (25) were managed in-house. Officers cited integration into existing council structures, capacities and cross-sector partnerships as reasons for this approach, as well as terms and conditions of funding. Independent businesses included commercial and non-profit enterprises, with municipal energy service companies (ESCos), private sector-led ESCos and community benefit societies. These illustrated alternative business models for LA energy provision with a range of partners including commercial energy utilities and community enterprises. Different business structures were used to meet similar goals, indicating there is no necessary relationship between objectives, technologies and business structures, but adaptability to local requirements, circumstances and expertise.

Regardless of the business structure in use, LAs in our case study sample perceived themselves as having a social, ethical and political responsibility to contribute to localised energy provision and energy management for purposes of climate protection and economic regeneration and welfare.

Financing energy projects and capital expenditure: Overall we observed a significant impact of public funding on the capacity for LA energy developments; commercial investments were regarded as more difficult to secure at an affordable price and on locally acceptable terms. Estimated capital expenditure had a total value of around £356 million with a significant range from £10,000 to £47 million.

Navigating challenges and improvising solutions: Implementing LA energy strategy and investing in projects often depended on fortuitous circumstances and a means of aligning a project with existing management processes (see Section 6). The lack of LA core funding for energy teams made energy a low priority compared to other service areas; projects were often a niche activity, with limited senior management or cross-council contributions. In addition, austerity in public finances has resulted in disruption to energy and sustainability teams through restructuring and redundancies; delayed project development due to limited resources in council legal, financial, procurement and engineering services; and dwindling finance for capital investment.

Our cases exemplify locally-devised solutions, which provide a basis for replicable development processes and institution building:

Solutions to lack of core funding for energy teams:

- **Making energy prominent in local strategy, future vision and investment**: vision statements translated into investment plans for clean, affordable energy made energy prominent in council business and decision making.
- **Making energy a responsibility of Chief Executive Office and Council Executive**: senior management and cabinet accountability for energy were significant routes to institutionalising responsibility for energy and reducing CO2 emissions at least with respect to the council's own estate.
- **Securing political leadership and cross party support**: elected members' political commitment was a critical complement to that of senior management, bringing specific pressures for action and assembly of resources; securing cross-party support was a significant source of stability and a route to institutionalising LA energy programmes.
- **Pragmatic starting points and "Easy Wins"**: when constrained resources and limited expertise put boundaries around ambition, 'easy gains' and bounded projects were a route to making energy more prominent in council business. Success in small schemes was a means to gaining 'hands-on' experience and knowledge about other energy opportunities and confidence to proceed.
- **Building LA capacity and expertise from public sector networks**: LA networks provided opportunities for officers to share solutions and were perceived as particularly valuable for officers working alone or in small teams.

Mitigating austerity in public finances and increasing the scope for LA energy provision:

- **Self-financing energy teams**: these were primarily using competitive UK and European grant funding to advance LA energy provision; a 'spend to generate' model was also used to support investment in an energy team.
- **Integrating energy services into finance and capital investment programmes**: in these cases energy services were constituted as part of capital projects and positioned as a new long term revenue source.
- **Project or Programme Delivery Units**: these centred on developing in-house technical capacity for a programme of low carbon energy investment.
- **Using intermediary organisations to support project development and to mitigate restructuring, staff turnover and institutional memory loss**: absence of council technical, financial and legal expertise in energy systems, and limited practical experience of energy services in recent LA history, made specialist engineering and business consultancy critical to assessment of options.
- **Pooled resources in Combined Authorities**: combined authority structures enabled investment in centralised resource and expertise with the aim of reliable, cost effective development of a pipeline of low carbon infrastructure projects.

In conclusion

The diverse solutions to current structural problems faced by those LAs with ambitions to act on clean energy demonstrate their resourcefulness in assembling capacities and finances. There is evidence of technical skills being rebuilt; energy being integrated into longer term capital investment strategies for local regeneration and prosperity; programme development units and national and regional authority structures creating new local capacities to act in energy markets. These solutions show that there is scope for more to be done, even within current financial stringencies, government structures and centralised energy markets.

Local authority energy provision is at an early stage, with issues to be resolved over the structures, powers and resources of local government in a devolved national and regional framework. Where LAs have succeeded in assembling energy projects, entrepreneurial officers, committed local politicians, and fortuitous financial circumstances, have been critical. Those circumstances have often depended on funding from European programmes which will need to be replaced when the UK leaves the EU. Existing LA initiatives help to exemplify the potential for a more mixed economy of energy, and a more distributed system, in the UK with private, public and civil society contributors, and a significant role for municipalities. The composition of this mixed economy cannot simply be read off from the experience of local authorities; many opportunities could however be opened up and current problems could be eased with a clearer central and devolved national government framework for LA action on energy and a consensus across levels of government on the local contribution to delivery of future energy systems.

Recommendations for UK and devolved national governments and actions for Local Authorities

Research findings suggest five areas for consideration at UK and devolved national, government levels and we propose six key actions for LAs. These suggestions are intended to secure more systematic, cost effective LA action on clean energy, and to enable scaling up when this is demonstrably a valuable contribution to a low carbon, affordable and resilient energy system. They are areas where more supportive institutions would make a LA contribution more feasible, but the current lack of a working consensus about the roles and responsibilities of LAs needs to be addressed.

Further detail on each item is in Section 7.

Recommendations for UK central and devolved national governments

1. Use the UK Clean Growth Strategy, and devolved national government plans to clarify the role and responsibilities of LAs in energy saving and clean energy, and to establish stable policy and support measures with clear trajectories against a timetable
2. Consider what additional powers LAs need to deliver their energy-related responsibilities
3. Consider further the need for support agencies and shared services for LA energy developments including national or regional energy agencies and specialist procurement organisations
4. Support LA access to low cost, long term infrastructure finance
5. Review and amend current energy market regulation to support local energy developers and operators, when this represents social, environmental and economic value to the public

Actions for Local Authorities

1. Articulate a LA clean energy plan geared to ensuring internal support from senior management and cross-party commitment
2. Create a management structure to scale up delivery of clean energy plans
3. Build a business case and assess financing options for energy projects
4. Collaborate with other LAs and intermediary agencies to build capacity and technical expertise in the sector
5. Use planning powers systematically to support development of clean energy and low energy buildings
6. Aim to facilitate and enable local and regional cross-sector action on clean energy and development of 'net zero carbon' districts

Endorsements

For the first time, this report provides a comprehensive analysis of energy activities by Local Authorities in the UK. It shows the extent of these activities as well as the challenges many Authorities are facing. Whilst they cannot implement the transition to clean energy on their own, the report shows that local government could do much more – and suggests how all levels of government could help to make that happen.

Jim Watson, Director, UK Energy Research Centre

The UK's energy system is currently undergoing a major transition in the way that it is conceived, structured and managed, as aging assets are replaced and the country seeks to ensure that energy remains affordable and secure whilst also becoming more sustainable. Local authorities have the opportunity to play a key role in the shaping of this transition. This report and the extensive work that has underpinned it have been invaluable in helping us to understand the current extent and future potential of these engagements.

Mike Colechin, Energy Technologies Institute

This research has been essential to understanding the reality and the potential of local energy in the UK, and its role in the transition to 100% clean energy. UK100 Cities Network relies on the insights and rigour of research like this to help us not only make the case for the clean energy transition but also for our members to make the transition a reality.

Polly Billington, Director, UK100

This timely research reveals the current extent of engagement with energy by the UK municipal sector. More importantly it points the way to what needs to be done to unlock the full potential of what local authorities could contribute towards de-carbonising the UK's energy system.

Michael King, Co-convenor, UK District Energy Vanguards Network

Councils are a key component with the future expansion of the energy sector within Great Britain. The initial research findings helps recognise the crucial role that local government plays in developing and delivering energy saving/generation and heat network schemes, which help contribute to their region's investment, regeneration and infrastructure.

Robert McKinnon, Local Partnerships

Contents

1. Introduction

This Report examines UK Local Authority (LA) energy plans and projects developed in the context of climate protection policies. We consider the ambitions, the investments and the challenges to be faced for ambitions to be realised.

Signatories[1] to the 2015 Paris Agreement to mitigate climate change restated the necessity for action across all scales of government and society, and over 1000 city and regional governments, businesses and civil society groups signed the associated Paris Pledge in support of clean energy and a sustainable future.

"Businesses, cities, civil society groups, investors, regions, trade unions and other signatories promised to ensure that the ambition set out by the Paris Agreement is met or exceeded to limit global temperature rise to less than 2 degrees Celsius."

parispledgeforaction.org

City leaders have also affirmed their commitment to municipal action on affordable clean energy (C40 and ARUP 2015; Larsson 2015; Vidal 2015), with more than 6,000 European cities joining the Covenant of Mayors, a voluntary commitment to develop Sustainable Energy Action Plans which go further than EU targets. In the UK this is strengthened by the public commitments of numerous city and local authorities to develop 100% clean energy by 2050 (see for example uk100.org).

Why Local Authorities?

There are good reasons for municipal action on clean energy and energy productivity. LAs are the only organisations unavoidably committed to the area for the long term; their democratic status, statutory duties, responsibilities in housing, waste, environment and transport, economic development and regeneration, planning and development powers, the scale and reach of associated operations and assets, and their relationships with civil society and businesses, are all significant. There is evidence that a more distributed system, with scope for local innovation and flexibility in energy supply and use, and making every building part of a networked clean, low energy infrastructure, would have system-wide benefits, serving policy goals for clean, affordable and secure energy.[2] These benefits seem unlikely to be feasible without LA participation. Moreover declining budgets from central government mean that LAs are having to adopt a more commercial approach to revenues. Energy saving measures and local infrastructures, such as combined heat and power (CHP), energy from waste and renewable electricity generation, can provide reliable and long-term income to support revenues.

In principle, LAs can take on diverse roles in energy system transformation:

- Establishing a cross-sector vision and strategy for their area
- Co-ordinating spatial and energy planning and investment with commercial network operators for clean energy districts
- Sharing and developing new resources, knowledge and capacities through partnerships with others from neighbourhood groups to inward investors
- Investing in local energy provision and services, including building retrofit for energy saving, CHP, energy from waste and heat recovery, heat networks, renewables, storage, retail supply and electric vehicle infrastructure

There are however big questions about political will at all levels of government, skills and expertise, finance and market regulation which need to be resolved for such roles to be realised effectively. In other European countries (see Section 2), municipal and community energy businesses have made a continuing contribution to a more diverse market in energy services than in the UK, where energy generation and supply was progressively centralised, under state ownership during the mid-20th century, before privatisation in the 1980s and 1990s. There is no substantial municipal or community energy sector, and technical expertise, resources and assets are concentrated in large, mainly transnational, corporations with primary responsibility to shareholders. Interest in municipal energy has been renewed primarily in the context of climate protection and clean energy policies, but the critical questions about powers and resources are as yet unanswered.

The research

Evidence to inform the debate on the value of municipal action as a contribution to a low carbon, affordable and resilient energy system is also limited. We know little about the actual capacity of 21st century UK LAs to act on energy, or the suitability of central government policies and institutions for facilitating localised energy provision.

This research addresses some of the gaps by examining what is being done now, why and what could be achieved with more supportive policy, resources and markets. We begin with a brief review of LA engagement with energy across Europe (Section 2), before providing a systematic overview of energy initiatives across the entire population of UK LAs (Section 3), and considering the UK context for LA action on energy (Section 4). In-depth analysis of energy projects and business structures in a cross section of 40 councils moves beyond claims about what could be done and beyond research on single case studies, to empirical appraisal of what is being done, where and how (Section 5). We discuss the challenges faced by LAs in moving from ambitious plans to implementation in the current context (Section 6), and identify key actions for local authorities, and recommendations for central and devolved national governments where more supportive institutions would make LA energy saving and clean energy provision more feasible (Sections 7).

The first stage of empirical research was a systematic overview and mapping of sustainable energy plans and projects in every UK LA, using two indicators:

- Evidence of an Energy and Carbon Plan or strategy was gathered from LA websites, and/or phone calls where necessary to obtain a copy of any unpublished strategy
- Evidence of financial investment in energy projects; data were compiled from 29 existing datasets published by the European Commission, UK and devolved governments and related agencies (Table A. 1). Data were collected in summer 2015.

The mapping exercise assessed LA engagement in energy through secondary data analysis. More in-depth evidence from primary data is needed to answer questions about emerging business developments, and likely consequences for energy systems. Stage two of the research hence examined energy projects and strategies in 40 LAs in more depth. We collected data between December 2015 and July 2016 (following pilot interviews in Spring 2015),[3] using an online questionnaire and subsequent semi-structured face to face or telephone interview.[4] The 40 case studies were a strategic sample of LAs spanning four dimensions derived from stage one findings: degree of engagement in energy; type of plans and investments; business and governance models; LA type. A list of participating LAs is in Appendix Table A. 2.

Cases were selected from the more active authorities and comprised 29 English authorities,[5] seven Scottish, three Welsh and one Northern Irish. These are not a representative sample of all types of LAs or all variants of LA action on energy (for example we did not focus on bulk electricity or gas purchasing). In order to gain more in-depth insight into the challenges of a specific LA energy development, we focused on a particular project in each case, rather than trying to examine all energy-related initiatives. This method provides good evidence about the actual changes taking place in LA energy provision. We know that most LAs have ambitious plans and we know how hard it can be to get plans implemented. Hence we wanted to find out more about specific investments, how these are being managed and funded and what these mean for the future. We also asked LA officials about the policy and institutional changes needed to make such developments more feasible, and to accelerate and scale up their contribution to clean, low energy systems.

2. European Local Authority Engagement in Energy

Early in the project we reviewed patterns of LA engagement with energy across European countries, drawing on a range of grey and academic literature.[6] The review found considerable diversity in LA energy activities across countries and over time. Historically LAs have played a strong role in energy provision in those countries where more general traditions of municipal service provision combine with a high degree of political and financial autonomy. In Hesse and Sharpe's (1991) typology of LA systems these are the *North and Middle European* countries. They contrast with other systems such as the *Anglo* and *Franco* types under which LAs have less autonomy or more limited roles in service provision. Among these latter countries are examples where a lack of local capacity to plan energy developments resulted in relatively inefficient fragmented systems. In these countries (e.g. France, Italy and the UK), central governments took control of energy systems leaving LAs with very limited, if any, roles.

While the financial and constitutional autonomy of LAs in *North and Middle European* countries contributed to their capacity to develop energy systems, they also tended to require support from central governments. This took various forms such as establishing specific powers and procedures for energy planning, supportive fiscal regimes and energy regulation. The alignment of central government policies and programmes with local action reflects a general phenomenon of mutual policy shaping across levels of government in these countries (Heinelt and Hlepas 2006; Le Galès 2002; Sellars and Kwak 2011).

Unbundling and privatisation of energy systems and local services has been a consistent trend across Europe since the latter decades of the twentieth century. Municipal energy could previously rely on cross-subsidisation, vertical integration, local monopoly and coordination with other municipal services such as housing, but liberalisation and privatisation have tended to prise these inter-relations apart. Nonetheless, our analysis indicates *North and Middle European* countries continue to have relatively high levels of local engagement with energy, and receive disproportionately high levels of Intelligent Energy Europe (IEE) funding.

Some of the objectives of privatisation and unbundling, such as economic efficiency and increased flexibility, are set against disadvantages articulated by local actors. These include: greater complexity in coordination between energy and other local developments; subordination of social and environmental objectives to commercial ones; and concerns that private enterprises extract excessive financial returns, particularly in the context of market concentration that followed liberalisation (Graham and Marvin 2001; Jamasb and Pollitt 2005; Monstadt 2007; Rutherford 2014). In a number of countries, dissatisfaction of some actors with privatised utilities has led to social movements to 'remunicipalise' systems, with a particularly strong impact in Germany (Hall et al. 2013; Moss et al. 2014).

Local authority entrepreneurialism was a common motif across the cases we examined, both before and after liberalisation, with local circumstances and individual leaders often being important to initiation of local energy programmes. Where LAs are successful, other authorities often emulate their approach, facilitated by international municipal networks. The persistence and growth of local energy programmes tends however to be dependent on supportive financial and regulatory contexts, underlining the importance of coordination between local engagement and central government policy. Many municipalities across Europe have received funding for pilot initiatives, but struggled to create momentum in the context of liberalised energy markets and unbundled local services. In spite of scaling up being a consistent theme of European funding programmes, projects often remain as bounded pilots (Labaeye and Sauer 2013). In particular where structural limits to LA capacities confine their activities to upgrading the public estate, spill-overs to other sectors have not generally been secured (e.g. ManagEnergy 2013). The local challenges associated with unbundling and fragmentation are paralleled by increasingly narrowly defined national and European support programmes, which have prevented LAs re-integrating *ad hoc* projects into more comprehensive initiatives (IEE and INTERact 2013).

While the history of LA engagement with energy shows considerable variation across European countries, some themes converge with current challenges to LA energy in the UK. These include challenges of coordination; scaling up pilot initiatives into resilient programmes; and having to pursue social and environmental objectives via regulatory and organisational configurations which prioritise commercial returns.

3. The Emerging Pattern of UK Local Authority Engagement in Energy

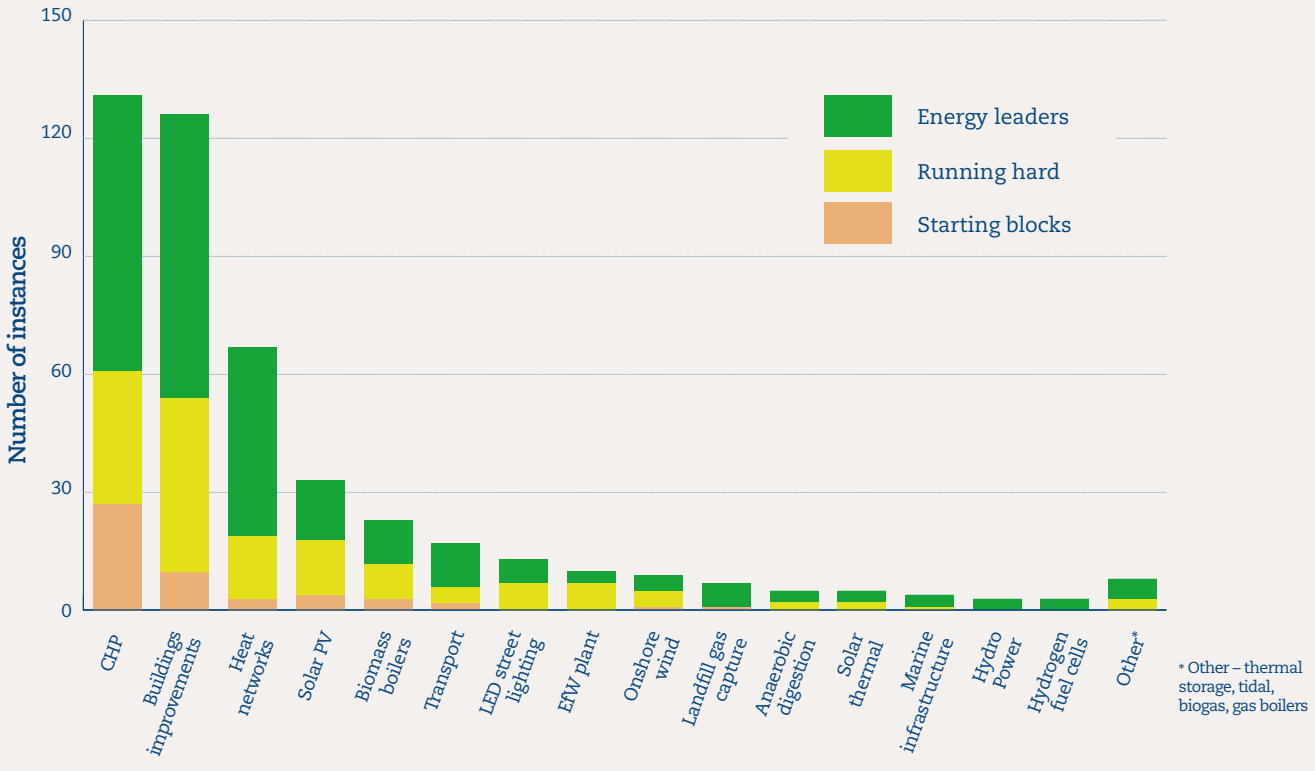
The systematic overview and mapping of the energy plans and projects of all 434 UK LAs[7] from secondary data revealed widely established ambition, but small scale and uneven material investment.[8] Every local authority was categorised into one of four groups: *energy leaders* had three or more projects in a programme of energy initiatives; *running hard* had one or two project investments and a published energy/carbon plan; *at the starting blocks* had one or two projects *or* a plan; *yet to join* had no accessible evidence of projects or plans. The majority of UK LAs are active to some extent, with 82% having energy and carbon management plans and/or investments in energy projects.

A total of 458 energy projects were identified across 208 LAs. The focus of action, accounting for three quarters of investment across these projects (Figure 1),[9] was in heat and energy efficiency for a low carbon, low energy building stock. Investment in new heating provision centred on infrastructures for CHP and heat networks. In summary:

- Identifiable investment varied: from as little as £4,000 from Intelligent Energy Europe towards behaviour change for energy efficient transport, to over £63 million from the UK Green Investment Bank as partial financing for an energy from waste facility in Derby (part of long term waste management contract between City and County councils).[10]
- Combining strategic planning with project delivery was less common: around 38% of UK LAs had both energy plans and investments, but only a small proportion (13%) – categorised as *energy leaders* in our analysis – had mobilised finance for a programme of energy initiatives.

(For detailed analysis of the mapping study see Tingey, Hawkey and Webb 2016; Tingey, Webb and Hawkey 2017; Webb, Hawkey and Tingey 2016.)

Figure 1. Technologies used in 458 LA energy projects

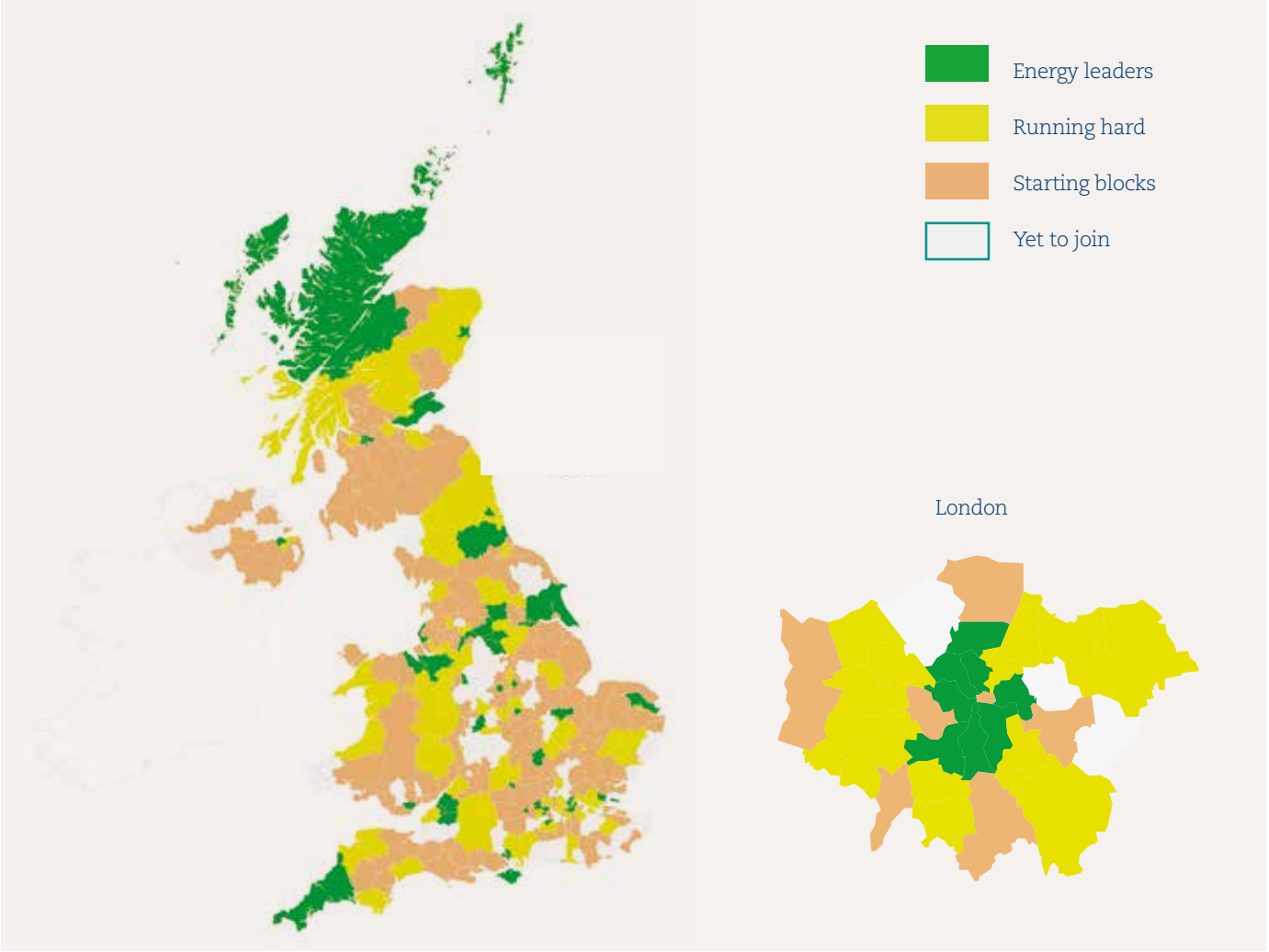


The distribution of energy activity across UK Local Authorities

Whilst most UK LAs are active to some extent, we find engagement with energy is differentiated across the countries and regions of the UK[11]:

- Taking into account that most LAs are English (over 80% of UK LAs), we find that Scotland had the greatest proportion of LAs actively engaging with energy. Scotland was the only country with all LAs active to some degree (either *energy leaders, runners* or *starters* in our analysis).
- At regional level in England, activity was highest in Greater London, Yorkshire & the Humber, and the North East, and equivalent to activity in Scottish LAs.
- The structure of local government is associated with different levels of engagement: Unitary authorities were the most active of the single tier authorities in England. In the two-tier county/district system, district borough councils were least active and the least engaged of all types of UK LA.
- All Scottish and almost 80% of English LAs have a published energy plan. This compared to 40% in Wales and around 10% in Northern Ireland. Public duties in the Climate Change (Scotland) Act require all Scottish LAs to develop and publish actions on energy and climate change.
- The types of energy projects varied across the UK. In Northern Ireland for instance almost all projects concerned heat and/or electricity generation, with a high proportion of onsite CHP. By contrast, English LA projects had greater diversity; less than half were heat and/or electricity generation and there were greater proportions of energy efficiency, low carbon transport and capacity building projects.

Figure 2. UK Local Authority engagement in energy systems



What does this mean for UK LA engagement in energy?

The patchwork pattern, and relatively small scale of energy investments reflects the unresolved questions about the future for UK municipal energy. In addition findings suggest the changeable status of local project pipelines: four of the 14 LAs identified as at the leading edge in the early 2000s (Shackley et al. 2002) do not appear to be *energy leaders* currently.

Some factors are however correlated with higher levels of activity. Notably there was a correlation between existence of a LA energy and carbon plan and number of energy projects.[12] Engagement also correlated with size of population; the most active authorities were, on average, about twice the size of the least active, supporting the contention that authorities with more resources are better able to develop energy initiatives. The most active authorities also had higher corporate energy consumption and corporate CO2 emissions (about twice the size of the least active) which could indicate greater concern to reduce corporate energy bills and may encourage investment in local energy provision for their corporate estate.[13] Authorities with overt political commitments to sustainable energy, defined as membership of the EU Covenant of Mayors, also tended to have higher levels of engagement, suggesting that buy-in at senior levels is significant.

These correlations should not be conflated with causation, but, when considered in concert with the mixed picture of engagement across the UK, the findings indicate that LAs with more responsibilities have greater scope for integrating energy into statutory service provision, especially in areas such as housing and waste management. Those with greater responsibility for local services also have larger budgets and estates, as well as more to gain from savings on corporate energy bills. Experience in Wales suggests that smaller authorities would also invest in significant energy projects such as solar farms, if they had capacity and competences. Enhancing specific LA powers and responsibilities could therefore lead to higher levels of engagement with low carbon energy and energy saving. Central and devolved governments could support action through dedicated infrastructure delivery agencies with the skill mix and resources needed to ensure that all viable projects can proceed. The UK debate about devolved and regional government powers is hence significant for the future of local energy planning and investment given the challenging context for local decision making discussed in the next section.

4. The UK Context for Local Authority Action on Energy

"What's happening with the Heat Networks Delivery Unit is really useful. It shows that the Government is putting quite a bit emphasis on heat networks as a way to deliver lower carbon heat, which I think is right for cities… There are scenarios where we would like to see LAs, particularly city authorities, having more responsibility around developing and managing heat networks. The Scandinavian models are wonderful and we'd love to see them in the UK, but we've got a long way to go to get there."

Programme Officer, Leeds City Council

LAs have experience in energy services for energy efficiency in housing and built infrastructure, but currently have no formal remit to supply energy. Unlike most of Europe, local government services and budgets are defined mainly by statutory duties set by central government, leaving limited scope for local discretionary action (Ladner et al. 2016). Clean energy, as well as energy efficiency, initiatives however serve LA need for new revenues and investment for regeneration, jobs and welfare, as well as climate protection.

Potential for municipal energy services has gained prominence with the introduction of climate protection legislation and clean energy policies, although the expectations on local authorities differ across central and devolved national governments. The Scottish Climate Change Act 2009 requires all public bodies to act in the way best calculated to contribute to delivery of emissions reduction targets; a stipulation absent in other parts of the UK. In England, until 2010 LAs reported corporate and area-based emissions and action on climate change adaptation as part of statutory national indicators. In 2006 the Welsh Commitment to Address Climate Change was established; all Welsh LAs joined the Commitment and have a voluntary target of 3% annual CO2 emissions reduction which is reported to the Welsh Government and contributes to the overall Welsh target. The Environment (Wales) Act 2016 has the same target (80% reduction of emissions by 2050 based on a 1990 base year) as the UK Climate Change Act 2008, and places statutory duties on Welsh ministers for emission reduction targets and carbon budgets. The Carbon Reduction Commitment applies across the UK (until 2018-19 when it will be incorporated into the Climate Change Levy), and requires all large energy users to purchase carbon allowances for their associated emissions; around a third of LAs were enrolled in 2015-16 (Environment Agency 2016). None of this specifically requires LAs to develop clean energy, although time-limited initiatives have provided dedicated capital funds. These include the UK Community Energy Programme (2002-06) targeting public sector organisations, Salix Finance (interest free finance, established 2004), and specific LA programmes such as the Low Carbon Infrastructure Fund (2008-09), Low Carbon Pioneer Cities Programme for heat networks development (Leeds city region, Greater Manchester city region, Newcastle, Nottingham and Sheffield in 2013), the Green Deal Pioneer Places (2012-13) and Green Deal Communities funding (2014), the Wales Funding Programme (open to the Welsh public sector, 2016 onwards), the England and Wales Heat Network Delivery Unit (HNDU) and Investment Project (HNIP) (2013-21) and the Scottish Heat Network Partnership. LAs have also been able to access funding from energy company obligations for energy efficiency and district heating (in eligible circumstances), and financial incentives such as the feed-in tariff have been available to LAs.

English regional devolution settlements and the City Deals programme also create new opportunities, but energy has thus far not been *central* to either the establishment of combined authorities or the role of elected mayors. The first regional devolution settlement, dubbed the Northern Powerhouse, saw devolution of transport and economic growth; proposals are furthest along in Greater Manchester where there is now an elected mayor, devolved health budget and new finance from the City Deal which includes the power to reinvest tax revenues. A greater strategic role for energy at regional scale could follow, possibly embedded in, or building on, the Low Carbon Hub, one arm of the Greater Manchester Combined Authority. Analysis of the first wave of City Deals with the English core cities however concluded that not enough had been done to link economic growth ambitions with low carbon objectives (Scott 2012). Some second wave agreements (see Ward 2015 for overview) nonetheless have energy *aspirations* including significant proposals for geothermal district heating in Stoke and Staffordshire City Deal (City of Stoke on Trent et al. 2014).

National government policy developments are continuing. The £320m HNIP in England and Wales announced in 2015, 'is expected to support up to 200 projects by 2021… and to lever in up to £2bn of wider investment, reducing bills, cutting carbon and forming a key part of wider urban regeneration in many locations' (Department for Business, Energy and Industrial Strategy 2017). During the pilot round of HNIP, £24 million was awarded to nine LA heat network projects. This builds on the existing funding and support provided through the Heat Networks Delivery Unit. In January 2017, the Scottish Government published the draft Climate Change Plan (RPP3, covering 2017-2032), and consultation on the draft Energy Strategy – one of the 3 themes is 'a smarter model of local energy provision' (Scottish Government 2017a); proposals include a statutory duty for LAs to develop Local Heat and Energy Efficiency Strategies (Scottish Government 2017b). In addition, in 2015 energy efficiency was declared a National Infrastructure Priority, the related Heat Policy Statement was published, and Scotland's Energy Efficiency Programme was announced. In Wales, the Well-being of Future Generations Act 2015 requires public bodies to act in line with sustainable development; it also created provision for Public Services Boards in each LA area tasked with improving economic, social, environmental and cultural well-being. Further to this, the Wales Act 2017 gives Welsh Government greater powers over energy, including planning consent for energy infrastructure (up to 350MW capacity). The question of publicly owned national energy companies in Scotland and Wales has also been aired (BBC News 2017; Scottish Government 2017a). In Northern Ireland, the Local Government Act (Northern Ireland) 2014 created 11 new LA areas (down from 26) with new powers over local development plans, planning, economic development, and urban regeneration and community development, but no specific energy powers. Councils are expected to deliver these under sustainable development principles.[14]

These policy developments are however at an early stage and lack of statutory remit and dedicated funding for LA energy initiatives means that ingenuity is required to situate energy services as a cost effective contribution to council core services. Governance and decision-making structures and work programmes have to be assembled through negotiation with public and community bodies, consultants, utilities, energy efficiency supply chains and investors. In a period of reductions in public finance and restructuring in public services the (already limited) capacity for such initiatives is constrained. This difficult context was a common theme across our case studies and workshops with LAs; main points are summarised below:

- Energy provision is discretionary in local government, and resources for discretionary activity are shrinking.
- Energy and sustainability teams were being scaled back often resulting in assembly of a project team from scratch for each initiative. This disrupted institutional memory and pathways for energy developments, making knowledge and expertise more fragmented.
- Internal technical expertise for energy projects is declining and transaction costs of commissioning and contracting can be significant.
- Hence there is no established 'problem owner' for clean energy and energy productivity.
- Austerity in public finances is creating uncertainty over the future of council building stock resulting in delayed or downsized energy efficiency investments.
- Removal of national indicators in England was damaging legitimacy because these had provided a rationale for LA action on energy.
- Abolishing English Regional Development Agencies had limited the scope for sharing information between LAs and led to institutional memory loss.
- Energy policy support for local initiatives was also experienced as unreliable; references were made to set backs stemming from:
    - Failure of the UK Green Deal
    - Unanticipated and rapid reductions in Feed-in-Tariff rates for small scale renewable energy
    - Reduced funding and eligible activities from the Energy Company Obligation (ECO) scheme for energy and heating improvements in housing also limited the capacity to plan a programme of retrofit
    - Scaling back of the Carbon Reduction Commitment
    - Removal of the Code for Sustainable Homes in England, zero carbon housing targets and allowable solutions

Current uncertainties, stemming both from UK energy policies and austerity in public finances were a significant factor in slowing down or stalling developments, and in reducing the scale of investments. Policy changes created a sense of uncertainty over government direction and support for local powers to engage in clean energy.

These changes, combined with short-term public funding cycles, were interpreted as sending 'stop-start' signals, disrupting longer-term energy planning and business development. Projects in development risked stalling, or were reduced in scale to meet shorter timetables and new proposals were made more challenging. Probity and accountability in LA spending is assured by public finance and procurement rules, and governance processes for review and decision on investment, but these procedures limit rapid responses to central (and devolved) government policy changes and short term funding cycles.

In the round, policy change created additional pressures, interrupted work planning and ability to develop and deliver a strategic programme. The following quotes below exemplify these issues. The value of allocating time and resources to sustainability strategies and project pipelines was perceived as diminishing; confidence in the legitimacy of projects was reduced, with officials and politicians tending to question whether they "should" be working on energy.

"We had grown [the solar programme] from the energy and carbon master plan as one of the strategic themes… then the Government's proposed [reduction to] the feed-in tariff was… extremely rapid, savage, and we had to respond accordingly… we'd done all this work already, we'd lose out if we didn't activate. To the Council's credit, they made a decisive move and we delivered on that and it was successful. But in normal cases, it would be a much longer, more conservative process."

City Energy & Carbon Officer, Glasgow City Council

"To retrofit and significantly improve the energy efficiency of existing homes in the borough we need some form of policy or incentive coming forward in the absence of the Green Deal. And for new buildings, zero carbon homes has been removed, but the UK still needs to achieve nearly zero energy buildings from 2020, so how will that be implemented?"

Energy Infrastructure Manager, Haringey Council

"More clarity around retrofitting – what's going to replace the Green Deal and ECO? We've suffered quite a big loss at the moment with our planning powers with the housing standards review… we have lost some of our powers as a council."

Corporate Sustainability Officer, Bath & North East Somerset Council

"The majority of central government have this tendency toward knee jerk reactions, 'Oh heck, there's a lot of money we need out the door by the end of March'… If central government could take a more proactive approach of saying, 'Right, let's do a bit of forward planning here.' Work out what we want to do, when we want to do it and give LAs enough time to properly think about what it is they want to do as well as time to make the necessarily links with stakeholders and think it through a little bit more."

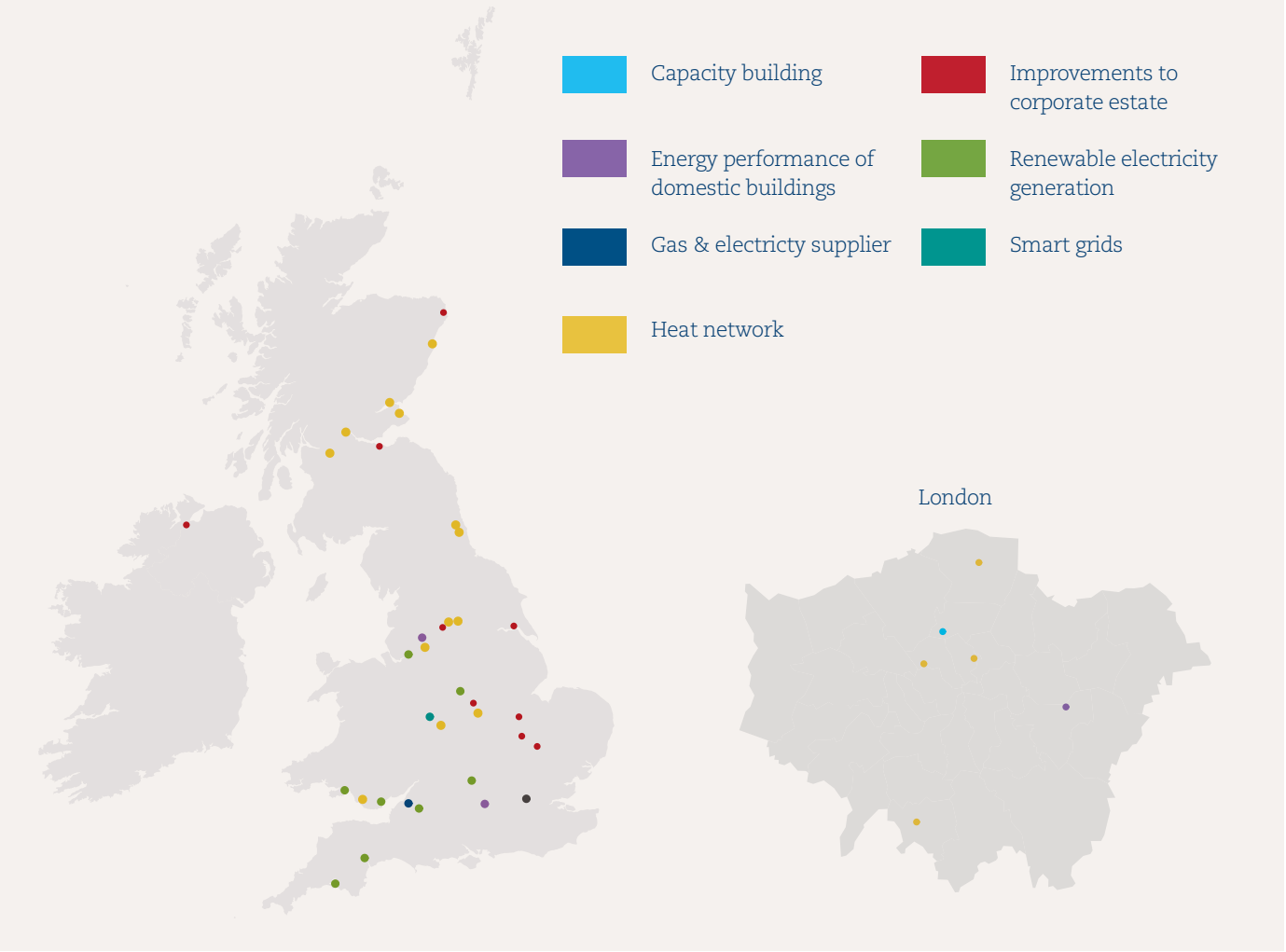
Infrastructure & Investment Projects Officer, West Yorkshire Combined Authority (for Leeds Enterprise Partnership)

5. Case Studies of Selected Local Authority Energy Initiatives

Sections 5 and 6 examine 40 LA case studies (see Figure 3). Section 5 examines the types of LA energy initiatives in the sample, their objectives and business structures; whilst Section 6 explores the challenges authorities faced in pursuing local plans and energy projects. The cases are a strategic sample of LAs (see Introduction for more detail); they are not designed to be representative of all LAs or all types of energy projects. Participants from 40 LAs were invited to select a specific project, ideally near completion or operational, for discussion (see Table 1).[15]

These projects are a lens through which we can gain more in-depth insight into the opportunities and challenges associated with LA energy provision and they offer a means to identifying key changes needed to improve progress and to create a step change in action.

Figure 3. UK Local Authority engagement in energy systems



Which service had lead responsibility in initiating the energy project?

LA energy initiatives in the current uncertain context had no predictable trajectory and there was no single service or directorate initiating projects. Instead projects emerged *ad hoc* where there was commitment to clean energy as a valuable component of core services, and an opportunity to assemble the finance (Table 2).

What objectives do LA energy initiatives serve?

Objectives were correspondingly diverse. LAs perceived themselves as having a social, ethical and political responsibility to contribute to energy provision both for climate protection, and economic regeneration and welfare. Carbon and energy saving were common goals, but projects were also variously expected to benefit economic development, and to generate new income, while cutting council energy bills or securing affordable warmth for households. LA energy provision was hence expected to work as a catalyst to deliver multiple objectives, necessitating strategic thinking (Table 3).

Table 1. Development stage of initiatives in case study sample at the time of survey

Project stage	N cases
Operational	22
Build or construction	7
Procurement	6
Development	1
Feasibility, initial scoping or pre-feasibility	4
Total	**40**

Table 2. Service directorate initiating energy project examined in the sample

Lead service/directorate	N cases
Environment	13
Corporate	11
Economic Development	6
Housing	4
Communities/Place	3
Planning	2
Highways	1
Total	**40**

Table 3. Council objectives for developing energy initiatives

Council objectives (multiple choice options)	Count
Carbon reduction	29
Energy resilience &/or security of supply	23
Energy demand reduction	19
Affordable warmth (including fuel poverty)	19
Local economic development	16
Financial saving for Council	15
Income generation for Council	14
Attracting inward investment	11
Local skills development	10
Job creation	8
Local population health improvement	4
Council's European/international profile or Council leading by example	4
Compliance with EU directives	3
Community empowerment	3
Compliance with national/devolved policies	2
Other objective drives project	3
Question response rate	36/40

Overview of the energy projects

Even within this restricted sample, projects were highly diverse. The largest proportion focussed on decentralised energy and energy efficiency for a low energy, low carbon building stock (Figure 4), hence tackling the most difficult policy issues of low carbon heat and building retrofit.[16]

Heat network infrastructure and supply comprised 16 of the case studies, some with CHP; improvements to the corporate estate and domestic buildings comprised 12 cases and renewable electricity generation from solar PV and small scale hydropower comprised 8 cases. The sample also included: Bristol's municipally owned licenced gas and electricity supply company *Bristol Energy*; Haringey's capacity building Innovation Hub; and Wolverhampton's smart grid feasibility project (see Table A. 1 for full list).

Figure 4. The different types of energy initiatives included in the LA case studies

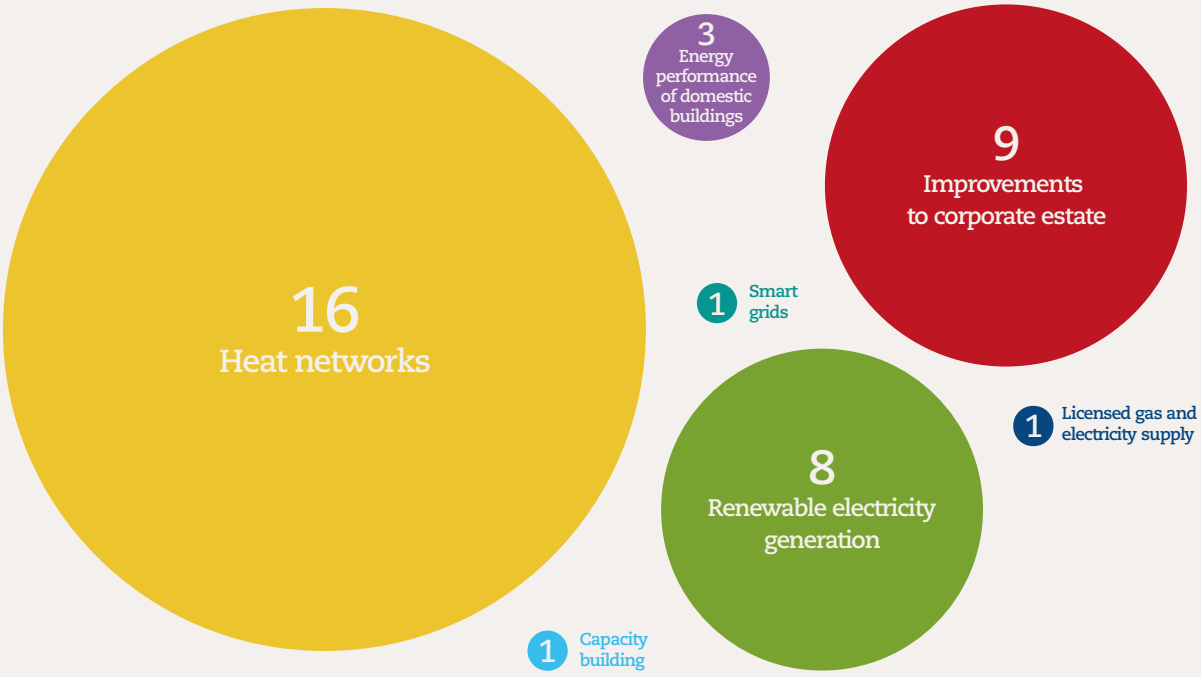


Figure is scaled according to the number of each type of energy initiative.

Heat network infrastructure and supply (16 cases). These projects prioritised either affordable heat for council tenants (for example Aberdeen and Islington), or cost and carbon saving for commercial and public buildings (for example Gateshead and Manchester); some networks supplied both domestic and non-domestic users (for example Fife and Leicester). The LA usually derived some financial benefit or cost saving from the scheme including reduced costs of housing maintenance, improved rental incomes, heat sales and (where directly operated) income from CHP electricity sales via private wire supply or grid export. The scale of projects varied: when fully built out Bridgend and Enfield heat networks expect to supply around 10,000 and 15,000 customers respectively[17]; much smaller schemes such as Somers Town Energy in Camden and Dundee's social housing scheme supply heat to a few hundred social housing customers.

Improving the LA corporate estate and street lighting (9 cases). These initiatives were designed to reduce corporate estate energy bills and carbon emissions. They improve the fabric of council buildings and street lighting and provide onsite heat (and sometimes power) using either Energy Performance Contracting (Cambridgeshire, Edinburgh, Hull, Leicestershire and Peterborough) or direct management (Derry City & Strabane leisure centre using CHP; Cambridge leisure centre using solar thermal heating; Aberdeenshire Aboyne Academy biomass heating system for five buildings and a swimming pool, and Calderdale LED street lighting upgrade).

Improving the energy performance of homes (3 cases). Our sample included three very different domestic energy efficiency initiatives (Greater Manchester, Greenwich and Reading). The Greater Manchester Combined Authority £20 million domestic energy efficiency and demand side response demonstrator was coordinating three housing providers (Northwards Housing, Six Towns Housing and Wigan and Leigh Housing) and two Japanese heat pump manufacturers (Daikin and Hitachi). It included investment from the Japanese R&D agency New Energy and Industrial Technology Development Organisation (NEDO). Six hundred households received air source heat pumps which were installed alongside technologies to test aggregation and flexible shifting of demand. In Greenwich, a £14 million regeneration of the Barnfield Estate (577 homes) under the Priority Investment Programme piloted the Greenwich Homes Standard. This involved a whole house approach to energy efficiency upgrades and renovation.[18] Reading council's Winter Watch initiative was concerned with energy vulnerability. Approximately 200 residents per annum were supported with emergency heating repairs, access to boiler replacement and income maximisation through benefit checks.

Renewable electricity generation (8 cases). These projects were of two main kinds. First those primarily focussed on income generation from feed-in tariffs, utilising council assets (rooftops and land) for solar PV and micro-hydropower and reducing corporate energy costs and carbon through use of electricity generated (Exeter, Warrington, Derby and Cardiff). In Exeter the council also sells electricity via power purchase agreements to leaseholders in buildings with solar PV. In Warrington, the programme began by installing PV on around 2,000 homes managed by the Golden Gates Housing Trust (the council's arm's length management organisation); tenants receive free electricity. The programme has been extended to council buildings, a rugby stadium and latterly commercial distribution centres.

The second group of projects were community partnerships. In Oxford, the council partnered with the Oxford Low Carbon Hub as part of OxFutures (2012-2016), an Intelligent Energy Europe (IEE) Mobilising Local Energy Investment (MLEI) project. Solar PV was installed on a range of council (city and shire), commercial and domestic rooftops and Osney Lock hydropower scheme was established.[19] In Plymouth, the council supported Plymouth Energy Community (PEC) as part of the co-operative agenda and provided grant and loan financing and rooftops for solar PV. Council staff are involved in day-to-day running of PEC through a service level agreement. PEC also offers an energy advice service. In Swansea, the council supported training, skills development and community ownership of assets through establishment of the Swansea Community Energy & Enterprise Scheme which installed solar PV on schools and a care home, financed through a combined member share offer and council investment. In Bath & North East Somerset, the council supported Bath & West Community Energy and provided loan financing for the 2.3MW solar array at Wilmington Farm which began exporting to the grid in March 2015.

Municipally owned licensed gas and electricity supply. Bristol Energy began trading in 2015 as a licensed gas and electricity supply company serving around 80,000 customers across Britain. Development finance was from the EU Elena fund for technical assistance.[20] In addition to developing the licensed supplier company, Bristol City Council's Elena programme has involved £50 million investment in decentralised energy, particularly heat networks and solar PV and energy efficiency upgrades to circa 1700 domestic properties and 800 private homes. The energy infrastructure is managed by the LA Energy Services team, but the longer term aim is to transfer this to Bristol Energy, creating a significant municipal energy business.

Capacity building for low carbon supply chain and demonstration of new technologies in construction and buildings. Haringey council was piloting the Low Carbon Innovation Hub (2015-16) to improve sourcing and uptake of low carbon energy technologies particularly among property developers and building owners (including LAs and social landlords). Local organisations were invited to join the Innovation Hub as potential buyers or demonstrators of new technologies and the project worked to bring this group together with technology developers or suppliers to facilitate partnerships for demonstration sites for near market technologies.

Local smart grids. Wolverhampton City Council was a partner in the pilot project Optimising Regional Clusters of Smart Energy Networks. The study explored management of electricity demand at substations in Wolverhampton to test the feasibility of distributed control of electricity networks, using network simulation and a prototype demand management algorithm. The longer-term aim was to develop a smart grid demonstration site enabling local demand management, storage, trading and distribution; a substation adjacent to a future site of 150 new homes was identified.

Capital investment in the energy projects

Estimated capital expenditure had a total value of around £356 million with a significant range from £10,000 to £47m (Table 4).

In our sample of cases the largest capital expenditure was for Bridgend's town centre district energy network which is planned to serve around 10,000 domestic, public and private sector buildings when fully built out.[21] The smallest capital expenditure was for Reading Council's Winter Watch fuel poverty initiative whose expenditure is primarily operational costs. Whether the capital expenditure was large or small, all energy initiatives were considered to add value, from generating local jobs and revenue streams to supporting those living in fuel poverty.

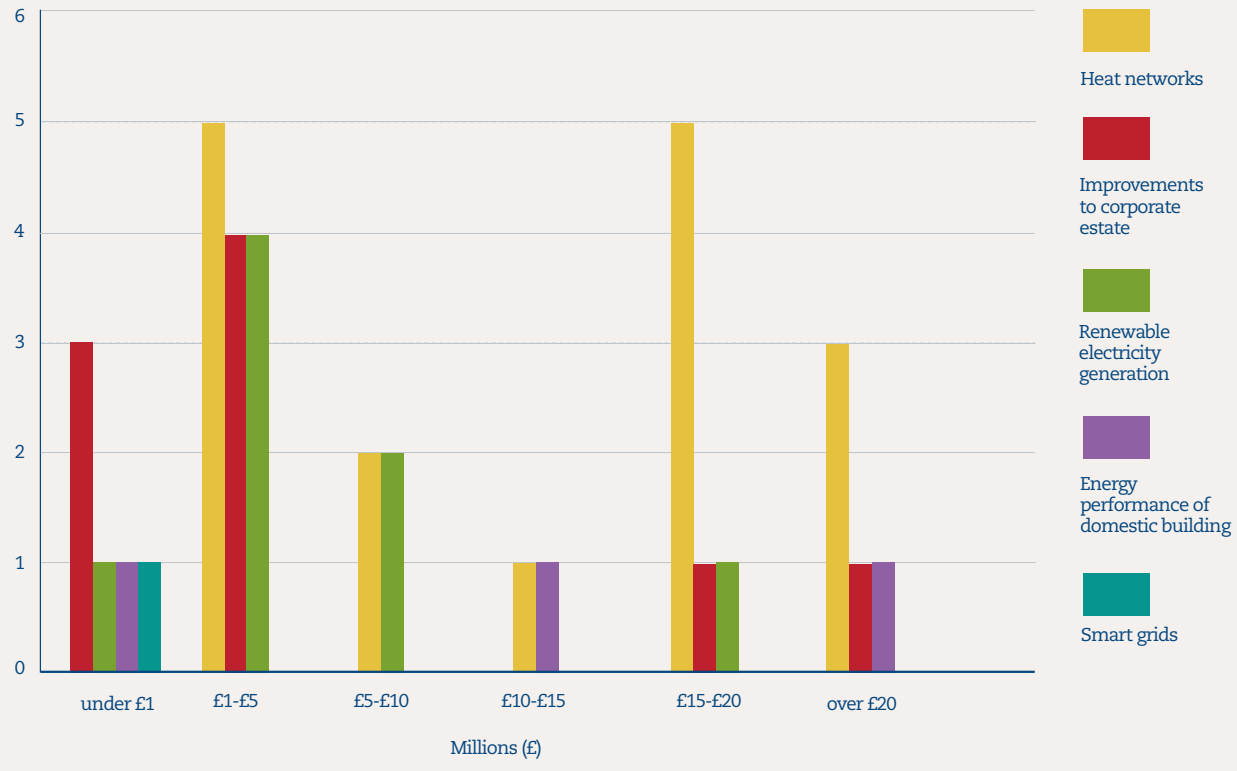
Higher capital cost initiatives (over £10m) tended to include heat network infrastructure (Figure 5). Initiatives combining several technologies were also associated with higher investments. At the lower end of the cost scale were local renewable electricity projects, some smaller heat network and most Energy Performance Contracting improvements to corporate estate.[22] Domestic retrofit projects ranged from less than £1m to over £20m.

Table 4. Summary of capital expenditure across 37 cases

Combined capex	Minimum capex	Maximum capex	Median	Mean	N valid cases[i]
£356,058,441	£10,000	£47,000,000	£4,600,000	£9,623,201	37

[i] We were unable to obtain capital expenditure data for one project, one project did not have capital expenditure, and the Leeds Enterprise Partnership case is excluded.

Figure 5. Capital expenditure across the different types of energy initiatives



In most cases, multiple sources of finance were combined (Table 5), with public funding playing a significant role; commercial investments appeared more difficult to secure at an affordable price and on locally acceptable terms. Due diligence costs in private sector finance generally mean that small projects are unattractive and models for scaling up, or creating portfolios for LA energy investments need further work.

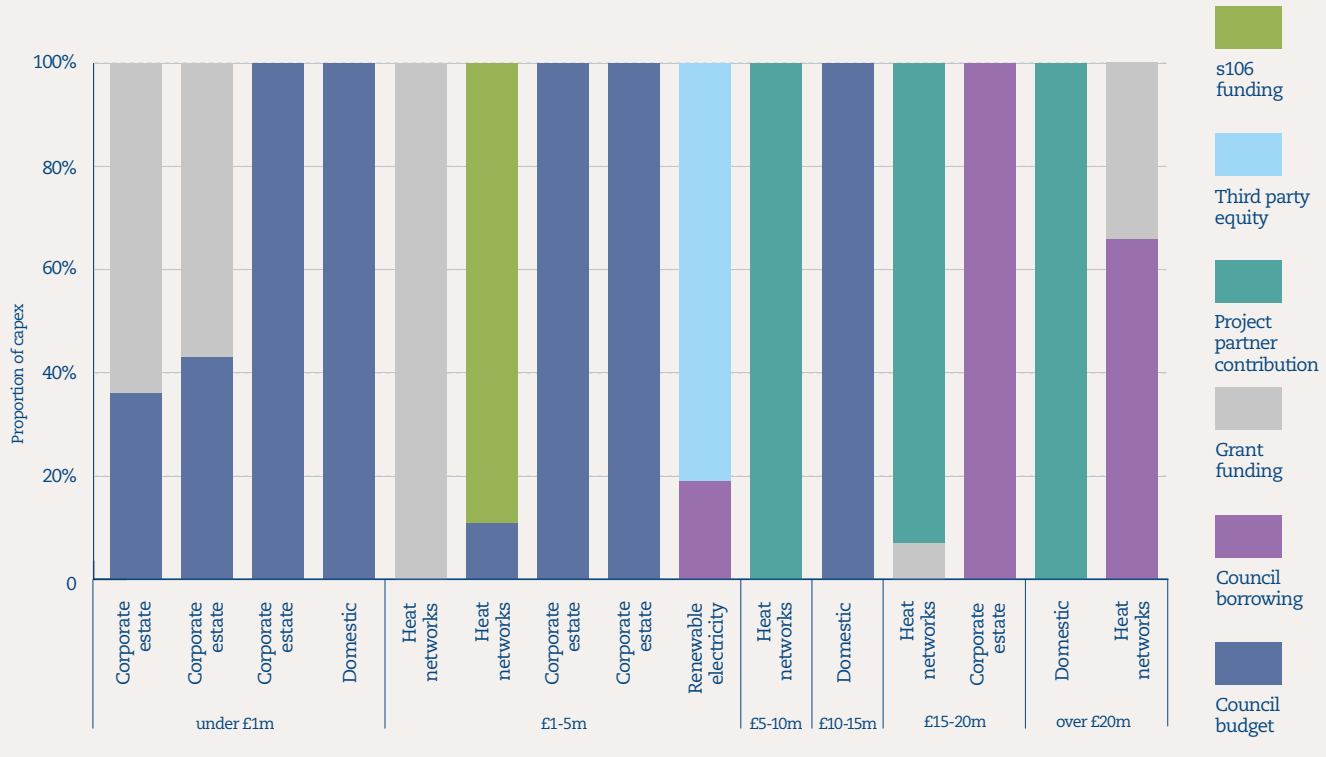
We obtained reliable data on the detailed breakdown of capital expenditure for 15 projects, which indicate the significance of public finance (Figure 6): 10 projects relied entirely on public funding, whether through council's own budgets, borrowing through the Public Works Loan Board (PWLB), and/or grant funding. The PWLB is a key source of long-term, low interest loans for viable energy projects which yield a return or savings. Lending is subject to UK Treasury debt management principles based on acceptable risk to the public purse. LAs take a different stance on PWLB borrowing, depending on circumstances such as the ratio of debt to reserves, and the level of risk of investments in their portfolio. In principle however the PWLB is an accessible route to LA energy finance.

In five of the 15 cases capital expenditure was funded via major contributions from third parties or commercial partners (where it comprised over 80% of project capex). At the lower end (under £5 million) was third party equity in the form of member shares in a renewable electricity cooperative; at the upper end (over £20 million), project partner contributions financed a domestic energy efficiency and demand side response demonstrator.

Table 5. The different sources of finance used for capital expenditure

Types of finance (multiple choice options)	Count
Grant funding (various sources)	19
Council budget (capital or revenue)	19
Council borrowing (eg PWLB)	13
Commercial partner project contribution	7
Third party contributions	7
Question response rate	35/40

Figure 6. Breakdown of the different sources of finance for capital expenditure across 15 projects



Business structures in the sample of Local Authority energy projects

In examining business structures and rationales for the sample of energy projects we differentiate between direct management by LAs and independent businesses. The term business structure is used to encompass the arrangement for managing the project. When a separate company or organisation with a defined legal structure (separate financial management and accounting) has been set up, this is classified as an independent business. This category includes commercial and non-profit enterprises. 'Directly managed' projects are those where the LA retains full internal responsibility and where demonstrators or pilots do not warrant a new independent business at this stage.

The majority of projects in the sample were directly managed (Table 6), and this group included all project types except municipally owned licensed gas and electricity supply (Figure 7 and Table 7). Council decisions about direct management of energy investments, contracting with commercial and community partners, or establishment of an independent business are not simply the outcome of technical-economic characteristics of projects, but are customised to local circumstances and priorities, including political strategies, financial opportunities and the composition of council skills, resources and procedures.

A common feature of directly managed projects was their potential for relatively easy integration into existing council structures, management routines, capacities and cross-sector networks, sometimes combined with a funding opportunity. Dependence on straightforward alignment with existing management processes, and additional fortuitous circumstances, is limited however as a route to larger scale energy investments which entail new responsibilities, borrowing and risk. The presence of independent municipal, commercial and community businesses in the case study sample suggests that some councils are moving beyond the more straightforward project opportunities to test out alternative business models, sometimes with commercial energy utilities and community enterprises. In some of these cases, councils continued to support independent businesses, variously using service level agreements to cover costs of LA staff time, or facilitating work with social housing tenants, or enabling access to funding in partnership with the LA.

Table 6. The types of business structures adopted

Business structure	N cases
Direct management by council (with/without project partners)	25
Municipal ESCo	4
Private sector ESCo/SPV with a long term concession contract from a council	4
Community owned (Community Benefit Society and Industrial & Provident Society)	4
Business structure not yet established, but independent business intended	2
Total	**39**

Figure 7. Types of projects according to business structure

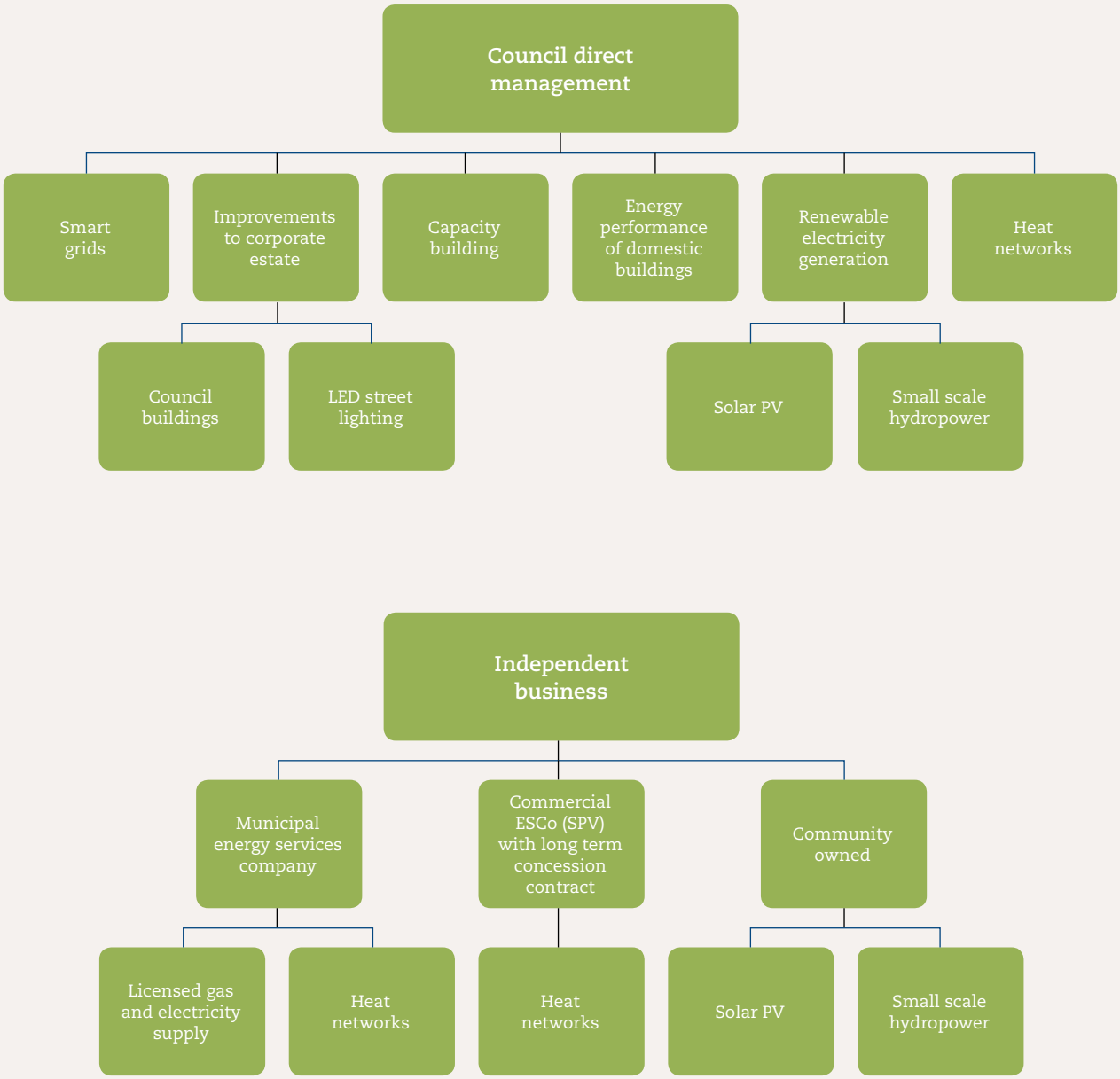


Table 7. Energy initiatives according to their business structures

Project Type	Council direct management	Municipal ESCo	Private sector ESCo/SPV	Community owned	Independent business planned	Total
Heat networks	7	3	4	-	2	16
Improvements to corporate estate	9	-	-	-	-	9
Renewable electricity generation	4	-	-	4	-	8
Energy performance of domestic buildings	3	-	-	-	-	3
Licensed gas & electricty supply	-	1	-	-	-	1
Capacity building	1	-	-	-	-	1
Smart grids	1	-	-	-	-	1
Total	**25**	**4**	**4**	**4**	**2**	**39**

Direct management of energy provision

In our sample 25 projects were directly managed, spanning heat networks, improvements to the corporate estate and domestic buildings, renewable electricity generation, capacity building and smart grid projects (Figure 7). Decisions leading to the LA retaining direct control were informed by multiple factors: project economics and finance were critical, as well as welfare, fuel poverty and energy affordability goals, organisational capacity, established management structures and/or specific programmes or procurement frameworks for energy upgrades to council buildings, notably energy performance contracting. In the following sections, we expand on these factors.

1. Projects managed within existing structures

Projects concerning the council's own estate, land and housing could be managed by corporate energy services, with work incorporated into operation and maintenance contracts. In our sample this included renewable electricity generation and improvements to the corporate estate and street lighting.

"We are taking on the general maintenance like clearing out twigs and trees and that. Because we have the Harbour Authority… there happens to be quite an expertise in the council."

Operational Energy & Sustainability Officer, discussing the internal expertise relevant to managing Radyr Weir's maintenance, Cardiff City Council

"For the council our [Sports and Recreation Facilities Manager] oversees a lot of our leisure facilities… They are run for us by another company… it's all part of a contract with the management company… [and it's] in their contract about energy savings and on-going management and maintenance systems."

Sustainability Officer, explaining how the Abbey Pool solar thermal system is managed within the existing management contract for the council's leisure facilities, Cambridge City Council

Seven heat network developments were also directly managed. Although managing a heat network required new skills and expertise in energy markets, there was still scope for using existing routines such as energy with rent payments which could be extended to district heating.

"We were trying to deliberately not set up new processes and structures because it works. Rent collection, everyone's used to it, they've worked with it for decades. So we haven't changed that… By changing as little as possible, the plan is to keep those processes simple, which de-risks things like bad debt."

Energy Services Manager, Islington Council, Bunhill Heat and Power

2. Public sector procurement programme to improve council buildings and reduce costs: Energy Performance Contracting

Energy Performance Contracting (EPC) is a distinctive model for retrofit on an estate-wide basis. It is intended to allow LAs to pay for energy efficiency upgrades through energy cost reductions under a guaranteed contract with an energy services company. The contract has pre-agreed terms, but can be adapted to local circumstances, including payback periods of 5, 7, 10 years etc, and has different maintenance contract options. Buildings are packaged together initially by the LA to avoid the risk of a contractor 'cherry picking' only the easiest upgrades. LAs appoint a contractor from an OJEU compliant framework using a 'mini competition' specification and contracting process to provide a value for money assessment. A number of agents manage the framework agreements and offer technical support for councils.[23]

In our sample the EPC model was used by Cambridgeshire, Edinburgh, Hull, Leicestershire and Peterborough, because of the guaranteed savings on bills and a contract perceived as allocating the main financial risk to the contractor while enabling councils to upgrade buildings.

"Everything hinges on the fact that our risk is pretty low because Bouygues [the contractor] have guaranteed returns."

Project Director, Cambridgeshire County Council

"I had become interested in RE:FIT, as a means of being able to achieve better buildings… But colleagues in finance thought, 'Ooh, hang on a minute, they're guaranteeing a saving, we get a revenue stream coming back in at such time that the original investment is paid off.' That works for us, we quite like that."

Sustainable Development Manager, City of Edinburgh Council

As a 'tried and tested' model energy performance contracting was attractive because officers could compare experiences across authorities, and learn from the contractor's technical expertise, and monitoring and verification data, to understand how savings are made. LAs could use such knowledge to decide whether to extend an energy performance contract and build a long-term partnership with the contractor, or to continue retrofit themselves through a spend to save process:

"We could learn how we verify and improve the investment just to deliver the energy savings that we start out with… we're going to learn how to take that process through for the RE:FIT… and then we can apply those principles to other spend to save projects."

Environment & Climate Change Strategy Officer, Hull City Council

3. Energy provision as a new revenue stream

A further step in integrating energy provision into council strategy was the translation of land and buildings into a source of income generation by installing relatively straightforward renewable electricity technologies, especially solar PV, which at the time provided income from feed-in tariffs, electricity supply and/or sales.

"We were facing huge budget cuts. And there was an opportunity within the authority instead of just cutting budgets, to look at income generation and commercialisation. As a result we were able to put forward a plan of how we could generate income for the council as a result of energy saving throughout our property assets."

Corporate Energy Officer, Exeter City Council

Some councils also regarded energy performance contracting as a new business opportunity. Peterborough City Council for example developed its own energy performance contracting framework agreement with Honeywell, emphasising the partnership component and ambition to extend the framework to other LAs as a means of income generation. Cambridgeshire County Council's energy performance contracting programme stemmed from an IEE 3-year funded MLEI project which the council had used to create a common investment fund for councils in the area (initially focussed on county council buildings and using PWLB borrowing to invest £15 million).[24] As part of the county programme, the council also developed a 12 MW solar farm which secured a UK Contract for Difference in 2015. Some of the profits were used to fund the team, hence building in-house skills and experience; the longer term aim was to develop the investment fund to attract private sector investment to meet Cambridgeshire's low carbon goals.

"The big challenge for LAs is that we're trying to commercialise to get revenue streams coming in from our assets. And we've got a lot of skillsets in the authority that can help to do that… for example a big transport project which is a finance project, that's a transferable skill. But you have to spend time understanding the nuance of energy projects… [which are] different to a transport project; you've got the skills, but you haven't necessarily got the experience. You might need a bit of hand holding on that transferable skillset. And that's what we spent three years trying to do."

Project Director, Cambridgeshire County Council

4. Using district heating to serve local goals

The most significant departure from established council routines entailed decisions to build and directly control new energy provisions. The rationale for direct control was that it enabled the council to balance social and commercial objectives, avoiding 'cherry picking' by a commercial operator and shaping developments according to local priorities, including affordable heat supply. In some instances there was an ambition to recuperate skills and expertise outsourced over the last 30 years as part of local government market contracting and commissioning:

"If the local authority has got confidence about owning infrastructure or managing it, this is easier. All ours have been coming back in. The Labour administration have brought the arm's length management organisation in. Our education is being managed by a company and that was brought back in. Grounds maintenance in parks, and now the maintenance in housing, is starting to be brought back in. They've got a general objective to bring everything in. So this fits… us doing it."

Energy Services Manager, Islington Council

"It was very low risk because it's just like continuing on our services. What we wanted was someone to come and design a really efficient scheme and deliver it as an O and M contractor… So if you're looking at more utility led contractors, they're interested in a customer base and having that control… and because the structure we went for is a Camden owned scheme, we retain the control and that was a really key consideration for us because we didn't want a third party organisation coming in and telling our customers what they would be charged. We have that control, because it's our responsibility to give them the fairest deal."

Low Carbon Energy Sustainability Officer, Camden Council, Somers Town Energy

Acceptance of financial risk and responsibility often included use of a social, rather than commercial, rate of return on investment:

"There's a real desire to see that we get as much benefit out of this energy from waste plant as possible. And there's a real nice piece about deprived people in Leeds benefitting from low cost, low carbon heat generated from the rubbish that other people don't use."

Programme Officer, Leeds City Council, Leeds city centre district heating spine network (entering procurement)

"We set the system up not to run at a profit, all we wanted was to recoup the cost as a council of providing [the heat]".

Home Energy Officer, Dundee City Council, Dundee social housing district heating system

5. Current circumstances limited the scope for independent heat network business

In some instances district heating development remained under council control by default rather than by design. Although councils aimed to establish an independent business, early stage revenues proved too low. Heat network infrastructure requires relatively high initial capital investment and revenues are often built up over several years. The first few years of operation may be challenging because revenues are insufficient to cover loan payments. In addition heat networks incur relatively higher business rates than gas networks; the rateable value of heat networks is based on capital invested, while rateable value of gas grids is determined by the energy transacted. This can pose a particular problem in the early period when there is a proportionally high volume of new pipework relative to the number of customers connected.[25] In Scotland the business rates issue has been partially addressed via a (temporary) 50% rate relief for district heating.[26] Heat networks with CHP may also sell electricity to the grid at a relatively low price, causing further cash flow challenges. Higher value is derived from retail sale to local customers but this requires investment in private wire infrastructure, or a sleeving arrangement with the distribution network operator who meets the regulatory requirements on the generator's behalf.[27]

6. Delivering projects with multiple partners

Finally, independent business structures were unnecessary for demonstration and pilot initiatives which supported LA capacity building through a range of partnerships:

"The NEDO project is run by two [project managers]… everything from Japan is being overseen by Hitachi consulting. On the UK side there's the three housing associations… and the installer agent, who are actually knocking on people's houses getting people interested. And Greater Manchester Combined Authority [are managing] collectively the UK side. So there are two [project managers], ourselves and Japan and as a group we all work as a partnership."

Low Carbon Energy Innovation Officer, Greater Manchester Combined Authority, Nedo demand side response project

"It's a hands on 'dating agency'… The Members are effectively a representation of the demand side of the built environment sector and the property sector… We understand that the technology is out there and we can bring it to the market and understand how to seed and scale it… All Members expressed their desire and commitment to source new and innovative low carbon technology for the property sector… through the Hub we asked them to articulate what that meant in more concrete terms… and we worked with our consultants to turn that into a robust, systematic search and evaluation criteria [for new low carbon products and solutions]. Our consultants used that to go out to the market.... and we end up with an initial long list of 100 to 120 technologies. We then whittle that down to 12. Then systematic information on those 12 technologies goes out to the Members; they're asked to vote on their top five. The top five do a presentation at the quarterly meeting, it's a really intensive Q&A and feedback session with Members… And then the Hub helps broker the initial phases of that relationship… [because] this is about really trying to drive activity... We're trying to get a project pipeline."

Low Carbon Innovation Hub Officer, describing the 'hands on' facilitating role of the council, Haringey Council

Projects with an independent business structure

Decisions to establish an independent energy services enterprise may require considerable time and financial investment in current circumstances, because this is uncertain terrain for LAs. Setting up such a business entails new systems for serving customers, and the full cycle of business planning, O&M, management of cash flow and reserves, and 'non-standard' legal frameworks for small energy businesses which are a-typical in the UK market. Support from chief executive's office, council leader and cabinet are critical.

In our sample there were 14 independent businesses; thirteen were heat and/or power generation and supply (Figure 7). Heat was supplied via heat networks; electricity generated via CHP, solar or hydro was supplied directly to customers and/or sold to the grid. The other independent business was Bristol Energy, trading as a licensed gas and electricity supply company. Within the 14 were municipal energy services companies (ESCos), private sector ESCo/special purpose vehicles (SPV) created under a long term concession contract with a council and community run businesses for renewable electricity. In two cases the intention was to set up an independent business (Table 8). In the following sections we discuss factors shaping decisions on such business structures and provide three brief examples of the different structures and rationales behind their adoption.

Table 8. The different independent business structures used to deliver 14 energy projects

Business structure	N cases	Type of initiatives	Energy businesses
Municipal ESCo	5	District heating	Aberdeen Heat & Power
			Energetik (Enfield)
			Gateshead Energy Company
			Sutton Decentralised Energy Network
		Municipally owned licensed gas and electricity supply	Bristol Energy
Private sector ESCo/SPV* with a long term concession contract from a council	4	District heating	Birmingham District Energy Company
			Leicester District Energy Company
			Re-Generate Newcastle
Community Benefit Society/Industrial & Provident Society	4	Renewable electricity	Bath & West Community Energy
			Low Carbon Hub (Oxford)
			Plymouth Energy Community
			Swansea Community Energy
Business structure not yet established, but independent business intended	2	District heating	Bridgend Town Centre
			Manchester Civic Quarter

* This model allocates responsibility for upfront capital investment to the contractor, although an initial financial contribution may be required as part of contract terms. An ESCo/SPV is set up by a parent company as a new company ltd by shares, recovering investment from long term guaranteed energy sales to the council and potentially to other customers such as universities, hospitals and social housing tenants. The SPV structure limits financial risk to the parent company.

Municipal energy service companies

A municipal ESCo structure was adopted with the aim of long term coordination and continuity of district energy development and a defined role for the council in shaping the remit and scope. The model provides the potential to integrate district energy with other new infrastructure such as energy from waste facilities.[28] It was also Bristol City Council's preferred route for ownership of a licensed gas and electricity supply company; the longer term aim is to transfer the council's other heat and electricity projects (particularly heat networks and solar PV) to the company, creating a significant municipal energy business. Separate financial accounting creates a clear division of business responsibility for cash flows and ring fences revenues to secure their use for further energy developments. Independence from council also reduces uncertainty caused by local electoral cycles and changing political control, as well as conferring some protection from restructuring given uncertainty about the future of local government. An additional factor may be council familiarity with using subsidiary companies to deliver services (arms-length organisations for housing stock, leisure services or building management). In common with council managed district energy schemes, a municipal ESCo can accept social rates of return on investment, and there is scope for selling the business at a later date. The initiative can emerge from different council services, including housing (in Aberdeen), the Chief Exec's office and Sustainability team (in Enfield) and dedicated energy service teams (in Bristol and Gateshead). Councils may also support these projects either by entering into agreements to sell council staff time and services, or to transfer council staff to the new business, or to partner with the ESCo in social housing upgrades.

"For the heat network, you've got control of the local benefit. A lot of heat networks, if they're [a private sector led] ESCo led, they're looking for an IRR of at least 12% and they won't extend unless they can get that. Whereas the local authority can think longer term. You can make a rate of return that's affordable for the Council, whilst ensuring a fair price for resident. We're putting the customer first, making sure that the heat networks commercially wash their face but without the profits of a private-sector ESCo. We're also focussed on expanding our heat networks. Achieving scale is key for heat networks focussed on energy efficient new builds."

Sustainability Officer, Enfield Council

"Each scheme will dictate the kind of vehicle you need and how it's funded, this was the one that fitted our scheme best. The other benefit is then wrapped up in a nice package, so that if the council wanted to sell that operating company it could do so quite easily. Equally, because the council owns the assets, it's still in control whether we want to sell the assets or not… It should be that the form of the ESCo follows the function of the project it's delivering… We didn't want the ESCo to be sitting with a lot of assets on its balance sheet and so the assets remain with the council and are operated under contract with the Gateshead Energy Company… The ESCo will buy back services from the council… But maybe that will be different in a few years time as other schemes get developed."

Energy Services Officer, Gateshead Council

Private sector ESCo/special purpose vehicle (SPV), established under a long term concession contract with a council

A long term concession contract (up to 40 years) issued by a council to a commercial utility for supply of heat (and power in some cases) is usually adopted as a means to externalise financial and operational risk and responsibility; the council makes little or no direct capital investment and returns to the supplier are guaranteed by the contract and paid from council revenue budgets. It is a solution to lack of willingness or capacity to increase council borrowing and it addresses perceptions of political risk that can be associated with large scale LA financed investment. It also offers the opportunity to establish or extend district heating networks under a cost avoidance model, where the council does not spend more than under a business as usual comparison.[29] The infrastructure can be extended and new connections secured without repeat procurement. In our sample, Birmingham and Leicester councils had signed contracts with Engie to design, build, finance and operate district energy using an SPV structure; Newcastle City Council was in the final stages of selecting a preferred bidder (through competitive dialogue procurement) at the time of our data collection.

"We want to set a partnership up that will allow us over the next 40 years to… build schemes without having to keep procuring, have an influence around being able to sell the concept, bring in customers, join systems together, bring in investment, work with developers, link it to planning our one core strategy with new development… It was very much related to the ambition to have a city-wide network, not to just build one off schemes and keep procuring them with a different partner each time. It was around how we deliver ambition. We didn't want to get into a quasi-partnership with a partner who just came in and cherry picked the good scheme and sweated the assets for 20 years… We felt that a partnership was the way to do it because ultimately it would be better value for money for the city."

Energy Masterplanner, Newcastle City Council

"We commissioned feasibility studies with ARUP and in the early 2000s were ready to go and invest in the scheme ourselves… However politically it was too great a risk and it didn't proceed and it was shelved for a year or two. Then it was dug out again with a view to the fact that we wouldn't invest in it ourselves but we would try and work with the private sector

partners… in 2010 we appointed a manager to take the procurement forward to a competitive dialogue route so that we could explore what more innovate solutions there might be out there. And ultimately we ended up with the winner of the contract being Cofely [now Engie]."

Head of Energy Services, Leicester City Council

Securing a commercial partner requires commercially attractive rates of return on finance; subsequent investment to extend networks typically requires guaranteed connections to additional buildings and building owners willing to sign long terms supply contracts. In practice this can be difficult, as exemplified in our sample; it relies on willing developers and building owners and planning policies that compel connections. Contracts can also become more complex than the concession model suggests. Examples in our cases related to interconnections and new flows of heat, sale of buildings connected to networks, and the division of existing and new assets between council and contractor.

Community owned businesses for renewable electricity

In these four cases the aim was innovative use of council resources to support more inclusive and clean energy services. LAs provided access to buildings, loan (and sometime grant) funding, staff time and expertise where needed in setting up community energy businesses and/or in day-to-day management. Community Benefit Society and Industrial & Provident Society structures were used in our sample. LAs could use their 'trusted brand' identity to partner with community groups. Each party could access funding opportunities as well as making joint bids. Local political priorities favoured community ownership and stemmed from councils' history of sustainable development work as well as recent enabling powers. Supporting community energy was seen as a route to local engagement and community responsibility for assets, as well as creating opportunities for training, skills development and empowerment. This was important in the face of dwindling council resources and the need for resilient communities.

"The objectives around [Swansea Community Energy]… isn't so much that carbon is important but actually the ways we can develop a sense of enterprise and self-help in communities by helping them set up a scheme that they can run and manage and deliver. And it's more important that the business is run by local people, so they can get a sense of the idea that they can help themselves."

Sustainability Officer, City and County of Swansea discussing the rationale behind setting up Swansea Community Energy

"The initial justification for working with Bath & West Community Energy was that they were the only organisation in our area that was able to offer a community benefit; the community fund idea and that commitment to local jobs and local projects. That was where they were different from, say, any other renewable operator. That has been fundamental to the whole way of working… and there was just this real emphasis on community enablement and community investment. And that was something that was seen as obviously [needed] in light of the need to do more with less as a council and to enable communities to deliver projects that we as a council might be unable to do… That was very much the thinking, it was all part of this drive for efficiency and community empowerment."

Corporate Sustainability Officer, Bath & North East Somerset Council discussing their partnership with Bath & West Community Energy

"[The] CEO at Low Carbon Hub was one of the big people driving forward Low Carbon Oxford in the beginning… they very much had the drive, ideas and experience that related to community owned energy and how that could be scaled up. The city council are lead partner on the bid, and one of the major things we did is lead that bid and sign up to it internally. The Low Carbon Hub couldn't apply, they weren't eligible… So they had to have a local authority partner... And then the other side of it was that the things that we looked for, us and the county, to be part of the whole project beyond just the community energy side of things were domestic retrofits and in particular one deprived area in the city that we wanted to pilot things in… [in the end] we put much more of a focus on a larger pipeline of community energy projects because that model was working."

Sustainable City Officer, Oxford City Council discussing the partnership with the Low Carbon Hub social enterprise to deliver OxFutures, the council's MLEI (IEE) funded low carbon investment programme

Early stage business planning and development

In two cases, teams with heat networks in development (one at feasibility stage and one in procurement) intended to establish independent businesses. Several factors informed discussion about an ESCo structure including: types and number of customers to be connected; the role of public sector ownership and control in district energy development; and new opportunities for councils to invest directly in schemes in order to secure new revenues. In the cases examined, a non-profit municipal model was preferred over a commercial model for residential customers, because this was perceived as providing a socially responsible and fairer deal. For non-domestic customers there were uncertainties

about the number of public buildings to be connected to the network – a factor in favour of a council controlled scheme; in contrast, the requirements of heat supply agreements and supply guarantees to buildings such as hospitals were perceived as reasons for using a commercial ESCo/SPV.

"It's a big step… to an actual role in an ESCo … [But] we wouldn't just want to hand it over to the private sector either…. If we'll be doing a joint venture it's a case of what kind of joint venture we want... because each one has risks attached to it, but also benefits and we want to be certain that we go in there and we know fully everything about those options."

Sustainable Development Officer, Bridgend County Borough Council, Bridgend town centre heat network (at feasibility stage)

"A lot of the GM local authorities are actually cash rich, but it's about converting that cash into new streams. It's difficult to spend it on people; you have to spend it on stuff. So it fits… and strategically it's mostly council controlled buildings. Why wouldn't the council want to take a key stake in that? There has to be a mechanism that if somewhere down the line the council wants to sell it as an asset they can do that... It's just always been a way of using public money to generate revenues."

Low Carbon Project Delivery Unit Officer, Greater Manchester Combined Authority (for Manchester City Council), Manchester City Centre heat network (entering procurement)

Case example of Municipal ESCo: Aberdeen Heat and Power

"We take on fuel poverty, we're reducing carbon significantly and the buildings are getting more energy efficient at the same time… Aberdeen Heat and Power also have the plan to do the city centre… and that's key for the long term future."

Housing Officer, Aberdeen City Council discussing the relationship with Aberdeen Heat and Power and extension of the network to the city centre.

Aberdeen Council's 1999 Fuel Poverty Strategy was the main motivation for developing district heating. Aberdeen City Council established Aberdeen Heat and Power Ltd (AHP) in 2002 as a non-profit ESCo to deliver affordable heat to residents 'for the benefit of the citizens of Aberdeen'. AHP owns and operates gas-fired CHP and district heating networks centred on clusters of multi-storey tower blocks (around 2,400 flats and 15 public buildings). The council buys heating and hot water from AHP, and supplies it to housing tenants under a heat with rent contract at a fixed weekly price using a non-profit heat tariff (currently £10.54 for a 2-bed flat). Project management, operations and maintenance functions are transferred to AHP. The council has representation on the AHP board and step-in rights should the company fail. AHP income is ring-fenced for system maintenance and replacement costs, as well as further district energy development, and to ensure the continuing affordability of heat for tenants.

AHP's district heating and CHP systems have been financed by a combination of central government grant, council Housing Capital Programme funds, ECO funding and loans from Scottish Government and the Co-op Bank (with Aberdeen City Council as guarantor).[30] For example the 2011 extension of the Seaton heat network connected an additional eight multi-storey blocks (740 flats) to the network and increased the capacity of the energy centre to 7 MW heat and 2 MW electricity capacity. Capital expenditure of around £4.2 million came from the council housing budget and ECO (at the time Community Energy Saving Programme, CESP); the small number of private homeowners in the multi-storey blocks also made a contribution.

Aberdeen Heat and Power have continued to extend their district energy business, and in 2013 established District Energy Aberdeen Ltd, a subsidiary company for heat supply to the commercial sector.

Case example of Private sector led ESCo/ SPV with long term concession contract: Leicester District Energy Company

"They [Engie] had a tried and tested very traditional model that they knew worked, they knew it gave them the returns that they wanted and it would achieve what we wanted from the carbon emission reductions. And it is doing that, it does what it says on the tin."

Head of Energy Services, Leicester City Council

In the mid-2000s Leicester City Council commenced planning for expansion of district heating established in the 1980s to supply heat to social housing. In 2010 the Council entered a 25-year concession contract with Cofely Ltd (now Engie) to create Leicester District Energy Company Ltd (LDEC). The existing heat generation assets were transferred to LDEC who own, operate and maintain the new gas CHP and heat networks; services have been extended into the city centre connecting 30 council buildings and the University of Leicester campus; older island networks serving around 3,000 social housing tenants have been upgraded. The council retained ownership of some of the pipework assets and equipment inside the buildings already connected to the network and is responsible for collecting heat payments. Due to sale of some buildings, the council also became the heat supplier to new customers taking over those buildings.

The concession contract has allowed the council to meet its objectives of carbon reduction, network renewal and extension into the city centre at no upfront capital cost. Engie invested around £14 million; an additional £1 million was secured from Engie's parent company GDF Suez, which allowed GDF Suez to meet its energy efficiency obligations under the ECO scheme. Extending the network beyond the initial council buildings and university campus has however been more difficult, because of Engie's required level of

commercial returns, and the necessity for guaranteed customer connections. Nevertheless new city centre student accommodation (550 flats) was connected in 2016.

Case example of community owned business: Plymouth Energy Community

"The council has been supportive in terms of providing host sites and financial support through loans… that's helped to create confidence in the organisation. Now there's the confidence that the organisation has achieved some stuff on the ground, and is trusted… Because it's got a track record it goes from strength to strength."

Low Carbon City Officer, Plymouth City Council

In 2012, the Plymouth Labour Party manifesto included a cooperative council model for delivering local benefits; this was subsequently integrated into the council's corporate plan. Plymouth Energy Community (PEC) was registered in 2013 as a community benefit society. In 2014 PEC Renewables Ltd, a second community benefit society was set up for electricity generation. In 2016, PEC partnered with Four Greens Community Trust to build a solar farm on derelict land, providing an income to the Trust. In addition to renewable electricity, PEC offers an energy advice service. The council acted as a strategic partner to PEC, providing loans and a start-up grant, which were combined with member share offers and other grant funding; a service level agreement buys Council officer time for day-to-day management. The Council is recognised as a trusted local partner supporting PEC growth, and enabling a more inclusive model of clean energy services for council, citizens and investors.

Summary of business structures for Local Authority energy initiatives

The case studies illustrate some of the diverse UK local authority energy developments, in a context where councils have had little direct involvement in energy systems since the early 20th century. The navigation of multiple uncertainties (see Section 6) encountered in project development and implementation requires improvisation within LAs, and across the evolving networks of partners and contractors. The resulting projects have varied motivations and objectives, which emerge from their different location in directorates spanning environment, economic development, finance, corporate management, communities, housing and planning. Their business structure, timescale, financing and eventual substance is contingent on what can be assembled from locally available resources, know how, procurement frameworks and organisational structures, and coincidences of, often short-term, financial opportunities, combined with professionally committed officials and politicians.

We compared projects directly managed by the LA with projects established as independent businesses. Decision-making is multi-dimensional; the diversity of structures used to serve similar goals indicates that there is no deterministic relationship between objectives, technologies and business structures, and indicates that structures can be adapted to suit changing local requirements, circumstances and expertise. This can be variously interpreted as local flexibility and as a reflection of the challenges of embedding energy provisions in council structures governed largely by statutory duties and central government financial control.

A common feature of directly managed projects was their potential for relatively easy integration into existing council structures, management processes and cross-sector networks, sometimes combined with a funding opportunity. Building retrofit and energy management for example are integral to corporate or housing services, and new projects can be introduced without major innovation. Cross-council coordination of projects, including solar thermal, solar PV, or single building CHP systems can be largely managed through established routines. Developing and operating heat networks, whether in-house or independent, is more demanding, because this is new business, often serving external customers, and requiring potentially complex procurement, construction, cash flow, legal, financial and service dimensions, and sale of electricity if CHP is used. Heat network business may nonetheless benefit from the opportunity to adapt structures in place from older community heating for social housing, such as billing and processing payments for heat with rent. The community owned businesses in our sample had relied on working in partnership with councils, gaining access to council buildings and funding opportunities.

Although the range of business structures is testament to the enterprise of council project teams, dependence on fortuitous circumstances and alignment with existing management processes is limited as a route to larger scale energy investments, which entail significant new responsibilities, borrowing and risk. It also seems a high cost, unpredictable and piecemeal pathway to LA energy development, rather than a reliable route to institutionalising forms of municipal provision. Experience from the UK Government HNIP pilot funding round also suggests that for heat networks greater capacity is needed at the project development stage to support more extensive investigation of options, including commercial structures, low carbon heat sources, and future proofing. Our sample demonstrates that some councils are testing out different commercial structures, through independent municipal enterprises and in partnership with commercial energy utilities and community groups, but much greater LA capacity and resources will be needed if municipal energy is to be a significant component of a clean energy system.

6. Navigating the Uncertainties of Energy Development at Local Scale: Local Government Solutions and Strategies

This section discusses what we can learn from the research about potential to routinise, accelerate and scale up the contribution of LAs to a low carbon, low energy system. We focus on uncertainties arising from the current governance and economic context, notably the lack of core funding for LA energy teams, the resulting low priority of energy compared to core services, and the specific further impacts of austerity. Our cases exemplify locally-devised solutions which in turn provide exemplars for replicable development and institution building. We use the concept of 'navigation' to represent problem-solving processes rather than 'pathway', because it captures the qualities of discovery which characterise current LA energy developments; it means 'finding a way' and includes identifying where alternatives ways might lead. In Section 7 we combine these solutions with findings from previous sections to propose key areas for further action by LAs and by central and devolved national governments.

Problem 1: Lack of core funding for Local Authority energy teams

"The first thing [Councillors] think is, 'Right, let's go 100% renewable' and from our current baseline that's a massive ten year project which will require huge amounts of projects and a whole new staff team. There's no understanding of what that change would be like."[31]

Council Officer, Metropolitan District Council A

Local authorities have no formal responsibilities for energy services and therefore no dedicated budgets, although general powers of advancing well being, permitted activities relating to energy and a track record of improvements to the energy efficiency of buildings provide a starting point. Energy projects are often a niche activity within a larger service area, and workload pressures tend to result in a lack of senior management contribution and limited capacity to develop necessary cross-service project teams.

Formally we've got a sustainability delivery group… but it's not sufficiently high on senior managements' radar … what I really need is a better route into senior management."

Council Officer, Metropolitan District Council B

In this difficult context, LAs have devised a series of routes to integrate energy into local priorities and objectives, and hence assemble some of the necessary resources. Our case studies suggest five interconnected solutions to this structural problem, all of which ultimately centre on making *energy* a prominent part of business plans, revenues and service provisions across the council; this is done at different scales and through different means, customised to local priorities and opportunities. All of the solutions have 'pitfalls' or risks, because of uncertainties over the status of work on energy, but they also represent evidence of the resourcefulness of local officials and politicians.

Solution 1: Making energy prominent in local strategy, future vision and investment

Vision statements for clean, affordable energy and public recognition strategies such as Bristol's 2015 European Green Capital award, make energy prominent in council business and create a degree of commitment to innovation. Public statements and associated pledges in turn open up access to political and economic networks which can be critical to progress. In Bristol for example, the energy services manager attributed the initial momentum for Bristol Energy to the connections to European expertise opened up by the Green Capital award.

Such vision statements are however ultimately insufficient unless they are translated into an investment plan, which is material to decision making. Enfield's sustainability programme *Enfield 2020* integrates energy into a capital investment programme mainly financed through PWLB. An £80 million European Investment Bank (EIB) loan was also secured for strategic infrastructure projects in Enfield including energetik. As a result LA energy provision is normalised as part of the 'day job' of the council. Similarly in Gateshead the development of Gateshead District Energy was integral to the capital investment programme.

"If you haven't got the appetite for investing you won't be able to generate the incomes you need from these schemes and then you'll always be looking for private investors or partners, in which case the return drops right off. We've not found many schemes that have better returns being funded by private finance… our capital programme with the council is now down to about £60 million a year… but within that a good £30 million plus is on energy schemes… But you need to make that kind of investment to start generating incomes from these schemes. And actually we've found that the scale of investment is large to generate modest incomes. But we do it because there are many other spin off benefits to that as well, for example, regeneration, growth and business rates and council tax income and supporting developers coming in."

Energy Services Manager, Gateshead Council

Solution 2: Locating energy as a responsibility of the Chief Executive's Office and Council Executive

Senior management and cabinet accountability for energy are significant routes to institutionalising action on energy and CO2 emissions, at least with respect to the council's own estate. Solutions included locating the energy and sustainability team in corporate strategy and performance, such as in Bath & North East Somerset, and the articulation of clear links between energy activities and Corporate Plan objectives, as in Wolverhampton.

"Our Sustainability team sits in the Strategy and Performance division, the corporate centre of energy and performance."

Corporate Sustainability Officer, Bath & North East Somerset Council

"The Corporate Plan is the driver for the council, so it's important to be able to link into that, to be able to say, 'Look, it's referenced in here, this is where we're supported'."

Sustainability Officer, Wolverhampton City Council

Where senior level buy-in was absent officers identified the need for greater accountability and suggested making corporate energy bills a routine reporting matter to the chief executive's office and to cabinet, providing a focus for corporate energy and cost saving.

"There's a bill of about £10-12 million pounds per annum and somebody should have responsibility for that… at chief exec level … That would be a massive driver because suddenly the chief exec's asking about why the bill is going up, or not going down... You could then align that with an elected member that has responsibility. And between the two they'd … make a real difference."

Council Officer, Scottish Authority A

Introducing a requirement to reduce greenhouse gas emissions into employment contracts of corporate services' and estates' staff and integrating this into performance reviews would further strengthen accountability:

"A CO2 target's … only [helpful] if it's got teeth… and makes the politicians and CEOs accountable. [It's got to be] something that gets recorded at cabinet level, not just stuck in an energy report… Would that ever appear in a chief exec's contract to reduce the CO2 emissions… wouldn't it be neat if that was enshrined in public sector contracts."

Intermediary Agency

Solution 3: Securing political leadership and cross party support

Elected members' political commitment is a critical complement to that of senior management, bringing specific pressures for action and mobilisation of resources. In Leicester for example, the commitment to clean energy was furthered by dedicating an assistant city mayor post to energy and sustainability.

"When the mayor was re-elected… they created a new assistant mayor for energy and sustainability. So that gave our area quite a priority focus within the council."

Head of Energy Services, Leicester City Council

Councillors' expertise in areas such as public finance, energy industries or investment has also been instrumental in supporting an ambitious LA energy strategy: the proposal for Aberdeen's municipal energy company, Aberdeen Heat and Power Ltd, was advanced by a deputy leader from the oil and gas sector, who set aside counter-advice from the legal team at the executive decision stage; Warrington benefited from an executive member with a background in LA finance who understood investment planning and risk management.

If commitment is solely from one political party the energy strategy risks being derailed with each electoral cycle. Hence securing long term cross-party support in cities such as Aberdeen and Bristol has been a significant source of stability and route to institutionalisation of their energy programmes:

"We have cross party support for the energy company and the energy investment programme… everyone signed a letter when we started the whole process in 2010 saying, 'We're going to support this in the longer term.'… What's key is political stability … establishing it into something we just do around here… And it's become part of the DNA of an organisation. That's very important… and one of the things that has been key to our success."

Energy Manager, Bristol City Council

Solution 4: Pragmatic starting points and "Easy Wins"

When constrained resources and limited expertise limit ambition, 'easy gains' and bounded projects are a common route to making energy more prominent in council business. Success in small schemes is a means to gaining 'hands-on' experience and knowledge about other energy opportunities and confidence to proceed. The pragmatic solutions exemplified in our cases included starting with projects that were smaller scale, had short term payback and delivered multiple benefits.

Most councils in the sample for example had a form of 'spend-to-save' energy efficiency investment fund for shorter term investments, with payback of 5-7 years, either investing their own capital (from council budgets or prudential borrowing), or using finance routes such as Salix interest free loans.

"Beyond seven years we don't even consider it. It's too long a payback period in the current climate. There's still a lot of projects [paying back in] under five years, and five to seven… within our own estates that we need to chew our way through those before we say, 'Well, we've got nothing left'".

Council Officer, discussing energy improvements to corporate estate with short payback terms, Unitary Council C

Cambridge City Council created a £1 million revolving Climate Change Fund for carbon reduction projects on the corporate estate, initially focussing on smaller projects; over time they began to include energy saving projects with payback periods in excess of 10 years. The smaller projects were perceived to be achievable with limited in-house expertise, at least in initial stages:

"There is a lot of commitment from officers to identify projects, but sometimes it's being realistic about the capacity to then drive them forward… With a project like district heating… we hadn't done anything like that before so it was quite far out of our comfort zone, whereas these smaller projects are just a little bit easier to handle."

Sustainability Officer, Cambridge City Council

The 'spend to save' model was used creatively to show the all round social and economic benefits to the locality:

"When we were making the case for retrofitting… we've used the multiplier effect… every pound spent on retrofitting generates X amount for the community... Just the amount of money that's leaving our local economy for energy bills… is very compelling."

Corporate Sustainability Officer, Bath & North East Somerset

It was also extended to fund additional temporary posts from revenue savings identified in specific services. For example, Bath & North East Somerset Council created a schools' energy officer on the basis of projected cost savings for the education budget.

Smaller scale projects usually exclude deep retrofit measures and tend to focus solely on the corporate estate, with limited impact on the geographical area. Financial circumstances also result in exclusion of some council buildings from consideration, because of their uncertain future, which reduces the potential for even these more straightforward projects:

"Another problem that we had getting the RE:FIT framework out of the door was the selection of the building. Although we've got hundreds, notionally they're all up for sale as we're in such a financial predicament… We had to be really clear about the choice of [x buildings for the first phase]."

Council Officer, discussing council estate energy performance, Welsh Authority A

The necessity for a short-term payback period in such projects was also recognised as an obstacle to more ambitious infrastructure investments, such as district heating, where short-termism was perceived as leading to false economies:

"We need to open up the discussion about long-term paybacks. The interesting thing [when I asked the energy consultants working for us], 'What is the energy price for district heat for that model over a 40 year and a 10 year payback?', [is that a] 40 year payback is two pence a unit, 10 year payback, eight pence a unit… District energy has a short early risk period and a very stable future period."

Council Officer, discussing the need to commit to longer payback period, Scottish Authority B

Solution 5: Capacity Building – from public sector networks to community and commercial partnerships

LA networks including APSE Energy and the Vanguards Network[32] were examples of officers sharing solutions: *"exactly the thing that gives you the confidence"* (Special Projects Manager, Warrington Borough Council), and were perceived as particularly valuable for those working alone or in small teams.

Interacting with other LAs was particularly valued at early stages of development where alternative business structures and risk allocation models needed to be investigated. Examples included Hull's development of energy performance contracting, and Bridgend's comparison of ownership structures for district heating:

"We went and saw Leeds to get a better understanding of how it works in Leeds, how you write the contract, how you do the guarantee… what are the challenges… That information enabled us to write a report for the authority… it gives us something we haven't got."

Environment & Climate Change Strategy Officer, Hull City Council

"We're going to set up some visits … to look at different authorities, some where it's public sector led, some where it's private sector led and some where it's a joint venture. So we can understand from the ones that went the public sector route, why they choose that route. And how they dealt with risk. Why was it the best option for them? And similarly with the joint venture and the private sector led models."

Sustainable Development Officer, Bridgend Council

A further step along this route is to collaborate with other organisations to deliver projects.

One model is the development of a local energy tariff through 'White Labelling' with an existing retail energy company for gas and electricity supply. This was a simpler solution than setting up a fully licensed gas and electricity supply company, and allowed the council to focus on local target groups rather than on supply across the GB market.[33] Examples from our sample of LAs include Leeds' White Rose tariff in partnership with Robin Hood Energy (owned by Nottingham City Council); and Peterborough Energy, partnered with OVO Energy.

Professional networks, and alliances such as white labelling schemes, do not of course resolve resourcing issues. As discussed in Section 5 councils developed various partnerships to assist in financing energy provision. Smaller scale projects, notably solar PV, were viable with community investors, and the Community Benefit Society and Industrial and Provident Society structures. This funding model is at an early stage in the UK energy sector and has been made more challenging by reductions in tax relief and subsidies. Under the ECO, funding from large commercial utilities for district heating and social housing renovation was significant, as for example in Aberdeen, Dundee and Leicester. ECO funding has however now been reduced in scale.

Problem 2: Austerity in public finances and the scope for Local Authority energy provision

Austerity in public finances, and resulting decreases in local government budgets and transformation in services, caused three specific problems for LA energy development. The first was restructuring and redundancies in energy and sustainability teams. Although there were instances of core funding for energy teams in our sample (for example in Camden & Islington), in many cases other alternatives were being devised. Energy teams were lower priority than statutory services and vulnerable to cost saving, even when embedded in core services:

"In this era of budget cuts we have to be extraordinarily creative in finding solutions… 'What do I cut? Do I cut another social care worker? Or do I cut the sustainability team?' At the moment the option is to cut the sustainability team."

Council Officer, Unitary Council A

Lack of cohesion and difficulties in coordination of projects across council were intensified, exacerbating existing 'silo' working *"when everyone is fighting for their very survival or not wanting to be outsourced"* (Council Officer, London Borough A).

The second problem related to limited resources in corporate council legal, financial, procurement and technical engineering services, which delayed development. Delays undermine the credibility of LAs with other organisations and present coordination challenges for both LA and multi-organisation initiatives. This is particularly challenging for projects with external customers, like some heat network projects, where delays may result in a prospective customer pursuing an independent heat solution. Overall limited expertise in procurement and contract management for *energy* infrastructure and services also exacerbated the problem.

"[Our energy officer] luckily has commercial experience … because they're having to negotiate and have discussions with sharp commercial entities. But when you go back to the ranch and can't even get a simple contract done, it makes you look stupid and feel stupid, but also, it's undermining the local authority's credibility when you're trying to position yourselves as a serious player and contender and mobiliser of the market."

Council Officer, London Borough B

Lack of procurement and engineering support results in small energy teams continuously using external professional and consultancy services with high transaction costs:

"It's been a huge programme and there's only two of us… and because of cut backs within local authority we lost key services that've made our job more difficult.

We've got no engineering department here at the moment and no large procurement department, so we'll have to go out and use external services."

Council Officer, District Borough A

The third problem related to dwindling financial resources for investment in infrastructure and buildings as a result of immediate cost saving and limits to council borrowing.

"Well there's no doubt we couldn't do any of these energy projects if we couldn't have access to PWLB borrowing. If you've got an authority which is constitutionally opposed to borrowing, which some of them are, just forget it."

Council Officer, Unitary Council D

Dwindling capital budgets made it increasingly difficult for councils to consider the integral longer term social, health and economic value of clean energy investments for the locality, as well as their contribution to climate protection; financial parameters were the dominant criteria in decisions to proceed:

"All decisions nowadays are much more heavily weighted towards the economic and commercial case."

Council Officer, Metropolitan District Council E discussing a heat network project

Again the case studies demonstrated varying strategies devised to navigate the different impacts of the structural problem of austerity; five solutions are summarised below.

Solution 1: Self-financing energy teams

Self-financing teams, primarily using competitive UK and European grant funding, were one route to enabling advances in LA energy provision. The Cardiff team for example was funded by Innovate UK and EU sources,[34] and since 2016 the Derby energy and climate change team has worked primarily with the local university using ERDF to support development of an SME low carbon supply chain. At least in the early years, before significant energy revenues are available, teams tend to be dependent on continuing success in external funding bids. This shapes the projects pursued, and results in a short term focuses on project by project development, rather than implementation of a locally-devised strategy:

"It's very hard to spare time for strategy … we did an annual report to the council which looks at … the bigger picture of what are we trying to achieve through the series of projects… but we're not going to be dedicating lots and lots of time to developing new strategies."

Council Officer, Metropolitan District Council D

"When funding is made available, thinking of the ERDF funding at the moment, everything is based on innovation and near to market solutions … We need to do traditional tried and tested stuff, just for the emissions and consumptions of our buildings. It's those traditional type of solutions that we know work, and these funding schemes don't help. We have a large number of solid wall properties in this city that will be very expensive to deal with, they'll be hard to treat. Private home owners and large social landlords have not got the capital to invest in the measures that are required on those buildings. Because it's not innovative we can't attract money from elsewhere either."

Council Officer, Unitary Council E

In some cases, a 'spend to generate' model produced revenues or savings capable of supporting teams of 8-10 officers. In Gateshead for example, the energy services team operates within a council trading unit with staff costs covered through energy project revenues. Arms length commercial organisations, such as Resource Efficient Solutions in Fife and Opportunity Sutton, were also established by councils.

An experienced local energy practitioner suggested that an effective strategy for establishing a self financing team is the development of a programme of energy projects which either save money or generate income; the monthly or annual amounts contributed to the bottom line can then be profiled across the payback period and beyond. This financial calculation provides the initial rationale for setting up an interim energy team. For instance an authority delivering three *ad hoc* projects, each signed off individually, may have seven more projects on file. If income and/or savings from a programme of 10 projects was instead combined in a single package, this could be used to demonstrate that a dedicated team would create higher efficiency, pace and scale, and increased incomes.

Solution 2: Integrating energy services into finance and capital investment programmes

In these cases the critical innovation was that energy services were constituted as part of 'capital projects' and positioned as a new revenue source. This provided a route to longer term investment appraisal and potential for acceptance of lower rates of return. Involvement of senior finance specialists with energy officers created a more productive working relationship supporting project delivery.

In Enfield for example over £1bn is being invested in over 50 large scale sustainability projects. Many of these projects had a direct energy focus with around £60 million committed to low carbon energy, mostly financed through PWLB and an EIB loan (with some additional loan, grant and ECO funding); in Gateshead the council had a £60 million capital programme, the largest component of which was for energy at about £30 million.

In Warrington the value of energy projects was defined in relation to long term revenue streams for essential services like care workers. The council initially used prudential borrowing which provided low interest finance to invest. Financial expertise and commitment from a new Finance Director were critical:

"It changed when [the new Finance Director] came in. His view on the way the capital programme should be financed changed completely. At the same time the public loan interest rates fell. We got a Labour controlled authority. And so it was like a perfect storm of everything positive that we could possibly do."

Capital Accountant, Warrington Borough Council

In addition to a £5m solar programme, capital projects included a £25m LED street lighting replacement; borrowing was structured according to the payback periods of different aspects of the latter investment (i.e. bulbs, cabling and columns) and debt repayments are met from energy savings and reduced maintenance costs.

The result was a sea change in the perception of energy initiatives from niche activities that were "*nice to have*" to "*mainstream… propping up our day-to-day services*". An investment accountant is funded through the capital projects programme and located in corporate finance. In 2015, the council secured a credit rating from Moody's and a £150 million CPI linked capital investment bond from the City of London, prioritising town centre regeneration and green energy investment.

"Our ambition as an authority is to be self funded. And using the income from the likes of solar projects, or green energy projects, is a significant part of that vision to become a self-funded authority."

Capital Accountant, Warrington Borough Council

In Peterborough, the energy team was situated within the finance department, and the finance director was responsible for translating energy projects into income or saving opportunities. There was also commitment to pursue projects which would benefit local people, such as collective energy switching schemes, even if these did not provide direct financial savings for the LA. Structuring energy projects as a task for finance meant they had a high profile and priority and a senior 'problem owner':

"Within the broad remit of 'make us money' I came up with a strategy which was really around generation, but also efficiency… Peterborough is a massively growing city, and so we wanted to use it for enabling regeneration… and to get financial benefits out of it that actually cost the council little, but have massive benefit in the community… And what you find with energy is firstly it's not an item for the Director's table… But because I'm an FD, people actually listen to me."

Finance Director, Peterborough City Council

Situating energy services as new revenues had considerable advantages in creating forward momentum, but is also a financial liability, where the focus on clean energy per se and its wider social welfare and climate protection purposes could become submerged.

Solution 3: Project or Programme Delivery Units – developing in-house technical capacity for a programme of low carbon energy investment

Making clean, affordable energy a core part of LA action can be achieved through creation of a Programme or Project Delivery Unit (PDU). These Units were integral to the EU EIB Elena and IEE MLEI funding structures, which also included budgets for finance, legal and technical consultancy (in our sample Bristol City, Cambridgeshire County, Greater Manchester Combined Authority, and Oxford City). The PDU is a means to create LA expertise and capacity through new appointments, usually for three years in the first instance, and hence to deliver investment in low carbon energy and further jobs. The terms of the grant require the LA to set an ambitious energy investment target, which disciplines decision-making.

"We had a target to deliver. And not delivering against that target was going to have either reputational damage or we'd have to give some money back. Nobody wanted to give any money back. So there was a huge benefit of going into contract on the Project, because it gave some form of focus to everybody, corporately."

Project Director, discussing the value of the MLEI funding programme, Cambridgeshire County Council

In the longer term, salaries are paid from revenues or savings from energy investments. The programme structures thus address the immediate capacity issues and provide a route to institutionalising skills and expertise in the long term:

"[The Elena programme] was really there to help LAs to establish large-scale energy efficiency and energy programmes… without the extra funding we would have never been able to move forward with it."

Energy Manager, discussing the value of the Elena funding programme, Bristol City Council

A PDU was a means to longer term learning and greater confidence in accepting responsibility for longer term paybacks and managing risk. In Cambridgeshire, the energy investment unit was funded by an IEE MLEI grant; a budget for financial support enabled development of the LA Investment Fund for energy performance contracting (see section 5). Some finance and legal expertise was drawn from the council's in-house service; additional support was accessed through Local Partnerships via the Refit framework being used:

"[Our accountant] helped me pull together committee reports when we were going to the finance and resources committee. Really I've been almost an apprentice on that, which has been fantastic learning journey, and they helped shape some of the risk that the councillors were going to take… We also had a lawyer who was very precise… very good at identifying where things could trip you up in terms of procurement… They would

provide what you would have as a standard template, and then we'd need to supplement what needed to go in through collaboration and discussion."

Project Director, Cambridgeshire County Council

In Leeds City Council, the Projects, Programmes and Procurement Unit (PPPU) combines financial, procurement and legal expertise with project delivery specialists. This has resulted in greater internal collaboration:

"The structure of the PPPU team means that there are project accountants and solicitors who are used to dealing with large PFI style projects. They've been able to help with the financial modelling, contractual issues and risk mitigation. We've also worked closely with people in our corporate finance team … to help build the business case in the right sort of way to secure prudential borrowing. They've been surprisingly relaxed, even when we highlighted all the risks and they've been very able to help us to get the paper to the Executive Board to get the borrowing approved."

Programme Officer, discussing the structure of the unit and how this has supported development of the city centre heat network, Leeds City Council

Like the Elena and MLEI programmes, the Unit in Leeds aims to develop expertise for investment in city scale low carbon infrastructure, positioning this as a priority. It draws on the transferable expertise of finance and legal officers accustomed to managing other large scale projects, particularly under the private finance initiative, as well as linking this with expertise elsewhere in the council.

Solution 4: Using intermediary organisations for energy performance and heat network development

Intermediary organisations can support project development and help to overcome stresses of restructuring, staff turnover and institutional memory loss. Absence of council technical, financial and legal expertise in energy systems design and development, and limited practical experience of energy services in recent LA history, makes specialist engineering and business consultancy critical to assessment of the full range of options: energy sources, technical solutions, performance standards, future proofing and financial, contractual and commercial structures. In our sample intermediary organisations were significant in LA energy performance contracting and heat network development. Intermediaries addressed 'translation issues' when consultancy reports were not understood by council:

"The Council could be saving £2million… They got a report… that identifies the asset savings, and they still haven't managed to implement it yet… They've had various people come and go in positions of management, so nothing's ever far through [in development]. They have a risk averse finance team because people haven't understood the opportunity. No one has translated the report into something that finance can understand."

Intermediary Agency

The Energy Performance Contacting model (see p25) was a significant intermediary for a number of case study councils and solved problems of resourcing and capacity in two main ways. First a consultancy service was provided by the framework manager, including Local Partnerships in England and Wales, Turner & Townsend in London for the GLA and Carbon Trust/Mott MacDonald in Scotland. LAs accessed assistance ranging from 'end-to-end' support to specific aspects of technical specification, business case, legal and procurement processes or delivery of the project. Case studies, benchmarking and cost information were also available. Depending on geographical location, consultancy support was either grant funded or required a small fee. Intermediaries were instrumental in mitigating problems over initial outlay, as well as reducing procurement timelines and costs. Frameworks are OJEU compliant and appointment of the contractor is through a 'mini-competition' of pre-approved suppliers, with quality assessment already in place.

"So Council X is … both really poor on resources and a LA that needs support. The energy managers have identified… £600,000 worth of savings from their street lighting… but the street lighting team has been decimated, there's only one person left in post, they're trying to deliver a day job and can't get their heads round how to be strategic about the asset. So you nibble at that conversation and then the next thing [is for the LA support agency to] identify the asset base, the age of the column of lights that are in there at the moment, the payback period… the guarantees or the warranties that you might expect … We can do that free of charge for them. And you still get stuck because the street lighting person doesn't feel they can leave their day job. And then along comes interest free money from … government that can make it happen. And still they're not listening because they're in their day job, so at that point you go up to the Director. And it's us, because we can do that. The energy officer just sort of grinds away at their desk, thinking, 'I daren't pick up the phone to Chief Exec."

Intermediary Agency

The energy services contractor in turn brought experience and expertise gained from work to improve the energy performance of buildings across multiple public sector estates, and provided new monitoring and verification data.

"Their level of experience was what really convinced us… it brings a level of the technical experience that we may not have in house, or if we do have it in house, they're already at capacity."

Sustainability Officer, (working with the county council's energy performance contracting programme), Cambridge City Council

Intermediary support for heat networks was also significant. Our sample of cases, together with experience from the UK Government Heat Network Investment Project pilot funding round, show the need for LA expertise in contract negotiations and professionalisation of the supply chain. Heat network development requires a skilled and knowledgeable buyer as well as high standards of expertise in a competitive supplier market:

"One of the surprising things that I found in terms of the bidders' own knowledge and approach to pricing is they'll just try and develop a cost to see what they can get away with. And when you ask them to benchmark against other buildings, they don't have that level of detail."

Council Officer, Metropolitan District Council C

"[We need] a bigger element of in-house supervision of the technical aspects. Because it was a design and build, there was no scrutiny of the initial plans and how the work was going to be done. I mean, when you award a design and build you assume the people who are providing it for you know what they're doing… evidence now shows that that was a bit of naïve assumption."

Council Officer, Scottish Authority C

The UK Government Heat Networks Delivery Unit (England and Wales) and Heat Network Partnership in Scotland provide expertise from early stages of project development to feasibility analysis, business planning and procurement. These intermediary organisations build increasing expertise through insights from multiple projects, reducing the risks and costs of project development and sharing lessons across the sector.

A proven model for improving technical capacity for municipal energy contracting, improving the quality of the resulting systems and bringing costs down, is the use of a specialist shared procurement agency:

"One of the other key elements is making a… competent negotiating partner … addressing these skills that councils don't have. Many have really good projects they want to develop… if we can take away a lot of the risk involved in procurement or contract negotiations … then that's probably a big selling point for LAs."

Low Carbon Project Delivery Unit Officer, discussing the potential value of the proposed District Energy Procurement Agency, GMCA

Different procurement models are under discussion currently. An initial proposal was a UK District Energy Procurement Agency (DEPA), hosted at Greater Manchester Combined Authority. The agency would be a non-profit mutual enterprise owned by its LA and other public sector members; it would act as an expert buyer, specifying detailed system requirements, and contracting. A further proposal is for provision at UK Government level through the Crown Commercial Service which would provide a central service for energy infrastructure development from design to operation.[35]

Solution 5: Pooled resources in Combined Authorities for low carbon investment

Combined authority structures such as Greater Manchester and West Yorkshire have invested in centralised resource and expertise, with the aim of reliable, cost effective development of a pipeline of low carbon infrastructure projects, particularly heat networks and street lighting.

In Greater Manchester, the PDU model was supported by Elena programme funding and used to develop a pipeline of potential heat networks across the region. The Unit built on earlier area-based energy planning and heat mapping; Low Carbon Pioneer Cities funding had supported full business case and development plans for three heat networks in Oldham, Stockport, and Manchester's Civic Quarter. Expertise was combined to achieve greater impact at GM scale.[36] Complementing the *delivery* focus on of the PDU, the Low Carbon Hub Innovation Team focussed on demonstration, pilot and experimentation opportunities; these included an energy efficiency and demand management demonstration (see p23); partnership with the ETI Smart Systems and Heat programme, and integration of energy and low carbon opportunities into the Greater Manchester long-term strategic vision.

"With [the Civic Quarter heat network], if our team didn't exist it just wouldn't happen. Just because of the resource and the capacity issues across the authority… And the Civic Quarter is so important because it's a path finder for the region and… once you get one project completed, you can tangibly demonstrate that it can be done, [and share learning about] how it has been done."

Low Carbon Project Delivery Unit Officer, GMCA

The West Yorkshire Combined Authority (WYCA) Infrastructure and Investment team interacts with the Leeds Enterprise Partnership Green Economy group to support low carbon investment in the region. WYCA officers assisted LA members in applications for financial support, and aimed for a consistent approach to planning policy and heat mapping. Multiple LAs could thus gain economies of scale from sharing a single piece of work such as analysis of area-based heat network economics.

"We do have a good perspective from different sort of sectors and organisation sizes on that [Green Economy] group. They work well together, all clued up… you can go to that group and they know immediately… what the value in that project actually is… I think the insight that they provide to projects is invaluable because they're working in the private sector."

Infrastructure & Investment Projects Officer, discussing the value of the LEP structure and relationships between private and public sector, (West Yorkshire Combined Authority for Leeds Enterprise Partnership)

In conclusion

The diverse solutions to current structural problems faced by LAs with ambitions to act on clean energy demonstrate resourcefulness and enterprise in assembling capacities and finances from the materials at hand. There is evidence of ambitions to rebuild technical skills; longer term capital investment strategies are positioning energy as key to local regeneration and prosperity, and programme development units and national and regional authority structures are creating new capacities to act in energy markets. These solutions show that there is scope for more to be done, even within current stringent finances, government structures and centralised energy markets.

LA energy initiatives are however at an early stage with issues to be resolved over the structures, powers and resources of local government in a more devolved and regional framework. In England, combined authorities are not established consistently and there are open questions as to how they will integrate with the already complex system of local government (see National Audit Office 2017). In addition, LEPs have no formal remit for low carbon investment or wider social welfare:

"We need to become cleverer, at the LEP… it's not just about growth because if you can bring people out of fuel poverty, for instance, then they have got more money in their pocket… which they can spend in the local economy, which stimulates the economic growth, but at the moment we're not really capturing that."

Infrastructure & Investment Projects Officer, West Yorkshire Combined Authority for Leeds Enterprise Partnership

In Scotland, a different model is in place using public agencies to support technical expertise:

"Scottish Futures Trust, Resource Efficient Scotland, Energy Saving Trust are critical. Because we feel they are our mutual friends, we go to them a lot and to the Heat Network Partnership… For us in local government … we need that trust element."

Sustainable Development Manager, City of Edinburgh Council

The devolved government, PDU and combined authority and city region structures are potentially significant routes to a local contribution to the energy system. The potential is significantly reinforced by the work of the Heat Networks Delivery Unit with 131 LAs in England and Wales, and the accompanying £320 million Heat Network Investment Project (HNIP). HNIP seeks to draw in £2 billion of construction investment over the next four years. In Scotland, the government has made energy efficiency a national infrastructure priority with commitments to around £0.5 billion investment in the programme up to 2020. The aim is to transform the energy efficiency and heating of buildings so that, wherever technically feasible and practical, buildings are near zero carbon by 2035. A new statutory duty for LAs to develop and implement Local Heat and Energy Efficiency Strategies, including district heating zones, is proposed. In 2017, £43.6 million was also awarded to thirteen low carbon infrastructure demonstrator projects, with direct LA and/or community stakes in ten of these (Scottish Government 2017c). In Wales, the Well-being of Future Generations Act 2015, Environment Act 2016, and the Wales Act 2017 create opportunities to develop the capacities for local authority energy as a contribution to carbon targets and well-being in Wales, and could build on the Energy Efficiency Strategy for Wales (Welsh Government 2016) and Green Growth Wales programme for Local Energy (Welsh Government 2015). Additional powers provided to Northern Irish local authorities following the 2014-15 restructure equally provide scope to maximise opportunities for area-based carbon reduction, potentially through their new community planning powers as does the ongoing discussion about the role of a Northern Ireland climate change act (Committee on Climate Change 2016).

Although all of these clean energy initiatives are at early stages, they set the direction of travel towards a more mixed economy of energy with public, private and civil society contributors, and a more distributed energy system in the UK, with a potentially significant role for municipalities. Energy use is implicated in every area of public services and is key to rethinking local government in an era when central government budgets are highly constrained. Strategies and problem owners are not yet clear, but motivations and principles are in place, rehearsed through emerging networks, intermediary agencies and experimental business models and commercial structures. In the next section we suggest actions for LAs and key recommendations for central and devolved national governments which could contribute to overcoming the problems LA face in delivering significant energy saving and clean energy goals.

7. Accelerating Local Authority Engagement in Energy – What Needs to Change?

Current uncertainties over UK government support for more distributed energy, and major energy saving, as part of a low carbon system are having some negative consequences for LA energy plans and investments, resulting in opportunistic, small projects, rather than strategic planning and long term capacity building. The increasing focus on financial performance indicators and short-term cost savings, as opposed to social welfare, climate protection and local economic prosperity are also leading some LAs to question the legitimacy of local energy plans. Where LAs have succeeded in assembling energy projects, entrepreneurial officers, committed local politicians, as well as some fortuitous financial circumstances have been critical. Those circumstances have often depended on funding from European programmes which will need to be replaced when the UK leaves the EU.

We use our data, and discussions at a 2017 practitioner workshop hosted by the UK Energy Systems Catapult, to highlight five recommendations where policy and institutional change, at UK and devolved national government levels, would make a LA contribution more feasible; these are areas where clear agreement is lacking at present. We also suggest six actions for LAs. The proposals are intended to secure faster, more systematic and cost effective LA action on clean energy, and to enable scaling up when this is demonstrably a valuable contribution to a low carbon, affordable and resilient energy system.

The diverse views about the best way to address these key issues are summarised below; at present the value of municipal action on energy remains a contested area in the UK. However, if the sector is to grow beyond the current pattern of *ad hoc*, precarious and opportunistic projects to make a more significant and systematic contribution to a clean energy transition, consensus building is needed. There is unlikely to be a single model for localised energy planning, development and management which works everywhere, but we know from European practice that coordination between local and national governments, as well as specific powers and procedures for energy planning, supportive regulation, and access to low cost, long term finance are all critical to energy systems with a strong municipal component.

Recommendations for central and devolved national governments

1. The UK Clean Growth Strategy and devolved national government plans need to clarify the role and responsibilities of LAs in energy saving and clean energy, and to establish stable policy and support measures with clear trajectories and timetables

UK government should ensure that the Clean Growth Strategy leads to clarity on the role and responsibilities of LAs in energy saving and clean energy, including district energy developments and major emissions reductions from buildings. Whilst the UK has met its carbon targets so far, the UK Committee on Climate Change (2017) has identified critical decision points, and timing, for carbon budgets; these decisions need to encompass the responsibilities of LAs and ensure adequate resources are available. Action is needed by devolved national governments. The Scottish Government Energy Strategy and Climate Change Plan refer to the responsibilities of local authorities, particularly for Local Heat and Energy Efficiency Strategies, but detail is needed on policies and resources. New powers in the Wales Act 2017, and discussion about a dedicated climate change act in Northern Ireland (Committee on Climate Change 2016) similarly need to be used to accelerate local authority action. The aim should be to build a working consensus on roles and formal responsibilities in order to channel local authority resources effectively, and to avoid frustrations arising from repeated need for improvisation in uncertain circumstances. In addition the following would facilitate LA participation in energy system transformation:

- Published timescales for clean energy support mechanisms to enable LA planning. Support mechanisms need to align with timescales for LA decision making. This could mean, for example, LAs being able to 'lock-in' funding earlier in project development.
- Clear trajectories for sectoral decarbonisation, identifying both sectoral emissions envelopes and, where relevant, critical decision points. In particular, a decision making framework for the future of the gas grid is required. This would support LA understanding of what, when and how decisions on energy infrastructure for heating and hot water in their locality must be made.

2. Additional powers for LAs to deliver their energy-related responsibilities

If LAs are to make a systematic contribution to a more distributed clean energy system, statutory powers and responsibilities need to be reviewed. There are differences of opinion among LAs and other parties on the desirability of a statutory energy function per se, particularly if this is merely a 'box ticking' exercise rather than a means of conferring meaningful resources. The Committee on Climate Change (2012) for example argued that LAs are critical to climate change mitigation and proposed the introduction of a statutory duty for LAs to 'develop and implement low-carbon plans' (p9). At our practitioner workshop some participants argued that a statutory power would overcome current uncertainties, drive structural change and mobilise resources to create a single problem-owner for local clean energy planning and implementation. It would also establish the route for coordination between national and local energy system planning and development. Others thought that it risked limiting local discretion and creativity, causing LAs to look instead for the lowest cost route to compliance. Clarifying expectations is hence a necessary part of building a consensus on the role and responsibilities of LAs for energy initiatives and on the operation of any statutory powers.

- Proposals for statutory energy powers for LAs are under consideration in Scotland, and are associated with production of a Local Heat and Energy Efficiency Strategy (LHEES), and implementation plan (Scottish Government 2017b). Initial proposals include a **statutory local power for clean energy, with additional ring fenced resources** for development and implementation of plans; this could include planning requirements for building owners to connect to district heating networks and ability to offer district heating concession zones to developers. The Scottish Energy Efficiency Programme is supporting pilot LHEES in several areas in 2018 (Scottish Government 2017d).
- Any new powers should avoid specifying particular business models, and encourage or require other public sector bodies to collaborate on energy planning.

3. Support agencies and shared services for LA energy developments

To support delivery of strategic plans and achieve economies of scale across LAs, central and devolved national governments should consider establishing hubs of expertise, building on existing capacity building structures and procurement processes (see examples below). These could take the form of national or regional energy agencies and/or specialist procurement organisations to support and assist in coordination of local and national energy plans, and identify opportunities for shared project delivery.

- LAs need technical and economic capacity and expertise, available over the long-term timescale of strategic local plans.
- Standardised socio-economic metrics are needed to quantify benefits arising from local projects for inclusion in the business case.

- In addition, standardised business templates and legal contracts can be used to guide local energy planning and investment propositions, and to reduce costs and timescales of development.
- LAs need cost effective and high quality procurement routes for district energy infrastructure and area-based retrofit of buildings. Specialist procurement would enable LAs to be intelligent buyers and should help reduce costs and delays, and ensure best value to the local economy. Suppliers would also have approved routes, assisting in quality assurance, high standards and performance guarantees.
- Existing support structures and procurement models include the Danish Energy Agency which has coordinated central and local government development of extensive district heating; the Norwegian agency Enova which supports transition to a low emission society and provides development support and funding for local authorities; and Sinfra, formerly Värmek, a Swedish non-profit procurement organisation for district heating, water and electricity. In the UK, different elements of support include the UK Government Heat Networks Delivery Unit and Scottish Heat Network Partnership, CLASP's sustainability and energy support service for local authorities; and procurement frameworks for Energy Performance Contracting in England, Wales and Scotland. Proposals for district energy procurement specialist services currently under discussion include a non-profit LA mutual enterprise District Energy Procurement Agency and the Crown Commercial Service proposal at UK Government level (see p40).

4. Local authority access to low cost, long term infrastructure finance

Central and devolved national governments should review the existing framework of support for LA access to low cost, long term finance to ensure that there are adequate and suitable provisions for the full range of local clean energy and energy saving investments. Application processes need to align with LA decision making timescales. In addition to established prudential borrowing from the PWLB and capital budget spending, support is needed for LA appraisal of the full range of financing options.

- A dedicated long term Local Energy Fund could build on the current £320 million Heat Network Investment Project, Salix fund and/or European and UK matched funds such as the London Energy Efficiency Fund, Scottish Partnership for Regeneration in Urban Centres and Regeneration Investment Fund for Wales.
- The Green Investment Group could use experience from the Green Loan, which aims to offer comparable rates to PWLB over the repayment term, to review offers for LA initiatives.
- The newly established Municipal Bond Agency aims to offer rates lower than PWLB.
- The UK Guarantees Scheme, currently available to 'nationally significant' schemes, could be customised for larger scale municipal energy enterprises.
- The Scottish Government proposed National Investment Bank (2017) may be a significant innovation for Scottish LAs.
- Better shared understanding of the potential of third party institutional investors to support municipal energy is needed.
- The German public development bank KfW shows how access to affordable long term finance works to support LA energy infrastructure investment.

5. Energy market regulation

In discussion with LAs, central and devolved national governments, Ofgem should explore further the issues faced by local energy operators, and the potential for increased contribution at locality scale. Ofgem's Innovation Link framework provides scope for bounded experiments in regulatory redesign. Existing work on 'non-traditional business models' (Ofgem 2015a) and the Future Insights programme, which has begun work on the system impacts of local energy (Ofgem 2017), as well as lessons from the Low Carbon Networks Fund (see Frame, Bell and McArthur 2016), are valuable starting points.

- Some local and regional authorities are proposing devolution of certain regulatory functions to the local level; there are also cases where project teams are hampered by a regulatory system designed around large centralised generators and transmission. Issues identified by interviewees were:
  - electricity grid constraints and export limits
  - limited avenues for local market access (i.e. complex arrangements for sleeving power or the cost of private wire infrastructure)
  - lack of requirements for gas and electricity distribution network operators to collaborate in area planning with LAs
  - low wholesale CHP electricity export price
  - historically weak design standards, performance guarantees and service standards for heat network customers compared with gas and electricity
  - unequal tax treatment of heat and gas network infrastructures
  - the need to integrate regulation of heat and gas to meet carbon budgets, socialise costs of heat network infrastructure and avoid uneconomic duplication of infrastructures

These issues either relate directly to energy market regulation or could be addressed through the regulatory framework.

- No regulatory system is neutral. If a greater role for local energy is a target (see Recommendation 1; a target for localised energy is also proposed in the draft Scottish Energy Strategy), there is a need for regulatory reform to support that objective.

Actions for Local Authorities

1. Articulate a clean energy plan geared to ensuring internal support from senior management and cross-party commitment

Senior officers and politicians need to be enrolled in negotiating the potential for energy initiatives to deliver local political and corporate objectives, and to contribute to core services. Internal support provides legitimacy for devoting scarce resources to energy initiatives, and alignment with local political and corporate objectives provides a clear rationale for engagement.

- A clean energy strategy needs to be backed by an investment plan which is material to decision making. It needs to be reinforced by senior management and political leadership, and long term cross-party political support is critical to effective implementation and overcoming disruption caused by political change.
- The plan needs to demonstrate how action on energy will fulfil LA core objectives for better local services, jobs and welfare; this will assist lead officers and politicians in mobilising support across the multiple teams involved in project development and implementation, and should assist in securing cross-party commitment.

2. Create a management structure to scale up delivery of LA clean energy plans

As well as clear articulation of plans, LAs need an organisational structure (energy team or delivery unit) designed to focus on implementation.

- Project or Programme Delivery Units have increased the scale and pace of projects, while enabling prioritisation of investment opportunities and continuity (examples include Bristol City Council, Leeds City Council and Cambridgeshire County Council). Successful delivery involves engaging LA finance, legal and procurement services at the earliest stage to assess in-house expertise and transferable skills.
- There is also scope for LAs to share the resource demands of delivery through combined authority structures. This enables expertise hubs for access by multiple LAs, and provides a route to aggregation of clean energy proposals and investment (examples include the Low Carbon Hub in Greater Manchester Combined Authority and the Investment and Infrastructure Unit in West Yorkshire Combined Authority).
- These structures have a cost, and in almost all cases we examined, establishing them relied on European EIB ELENA and IEE MLEI funding programmes which require the LA to deliver an agreed scale of investment in energy. An interim team or unit is also a valuable starting point, profiling the money saved and income generated from a programme of projects; whole life cost models can be used to provide the initial rationale for setting up an energy team.

3. Build a business case and assess financing options for energy projects

Building a business case that captures the wider material benefits of energy projects enables the articulation of links between energy, and local political and corporate objectives. It also creates the basis for longer term investment appraisal incorporating the non-financial benefits associated with LA provision.

- Options appraisal of pros and cons of business structures and available funding opportunities needs to be as comprehensive as possible. There are for example different views about borrowing, and about applying for grants which require multiples of capital investment in order to avoid penalties. In some LAs, the requirement to leverage a specified target of investment has been regarded as a helpful way of ensuring rigorous decision-making on risk and economic viability of projects. Some regard the higher hurdle rate of commercial loans as too costly; grant, interest free or low cost loans, and ring-fenced funding are likely to be critical.
- Whole life costing is seen as a valuable component of the business and financial case because it offers a means to incorporate all anticipated present and future costs and revenues over the lifetime of the asset. It was not used by all local authorities in our sample, but was suggested as particularly helpful in providing evidence of the relative costs of delivering heat by district heating compared to gas boiler installation or replacement in individual homes.
- Options for integrating energy services into finance and capital investment programmes may be significant in constituting energy provision as a new long term revenue source. A balance must be struck, however, between projects supporting the financial position of LAs and the achievement of broader policy objectives. For example, district heating networks anchored around the most lucrative heat sources should be designed with extension to a wider user base in mind.
    - The PWLB provides long-term low interest loans for energy investments yielding a return or savings, suggesting one viable route to financing LA energy.
    - The newly established Municipal Bond Agency aims to offer rates lower than PWLB, and LAs have also made use of borrowing from lenders such as Salix Finance, Green Investment Bank and the European Investment Bank.

4. Collaborate with other LAs and intermediary agencies to build capacity and technical expertise in the sector

Intermediary organisations can be used to overcome skills or capacity gaps. Examples include Framework Managers for Energy Performance Contracting, the UK Heat Networks Delivery Unit and Scottish Heat Network Partnership. Targeted use of external expertise is also best when translated into opportunities to capture learning and to develop new internal skills and expertise among LA officers.

- Using intermediary support can help LAs to be a better user/customer of external expertise in future and to avoid outsourcing the development of expertise.
- Technical and commercial consultancy and commercial partnerships may provide routes for increasing internal expertise, where there are clear paths for access to information and data, transferrable knowledge and in-house replication.
- Sharing learning and experience about best practice through public sector networks provides insight into alternative business structures and helps to resolve common project management problems.

5. Use planning powers systematically to support development of clean energy and low energy buildings across the LA area

Planning authorities have scope to use planning powers to set standards for developers. Local planning should be informed by, and supportive of, the overarching local authority clean energy plan.

- Planning authorities should make best use of local development planning powers and supplementary guidance to support the highest energy efficiency standards and take up of district heating through presumption in favour of connection and/or enabling new building for future connection. To be successful and mitigate risks of 'developer flight', coordination of standards across authorities in a region is important. For example, in Scotland planning authorities are working together through the Scottish Cities Alliance to produce standardised guidance for district heating and to pilot local heat and energy efficiency strategies; in London, the GLA's spatial development strategy *the London Plan* and minimum standards for district heating are key references for local authorities.
- One further option to support specified energy development is through use of local development orders (examples include Leeds City Council's LDO for district heating).
- Planning and energy officers need to collaborate to ensure that relevant expertise and information is shared between teams; this is critical in instances where planning officers have limited experience of energy technologies.

6. Aim to facilitate and enable local and regional cross-sector action on clean energy

To move from near-term projects to more ambitious longer-term developments, LAs need to identify the critical parties and bring them into the process of setting a clear local strategy for energy and investing in its implementation. More ambitious strategies generally involve multiple local organisations, and multi-lateral negotiation and decision-making (e.g. a larger heat network which sells heat to multiple users).

- Cross-sector partnerships can be used to identify which actors could contribute to achieving clean energy goals, and to specify contributions and timescales for different parties.
- A *delivery* partnership is likely to be important as a route from initial projects to a more systematic area-based programme. For example, early stage proposals for a city-based partnership approach were a key ingredient for Dundee's Sustainable Energy and Climate Change Action Plan, and for Exeter City Futures plan. However, these partnerships need material projects and investment plans to avoid becoming mere 'talking shops'.

Notes

1. The Paris Agreement was signed by political leaders of 175 countries, including the UK.
2. For domestic energy efficiency alone, recent analysis suggests a 'cost effective' scenario from investment in energy efficiency, heat pumps and heat networks would reduce current UK household energy demand by around 25% (Rosenow et al. 2017). Further system-wide benefits of distributed energy include local energy generation and storage providing grid balancing services through battery or distributed generation from CHP with thermal storage (Streckiene and Andersen 2010), flexible demand across heat and power, utilising 'waste' heat and renewable energy sources (Connolly et al. 2014; Lund et al. 2014). These services reduce the need for investment in under-used (high carbon) 'stand-by' plant and network infrastructure, because they can operate as short-term operating reserve; the National Infrastructure Commission's *Smart Power* report (2016) identifies interconnection, storage and flexible demand as key components for maximising distributed energy. In addition, recent analysis by the University of Leeds (2017) suggests significant carbon and cost savings for UK cities and local authority areas from investment in distributed energy and energy saving measures.
3. In total officers from 51 LAs were contacted; 40 agreed to take part, seven did not respond to emails and telephone requests, and four declined. One intermediary agency was also interviewed.
4. 24 interviews were face-to-face and 16 were by telephone.
5. English LAs in the sample comprised: 9 unitary, 7 metropolitan districts, 6 London boroughs, 3 district boroughs, 2 county councils, 1 combined authority and 1 local enterprise partnership (coordinated by a combined authority).
6. The review can be found online at www.sps.ed.ac.uk/leukes.
7. In April 2015, LA in Northern Ireland was reformed reducing the number of authorities from 26 to 11 (see Northern Ireland Executive Information Service 2015). Our database records activity in Northern Ireland under the old LA areas because the new LAs areas were not represented in the datasets used.
8. This extended and updated a pilot study undertaken in 2013-14. Reports are available at: www.sociology.ed.ac.uk/leukes.
9. 376 projects had a direct technology focus of which 83 included investment in more than one technology (e.g. CHP and heat networks, or EE technologies and Solar PV). The total number of technologies therefore exceeds the number of projects that installed energy technologies.
10. The site is due to open in autumn 2017 and is operated by Resource Recovery Solutions (Derbyshire) Ltd, a partnership between Shanks and Interserve (see www.rrsderbyshire.net). It is financed through the GIB, Germany's Bayerische Landesbank and Japan's Sumitomo Mitsui Banking Corporation. See www.greeninvestmentbank.com/news-and-insights/2014/uk-green-investment-bank-investment-in-new-green-power-plant-in-derby/.
11. Local government is devolved Scotland, Wales and Northern Ireland where there are single tier unitary authorities. In England there is a mix of single and two tier authorities (see Sandford 2016; Slack and Côté 2014; Wilson and Game 2011).
12. Statistically significant X2=13.87, df=2, p=0.0009. In a contingency table at the level of Scotland, Wales and Northern Ireland cell counts are too low to calculate chi square test of significance.
13. Data on these correlations is found in (Tingey, Hawkey and Webb 2016).
14. Operating with consideration of sustainable development principles has been in place since 2006.
15. Both Leeds City Council and the Leeds Enterprise Partnership (coordinated via West Yorkshire Combined Authority) were included in our sample of 40 LAs. We examined the Leeds city centre heat network from the perspective of the city council (as the project sponsor) and the Leeds Enterprise Partnership which has a specific remit in supporting low carbon investment in the region. To avoid double counting the heat network, the Leeds Enterprise Partnership case is excluded from some of this section.
16. The Leeds Enterprise Partnership case is excluded in this part of the analysis, hence the total number of 'valid' cases is 39.
17. energetik's Business Plan (Enfield Council) aims to supply low carbon heating and hot water to over 15,000 homes and businesses, with the capacity to expand to supply over 30,000 homes and businesses. The first customers were connected in 2017. The Business Plan was approved by Enfield Council in January 2017 (Enfield Council 2017a; 2017b), with a £58 million investment by the Council (i.e. after our data were collected).
18. This included a range of internal and external improvements with energy efficiency integrated.
19. A small energy efficiency retrofit of 100 homes had also been completed.

20. The European Local ENergy Assistance (Elena) programme provides grant funding for 'technical assistance' to LAs to leverage investment into low carbon energy initiatives according to a specified leverage factor (multiplier). It is delivered through the European Investment Bank (EIB) and jointly funded through the EIB and European Commission. See: www.eib.org/products/advising/elena/index.htm.
21. Bridgend Council is involved in the ETI's Smart Systems and Heat demonstrator programme (as are Newcastle City and Greater Manchester Combined Authority). Bridgend's project was at feasibility stage when our data were collected.
22. As Energy Performance Contracting schemes can be staged over time the capital expenditure across a corporate estate may exceed these values.
23. The most commonly used energy performance contract framework in our sample for council buildings was the RE:FIT framework, initially established in London through the GLA and managed in England (outside London) and Wales via Local Partnerships and Green Growth Wales and now in Scotland via the Non-Domestic Energy Efficiency Framework. A variety of contractors were being used in our sample including Bouygues in Cambridgeshire and Leicestershire, Mitie in Hull and Matrix Control Solutions (an E.ON company) in Edinburgh. Peterborough City Council established its own single supplier framework agreement with Honeywell.
24. Including an off-balance sheet solution for academy schools through a Managed Service Arrangement.
25. In networks run by large utilities, as part of the regulated asset base model, costs (and risks) are spread across a much larger customer base.
26. Announced in February 2017 see www.beta.gov.scot/publications/support-for-business-and-the-economy-ministerial-statement/.
27. A sleeving arrangement is 'used by corporates with own-generation on one site seeking to supply load on another. Supplier manages the imbalance risk.' See Ofgem (2017, p. 8). Under a sleeving arrangement the licensed supplier meets the licensed standards required to use the public network on behalf of the generator.
28. For example Enfield Council's energetik network intends to utilise heat from the new energy from waste plant at Edmonton Park via a heat supply agreement with the North London Waste Authority. In Sutton, SDEN will utilise heat from the Beddington Lane new energy from waste plant due to be operational in 2018 in addition to the existing landfill gas plant (operated by Viridor for the South London Waste Authority).
29. For example the purchase of heat from the commercial ESCo costs no more than what the council paid for heat at the time the contract was awarded and/or the council makes other savings such as from reduced CRC or avoided spend in the housing capital programme.
30. The networks were part financed through Community Energy Programme (UK Government Defra 2002-2006) grants covering 40% of capital costs for the first three energy centres and networks.
31. Some quotes have been anonymised at the request of interviewees.
32. For more information about these networks see www.apse.org.uk/apse/index.cfm/local-authority-energy-collaboration and www.heatandthecity.org.uk/dh_vanguards_network.
33. The GLA has also been pursuing a Licence Lite approach to purchase electricity from local generators and sell to consumers (initially Transport for London) with the support of a third party licensed supplier (RWE npower) who meets some of the licensing considered required on behalf of the Licence Lite holder (GLA 2016; Ofgem 2015b).
34. At the time of our research this was small scale development or demonstration projects: retrofitting heritage buildings, shallow water ground source heat, hydrogen injection into methane gas burner at landfill site, portable solar PV, data monitoring of high efficiency standard buildings and smart ICT solution for water and energy.
35. For more information see http://ccs-agreements.cabinetoffice.gov.uk/node/7043.

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Appendix

Table A. 1 Datasets Incorporated into Local Engagement in UK Energy Systems Database, data was collected in Summer 2015

Data set name	N. LA energy projects [i]	Type of data	Data source	Operational measure	Type of energy project
Energy Strategy/Plan	311	Energy Strategy/ Plan Document	Council websites	Identifiable ECP/ SEAP/equivalent	Identifiable Energy & Carbon Plan (ECP), Sustainable Energy Action Plan (SEAP) or equivalent document which includes carbon emissions reporting, baseline data, reduction targets, monitoring (may include a project list)
CHP Focus	88	Operational project	UK Dept. of Energy & Climate Change (DECC)	Named organisation	Operating CHP
Green Deal Pioneer Places Fund	40	Investment	UK DECC	Lead organisation receiving finance	Develop GD proposals & capital works for domestic EE
Challenging Lock-in through Urban Energy Systems (CLUES)	40	Operational project	CLUES Project, University College London	Named organisation	Heat supply (esp. biomass & solar thermal), electricity supply (solar PV, onshore wind, hydropower), CHP & district heating, EE (esp. insulation)
Community Research & Development Information Service (CORDIS)	29	Investment	European Commission	Lead organisation receiving finance	Range of projects, mostly: transport, knowledge exchange/ transfer (KE/KT), demand management, capacity building for strategic energy management (CB)
Intelligent Energy Europe (IEE)	26	Investment	European Commission	Lead or partner organisation receiving finance	Range of projects, mostly: KE/ KT, CB, low carbon investment programmes
European Regional Development Funds (ERDF) England 2007-2013	25	Investment	UK Dept. for Communities & Local Government	Lead organisation receiving finance	Demand management & EE projects
FP7 (7th Framework Programme 2007-2013)	24	Investment	European Commission	Lead or partner organisation receiving finance	Range of projects, mostly: transport, KE/KT, demand management, CB
Green Deal Communities	24	Investment	UK DECC	Lead organisation receiving finance	Develop GD proposals & capital works for domestic EE
Community Energy Programme	15	Operational project	Energy Saving Trust Scotland	Lead organisation receiving finance	Development of CHP & district heating
Ofgem Renewables and CHP Register - RO	15	Operational project	Ofgem	Named organisation	Electricity supply: hydropower, landfill gas, onshore wind, solar PV, bio fuels
ERDF Scotland 2007-2013	13	Investment	Scottish Government	Lead organisation receiving finance	EE, supply chain development
Ofgem Renewables and CHP Register - REGO	13	Operational project	Ofgem	Named organisation	Electricity supply: hydropower, onshore wind, solar PV
Low Carbon Infrastructure Fund	12	Investment	UK Homes & Communities Agency	Lead organisation receiving finance	Development of CHP & district heating

Table A. 1 Datasets Incorporated into Local Engagement in UK Energy Systems Database, data was collected in Summer 2015

Data set name	N. LA energy projects [i]	Type of data	Data source	Operational measure	Type of energy project
Equitix Fund	11	Investment	Green Investment Bank	Lead organisation receiving finance	LED Street Lighting & Energy from Waste Plant
Interreg IVC	8	Investment	European Commission	Lead or partner organisation receiving finance	KE/KT, CB
Interreg IVB	8	Investment	European Commission	Lead or partner organisation receiving finance	KE/KT, heat supply, electricity supply
Core Cities Project (Green Deal & Energy Company Obligation)	8	Investment	UK DECC	Lead organisation receiving finance	Develop GD proposals & capital works for domestic EE
Green Investment Bank	7	Investment	Green Investment Bank	Lead or partner organisation receiving finance	LED Street Lighting & Energy from Waste Plant
DH Map of Scotland	7	Operational project	EST Scotland	Named organisation	Operating DH (annual capacity ≥1,000MWh)
Renewable Energy Planning Database	7	Operational project	UK DECC	Named organisation	Electricity supply, electricity & heat supply: landfill gas, anaerobic digestion, solar PV, onshore wind, Energy from Waste
European Local ENergy Assistance (ELENA)	6	Investment	European Investment Bank	Lead organisation receiving finance	Low carbon investment programmes & developing pipeline of projects
Arbed Phase 1	6	Investment	Welsh Government	Housing provider involved in project	Domestic EE
Energy Demand Reduction Pilot Auction	5	Investment	UK DECC	Lead organisation receiving finance	Demand reduction during peak winter hours (LED lighting)
Low Carbon Pioneer City – Heat Networks	5	Investment	UK DECC	Lead organisation receiving finance	Development of CHP & district heating
Horizon 2020	4	Investment	European Commission	Partner organisation receiving finance	EE, KE/KT, CB, transport
Future Cities Demonstrator Programme	4	Investment	Technology Strategy Board	Lead organisation receiving finance	Large & small scale demonstrator of Low Carbon Smart Cities
ERDF Scotland 2014-2020 Local Energy Challenge Fund	3	Investment	Scottish Government	Partner organisation for Phase 2 funded projects	Electricity supply, heat supply, low carbon transport
Large scale CHP schemes in the United Kingdom, December 2014 5.11 (Digest of UK Energy Statistics)	3	Operational project	UK DECC	LA associated CHP (but may not be operator)	Local Authority-led CHP (≥1MW installed electrical capacity)
ERDF Northern Ireland (NI) 2007-2013	2	Investment	NI European Funding Database	Lead organisation receiving finance	Demand management projects

(i). Number of local authority energy projects after duplicates across the datasets were removed.

Table A. 2 List of participating local authorities in phase two of the research

Authority	Location	Energy Initiative	Stage
Aberdeen City Council	Scotland	Aberdeen Heat & Power, and Seaton Extension	Operational
Aberdeenshire Council	Scotland	Aboyne Academy Biomass Heating	Operational
Bath & North East Somerset Council	South West	Bath & West Community Energy	Operational
Birmingham City Council	West Midlands	Birmingham District Energy Company	Operational
Bridgend County Borough Council	Wales	Bridgend Town Heat Network	Feasibility
Bristol City Council	South West	Bristol Energy	Operational
Calderdale Council	Yorks & Humber	LED Street Lighting	Pre-feasibility
Cambridge City Council	East of England	Abbey Pool Solar Thermal	Operational
Cambridgeshire County Council	East of England	Cambridgeshire Mobilising Local Energy Investment	Build/construction
City & County of Swansea	Wales	Swansea Community Energy & Enterprise Scheme	Development
City of Cardiff Council	Wales	Radyr Weir Hydro	Build/construction
City of Edinburgh Council	Scotland	Energy Retrofit RE:FIT	Procurement
City of Wolverhampton Council	West Midlands	Optimising Regional Clusters of Smart Energy Networks	Feasibility
Derby City Council	East Midlands	Derwent Hydro	Operational
Derry City & Strabane District Council	Northern Ireland	Foyle Arena Leisure Centre CHP	Operational
Dundee City Council	Scotland	Dundee Social Housing District Heating	Operational
Exeter City Council	South West	Solar Programme	Operational
Fife Council	Scotland	Dunfermline District Heating Network	Operational
Gateshead Council	North East	Gateshead Energy Company	Build/construction
Glasgow City Council	Scotland	Commonwealth Games Village District Heating	Operational
Greater Manchester Combined Authority	North West	Nedo ASHP & Demand Side Management	Operational
Kingston upon Hull City Council	Yorks & Humber	Hull RE:FIT	Build/construction
Leeds City Council	Yorks & Humber	Leeds City Centre Heat Network	Procurement
Leeds Enterprise Partnership	Yorks & Humber	Leeds City Centre Heat Network	n/a
Leicester City Council	East Midlands	Leicester District Energy Company	Operational
Leicestershire County Council	East Midlands	Leicestershire RE:FIT	Operational
London Borough of Camden	Greater London	Somers Town Energy	Operational
London Borough of Enfield	Greater London	Energetik	Build/construction
London Borough of Haringey	Greater London	Low Carbon Innovation Hub	Operational
London Borough of Islington	Greater London	Bunhill Heat & Power, and Celsius Extension	Operational
London Borough of Sutton	Greater London	Sutton Decentralised Energy Network	Procurement
Manchester City Council	North West	Manchester Civic Quarter Heat Network	Procurement
Newcastle City Council	North East	Re-Generate Newcastle Science Central Phase 1	Procurement
Oxford City Council	South East	Oxford Mobilising Local Energy Investment	Operational
Peterborough City Council	East of England	Blue Sky Peterborough	Operational
Plymouth City Council	South West	Plymouth Energy Community	Operational
Reading Borough Council	South East	Winter Watch	Operational
Royal Borough of Greenwich	Greater London	Barnfield Estate Retrofit	Build/construction
Stirling Council	Scotland	Millhall Solar Thermal District Heating	Pre-feasibility
Warrington Borough Council	North West	Solar Programme	Build/construction

Table A. 3 Organisations represented at June 2017 Workshop to discuss emerging research findings

Birmingham & Solihull Local Enterprise Partnership	Local Partnerships
Brighton & Hove City Council	Nottingham City Council
Bristol City Council	Plymouth City Council
Calderdale Council	Reading Borough Council
City of Wolverhampton Council	Sustainability West Midlands
Energy Systems Catapult	UK Energy Research Centre
Energy Technologies Institute	UK Gov. Department for Business Industrial & Energy Strategy
Greater Manchester Combined Authority	University of Oxford
Leicester City Council	UK100

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