The role of energy service contracting in delivering energy efficiency measures for local authorities in the UK

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Abstract

Energy service contracting is a niche activity in the UK, encompassing a variety of approaches that allow organisations to tap into underexploited energy efficiency, cogeneration and increasingly also renewable energy generation potentials. It involves outsourcing of one or more energy generation, conversion or management process(es) by sharing, spreading and/or transferring risk, which may involve funding investments through savings in energy costs. The last point is of particular relevance to local authorities in the UK as tightening budgets resulting from austerity measures imply that both investment backlogs and the need to comply with carbon reduction commitments are rarely addressed.

Several public procurement and delivery frameworks for energy service contracting have been established in recent years to address these issues, most notably the RE:FIT programme in London, and their popularity and increasing diversity point towards an increasing acceptance of their capacity to deliver energy efficiency benefits at a local level.

Drawing on qualitative research findings from a market mapping exercise, this paper analyses the development and governance of these frameworks, their significance for local authorities, their success in encouraging the implementation of energy efficiency measures, their replicability and diffusion and their wider role in delivering energy services locally.

The results indicate that energy service contracting and energy performance contracting in particular are rapidly gaining recognition as a means for UK local authorities to establish links between long-term contract payments, equipment performance, engineering expertise and financial services without the need for significant up-front investments. In some cases this trend is fostering the emergence of local energy companies with the intention of combining the delivery of energy efficiency measures with renewable energy generation to address a wide range of challenges such as offshoring of profits, rising energy prices and fuel poverty.

Introduction

Austerity measures, rising fuel poverty and climate change are encouraging UK local authorities to consider socially and environmentally beneficial alternatives to incumbent energy supply structures. Around 30 % of the UK's 434 local authorities are actively planning, and investing in, energy productivity and provision, although only 9 % are showing evidence of 'significant' energy project investments (Hannon and Bolton, 2014). These figures indicate increasing local authority engagement in energy service delivery such as the supply of heat or electricity locally, together with improving energy efficiency. Energy service contracting can provide a cost-effective approach for the supply of useful energy streams (such as steam, hot water and coolant) and energy services (such as space heating and lighting) locally.). Either can be achieved using local authority affiliated or private sector energy service companies (ESCOs) although the use of energy service contracts is limited to a limited number of useful energy streams and energy services within a subset of organisation (public sector, specifically hospitals) (Sorrell, 2007; Bertoldi et al., 2014). Energy service contracts addressing energy efficiency usually involve partnering with established ESCOs.

Interest in energy service contracting at a local authority level in the UK has increased significantly with the emergence of public procurement and delivery frameworks (henceforth public procurement frameworks). London's RE:FIT project, the most prominent framework, provided the basis for model Energy Performance Contracts (EPCs) and guidance notes published by the Department of Energy and Climate Change (DECC, 2015a, b). EPCs focus specifically on reducing demand, for instance by retrofitting existing technologies and building stocks (such as a 'fabric first' approach), and links may be established between long-term payments and technology/building performance. EPCs are proving increasingly popular to address skill and financial shortfalls for required investments.

This paper seeks to highlight the diverse nature of UK local authority engagement in energy service contracting. Specifically, it analyses the role of EPCs for the delivery of energy efficiency measures. The following research questions are addressed below:

- How are UK local authorities engaging with energy service contracting?
- How does engagement with energy service contracting for energy efficiency improvement differ from energy service contracting for the supply of heat or electricity locally?
- What is the role of public procurement frameworks in diffusing EPCs?

The following sections introduce the relevant literature, theoretical models and the methodology before moving on to the empirical section.

Energy service contracting

Confusingly, ESCOs and energy service contracting are often used synonymously. In the context of this paper, *energy service contracting* refers to a form of outsourcing and ESCOs to the companies offering energy service contracts. *Energy service contracting* will only be applied if the (lower) production cost ('expenditures for inputs such as fuel and electricity') of supplying energy services can more than offset the transaction costs ('the costs associated with organising ('governing') the provision of those streams and/or services') of negotiating and managing the contract(s) (Sorrell, 2005, 2007: 512).

It is useful to distinguish between the different *activities* involved in supplying energy services to a client or group of clients, together with the different types of *energy service contract* that may be associated with these activities. Figure 1 (adapted from Sorrell, 2005) distinguishes between delivered energy commodities, useful energy streams and final energy services. Delivered energy supply (left side of Figure 1) has historically been the responsibility of energy utilities, while the provision of *useful energy streams* and *final energy services* has historically been the responsibility of the client(s). But the declining cost of renewable energy and other distributed generation technologies has encouraged a greater range of actors, including local authorities, to engage in the supply of useful energy streams (centre of Figure 1), often through the terms and conditions of an *energy supply contract (ESC)*. In some cases, such contracts may also extend to the supply of final energy services (right of Figure 1), or may solely focus on the supply of those services. This type of contract is frequently termed an *energy performance contract (EPC)* and usually involves investment to improve energy efficiency and lower energy costs. EPCs are typically more complex than ESCs and the associated transaction costs tend to be much higher (Sorrell, 2005).

Production cost savings result from the opportunities available to the ESCO to increase the efficiency of the system and to provide useful energy streams and/or final energy services at the lowest cost by reducing demand for delivered energy (left of Figure 1). Apart of efficiency improvements, production cost savings are achieved through lower financing (capital) costs for replacement (primary conversion) equipment, its technical and operational efficiency, lower operation and maintenance (O&M) costs and lower purchase costs for energy commodities as part of and ESC. An EPC enables the ESCO to influence the demand for specific final energy services (right of Figure 1). This allows the ESCO to influence the demand for useful energy stream (centre of Figure 1) and in turn the demand for delivered energy (left of Figure 1). In this case, production cost savings are determined by the same variables as above (O&M etc.) for secondary conversion, distribution and control equipment, by the opportunity to reduce the demand for final energy services (for instance by taking a 'fabric first' approach) *and* by the option of taking control over useful energy streams (Sorrell, 2005; 2007).

The delivery of useful energy streams and final energy services can be achieved through a wide range of business models that may be more or less efficient in different situations.

UK local authority energy service contracting

Apart from the need for production costs to offset transaction costs, the choice of business model for engaging with the supply of useful energy or final energy services depends on a variety of factors. Local authorities may seek energy service contracting as a means of mitigating against increasingly expensive energy service delivery by incumbent energy suppliers, of generating income for the local authorities and/or of protection from volatile energy prices (Hannon and Bolton, 2015). Additional income streams can be secured by implementing technologies supported by feed-in tariffs (FiTs) and the renewable heat incentive (RHI), the world's first long-term financial support programme for renewable heat (DECC, 2014a). EPCs may guarantee cost savings if a link is established between long-term payments and technology/building performance. Both the securing of income streams through ESCs and guaranteed energy savings especially through EPCs can be used to offset revenue funding cuts and for recycling revenues back into further energy and income generation and demand reduction projects.

Local authorities also consider that energy has an important role to play in economic development - for example through attracting green industries, creating jobs and developing local infrastructure (Wilkes, 2014). By contributing to national and international climate change and sustainable development targets (Bulkeley and Betsill, 2003; Bulkeley et al., 2010), local authorities can also mitigate against financial and other penalties for not complying with Carbon Reduction Commitments, a scheme designed to incentivise energy efficiency and cut emissions in the public and private sector across the UK (DECC, 2014b). These factors contribute to a changing energy governance role of UK local authorities and this is reflected by

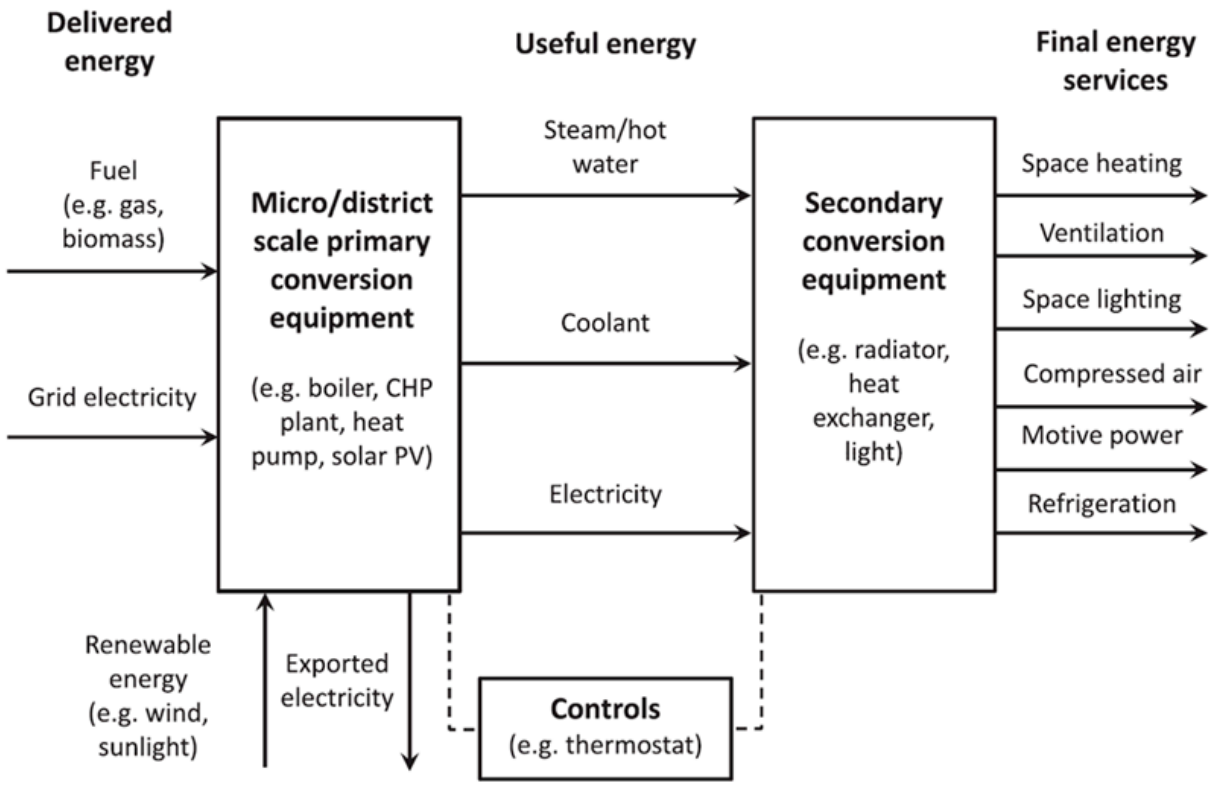

Figure 1. Final energy, useful energy and energy services within a client site (adapted from Sorrell, 2005; Hannon and Bolton, 2015).

a diversification of business models for the provision of both useful energy streams and final energy services.

The diversity of options implies that local authority involvement in energy services is currently undergoing rapid change. Technological innovation and diffusion is contributing to this trend and it is becoming increasingly common for technologies to be physically and/or virtually combined to provide innovative area-based (local energy governance, Wade et al., 2013) solutions. UK examples of this include Woking Borough Council's Brockhill sheltered housing complex. By combining solar technology with CHP, 100 % of energy demand can be covered on-site from sustainable sources provided by the local authority (Woking Borough Council, 2007). A good example of an innovative approach combining a wide range of technologies and partnerships across the public and private sector is King's Cross Central in London, one of the largest regeneration sites in Europe. It combines CHP, solar thermal, roof mounted wind, ground source heat pumps and a district heating network to enable 95 % of the development's heat demand and 79 % of total power demand to be met by the on-site energy centre (King's Cross, 2014).

The Institute for Public Policy Research (IPPR, 2014a) identified many further examples of innovative approaches currently pioneered in the UK with varying degrees of local authority involvement: Cardiff (smart meters for up to 142,000 homes), Aberdeen (hydrogen public transport project), Bristol (European Green Capital), Cornwall (community energy), Leeds (energy efficiency, currently focussing on loft and cavity wall insulation but plans are underway for comprehensive energy solutions combining energy efficiency and small-scale renewables), Lancashire County Pension Fund (investing £100+m in renewables)[1], Manchester (600 air source heat pumps linked to 'smart' aggregation system to reduce the level of electricity used at times of peak demand), Nottingham (district heating) , Oldham (collective energy supplier switching), Woking (Thamesway Energy Ltd providing electricity from 60 local generators providing customers through 'private wire') and London (GLA's Licence Lite model). Of these examples, both Nottingham and London are analysed in more depth in this paper.

There is no standard role or form of local authority energy engagement and even specific pathways, such as outsourcing using EPCs, may differ according to issues and objectives particular to local circumstances. Options available to local authorities for the supply of useful energy streams and final energy services to their own estate relevant to this research are presented below (adapted from Hannon and Bolton, 2015; IPPR, 2014; The City of Edinburgh Council, 2014):

The first column in Table 1 shows the underlying governance structure according to theories on the organisation of the firm (Coase, 1937; Williamson, 1985; adapted from Pint and Baldwin, 1997). The second column indicates the amount of local authority supply responsibility a particular governance structure

1. Lancashire County Pension Fund was the first pension fund in the UK to invest in community energy. Investments have included the refinancing of by a £12m bond into a community-owned solar power station, £50m in biomass electricity generation plants, £17m in a Solar Energy Fund and a £30m commitment to a clean energy fund focussed on wind energy assets (IPPR, 2014b). It has also received the British Renewble Energy Association's Pioneer Award for its innovative funding of a solar farm in Wiltshire (Pension Fund Online, 2014, First stage of ground-breaking pension partnership launches, http://www.pensionfundsonline.co.uk/content/pension-funds-insider/investment/first-stage-of-ground-breaking-pension-partnership-launches/1674)

entails. The central column shows the approach available to local authorities for particular governance structure and associated devolution of responsibility (adapted from IPPR, 2014; Hannon and Bolton, 2015; The City of Edinburgh Council, 2014: 4). The fourth column indicates specific examples of options available for the supply of useful energy streams (discussed in the next section) and the last column for final energy services (discussed in the following section). Special purpose vehicles for the supply of useful energy streams are discussed in the next section.

THE SUPPLY OF USEFUL ENERGY STREAMS AND ENERGY SUPPLY CONTRACTING

The supply of useful energy streams (centre of Figure 1 and the fourth column of Table 1) can be achieved using a number of different business models. The IPPR (2014a: 2) distinguishes between five different energy supply business models for local authorities but only three are of importance for this research of local authority useful energy stream supply options:

In practice, a full supply licence (top row in Table 2) implies that the local authority will share the delivery of operational tasks associated with the supply of useful energy streams with a third party although it retains the majority of shares. Joint Ventures and Licence Lite (middle and bottom row in Table 2) imply an increasing share of delivery devolved to third parties. The full supply licence is being pursued by Nottingham City Council and Licence Lite by the Greater London Authority (GLA, more details in the section on case studies). These models provide local authorities with the opportunity to support local generation projects *and* offer bespoke tariffs to selected local authority/public sector buildings (for electricity and/or heat), the population within the local authority through local tariffs (for electricity) and/or all potential customers within the range of a district heating system (for heat) (more information in the section on Local authority supply side energy services). In the case of local authority supplying heat to clients it is likely that energy supply contracts (ESCs) would be in place guaranteeing availability via long-term contracts as the responsibility of managing primary conversion equipment lies in the hand of the ESCO. Some approaches for electricity, on the other hand, only focus on bundling local, distributed generation capacity with the intention of gaining a supply licence for local authority estates and/or the public sector, rather than supplying electricity to a local area.

It is necessary to distinguish between local authorities as (co-) providers and as clients of energy services. As co-providers, local authorities could serve the wider public sector, including schools and hospitals as well as social housing, even commercial properties. Local authorities may choose to play a less active role by outsourcing the supply of useful energy streams using long-term contracts (ESCs, bottom row of Table 1). In this case, established ESCOs may recoup upfront costs associated with delivering energy services via on-going revenue streams such as the sale of useful energy (in the centre of Figure 1) to the local authority (adapted from Sorrell, 2005, 2007; Hannon and Bolton, 2015).

THE SUPPLY OF FINAL SERVICES AND ENERGY PERFORMANCE CONTRACTING

What is more interesting in the context of energy efficiency is the development of relational and long-term contracts for the supply of final energy services. Traditionally the remit of local authorities using in-house energy management teams, the possibility of establishing Special Purpose Vehicles and using external finance emerged in the late 1980s and early 1990s (Fawkes, 2007; Grout, 1997; Sorrell, 2005). Similar to emerging business models for the supply of useful energy streams, emerging approaches for sup-

Table 1. Indicative overview of options available to local authorities for the supply of useful energy streams and final energy services to their own estate (adapted from Hannon and Bolton, 2015; IPPR, 2014; Pint and Baldwin, 1997; The City of Edinburgh Council, 2014).

Spectrum of governance structures and distribution of responsibilities		Local authority option	Useful energy streams	Final energy services
Vertical integration	In-house responsibility	the local authority energy management team engages in facilitating project development	In-house	
Relational contracts	Devolving responsibility	to a not-for-profit ESCO owned by the local authority (arm's length)	Special Purpose Vehicle	
		to a not-for-profit ESCO with a range of stakeholders holding the majority of shares		
		to a for-profit ESCO with a private sector partner (ESCO) holding the majority of shares		
Long-term contracts	Outsourcing responsibility	to a private sector ESCO (may include energy service contracting)	Energy Supply Contracting	Energy Performance Contracting

Table 2. Examples of business models available to local authorities for devolving responsibility for the supply of useful energy streams (adapted from IPPR, 2014; The City of Edinburgh Council, 2014).

Local authority option devolving responsibility	Business model	Details
to a not-for-profit ESCO owned by the local authority (arm's length)	Fully Supply Licence	The local authority sets up and runs an independent ESCO and takes full responsibility for meeting license conditions
to a not-for-profit ESCO with a range of stakeholders holding the majority of shares	Joint Venture	The local authority works with one or more commercial ESCO or utility to set up and run an independent ESCO
to a for-profit ESCO with a private sector partner (ESCO) holding the majority of shares	Licence Lite	The local authority becomes a 'junior supplier' while an ESCO or a utility takes responsibility for the rest of the business as a 'senior supplier'

plying final energy services are lacking standardisation (Nolden and Sorrell, forthcoming). The bespoke nature of final energy services specific to buildings and building uses also implies a strong focus on contractual and financial arrangements (Fawkes, 2007, 2012; Sorrell, 2005, 2007), as opposed to technological factors that tend to dominate the debate surrounding useful energy streams. This may change if guidance on energy performance contracts (EPCs) recently published by the UK's Department of Energy and Climate Change (DECC, 2015a,b) in compliance with the EU Energy Efficiency Directive (EU, 2012) succeed at simplifying contract negotiation procedures. Significant energy efficiency improvements through EPCs, however, will still require bespoke solutions as replicability only applies to certain contractual, financial and generic technical aspects.

Similar to long-term ESCs, EPCs by nature require local authorities to partner with established ESCOs. However, contracts may also contain the provision of technical expertise and innovative business model and management solutions. More importantly, outsourcing final energy services can help establish a link between contract payments and equipment performance as ESCOs recoup upfront costs associated with delivering energy services through cost savings achieved on the customer's energy bill over the duration of the contract (Nolden and Sorrell, forthcoming; Sorrell, 2005). This is often considered the key benefit of EPC, as it enables implementation of cost-effective energy efficiency measures (Sorrell, 2005).

The closest the UK gets to local authority led Special Purpose Vehicles for the supply of final energy services locally are public procurement frameworks such as RE:FIT and Peterborough's EnPC (see next section). Examples from other countries such as Germany and Denmark indicate that local authorities increasingly occupy facilitatory roles, which could strengthen their position within public-private and public-public partnerships (Jensen et al., 2013; Polzin et al., 2015).

PUBLIC PROCUREMENT FRAMEWORKS AND THE DIFFUSION OF ENERGY SERVICE CONTRACTING

Public procurement frameworks have proven useful for helping UK public sector organisations achieve energy, financial and CO_2 savings through improvements in building energy performance using energy service contracts, specifically EPCs. Some frameworks, such as the Carbon and Energy Fund (CEF), Essentia and Ecovate have emerged from hospital projects for the UK's National Health Service (NHS). They can also be used by local authorities although contractual complexity associated with procurement frameworks designed for large-scale health sector projects generally limits their use to similar project scales, such as district heating or a portfolio of buildings (i.e. university campuses). RE:FIT is designed for public sector application and Peterborough EnPC specifically for local authority application (Nolden and Sorrell, forthcoming).

In this research context, public procurement frameworks may be classified as Special Purpose Vehicles (the last column of Table 1) that save time, reduce advisor cots and generally simplify the procurement process for energy services through pre-negotiated, EU-regulation (Official Journal of the European Union – OJEU) compliant, one-size-fits-all (for specific project sizes and sectors) contracts and by helping source finance if required (RE:FIT, 2015). They also ensure that public sector clients get the right contractor for the design and implementation of energy efficiency measures, that performance can be guaranteed, measures and verified and that appropriate actions are undertaken in case of non-compliance (CEF, 2015).

RE:FIT is currently the most prominent public procurement framework for EPCs in the UK. Launched in 2011 by the Greater London Authority (GLA), its success has attracted interest from local authorities, councils and cities both nationally and across the EU. It has recently been expanded to cover both London (RE:FIT London, see Case study 4) and England (RE:FIT England, see Case study 6). The main differences lie in funding and contractual terms. The difference in funding implies that RE:FIT England needs to be financially self-sufficient within three years. RE:FIT London, on the other hand, received ELENA[2] funding for its Programme Delivery Unit to support clients through the RE:FIT process at no cost to the client. The

2. European Local Energy Assistance (ELENA) provides financial and technical assistance to help local and regional authorities attract funding for sustainable energy projects (http://ec.europa.eu/environment/ecoap/about-eco-innovation/policies-matters/eu/535_en.htm).

differences in contractual terms imply that RE:FIT London allows the client to suggest targets in %, capital costs and payback periods (target bidding) while RE:FIT England enables the specification of one target or a partnership approach to develop the project further before the savings are guaranteed (partner bidding). Another example of a local authority procurement/delivery framework is Peterborough EnPC (see Case study 5). It is considered less transparent than RE:FIT's open book approach but it may enable greater energy demand reduction.

Their importance is reflected by the UK's Department of Energy and Climate Change using RE:FIT contracts as model contracts to comply with EU regulation (DECC, 2015a, b; EU, 2012). Procurement frameworks specifically for local authority application will be analysed in more depth in the case study section.

Theoretical framework

Insights into the governance structure of organisations originate from institutional economics (Williamson, 1985; Coase, 1937) while this piece of research is embedded within the wider framework of socio-technical change (Borras and Edler, 2014). Combining these theories provides insights in the areas of governance structures (ranging from vertically integrated governance structures to long-term contracts), driving forces (austerity measures, fuel poverty, climate change, revenue recycling to maintain frontline services, procurement frameworks), financing (capital budgets, operating budgets, ESCOs, third party finance) and rescaling (decentralised energy governance, decentralised generation, decentralised demand management, decentralised demand response), although this paper focuses more on governance structures and rescaling.

To date, the centralised energy system has provided few opportunities for decentralisation but we are increasingly seeing local authorities engaging in the supply of useful energy streams by setting up or partnering with established ESCOs (Hannon and Bolton, 2015), both as clients and as providers. Where local authorities previously had contracts in place for delivered energy as clients (left of Figure 1), the trend is towards increasing engagement with suppliers for useful energy and final energy services. Public procurement frameworks provide an incentive for outsourcing responsibility using long-term contracts especially for final energy services.

Transaction costs pose significant barriers to these emerging forms of energy service contracting and it is unclear which approaches are proving most useful for increasing energy efficiency as well as energy demand reduction, fuel poverty alleviation, revenue recycling, carbon emission reductions, reducing energy expenditures and the development of sustainable regional economies. Transaction costs are not analysed in great detail in this paper but they provide useful insights into the choice of governance structure (for more information on Transaction Cost Economics in the context of energy service contracting see Sorrell, 2007).

Methodology

The core analytical concerns are changing governance arrangements associated with increasing interest in energy service contracting, evidence of diffusion in terms of both governance arrangements (ranging from full supply licences to EPCs using procurement frameworks) and associated business models as well as low-energy innovations, and the alternatives these provide to the incumbent energy system. As part of an ongoing research project on the diffusion of energy service contracting in the UK (Nolden and Sorrell, forthcoming), primarily qualitative research methods have been used for this paper. The literature review included web-based surveys of academic and grey literature to gain an overview of the role that different kinds of ESCOs, energy service contracts and procurement frameworks play in changing local authority approaches to energy service delivery. Primary data was gathered using around 20 interviews with experts on energy service contracting to date. Of particular interest for this paper are the interviews conducted with representatives of public procurement frameworks and local authorities themselves.

Case studies (Yin, 2009) of procurement frameworks and local authorities (including county and city councils) provide in-depth insights into the different approaches to energy service delivery and ESCOs at a local level. The following empirical/analytical sections analyse six local authority case studies, three on the supply of useful energy streams and three on the supply of final energy services. The Greater London Authority (GLA) and Peterborough City Council appear in both local authority supply and demand side energy services as they are seeking a dual strategy.

Supplying useful energy streams to local authorities

To date, heat delivery through district heating networks has been the most common approach for local authorities to actively engage in local energy governance. Examples include Aberdeen, Woking and Birmingham where ESCOs operate district heating schemes (Hannon and Bolton, 2015). Aberdeen Heat and Power Ltd serves local authority owned multi-story residential blocks, schools and sports and leisure facilities. This is the best example of a local authority providing useful energy streams to its own estate. Thameswey Energy Ltd in Woking serves council, public and commercial buildings, thereby taking on the role of a general supplier. Similarly, Birmingham District Energy Company Ltd serves council, public and commercial buildings as well as a small number of council housing tenants. Their governance approaches vary according to the balance between social and financial capital in their business models, locally embeddedness vs non-local ownership, the governance role of main subscribers (i.e. local authorities themselves or their clients) and in-house vs outsourced expertise (Hawkey et al., 2012). Aberdeen is an example of a not-for-profit ESCO owned by the local authority with strong community involvement and a greater focus on social than financial capital. Woking is an example of not-for-profit ESCO with a more diverse ownership base while Birmingham may be classified as a for-profit ESCO with a private sector partner holding the majority of shares (middle column of Table 1; Hannon and Bolton, 2015). In terms of energy flows, primarily combined heat and power (CHP) is used for heating water, which is transferred to the clients using the district heating pipe network. Associated ESCs usually guarantee availability via long-term contracts as the responsibility of managing primary conversion equipment lies in the hand of the ESCO.

As Scandinavian countries in particular have demonstrated (see IEA, 2008 for an example), district heating networks provide opportunities for energy efficiency improvements as well as the

delivery of low carbon heat using CHP technology (Hannon and Bolton, 2015). However, the focus on supply to the point where heat enters the building may reduce the incentive to look beyond efficient supply. It has been pointed out that Aberdeen for example chose to focus more on heat delivery, as opposed to a 'fabric first' approach which might have reduced heat demand in the first place. If demand reduction through a fabric first approach had been prioritised, the heat load and consequently the size and scale of generation technologies involved could have been minimised. On the other hand, its not-for-profit approach specifically targets fuel poverty through strong community involvement.

The following case studies are more focused on a combination of heat and electricity delivery, which enables closer comparison with the demand side energy services case studies.

CASE STUDY 1: THE GREATER LONDON AUTHORITY

The Greater London Authority (GLA) is seeking a variety of approaches to energy generation and energy efficiency. As a result it appears both under supplying useful energy streams and supplying final energy services. To address its desire to operate as a junior electricity licensee, the GLA is seeking tenders through Transport for London (TfL) for electrical generating capacity under Licence Lite (TED, 2014). The GLA is the first public authority to apply for this licence (Cornwall Energy, 2013). The objective is to support the development of decentralised electricity systems (renewable and CHP) in London by providing decentralised generators with better value for the electricity they generate. The GLA will buy excess electricity produced by London's boroughs and public bodies before selling it at cost price to other public sector organisations, such as TfL, the Metropolitan Police (London) and NHS hospitals. The first customer will be TfL (Tate, 2014). As electricity generators will be offered 20–30 % more than they are currently offered, CHP in particular will become more economically viable. Heat produced through electricity generation will be used to heat local buildings (Beech, 2014; Goode, 2014). According to the GLA, License Lite could spark over £300m worth of investment for 22 heat and power project in the short term and potentially over £8bn of investment as well as around 850 jobs until 2025. Energy efficiency gains are primarily achieved by heating local buildings through the electricity generating process (GLA, 2015). Exact details of associated ESCs have yet to be published.

CASE STUDY 2: BLUE SKY PETERBOROUGH LTD.

Blue Sky Peterborough Ltd. (BSP) is the UK's first public micro-utility (The Guardian, 2014) and it is often referred to as an ESCO. It was set up on the back of Section 95 of the Local Government Act 2003 (HM Government, 2003), which allows local authorities to trade electricity through a company limited by shares. Peterborough City Council aims at generating renewable energy and use BSP to joint venture with licence holders to avoid unnecessary regulation for distribution and supply to local authority buildings. This joint venture arrangement with a licence holder helps secure income for the local authority through municipal and community energy while reducing price uncertainty (Harrison, 2014).

Peterborough Council also aims to provide an alternative tariff with British Gas ('Peterborough Tariff') for both single (electricity) and dual fuel (electricity and heat) for the public, thereby tackling fuel poverty. Similar to License Lite, this model can also be used by other local authorities although specific details on proposed ESCs have yet to be published. BSP is partly responsible for managing Peterborough City Council's EPC with Honeywell (more details in Local authority demand side energy services section) and the contract with British Gas. Although BSP was not necessary for the development of the contracts, it may take over some managerial elements on behalf of the council. Energy efficiency measures are therefore independent from trading, the main remit of BSP.

CASE STUDY 3: ENVIROENERGY (NOTTINGHAM CITY COUNCIL)

Nottingham City Council's district heating network is the largest in the UK. It has been providing heat and hot water for four decades and it is considered by many as a role model. Originally managed by British Coal, it is nowadays managed by an independent ESCO EnviroEnergy, which is wholly owned by Nottingham City Council, along with delivery partner Vital Energi, a commercial ESCO. In total, Nottingham's Eastcroft energy-to waste 14.5 MW CHP system serves around 4,600 homes, around 150 commercial customers and many public buildings using 68 km of pipework and generating 180.000 MWh/a of high pressure steam. It also generates around 20 GW (60,000 MWh/a) of electricity. Carbon savings amount to around 27,000 tCO_2/a (CHPA, 2011; Vital Energi, 2015). According to EnviroEnergy, the carbon emission factor for heat from their district heating schemes amount to 0.086 kg CO_2/kWh and for electricity through their private wire system to 0.171 kg CO_2/kWh (EnviroEnergy, 2015)[3]. Respective figures are 0.184 kg CO_2/kWh for gas and 0.499 kg CO_2/kWh for grid electricity (Jenkins, 2012)[4]. ESCs are in place with several developers as the Merton Rule requires them to source at least 10 % of their schemes' energy from on-site renewables, which also includes district heating from waste-to-energy (CHPA, 2011). EnviroEnergy is an ESCO wholly owned by Nottingham City Council responsible for distribution, metering and billing and it provides an example of a local authority owned not-for-profit ESCO that supplies useful energy streams not only to its own estate but also to public and private sector clients throughout the city. It is also the first local authority to apply for a full supply licence (CLUES, 2012).

Supplying final energy services to local authorities

Addressing the supply of final energy services using energy service contracting at a local authority level promises great opportunities for energy efficiency and savings on energy expenditures. Current EPC models often exclusively address local authority estates and other public sector organisations by outsourcing the supply of final energy services to private sector ESCOs. This stands in contrast the business models employed for the supply of useful energy streams, which often involve local authority owned or share-owned ESCOs serving a greater range of clients, rather than outsourcing their supply to a third party ESCO.

On the other hand, opportunities for local authority EPCs may also arise out of area-based approaches. Your Energy Sus-

3. The carbon emissions factor provided by EnviroEnergy have been calculated using a formula approved by Adkins, Nottingham City Council and Salix Finance.

4. The carbon emissions factor of UK grid electricity and gas have been provided by the UK National Grid for the year 2010.

sex (YES) for example was set up by several pro-active county councils by appointing a private sector ESCOs specifically for the delivery of energy services, the achievement of energy efficiency targets and fuel poverty alleviation for homes and non-domestic buildings across Sussex in the south of England. YES aims at saving money and providing recipients of income related benefits with warmer living environments by making use of the Green Deal and the Energy Company Obligation (ECO)[5] with the ultimate target of installing energy saving measures in up to 680,000 households over the next 25 years. Carillion, the ESCO appointed as delivery partner, has also undertaken surveys of local authority estates with the possibility of developing performance contracts. This example indicates that opportunities for EPC may arise out of area-based approaches to energy governance.

A more common approach, however, is the direct targeting final energy services on local authority estates. Traditionally the remit of in-house energy management, several recent developments are contributing to the diffusion of hybrid and market based governance structures using relational or long-term contracts with a particular focus on performance contracting. Austerity measures and budget restrictions are key drivers but investment backlogs and incentives for local economic growth through energy led funding solutions (LCA, 2014) also play an important role in the development of more market-based approaches. London's RE:FIT project, as mentioned above deserves a special mention is this context (see Case study 4).

CASE STUDY 4: THE GREATER LONDON AUTHORITY

The GLA's RE:FIT (RE:FIT London) project is both the most successful local authority approach to EPC in the UK and the UK's most prominent public procurement framework. It is funded by the European Investment Bank (90 %) and the GLA (10 %). The GLA has a contract with the Programme Delivery Unit (Turner Townsend and PA Consulting Group) to support public sector organisations in greater London. RE:FIT London is designed to reduce energy demand through a fabric first approach for retrofitting public sector buildings using EPCs, although renewable energy technologies may also be installed as part of the package. The GLA expects RE:FIT to reduce CO_2 emissions by 2.5 mt/a by encouraging the retrofitting of around 40 % of London's public sector floor space (11m m^2 or 27.5m m^2 in total). 12 private ESCOs were procured under the OJEU process and it now provides an open book framework. Pre-approval also streamlines the implementation process and on average, 4–6 of the approved ESCOs bid for a a project. The ESCOs guarantee savings in kWh, 20 % on average, with typical payback periods of 5–8 years. RE:FIT London has retrofitted or is in the process of retrofitting over 400 public sector buildings in London, saving £5m/a and 30,000 tCO_2/a from investment of £55m. RE:FIT London also targets schools specifically in its RE:FIT Schools Programme. Usually excluded from EPC due to high transaction costs, this framework allows schools with annual energy bills as low as £60,000 to attract interest from established ESCOs, while the largest RE:FIT London project is valued at £6m. Major projects are expected to have project values of up to £10m, medium projects up to £5m and small projects, which primarily applies to schools and small organisations, up to £500,000.

Due to the high transaction costs associated with more in-depth refurbishment projects, however, most of the technologies installed for small projects tend to be off-the-shelf as companies guaranteeing savings tend to install what has been tried and tested before. Potential lock-in effects (Arthur, 1989) of this approach will be analysed in the discussion section. Interestingly, most organisations use their own funding as current returns are good thanks to low interest rates and many projects can be paid for through operating (maintenance) budgets, as opposed to capital budgets, although some borrow directly.

CASE STUDY 5: PETERBOROUGH ENPC

Similar to RE:FIT, Peterborough EnPC is also a procurement framework. Compared to RE:FIT, however, it relies on one delivery partner. Honeywell was pre-approved as a supplier out of 18 applicants. The final selection process between British Gas and Honeywell went in favour of the latter as British Gas offered financial savings while Honeywell offered a 20 % energy savings guarantee (known as the 80 % guarantee). This approach is seen as an opportunity to develop a long-lasting relationship as Honeywell are responsible for both installation and the guarantee. If the guarantee is not met, Honeywell will pay up, which provides the council with an exact figure of how much money can be saved. Interestingly, O&M of installed technology is provided by Honeywell in collaboration with Amey, Peterborough's contractual O&M partner. Money was sourced through a Public Works Loan Board (available only to local authorities in the UK and it allows local authorities to borrow from central government) capital budget with a 4 % interest rate as opposed to revenue budgets. As part of austerity measures, Peterborough City Council needs to save £25 m and current projects under Peterborough EnPC provide a net savings of £2.1 m. It is expected that by mid-2015 the entire estate of Peterborough City Council will be part of the contract.

The underlying model of Peterborough EnPC can be applied to any council in the UK and their legal partner, Pinsent Mason, is in negotiation with several local authorities. As mentioned above, the approach has been criticised for being less transparent than RE:FIT's open book approach and for resembling a 'one-man-show', as Peterborough's executive director of strategic resources has been the single most important driving force behind it. On the other hand, this partnering approach may enable more in-depth refurbishment. It also provides the benefit of not requiring individual tenders for individual buildings. This allows multiple sites and buildings to be addressed as part of one contract, including 33 schools that would not usually be considered viable targets under an EPC due to high transaction costs. However, this approach requires significant capacities on behalf of the delivery partner to comply with the specifics of the contract. The benefit of Peterborough's approach is that the savings are guaranteed by Honeywell, whose size and history should provide sufficient securities. One of the interviewees described Peterborough's EPC as a journey that needs to include the reduction of demand, which usually involves asset upgrades, followed by optimisation of generation, followed by active demand management.

5. National programmes aimed at funding the installation of energy saving measures in private households.

CASE STUDY 6: CAMBRIDGE COUNTY COUNCIL

Cambridge County Council (CCC) appointed Bouygues Energies & Services as their energy service delivery partner (for both energy efficiency and renewable energy generation) following a procurement process supported by the RE:FIT England programme and led by the Council's MLEI (Mobilising Local Energy Investment Cambridgeshire) team. Bouygues will deliver a retrofit programme for public sector buildings such as schools and offices. 42 schools have signed up a commitment and up to 20 of the 90 buildings that are likely to remain with CCC in the foreseeable future are likely to be included in the programme. It is also open to other local public sector organisations. 10 sites have been identified for initial assessment including the council headquarters, 5 secondary schools and 4 primary schools. Loans will be provided by the council or other financial sources and payback periods are expected to be around 10 years. The initial aim is to invest at least £5m in Cambridgeshire public sector buildings by August 2015 with grant funding from the European Commission's Intelligent Energy Europe Programme[6], and to continue investment over the next 10–15 years (Bouygues, 2014).

Compared to RE:FIT London, which offers the equivalent services free of charge, RE:FIT England charges are in general 2–3 % of the value of capital works for RE:FIT but costings are according to client capacity and would be capped for higher value projects to only reflect the cost of support required to deliver the projects. Clients either pay up front using operating budgets or RE:FIT fees are capitalised and either paid by the client or by the ESCO, who integrates the fees into the overall project value using capital budgets. RE:FIT England is still evolving and only a very small number of contracts are currently in place but it also offers the option of partner bidding, as opposed to target bidding (see Public procurement frameworks and the diffusion of energy service contracting section above). Similar to Peterborough EnPC, this approach allows the ESCO and the client to enter a partnership to develop the project further before savings are guaranteed. Greater flexibility allows projects to move away from predetermined budgets as ESCOs can sometimes increase savings significantly with only a moderate budget increase.

Discussion

What is evident from this piece of research is that there is no standard role for ESCOs or form of energy service contracting that is emerging. Different local authorities have different models depending on area specific issues and objectives. The responsibility for supplying useful energy streams at a local authority level appear to be more likely to be linked to area-based, local authority-led approaches to ESC while the supply of final energy services is more likely to be outsourced using EPCs with third party ESCOs. Public procurement frameworks in particular are proving important drivers for the diffusion of EPCs across a variety of public-sector buildings and projects across local authorities and cities. Despite the success of public procurement frameworks, however, it remains to be seen whether they constitute universally applicable models for significant improvements in energy efficiency.

One interesting aspect of particular relevance for the supply of final energy services is the scale of EPCs, the ESCOs, the delivery frameworks and the technologies involved. 'Small' projects may involve schools or individual local authority buildings. 'Medium' may include a set of buildings, either on a single site or as part of a portfolio. 'Large' projects may serve a portfolio of or single sites such as university campuses or hospitals. The contractual complexity increases with scale but the larger the project the larger the energy bills and potential costs savings. To keep things simple, local authority procurement frameworks have an upper limit in terms of scale for applicability by keeping contracts relatively simple (i.e. 50 pages as opposed to 300 pages for NHS procurement frameworks). This approach increase replicability but may hinder the exploration of possibilities for deeper retrofits and more comprehensive energy savings as technologies tend to be chosen according to a predetermined savings level as opposed to a dynamic target based on net annual savings across 15–20 years. 'Large' projects tend to require stand-alone contractual agreements and bespoke contracts. This increases transaction costs but can lead to greater total energy savings as well as in percentage terms along with the development of potentially innovative socio-technological configurations. 'Small' projects under a replicable contract framework, on the other hand, may be subject to unfavourable lock-in effects (Arthur, 1989) as replicable, off-the-shelf technological application and associated guarantees may limit deeper retrofit opportunities over the duration of a contract. The same danger might arise out of 'larger' contracts but the assumption is that more bespoke contracts allow for contingencies such as technological advancement.

If a non-in-house approach is being considered, local authority supply of final energy services is therefore more likely to be outsourced to third party ESCOs while the responsibility for supplying useful energy services is more likely to be devolved to local authority linked ESCOs. The fact that several local authorities are approaching local sustainable energy developing using a dual approach, with a more or less vertically integrated not-for-profit ESCO owned by the local authority responsible for supplying useful energy streams and responsibility for the supply of final energy services outsourced using long-term EPCs serves to illustrate the complexity and the dynamism of UK local authority energy engagement. The complexity of achieving, measuring, verifying and sustaining revenue streams through energy saving as opposed to the comparatively simple procedure of securing income streams through subsidised renewable energy generation[7] in particular appears to be an important driver for this development. On the other hand, ESCOs increasingly make use of these income streams to balance out retrofit measures with long payback periods as part of EPCs. What this ultimately points towards is that if a local authority has the resources and capacities to supply useful energy

6. MLEI Cambridgeshire has been running since late 2012 and Cambridgeshire County Council secured €840 k over the 36 month duration of the project from Intelligent Energy Europe Grant. The aim was to set up a long-term finance model for joint private and public sector investment to support low carbon infrastructure development with projects costs of €1,120 k triggering investments of €17 m (IEE, 2014, Mobilising Local Energy Investments (MLEI) projects supported by the Intelligent Energy-Europe programme – Factsheets, European Commission, Executive Agency for Small and Medium-sized Enterprises, Brussels http://ec.europa.eu/energy/intelligent/files/mlei-projects-2011-12.pdf).

7. Over 600,000 households in the UK benefit from the FiT for solar PV panels.

streams in-house, it is more profitable to do so in the long-run than to choose a more devolved responsibility or an outsourcing option, which may provide returns from day one.

What these projects also indicate is that it is not always helpful to distinguish between useful energy streams and final energy services as many projects combine a number of approaches and technologies to deliver energy efficiency, energy demand reduction and renewable energy or other forms of distributed energy generation. Very few projects focus exclusively on particular technologies or approaches, such as district heating, and the decision about which approach to choose depends on issues such as cost, funding, risk, the in-house capacity in energy management and whether the focus lies on individual projects or a portfolio of projects.

Energy service contracting as a particular form of outsourcing using long-term contracts has the benefit of transferring risks to private ESCOs and the figures provided by the local authorities and their procurement frameworks indicate that investments in guaranteed energy savings of around 20 % can be paid back in significantly less than 10 years. For greater carbon and energy savings, however, dual strategies combining hierarchical and market based strategies are proving particularly useful.

From a capacity building perspective, somewhat surprisingly, any form of engagement with energy is proving useful for local authorities as even outsourcing, as is the case with Peterborough City Council, encourages the development of in-house skills and capacity to manage the contracts and the new infrastructures but also to create and manage revenues. Unusually, Peterborough started with outsourcing the supply of final energy services before moving into useful energy streams. A more common approach, not only for local authorities but also for community energy groups and other non-traditional businesses and organisations engaging in energy projects, is to start with a generation technology such as solar PV. Thanks to FiTs, continuous revenue streams enable engagement with energy and may encourage local authorities to embark on restructuring more complex supplies of final energy services to take relational or long-term contracting opportunities such as energy service contracting into account. In these cases the FiTs provide the initial business case for energy engagement and once resources have been allocated towards developing generation projects, energy efficiency and demand side management projects follow.

Conclusion

This paper set out to analyse the role of energy service contracting in delivering energy efficiency measures for UK local authorities. Energy service contracting and ESCOs in particular potentially address a wide range of useful energy and final energy services, both within local authority estates and their geographical area. As a result, it is not always useful to limit the unit of analysis to energy efficiency as business model, contractual, technological and social innovation are providing multiple pathways towards sustainable local energy provision and management. This is reflected by the fact that the organisations hosting the most successful procurement frameworks for energy efficiency using energy service contracting, specifically EPCs, are following dual strategies where energy refurbishment and management of individual buildings is outsourced using market based governance structures with long-term contracts while area-based approaches may use a combination of governance structures, often using relational contracts. Such contracts between local authorities and (not-)for-profit organisations either wholly owned or part-owned by local authorities play an important role in supplying useful energy streams to local authorities (as well as clients within the geographical area).

The rapidly increasing number of local authorities engaging in the supply of useful energy streams and final energy services and the lack of standardisation potentially enables the combination of a wide range of technological and social innovations capable of reducing energy demand and managing sustainable energy independent of centralised generation infrastructures. District heating networks as fundamentally local approaches often provide the basis for deeper local authority engagement in energy services but falling prices for renewable energy technologies and business model/contractual innovation for energy efficiency investments are similarly encouraging local authorities to consider both building specific and area-based alternatives to the dominant energy delivery infrastructure.

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