

## Is Energy a Key Enabler for the Economic Resilience of UK Cities?

### The Role of Cities in the UK Energy Agenda - Their Importance as facilitators, co-ordinators and possible Implications

#### Executive Summary

The proportion of UK electricity generation capacity which is decentralised has risen from 16% to 23% in the period 2011 - 2013 and could increase as a result increased emphasis on decentralised energy in local planning policies, government support mechanisms and falling technology costs. At the same time there is the increased priority being given to the city devolution with a recognition that decentralising government control of budgets to civic local authorities could have substantial economic benefits on productivity, equity and living standards. For example, UK's 8 largest cities could add £222 B and 1.16M jobs to the UK economy by 2030. Furthermore, as budgets are being cut, local government is actively looking to attract new investment opportunities and are engaging in infrastructure and energy having realised their importance in regional economic resilience.

Growing policy focus on demand side energy solutions is requiring an increased role for local government to act as facilitators and coordinators in the evolution of the UK energy system. An example is the roll out of decentralised capacity, where future energy planning for heat and electricity, will need to take into account spatial characteristics and infrastructure. This is where this work is centred.

The key findings are as follows:

- **Economic Resilience:** The engagement of UK cities in shaping a future energy systems could provide opportunities in facilitating regional economic regeneration through local job creation, skills development and the amelioration of social issues such as fuel poverty and deprivation.
- **Decarbonising Energy:** Greater involvement of UK cities in the provision of energy services could bring about significant changes to the way that the UK generates electricity, decarbonises heat, manages the demand side, provide solutions such as area wide energy efficiency programmes, the roll out of smart meters, and involvement in the demand side response market.
- **Policy and regulatory needs:** Explicit central Government recognition of the role of local authorities in the development of energy is key to achieving these aims. It will require a review and revision of existing policy and regulation to realise the full economic, social and environmental benefits that local government can deliver.
- **The role of cities and local authorities as an enabler:** There are different challenges, opportunities and actions for a wide range of actors such as infrastructure developers, institutions (universities and hospitals), community groups and industry that operate in UK cities to realise the opportunities of distributed energy, demand reduction and demand side response.

Benefits that could arise out of a more of a decentralised centric UK energy system range from the introduction of new sources of investment finance into the energy sector; increased diversity of generation providing enhanced energy system resilience; and the creation of new market opportunities such as local demand side reduction and response services. These benefits are by no means guaranteed and the role of local authorities in supporting the effective implementation of the energy system transition by facilitating and co-ordinating the multiple actors involved is likely to be vital. This system transition is, however, happening at a time when local authorities are having to manage significant reductions to their budgets as a result of 40% central government funding cuts. There are also substantial technical, financial, regulatory, innovation and capacity development implications of an increasingly decentralised UK energy system which need to be considered.

The central recommendation of this work is that there is a need for central Government recognition of the role of local authorities in the facilitation and co-ordination of the development of the UK energy system via the establishment of a Cities and Energy Unit in DECC. This unit would address the capacity gap in cities to engage in the utility sector and ensure integration of local-national agendas.

## 1. Introduction

City authority engagement with energy has been substantial for some time: As consumers, they probably make up one of the largest consumers in their jurisdiction<sup>1</sup> and can establish significant influence over energy use in residential, public and commercial buildings and transport; they have been participating in energy efficiency and demand side reduction policy<sup>2</sup>; and as enablers, through their statutory and planning powers and duties, they can allow low energy infrastructure development. However, the scope of their engagement in energy is increasing as a result of energy policy e.g. the management more prescriptive building regulations such as Zero Carbon Homes, Smart Meter roll out, smart grid development and the substantial reduction in decentralised energy technology costs. Decentralised energy in the form of Photo-Voltaics, wind, Combined Heat and Power are being added to the UK energy system at an unprecedented rate. For example, the cost of silicon PV modules have fallen from \$10 to 0.14 per Watt in 25 years which along with a favourable policy environment is meaning that solar PV is being added at 8 MW per week in the UK. In 2008 it was being added at 8 MW per year.

At the same time, the UK electricity retail sector has seen substantial price increases. Since 2006, average year on year rises have reached 15 % with a compound rise of 71% in average dual fuel bills, rising from £760 in 2006 to £1,320 in 2013. At the same time domestic energy consumption has dropped by 9.1% for electricity and 6.8% for gas. Retail customers are paying more for less<sup>3</sup> which is raising consumer concerns regarding energy prices and a lack of trust in electricity companies<sup>4</sup> as well as increasing incidence of fuel poverty - a principal concern for local politicians. Furthermore, substantial budgetary cuts of up to 40% are forcing city authorities to be innovative to address budget shortfalls to deliver core services. In line with this, they are also seeking to attract new investment opportunities and are engaging in infrastructure and energy having recognised the role of infrastructure on regional economic resilience, for example, Capital/GVA return for electricity and gas systems is ~0.43 and ~0.3 pa, respectively.

Finally, there has also been the realisation that the UK is fiscally one of the most centrally driven countries in the world - 95% of local authority revenues are from central grants - whereby decentralising government control of budgets could have substantial economic benefits on productivity, equity and living standards. For example, UK's 8 largest cities - excluding London - could add £222 B and 1.16M jobs to the UK economy by 2030<sup>5</sup>. This is resulting in the devolution of powers and budgets in the form of City and Growth Deals.

There is a tension, therefore, in that central government policies especially around energy are placing a greater need for the involvement of local authorities at a time when the capacity for them to engage is being reduced. Furthermore, with energy not being a core delivery area for authorities and the pressure on other services - the lack of central government strategy as to how to involve authorities and the lack of formal recognition may be to the detriment of UK energy system development.

---

<sup>1</sup> <http://www.agma.gov.uk/latest-news/launch-of-greater-manchester-s-energy-plan/index.html>

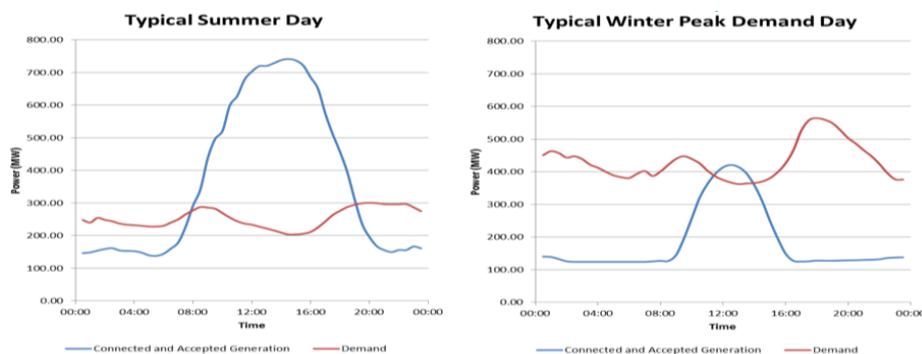
<sup>2</sup> DECC, 2012. Energy Efficiency Strategy; RE:FIT, 2013: [www.refit.org](http://www.refit.org); There are also league tables assessing the energy efficiency of local authorities: [www.laenergyindex.co.uk](http://www.laenergyindex.co.uk); Also ECO and Green Deal.

<sup>3</sup> Williams, 2015 APSE State of the Market Report

<sup>4</sup> Which? Consumer Insight Tracker, February 2015.

<sup>5</sup> Oxford Economics forecast for Core Cities 2013. Competitive Cities, Prosperous People: A Core Cities Prospectus for Growth. Manchester: Core Cities Group.

This work focuses on the role of city authorities as facilitators and coordinators in the evolution of the UK energy system characterised by ever increasing decentralised capacity. The proportion of decentralised UK electricity generation capacity has increased from 16% to 23% in period 2011-2013<sup>6</sup>. Decentralised generation capacity is already having an impact on the UK electricity system e.g. local grid balancing is proving difficult in summer months in Cornwall (see figure 1).



**Figure 1:** Cornwall electricity demand and generation profiles (WPD). On a summer's day electricity supply as a function of solar PV generation is 3.5 times the demand.

The potential benefits of an increasingly decentralised UK energy system are substantial as it: (1) opens up the UK energy market to new sources of investment finance when the balance sheets of centralised incumbents are shrinking; (2) could alleviate social equity concerns which are being realised with present macro policy as the less affluent are stranded on assets which have a falling customer base e.g. as would happen with the gas grid should heat be electrified via retrofitted heat pumps; (3) work suggests that infrastructure interdependencies and energy systems resilience are better facilitated in a more distributed system<sup>7</sup>; (4) demand side response and demand reduction are easier with a local, geographic focus; (5) results in local value capture from the energy system which at present 'leaks' to private sector utility companies; and (6) gives direct accountability to consumers who have seen substantial increase in electricity and gas prices of the order of 70% in dual fuel bills since 2006 despite overall falling demand and are therefore increasingly untrusting of the Big Six utilities<sup>8</sup>.

With the transition to the greater use of decentralised energy systems, the drive to decarbonize heat and address demand reduction and demand side response, the energy system will become more spatially heterogenous. This will mean that future energy planning for heat and electricity will increasingly need to take into account spatial characteristics and infrastructure. Detailed local knowledge will be essential to convene multiple stakeholders and for the individual choices of actors to be addressed across communities and commercial interests. Local authorities are therefore best placed to address these complex socio-technical and socio-economic requirements. Local authorities, however, have no clear mandate to engage in development of the UK energy system. If central Government does not fully develop a framework that both recognises and allows the capacity for local authorities to facilitate and co-ordinate UK energy system evolution - then, the risk,

<sup>6</sup> DUKES, 2014. *Digest of UK Energy Statistics 2014, Chapter 5, Electricity*. UK Government.

<sup>7</sup> Thacker et al., 2014. Exploring the vulnerability of future configurations of the UK electricity network system. [Conference Paper....](#)

<sup>7</sup> Icaro consulting, 2009. Understanding

<sup>8</sup> Which? Consumer Insight Tracker, February 2015. Where it was found that the energy sector is the least trusted sector with the exception of car dealers - being seen as 'profit driven or greedy'.

is not only that the optimisation of the UK energy system be compromised but also the economic value add, social and environmental benefits will be missed.

The role of local authorities, particularly city authorities is under studied and not well recognised in UK energy policy, or policy development more broadly. In the energy initiatives that have been launched by government departments, though local authorities have been the targets of some policy, their fundamental role as facilitators and co-ordinators has been largely omitted<sup>9</sup> with strategic implications on UK economic development and optimal energy system development. This is taking place when local authorities have had to manage substantial budget cuts of up to 40%. Therefore, the need for greater capacity to facilitate, co-ordinate and/or engage directly in energy system development is being compromised as local authority resources are reducing.

A range of local authorities, both large and small, are now engaging directly in planning and developing their own decentralised energy projects. It is important, however, to differentiate the needs of local authorities in order to (1) enable the effective evolution and realisation of the increasingly decentralised UK energy system through facilitation and coordination of the relevant actors - from (2) their needs to participate in the energy system directly. The needs of local authorities are different in each case. It is the Energy Research Partnership's (ERP) belief that the role of local authorities as facilitators and coordinators which will be more significant than through direct participation - though the importance of the latter cannot be discounted.

#### ***What aspect of Cities and Energy does this work cover?***

This research took a city as being *'a functionally contiguous urban area which may cross governance boundaries'*. The work sought to develop an *.....understanding of the gap between the energy aspirations of UK cities and the regulatory/policy frameworks, processes and factors which are needed to realise those aspirations.*

The focus on cities is because a substantial proportion of energy engagement activity is taking place in municipal authorities<sup>10</sup> though many of the recommendations of this work are applicable to local authorities more broadly.

To do this, the project sought to identify:

- What could wide spread decentralised energy look like in a city and how is this delivered?
- What could the benefits that can be realised if it is successful and what dis-benefits should be avoided?
- What could the role for cities and local authorities be in delivering this new infrastructure?
- And, the operational, regulatory, energy market and policy implications of greater decentralised energy in the context of the UK's decarbonisation targets to 2050.

---

<sup>9</sup> See [link](#)

<sup>10</sup> Hawkey, D., Tingey, M. and Webb, J. 2014. Local engagement in UK energy systems - a pilot study of current activities and future impact. Edinburgh: Energy Technologies Institute and University of Edinburgh

## ***Our process?***

The Energy Research Partnership sought to understand the implications of the role of cities and their potential impact on UK energy system development in order to inform policy, regulation and innovation funding<sup>11</sup>.

A Steering Group<sup>12</sup> was formed from membership organisations to scope, manage and prioritise messaging for the project. Other partners were also invited into this fast moving and understudied area - these included: the Realising Transitions Pathways Consortium, Ofgem, Ameresco and the APSE Energy Collaboration<sup>13</sup>.

A number of actors in local authorities were consulted including Cardiff City Council\*, Buckinghamshire County Council, Nottingham City Council\*, the Greater London Authority and consultants to Peterborough City Council. The project also assisted in the organisation of an Energy Summit<sup>14</sup> and set up a workshop which involved a broad range of actors working in this space<sup>15</sup>. A visit to Copenhagen also allowed insights to be developed on the role that municipal authorities play in the energy and utility sector on the European continent.

In the pages that follow we provide:

- A summary of the four key findings in UK city authority engagement with energy;
- Potential technical, financial, regulatory, innovation and capacity development implications of these findings; and
- Recommendations as to how to address these findings and their implications.

The Energy Research Partnership believes that UK cities as facilitators and coordinators in the evolution of the UK energy system should be more explicitly recognised by central government. If acted upon it could have energy system, social, environmental, carbon and UK economy wide benefits.

## **2. Key Findings**

**2.1 *Economic Resilience:* The engagement of UK cities in shaping a future energy systems could provide opportunities in facilitating regional economic regeneration through local job creation, skills development and the amelioration of social issues such as fuel poverty and deprivation.**

The UK is fiscally one of the most centrally driven countries in the world when it comes to tax raising and spending. Ninety five percent of revenues come from central grants with local authorities only having 1.7% of tax raising powers - the balance of their income being made up from miscellaneous sources such as parking and management of leisure facilities. An increasing body of work suggests that decentralising government expenditure and revenue could have economic benefits such as:

<sup>11</sup> <http://erpuk.org/about-erp/>

<sup>12</sup> <https://futureofcities.blog.gov.uk/2014/12/17/energy/>

<sup>13</sup> <http://www.realisingtransitionpathways.org.uk/> | <https://www.ofgem.gov.uk/>  
| <http://www.ameresco.com/> | <http://www.apse.org.uk/apse/index.cfm/local-authority-energy-collaboration/>

<sup>14</sup> <http://www.apse.org.uk/apse/index.cfm/events/previous-seminars/the-big-energy-summit/>

<sup>15</sup> <http://erpuk.org/uk-cities-energy-systems-round-table-policy-workshop-24-march-2015/>

\*A Core City: <http://www.corecities.com/about-us/core-cities>

- Increasing national productivity by narrowing regional variations in economic value produced - see figure 2, below
- Reduce the 'fiscal gap' which reflects the discrepancy between cities attributable tax revenues and their level of public expenditure e.g. Greater Manchester is in annual £4.8 billion fiscal deficit to HM Treasury. This is not sustainable<sup>16</sup>; and
- Smooth income differences between regions<sup>17</sup> reducing inequity.



**Figure 2:** The UK is one of the most economically unbalanced nations in Europe. The gap between London and its regional cities is substantial. Seven of the 8 largest cities outside London perform below national averages per person. In Germany 8 of the largest cities outside Berlin outperform the national average<sup>18</sup>.

It has been suggested that closing the productivity gap by granting the eight English core cities<sup>19</sup> would generate an additional £222 B and 1.16M jobs to the UK economy<sup>20</sup>.

Pressure on local authority budgets is also increasing. Following the austerity measures introduced by the coalition government in 2010 local authorities have had to manage a ~40% spending reduction in central funding to 2015 and are facing a £12.4 B funding shortfall to 2020. Therefore, devolving fiscal power from central government is shrewd for both political and economic reasons:

- It places the responsibility for allocating the reduced budgets to those who the electorate have more trust in;
- It reduces duplication in the public sector from national and local levels and integration of the management of budgets saves administrative costs<sup>21</sup>; and
- Ensures that spending reflects local needs e.g. skills, innovation, education, planning, housing etc.

It is against this economic and political backdrop that the UK cities facilitation and coordination role in the energy and utility sector more broadly must be considered. It is the role of energy as an enabler for the operation of economically important infrastructure and the importance of that infrastructure to economic development: skills development, competitiveness to attract businesses, employment and regional economic growth - that are key.

Greater local authority engagement in energy is part of the broader recognition importance of infrastructure to their function and in economic development and resilience, social welfare and well-

<sup>16</sup> New Economy 2014. Fiscal Decentralisation Briefing 32.

<sup>17</sup> See Working Paper from the IMF in April 2014: <http://www.imf.org/external/pubs/ft/wp/2014/wp1464.pdf>

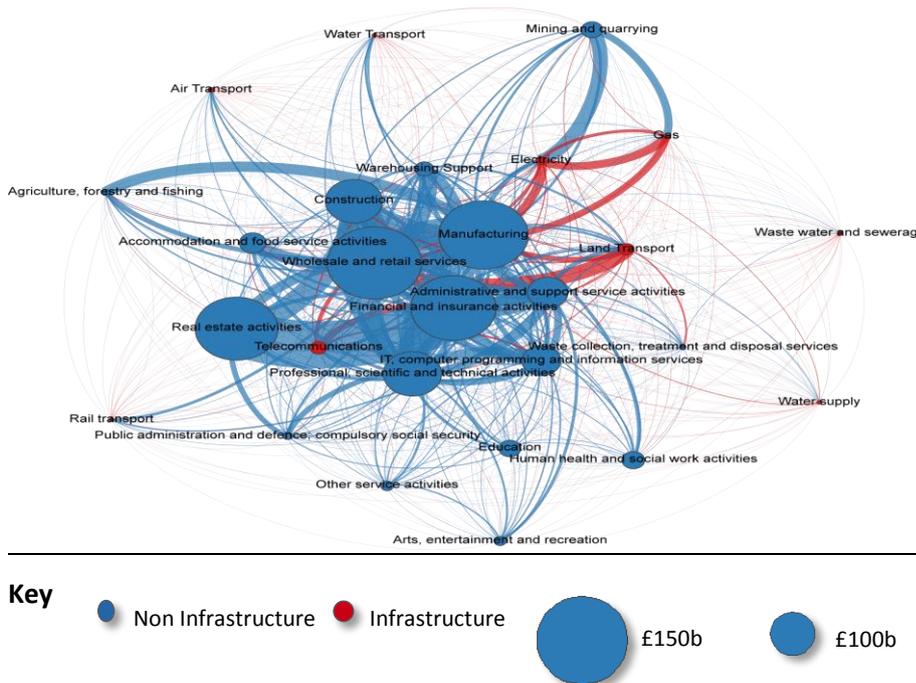
<sup>18</sup> Economist, 2015. England's Cities: Spreading their wings dated 6<sup>th</sup> June 2015.

<sup>19</sup> These include: Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield

<sup>20</sup> Oxford Economics forecast for Core Cities 2013. Competitive Cities, Prosperous People: A Core Cities Prospectus for Growth. Manchester: Core Cities Group.

<sup>21</sup> Ernst & Young, 2013. Local Government Association: Whole Place Community Budgets: A Review of the Potential for Aggregation. January 2013.

being. According to recent work<sup>22</sup>, the most productive infrastructure in the UK is telecommunications which has a GVA/Capital Ratio of 0.67 pa, this is then followed by gas and electricity at 0.43 and 0.3, respectively in 2012 i.e. investing £1 in electricity capital infrastructure will generate 30p return pa meaning that the capital will be paid back in the form of regional GVA in 3.33 years. The need for resilience of the municipal infrastructure systems is also demonstrated by figure 3, below - increasingly interconnected, across sectors and between scales, infrastructure systems are susceptible to cascade failure with consequential economic second and nth order impacts.



**Figure 3:** Dependency of UK economic activity on infrastructure - especially energy (electricity and gas), telecommunications and transport. This UK national perspective will be replicated at a smaller scale for UK Cities<sup>23</sup>. The exact figures being dependent on the economic base of the city concerned.

Furthermore, it is estimated that up to 10% of GVA leaks out from a local economy in the payment of an energy bill to a private sector centralised utility company<sup>24</sup>. The re-localisation of energy generation ownership would ensure the capture of this value to the benefit of the local economy.

Other direct economic benefits of investing in the energy sector include: (1) job creation reducing welfare and social bills e.g. Cardiff City Council’s Energy Prospectus intends to create 4,000 new jobs; (2) skills development e.g. Strategic partnering with the private sector allows access to expertise through education and training in the latest energy technologies e.g. AVIC and Peterborough City Council; (3) technology transfer for energy technologies including from smart meter access e.g. AVIC and Peterborough City Council; (4) technology development e.g. Aberdeen’s Hydrogen Bus Project (£20 M) is EU’s largest hydrogen transport project; and (5) investment e.g. Cardiff City Council’s Energy Prospectus intends to attract >£4B of investment.

<sup>22</sup> Kelly, S. 2014. The cost of cascading failure: Risk and Resilience within UK infrastructure networks. Presentation at #UKEW workshop on 2<sup>nd</sup> December 2014.

<sup>23</sup> Kelly, S. 2014. Ibid.

<sup>24</sup> <http://climatesmartcities.org/case-studies>

Social benefits include: (1) local decision making and empowerment of local governance and political processes; (2) Improvements in housing stock, retrofit and reductions in energy loss and associated health benefits plus improved quality of life and wellbeing; (3) community development and ownership of local assets; and (4) direct engagement in energy services provision by local authorities also allows cities to reduce costs for those sectors of the community who are suffering from fuel poverty<sup>25</sup> and reduce elderly deaths during winter<sup>26</sup>.

It is noteworthy that the distribution of economic and social benefits at different scales i.e. regional (inter-city), intra city or intra community - has yet to be reconciled.

**2.2 Decarbonising Energy: Greater involvement of UK cities in the provision of energy services could bring about significant changes to the way that the UK generates electricity, decarbonises heat, manages the demand side, provide solutions such as area wide energy efficiency programmes, the roll out of smart meters, and involvement in the demand side response market.**

Distributed generation now makes up 23% UK energy generation capacity and, in the last few years, has increased at a rate of 2 GW pa<sup>27</sup>. Going forwards, cities are likely to become key enablers of decentralised energy in the urban space as a function of their role in planning regulation and infrastructure development. Modelling has suggested that up to 50% of UK electricity in 2050 could be from distributed energy sources with an increasing body of work that suggests municipal scale engagement in the UK energy system are key to the facilitation of the high levels of distributed energy generation penetration - see Box 1, below<sup>28</sup>.

Cities also have a key function in reducing the demand for energy by addressing energy efficiency measures ranging from appliances to insulation standards. In assessments of the capacity for the UK to decarbonise heat<sup>29</sup>, however, retrofitting of heat demand reduction to the highest of standards is expensive and only results in the attaining of 50% of required emissions savings from the domestic sector. Therefore, the decarbonisation of the heat source will be required. With this in mind, it is likely that in more densely populated areas shared heat networks will be most ideal and in lower density housing that electrically powered heat pumps will be optimal. City authorities therefore have a key role in delivering heat networks with assessments of the role of district heating in UK decarbonisation agenda estimating that between 14 to 43% are economically viable in cities<sup>30</sup>.

Fundamentally future energy planning for heat and electricity will need to take into account spatial characteristics and infrastructure. Local authorities will have to play a role as they are key in the co-ordination and enabling of UK energy development in a more spatially heterogeneous system: they have the local knowledge and convening power for the multiple actors engaging in UK energy system development - see Table 1, below.

---

<sup>25</sup> Lynch, B. Technical Support Manager, Carbon Trust Conference presentation 30<sup>th</sup> April 2015.

<sup>26</sup> There were 165 Cold Related Deaths in Lambeth in 2014.

<sup>27</sup> DUKES, 2014. *Digest of UK Energy Statistics 2014, Chapter 5, Electricity*. UK Government.

<sup>28</sup> Realising Transition Pathways Engine Room, 2015. *Distributing Power: a Transition to a civic energy future*. Realising Transition Pathways Research Consortium.

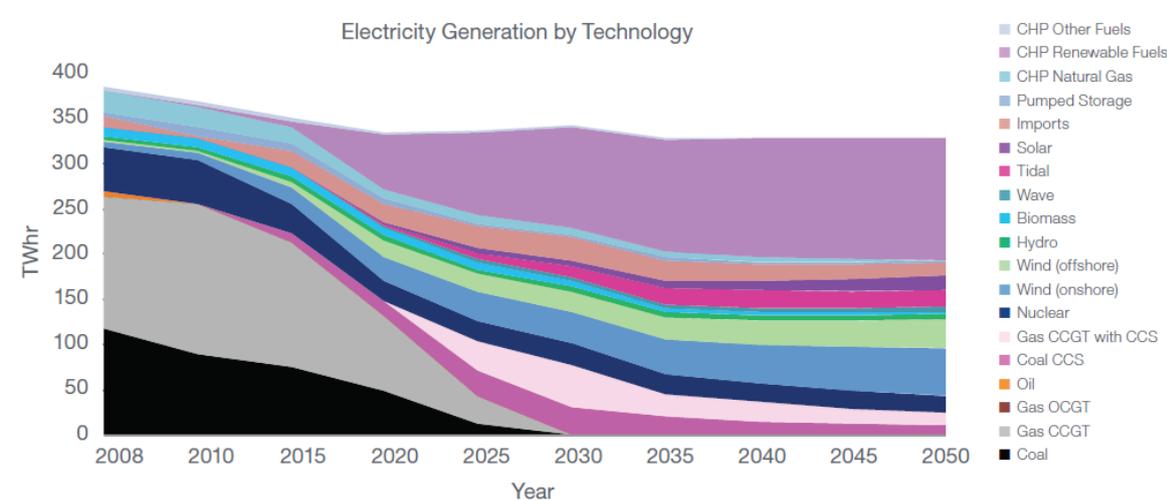
<sup>29</sup> Energy Technologies Institute, 2015. *Smart Systems and Heat: Decarbonising Heat for UK Homes*.

<sup>30</sup> Wiltshire et al., 2013. *Research into barriers to deployment of district heating networks*. DECC dated 26<sup>th</sup> March 2013.

Work has also suggested that local authorities have a substantial role in attaining the UK carbon targets and building in UK infrastructure resilience to climate change. Estimates for UK emissions that come under the direct influence of local authorities is 220 MtCO<sub>2</sub> or ~40%<sup>31</sup>. An additional 150.9 MtCO<sub>2</sub> (~26%) is considered as being indirect control of local authorities via the present centralised power generation network. As a function of their increased engagement in the energy system development a greater proportion of the power generation emissions will be under increasing influence of local authorities<sup>32</sup>. Furthermore:

- It has been estimated that local authorities can reduce emissions in buildings, surface transport and waste where there is an opportunity to reduce emissions by 46 MtCO<sub>2</sub> to 2050 (8% of present emissions); and
- Through their planning and policy controls they can ensure local infrastructure is resilient to flooding and heat stress<sup>33</sup>.

**Box 1: What a UK Distributed Energy Future System might look like in 2050<sup>34</sup>.**



- The distributed energy system can meet 50% of final electricity demand but new infrastructures and emerging technologies are key.
  - Novel technologies are rapidly developed e.g. wave power, fuel cells, energy storage etc.
  - Grid reinforcement and interconnection increase at all levels - from local to international.
  - Grid balancing mechanisms not dependent on the present top down approach are key.
- The distributed energy pathway relies on strong demand reduction and demand side participation and management. Smart grids are key to facilitating this.
- A local and regional approach to distributed energy is vital.
  - This involves regional energy strategies and local capacity building for city regions, municipalities and communities.

<sup>31</sup> Committee on Climate Change, 2012. How local authorities can reduce emissions and manage climate risk dated May 2012. Of which 74.7 MtCO<sub>2</sub> Residential buildings (heat); 15.7 MtCO<sub>2</sub> Non-residential buildings (heat); 113.1 MtCO<sub>2</sub> surface transport include all sources of emissions, including motorways; and 16.9 MtCO<sub>2</sub> is waste. Industry emissions are excluded.

<sup>32</sup> Committee on Climate Change 2012. How local authorities can reduce emissions and manage climate risk dated May 2012.

<sup>33</sup> <https://www.london.gov.uk/sites/default/files/Adaptation-oct11.pdf>

<sup>34</sup> Realising Transition Pathways Engine Room, 2015. Distributing Power: a Transition to a civic energy future. Realising Transition Pathways Research Consortium.

- These organisations must have the right resources, finance and expertise.
- The right mix of institutions and engagement of appropriate civic and municipal actors in the form of Local Energy Schemes (LES) and Municipally Owned Energy Service Companies (MU-ESCOs) are required. Other institutional developments required include:
  - OFGEM+ which has a dual focus on regulation for delivering national capacity and system balancing as well as enable and regulate distributed energy from LES and MU-ESCOs
  - Regional Energy Partnerships which would work with LES and MU-ESCOs, DNOs and OFGEM. They would set regional strategic energy plans.
  - State interventions would need to encourage Transmission level generation.
- Affordability in terms of the impact on consumer bills of the 50% distributed energy system is marginally more expensive in the short to medium term than for other energy system scenarios but lower by 2050.

**Note.** That over 150 TWh of Combined Heat and Power forms the scenario therefore addressing the decarbonisation of the heat agenda as well.

Finally, new legislation introduced by DECC in August 2010<sup>35</sup> has allowed local authorities to sell renewable electricity for the first time. Previously Councils could sell electricity only *if* it was combined with a heat load. They are therefore already participating directly in the UK energy system with the leading authorities having between 3 to 9 generation projects. With the top 10 authorities having 0.58 GW of generation capacity between them the potential for scale up is not insignificant<sup>36</sup>.

**2.3 Policy and regulatory needs: Explicit central Government recognition of the role of local authorities in the development of energy is key to achieving these aims. It will require a review and revision of existing policy and regulation to realise the full economic, social and environmental benefits that local government can deliver.**

The role of local authorities in UK energy system development has largely been considered to be that of a passive or marginal agent in energy system change. Local authorities therefore have no clear mandate as to their role in the development of the low carbon energy system<sup>37</sup>. Yet the increase in the development of decentralised generation on the UK energy system and the increasingly spatial heterogeneity that the decarbonisation requirements will need to address - make their role increasingly important as facilitators and co-ordinators for other actors<sup>38</sup>.

The role of UK local authorities and municipalities in energy is substantially less than in other nations. For example, in Germany where the Stadtwerke system operates municipal companies market share in energy generation amounts to 12% for electricity<sup>39</sup> and 14% in district heating. With the capacity and experience that German municipal companies have they have gone down the energy value chain and their share in energy retail amounts to 46% in electricity, 59% in gas and 65% in heat distribution. In Denmark, municipalities and local authorities own the majority of utility companies.

<sup>35</sup> <https://www.gov.uk/government/news/huhne-ends-local-authority-power-struggle>

<sup>36</sup> Hawkey, D., Tingey, M. and Webb, J. 2014.Ibid.

<sup>37</sup> See the substantial list of [recent DECC publications](#) to demonstrate the lack of identification of the important role that local authorities can have in the development of these activities.

<sup>38</sup> For example, the Home Energy Conservation Act ([HECA Reports](#)) which amongst other issues covers details on planned area-based approaches, outline of partners and details of cofounding were appropriate.

<sup>39</sup> <http://www.cleanenergywire.org/factsheets/small-powerful-germanys-municipal-utilities>

The capacity for local authorities in the UK to replicate the activity in other nations is impacted by<sup>40</sup>:

- The provision of (low carbon) energy is not seen as a priority by national government on local government. In most Councils 'energy' is not seen as a political, corporate and community priority and have found it a sector that is difficult to engage with<sup>41</sup>;
- Concerns about the policy environment within which they are operating and the need for more consistency at Government level to afford authorities the ability to properly plan and implement their programmes;
- A lack of both internal and external resource to support the development of local programmes and to implement projects. This is particularly the case in terms of access to technical, financial and legal expertise to support projects and revenue funding to undertake initial feasibility and business cases;
- At present the mechanisms to allow exchange of intentions and respective needs between actors in the energy system and local authorities is limited
- The present regulatory framework favours the centralised utility model making access for smaller actors problematic<sup>42</sup>; and
- At present the government policies related to the decentralisation of energy agenda including demand reduction and demand side response (D3) are fragmented across departments with a lack of an overall unifying purpose and lack of holistic plan<sup>43</sup>.

**2.4 The role of cities and local authorities as an enabler: There are different challenges, opportunities and actions for a wide range of actors such as developers, institutions (universities and hospitals), community groups and industry that operate in UK cities to realise the opportunities of distributed energy, demand reduction and demand side response.**

There is a very broad range of private and increasingly public sector actors participating in the UK energy system across decentralised generation, electricity supply, the decarbonisation of heat, demand side reduction and demand side response. These actors all face different challenges and motivations for engaging in the energy sector which can make it difficult to identify the appropriate engagement; makes standardisation difficult; and require different actions to facilitate their role in the increasingly decentralised UK energy system.

The leveraging of city authorities' potentially pivotal facilitation and co-ordinating role in optimising the decentralised centric UK energy system and the opportunities that it might provide is problematic. They have no central government mandate and is also complicated by the present lack of mechanisms and fora between the actors and the city authorities and especially between the city

---

<sup>40</sup> APSE 2014, Barriers to local authority involvement in municipal energy schemes. Members Survey November 2014.

<sup>41</sup> Hawkey, D., Tingey, M. and Webb, J. 2014.Ibid.

<sup>42</sup> Ofgem 2015. Discussion Paper on Non-Traditional Business Models

<sup>43</sup> After DECC 2014. External review of D3 - Demand Reduction, Demand Response, and Distributed Energy generation - policy landscape and modelling: D3: Opportunities for integrated demand side energy policies and An analysis of D3 in DECC's energy system models. August 2014.

authorities and policy makers and regulators. [The capacity for partnership - with other actors including the private sector will be crucial]

**Table 1:** The differing challenges, motivations and opportunities of energy stakeholders operating in the urban space – the role of local authorities as facilitators and coordinators (shaded area).

	Stakeholder	Challenge	Opportunities
Enabling Role: Policy, Regulations and Finance	Government - DECC, DCLG, DfT	<ul style="list-style-type: none"> <li>Fragmented policies across departments e.g. DECC, DCLG, DfT, DoH, DoE, Defra, HMT, BIS, GIB, Cabinet Office, EA.</li> <li>Lack of unifying purpose and holistic plan</li> </ul>	<ul style="list-style-type: none"> <li>New finance - investor confidence</li> <li>Demand side management / reduction.</li> <li>Infrastructure resilience.</li> <li>Social equity and Standard of living.</li> </ul>
	Local Government Authority	<ul style="list-style-type: none"> <li>Degree of political prioritisation and corporate oversight.</li> <li>Capacity to understand utilities, develop business cases and risk.</li> <li>Few statutory powers, duties or dedicated budget for energy.</li> <li>Austerity measures resulting in substantial reduction in capacity.</li> <li>Need to work across heavily regulated utility sectors to address area infrastructure needs.</li> </ul>	<ul style="list-style-type: none"> <li>Resilient infrastructure and competitive business environment: Investment.</li> <li>Job creation.</li> <li>Skills and expertise development.</li> <li>Economic value capture.</li> <li>Technology transfer.</li> <li>Technology development to scale.</li> <li>Addressing Social and Environmental needs.</li> <li>Quality of Life.</li> <li>Understanding the individual needs of stakeholders, local built environment and infrastructure.</li> </ul>
	Combined Authorities (e.g. Greater Manchester)		
	Large Municipal Authorities e.g. Peterborough CC		
	Rural Local Authorities and County Councils		
Agents in Transition Development Role	Developers / Landowners e.g. Land Securities, London	<ul style="list-style-type: none"> <li>Integration of national / Regional / Local infrastructure plans.</li> <li>Margin maximisation from investment v's regulations and local social needs.</li> <li>Competing uses for capital.</li> </ul>	<ul style="list-style-type: none"> <li>Long term perspective of asset management.</li> <li>Return on investment.</li> <li>Knowledge of local opportunities.</li> <li>Supports CSR targets.</li> <li>Long term opex reduction.</li> </ul>
	Institutions e.g. Hospitals and Universities	<ul style="list-style-type: none"> <li>Business case: low priority as not seen as seen as core function.</li> <li>Planning requirements and integration into master plan.</li> <li>Risk perception.</li> <li>Capex opportunity cost</li> </ul>	
	Community Groups e.g. Repower, London	<ul style="list-style-type: none"> <li>Need for local authority buy-in.</li> <li>Complex regulatory environment.</li> <li>Lack of specialist skills and expertise in energy issues.</li> <li>Access to capital.</li> </ul>	<ul style="list-style-type: none"> <li>Long term planning.</li> <li>Skills development for community</li> <li>Return on investment and local value capture.</li> <li>Addresses local, individual needs such as fuel poverty.</li> <li>Ownership and empowerment.</li> </ul>
	Housing Associations	<ul style="list-style-type: none"> <li>Need for local authority buy-in.</li> <li>Capacity for resident engagement.</li> </ul>	
	Industry e.g. Hitachi	<ul style="list-style-type: none"> <li>Capacity to engage multiple stakeholders in appropriate fora.</li> <li>Customer unaware of needs.</li> </ul>	<ul style="list-style-type: none"> <li>Technology development.</li> <li>Market / Commercial development opportunities.</li> </ul>

### 3. Implications

These five key trends have a number of potential technical, financial, regulatory, innovation and capacity development implications on the development of the UK energy system. These are categorised below into opportunities, risks and considerations.

#### *Opportunities*

- ***The addressing of a number of concerns in the UK low carbon transition.*** The devolution of utility issues to smaller and non-national actors will allow: (1) interdependencies to be managed according to multiple agendas across and within scales and £5 B of savings to be made<sup>44</sup>; and (2) local authorities' increasing participation in the energy sector are accommodating issues such as investment and social equity concerns regarding the transition e.g. the roll out of solar resulting in the socialisation of costs of electricity infrastructure.
- ***The participation of local authorities and other actors in the energy system opens up new routes to financing.*** This includes municipal bonds, working with the private sector in Joint Venture's realising international sources and augments those from other actors including community groups.
- ***There is evidence that Demand Side Response (DSR) is easier with a geographic focus<sup>45</sup> and that this will assist in system balancing to account for increasing intermittent supply capacity<sup>46</sup>.*** Local suppliers should be able to engage directly with consumers in their area which is not as easy in the present market structure of network managers, suppliers and system managers.
- ***It is suggested that real energy efficiency gains can be realised with local energy provision<sup>47</sup>.*** Work has suggested that the Energy Service Companies (ESCO's) business model, which focus on energy service provision, can enable between 22 to 35% demand reductions compared to traditional business models<sup>48</sup>.
- ***Re-localisation of energy value and direct accountability to consumers.*** The re-localisation of energy generation ownership would ensure the capture of 10% of GVA to the benefit of the local economy<sup>49</sup>. Furthermore, once re-localised and under municipal control there is an element of local and democratic accountability which is presently not present with the centralised utility company model.
- ***Greater penetration of distributed energy generation capacity also stands to make the UK energy system more resilient to natural hazard impacts.*** Distributed renewables configurations have a reduced number of paths that have both long lengths and large customer assignments<sup>50</sup>.
- ***Infrastructure development which is perceived to benefit local communities is more likely to be given consents than nationally imposed infrastructure.*** The willingness for communities to

<sup>44</sup> Frontier Economics, 2012. Systemic Risks and Opportunities in UK Infrastructure. Report for HMT IUK.

<sup>45</sup> Hall, S. and Roelich, K., 2015. Local Electricity Supply: Opportunities, archetypes and Outcomes. March 2015.

<sup>46</sup> Realising Transition Pathways Engine Room, 2015. Distributing Power: a Transition to a civic energy future. Realising Transition Pathways Research Consortium

<sup>47</sup> Hall, S. and Roelich, K., 2015. Local Electricity Supply: Opportunities, archetypes and Outcomes. March 2015.

<sup>48</sup> Fang, W.S. and Miller, S.M., 2013. The effects of ESCO's on energy use. Energy Policy . 51. 558-568.

<sup>49</sup> <http://climatesmartcities.org/case-studies>

<sup>50</sup> Thacker et al., 2014. Exploring the vulnerability of future configurations of the UK electricity network system. Conference Paper....

accept infrastructure are far more likely to be given consents when it is seen to be benefiting the local area<sup>51</sup>. Though this does not negate the need for a robust process of public engagement<sup>52</sup>.

### Risks

- **Electricity Infrastructure Asset Stranding.** According to DECC<sup>53</sup> between 2010 and 2013 £45 B was invested in the energy sector with an addition £117 B of investment in the pipeline to 2020. Failure to accommodate and co-ordinate the impact of decentralised energy development in the UK will stand to strand a substantial proportion of this investment.
- **The future of the centralised utility business model.** In the scenario presented in Box 1 - low carbon dispatch-able capacity in the form of centralised utilities will be responsible for delivering 50% of total electricity demand. Indeed, the capacity for the electricity system to operate without low carbon dispatch-able capacity to realise economically efficient emissions performance targets and frequency management is considered to be highly problematic<sup>54</sup>. However, the manner in which the Centralised Utility Business Model will function in the transition to a more distributed energy system whilst ensuring they are a viable going concern to provide to vital energy system service functions will be difficult in the present volume based market model<sup>55</sup>.
- **The medium term higher costs of the distributed centric energy system prevents its realisation due to customers not internalising the potential environmental, social, local benefits and energy system benefits that it has.** The impact on consumer bills of the distributed energy centric system is marginally more expensive in the short to medium term than for other energy system scenarios but lower by 2050<sup>56</sup>.
- **The need to integrate national infrastructure needs / carbon targets with regional, municipal and community needs / targets.** There is as yet no clear mechanism to integrate national top down infrastructure requirements and carbon targets with local ones. Furthermore, economic development may be prioritised over carbon targets as the present institutional frameworks mandate economic imperatives rather than carbon ones<sup>57</sup>. The loss of reporting frameworks such as the national indicator framework will not allow this to be tracked.

### Considerations

- **There is a need for the grid to be able to develop capacity to manage 2 way flow.** The present Transmission and Distribution (T&D) network has been designed for step down one-way power

<sup>51</sup> Icaro consulting, 2009. Understanding Consumer Attitudes to 'Sustainable Community Infrastructure'. Research for the UK Green Building Council and the Zero Carbon Hub, Nov 2009.

<sup>52</sup> Green Alliance, 2015. Opening up infrastructure planning: The need for better public engagement. February 2015.

<sup>53</sup> DECC, 2014. [Delivering UK Energy Investment](#) dated July 2014

<sup>54</sup> Energy Research Partnership, 2015. Managing Flexibility of the Electricity System - see [link](#)

<sup>55</sup> Realising Transition Pathways Engine Room, 2015. Distributing Power: a Transition to a civic energy future. Realising Transition Pathways Research Consortium. p36

<sup>56</sup> Cox, E. (2014) Assessing the future security of the UK electricity system in a low-carbon context. Conference Paper, BIEE 14th Academic Conference, Oxford, 17-18 September 2014.

<sup>57</sup> Green Alliance, 2011. Is localism delivering change? Emerging responses from local authorities, local enterprise partnerships and neighbourhood plans. October 2011.

flow. For the decentralised centric energy system to function there will be a need to allow two-way and step up capacity to be developed on the T&D network<sup>58</sup>.

- **Local grid management requirements requiring storage or greater regional connection or international interconnection.** The transition of the T&D network to a decentralised centric energy system will be problematic in the present regulatory framework where DNO's are not able to anticipate increased capacity<sup>59</sup>. Furthermore, for local grid balancing to take place when there is a lack of balance between supply and demand requires energy storage and / or connections to other regions / countries. How these issues need to be reconciled needs to be considered.
- **Should there be a large scale penetration of distributed energy in the future UK energy system (up to 50%) this would require both a rapid technological change and new institutional architecture to be developed<sup>60</sup>.**
- **With high proportions of distributed power capacity on the UK energy system and the number of actors participating both producing and consuming - energy the management of the network will become increasingly complex. The number of business models will proliferate.** A Trans-active Energy<sup>61</sup> framework might develop whereby consumers and producers might interact according to differing intermittent supply and demand requirements and individual generators will effectively become pro-sumers. Energy patterns will develop stochastic patterns as supply and demand become aggregated over smaller generation and demand pools. The increased number of actors participating in the UK electricity market and the business models that are being manifest is resulting in substantial diversification in the types of models that exist in the UK energy sector<sup>62</sup> which will potentially proliferate<sup>63</sup>. Not only that but the motivations of the different actors are diverse and often non-economic Regulators presently function in oligopolistic markets which incentivise behaviour by economic signals.
- **How can local authorities' facilitation and co-ordination activities ensure that they are working in the best interests of consumers?** In a recent study of District Heating systems many consumers felt let down and frustrated by poor customer service and complaints handling procedures<sup>64</sup>.
- **There is a need to develop an evidence base as to the benefits and costs of the facilitation and co-ordination of energy systems.** This will be needed to validate the as yet uncontested evidence base.

<sup>58</sup> See current research <http://ireneproject.eu/>

<sup>59</sup> UKRN are undertaking a piece of work on strategic investment to assess the extent that DNOs can take into account of future demand i.e. balancing efficiency and future demand.

<sup>60</sup> Realising Transition Pathways Engine Room, 2015. Ibid

<sup>61</sup> [http://www.gridwiseac.org/pdfs/te\\_framework\\_report\\_pnnl-22946.pdf](http://www.gridwiseac.org/pdfs/te_framework_report_pnnl-22946.pdf)

<sup>62</sup> Ofgem 2015. Discussion Paper on Non-Traditional Business Models; and Hannon, M.J. and Bolton, R., 2014. UK local authority engagement with the Energy Service Company (ESCo) model; Key Characteristics, benefits, limitations and considerations. International Workshop on Research Findings on Sustainable Heat Provisions and Cities: Theory Practice and Future Implications, Edinburgh, 203 October 2014.

<sup>63</sup> Hall, S. and Roelich, K., 2015. Local Electricity Supply: Opportunities, archetypes and Outcomes. March 2015

<sup>64</sup> WHICH? 2015. Turning Up the heat: Getting a fair deal for District Heating Users. March 2015.

#### 4. Summary

UK cities have a pivotal role in facilitating and coordinating the UK energy transition. Through their need to think long term they can develop strategic planning for energy infrastructure. The powers and responsibilities - which include owning and running a substantial built estate, land holding, local transport and planning regulations means that they have substantial influence over infrastructure development and especially the scale and rate at which decentralised, demand reduction and demand response measures can be implemented both directly or indirectly. This can be through enabling activities for community energy<sup>65</sup> and national energy infrastructure projects<sup>66</sup>, their local knowledge, aggregation and convening power for the multiple actors operating in an energy transition which needs to take into account spatial characteristics and infrastructure. As consumers, they probably make up one of the largest consumers in their jurisdiction and can establish significant influence over energy use in residential, public and commercial buildings and transport.

This work suggests that they are engaging not only in infrastructure but also as a function of the decentralisation evolution are having to engage in energy system activities at a rate which is not yet fully recognised by central government policy. This engagement, if co-ordinated between national and local government, could bring substantial benefits to not only energy system development but also provide local social, economic and environmental benefits as well as UK economic growth and resilience. The role of energy being the key enabler for the operation of other economically critical infrastructure providing the best chance of safeguarding sustained economic growth and the raising of UK living standards<sup>67</sup>.

Local authorities, however, have very limited capacity for strategic energy management, because they have few statutory powers or duties, and no dedicated budget, for energy oversight or provision. Energy management is thus found in different functions within organisational structures, with no overarching oversight and the degree of importance being highly variable<sup>68</sup>. There is a need for responsibilities and accountabilities need to be placed into local authorities to deliver against the energy agenda and carbon emission reductions and a better understanding of energy issues for different stakeholders in these roles. This is being compromised by the severe cuts that they are being subjected to and will potentially result in the forfeiting of the opportunities for economic, social and environmental benefits being captured locally.

#### 5. Key Recommendations

The recommendations to address the findings of this work and the implications are as follows:

- **Demonstrate economic benefits of greater decentralisation including the benefits and costs of greater decentralisation of energy on UK energy system operation.** Further research is required to identify the economic and energy system benefits, clarify the value that could be created and

---

<sup>65</sup> See slide 9 in: [Louise Marix Evans, Quantum Strategy and Technology Ltd](#)

<sup>66</sup> Green Alliance 2015. Opening up infrastructure planning. The need for better public engagement. February 2015.

<sup>67</sup> See Economist Article dated 30<sup>th</sup> May 2015. [‘The Productivity Puzzle: Under the Bonnet’](#)

<sup>68</sup> Hawkey, D., Tingey, M. and Webb, J. 2014. Local engagement in UK energy systems - a pilot study of current activities and future impact. Edinburgh: Energy Technologies Institute and University of Edinburgh.

their distribution for all groups operating in the urban space from community groups to commercial organisations. Funding for the national strategic research and development of the evidence base on urban energy policy and technologies by the RCUK should be maintained.

- **Create a cross-departmental 'Cities and Energy Unit' based in DECC** with responsibility for the co-ordination of UK cities energy activities. It should be populated by energy system professionals and local authority representatives and have strong links to the DCLG cities programme.
  - To recognise and clarify local authorities' roles and responsibilities in the facilitation, co-ordination and effective development of the UK energy system with a view to identifying policy and regulatory enablers.
  - To consider targets and monitoring around energy system co-ordination for local authorities. This should be done in conjunction with new funding.
  - Defining the need for skills capacity to support local authorities to deliver efficient and effective decentralised energy solutions, in particular the technical, legal and commercial frameworks.
  - To align research and policy, by bringing together the burgeoning but fragmented work that is being undertaken in the cities space across government, industry and academia in order to allow the identification of best practice. The Cities and Energy Unit in DECC would be responsible for disseminating that best practice via the development of a tool kit - see below.
  - Should draw together elements of existing programmes where energy policy interfaces with local authorities. This not only includes decentralised energy activity (e.g. Combined Heat Power, District Heating, solar, renewable heat technologies, energy from waste, anaerobic digestion etc) - but also other key energy policy areas such as the smart meter roll out, area based energy efficiency retrofit, business energy efficiency initiatives and other non-domestic building sector retrofit activities, fuel poverty, community energy, distribution networks, smart grid, demand side response, EVs and charging infrastructure, bio-methane production, smart city action on energy data. It could also consider their role in Adaptation – by linking with Defra.
  - The Unit should map out existing activities where DECC, BIS, DCLG already liaise with local government on issues such as planning, building regulations.
- **Develop Resources and a Toolkit** for cities which would assist in:
  - decision making frameworks around engaging in the utility sector;
  - where to go for funding, advice and capture case studies of best practice; and
  - The best approaches and skills needed to deliver effective energy initiatives at different scales to drive efficiency benefits.
- **Integration with national infrastructure planning:** There is a need to ensure that there is an integration of city centric energy plans and climate strategies into national infrastructure and planning frameworks.

- The capacity and role of local authority, area, regional and national Master Planning integration needs to be developed
- **Create City Roadmaps** which would allow cities to better understand what options they have, allow the development of initiatives to achieve policy goals across economic and energy agendas and where these responsibilities should sit in local authorities to drive maximum impact.
  - This would allow the capacity for cities to understand, co-ordinate and enable energy infrastructure, integrating them with other utilities, within their economic resilience strategies.
  - The role of parties, from local community groups, institutions, private sector developers in the development of initiatives would be clarified.
  - Roadmaps might also develop the confidence for the development of an ecosystem of trusted intermediaries to address the reduced capacity in cities for energy system development.
  - In conjunction with Government policy priorities a road map could highlight policies which need local authority involvement to 2030.

**The following next steps are recommended for this work going forwards:**

- Get broad key stakeholder validation as to the need for these recommendations to be implemented. This will be achieved by getting as wide dissemination of the work amongst key stakeholders; and
- The role of local authorities in the decentralised centric energy system should be identified by the development of a roadmap. This will allow a better understanding the challenges, opportunities and needs for the diverse set of actors that operate in the city space to be captured and the need for the development of a DECC Cities and Energy Unit can then be better assessed.