

September 2015 Energy Research Partnership Technology Report

Economic Resilience of UK Cities?

**The Role of Cities in the UK Energy Agenda –
Their Importance as Facilitators and Co-ordinators**



The Energy Research Partnership

The Energy Research Partnership is a high-level forum bringing together key stakeholders and funders of energy research, development, demonstration and deployment in Government, industry and academia, plus other interested bodies, to identify and work together towards shared goals.

The Partnership has been designed to give strategic direction to UK energy innovation, seeking to influence the development of new technologies and enabling timely, focussed investments to be made. It does this by (i) influencing members in their respective individual roles and capacities and (ii) communicating views more widely to other stakeholders and decision makers as appropriate. ERP's remit covers the whole energy system, including supply (nuclear, fossil fuels, renewables), infrastructure, and the demand side (built environment, energy efficiency, transport).

The ERP is co-chaired by Professor John Loughhead, Chief Scientific Advisor at the Department of Energy and Climate Change and Dr Keith MacLean (formerly Director of Policy & Research at Scottish and Southern Energy). A small in-house team provides independent and rigorous analysis to underpin the ERP's work. The ERP is supported through members' contributions.

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The Energy Research Partnership Reports

ERP Reports provide an overarching insight into the development challenges for key low-carbon technologies. Using the expertise of the ERP membership and wider stakeholder engagement, each report identifies the challenges for a particular cross-cutting issue, the state-of-the-art in addressing these challenges and the organisational landscape (including funding and RD&D) active in the area. The work seeks to identify critical gaps in activities that will prevent key low-carbon technologies from reaching their full potential and makes recommendations for investors and Government to address these gaps.

The views in this report are not the official point of view of any organisation or individual and do not constitute government policy.

This project was guided by a steering group made up of experts from ERP members and other key organisations, as listed below.

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Executive Summary

Local Authorities have a key role to play in the future development of the UK energy system to maximise energy system and wider economic, social and environmental benefits.

Over the past 4 years there has been a rapid increase in decentralised energy generation, with up to 2GW added to the grid each year and forecast to be maintained at similar rates until 2036. Furthermore, with the drive to decarbonise heat and address demand reduction and demand side response, the UK energy system will become more spatially differentiated. This will mean that future energy planning for heat and electricity will increasingly need to take into account spatial characteristics and infrastructure.

Cities are centres for economic growth accounting for 63% of UK annual economic value add and their engagement with energy is substantial – as consumers of gas and electricity, enablers of energy infrastructure development and demand reduction programmes. However, the scope of their engagement in energy is increasing as a result of a number of energy policy initiatives that have been introduced over the last decade. A more co-ordinated approach to decentralised energy in cities could create benefits both in the city or city region, creating more resilient cities which benefits include:

- Supporting economic productivity through local job creation and skills development;
- Alleviating fuel poverty (in particular heat) and delivering related health and social benefits;
- Generation Capacity. The UK is currently facing the smallest capacity margin in 20 years, with only 3% capacity margin anticipated for winter 15/16;
- Addressing emissions targets – cities have a direct role in managing 40% of UK emissions.

The co-ordination of energy in cities requires both local knowledge and the ability to convene multiple stakeholders across communities and commercial interests and the different scales of decentralised energy schemes from community energy to municipal scale Combined Heat and Power (CHP) Plants. This knowledge is needed to maximise the benefits realisation of the value which could come from community energy schemes, or from institutions such as hospitals located within the city. At present City Authorities have no clear mandate to engage in development of the UK energy system and the ability for Local Authorities to take on more fiscal responsibility and engage in energy development is limited given their renewed focus on core services due to austerity measures. However, City or Local Authorities are best placed to enable this co-ordination given the complex socio-technical and socio-economic requirements and their knowledge of locations of need or opportunity within the city. 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.

This report provides 5 key recommendations:

1. Create a Cities and Energy unit within Westminster and devolved government departments for co-ordination and alignment of priorities and focus – ensuring Local Authorities have a clear role in the co-ordination and development of the UK energy system. The risk of not doing so, is not only that the optimisation of the UK energy system will be compromised but also the economic value add, social and environmental benefits will be missed.
2. Integration with national infrastructure planning: ensuring that integration of city centric energy plans and climate strategies with national infrastructure and planning frameworks.
3. Demonstrate economic benefits: further research is required to quantify the value that could be created at all levels, from community groups, to businesses and Local Authorities.
4. Develop energy toolkit for cities: decision making frameworks, funding streams, advice and case studies of best practice.
5. Create city roadmaps: to allow individual cities to understand future energy development opportunities.

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 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; 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 a number of energy policy initiatives that have been introduced over the last decade. These include energy efficiency building retrofit programmes (e.g. CERT, CESP, ECO, Green Deal); increasing emphasis of energy and carbon in building and planning regulations¹;

and the Government's ambitious smart gas and electricity meter roll out to 2020, major transport initiatives such as the development of electric vehicle infrastructure, low carbon emissions buses and the move to smart grids. Furthermore, the substantial reduction in decentralised energy technology costs has resulted in the growth in the deployment of renewable energy systems ranging from wind to anaerobic digestion and photovoltaics. The proportion of decentralised UK electricity generation capacity has increased from 14% to 22% in period 2011-2014². Furthermore, the rate of decentralised energy penetration is anticipated to continue; this is increasingly recognised in energy systems modelling – see figure 1, below.

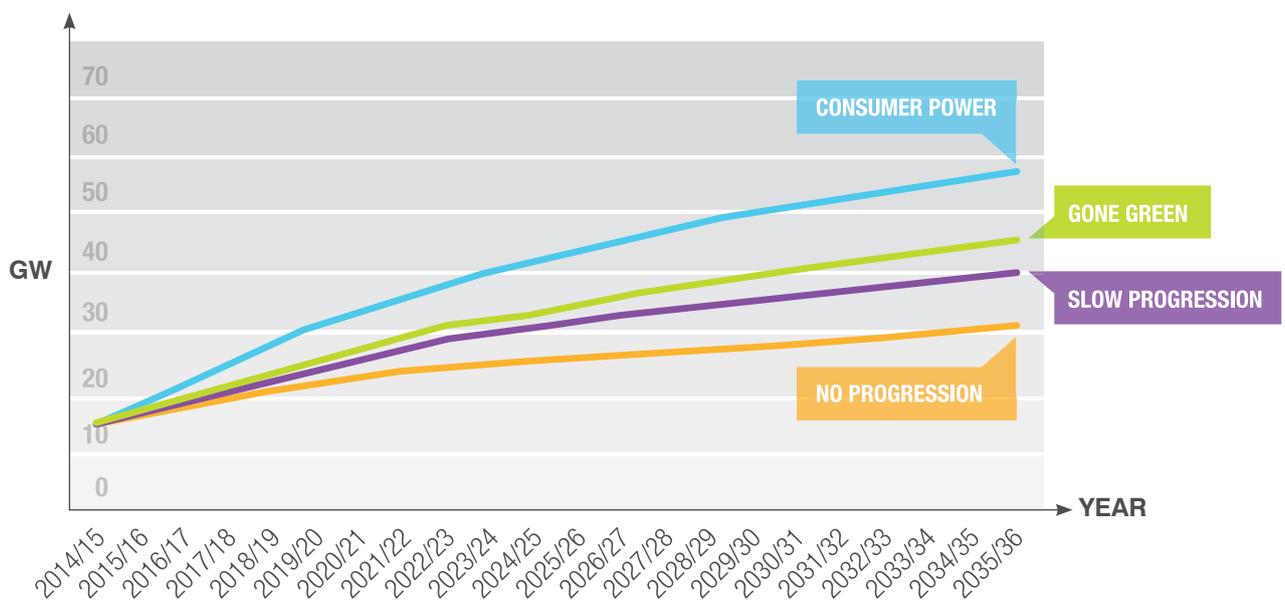


Figure 1: Distributed Energy and micro-generation installed capacity³. The built out rate for the upper and lower bound scenarios is 2.25 and 0.75 GW pa from present to 2036.

Notes. 1. Each of these scenarios were designed to meet the security of supply rule whilst staying with the LCF's budget; and 2. It is noteworthy that the more environmentally considered scenario (Gone Green) does not result in the maximum distributed energy penetration which is realised in – Consumer Power. This possibly represents the fact the scenario does not consider the benefits of decentralised energy to be aligned with environmental goals.

¹ The EU Energy Performance of Buildings Directive (EPBD) will require that, from 2020 onwards (and from 2018 for the public sector), new buildings must meet a net or nearly zero energy standard. EU Directive 2010/31/EU on the energy performance of buildings (European Parliament and Council, 2010)
² DUKES, 2014. Digest of UK Energy Statistics 2014, Chapter 5, Electricity. UK Government.
³ National Grid, 2015. Future Energy Scenarios UK Gas and Electricity Transmission. National Grid.

The development of the centralised UK energy system since the 1950's facilitated broader access to modern energy services and has the advantage that it allows the realisation of scale efficiencies in engineering and economic terms for both the electricity and the heating services^{4,5}. Today, there are potential benefits in increasing the diversity and decentralisation of this centralised system – these range from the introduction of new sources of investment finance into the energy sector; increased diversity of generation providing enhanced energy system resilience – subject to the right strategies being put in place; and the creation of new market opportunities such as local demand side reduction and response services. These benefits are, however, not guaranteed. There is a lack of data to validate the economic, environmental and social benefits of increased decentralisation of the UK energy system in terms of size, scale, cost and carbon benefits⁶.

What is clear, however, is that with the transition to the greater use of decentralised energy systems, the drive to decarbonise heat and address demand reduction and demand side response, the UK energy system will become more spatially differentiated. 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, 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.

At the same time, substantial budgetary cuts of up to 40% are reducing the capacity for Local Authorities to deliver even core services. 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.

What aspect of Cities and Energy does this work cover?

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. It differs from their needs to participate in the energy system directly⁷. It is the Energy Research Partnership's (ERP) belief that the role of Local Authorities as facilitators and coordinators will be more significant than through direct participation – though the importance of the latter cannot be discounted. The focus on cities is because a substantial proportion of energy engagement activity is taking place in municipal authorities though many of the recommendations of this work are applicable to Local Authorities more broadly.



⁴ GO Science, 2008. Foresight Report Powering our Lives: Sustainable Energy Management and the Built Environment. Final Project Report.

⁵ <http://www.nationalgrid75.com/timeline>

⁶ Utiylx, 2013. Coming of Age – decentralised energy? Realising the strategic potential of on-site generation.

⁷ 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

Key Findings

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. A substantial proportion of revenues (~95%) 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 increasing national productivity by narrowing regional variations in economic value produced – see figure 2, below and smooth income differences between regions⁸ reducing inequity.

Well-developed infrastructure reduces the effect of distance between regions, integrating the national market and connecting it at low cost to markets in other countries and regions¹². According to recent work¹³, 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. However, the UK's ranking for the quality of infrastructure has dropped from 24th to 28th in the World Economic Forum Rankings. Therefore, 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-being. The desire for more autonomy is based on having more control in their economic destiny without having to rely on central government¹⁴. With the capacity margins for UK generation forecast to reach a low of 3% in winter 2015/16¹⁵ the issue is becoming increasingly prescient.

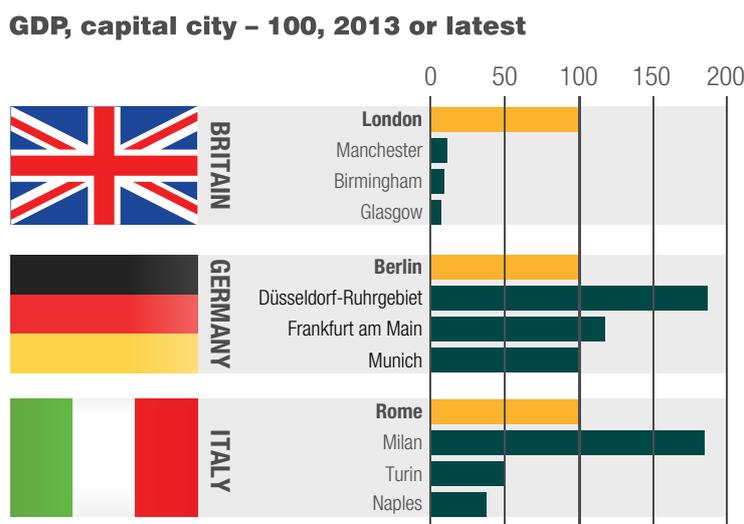


Figure 2: The UK is one of the most economically unbalanced nations in Europe. The gap between London and its regional cities is substantial. Seven of the 8 largest cities outside London perform below national averages per person. In Germany 8 of the largest cities outside Berlin outperform the national average⁹.

It has been suggested that closing the productivity gap by granting the eight English core cities greater fiscal autonomy¹⁰ would generate an additional £222 B and 1.16M jobs to the UK economy¹¹.

⁸ See Working Paper from the IMF in April 2014: <http://www.imf.org/external/pubs/ft/wp/2014/wp1464.pdf>

⁹ Economist, 2015. England's Cities: Spreading their wings dated 6th June 2015.

¹⁰ These include: Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield

¹¹ Oxford Economics forecast for Core Cities 2013. Competitive Cities, Prosperous People: A Core Cities Prospectus for Growth. Manchester: Core Cities Group.

¹² World Economic Forum, 2014. Insight Report: The Global Competitiveness Report 2014-2015.

¹³ Kelly, S. 2014. The cost of cascading failure: Risk and Resilience within UK infrastructure networks. Presentation at #UKEW workshop on 2nd December 2014.

¹⁴ Institution of Civil Engineers, 2014. The State of The Nation: Infrastructure 2014.

¹⁵ National Grid, Winter Outlook Report 2014/15. October 2014.



Other direct economic benefits of local investment 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 – at £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.

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 well-being; (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 poverty¹⁶ and reduce elderly deaths during winter¹⁷.

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 and manages the demand side. On the demand side they might 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 22% of UK electricity generation capacity and, in the last few years, has increased at a rate of 2 GW pa¹⁸. 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. Cities also have a key function in reducing the demand for energy by addressing energy efficiency measures ranging from appliances to insulation standards as well as the decarbonisation of heat. City Authorities will have a key role in delivering heat networks with estimates that between 14 to 43% of heat demand are economically best served by urban heat networks¹⁹.

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 differentiated system across a number of policies. For example, in Denmark as part of the development district heating systems since the late 1970's municipal authorities were instrumental in the development of least cost zonation to avoid the duplication of heating infrastructure across industrial, commercial and residential sectors.

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 MtCO₂ or ~40% of the UK total²⁰.

¹⁶ Lynch, B. Technical Support Manager, Carbon Trust Conference presentation 30th April 2015.

¹⁷ There were 165 Cold Related Deaths in Lambeth in 2014.

¹⁸ DUKES, 2014. Digest of UK Energy Statistics 2014, Chapter 5, Electricity. UK Government.

¹⁹ Wiltshire et al., 2013. Research into barriers to deployment of district heating networks. DECC dated 26th March 2013.

²⁰ Committee on Climate Change, 2012. How Local Authorities can reduce emissions and manage climate risk dated May 2012. Of which 74.7 MtCO₂ Residential buildings (heat); 15.7 MtCO₂ Non-residential buildings (heat); 113.1 MtCO₂ surface transport include all sources of emissions, including motorways; and 16.9 MtCO₂ is waste. Industry emissions are excluded.

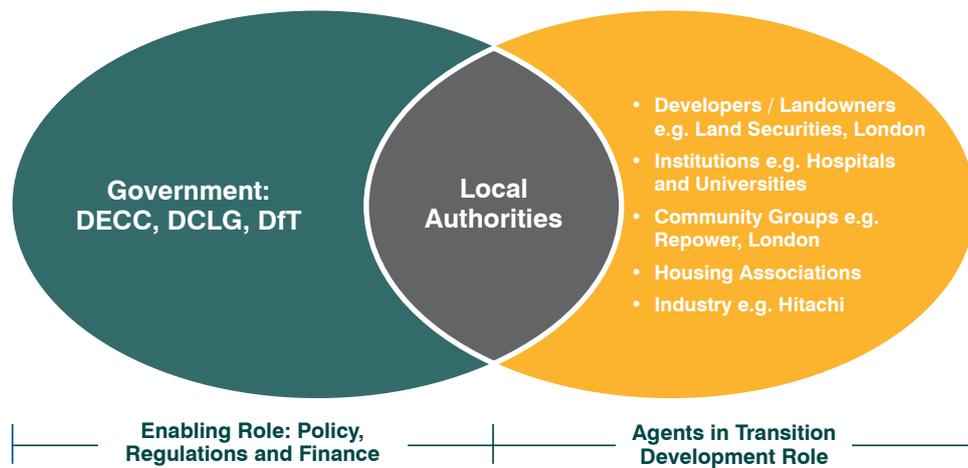


Figure 3: The convening power of Local Authorities across a broad range of actors in an increasingly spatially heterogeneous UK energy system which will require the accommodation of different actors needs.

3. 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 – see figure 3 above.

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. Local Authorities are best placed to address the needs of these actors through their local knowledge and convening power.

4. 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 system²¹. Yet the increase in the development of decentralised generation on the UK energy system and the increasingly spatial differentiation that the decarbonisation requirements will need to address – make their role increasingly important as facilitators and co-ordinators for other actors²². However, at present it is unclear what multi-level governance of the UK energy system would look like and indeed how national infrastructure agendas and local needs can be reconciled; this is an area in need of further work.

²¹ 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.

²² 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.

Key Recommendations

These four key trends have a number of potential technical, financial, regulatory, innovation and capacity development implications on the evolution of the UK energy system. Many of these will not be realised or addressed unless there is greater understanding of the mechanisms by which the potential realisation of economic, social, environmental benefits and energy system can be optimised. With this in mind the recommendations to address the findings of this work and the implications are as follows:

- **Westminster and devolved Governments should create Cities and Energy Units** 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 and BIS 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.



- **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. This should be co-ordinated by DECC and HM Treasury's Infrastructure UK.

- The capacity and role of Local Authority, area, regional and national Master Planning integration needs to be developed.

- **Demonstrate economic benefits and costs of greater decentralisation on the UK energy system operation.**

Further research is required to identify the economic and energy system benefits and costs, clarify the value that could be created and their distribution for all groups operating in the urban space from community groups to commercial organisations. This should be integrated into the present suite of RCUK research in the urban domain and the findings prioritised for dissemination.

- **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 to 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.

The responsibility for this should lie with the Cities and Energy Units as per the first recommendation.

- **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 between national government and Local Authorities within a multi-level governance framework for the energy system – 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 responsibility for this should lie with the Cities and Energy Units as per the first recommendation.





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