planning for change in urban energy systems

Catalina Turcu and Yvonne Rydin look at the change in urban energy systems and examine the implications for energy infrastructure planning

Photos: Dr Ksenia Chmutina

Above

The Hague – dwellings connected to the sea water district heating system

National energy security and achieving substantial cuts in carbon dioxide emissions are the most pressing challenges facing the UK in the period to 2050. Restructuring the energy sector will be central to meeting these challenges. Yet the current energy system is characterised by 'lock-in' into centralisation.[1-3] The lock-in relies on one-way energy systems linking centralised supply with distributed demand. In fact, utility companies still operate the same basic practices devised by Edison in the 19th century,[4] while the main technologies continue to be based on the same thermodynamic steam cycle that initiated the industrial revolution.[5]

The 'centralisation pathway' advances the idea that the challenges of dealing with climate change and energy security can only be dealt with through a centralised energy system, including nuclear power generation, driven forward by traditional actors such as energy utilities and regulators, the government, intensive users and associate professional communities.[6] More recently, however,

'decentralisation pathways' have started to emerge, focusing on diverse energy needs and matching these with a variety of technological, economic and institutional options. Over the last few years we have seen the advent of energy service companies (ESCOs); information technology, including intensive energy exchange markets operating in smart two-way grids; building-based technology such as integrated PVs (photovoltaic cells) and co-generation; offshore renewable energy; and distributed storage, embodied in shifts to electricity-based transports.[7]

We have also seen a range of policy measures put in place to encourage the take-up of such options.[8] These measures range from innovative local planning policies requiring on-site renewable energy generation in new developments and targeted subsidies for installation of new technologies, through to the introduction of the Clean Energy Cash Back scheme (a Feed-In Tariff) and initiatives such as the Department of Energy and Climate Change's (DECC's) Low Carbon Communities Challenge programme.

A variety of governance processes are involved in promoting these initiatives. The planning system plays a key role within such governance processes, regulating the development of both major and smaller-scale decentralised energy infrastructure and removing regulation from the very smallest. It also seeks to encourage community engagement with energy and to co-ordinate change across local space.

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This article looks at this change in urban energy systems and examines the implications for energy infrastructure planning. To do so, it draws on a database of 182 urban energy initiatives in the UK, compiled under the EPSRC-funded CLUES (Challenging Lock-in through Urban Energy Systems) study to include as many different kinds of project as possible. The database was collated during October 2010 to January 2011, and the main sources were published documents and online material, supplemented by telephone interviews where necessary to gather more information about specific projects.

A wide range of grey and secondary literature was consulted, including local authority websites, a number of databases, including the Energy Efficiency Partnership for Homes (now the Energy Efficiency Partnership for Buildings) database and the DECC's CHP database, and case studies from CABE (the Commission for Architecture and the Built Environment), the Sustainable Development Commission, the *Urban Design Compendium*, the Low Carbon Communities Challenge programme and Sustainability Awards such as the RIBA and Ashden Awards. The database is discussed in more detail in the following section.

Pathways of urban energy decentralisation

The information collected under the database was organised and structured into a 'matrix' of governance, economic, social and technological features of urban energy initiatives. Each of the matrix's main categories was then further subdivided as follows:

- ***Governance*** was divided according to who led the project – a local authority, the private sector, the third sector (including community groups, non-governmental organisations (NGOs) or housing associations), and partnerships (including formal agreements between public, private and third-sector bodies).
- ***Economic*** looked at whether a subsidy was in operation, whether price regulation or a Feed-In Tariff was relevant, whether both forms of economic instrument pertained, or whether there was no such reliance on an economic instrument.
- ***Social*** tabled information on whether there was an element of public awareness activity involved, such as information provision, whether more extensive and active public engagement was involved, whether both forms of public involvement activity were occurring, or whether there was no apparent public involvement activity.
- ***Technological*** information was collected on 14 different types of technology that were involved in these urban energy projects.[9] However, within the matrix the emphasis was on whether the project included energy generation technology, technology oriented towards demand management, or both – a category for recording the absence of any such technology was also included.

Using a sorting methodology to group initiatives into similar combinations of the governance, economic, social and technological dimensions, we identified 51 such combinations or 'pathways'. Figs 1-4 outline the aggregate features of these pathways.

At glance, these figures show that very few (2%) of the identified project types are private sector led (Fig. 1), that subsidies dominate (Fig. 2), that some 57% of the project types do not involve any discernable level of public involvement (Fig. 3); and that energy generation technology is a key factor in 51% of projects types on its own and in another 22% in combination with demand management

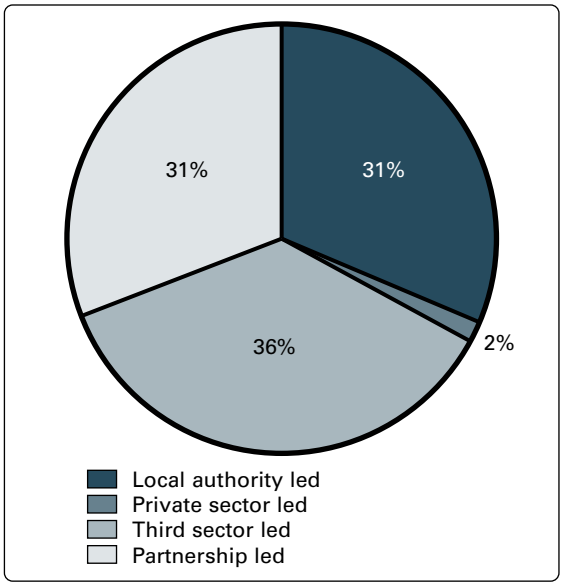

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Fig. 1 Distribution of governance pathways in urban energy projects

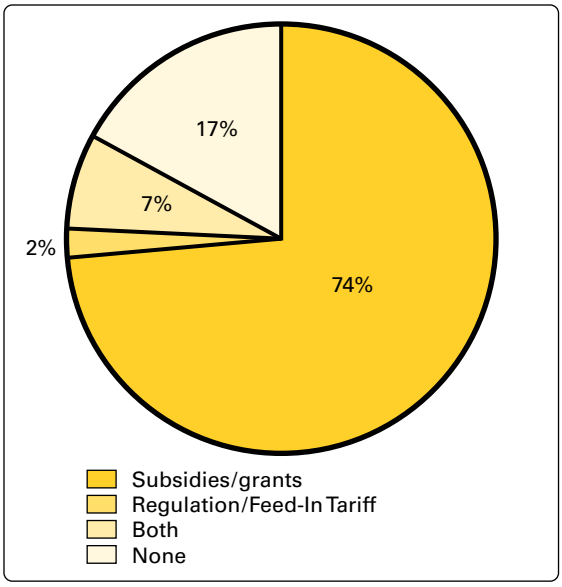

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Fig. 2 Distribution of economic tools pathways in urban energy projects

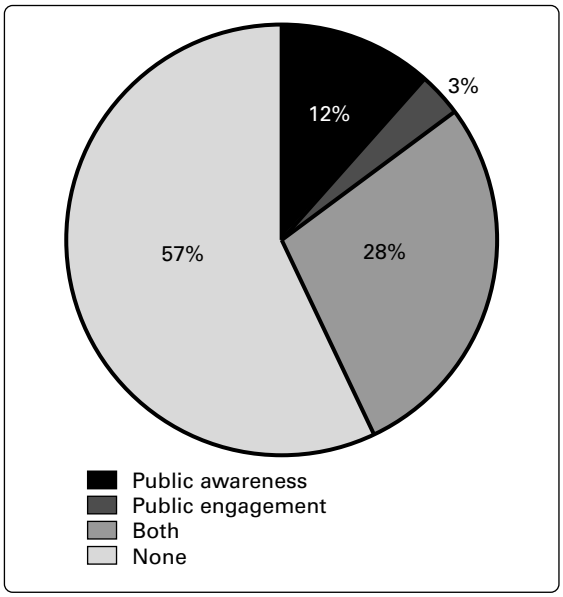

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Fig. 3 Distribution of public involvement pathways in urban energy projects

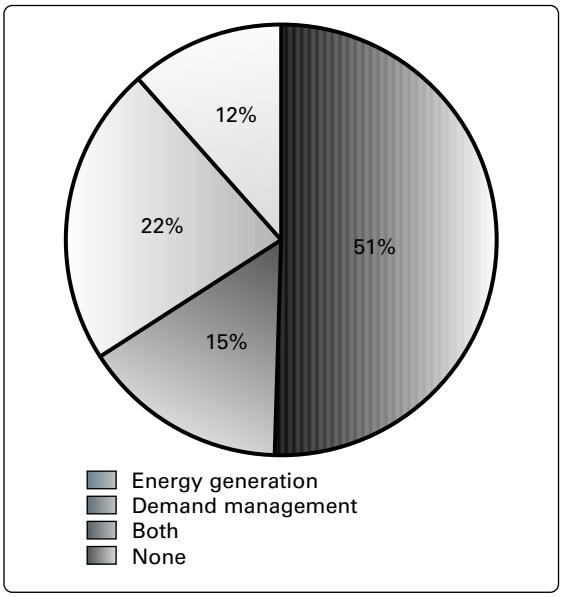

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Fig. 4 Distribution of technological pathways in urban energy projects

technology (Fig. 4). However, this is only a simplistic overview, and the many 'twists and turns' of these pathways are discussed in more detail below, using as the governance dimension as a starting point and distinguishing between pathways led by local authorities, the private sector, the third sector, and partnerships.

Local-authority-led pathways

Looking at projects typified by the local-authority-led pathways, two main patterns can be identified among the 12 pathways or categories of distinctive project combinations. First, there are a number of schemes where the local authority does not rely on any economic tools or any form of public

involvement, but simply invests directly in a range of technological options in pursuit of energy and financial savings.

For example, Barnsley Council has installed a 500 kilowatt biomass boiler at its Westgate Plaza headquarters as part of its 'Econergy Initiative', with reported savings of over £500,000 per annum for an initial additional capital cost of £132,0900. Similarly, the London Borough of Lambeth has invested in a full energy-efficiency retrofit at its Angell Town council estate, with the effect of halving energy consumption.

Second, we found local-authority-led schemes that rely on subsidies, combined with price regulation mechanisms such as Feed-In Tariffs, and use this approach to support various kinds of public involvement and a range of technological applications, sometimes with use of a Feed-In Tariff and sometimes not.

Subsidies seem to support innovation and flexibility in local authority action on urban energy, and local authorities have used them to extend their involvement with local communities. The initiatives under the Greater London Authority's Low Carbon Zones fall into this category. For example, the Wandle Valley Low Carbon Zone project has installed PVs on local schools and free energy-saving devices in 500 homes, but has also undertaken a range of low-carbon education activities, including the recruitment of two 'Green Doctors' and the development of energy advice surgeries and a Climate Change Volunteers scheme.

Private-sector-led pathways

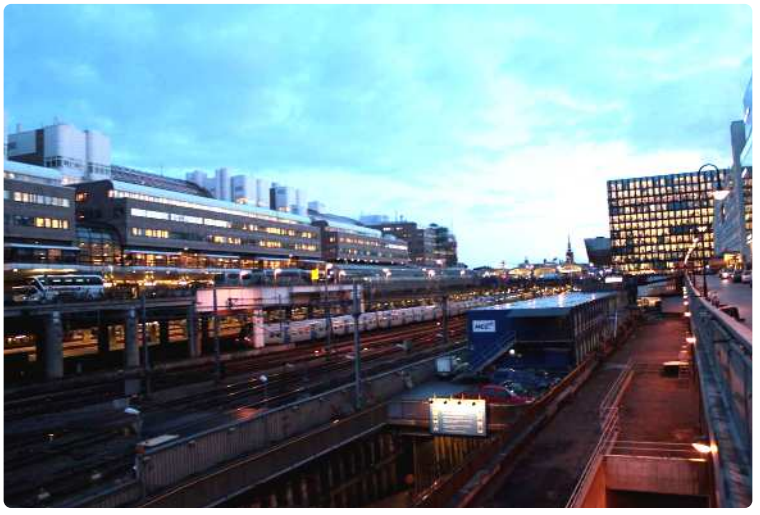
Private-sector-led projects cover private companies and businesses investing in decentralised energy in urban areas. It is notable that we identified only two pathways. Sometimes economic instruments were relied on and sometimes they were not, but in all cases there was no public involvement activity and a tendency to focus on energy generation. For example, in Lyme Regis, Dorset a private trust installed a micro hydro-electric system at Town Mill, partially funded by a Clear Skies renewable energy grant and EDF Energy's Green Fund. Green Park wind farm in Reading provides another example, in which a private developer, the Prudential, and an energy supplier, Ecotricity, invested in the installation of a 2 megawatt wind turbine, selling energy to a business park and 1,000 adjacent homes.

Third-sector-led pathways

Third-sector-led projects include initiatives headed by community groups, NGOs and housing associations. There were 18 types of these projects, which fell broadly into two groups.

The first group involved the use of price regulation instruments, either on their own or with subsidies; these were all associated with public involvement activities and with energy generation technology (sometimes with additional demand management measures). For example, the Transition Streets Project in Totnes, Devon has tapped into Feed-In Tariff agreements by installing PVs on the local town hall. This builds on Transition Towns Totnes, a community-led initiative funded under the Government's Low Carbon Communities Challenge programme. It involves extensive public engagement through 'Transition Together', a behaviour change programme which is a pre-requisite for subsidised retrofits and low-interest loans for PVs.

The second group involved either subsidies or no economic instruments but were notable for both the variety of forms of public engagement and the different uses of technology, i.e. for the multiplicity of possible pathways. The Bristol Green Doors project is led by a voluntary organisation and seeks to enhance energy awareness and promote home



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Heat 'scavenging' at Stockholm's central train station

retrofitting. It offers advice and publicises demonstration homes. Funding is received from some local businesses but not from central government.

These 'third-sector pathways' showed considerable commitment to some form of public involvement, with 14 of the 18 pathways including public awareness and/or engagement activities. Energy generation technology was also a key motif, with 12 of the third-sector-led pathways involving such technology.

Partnership-led pathways

Partnerships are 'joined-up' or 'multi-agency' bodies providing leadership to a group of organisations. They usually include local public authorities such as local government, housing associations, local service providers, residents and community-based organisations, and sometimes local businesses as well. Partnership project types fell into 19 different pathways, which followed three main patterns.

The first pattern involved subsidies, sometimes supplemented by a Feed-In Tariff. As with the third-sector-led projects, the presence of subsidies was associated with a variety of forms of public involvement and a range of technological possibilities. The second parallel pattern involved a reliance on price regulation, sometimes supplemented by subsidies. These were also associated with different kinds of public involvement, but always with investment in energy generation technology – of necessity given the nature of Feed-In Tariffs; sometimes demand management technology was also included. The third pattern included projects which did not involve any economic tools or public involvement and targeted energy generation technologies.

An example is provided by the Cirencester Energy Neighbourhood project, which received European Union funding through the Intelligent Energy – Europe grant fund to encourage energy saving through changes in behaviour. Households formed 'Energy Neighbourhood Teams' and, under the guidance of an 'Energy Master', used a toolkit to monitor and reduce their consumption. The partnership involved Cirencester Town Council, Severn Wye Energy Agency and two housing associations.

Another example is the Sustainable Moseley project in Birmingham, where partnership between community organisations, housing associations, schools and churches led a programme of PV installation and resident-led campaigning for behavioural change. Funding here came from the British Gas Green Streets programme.

The 19 partnership pathways or project types included 12 pathways with some form of public involvement and ten pathways integrating energy generation technology. Again, the presence of subsidies seemed to galvanise partnerships to engage in a range of possible combinations.

Discussing implications for planning

We have shown that there is considerable complexity in the current shift towards more decentralised energy system in urban areas, including a complex web of actors, incentives, institutions, and implementation models, operating at different scales and levels. The way that the unlocking of energy centralisation is currently being pursued in the UK is resulting in a proliferation of 'decentralisation pathways'. However, it is still unclear how far these pathways will drive change in particular settings. Different constituencies and institutions, powerful pressures from technical standardisation, globalised markets, integrated regulations and cultural expectations are, over time, all likely to consolidate momentum into a smaller number of pathways.[2]

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We have also shown that each pathway involves finding a specific combination of economic instrument, governance structure and public involvement strategy for a given technology. There is clearly considerable discretion and variation in agency involved in challenging the lock-in to centralisation. This is not just a matter of identifying and applying a given technology, and it poses a considerable challenge to the current planning system.

On the one hand, centralised energy infrastructure implies a strong hand for national level actors in infrastructure planning. In the UK this is indeed the case, with a current strengthening of central direction through the Major Infrastructure Planning Unit within the Planning Inspectorate, which reviews applications for major infrastructure against National Policy Statements, and with decisions taken by central government Ministers. On the other hand, decentralised energy systems cannot be handled in such a streamlined way. As seen from the analysis above, the path to

decentralisation involves many different twists and turns – technological options are not the only factor in delivering decentralised urban energy; economic mechanisms, cultural factors and institutional arrangements are important too.

There are multiple possibilities at the local level, and these involve demand management in much greater integration with energy generation options. Central government cannot direct such decentralisation, although it can seek to incentivise. The onus for promoting, delivering and co-ordinating urban energy decentralisation is therefore likely to fall on local government. We have seen that local authorities are often involved in leading decentralisation initiatives or are involved in partnerships that are taking such a leadership role. But overall planning on an urban scale goes beyond individual initiatives of these kinds. How can a local authority plan for urban energy decentralisation?

Currently much more emphasis is being placed on infrastructure delivery within local planning in the UK. This has been an element of local planning since the Local Government Act 2000, reinforced by Local Government Act 2007 together with the 2008 revision of Planning Policy Statement 12 (PPS12: *Local Spatial Planning*).

Spatial planning at the local scale is meant to include proactive planning for infrastructure investment alongside new urban development and changing local demographic and economic needs. Such infrastructure is understood broadly to encompass transport, education and health services, as well as drainage, water and energy supply. The local planning documents in the Local Development Framework should consider the need for and costs of new infrastructure investment and

'The onus for promoting, delivering and co-ordinating urban energy decentralisation is likely to fall on local government'

should link these factors to the phasing of new urban development and identify both funding sources and responsible delivery agents. It will prove challenging to link such an analysis to the bottom-up proliferation of different kinds of decentralised energy initiative that this article has identified.

Furthermore, the current system is expected to identify the financial gap between all committed infrastructure investment from public and private sources and compare this with identified needs. The gap can then form the basis for setting the Community Infrastructure Levy (CIL) – a tariff on all new development. CIL is expected to form part of local planning documents and also support the local Infrastructure Delivery Plan. Again, the number and variety of urban energy initiatives may make it much more difficult to cost infrastructure requirements or to re-allocate the income from CIL to specific local schemes where needed.

It may be that the new infrastructure planning regime will favour local-authority-led schemes in order to simplify informational requirements for planning and ensure the steady flow of funds into new decentralised urban energy schemes. However, the above analysis has shown that this is unlikely to be effective. There is considerable momentum behind the current variety of decentralisation initiatives, and it cannot be desirable to choke this momentum off.

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Notes

1 N. Bergman and N. Eyre: 'What role for microgeneration in a shift to a low carbon domestic energy sector in the UK?' *Energy Efficiency*, 2011, Vol. 4, 335-53
2 G. Unruh: 'Understanding carbon lock-in'. *Energy Policy,* 2000, Vol. 28, 817-30
3 G. Unruh: 'Globalising carbon-lock-in'. *Energy Policy,* 2006, Vol. 34, 1185-97
4 T.P. Hughes: *Networks of Power Electrification in Western Societies 1880-1930*. John Hopkins University Press, Baltimore, USA, 1983
5 W. Patterson: *Transforming Electricity*. Earthscan, 1999
6 M. Leach, I. Scoones and A. Stirling: *Dynamic Sustainabilities*. Earthscan, 2010
7 W. Patterson: *Keeping the Lights On*. Earthscan, 2007
8 Y. Rydin: *Governing for Sustainable Urban Development*. Earthscan, 2010
9 The 14 different types of technology were: air source heat pump (ASHP); biomass; combined heat and power (CHP); geothermal; ground source heat pump (GSHP); hydro; insulation; solar PV; solar thermal; waste; wind; anaerobic digestion (AD); aquifer thermal energy storage (ATES); and community heating/district heating (CH/DH)