European Engagement with Local Energy Systems

This report is one of the outputs from the *Local Engagement in UK Energy Systems* research project (2014-2017), University of Edinburgh, funded by UKERC/EPSRC and UK ETI.

Dr David Hawkey

Date: 16 January 2015

Contact:
David Hawkey
School of Social and Political Science
University of Edinburgh
Chisholm House
High School Yards
Edinburgh. EH1 1LZ
Tel: +44 (0)131 650 2841
Email: dave.hawkey(at)ed.ac.uk

Local Engagement in UK Energy Systems www.sociology.ed.ac.uk/leukes
Heat and the City www.heatandthecity.org.uk

Cite as: Hawkey, D. 2015. *European Engagement with Local Energy Systems*. Edinburgh, University of Edinburgh. Available from www.sociology.ed.ac.uk/leukes

THE UNIVERSITY of EDINBURGH

UKERC

energy technologies institute

Research Councils UK Energy For a Low Carbon Future

European Engagement with Local Energy Systems

David Hawkey

January 16, 2015

Contents

1 Introduction

This paper reviews academic and grey literature concerning local engagement with energy systems in Europe. Through international comparison, the paper aims to identify factors shaping the form and extent of engagement with energy at local levels in Europe. The paper considers high-level patterns of engagement across European countries by examining the extent to which actors in different countries engage with Europe-wide processes (the Covenant of Mayors and Intelligent Energy Europe). This leads on to discussion of how local energy historically has interacted with broad patterns of central-local government relations. Contemporary issues in European local energy, in a context of "unbundled" energy systems *and* local governance are then discussed.

1.1 Contemporary snap-shot: where are levels of local engagement with energy relatively high?

This section explores data from the Covenant of Mayors and grants awarded under the Intelligent Energy Europe programme to investigate country-level differences in contemporary levels of local engagement with energy across Europe. As local engagement with energy can cover a wide range of activities, and national energy contexts vary across Europe, any quantitative comparison will rely on some metric

1.1.1 Covenant of Mayors signatories

The Covenant of Mayors has become central to European funding, as being a signatory to the covenant (which imposes minimum standards for local Sustainable Energy Action Plans, SEAPs) has become a requirement for local governments to access some sustainable energy funding programmes. The Covenant lists 5,644 signatories on its website (data downloaded in November 2014) predominantly in Europe but also including local governments from other countries including Chile, New Zealand and Kazakhstan. By signatory numbers, the Covenant is dominated by Italy (52%) and Spain (27%), Belgium having the next largest proportion of Covenant signatories (3%). However, this in part reflects the small size of Italian and Spanish local administrative units (with average signatory populations of 12,000 and 17,000 respectively compared with 107,000 average population across all other countries).

Comparing country participation by population covered by each signatory is complicated by multiple levels of local government (meaning summing populations will include an element of double counting). However, ignoring this complication, Italy and Spain remain the most represented countries with 19% and 14% of signatory populations. The UK, with 34 local authorities signed up represents 1% of signatories, but the relatively large size of these authorities mean they represent 9% by population, the third largest contribution (London alone accounts for 4%).

Which countries have high rates of Covenant signatories? Danish and Italian signatory populations account for 59% of their respective total national populations. In Spain signatory populations are 56% the national total. On this metric the UK is average, with signatories representing 24% of the national population as compared with 23% averaged across all countries with at least one signatory.

1.1.2 Intelligent Energy Europe grants

An alternative metric to compare local engagement with energy across countries arises from grant funding programmes. The Intelligent Energy Europe (IEE) programme disburses grant funding to projects usually comprising international partnerships across sub-national organisations. These include, but are not limited to, local and regional authorities. This approach allows a degree of standardised comparison across countries on

the assumption that the amount of IEE grant funding received by organisations in each country reflects the degree of local engagement with energy. Of course, this assumption may be questioned as, for example, local actors in different countries may have access to resources at a national level and so have less need to engage with international programmes (c.f. Emelianoff, 2014).

Inspection of grants awarded under the Intelligent Energy Europe programme between 2009 and 2011[1] shows variability in the extent to which different countries receive grant funding (see figure 1). The large countries of Europe (Germany, France, UK, Italy and Spain) are in the top six by both number and value of grants (along with Belgium). This suggests the amount of grant money received by countries is related to their size. However, comparing countries' on a per capita basis overemphasises small countries (such as Slovenia, Malta, Cyprus, Estonia and Latvia none of which have populations above two million).

This pattern can be accommodated by assuming countries tend to receive the same basic amount of grant funding under IEE, plus a variable amount proportional to their population.[2] This assumption can be expressed as a linear model, which in turn can be fitted to the total of IEE grants given to organisations in each country.[3] Comparison of the total grant award predicted by the model with actual grant awards can be interpreted as indicating the extent to which each country receives a higher/lower total grant than would be expected on the basis of their population. Deviations from the model for each country are shown in figure 2.

How can these figures be interpreted? Belgium appears to have done best out of the IEE programme over the period covered. This may reflect relatively high levels of local engagement with energy in Belgium, though

[1]The Intelligent Energy Europe programme has had two phases, one from 2003 to 2006, and the second from 2007 to 2013. From 2014 Intelligent Energy Europe funding has been part of Horizon 2020. The IEE website provides data on grants awarded, but at the time of writing data breaking grants down across different international beneficiaries were only available for 2009–2011.

[2]There does not appear to be an explicit policy in the IEE programmes that would enforce this pattern, but it is consistent with an approach that seeks to ensure all countries receive at least some grants under the programme.

[3]The linear model reveals a significant effect of population ($F_{1,28} = 62.5$, $p < 10^{-7}$), with a significant intercept of €2.5m per country and population coefficient of €0.21 per capita.

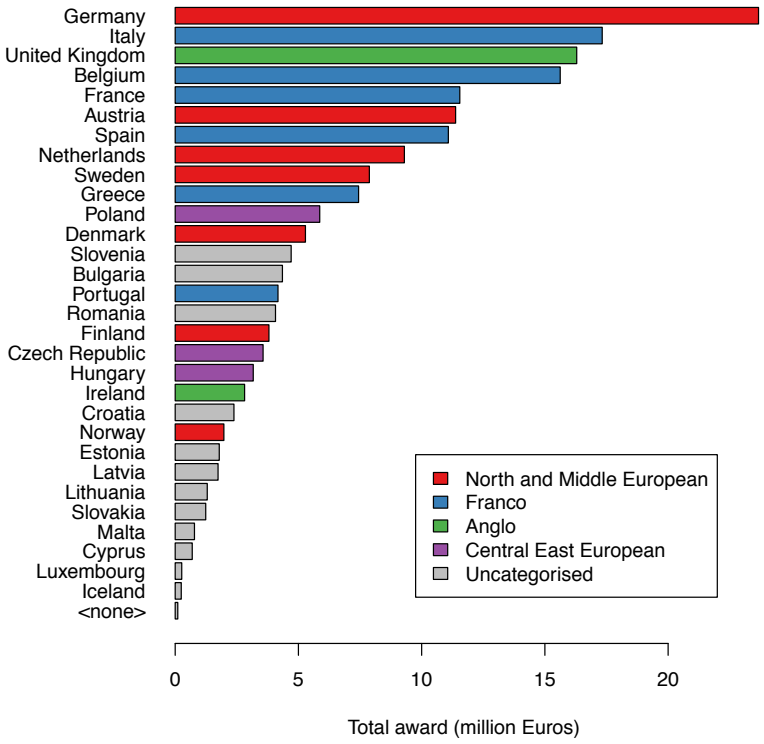

Figure 1: Total value of grants awarded under Intelligent Energy Europe between 2009 and 2011. Grants are awarded to beneficiaries within countries, not to national governments.

to some extent it may also be an artefact of advantages related to the location of European Union institutions in Brussels and the co-location of organisations such as EuroCities whose principal focus is coordination of EU funded initiatives.[4] Austria, Germany, Sweden and the Netherlands after Belgium appear to have received the greatest excess of grant funding over the population model prediction. These four countries have some similarities in the organisation of local government, and in the historical organisation of energy through municipal companies. These characteristics are

[4]For example, of all grants awarded to Belgian organisations 18% were to the coordinator of a project. Only Germany and Finland had higher rates of coordinator grants at 20% and 19% respectively.

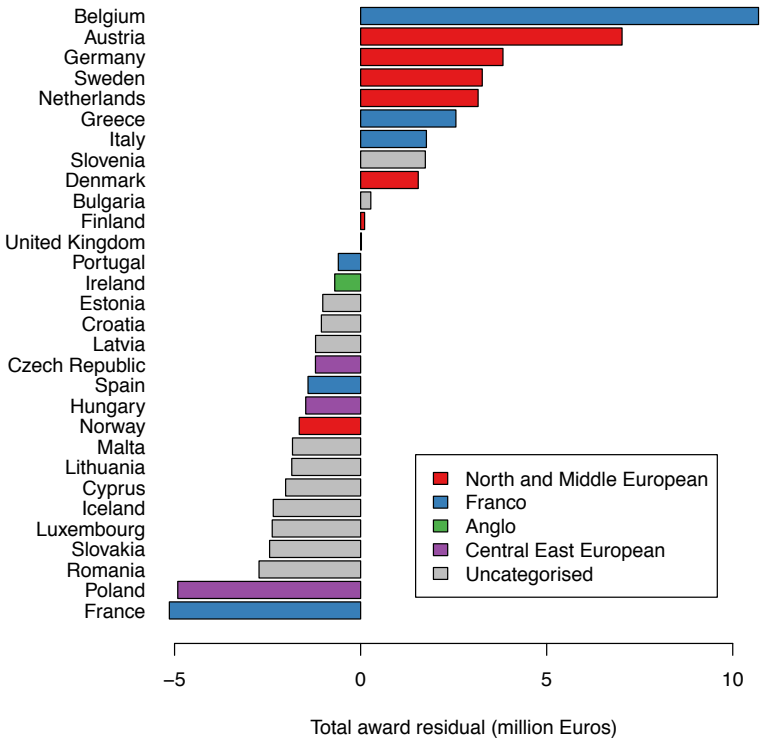

Figure 2: Residuals of model fitting total IEE grant awards in 2009-2011 to country population.

discussed further in section 2. France and Poland appear to receive considerably less IEE grant funding than the population model would suggest.

Do rates of participation in the Covenant of Mayors influence the amount of EU funding for local energy initiatives awarded to organisations in different countries? Inspection of figure 2 suggests neither Italy nor Spain, in spite of their high participation in the Covenant of Mayors, received unusually high levels of grant funding from IEE. Extending the linear model to include the number of signatories in a country as a dependent variable did not significantly improve the model ($F_{1,27} = 0.23$, $p = 0.64$). This suggests that, at least for drawing IEE grants into a country, participation in the Covenant of Mayors does not increase resources for local engagement with energy.

2 Local authority engagement with energy in relation to government infrastructure

Section 1.1 provides a contemporary snap-shot of national patterns of local engagement with energy, albeit using somewhat crude metrics. In section 1.1.2 we noted that the four countries after Belgium which received the greatest excess of IEE grants over a population-based prediction also had traditions of municipal organisation of energy. Here we discuss the relationship between historical municipal-led approaches to energy and the organisation of local government in different countries.

2.1 Varieties of local government and histories of energy systems

The development of energy systems, particularly network-based systems, in Europe historically tended to originate in local activity, in part due to technical limitations on the scale of early systems, and in part due to the need to build a consumer base for energy supply. In different countries, and different local areas within countries, patterns of development took different forms. Hughes (1983) compared development of electricity systems in several cities including London and Berlin around the end of the nineteenth century: whereas competition between commercial interests, municipal, county and national authorities for control over electricity produced a chaotic patchwork of incompatible systems in London, the Berlin authorities adopted a flexible approach to regulation which developed with technological change, establishing a regulated commercial monopoly to supply electricity which was subsequently brought under municipal control. Hughes gives a rich account of the development of electricity networks in both cities, one component of which is differences in government structures[5]: whereas Berlin was governed by a single bicameral local government, in London borough councils competed for control with the London County Council and even national government (in terms of where regulation of electricity should be undertaken). In Berlin

[5]Hughes (1983) also discusses the role of different banking systems, broad patterns of industry in each city and relationships between system builders and electricity technology manufacturers.

development of the electricity system was integrated with other municipal developments, supporting its technologically rational expansion. For example, the Berlin tram system used the concessionnaire's electricity system whereas in London, amid multiple competing electricity systems tram operators constructed their own electricity generators, further fragmenting electricity systems and failing to achieve network economies (i.e. balanced loads using the same system at different times).

The specific contrast between technologically rational and dysfunctional electricity development in Berlin and London respectively finds a broader exemplification in the post-war organisation of electricity systems in different countries. Italy, France and the UK all had large numbers of competing electricity undertakings which were perceived to be dysfunctional. The response of national governments in these countries was to nationalise (most of) these separate undertakings to rationalise their development and operation. By contrast, in countries such as Sweden, Denmark and the Netherlands local government continued to play a central role in energy systems, developing and operating distribution networks and local power plant, purchasing energy from centralised producers which, in some instances, they held ownership stakes in with other municipalities.

Differences in the role played by local actors in post-war energy system development does not appear randomly distributed across European countries, but corresponds to different patterns of relationship between central and local government more broadly. These relationships can be categorised in various ways, but here the focus is on the responsibilities and powers of local governments and their financial independence. Heinelt and Hlepas (2006) extend the typology suggested by Hesse and Sharpe (1991) to categorise countries according to the role local governments play in shaping public service delivery, and their degree of formal autonomy. Under this typology, the *Franco* group of countries is characterised by limited discretion over the provision of public services for local government, which instead functions to represent the interests of territorially defined communities at higher levels of government and to mediate between different interests within their territories. Countries identified with this ideal type include France, Italy, Belgium, Spain, Portugal and Greece (Heinelt and Hlepas, 2006, 26). By contrast, local governments in countries of the *North and Middle European* group tend to play a central role in shaping and delivering public services and, relative to other countries, occupy strong positions in relation to central government both through their constitu-

tional status and their high degree of financial autonomy. The Scandinavian countries, the Netherlands, Germany, Austria and Switzerland can be identified with this group (Heinelt and Hlepas, 2006, 26). A third group, the *Anglo* group, exemplified by the UK, Ireland, Australia, Canada and New Zealand, has, like the *North and Middle European* group, considerable responsibility for shaping the delivery of public services locally, but, like the *Franco* group, relatively weak legal and political status and limited financial autonomy. Heinelt and Hlepas (2006, 27) add *Central and East European* to Hesse and Sharpe's original three-way typology and identify ex-communist states Hungary, Poland and the Czech Republic in this group. This group has some overlaps with the *North and Middle European* group in having discretion over public service delivery and strong constitutional and financial positions, but is differentiated by the recency of this decentralisation of power and historically conditioned differences in understandings of what is and isn't appropriate action on the part of local government.

A strong municipal role in energy systems in the post-war period is found in the *North and Middle European* countries. These countries also tend to receive a higher share of grant funding from the IEE programme than would be predicted on the basis of their populations.[6] Nationalisation of electricity systems occurred in countries of the *Franco* and *Anglo* groups, though the relationship is not unequivocal (for example, the United States of America is partially identified with the *Anglo* group but electricity was not nationalised there). Inspection of figure 2 suggests a mixed picture for these and the *Central and East European* states in terms of contemporary local engagement with energy.

2.2 Development of local heat networks in *North and Middle European* countries

District heating is usually localised to specific settlements (towns, cities) as the infrastructure costs of transporting heat long distances are high (Roberts, 2008). It is therefore a helpful case to illustrate some aspects of local engagement with energy in the *North and Middle European* countries

[6] A one sided t-test comparing the residual of total IEE grants after modelling against population for the *North and Middle European* countries against the other countries in figure 2 is significant: $t_{28} = 2.46$, $p = 0.010$

as complications associated with large power supplies and transmission networks are avoided. Note that not all *North and Middle European* countries developed district heating (for example, in the Netherlands heating became dominated by natural gas). The role of local government in energy systems does not determine technology choices.

2.2.1 Development of district heating in Denmark

A number of experiments with district heating in Denmark preceded the 1970s oil crises, exploiting the difference in price between light oil (which could be burned for heating in individual-building boilers) and heavy oil (which required larger systems) (Lauerson, 2011). In the 1960s these initial experiments tended to focus on peculiar niches formed by clusters of willing organisations. These schemes were a mixture of private and municipal initiatives, and resulted in a degree of indigenous expertise, but developed outwith significant national direction.

At the time of the first oil crises, Denmark imported 99% of its primary energy, principally oil and coal (Lauerson, 2011). Various measures were adopted nationally including a ban on driving on Sundays. The 1976 Electricity Supply Act stipulated that all new electricity generators must also supply heat (Chittum and Østergaard, 2014). The growth of combined heat and power (CHP) was an important component of Danish local engagement with energy systems, as it created heat sources which would be used to replace individual-building oil-fired boilers with district heating. However, the transition from the early niche heat networks to more comprehensive city-scale heat networks did not happen spontaneously but was the outcome of an energy planning system, instituted in the Heat Supply Act of 1979, which empowered and required local government to plan local heat provision (Chittum and Østergaard, 2014). Local authorities analysed local patterns of heat provision and demand, and established zones within which either district heating (in built up areas) or gas networks (in less dense areas) would be developed. The Act envisaged gas would meet 15% of heat demand and district heating 60% by 2020, with a planned approach understood as required to achieve the lowest cost configuration of different energy networks (Bertelsen, 2011, Dyrelund and Steffensen, 2004). Local authorities' plans had greater force than the articulation of a vision or expectation, as they were the basis on which investment was actually made, and local authorities had powers to se-

cure the user base they had identified, for example by requiring buildings (new and existing) to connect to a heat network, and through the power to ban electric heating within identified zones. National government maintained oversight of local planning, with approval from the Danish Energy Agency being required before plans could be implemented. District heating enterprises were (and still are) required to operate on non-profit bases, charging customers cost-reflective prices and either reinvesting surpluses in the network, or using them to lower tariffs. Heat network governance is also characterised by local engagement: around half of Danish district heating (by supplied energy) is supplied by municipal companies, giving local people a role in governance via democratic engagement with local government; non-municipal district heating companies are required to reserve seat on the board of directors for a local government representative, are typically organised as consumer cooperatives (giving users power over selection of directors), and must give users first refusal to take over the company should it cease trading or be put up for sale (Chittum and Østergaard, 2014).

District heating grew rapidly, from 31% of residential buildings in 1981 to 61% in 2009. Large city networks integrate a range of heat sources, including coal- and biomass-fired CHP, energy from waste, and in some cases large scale electric heating (which absorbs surplus electricity when prices are low). Some heat sources are owned by district heating companies, but they also take heat from third parties, creating a market in heat generation.

Local engagement was clearly crucial to the growth of district heating in Denmark, but was not the sole determining factor. Local activities were undertaken and structured by a national context, with national government making important interventions which served to support local initiatives. These include systems of tax and subsidies which both increase the price advantages of district heating, and encourage heat networks to switch heat sources, particularly in favour of CHP, away from coal and towards biomass (Lauerson, 2011). Whereas the 1979 Act forced local government to develop heat plans, subsequent reforms have relaxed this requirement and have given more local discretion as to whether buildings within district heating zones should be required to connect. Their capacity to plan for heating is supported by powers to collect data from private heat suppliers. Chittum and Østergaard (2014, p. 471) argue these reforms have strengthened local control over heat networks, and given "local ac-

tors . . . a true sense of agency."

2.2.2 Development of district heating in Sweden

Municipalities also played an integral role in the development of local heat networks in Sweden. Early development following the Second World War was driven by values of equitable public services, including cross-subsidisation with other municipal services (Rutherford, 2008). The Swedish government initiated a housebuilding programme, targeting construction of one million homes between 1965 and 1975, which was delivered through local government and which created significant opportunities for local authorities to coordinate the development of heat loads with heat network roll out (Ericson, 2009).

In response to the 1970s oil crises, national government sought to define a clearer role for local government in delivering its energy policy goal of reducing exposure to oil price fluctuations, with heat planning and district heating as central components. However, whereas Danish district heating was closely linked to CHP, most Swedish district heating relied on heat-only energy centres. Ericson (2009) explains this in terms of decisions to rely on centralised hydroelectric and nuclear resources for electricity production.

Sweden's 1977 law requiring municipalities to develop municipal energy plans was in practice less forceful than the Danish 1979 Heat Supply Act, with around a quarter of local authorities failing to develop a plan by 2006, almost three decades later (Ericson, 2009). Whereas Danish local authorities had power to compel buildings within district heating zones to connect to a network, an equivalent Swedish power was slightly more oblique (in that buildings within district heating zones could be charged for district heating services even if they refused to connect, Summerton, 1992) and was rarely used. However, in addition to the integration of district heating with local translation of the national housebuilding programme, Swedish local authorities were able to coordinate heat network development with use of electric heating (including heat pumps) as in most instances they controlled electricity distribution networks via municipal companies (Summerton, 1992).

Prior to the liberalisation of energy markets in 1996, district heating was predominantly run by municipal companies and inherited regulations that applied to local authorities generally. Companies were not per-

mitted to operate in other local authority areas and had to adopt cost-based pricing. Ericson (2009) suggests the prohibition on district heating companies competing within geographical areas supported collaboration through the Swedish District Heating Association, which was successful in sharing information particularly on the performance of heat network components, allowing poor performing technologies to be quickly weeded out.

2.2.3 National-local relations in historical development of local energy systems

In both Danish and Swedish district heating development, the activities of local governments were not independent of each other, nor of decisions made at central government level. While both cases saw a degree of local entrepreneurialism in the early development of heat networks, reaching the high levels of penetration seen today required local action embedded in nationally articulated visions and attendant policy support. This support took various forms including national governments positioning local authorities as important actors in energy planning, setting aspects of the fiscal context (including subsidies, taxes and low cost loans) and regulating the activities of municipal energy companies. The picture that emerges is not one in which local authorities, through their constitutional and financial independence, developed local energy systems *independently* of national government policy and direction, but one in which local and national policies were coordinated.

The dependence of local action on national policy at first sight may seem to undermine the characterisation of local government in these *North and Middle European* states as possessing a high degree of autonomy. However, this can be understood as reflecting reciprocal influences between local and national governments (c.f. Emelianoff, 2014). Indeed, a systematic survey of local government Chief Administrative Officers in the mid-1990s found that the influence of central government on local budgetary processes and economic development was *higher* in these countries than elsewhere (Sellers and Kwak, 2011). While Le Galès (2002) argues that in the twentieth century local governments in Europe became subservient to national government, the historical process by which this happened resulted in different settlements in different countries, with local elites being absorbed into national processes in Northern countries but being replaced

by new creations of central governments in Southern countries (Heinelt and Hlepas, 2006).

The contrast with the cases above and the history of district heating in the UK suggests the difference in central-local relations was a component of the failure of post-war and post-oil crisis visions of communal heating. In the post war period each local authority interested in developing district heating was required to obtain specific dispensation in the form of an Act of Parliament, and the Lead Cities programme of the 1970s/1980s was damaged by central government's apparent ambivalence to its objectives (Russell, 1996). This is not to say that historically similar coordination of central and local action has not occurred. Szreter (1988) argues that the development of public health infrastructure in the UK initially failed as a centrally imposed model was unacceptable. Instead, infrastructure (including sewage systems) were developed by local authorities, but only once central government had both articulated a vision for the expansion of universal public health infrastructure and enacted statutes both empowering and requiring local authorities to undertake such works. Without central support local opposition to the levels of local government spending required had previously prevented a locally-led model.

3 Local engagement with energy after liberalisation

Since the 1990s, the organisation of both energy supply industries and local government across Europe has undergone considerable transformation (Graham and Marvin, 2001, Helm, 2004, Le Galès, 2002). Energy markets have been liberalised across Europe, requiring considerable "unbundling" of energy supply activities, separating out those considered amenable to competition (generation and retailing) from those considered "natural monopolies" (transmission and distribution networks). Organisationally this has been accompanied by (partial) divestments by previously nationalised companies and absorption of small utilities into much larger transnational companies, resulting in market concentration and consolidation across Europe (Jamasb and Pollitt, 2005). Local government has been progressively repositioned in response to perceived competitive pressures arising from European integration and globalisation, shifting in emphasis from the ter-

ritorial management of "collective consumption" to a more entrepreneurial and business-responsive mode of governance (Le Galès, 2002). The transfer of previously municipal energy companies to the private sector is one example of the organisational effects of changes in local government, with increasing rates of outsourcing and organisational rationalisation, with a decline in local government directly providing services and a rise in facilitative modes of governance whereby local authorities work to set conditions within which other actors will deliver intended outcomes (Bulkeley and Kern, 2006, Rutherford, 2008). These changes, underpinned by neoliberal political analyses and philosophies emphasise the role of markets in efficient allocation of resources and are accompanied by declining tendencies at national levels for governments to engage in planning (Russell and Williams, 2002). Reforms have been adopted in different ways and to varying degrees in different countries, and Le Galès in particular stresses that for local government

> Competition is unquestionably one element of the discourse and a constraining factor [...], but it does not erase all the rest; it can, with varying degrees of difficulty, be linked with other priorities such as integration, security, or sustainable development. (Le Galès, 2002, 208)

This section explores some of the impacts of "unbundling" of both energy and local government for local engagement with energy.

3.1 Eco-city pioneers: Graz

The examples of Danish and Swedish district heating illustrate local development of energy systems within a nationally defined and supported framework. Graz (Austria) is an interesting alternative case which Rohracher and Späth (2014) discuss, asking to what extent local energy initiatives can successfully deviate from established dominant regimes.

Graz's development as an international-award winning "eco-city" pioneer emerged in response to the city's poor air quality in the 1980s, a consequence of local emissions (transport and heating) and the city's geographical location in a basin. A group of energy and environmental activists successfully took up strategic positions within the local authority at both administrative and political (via the local Social Democratic Party).

The group also included professors at the local technical university. Regulatory pressure from provincial government to deal with air pollution created a window of opportunity which this group exploited to build municipal sustainable energy programmes in coordination with expansion of the energy research group in the technical university.

Through participative processes involving local companies, NGOs, municipal utilities and researchers, Graz developed a series of local initiatives, some linked to international processes and networks (for example it was the first Austrian authority to develop a Local Agenda 21 programme) others locally specific. These included demand-side management plans, development of an energy performance contracting model for both building refurbishments and connections to the district heating network, and initiatives to support the feed-in of solar energy to the district heating system. The interface between municipal, research, commercial, civil society and international actors was mediated by a newly created local Energy Agency, which organises various stakeholder participation processes, acts as a knowledge broker, and engages with European and international networks and programmes.

Rohracher and Späth (2014) argue that an important political dynamic emerged around the eco-city concept. Although the implementation of many programmes was slow, the city received international accolades on the basis of what was perceived as a pioneering approach and ambitious targets. These helped reinforce support at both local political levels and, Rohracher and Späth argue, public support for an eco-city identity. However, political momentum proved fragile when the key activists with positions in the council ignominiously left the administration as the result of a financial scandal. The eco-city identity was not resilient to other identities which overtook it (such as "cultural capital").

Rohracher and Späth describe the tangible achievements of the eco-city programme as "gradual improvement rather than a disruptive transformation," though from a UK perspective they seem significant: the district heating network was substantially expanded, a large number of companies implemented energy efficiency and pollution reduction measures, and a municipal bus fleet running on biodiesel. However, from an Austrian perspective these changes are cast by Rohracher and Späth as largely consistent with the national energy regime, modifying processes dominated by the national context towards the eco-city vision. They link the gap between early visions and eventual outcomes to the part privatisation

of municipal utilities, which decreased the local authority's capacity to influence development of local infrastructure. What does appear to have been resilient to the declining political capacity and momentum of the eco-city programme is the introduction of various forms of energy contracting, involving intermediaries whose business models rely on cost-saving interventions.

A number of themes from the Graz case are evident in other examples discussed below. The initiative was led by a small group of entrepreneurial actors taking advantage of specific opportunities and developing a political dynamic that focused attention on the eco-city vision, but which proved fragile. The extent to which local government was able to shape local energy development was diminished when it lost control over the local energy utility. And various intermediary organisations emerged, both the Graz energy agency which coordinated local activity and represents the city's initiatives on an international stage, and organisations structured to intervene between users and suppliers of energy, with business models oriented to capturing the value of energy savings.

3.2 Växjö and Stockholm

The Swedish cities of Växjö and Stockholm provide contrasting cases of how local engagement under more liberalised forms of local and energy governance can coexist within a national context. The differences within a single country illustrate that national contexts do not determine local outcomes, and the Växjö case indicates a degree of continuity with earlier modes of central/local government policy interactions.

Local authority engagement with sustainable energy in Växjö dates back to the early 1980s (i.e. long before energy liberalisation). The municipal energy company, responsible for electricity and district heating, was the first in Sweden to make significant investment in energy systems based on biomass. It obtained significant first-mover advantages in the form of grants drawn both from Swedish national programmes and European Union initiatives. In 1997 a 110MW biomass CHP plant began generating electricity and supplying heat to the local heat network. The heat network itself was expanded to a larger user base. Emelianoff (2014) argues two local conditions were crucial in Växjö's decision to pioneer the use of biomass. First, local economic conditions in Swedish forest regions were

precarious, so the possibility of establishing a new forest-based industry held the promise of reviving Växjö's local economy and securing local employment. Second, local sustainability initiatives received cross-party support, having been initiated under a Social-Democrat/Green coalition in the mid 1990s, and continued under a Conservative administration in the mid 2000s. Emelianoff argues this cross-party support was unusual in Sweden, where most Local Agenda 21 programmes had failed to impact local energy systems due to local political disagreement.

The potential to exploit local biomass was translated into a political vision to make the city completely free of fossil fuels by 2050. This was adopted in 1996, the same year Swedish energy markets were liberalised. The municipality retained ownership of its energy utilities, and this, coupled with its ownership of most rented housing, facilitated its expansion of the district heating network to three quarters of homes by 2007. Around one quarter of the costs of local initiatives were financed by central government infrastructure grants targeting sustainability (LIP) and climate change (KLIMP) for which the cross-party support behind the Local Agenda 21 programme was important (Emelianoff, 2014). The local initiative was also supported by the Swedish Society for Nature Conservation which helped create a network of Swedish cities (which itself was supported by EU Renewable Energy funding). This network, Emelianoff argues, played an important lobbying role in transposing the "fossil free" ambition from local policies to national government policy in 2006. This ambition appears again in other local policies, including in Stockholm.

Whereas Växjö persisted with an ownership model of coordination between energy and housing, Stockholm followed a different route. In Stockholm local energy was more politically contentious, with arguments focusing on privatisation rather than environmental concerns. In 1994 the incoming Social Democrat coalition local government reversed its Conservative predecessor's decision to part-privatise Stockholm Energi, the municipal energy company responsible for both electricity and district heating. However, subsequent changes to the political makeup of the council eventually resulted in the separation of electricity and district heating, with the eventual sale of all shares in the electricity business to Fortum, a Finnish energy company. Ownership and governance of the separated district heating company was more complex, and the result of a "political compromise," with Fortum providing 90.1% of the company's equity but holding just 50.1% of company shares (Rutherford, 2008). The munic-

ipality received over fourteen billion Swedish Kronor in the deal. When political control returned to the Social Democrats they did not seek to reverse the privatisation, instead prioritising other uses of the money received (Rutherford, 2008, 2014).

Progress on sustainable energy in Stockholm at first sight appears similar to Växjö. Significant reductions in CO_2 emissions have been achieved since 1990 largely through switching the district heating system to renewable sources, with financial incentives created by Swedish CO_2 taxes. Stockholm has also adopted the goal of becoming 'fossil free' by 2050 (Rutherford, 2014). However, Rutherford argues that the municipality in effect takes little control over the district heating company, which has seen prices rise since its conversion into a public/private joint venture. Prices are now set by comparison with alternatives rather than to reflect costs (in spite of the market dominance of district heating which serves around three quarters of heat demand in the city). Perhaps more significantly, the historical coordination between the elaboration of district heating and other municipal services, particularly housing, has declined. Greater organisational distance between municipal officers engaged in planning new development areas and the management of (quasi-)privatised energy networks is described by municipal officers as creating barriers to coordinated development, partly due to communication difficulties, partly due to the replacement of shared goals with competition to secure greatest benefits from a development (Rutherford, 2008). One municipally owned housing company, Stockholmshem, concerned about high prices in the ex-municipal heat network, threatens to bypass the system with their own heating plant (Rutherford, 2008).

Furthermore, the responsiveness of the district heating company to municipal sustainability programmes is questioned by Rutherford (2014). While the shift to renewables for district heating accounts for the majority of reduction in CO_2 emissions since 1990, a single CHP plant which co-fires biomass and coal is claimed by local activists and opposition politicians to be responsible for one quarter of the city's emissions. Rutherford quotes a municipal official who cites the city's 50% governance stake as preventing the municipality directing the company in relation to the plant. The district heating company has stated it intends to increase the proportion of biomass input, but critics point out it has not clarified its role in the city's overarching aspiration to become "fossil fuel free".

The picture Rutherford (2014) paints of Stockholm's municipal engage-

ment with sustainable energy is in which sustainable energy is associated with political capital, forming part of the way city authorities seek to promote the city internationally, while at the same time the capacity and perhaps willingness of city authorities to tackle sustainable energy issues declines. In addition to the limited control municipal authorities appear to exert over the district heating system, Rutherford highlights the small proportion (7%) of the income the city received from transfering municipal energy assets to private ownership that was used for environmental initiatives, and falling budget for the municipal environment department. However, he also notes that locally the availability of external resources is an important factor in Stockholm, for example between 2004 and 2008 it received 80 million kronor for local climate change investment from the national KLIMP programme, and quotes a municipal political adviser claiming municipal environmental activity is becoming increasingly focused on *ad hoc* projects, suggesting a growing role for external funding for example through Intelligent Energy Europe.

Where Stockholm municipality has retained ownership, it is pursuing sustainable energy initiatives. It was a runner up in the 2014 ManagEnergy Awards for its retrofit of housing owned via a municipal housing company. The project, in the Järva suburb, combines energy efficiency with solar photovoltaics and aims to refurbish all 200 apartment blocks owned by the company in Järva by 2022. The small initiative is positioned as a pilot project (ManagEnergy, 2014).

3.3 Challenges in coordination — local energy in Amsterdam

Whereas Rutherford's account of Stockholm presents a city authority with declining capacity and interest in management of local district heating, the efforts of the local authority in Amsterdam to take greater control over heat networks presents an interesting contrast. The following account is drawn from a peer learning exchange visit to Amsterdam in 2012 which the author participated in.

Engagement with sustainable energy by Amsterdam municipality is presented in official documents as part of attracting and retaining high value businesses and an associated population (e.g. with high levels of education). That is, the presenting logic relates to Amsterdam's competi-

tive position, though in practice older ideas about collective consumption exert a degree of influence on local action (e.g. concerns about energy affordability among lower income citizens). The municipality has a target to reduce greenhouse gas emissions 40% by 2025 against a 1990 baseline. As emissions rose after 1990 this is equivalent to a 50% reduction on 2010 levels. The municipality aims to achieve "climate neutrality" for its own operations and its buildings codes by 2015. These targets are regarded as stretching and some within the municipality express doubt that they will be met, particularly the 2025 target. Part of the account of sustainable energy efforts offered by politician is a shift away from pilot or demonstration projects which have limited impact, to focus instead on a small number of areas seen as scalable. These are

- Reducing demand for energy by using powers granted under national law to compel commercial enterprises to invest in energy efficiency measures if they pay for themselves within five years. Efficiency improvements are envisaged for stock owned by housing corporations, and the municipality focuses on lobbying national government for a change to regulations with the aim of enabling housing corporations to capture as rent increases some of the cost savings created by their investment in efficiency measures. The city is also investigating establishing an ESCo to provide energy performance contracting approach to energy efficiency within the city.

- Generating renewable electricity from wind and solar technologies. In 2012 there was 66MW installed wind capacity within the city boundary, and a target of 400MW by 2040. Amsterdam municipality owns around 80% of the land within its jurisdiction and can pool planning risk across this area. However, once sites have passed through the planning process the municipality envisages community and commercial enterprises to take on their development, financing and ownership.

- Expanding the use of district heating from the equivalent (in heat demand) of 60,000 homes to 100,000 by 2025 and 200,000 by 2040.

There are two district heating networks in Amsterdam. The oldest (begun in 1997) is owned and operated by Nuon, a company formed by the progressive merger of several Dutch municipal energy companies prior to

market liberalisation, and subsequently purchased by the Swedish energy company Vattenfall (for its 10% share the City of Amsterdam received almost €1 billion). The network, situated in the East of the city, delivers the equivalent of 47,000 households' heat demand from Nuon's *Diemen* gas-fired CHP plant. The newer (2000) smaller (17,000 household equivalent) network in the West is a 50/50 joint venture between the municipality and Nuon, and draws heat from the city's waste incinerator, itself operated by a municipal company. Local actors identify the development of the western network with an entrepreneurial individual (the head of the municipal waste company) without whom the project would not have developed.

The municipality and Nuon describe a shared vision of an integrated district heating system, with the two networks eventually physically interconnecting to improve system efficiency. At present, however, the organisational form under which an integrated system would operate has not been decided. Options range from expanding the joint venture model to the whole system, through public sector ownership of the network independently of Nuon and on to integrated public ownership of the network and generating plant. Key issues influencing the organisational form are the degree of control the municipality could exert (particularly if public policy goals conflict with commercial priorities for the network) and Nuon's commercial interest and sunk investment (particularly if a model which diluted their stake were adopted). As municipal representatives noted in meetings, Nuon has not voluntarily put its share of district heating in Amsterdam up for sale, so the price of any public sector buy-out could be high.

Public sector stakeholders in Amsterdam consider the municipality's in-house technical expertise adequate to deal with heat network development. However, some officers suggest that the capacity of the municipality to handle the commercial aspects of its involvement in district heating, and to analyse and shape business models in the city, is limited. The municipality has limited access to data and expertise concerning the long-run development of the Dutch energy context (for example, the crucial issue of gas price trends), particularly in comparison with Nuon (which can draw on Vattenfall's international resources and hedging strategies). While the 50/50 joint venture model for the western network is identified by some as a strength (allowing public policy goals to be pursued in a commercially efficient way), some stakeholders express concern that the information asymmetry between Nuon and the municipality weakens the latter in

negotiations (for example, around decoupling heat tariffs from gas prices, the investment case for network extensions, and analysis of different options for integrating the two networks).

One specific example illustrates the challenge of governing local energy in this context. The geography of Amsterdam, with canals and river separating areas of dry land accentuates certain challenges of heat network development. The prevalence of canals in the historic centre mean that area is not considered suitable for district heating. However, the networks do cross bodies of water between islands and across the river, and this configuration illustrates some of the challenges coordinating the two networks. Zeeburger island, to the east of the city is strategically located as a potential link across the river, bringing Nuon's network from the east over to the north of the city where the joint venture network is already developing. Furthermore, the Zeeburger island network would be developed by the joint venture to take heat from the eastern network, making it the first instance of (organisational) integration across the systems. However, Zeeburger is the third of a cluster of islands which sit in a line running from east to west, the first two islands already being served by Nuon's network. Nuon's connection of the middle island, Steigereiland was constructed at a time when development on Zeeburger was uncertain, and the company was willing only to invest in enough capacity for Steigereiland's heat demand. Consequently supply to Zeeburger would require a more costly connection to the first island, Haveneiland.

This increases the cost of the connection. From Nuon's commercial perspective, in spite of endorsing the vision of a future interconnected system, connection from Zeeburger onwards to other parts of the city represents an investment risk, in terms of both the scale and the timing of benefits created by integrating the east and west networks. Nuon therefore emphasises the revenue from heat sales on Zeeburger island to justify investing in this part of the network, and calculates a minimum level of heat demand required in order to invest. This demand, coupled with a decline in the envisaged scale of development on Zeeburger means the investment is only judged viable if *all* planned development connects to the network. The municipality has power to enforce this, but developers have reacted negatively to the loss of freedom they experience in other zones targeted for district heating in the city.

Municipal interviewees identify the emerging tensions between the network and developers as a tension between optimising at a building

scale and optimising at community scale. However, there are different ways of optimising at a community scale, and the description of Nuon's position offered through the exchange visit represented a tightly bound conception of the value of investment, focusing on locking in heat demand in sufficient quantities to meet the company's hurdle rate of return. The value of the island in enabling the longer term interconnection of the systems cannot be factored into a commercial model without assuming particular organisational forms for the larger integrated system, which as noted above is far from clear and an issue the municipality feels it is at an informational disadvantage over. Whereas conceiving of municipal infrastructure in terms of collective consumption (Le Galès, 2002) would place more weight on the strategic growth of the network, conceiving of each investment as a financial package required to achieve minimum returns is more restrictive (Graham and Marvin, 2001), particularly in a context of competing economic interests (namely, between Nuon and the municipality). This is not to say that were the municipality to own the eastern network today it would necessarily behave differently, particularly in the contemporary context of its own budget constraints and pressure to demonstrate its own return on investment. However, the presence of competing interests and informational asymmetries accentuate the challenges of developing local energy infrastructure in Amsterdam.

3.4 Regulation for coordination — district heating in Norway

Heat network development in Amsterdam illustrates some of the difficulties faced by local attempts to interact with the private sector in development of a local energy system. In Norway, a contrasting approach relying on a national regulatory framework is effective in supporting development of local heat networks within a liberalised model which accommodates public or private sector led initiatives.

At the time of energy market liberalisation in 1990, Norway had little district heating in comparison with its Scandinavian neighbours, relying instead on electric heating. Strain on local distribution networks, coupled with environmental concerns and the volatility of electricity prices that resulted from integration of the Norwegian electricity market into Nordpool, have contributed to arguments in favour of heat network develop-

ment. Regulation of waste incineration, imposing minimum energy recovery efficiency levels have also contributed, making district heating a solution to regulatory problems faced by waste management companies.

Norway adopted a distinctive form of licensing for district heating in the 1990 Energy Act (which also liberalised energy markets). Systems over 10MW are required to hold a licence which applies over a defined geographical area (the licence applicant proposes the area over which they consider the network will extend in a 5-10 year period). Licences are geographically exclusive, giving the licence holder greater certainty in its capacity to build a market beyond an immediate niche opportunity. Licence applicants are required to produce detailed development plans, including evidence of integrated social, economic and environmental advantages relative to other options, and of customer commitments to connect (NVE, 2009). Customer protection is included in licence conditions, lending legitimacy to the technology by establishing service standards and requiring tariffs to be competitive with electric heating. The state also has powers to require systems to interconnect, and to assume ownership of networks when licences expire.

The Norwegian system liberalises district heating in the sense that any qualified company can hold a licence. This, coupled with the centralisation of the licence granting process establishes a formally weak role for local authorities. District heating development in Bergen, for example, was driven by an electricity company and a waste management company with little input from the municipality. Although the municipality *owned* the waste company and held shares (with other municipalities) in the electricity company, these were treated as financial interests and not used (in the account given by a local municipal officer) to direct the companies. However, the municipal government has shifted from an initially ambivalent position to seeking a more active role in the district heating system as this is seen as key to achieving climate change commitments, which have become politically salient both nationally and at a local level. The municipality has been able to support the heat network in various ways, including connecting its buildings, some of which have been converted to wet central heating, whose large demand levels help anchor the system; facilitating the district heating company's search for energy centre locations likely to be granted planning permission; and sharing local development information with the district heating company to help inform decisions on investment in network extension. Thus, while Norwegian regulation

is open to heat network development by a range of organisations, local government's strategic overview of an area and its large estate means it retains a potentially influential role on local energy development.

3.5 Remunicipalisation of networks in Germany

A relatively high profile recent development in European local engagement with energy systems has been the movement in some German communities to bring ownership of energy interests back into municipal hands. This has been possible through two principal routes. The first is repurchase of shares in ex-municipal Stadtwerke, the second is via the concession model used to bring private capital and operations into local networks. These concessions have limited lifespans and must be renegotiated, with municipalities having rights to return networks to public ownership (Hall et al., 2013).

The shift towards remunicipalisation is exemplified in various ways, including referendums both deciding against privatisation of still-municipal companies, and deciding in favour of municipal take-over of networks. Remunicipalisation by repurchase of shares has been made possible both by EU requirements for large companies to reduce their market dominance, and due to difficulties emerging in German private sector energy business models, linked both to excessive debt and declining profitability (Hall et al., 2013). By 2011 the majority of German energy distribution networks were publicly owned (by consumption, 57% of electricity, 52% of gas and 50% of district heating networks were in public hands, Hall et al., 2013).

A number of arguments are deployed in Germany in favour of remunicipalisation. The referendum campaign for remunicipalisation in Hamburg identified 10 arguments which variously concerned perceived misalignment between the interests of the private companies (Vattenfall and E.On) and public interests, both in general and on specific issues such as security of supply and decarbonisation (see box). In addition, economic arguments were deployed concerning the re-localisation of (at least parts of) the energy economy and the campaign's projection that the costs of transferring networks to public ownership would be met from network revenues rather than straining the municipal budget. Surveys indicate this is a common mix of motivations, and that issues of influence and control

are most commonly cited as reasons, with concerns about the efficiency and social impact of private business models, along with potential for revenue generation identified as secondary factors (Hall et al., 2013).

The following items are translated from the Hamburg campaign to remunicipalise the city's networks (`http://unser-netz-hamburg.de/10-gute-gruende/`, accessed December 2014)

1. General Interest. The supply of electricity and heat is part of the basic protection of the population. Its design must not be subordinated to the interests of individual, purely profit-oriented, corporations.

2. Future. The decision on who will control the networks, will apply for 20 years.

3. Freedom. The current 25.1% participation of the city in the network companies brings little impact, but also ensures that only the market power of Vattenfall and E.on is effective. With the referendum Hamburg will be independent again.

4. Welfare. A local network operator is committed to the common good. These include fair and adequate network charges and heat prices, as well as job security.

5. Security of supply. The city itself has the strongest interest in a reliable and cost effective energy supply. The know-how in network operation will be maintained as the staff will be taken over.

6. Good Business. The transfer can be paid out of operational revenues. The municipal budget is not charged. Nationwide, 170 municipalities have already taken their networks again.

7. Profit. Each and every citizen of Hamburg relies on to use the energy networks and must pay for it. The profits from the mains power and heat supply should remain in Hamburg.

8. Climate. The conversion and management of local distribution networks and district heating distribution play a crucial role in a decentralized and efficient energy from renewable sources.

9. Democratic Control. Only under democratic control a balance be struck between the various objectives: fair energy prices, secure jobs, investments in the energy transition.

10. Transparency. A local network operator must determine its business activities and disclose its pricing transparently.

Politically remunicipalisation has been supported at a local level by different parties, with those on the Left tending to emphasise redistributive and welfare arguments, and those on the right focusing on capturing revenue streams (Hall et al., 2013). However, the policy does not command universal assent, and parties supportive in one case may oppose in others. In Hamburg the local referendum was the outcome of local citizen activism, with opposition from the local political administration (Leidreiter, 2013). Moss et al. (2014) describe two competing grass-roots organisations in Berlin seeking to define visions of sustainable energy for the city, both of which promoted remunicipalisation. The governing coalition, however, was divided over the issue, and political opponents were able to prevent the referendum taking place on the same day as other elections (as had been the case in Hamburg). Consequently, although remunicipalisation received 83% of the vote this represented 24.1% of Berlin's electorate, just under the 25% required.

Cases in Austria, Sweden and the Netherlands discussed above indicate that local authority control over energy infrastructure can be an important component in realising ambitious, long term local sustainable energy visions. However, municipal control over energy networks is unlikely to be a sufficient condition for achieving local sustainable energy systems, or the other goals articulated in German debate. Hall et al. (2013) compare remunicipalisation of energy in Germany with a parallel tendency in France for water companies to be remunicipalised. In France econometric analyses indicate private ownership adds 17% to water prices. Hall et al. do not cite similar statistics in German debates, and in some

high-profile cases (e.g. Hamburg) remunicipalisation has been adopted as a policy but has not yet been effected. In addition, the benefits of remunicipalisation in Germany are often contested and may be adopted through popular referendum against the advice of local political elites (Moss et al., 2014). Thus, while remunicipalisation resonates with the content of the German Energiewende (which emphasises renewable *and decentralised* energy) its impact is likely to be variable.

3.6 Local engagement with energy outwith control over infrastructure

The above sections have focused on the role of local control over infrastructure in supporting local sustainable energy engagement. This section explores forms of local engagement with sustainable energy which are independent of infrastructure control.

3.6.1 The Covenant of Mayors

The Covenant of Mayors (see section 1.1.1 is just one of 46 transnational municipal networks reviewed by Labaeye and Sauer (2013). These networks have been established to perform various functions, including mobilising resources for local initiatives, lobbying national governments and European institutions, and promoting learning across members (Emelianoff, 2014). Increasingly, access to European funding initiatives (such as IEE programmes) for local authorities is conditional on membership of the covenant, so it does perform a resource mobilisation function (at least, by acting as a gatekeeper for funds). However, in their review of transnational networks, Labaeye and Sauer (2013) note that it is unclear whether the Covenant has achieved additional outcomes beyond those directly funded by European initiatives. In particular it isn't clear that embedding specific funded actions (often construed as pilot projects) in an international network of formal commitments in practice enhances the impact of those actions, for example by stimulating further action outwith grant funding programmes. A comment made by a local politician in Amsterdam, to the effect that the city had tired of creating low impact pilot projects and instead decided to focus on three core opportunities, indicates the scaling up of grant funded pilots to more significant interventions is

not inevitable.

Core to the Covenant approach is the articulation of a local Sustainable Energy Action Plan (SEAP) covering buildings, equipment/facilities and transport within the local authority's geographical boundary, with electricity and heat/cooling generation as secondary, optional elements. Guidance on SEAP development suggests local authorities should take exemplary action and that measures should focus first on local authority buildings and facilities (EU Covenant of Mayors, 2010). Guidance is not explicit on how exemplary action by a local authority could translate into more widespread action across other organisations with local presence. An initiative in Brussels suggests that relying on local actors volunteering to emulate their proactive local authorities may be insufficient to achieve local ambitions. In 2005 the Brussels regional authority developed an energy efficiency methodology for large public and private sector buildings, and funded the appointment of energy managers in participating organisations to develop energy inventories, efficiency interventions and results monitoring. The scheme was considered a success by the regional authority, but roll out was enforced through regional regulation requiring large public and private sector buildings to adopt the methodology (ManagEnergy, 2013). This suggests that exemplary public sector action is insufficient to inspire private sector actors to adopt similar practices, though early action by the public sector may build legitimacy for a subsequent regulatory approach.

Where exemplary action by local government does appear to be effective is in establishing the viability of an approach for other governments (local or national) to emulate. Indeed, some local initiatives are explicitly positioned as demonstrations to be taken up elsewhere (c.f. the "Merton rule" in the UK). For example, Freiburg (Germany) developed local standards of energy efficiency for new buildings, initially increasing development costs by 5–15 percent but with national standards emulating Freiburg's within about five years (Rohracher and Späth, 2014). Barcelona required solar thermal to be incorporated in new build development, a policy which has been copied by other local governments in Spain and elsewhere (REN21 et al., 2011).

3.6.2 Planning and coordination in local Sustainable Energy Action Plans

The Covenant of Mayors offers guidance to local authorities on developing a SEAP, but does not offer a template, meaning plans may vary in form, content, degree of ambition[7] and degree of coherence. Multi-initiative analyses, however, have identified certain aspects of local authority coordination and planning which are important to deployment of sustainable energy technologies and which are challenging to many European local governments. IEE and INTERact (2013) argue that spatial planning is an important dimension of SEAP realisation, but found the capacity of local authority spatial planners to handle energy issues to be weak. This reflected both failures to establish clear local visions with local political support, and difficulties integrating sustainable energy planning across local government departments, and applied both to energy efficiency and to low carbon heat and electricity generation technologies. Fragmentation in local authority structures was paralleled by fragmentation in sources of finance with the report finding no significant examples of pooling different funding sources to support "a more universal approach in developing low carbon neighbourhoods in urban settings," (IEE and INTERact, 2013, p. 31).

Sperling et al. (2011) argue that even in Denmark, often identified as exemplary in municipal energy planning (Chittum and Østergaard, 2014), local government activities and powers are insufficient to adequately contribute to the country's target to transition to a system independent of fossil fuels by 2050. Sperling et al. note considerable diversity in Danish municipal plans and strategies, a tendency to focus on well established areas of municipal activity, and a lack of quantitative detail in local visions. While municipalities continue to be involved in management of district heating companies, their role in planning heat supply has declined as the requirements of the Heat Supply Act have been relaxed. In other areas, such as transport electrification or integration across energy systems at a local level, there is no institutional framework for municipal planning (Sperling et al., 2011, p. 1345). This has led to calls from municipalities to a "return" to the heat planning regime, expanded to include other energy issues. At present this is developing on a voluntary basis, with some

[7] All signatories commit to exceeding the EU's 20% CO_2 reduction target.

funding set aside under the cross-party national Energy Agreement (Danish Energy Agency, 2012).

3.6.3 Intermediaries

Europe-funded initiatives have engaged with various sustainable energy intermediaries (c.f. Hodson et al., 2013, Moss, 2009). These perform various functions, aggregating local projects in small municipalities across a region into a financeable package, offering technical advice to local authorities developing SEAPs and projects, and achieving energy demand reductions through energy performance contracts (EPCs). Examples of the latter include the Graz Energy Agency (see 3.1) and the Berlin Energy Saving Partnership (IEA-RETD, 2013). EPCs are attractive to public sector organisations across Europe as a means of achieving energy savings without having to deploy public sector capital. Indeed, the Berlin Energy Saving Partnership was established in 1994 at a time when Berlin's economy (and municipal finances) were under strain, and replaced a municipal programme of capacity building and institutional reform aimed at supporting public sector investment in energy efficiency (Monstadt, 2007). Intermediaries in EPC contracts typically manage a framework of qualified suppliers and support technical and financial aspects of development. Examples cited in the literature tend to be restricted to public buildings where multiple sites can be pooled into a single long-term contract (IEA-RETD, 2013, IEE and INTERact, 2013). The approach has developed rapidly across Europe prompting concerns about fairness and transparency in these novel forms of contract. The European Commission has responded by developing minimum standards for EPCs in the Energy Efficiency Directive.

The EPC approach to energy efficiency illustrates a growing role for intermediaries, both in the form of energy agencies brokering contracts, and in the form of energy service companies (ESCos) finding a business model in between energy users and suppliers. Various other examples of this kind of intermediation are reported across Europe. Greenchoice, a company in the Netherlands contracts with households to install solar panels on their roofs and supply them with electricity at a fixed price over 20 years, supported by national incentive programmes (IEA-RETD, 2013, 139). LichtBlick, a German company, has partnered with Volkswagen to "rent" clients' boiler rooms in which they install and operate micro-CHP units (manufactured by Volkswagen). The approach targets large build-

ings (with heat demand above 40MWh per year) and includes heat storage. The business model is supported by the German Feed-in-Tariff, but targets 100,000 installations which could be jointly operated as a 2GW virtual power plant (IEA-RETD, 2013, 143). In Andalusia the regional energy agency has partnered with local microrenewables installation companies to create new offerings to consumers. The partnership handles the administrative procedure of applying for subsidies on behalf of households. Instead of separately paying for measures and claiming subsidies, households were instead offered discounted measures (ManagEnergy, 2014).

These forms of intermediation support local energy interventions by shifting aspects of the work, financing, risk, etc. associated with building-scale interventions from the building owner or manager to a third party. They are local in the scale of technology deployed, but are not necessarily local in the scale of their organisation. LichtBlick's business model targeting 100,000 micro-CHP units, for example, would not appear to have any advantage in being restricted to a particular locality or region. However, in other cases, particularly where activity is led by public sector organisations, existing institutional relationships which reflect geographical relationships (e.g. between regional and local jurisdictions) shape the geography of energy engagement. This is particularly evident in relation to regional energy agencies. For example, both the Autonomous Region of Sardinia and the Barcelona Provincial Council have used European Investment Bank funding to support actions of their municipalities (ManagEnergy, 2011, 2014). In both cases technical expertise supported the development of SEAPs: 102 of Sardinia's 377 *comuni* were supported between 2012 and 2014, and 122 of Barcelona's 311 *municipios* between 2008 and 2010. Case study reports indicate municipalities tend to focus on public buildings, principally improving their energy efficiency but also using them to host microrenewables (particularly solar PV). In addition the support has led to deployment of more ambitious measures including concentrated solar power plants, biomass refiners and electric mobility schemes (ManagEnergy, 2011, 2014).

3.6.4 100% Renewable Targets

REN21 et al. (2011) review the approaches taken by a number of local au-

thorities which have adopted targets to become "100% renewable".[8] Often these ambitious targets grow out of local renewable energy success stories, which themselves have a number of overlapping features: citizen financial participation (in the form of share ownership), entrepreneurial leadership associated often with a single person in the municipality, and local programmes of awareness and support raising. The cases identified in the REN21 et al. (2011) report tend to be small communities for whom local energy initiatives are in part a response to local economic difficulties and new economic opportunities created by national policy (for example, through Feed-in-Tariffs). Economic benefits are also perceived by smaller local authorities from "early adopter" advantages and stimulation of innovation. While small communities appear in REN21 et al.'s review to adopt the most ambitious targets, the report argues that mid-sized cities (100,000–500,000 inhabitants) tend to be most active. In addition to focusing on energy within their areas, these towns and cities frequently establish information and demonstration centres, positioning themselves as leaders for others to learn from, organising training and expertise, and providing a focus around which a critical mass of expert and innovative commercial actors are envisaged to coalesce (REN21 et al., 2011).

3.7 Civil society engagement with energy systems

The shift from state-organised patterns of energy system development (with local authorities as key conduits for national policies) to formally more open frameworks for engagement with energy have led to new examples of civil society organisations and initiatives.

Loring (2007) identifies three principal arguments deployed by proponents in favour of local participation in decision making for energy initiatives, focusing specifically on onshore wind:

1. Normative: public participation in planning is an essential element of democracy

[8] The target of being "100% renewable" can mean different things, including that 100% of energy generated within an area is from renewable sources, that the quantity of renewable energy generated annually in an area is 100% of the quantity of energy demand over the same period, or (rarely) that the area relies only on renewable resources to meet demand (i.e. that short-lived mismatches in local energy supply and demand are *not* balanced by integration into a wider system that incorporates non-renewable sources).

2. Instrumental: public participation in planning reduces conflict and increases trust (important for securing local planning consent)

3. Substantive: public participation is likely to draw on local knowledge and to result in higher quality, more robust decisions.

Comparing England and Denmark, Loring (2007) found similar patterns when these prescriptions were tested. Where public participation in wind planning was high, local acceptance was also high, and local acceptance correlated with (though did not determine) success in securing planning permission. Projects without public participation sometimes experienced low levels of local acceptance, but not in all cases. Local opposition groups in both countries tended to focus on a discourse of locals versus outsiders, with objections centring on benefits being extracted by outsiders at the expense of local interests.

Systematic surveys of civil society groups engaged with energy are rare, with research tending to focus on issues affecting civil society groups' engagement rather than the volume of such activity. One example is Boon's 2012 survey of civil society energy initiatives in the Netherlands conducted in 2012. His survey suggested a break in civil society initiatives around the period of Dutch market liberalisation (2006), with about a quarter of the initiatives pre-dating liberalisation, and those established after liberalisation clustering in more recent years. This pattern could be interpreted in several ways. For example, liberalisation, as a moment of change, may have reduced the numbers of civil society groups seeking to set up new initiatives, creating a natural dip in the temporal profile. Alternatively (and possibly complementarily) initiatives established after liberalisation may have shorter lifespans than those established before, with the low numbers of initiatives active in 2012 but established in the years following 2006 being those few which managed to persist.

Boon (2012) found a wide variety of different factors implicated in decisions to develop energy initiatives by civil society groups: different initiatives responded to different opportunities and motivations. However, there were some common themes. Civil society organisations tended to identify niches which they considered larger organisations unable to exploit, almost all cited perceived incompetence of (national, regional or local) government to achieve its environmental aims, learning from other initiatives was important, and groups focused on proven technologies with fast payback times. Rural initiatives responded to local dissatisfaction

with large energy companies, whereas urban initiatives were more strongly motivated by dissatisfaction with government policies perceived to be inconsistent.

4 Conclusions

Across Europe, local actors have historically played important roles in the development energy systems, though the degree to which local organisations remained important as energy systems (particularly electricity networks) expanded into regional and then national systems varied across countries. Local government in the *North and Middle European* countries tended to retain strong positions in energy through the post-war period, reflecting more general characteristics of national-local government relations. Investigation into the development of district heating networks in these countries, as both an inherently local system and one developed in more recent history, illustrates how these relationships across levels of government supported development. The financial and constitutional strength of local government played an important role, but significant expansion of district heating happened not solely through autonomous local entrepreneurialism, but was supported and guided by national visions and policies. This reflects a pattern of mutual policy shaping across national and local levels of government in these countries, less common in countries where local government has lower degrees of autonomy (Sellers and Kwak, 2011).

However, since the 1990s both local government and energy systems have undergone considerable reforms to their organisation, driven by shifts towards neoliberal political and economic models. This has led to the unbundling of activities across energy systems, and the unbundling of local authority activities and patterns of service provision. Stockholm is a paradigm case, wherein previously municipal energy companies have been privatised in whole and in part, and integrated management of local public services, supported by patterns of cross-subsidisation, have been rationalised creating greater organisational hurdles to coordinated development of energy and other aspects of the urban fabric (Rutherford, 2008, 2014). However, examination of Intelligent Energy Europe grants suggests that, while local government and energy reforms have been pursued across Europe, local actors in *North and Middle European* countries continue

to be relatively more active in local energy.

The relationship between control of energy infrastructure and the capacity of local actors to direct the realisation of local visions of sustainable energy is illustrated by the case of Amsterdam, and is a component of the arguments deployed in German debates on remunicipalisation. National regulation in Norway supports development of local energy systems, without requiring that local authorities play a leading role. However, the case of Bergen indicates that local authorities retain important capacities (particularly through their control of planning) that can support development of local energy infrastructure and can be deployed to help realise municipal ambitions in relation to sustainable energy.

Outside control over energy infrastructure, a wide range of local initiatives can be found across Europe. The high degree of interest in energy performance contracting for public sector organisations, and programmes to mobilise citizen finance (for example, through local share offers in renewable energy initiatives) illustrates a broader trend for local government to organise opportunities for other actors rather than to invest public money and to deliver services directly. The Covenant of Mayors model of Sustainable Energy Action Planning, adopted across many local authorities in Europe, emphasises exemplary action by the public sector, though whether this in practice stimulates parallel activity in the private sector is unclear. Certainly in Brussels the approach has relied on local regulation to require private sector organisations to adopt an approach to energy efficiency piloted in the public sector.

The cases reviewed in this paper suggest that, while post-oil crisis local engagement in energy in *North and Middle European* countries was conducted within a nationally supportive institutional framework, more recent examples of local engagement depend on entrepreneurial experimentation, with accounts frequently identifying particular (charismatic) individuals and fortuitous alignment of circumstances. In some cases, stretching building regulations and ambitious targets such as becoming "fossil-free", local activity has been taken up in other localities and at other levels of government. This suggests a looser model of the institutions within which local actors engage with energy could be more innovative, with new approaches diffusing from their sites of origin. However, this benefit may be counterposed by the risk that local action becomes caught in a cycle of pilot and demonstration projects, unable to scale up without institutional support, and with limited aggregate impact.

4.1 Relationship with LEUKES project factors influencing local engagement

The review supports the set of factors in the LEUKES proposal identified as relevant to shaping patterns of local engagement with energy. Rather than suggesting new factors, or indicating some factors may not be relevant, the review has helped put some detail behind how each factor may operate in European countries. Most of this is implicit in the material above, but a brief commentary on the factors is provided here:

- Resource endowments: presence/absence and constraints of grants, incentives, low cost loans, local skills and energy resources;

  The review indicates that these factors all feature in European local engagement with energy. Pre-liberalisation examples of local energy engagement were supported by low cost loans and energy taxes, and several examples of more recent local energy initiatives are structured around incentive schemes such as Feed-in-Tariffs. However, local actors across Europe appear to struggle to coordinate different sources of financial support into integrated projects.

  Local resources can also be significant. The example of Växjö has a strong relationship with the local forest resource and its repositioning as economically valuable.

- Local organisational structure and priorities;

  The internal organisation of local government, as well as its place within the national system of government, clearly influences the form and extent of local engagement with energy. The "unbundling" of energy systems has been paralleled by a degree of local government unbundling, creating organisational challenges to the coordinated development of local energy initiatives.

- Interactions between local, regional and national political and policy commitments;

  There are diverse ways in which these interactions affect local engagement with energy, from civil society pressure on local politicians to remunicipalise energy infrastructure in Germany, to policy experimentation and copying across different local authorities and across levels of government.

- Particular opportunities relating to locality, or fortuitous timing;

  Case study accounts indicate locality-specific opportunities do influence local engagement with energy, but that these opportunities are not structured solely by local factors. A clear example of this is the extent to which local initiatives are stimulated or supported by the presence of financial incentives, and the extent to which civil-society initiatives may relate to specific opportunities which large and commercial energy suppliers are unwilling to exploit.

- Impact of capital support programmes: do these sustain activity after they end, through development and embedding of expertise and supply chains, or lock in piecemeal development?

  Different cases covered above indicate variability in how specific initiatives (whether or not explicitly supported through capital grants) do or do not lead to sustained activity. The dependence of some local visions on charismatic individuals contributes a degree of fragility in some cases, with programmes vulnerable to scaling back (e.g. Graz). While SEAP development involves a degree of local authority commitment, the practical models of implementation, depending on organising opportunities for third parties to deploy technologies, may also be vulnerable to rapid changes of priorities.

- Quality and availability of data to monitor end use of energy, carbon savings and local potential for energy from waste;

  The Covenant of Mayors requires signatories to create Baseline Emissions Inventories using specific categories of energy demand and user. An Intelligent Energy Europe project, *Meshartility*, has surveyed European local authorities regarding their experience obtaining data from energy suppliers, with 28% unable to obtain the data they sought and 67% receiving data for free. In only one case (in the UK) was data from an energy supplier prohibitively expensive. In 90% of cases where data was supplied local authorities were able to make use of it, though in just under half of these cases data was not geographically disaggregated (MESHARTILITY, 2013).

  The growing role of intermediating business models, particularly energy performance contracting, indicate data availability is a critical component of some delivery models.

- Local relationships with other scales and structures of government (UK government, devolved administrations, regional actors such as LEPs, other LAs, EU regional and city networks);

  The review indicated that multi-level government relations have been important in European local engagement in the past, but that their character has changed in more recent years. Regional actors act as energy agencies supporting local development of SEAPs, and while aspirations to play a more active role (such as organising finance for an aggregation of local projects) are discussed in grey literature, the review did not come across any successful examples of this.

- Types and extent of community engagement (neighbourhood organisations, social enterprises, tenants and residents, SMEs).

  Community engagement as a component of local energy engagement featured in the review in several ways. German popular referendums reaching decisions argued against by local political elites are perhaps the most extreme case. More common are modes of community incorporation (for example, through creating local investment opportunities), and these tend to be regarded as positively supporting sustainable energy development, particularly in receiving planning permission.

- Relationships between local actors and distribution network operators (DNOs)

  Most material in the review relating to the relationship between local actors and the network operator concerned whether or not the local authority controlled the network (through a municipal company). Some IEE projects have looked at data sharing and other relationships between network operators and local authorities (e.g. STEP-UP in which Glasgow City Council is a partner[9]) however, the review didn't find documentary outputs from these projects.

[9] `http://http://www.stepupsmartcities.eu`

References

Bertelsen, F. (2011). Energy policy and district heating / CHP in Denmark. Danish Energy Agency presentation to CHPA study tour of Copenhagen and Malmö.

Boon, F. P. (2012). Local is beautiful: The emergence and development of local renewable energy organisations. Masters thesis, Utrecht University.

Bulkeley, H. and Kern, K. (2006). Local government and the governing of climate change in germany and the UK. *Urban Studies*, 43(12):2237 – 2259.

Chittum, A. and Østergaard, P. A. (2014). How Danish communal heat planning empowers municipalities and benefits individual consumers. *Energy Policy*, 74:465–474.

Danish Energy Agency (2012). Energy policy in Denmark. Technical report.

Dyrelund, A. and Steffensen, H. (2004). Best practice in Danish district heating. Technical report, Rambøll.

Emelianoff, C. (2014). Local energy transition and multilevel climate governance: The contrasted experiences of two pioneer cities (Hanover, Germany, and Växjö, Sweden). *Urban Studies*, 51(7):1378–1393.

Ericson, K. (2009). Introduction and development of the Swedish district heating systems: Critical factors and lessons learned. Technical report, Policy development for improving RES-H/C penetration in European Member States.

EU Covenant of Mayors (2010). *How to develop a sustainable energy action plan*. Publications Office of the European Union, Luxembourg.

Graham, S. and Marvin, S. (2001). *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. Routledge, London ; New York.

Hall, D., Lobina, E., and Terhorst, P. (2013). Re-municipalisation in the early twenty-first century: water in France and energy in Germany. *International Review of Applied Economics*, 27(2):193–214.

Heinelt, H. and Hlepas, N.-K. (2006). Typologies of local government systems. In Bäck, H., Heinelt, H., and Magnier, A., editors, *The European Mayor*, pages 21–42. VS Verlag für Sozialwissenschaften.

Helm, D. (2004). *Energy, the state, and the market: British energy policy since 1979*. Oxford University Press, Oxford ; New York, rev. ed edition.

Hesse, J. J. and Sharpe, L. J. (1991). Local government in international perspective: some comparative observations. In Hesse, J. J., editor, *Local Government and Urban Affairs in International Perspective: Analyses of Twenty Western Industrialised Countries*. Nomos Verlagsgesellschaft, Baden-Baden.

Hodson, M., Marvin, S., and Bulkeley, H. (2013). The intermediary organisation of low carbon cities: A comparative analysis of transitions in Greater London and Greater Manchester. *Urban Studies*, 50(7):1403–1422.

Hughes, T. P. (1983). *Networks of power: Electrification in Western society 1880–1930*. Johns Hopkins University Press, Baltimore.

IEA-RETD (2013). *Business models for renewable energy in the built environment*. Routledge, Abingdon, Oxon ; New York, NY.

IEE and INTERact (2013). Accelerating change - delivering sustainable energy solutions: Good practices from intelligent energy europe and european territorial co-operation projects. Proceedings of a joint seminar, Intelligent Energy Europe and INTERact.

Jamasb, T. and Pollitt, M. (2005). Electricity market reform in the european union: Review of progress toward liberalization & integration. *Energy Journal*, pages 11–41.

Labaeye, A. and Sauer, T. (2013). City networks and the socio-ecological transition: A European inventory. Technical Report Working paper 27, WWWforEurope.

Lauerson, B. (2011). What's happening today with district heating in Denmark. Danish District Heating Association presentation to CHPA study tour of Copenhagen and Malmö.

Le Galès, P. (2002). *European Cities*. Oxford University Press.

Leidreiter, A. (2013). Hamburg citizens vote to buy back energy grid. http://power-to-the-people.net/2013/09/hamburg-citizens-vote-to-buy-back-energy-grid/.

Loring, J. M. (2007). Wind energy planning in England, Wales and Denmark: Factors influencing project success. *Energy Policy*, 35(4):2648 – 2660.

ManagEnergy (2011). Sustainable energy action plans (SEAPs) in the province of barcelona. Technical report.

ManagEnergy (2013). Local sustainable energy action good practices 2013. Technical report.

ManagEnergy (2014). Local sustainable energy action good practices 2014. Technical report.

MESHARTILITY (2013). Measure and share data with utilities for the Covenant of Mayors: Survey results. Technical report, MESHARTILITY.

Monstadt, J. (2007). Urban governance and the transition of energy systems: Institutional change and shifting energy and climate policies in berlin. *International Journal of Urban and Regional Research*, 31(2):326–343.

Moss, T. (2009). Intermediaries and the governance of sociotechnical networks in transition. *Environment and Planning A*, 41(6):1480–1495.

Moss, T., Becker, S., and Naumann, M. (2014). Whose energy transition is it, anyway? organisation and ownership of the energiewende in villages, cities and regions. *Local Environment*, 0(0):1–17.

NVE (2009). Veileder i utforming av konsesjonssøknad for fjernvarmeanlegg (guidance on the design of a license application for district heating). Technical report, Norwegian Water Resources and Energy Directorate.

REN21, ISEP, and ICLEI (2011). Global status report on local renewable energy policies. Technical report, Renewable Energy Policy Network for the 21st Century, the Institute for Sustainable Energy Policies and ICLEI–Local Governments for Sustainability.

Roberts, S. (2008). Infrastructure challenges for the built environment. *Energy Policy*, 36(12):4563–4567.

Rohracher, H. and Späth, P. (2014). The interplay of urban energy policy and socio-technical transitions: The eco-cities of Graz and Freiburg in retrospect. *Urban Studies*, 51(7):1415–1431.

Russell, S. (1996). At the margin: British electricity generation after nationalisation and privatisation, and the fortunes of combined heat and power. In *SHOT '96*, London.

Russell, S. and Williams, R. (2002). Concepts, spaces and tools for action? exploring the policy potential of the social shaping perspective. In Sørensen, K. H. and Williams, R., editors, *Shaping technology, guiding policy: Concepts, spaces and tools*, pages 133–154. Edward Elgar, Cheltenham.

Rutherford, J. (2008). Unbundling Stockholm: The networks, planning and social welfare nexus beyond the unitary city. *Geoforum*, 39(6):1871–1883.

Rutherford, J. (2014). The vicissitudes of energy and climate policy in Stockholm: Politics, materiality and transition. *Urban Studies*, 51(7):1449–1470.

Sellers, J. M. and Kwak, S.-Y. (2011). State and society in local governance: Lessons from a multilevel comparison. *International Journal of Urban and Regional Research*, 35(3):620–643.

Sperling, K., Hvelplund, F., and Mathiesen, B. V. (2011). Centralisation and decentralisation in strategic municipal energy planning in denmark. *Energy Policy*, 39(3):1338–1351.

Summerton, J. (1992). *District heating comes to town: The social shaping of an energy system*. Linköping University, Linköping.

Szreter, S. (1988). The importance of social intervention in Britain's mortality decline c.1850–1914: a re-interpretation of the role of public health. *Social History of Medicine*, 1(1):1–38.