ELECTRICITY NETWORKS AND LOCAL AUTHORITIES - OPINION PAPER

Liverpool City Council / Liverpool City Region

Final Report

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1 EXECUTIVE SUMMARY

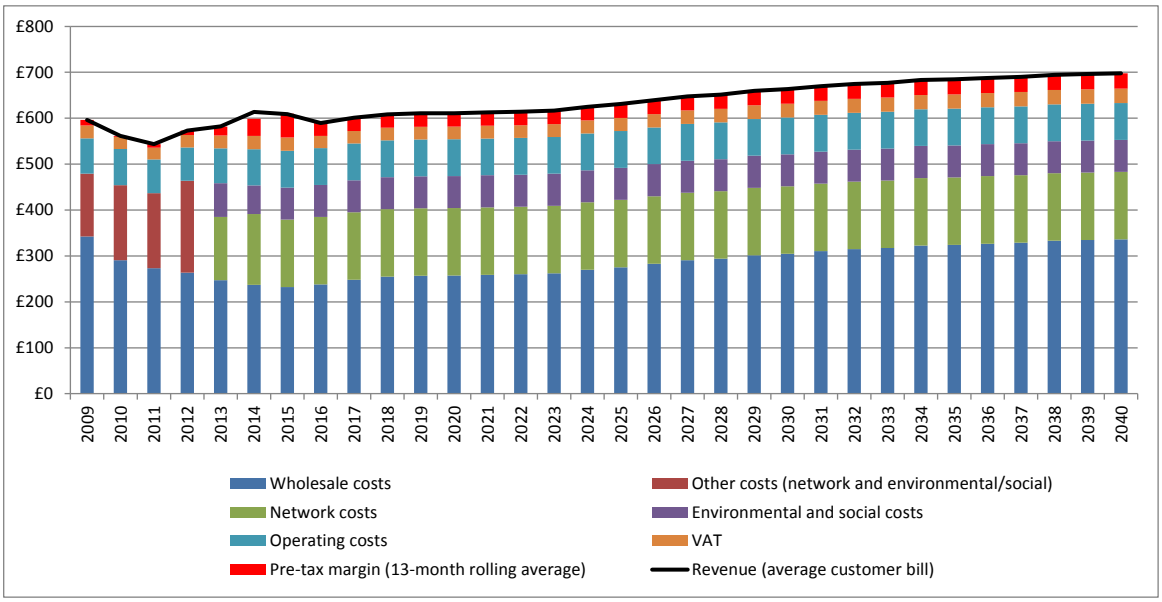
WSP | Parsons Brinckerhoff (WSP) were appointed to produce an opinion paper for Liverpool City Council (LCC) on the future direction of travel for electricity networks and how this can be influenced from a local authority perspective.

The project is a continuation of work conducted to date by LCC in partnership with the Liverpool City Region Local Enterprise Partnership (LEP), Scottish Power Energy Networks (SPEN) and Ofgem. It has been produced in response to concerns around electricity network constraints in the City Region with the network anticipated to require substantial and expensive reinforcement, if undertaken by traditional means, to provide the required capacity. In particular, there are concerns about security of supply and resilience, both of which have a significant impact on business confidence and the economic growth environment.

An executive summary presentation has been provided separately and a glossary of terms can be found at the end of the report.

ESTIMATE OF ENERGY COSTS

As part of the work, WSP were required to provide a substantiated estimate of future energy costs based on work available in the public domain – this is provided in detail in Appendix C. The forecasts are derived from wholesale and retail price trends, a breakdown of energy bills (wholesale, network and other charge composition) and the impact of policy.



Findings show that network costs remains a significant element of overall energy bills, with continuing national government emphasis on fuel poverty issues highly likely. This serves to highlight potential for greater Local Authority intervention in respect of the economic, social and environmental concerns.

PESTLE ANALYSIS

In June 2016, WSP and LCC invited key stakeholders to a PESTLE Workshop as an effective way of gathering evidence around the Political, Economic, Social, Technological, Legal and Environmental factors / changes in the external environment affecting the future of electricity networks in Liverpool. The findings of this workshop are detailed further in Appendix B.

FUTURE DIRECTION OF TRAVEL

This section of the paper looks at the future direction of travel for electricity distribution networks, and the barriers to innovation adoption for Distribution Network Operators (DNOs), including SPEN, with its particular interconnected network within Liverpool, and suggests how these can be addressed.

Various Ofgem mechanisms enable DNOs to conduct innovation projects and trials through the "Network Innovation Stimulus" with licensees required to publish project progress through the Energy Networks Association (ENA) portal. This enables key learning to be shared whilst identifying gaps and priorities for future research and development although evidence of implementation of successful trials as "business as usual" in other DNO areas is perhaps less obvious. It is apparent that DNOs find it easiest to adopt innovations which they have trialled and progressed themselves whereas there is less evidence of DNOs adopting innovations trialled by other DNOs. A number of trials and innovation projects with particular relevant to the Liverpool City Region and SPEN are detailed in the report including those around anticipatory investment and releasing unused capacity.

Future regulation and funding changes are planned over the coming years and Ofgem is specifically looking at how to make the grid more flexible, in line with the Distribution System Operator (DSO) model which envisages DNO's taking a more pro-active role in network management.

CURRENT AND FUTURE ROLE OF LOCAL AUTHORITIES

Local authorities are becoming increasingly active in energy as a means of achieving a range of economic, social and environmental objectives. Examples include city wide energy plans, the work / collaboration of the core cities group and the Association for Public Service Excellence (APSE energy). City devolution deals may open opportunities for greater influence but only the Liverpool and Cornwall devolution deals currently reference network constraints or energy issues in general.

Finally, a number of local authorities are developing municipal energy companies through a variety of mechanisms including "white label" licences and Ofgems Licence Lite. Examples here include Bristol Energy and Robin Hood Energy whilst LCC are working towards development of their own offering "Liverpool LECCy". To date this work has focused mostly on energy supply and energy generation though in the longer term energy distribution could potentially join this mix.

Effective engagement in distribution network development may be harder, historically DNO's have acted as regulated monopolies and the regulations and language have developed in a highly specialist manner.

RECOMMENDATIONS FOR LOCAL AUTHORITIES

A number of recommendations are put forward for Local Authorities as follows:

- Develop an energy plan which identifies future requirements for different scenarios exploring how much energy their area would need in the future, where it might be needed, and the different ways of supplying that energy.

- Collaborate through Core Cities and the Local Authority Energy Collaboration (APSE) to influence the future direction of electricity networks to better serve local needs and requesting greater transparency and Ofgem focus on the local impacts of networks decisions, including economic growth objectives and low carbon targets. This would include establishing a process to monitor future government consultations on the future of the UK energy system, and collaborating in responses to consultations from Ofgem and central government.

- Work with their local DNOs who are now incentivised by Ofgem to carry out effective stakeholder engagement, to identify areas where there are plans for future developments and where it is sensible to reinforce the network ahead of need, and to provide the evidence required for anticipatory investment.

- Work with local DNOs to support the adoption of innovation into Business as Usual. This could include participating in Network Innovation Stimulus projects which trial smarter and cheaper ways of relieving network constraints.

- Review past Network Innovation Stimulus projects undertaken in other regions and engage with the DNO on any which have particular relevance within the Local Authority area.

- Work with other Local Authorities in a given DNO area to co-ordinate a shared voice on the future of the network.

2 INTRODUCTION

This opinion paper advises on the future direction of travel for electricity networks and how this can be influenced from a local authority perspective.
It incorporates views and experiences from a range of local and national stakeholders who, in the early stages of the project, attended a 'PESTLE' workshop to look at Political, Economic, Social and Technological Legal and Environmental factors. It also takes into account work already completed by Liverpool City Council, Liverpool City Region Local Enterprise Partnership (LEP), and Scottish Power Energy Networks (SPEN), as well as reports, consultations and other information available in the public domain.

The paper is structured to first give some background and context to the work, including the work already completed by Liverpool City Council, working with SPEN and the Core Cities group, and case studies to illustrate the issues.
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The paper then looks at the future direction of travel for electricity networks, and the barriers to innovation adoption for Distribution Network Operators (DNOs), including SPEN, with its particular interconnected network within Liverpool, and suggests how these can be addressed.
This section of the paper also considers the funding mechanisms required for change, including capital and revenue costs, taking into consideration the existing regulatory environment.

The paper next considers the role which local authorities could play to influence and improve developments in electricity networks, this includes real examples of current best practice, from a local authority perspective. The paper concludes by recommending options that are worthy of further exploration by local authorities.

The appendices explain in non-technical terms how today's electricity networks function, are regulated and are funded, give a 'PESTLE' analysis to identify the key changes in the external environment which affect the future of electricity networks and which affect the ability of a local authority to influence this future and present a substantiated estimate of the predicted unit cost of energy over the next 20 years, developed from key sources in the public domain.

3 BACKGROUND TO PAPER

3.1 CONTEXT

Across the Liverpool City Region there are a number of economic growth areas which are to be constrained by available electricity network capacity. Network reinforcements are likely to be needed, if the capacity is increased by traditional means. Liverpool City Council is also concerned about security of supply and resilience, both of which have a significant impact on business confidence and the economic growth environment.

There are also constraints on the ability to generate energy locally. This is likely to be constrained by grid capacity, system inertia issues and also concerns about voltage levels changing beyond acceptable limits.

Work had already been undertaken by Liverpool City Council, in conjunction with the Liverpool City Region LEP, to identify the utility infrastructure necessary to support growth across the city region, and models to fund this that are more acceptable (particularly to smaller developers) than the present connection costs arrangements. This had been done in partnership with Scottish Power Energy Networks (SPEN), formerly SP Manweb, who is the DNO (District Network Operator) for the majority of the Liverpool City Region and formed the basis of working with the Greater London Authority (GLA), Ofgem and treasury to develop a number of new models that formed the basis of the Ofgem "Quicker and more efficient distribution connections" consultation. This work was of interest to the Core Cities network, Ofgem, DECC and Treasury.

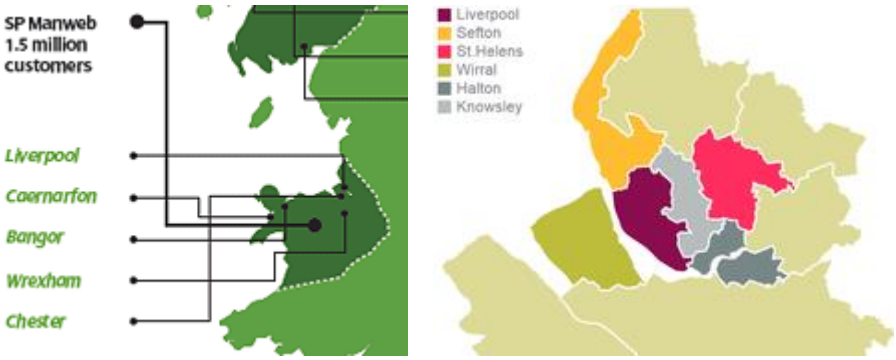


Figure 3-1 Manweb area and Liverpool City Region[1]

Liverpool City Council is also concerned about energy costs, and the impact which electricity price has on residents, fuel poverty and local businesses. These concerns are compounded by predictions for significant price rises over the next few years.

Liverpool City Council would like to review, in non-specialist parlance, the regulatory barriers preventing investment ahead of non-immediate need, and the implications of a statutory duty on the District Network Operators to demonstrate Local Authority approval for the significant investment plans and decisions that impact upon local economic regeneration.

[1] From SP Energy Networks website

To reach this position the local authority required independent advice regarding the technical and financial aspects of the regulatory frameworks controlling investment and management decisions, the barriers and the opportunities. They therefore commissioned WSP | Parsons Brinckerhoff to provide this opinion paper and a substantiated estimate on the predicted unit cost of electricity over the next 20 years.

3.2 BACKGROUND INFORMATION

There were a number of reports provided by Liverpool City Council at the start of the work, and which have been referenced. These include:-

- London Electricity Infrastructure Review - Technical Working Group Report
- Core Cites/SPEN/Ofgem work and Baltic Triangle case study
- LCC Utility Master Planning (UMP) Tool
- Liverpool City Region Devolution Agreement

There are also a large number of public domain reports and references which have been used, the key ones include:-

- Information available through the Energy Networks Association smarter networks portal http://www.smarternetworks.org/
- https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-distribution-connections
- https://www.ofgem.gov.uk/publications-and-updates/non-traditional-business-models-supporting-transformative-change-energy-marketOfgem – next steps
- Ofgem – 'Making the electricity system more flexible and delivering the benefits for consumers', published 30/9/15. http://www.energy-uk.org.uk/publication/342-research-and-reports/pathways-2030.html

3.3 LIVERPOOL CITY COUNCIL AND UTILITIES

Prior to privatisation, local authorities had a long history of involvement in the utilities sector. The Electricity Act of 1947 nationalised 505 separate organisations involved in electricity supply and generation, combining them to create 14 area electricity boards. Liverpool was covered by the Merseyside and North Wales Electricity Board (MANWEB) of which the Liverpool County Borough Corporation was a member – it is thought that the corporation gained over 50% of its total income from utility work.

As part of the process of privatisation in 1989, a number of regulatory changes have taken place with the effect of separating supply, generation, transmission and distribution businesses that are managed through licences and regulated by Ofgem.

More recently, Liverpool City Council has been working in this area on a number of initiatives and with several different stakeholders, including:

Energy Master Planning – outlining a number of case study examples, opportunity areas and constraints under demand, generation and demand side response.

Utility Master Planning (UMP) Tool - this is an automated online data collection tool in which data on planning applications can be accessed, downloaded and interpreted.

Core Cities working with the GLA – on DNO barriers to regeneration and Investment in electricity distribution infrastructure in advance of need. Liverpool worked with the Core Cities group to identify barriers to economic growth in the current regulatory framework and to develop new methodologies for introducing improved anticipatory planning and additional investment.

Ofgem – interaction and consultation with Ofgem around the 'Quicker and more Effective Distribution Connections' work.

Liverpool City Region Devolution Agreement – Energy and Environment is included within the cities devolution deal, including a commitment to "explore further Liverpool City Regions proposals on how innovation and collaboration can enable a more coordinated approach to network investment in order to meet growing network demands".

Municipal Energy Company – The Council is taking steps to create a locally branded local energy supply company (Liverpool Energy Community Company LECCy) and is working with the City Region LEP to review options for local energy company intervention in the generation and distribution markets.

3.4 LIVERPOOL CASE STUDIES

Two case studies are outlined below to illustrate the challenges which exist for economic growth areas in the Liverpool city region.

CASE STUDY BALTIC TRIANGLE

Liverpool's Baltic triangle is a former industrial area of the city housing a number of old warehouse buildings associated with the nearby docks. More recently it has become an up and coming area for creative and digital businesses as well as housing a growing nightlife and strong interest from residential property developers. Being generally an underdeveloped part of the city, current electricity demand is likely to be of low volume and density, with ageing infrastructure and a requirement for upgrades in the future. The area is characterised by a large number of smaller businesses looking to develop premises and are therefore not likely to be the type of development that can sustain high grid connection charges. Furthermore, the speed of local area regeneration has meant that this area was not identified by the DNO for investment within the current 8 year RIIO cycle. The City Council has recognised this issue and is concerned that connection costs could deter investment in the area with a particular effect on small businesses. LCC have engaged with both SPEN and Ofgem regarding this case study, and it was offered as a potential trial scheme under the 'Quicker and more Effective Distribution Connections' consultation. In response Ofgem have contacted Scottish Power to continue to work with the city to devise a workable solution.

The Baltic Triangle and surrounding area is seen as an important example of the issues being faced both in Liverpool and in other city regions where there is no large clear investor, though anticipatory investment would seem to make business sense.

CASE STUDY – ANFIELD

In North Liverpool, the Anfield regeneration area involves a range of developments including new housing, public spaces, retail and the expansion of Liverpool FC's Anfield stadium. As part of the stadium redevelopment, it is understood that developers Carillion were able to make significant cost savings of as much as £0.5m, compared to the solution from SPEN, by using an Independent Connections Provider (ICP) for grid connection works. Whilst DNOs may be restricted in the way their designs and solutions are produced, this is a good example of why increased competition in connections could be seen as a positive solution. However, this does raise questions as to why such costs savings can be made and whether the full cost of reinforcement and forward planning is taken into account by the ICP. In its Utilities Masterplanning work LCC have questioned whether a Local Authority could support development by better understanding the cost calculations for DNOs and wider grid benefits.

4 FUTURE DIRECTION OF TRAVEL FOR ELECTRICITY NETWORKS

4.1 INTRODUCTION

This section of the paper looks at the future direction of travel for electricity networks, and the barriers to innovation adoption for Distribution Network Operators (DNOs), including SPEN, with its particular interconnected network within Liverpool, and suggests how these can be addressed. This section of the paper also considers the funding mechanisms required for change, including capital and revenue costs, taking into consideration the existing regulatory environment.

Appendix A explains in more detail how today's electricity networks function, are regulated and are funded.

4.2 FUTURE ELECTRICITY NETWORKS

INNOVATION PROJECTS AND TRIALS

When the electricity supply industry was privatised in 1989 DNOs were spending almost £12million a year on research, design and development. By 2003/2004 this expenditure had dropped to just £1 million[2]. In 2003 Ofgem realised that network licensees needed to innovate more, so that electricity networks could cope efficiently with the move to towards a low carbon future with increased distributed renewable generation, and with greater use of low carbon technologies. Innovative projects were required which would help develop crucial knowledge and expertise and share it across the industry. To enable this Ofgem introduced two new mechanisms into the regulatory regime, the 'Innovation Funding Incentive' and 'Registered Power Zones'. In 2010 Registered Power Zone funding was discontinued and the 'Low Carbon Network Fund' was introduced. This has now been replaced by the Network Innovation Stimulus, which was introduced as part of the new RIIO regulatory regime. The Network Innovation Stimulus includes the Network Innovation Competition and the Network Innovation Allowance. The following table

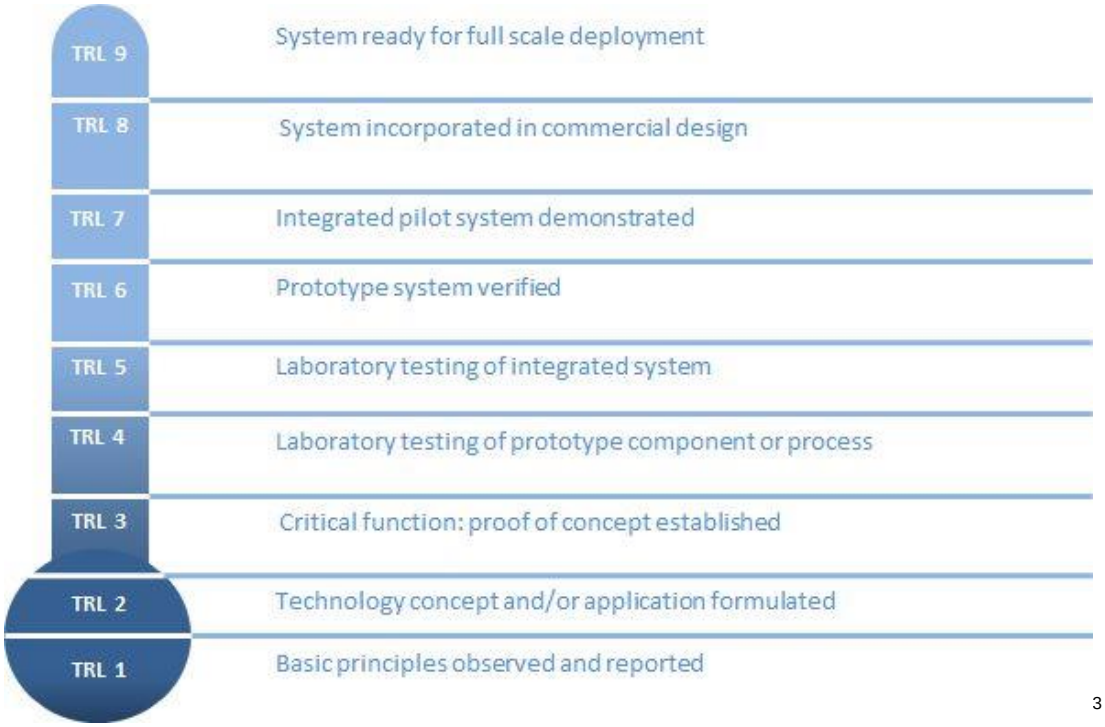
[2] http://www.ukerc.ac.uk/publications/a-review-and-synthesis-of-the-outcomes-from-low-carbon-networks-fund-projects.html

summarises these various innovation mechanisms, their objectives, timescales, available funding and the 'Technology Readiness Level' (TRL) which each addressed.

The TRL scale shown in Figure 4-1 is a metric with nine levels for describing the maturity of a technology. Each level characterises the progress in the development of a technology, from the idea (level 1) to the full deployment of the product in the marketplace (level 9). This scale was developed by NASA in the 70s to assess the maturity of a technology prior to integrating this technology into a system.

Ofgem were not always explicit in defining the TRLs associated with each innovation mechanism, so some of these ranges are our own estimates based on Ofgem's descriptive text. TRL 9 was excluded by Ofgem since it was thought that TRL 9 projects would be to be too low risk and would offer limited scope for new knowledge to be generated.

Figure 4-1 TRL scale



[3]

[3] http://www.innovationseeds.eu/Virtual_Library/Knowledge/TLR_Scale.kl

Table 4-1

Innovation Funding Incentive	• Ofgem mechanism to encourage distribution network operators (DNOs) to invest in research and development in a wide variety of distribution related activities. • TRL 2 to 8 • Finished 31 March 2015
Registered Power Zone	• Ofgem mechanism focused specifically on the connection of generation to distribution systems. This mechanism was intended to encourage DNOs to develop and demonstrate new, more cost effective ways of connecting and operating generation. • TRL 8 and 9 • Finished March 2010
Low Carbon Networks Fund	• Ofgem mechanism to fund projects sponsored by DNOs to try out new technology, operating and commercial arrangements. Objective of the projects is to help all DNOs understand what they need to do to provide security of supply and value for money as Great Britain moves to a low carbon economy • Tier 1 – Each DNO given an annual allowance to fund small projects or to put into place people, resources and process to design and develop innovative projects. • Tier 2 – Annual competition to allocate project funding which is judged by a panel of experts • TRL 5 to 8 • Awarded innovation funding of almost £250 million from 1 April 2010 – 31 March 2015 (some of the projects funded under this mechanism will run through to April 2019).
RIIO (Revenue=Incentives + Innovation + Output)	• Ofgem's new way to regulate networks as of 2015. • Based on performance rather than the retail price index. In order to attract efficient investment the new framework rewards companies that innovate and run their networks to better meet the needs of consumers and network users. It does this by setting longer eight-year price controls, offering incentives focused on delivering results, and introducing the Network Innovation Stimulus.

Network Innovation Stimulus	• Supports network companies with funding for the research, development and demonstration of new technologies, operating and commercial arrangements
	
	• Objective of the innovation projects is to help network companies understand what they need to do to provide environmental benefits, cost reductions and security of supply as Great Britain moves to a low carbon economy.
	
	  ○ Electricity Network Innovation Competition which is an annual opportunity for electricity network companies to compete for funding pot of up to £81m per annum
	
	  ○ Network Innovation Allowance is a smaller allowance each network licensee receives for two purposes, 1) to fund smaller technical, commercial, or operational projects directly related to the licensees network that have the potential to deliver financial benefits to the licensee and its customers; and/or 2) to fund the preparation of submissions to the Network Innovation Competition (NIC) which meet the criteria set out in the NIC Governance Document.
	
	• TRL 5 to 8
	
	• For DNOs this will run from 1 April 2015 to 31 March 2023

The network licensees are required to publish their Project Registration Information and regular updates on all innovation projects on the Energy Networks Association 'Smarter Networks Portal'[4]. This currently has 732 projects listed under electricity distribution, and 501 projects listed under electricity transmission. The recently published report 'A Review and Synthesis of the Outcomes from Low Carbon Networks Fund Projects'[5] from the University of Strathclyde includes a useful summary and categorisation of the key LCNF projects for different research areas.

This report also reviews the key learning from the projects, identifies gaps and suggests priorities for future research and development. The authors found a wide variation in what had been reported, with a lot of positive results, but they also reported that not all of the trialled 'smarter' network innovations are ready for adoption as 'business as usual' (BAU).

[4] http://www.smarternetworks.org/

[5] http://www.ukerc.ac.uk/publications/a-review-and-synthesis-of-the-outcomes-from-low-carbon-networks-fund-projects.html

BARRIERS AND SOLUTIONS TO ADOPTION OF INNOVATION INTO BUSINESS AS USUAL

The DNOs who have completed LCNF projects all have to complete project close down reports, which provide details on project replication (including Business As Usual (BAU) costs) and planned implementation of the innovation. All LCNF projects provide learning about the innovation and improve certainty about whether it could reach TRL9 and be cost-effective. Some LCNF projects may even be able to progress an innovation from its original TRL to TRL 9, where it is ready for BAU implementation, but this will not be the case for all projects.

The review by the University of Strathclyde considered '*whether a project has generated robust evidence on whether the innovation can be considered as a BAU option ready for appropriate deployment when required or whether the innovation has, in fact, insufficient benefit and should not be regarded as a viable option by the DNO.'*

The university concluded that there are a number of areas of innovation which are already embedding into BAU, including 'active' management of distributed generation, and flexible industrial and commercial demand. They identified other technologies which are viable, have performed well in trials, could be used more often and could release network capacity more cheaply than historical 'fit and forget' solutions, for example voltage control equipment. Other innovations require further development both in terms of implementation and the commercial frameworks within which they might be used, for example, battery storage, and flexible domestic demand. Finally, there were some innovations, for example the use of real-time thermal ratings and network reconfiguration for power flow management, where different DNOs came to different conclusions regarding readiness for BAU.

From the review completed by Strathclyde it is evident that the barriers to adoption of innovation into BAU depend upon the nature of the innovation. In some cases further work is required to bring particular innovations to TRL 9, or the commercial and regulatory frameworks required are not yet in place.

From our own review of what different DNOs are doing, it is also apparent that DNOs find it easiest to adopt innovations which they have trialled and progressed themselves. There is less evidence of DNOs adopting innovations trialled by other DNOs. This can be seen in the information made available by various DNOs about the different arrangements for flexible connections that are offered. What is offered by each DNO is different, and with most DNOs there is a clear linkage to one of their own innovation projects. [6]

There is, however, also evidence that DNOs do adopt some of the ideas and innovations trialled by other DNOs, for example, SP Energy Networks published in March 2014 an Innovation Strategy as an Annex to their Business Plan. This identified the sources of innovation which they plan to apply on their network during 2015 – 2023. These sources include innovation trials run by other DNOs.[7]

Ofgem is the key to overcoming barriers to innovation, in that they will make the future decisions about which innovation projects should receive future funding. They are also able to direct and incentivise or penalise the DNOs. They have, for example, brought in as part of RIIO an

[6] http://www.energynetworks.org/electricity/futures/flexible-connections.html

[7] http://www.spenergynetworks.co.uk/userfiles/file/201403_SPEN_InnovationStrategy_MH.pdf

'Innovation Roll-Out Mechanism' whereby DNOs can apply under certain circumstances for additional funding for rolling out innovations into BAU.[8]

It is also worth noting that Ofgem have been carrying out a review of distribution network innovation funding, and will go out to consultation on the changes proposed during November 2016. As part of this review Ofgem commissioned a report from consultants Poyry , this has not yet been published, however Ofgem have recently outlined some of the key Poyry conclusions, as follows:-[9]

'*Poyry has estimated discounted net benefits to consumers of between £800m and £1.2bn if projects are not rolled out beyond the distribution network operators trialling them. If the projects are rolled out across Great Britain, the discounted net benefits are estimated at between £4.5bn and £7.8bn.*

Poyry also looked at whether the LCNF had resulted in a cultural shift among DNOs to become more innovative. It found that the programme had succeeded in encouraging the DNOs to innovate and had moved the level of innovation from a "low" base to a "moderate" level. '

4.3 FUTURE REGULATION AND FUNDING OF ELECTRICITY NETWORKS

The current price control period for DNOs (RIIO-ED1) started on 1 April 2015 and lasts for eight years, through to 31 March 2023. Previous price control periods have been five years, so RIIO-ED1 includes 're-opener' mechanisms (High Value Projects or Load Related Reopeners) to help the DNO to recover the costs of unanticipated expenditure. It is unlikely that there will be significant changes to regulation or funding during this eight year period, however, Ofgem does respond to feedback from stakeholders, as can be seen in the 'Quicker and more efficient connections' consultation, and the actions which have come out of it.

There are some legislative changes planned, including secondary legislation (statutory instrument) relating to second comers (Electricity (Connection Charges) Regulations), due to be revised in October 2016; among other things this will extend the period over which connection charges can be recovered from second comers from five to ten years.

Ofgem is also looking at how to make the grid more flexible and at potential changes in the role of DNOs towards a Distribution System Operator (DSO) role. In addition to the traditional DNO responsibilities a DSO would have an operational role, for example managing the balancing of generation and demand locally. The transition from DNO to DSO is already under way, and further changes are due to be consulted on, through a call for evidence on flexibility due to be published by Ofgem soon.[10] Scottish Power Energy Networks itself has also published a DSO Vision Consultation.[11]

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[8] https://www.ofgem.gov.uk/publications-and-updates/assessment-benefits-rollout-proven-innovations-through-innovation-roll-out-mechanism-irm

[9] https://www.ofgem.gov.uk/publications-and-updates/dermot-nolan-speech-enas-low-carbon-network-innovation-conference

[10] https://www.ofgem.gov.uk/publications-and-updates/dermot-nolan-speech-enas-low-carbon-network-innovation-conference

[11] http://www.spenergynetworks.co.uk/pages/dso_vision_consultation.asp

4.4 CHANGES IN CONNECTING TO THE NETWORK

QUICKER AND MORE EFFICIENT CONNECTIONS

A number of stakeholders felt that getting connected to the electricity distribution network was taking too long, and was slowing down economic growth and the connection of distributed generation. The Core Cities, through Liverpool City Council, the GLA, UK Power Networks (UKPN) and SPEN worked with DECC and treasury to suggest to Ofgem alternative models which could enable investment to be made in anticipation of a connection, instead of in response to a connection request. Ofgem therefore went out to consultation in February 2015 on 'Quicker and more efficient connections'[12].

In this they described a range of measures that could make better use of the existing network and avoid the need for time-consuming (and costly) reinforcements to accommodate a new connection. They also presented three different models to enable investment to be made in anticipation of a connection.

Ofgem published the consultation responses and next steps proposed at the end of September 2015, and finally published at the end of January 2016 an update on industry progress [13] with the required actions. There has been further progress since then, as evidenced by recent consultations by the Energy Networks Association on the fair and effective management of DNO connection queues[14]. Individual DNOs have also carried out their own consultations with their own stakeholders.[15]

Progress in the last twelve months

The main actions completed and changes which have taken place in the last twelve months as a result of the 'Quicker and more efficient connections' consultation are:-

- **Improved visibility and availability of flexible connections**

  Ofgem asked the DNOs to make information publicly available about the different arrangements for flexible connections that are offered across the DNOs. The ENA has developed a webpage containing a summary of information on flexible connections[16] from all DNOs and National Grid.

  Ofgem also asked the DNOs to clearly outline in their connection offers that there may be alternative methods of connecting to the network. This is now being done by the DNOs, albeit with variations in the wording used.

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[12] https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-distribution-connections

[13] https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-connections-update-industry-progress

[14] http://www.energynetworks.org/news/publications/consultations-and-responses/

[15] http://www.spenergynetworks.co.uk/pages/stakeholder_information.asp

[16] http://www.energynetworks.org/electricity/futures/flexible-connections.html

- **Consortia for connecting customers**

  The cost of connection can potentially be reduced where prospective connection customers come together in a consortium and share the associated reinforcement costs. This may not be practical in all situations, however Ofgem were keen for DNOs to encourage and facilitate the establishment of consortia where appropriate. All DNOs were therefore asked to clearly publicise the potential advantages of forming a consortium and the arrangements available for consortia. This is now being done, however different DNOs are taking different approaches, including website based guidance, consortia registers, and local workshops with customers.
  There have also been consortia trials, including one by [17] Regen SW and Western Power Distribution (WPD) who aimed to:

  - test the commercial viability of a consortium based approach to grid reinforcement
  - to provide learning to DNOs on how to facilitate consortia
  - to provide learning to developers on practical approaches to forming and progressing consortia.

- **Development of a set of principles and rules for the introduction and enforcement of milestones in connection offers**
  Every connection offer which is made reduces the capacity that a DNO can assume is available for other prospective connections, until the offer is either accepted or rejected. Even when offers have been accepted projects may be delayed (sometimes indefinitely) but the customer may prefer to hold onto the capacity they have been allocated, rather than making it available for others to use.

  Ofgem believe that connecting customers will benefit from better management of the connections queue, by introducing milestones in connection offers. If these milestones are not met, the DNO would be able to withdraw its offer and reallocate the capacity which is not being used.

  The ENA (DNO-DG Steering Group) was requested by Ofgem to develop a draft set of principles and rules that will apply to using milestones in connection offers. These have been produced and the ENA has led a public consultation which closed on the 13th May 2016 on these principles.[18]

- **Releasing unused capacity**

  Some existing customers underuse capacity for long periods of time, and this can also contribute to a lack of available capacity for new connections.

  The Distribution Connection and Use of System Agreement (DCUSA) modification proposal DCP 115[19], which was approved in July 2015, amended the national terms of

[17] https://www.regensw.co.uk/blog/2016/02/10553/

[18] http://www.energynetworks.org/news/publications/consultations-and-responses/

[19] https://www.ofgem.gov.uk/publications-and-updates/distribution-connection-and-use-system-agreement-dcp114-national-terms-connection-amendments-capacity-management-overutilisation-and-dcp115-national-terms-connection-amendments-capacity-management-underutilisation

connection to clarify DNOs' rights to act when customers underuse their capacity. This should enable DNOs to proactively approach customers underusing capacity.
SPEN have already taken this approach, as outlined in case study 6 of their 'Incentive on Connections Engagement (ICE) Submission 2016 / 2017'[20], however so far they have only succeeded in agreeing a 4.4MVA reduction in agreed Maximum Export Capacity.

The ENA and the DNO-DG steering group are investigating options to withdraw underused capacity via:
- powers under section 17 of the Electricity Act to take away unused capacity,
- DNOs utilising DCP115 changes to 'propose' a reduction,
- consideration of whether DG customers who make slight changes to connections requests (e.g. transformer location) should be treated as a new request and move to the back of the queue.

This group has put together a plan to investigate these options and is due to report back to Ofgem in September 2016. The ENA has led a public consultation which closed on the 9th June 2016 on the 'Fair and Effective Management of DNO Connection Queues: Treatment of Changes to Connection Applications'.[21]

Potential Future Changes

The potential future changes which should enable quicker and more efficient connections are:-

- **Industry agreement and formalisation of a set of principles and rules for the introduction and enforcement of milestones in connection offers**
- **Industry agreement on how DNO connection queues can be managed fairly and effectively**
- **Possible reintroduction of 'assessment and design' fees[22]**

  DECC led a consultation which closed on 6th May 2016 seeking views on allowing DNOs to charge upfront assessment and design fees for connection applications. This followed the submission of a business case from the ENA requesting the reintroduction of 'assessment and design' fees, in the expectation that this would reduce the number of speculative applications that have to be produced. This could free up DNOs to improve the quality of 'genuine' quotes issued and avoid situations where remaining spare capacity on a network is allocated to projects that may never proceed. Currently connection applications are free to all customers and only those who accept the connection offer have to pay the DNO costs of providing all offers. The responses and conclusion from this consultation are not yet available.

Anticipatory Investment

Anticipatory investment is supported by a number of stakeholders who see that it could speed up and potentially reduce the cost of the connection of new urban developments and clusters of distributed generation. It is Ofgem's view that:

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[20] http://www.spenergynetworks.co.uk/pages/stakeholder_information.asp

[21] http://www.energynetworks.org/news/publications/consultations-and-responses/

[22] https://www.gov.uk/government/consultations/assessment-and-design-fees-call-for-evidence

'the existing regulatory framework already allows DNOs to undertake this type of investment.'

Within the original 'Quicker and more efficient connections 'consultation, Ofgem presented three different models which could enable network investment to be made in anticipation of a connection.

- **Model 1 - the DNO funds the anticipatory investment**

Under Model 1, a DNO reinforces its network in anticipation of future connection requirements. The costs of doing so are spread across all of the DNO's customers and customers that wish to connect in the future do not have to pay directly for this reinforcement. DNOs can already undertake this type of investment and should be doing this when it is more cost-effective than a piecemeal approach. This would be consistent with their obligation to develop and maintain an efficient and economic network. This expenditure should be funded through the revenues which Ofgem allows each company to recover during the price control period (RIIO-ED1, 2015-2023). If necessary, a DNO may also be able to use one of the mechanisms already in place (High Value Projects or Load Related Reopeners) to help recover the costs of unanticipated expenditure.
Forecasting future connections demand can however be very difficult. A range of external factors, including economic conditions and government policies, can significantly impact what needs to connect, as well as where and when the connection is required. If a DNO's forecasts turn out to be wrong, then network infrastructure will be built that is not needed. This expenditure will still need to be paid for by either consumers or, potentially by the DNO's shareholders if Ofgem considers that the expenditure was inefficient.
Ofgem incentivises DNOs to carry out effective stakeholder engagement, which should include liaising with local authorities, government, planning authorities and developers. DNOs should be using this engagement to identify areas where there are plans for future developments and where it is sensible to reinforce the network ahead of need. Third parties, such as developers or local authorities, could provide the DNO with sufficient assurance that growth is highly likely to materialise. This could include evidence that the scheme is part of a regional government/local authority's development strategy and that investment in any associated infrastructure (transport, housing, other utilities) necessary to support growth is also being progressed. This type of evidence could help the DNO to demonstrate that this investment is in the consumer's interest, with cost savings to be made by investing upfront, rather than on an incremental basis.

- **Model 2 – the DNO funds initial investment, but recovers this from connection customers**

Under Model 2, a DNO would reinforce its network when providing an initial connection, in anticipation of further connections in the region. The additional cost of doing so would then be recovered over a five year period under the 'Second Comer' rule from subsequent connection customers who would use the new network capacity that has been created.

There is a risk for the DNOs regarding the certainty of the future connections over the following five years, and how Ofgem would treat any 'unrecovered' expenditure. Again the DNOs should be carrying out effective stakeholder engagement with local authorities, government, planning authorities and developers to identify what the 'pipeline' of current and future developments might look like in a particular region. The risk could also be reduced by establishing a consortium of prospective customers whose requirements could inform the scheme design and whose members give some (financial) commitment to using the enhanced scheme.

There may also be restrictions on what a DNO can charge associated with the need to comply with its connection charging methodology, however Ofgem have stated that it will consider scheme-specific requests to derogate a DNO from complying with its published

charging methodology. The current regulations do not permit DNOs to add a premium to connection charges in order to ensure the recovery of initial investment, and do not allow DNOs to restrict who can connect to the new network created.

- **Model 3 – a third party funds initial investment, but recovers this from connection customers**

Under Model 3, a third party (for example a Development Company) or group of parties (which could be an initial connection customer) would fund the cost of additional reinforcement to allow others to subsequently connect. Under the existing arrangements a third party can request (and pay for) the DNO to carry out additional work over and above the work strictly required to provide an initial connection. The third party provides a vehicle for funding investment, which means that investment can take place ahead of need. The second comer rules allow the third party to be reimbursed by customers connecting to that reinforced part of the network over the following five years.
This approach may be suitable where the DNO cannot justify funding the work itself, either because the wider customer base is unlikely to get any benefit from the new infrastructure, or because there is lack of certainty on future development plans in an area. Although it would not be appropriate for a DNO to invest in these circumstances, a third party may still be prepared to do so. This type of scheme already takes place, but only to a limited extent. Difficulties in identifying a third party who has a vested interest in speeding up the process for future connectees could be a reason why this approach is not commonly undertaken. The third party also faces the risk that if forecasted connections don't come forward they will not recover their initial expense. This model would be most suited to large new demand developments and urban regeneration projects.

Following the consultation Ofgem decided that they wanted to use real-life examples to understand what might be possible under current regulations and legislation, and where some additional guidance or clarification may be required. Ofgem invited DNOs and stakeholders to offer schemes that could serve as trials for anticipatory investment.

Six trials were offered, three were for areas where there were a large number of distributed generators applying to connect to a congested network, and three were for urban developments. One of the latter was the Baltic Triangle and Ropewalks area, proposed as a trial by Liverpool City Council. In their January 2016 update on industry progress [23] Ofgem stated:-

'Some of these schemes are at a very early stage. But we have talked to the DNOs and stakeholders who have put these trials forward and highlighted the additional information that we would like see - this includes the criteria that could apply to each scheme to demonstrate the necessary certainty to justify the need for early investment.

We will continue to discuss these trials to see how they can be progressed, and understand whether they are permissible under current regulatory arrangements. We will also judge whether there might be any unanticipated effects on competition in the market for new connections.'

In the same paper Ofgem also detailed three schemes where one DNO, Northern Powergrid had undertaken anticipatory investment within the existing regulations.

[23] https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-connections-update-industry-progress

For these schemes the DNO was able to develop legal and connection agreements which sat outside the standard connection agreements. There was a much clearer case for the DNO to invest in significant reinforcement when real local load growth coincided with clear, staged development plans and connection offer activity. Two of the three schemes were able to move forward as a result of third party European or local authority funding, with some additional funding provided by the DNO on one of these schemes. The commercial aspects of all these arrangements were complicated and time-consuming for both the customer and DNO, but were necessary to ensure that other customers were not paying an unfair share of the upgrade costs through their electricity bills.

INCENTIVES ON CONNECTIONS ENGAGEMENT

The RIIO-ED1 price control included an 'Incentive on Connections Engagement', under which DNOs must provide evidence that they have engaged with their larger connection stakeholders and responded to their needs. The DNOs have to provide evidence that they have done this to Ofgem on an annual basis, through publication of:-

- a Looking Back report on their activities during the previous year, demonstrating how they have met the needs of large connection customers and
- a Looking Forward plan for the coming year, describing the activities the DNO plans to undertake.

Ofgem then carry out a public consultation to give stakeholders the opportunity to respond with their views on the effectiveness of the engagement[24]. Ofgem have recently published their assessment of the first year, and have determined that all DNOs met the minimum criteria.[25] It should be noted that only two city councils responded formally to this first public consultation.

It is also worth noting that SPEN, in their Looking Forward Plan have included the following[26]:-

> C5 *Improve our communication with Local Authorities*
> *We will continue to develop our engagement programme with all Local Authorities and embed it as a business as usual process*

CONCLUSION ON CONNECTIONS

A number of changes have been made to the connection process which should make it quicker and more efficient, and there are further improvements planned.

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[24] https://www.ofgem.gov.uk/publications-and-updates/consultation-distribution-network-operators-2016-submissions-under-incentive-connections-engagement

[25] https://www.ofgem.gov.uk/publications-and-updates/incentive-connections-engagement-qualitative-assessment-distribution-network-operators-dnos-performance-2015-2016

[26] http://www.spenergynetworks.co.uk/userfiles/file/2016_17_Ice_Submission_Final_Report_310516.pdf

Under current regulations it is possible for DNOs to invest in anticipation of a connection, however it is not common practice, and the criteria to be used are still being worked through by Ofgem, the DNOs and the stakeholders wishing to progress anticipatory investment trials.

There does need to be as much certainty as possible to reduce risk to the DNO of a stranded asset and the Local Authorities have a clear role to play in enabling by providing sufficient assurance that growth is highly likely to materialise. This could include evidence that the scheme is part of a regional government/local authority's development strategy and that investment in any associated infrastructure (transport, housing, other utilities) necessary to support growth is also being progressed.

Equally DNOs are incentivised by Ofgem to carry out effective stakeholder engagement, so should be liaising with local authorities, government, planning authorities and developers to identify areas where there are plans for future developments and where it is sensible to reinforce the network ahead of need. DNO's across the UK will vary in their attitude to risk and in their resources available to engage in long term forward planning. Stakeholders have an annual opportunity to provide feedback to Ofgem on whether or not particular DNOs are engaging effectively.

5 CURRENT AND FUTURE ROLE OF LOCAL AUTHORITIES

5.1 INTRODUCTION

This section reviews the role which local authorities are currently playing to influence and improve developments in electricity networks. This includes real examples of current best practice, from a local authority perspective. The future role which local authorities could play is then discussed.

5.2 CURRENT ROLE OF LOCAL AUTHORITIES

Local Authorities (LAs) are becoming increasingly active in energy as a means of achieving a range of economic, social and environmental objectives, including the delivery of low carbon targets through supporting local renewable energy projects, the reduction of the price of electricity to local residents and businesses, the reduction of fuel poverty and as another LA revenue stream.

ENERGY PLANS

A number of LAs have developed energy plans which identify future requirements for different scenarios. Examples are:-

- Greater London Authority has developed a London Energy Plan [27]which explores how much energy London would need in the future, where it might be needed, and the different ways of supplying that energy. A spatial map has been produced showing London's energy supply and demand to 2050 and options for the required supporting infrastructure.

[27] https://www.london.gov.uk/what-we-do/environment/energy/scenarios-2050-london-energy-plan

INFLUENCING ELECTRICITY NETWORK DEVELOPMENT

The LA collaborative bodies, and a small number of individual LAs, are starting to move towards influencing and improving developments in electricity networks, particularly where there are constraints in the local electricity network. These are outlined below.

Core Cities Group

One collaborative body, the Core Cities group, representing the councils of England's eight largest city economies outside London, along with Glasgow and Cardiff, published in 2013 a Growth Prospectus, including 'Step 6: Power up the Cities'[28]. This proposed independent distribution licences and more national influence. It also called for a review of the relevant regulatory and incentive frameworks. The Core Cities group, using the Liverpool examples, have worked with the GLA, Ofgem and Government to find new ways of working.

APSE Energy

The Association for Public Service Excellence (APSE) has a Local Authority Energy Collaboration 'APSE Energy'. This has 62 LA members, including four from the Core City Group (Cardiff, Glasgow, Newcastle and Nottingham). The vision of APSE Energy is:-

"To form an effective collaboration of a large number of local authorities to enable and facilitate the local municipalisation of energy services. By this we mean the public and community, as well as private, ownership and managerial control of local energy generation, distribution networks and delivery of energy efficiency works. Local authorities working together in this way would have great influence and would be able to deliver economies of scale in green energy to promote economic growth and combat fuel poverty."[29]

APSE Energy runs a number of events, including an annual 'Big Energy Summit', which is a useful source of information on latest LA energy activities and expert views.[30]

Cornwall

Within the recent devolution deals only Liverpool and Cornwall have explicit references to tackling network constraints.

The Cornwall Devolution Deal, published 22 July 2015, includes the following statements:-

'The Government will work with Cornwall to consider what role it could play in helping to address network constraints within the region, with a focus on the deployment of smart grid solutions and innovative investment models that offer value for money for taxpayers and consumers.

As a result of this Devolution Deal, Cornwall Council and Cornwall and Isles of Scilly Local Enterprise Partnership will commit to:

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[28] http://www.corecities.com/what-we-do/publications/core-cities-growth-prospectus-policies-step-6-power-cities

[29] http://www.apse.org.uk/apse/index.cfm/local-authority-energy-collaboration/about/

[30] http://www.apse.org.uk/apse/index.cfm/local-authority-energy-collaboration/past-events/the-big-energy-summit-2016/

Co-ordinating a task and finish group, if required, to facilitate the co-development of grid and smart grid solutions that unlock increased grid capacity for Cornwall.' [31]

The progress to date (reported January 2016) [32]has been to set up an 'Energy and Resilience Board' to oversee relevant work. It is stated that business cases have been completed for all the projects and that they are now working with the Government to agree funding options, as well as engaging with local and national stakeholders on the proposals.

Greater London

Greater London has the greatest similarity to the Liverpool region in terms of the structure of the local distribution network, which is also heavily interconnected. London has a very high density of demand, a commitment to decentralised energy, and had experienced distribution network capacity constraints before Liverpool. The GLA has been looking at ways to address this since 2012, and work has been completed by a high level working group [33]and a technical working group, made up of representatives from the two local Distribution Network Operators (DNO's), National Grid, Ofgem, from the business and development sector, and from local authorities.

The aim of the work has been *'to secure a resilient electricity network in London able to deliver connections and capacity timely and cost-effectively to ensure that London can compete with other world cities in terms of access to electricity supply and support for development and business growth where and when it is required.*'

Deliverables from this work have included:-

- a June 2014 briefing note for Government on ' Electricity Distribution Infrastructure – Facilitating Investment in Advance of Need'. This was discussed at a meeting held at Downing Street.
- Input into UKPN's Business Plan for 2015 – 2023
- An agreed mechanism to provide UKPN regularly with up-to-date data from the GLA's London Development Database

DNOs working with LAs, and LAs working with DNOs

At the stakeholder workshop, SPEN cited an example in Wem in Shropshire where they have had productive engagement with a local storage and distribution business, Grocontinental, and the local authority for the town. The cost of the enhanced electricity connection required for the SME to continue to grow without moving elsewhere was significant due to the remote nature of the town and the insufficient capacity of the network to provide 2MVA. Engagement with the council resulted in efforts to secure funding from alternative sources, in order to prevent the business,

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[31] https://www.gov.uk/government/publications/cornwall-devolution-deal

[32] https://www.cornwall.gov.uk/community-and-living/communities-and-devolution/devolution/devolution-to-cornwall/devolution-deal-newsletter/devolution-deal-newsletter-edition-one/local-flexibility-to-address-our-energy-and-resilience-needs/

[33] https://www.london.gov.uk/what-we-do/planning/who-we-work/planning-working-groups/london-electricity-working-group

which was a significant employer locally, from moving away. This led to incremental works being possible, through continuous dialogue between SPEN and the local council, to install cables in favourable circumstances when other work was being done on the roads. Subsequently substations were able to be installed, and this was a success story.

An example of a coordinating role being taken on by LAs was given by the representative from the GLA: for the Vauxhall/Nine Elms/Battersea development, for which the London Boroughs of Wandsworth and Lambeth coordinated meetings to help the developers to organise themselves to behave as a single rationalised actor.

At the stakeholder workshop the very successful co-ordinated approach to infrastructure development in the run up to Liverpool becoming the City of Culture was discussed. The main driver had been the requirement to minimise disruption in the City. This forced the utility companies to carefully consider what works were required and work together and with LCC. The LCC team was funded from the £2 billion investment that the City of Culture attracted, and there had been a deadline to meet. Such works are always possible with projects being done at scale and with a clear deadline, but that way of working doesn't really address how to improve business as usual.

Local Planning Policy

Alongside National Building Regulation standards, Local Authorities can set specific energy requirements for new developments within Local Plans and Core Strategy's. The well-known "Merton Rule" (requiring all new developments to meet 10% of energy consumption from low carbon sources) has been adopted and developed in a number of regions, most notably through the London Plan. The London Plan requires detailed energy strategies to be submitted with planning applications, outlining how the buildings emissions will be at least 35% lower than the level required from Part L of the Building Regulations. Additionally, the policies force developers to connect to local heat networks where technically feasible whilst further carbon offsetting schemes have recently been implemented. In previous times, DNO's had personnel based in Local Authority offices who were aware of an engaged in development planning. The loss of this way of working has created a gap in understanding of mutual processes.

5.3 FUTURE ROLE OF LOCAL AUTHORITIES

Published Thought Leadership

There has been significant research work carried out into how the UK can move to a more electric, low carbon future. A particularly relevant piece of work was delivered as a working paper 'Distributing Power - A transition to a civic energy future' on the 'Realising Transition Pathways' project[34].

There has also been more localised thought leadership published, this includes 'Grid Constraints in the South West: How the LEP could respond'. This provides suggestions to the Heart of South West (HOSW) LEP regarding actions that can be taken to support the unlocking of the grid in the south west, supporting local economic benefit.[35]

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[34] http://opus.bath.ac.uk/48114/

[35] http://www.heartofswlep.co.uk/sites/default/files/user-1889/HoSW%20LEP%20-%20Grid%20constraints%20Executive%20Brief.pdf

GLOSSARY OF TERMS

Distribution Code Review Panel (DCRP) – The distribution code is a requirement of distribution licences and covers technical aspects relating to connection and use of the distribution system. Any changes to the distribution code are managed through the Distribution Code Review Panel, which is made up of DNOs, Generators, Suppliers, Ofgem, National Grid, Citizens advice and the ENA.

Department of Energy and Climate Change (DECC) – Government department responsible for UK energy policy. It has now merged into the Department for Business, Energy and Industrial Strategy (BEIS).

Distribution Network Operator (DNO) – DNOs build, own and operate the electricity distribution network in the UK. They are private companies but operate within a heavily regulated market.

Distribution System Operator (DSO) – This is a new model of management for the distribution network whereby a DSO is more actively involved in managing the network. Rather than simply building / operating the network and connecting new customers, a DSO might manage balancing generation and demand locally – calling on smart technologies and embedded generators.

Electricity Networks Association (ENA) – The ENA represents gas and electricity network operators in the UK, with overriding goals to ensure networks are safe, reliable, efficient and sustainable. They have a key role in influencing regulation in the UK.

High Value Projects – Defined as discrete projects with a value of more than £15m over the lifetime of the project. Within price control measures, Ofgem make special allowances for these high value projects. Reopener mechanisms allow DNOs to apply to Ofgem for adjustments to revenues where costs for these projects are at least 20% higher than anticipated.

Independent Connections Provider (ICP) – An ICP is an accredited company with the authority to design and construct certain contestable elements of grid connection and electricity networks.

Independent Distribution Network Operator (IDNO) – IDNOs build, own and operate smaller networks located within the areas covered by DNOs. They are usually extensions to the DNO networks serving new housing and commercial developments.

Load Related Reopener – This is a mechanism that allows DNOs to apply to Ofgem to adjust their revenues to accommodate costs associated with specific uncertain cost categories (i.e. costs that were uncertain at the time of establishing price control budgets.

Low Carbon Networks Fund (LCNF) – The LCN fund was established by Ofgem to support DNO projects involving new technology or new operational and commercial arrangements. Overall £500million is to be provided between smaller (Tier 1) and larger projects decided through an Ofgem bidding process each year (Tier 2).

Ofgem – The Office of Gas and Electricity Markets regulates the UK energy markets in terms of supply, generation, distribution and transmission.

RIIO (Revenue=Incentives + Innovation + Output) – As of 2015, RIIO is Ofgem's new way of regulating DNOs which is based on performance and rewards for meeting the needs of network users. It involves an 8 year price control period with the current period ending in 2023.

Scottish Power Energy Networks (SPEN) – SPEN are the DNO operator for the Liverpool City Region.

Stranded Assets – When it comes to investment in anticipation of a connection, one of the issues / risks for DNO's is that of stranded assets. In simple terms, stranded assets are those that have been built but are no longer useful. An example could be where a new substation is built ahead of a proposed development, but then ends up not being required or utilised fully due to that development not emerging.

System Inertia – in the context of electricity networks, inertia helps to handle changes in system frequency – effectively stabilising the system by limiting the rate of change of frequency. Traditional power systems involved thermal power plants with rotating turbines contributing to system inertia but as we have added more low carbon technologies, such as solar PV, total system inertia reduces. This is a relatively new challenge for National Grid.

Appendix A

TODAY'S ELECTRICITY NETWORKS – HOW THEY OPERATE

Introduction

This section of the paper explains in non-technical terms how today's electricity networks function, are regulated, and are funded.

Structure of Electricity Networks

In Great Britain large power stations are connected to the transmission system which operates at 275kV and 400kV in England and Wales, and at 132kV and above in Scotland. Figure A-1 shows the ownership of the transmission system which was designed to transport electricity from large power stations to the load centres securely and efficiently. National Grid is the system operator and operates the two Scottish transmission systems and its own England and Wales system as one, balancing electricity supply and demand in real time and managing system frequency.

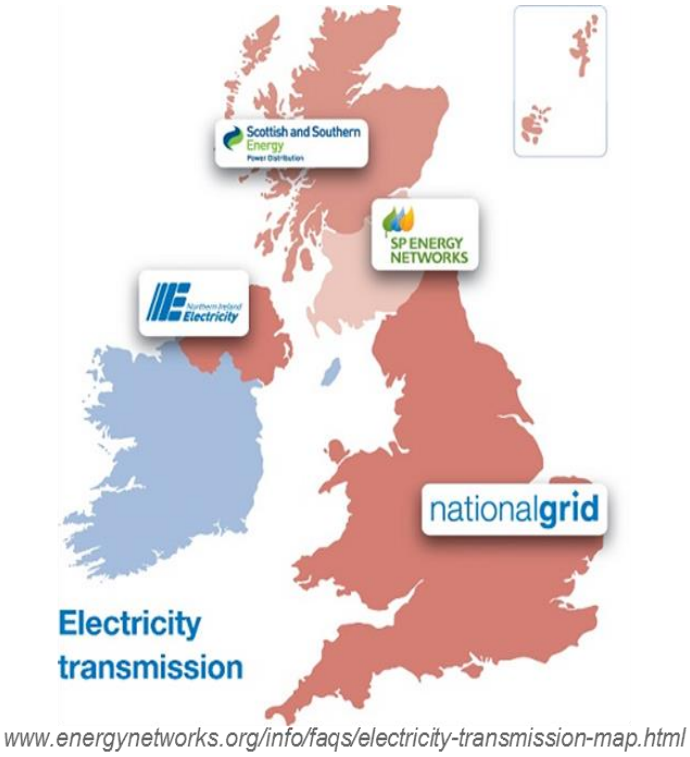
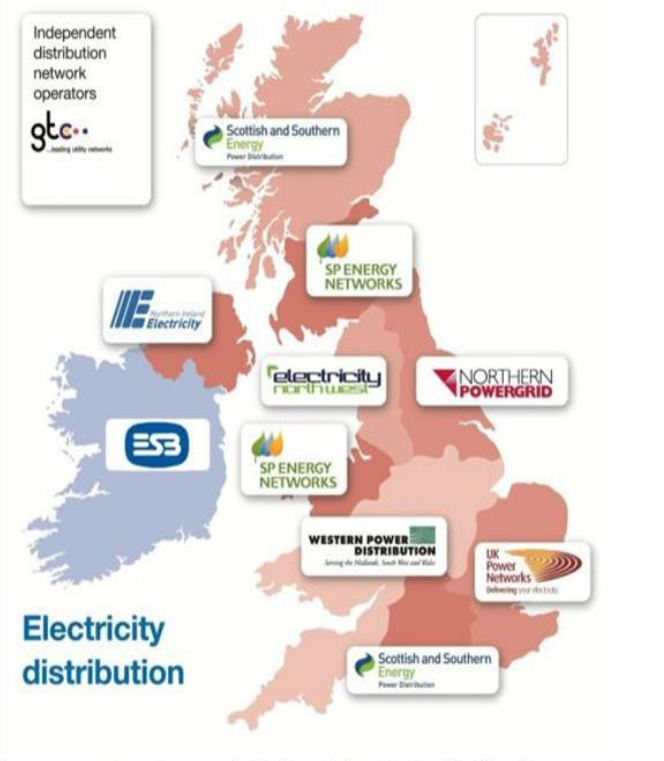


Figure A-1: Transmission system ownership

The transmission system is connected to the distribution system through transformers which step the voltage down to 132kV at substations known as 'Grid Supply Points'. The electricity distribution networks are designed to carry electricity from these grid supply points to industrial, commercial and domestic users.

Most of the electricity distribution network is built, owned and operated by distribution network operators (DNOs), as shown in Figure A-2. Independent distribution network operators (IDNOs) build, own and operate smaller networks located within the areas covered by the DNOs. IDNO networks are usually extensions to the DNO networks serving new housing and commercial developments.

DNOs do not sell electricity to consumers, electricity suppliers do this.



www.energynetworks.org/info/faqs/electricity-distribution-map.html

Figure A-2: Distribution system responsibility for ownership and operation

Electricity users are supplied at different voltage levels depending upon their maximum electricity demand. This is illustrated in simplified form in Figure A-3 which also shows the terminology used for the various stages of voltage step down.

Electricity is distributed to domestic customers at low voltage (LV), generally single phase, at 230V. The 500 kVA urban secondary transformer illustrated would supply about 100 domestic customers (assuming little commercial or industrial load).

Figure A-3: Distribution Network Voltage Levels

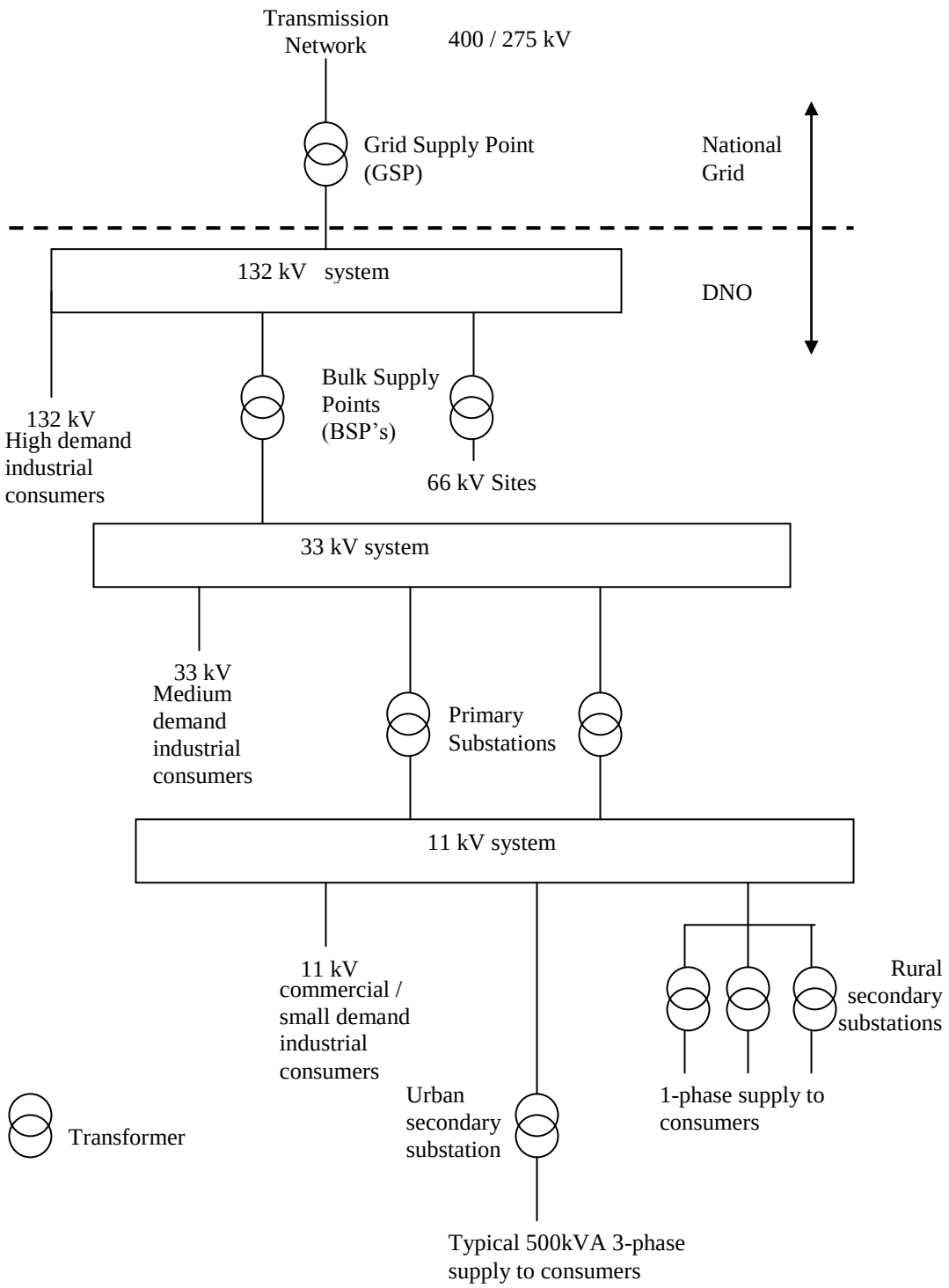


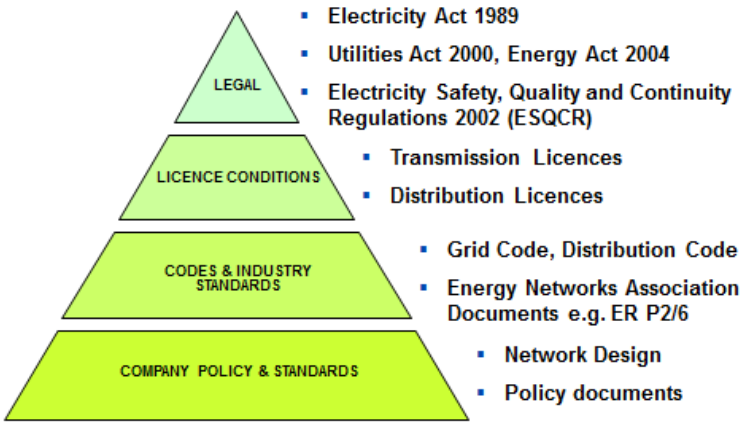
Figure A-3 shows the more usual distribution operating voltages of 132kV, 33kV and 11kV, but it should be noted that there are some parts of the distribution system which still have operating voltages of 66 kV, 22 kV and 6.6 kV. The reasons for this date back to when the electricity supply in Great Britain was the responsibility of a multiplicity of private and municipally owned utilities, each operating largely in isolation until the 1930's. There was some rationalisation in later years after the transmission system had been constructed, the industry had been nationalised and the Electricity Council and Central Electricity Generating Board set up. Post privatisation, variations still remain in operating voltages, and in the way that local distribution networks are designed. This is largely because the network infrastructure (transformers, cables and switchgear) all have asset lives of 40 years or more, so it is usually most cost effective to retain the original design principles.

At the higher voltage levels the distribution network is normally designed as radial feeds, with duplicate circuits, each rated to supply the maximum demand at the end of the feed. This enables maintenance or fault outages to take place without disruption to the customer supply. Exceptions to this can be found in the Manweb and London distribution networks which were designed with large amounts of interconnection at all distribution and LV voltage levels. This configuration has the benefit, over duplicate radial feeds, of improving the customers' security of supply. It does however result in higher levels of short circuit current and higher management costs.

The distribution network was originally designed to transport electricity in one direction down to consumers, and to operate under both minimum and maximum demands. Over the last 15 years however there has been a change in the size and type of generation connecting onto the electricity network, in particular an increase in 'distributed' generation connecting onto the distribution network at all voltage levels. This has meant that distribution networks now have to handle the flow of electricity in both directions, this can make it more difficult for the DNOs to manage voltages, particularly in rural areas.

Distributed generation can supply local load, however the generation profile does not tend to match the demand profile, for example domestic PV will be at maximum output in the middle of the day when domestic load is likely to be low because homeowners are out. In some parts of the distribution network, where there are clusters of distributed generation, there is now power being exported back up onto the transmission network.

Overview of Statutory Obligations



Under the Electricity Act 1989 certain activities concerning electricity may only be carried out with a Licence (or under a relevant exemption or exception).The Electricity Act 1989 and Utilities Act 2000 place a duty on Distribution Licence holders to develop and maintain an efficient, coordinated and economical system of electricity distribution. The Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002 gives standards for the quality of supply customers should receive including the voltage and frequency limits at supply terminals.

The Distribution Licence requires the licence holders to develop the Distribution System in accordance with Engineering Recommendation P2/6. The Distribution Licence[36] covers commercial and administrative arrangements for connection to the Distribution System. There are a number of obligations relating to the connection of consumers and generators, including:-

- **Condition 25: Long Term Development Statement**
  This requires the licensee to prepare and maintain a statement on an annual basis in respect of the next 5 years on a rolling basis. The provision of information is to enable a potential connectee to evaluate connection options and includes the identification of those parts of the licensee's distribution network that are likely to reach the limit of their capability during the five-year period covered by the statement, including those parts that may experience thermal overloading, voltage problems, or excess fault levels;

[36] https://www.ofgem.gov.uk/licences-codes-and-standards/licences/licence-conditions

- **Condition 25A. Distributed Generation: Connections Guide**

  This condition requires the licensee to make information available in the public domain to assist a potential distributed generator connectee to understand and evaluate the connection process.

The licences also contain conditions which limit the amount of revenue which network companies can recover from their customers.

The Codes and Standards establish rules that govern market operation and the terms for connection and access to energy networks. The Codes cover all technical aspects and are approved by the regulator Ofgem (the Office of Gas and Electricity Markets).

The Distribution Code is a condition of the Distribution Licence and relates to the Distribution System and connections to it. Any changes to the Distribution Code are managed through the Distribution Code Review Panel (DCRP). The Distribution Code references a number of Engineering Recommendations which are owned by the Energy Networks Association.

The Energy Networks Association[37] (ENA) is an industry body funded by UK gas and electricity transmission and distribution licence holders. The ENA represents and promotes the interests of these companies. They also manage on behalf of the industry, a number of technical documents including Engineering Recommendations, Technical Specifications and Engineering Technical Reports. These documents cover various aspects of distribution networks including network design requirements, network security and quality of supply as well as equipment specifications.

Changes to the contents of the Engineering Recommendations that form the technical requirements of the Distribution Code are also managed by the DCRP who consult publicly on proposed changes to ensure that all users of the distribution network are able to comment. Ofgem has the final authority to approve changes to these documents.

Other national industry standards that are not part of the Distribution Code obligations but are considered material to both DNOs and distribution system users are also subject to governance by the DCRP although changes to these documents do not formally require approval by Ofgem.

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[37] www.energynetworks.org

Industry consultation can take months or even years to agree a change to the Transmission and Distribution Codes and associated technical standards. There are often many iterations of the process before a change is agreed, in order that the full impact of any change may be reviewed by:

- The system owner,
- The system operator, and
- All the system users.

In addition to the national industry standards, each transmission and distribution company has its own set of standards and codes of practice covering planning, equipment specification, construction and operation of their distribution network. These standards provide more detailed guidance on how to implement the company's obligations to meet its licence conditions and comply with health and safety legislation. They will reference ENA, IEC and British Standards where appropriate. However each company may have a different approach to meeting these standards and this approach will be detailed in the company documents. These company specific documents tend to be internal documents with only limited public access on request.

Independent District Network Operators are regulated in the same way as DNOs, except the IDNO licence does not have all the conditions of the DNO licence.

Regulation and Funding of Electricity Networks

National Grid and the DNOs are natural monopolies, with all of their revenue being obtained through customer electricity bills and charges or levies on suppliers, generators and other network users. As a result, DNOs are regulated by Ofgem to protect consumers from potential abuse of monopoly power – controlling the amount of charges and the extent of future rises.

The regulatory framework gives the DNOs strong incentives to deliver a low-carbon, high-quality and sustainable energy sector at good value for money for all consumers. Ofgem monitors DNOs' compliance with the legal and regulatory framework and will take action where they find companies are not complying with these requirements.

The network companies currently have a need for significant investment in their networks due to the changes in demand and generation that will occur in a low carbon future, and also due to having assets which were largely installed in the 1960s and are reaching the end of their useful life. To ensure that this is delivered at a fair price for consumers Ofgem have developed a new framework for setting price controls for network companies, RIIO (Revenue=Incentives + Innovation + Outputs). This is a performance based model for setting the network companies' price controls which lasts eight years.

RIIO is designed to encourage network companies to:

- Put stakeholders at the heart of their decision-making process
- Invest efficiently to ensure continued safe and reliable services
- Innovate to reduce network costs for current and future consumers

- Play a full role in delivering a low carbon economy and wider environmental objectives.

Ofgem can take action if the DNOs fail to deliver against their obligations to maintain efficient and economic networks. The DNOs should therefore anticipate where an increase in local demand and generation is going to arise and where more capacity is needed on the network. DNOs forecast the need for this type of investment and Ofgem allow them to recover revenue for these costs from their customers in the price control settlement.

There is a strong incentive on DNOs to 'outperform' this settlement. If they spend less than they forecast and still deliver the same outputs, such as a reliable network, then they keep a share of any underspend, with the remainder passed to their customers. There are also mechanisms in the regulatory framework, namely High-Value Projects and load-related reopeners which allow a DNO to fund additional expenditure not previously foreseen.

These arrangements should encourage DNOs to invest strategically in the network (ie before existing capacity has been reached) if in time this leads to a lower overall cost of reinforcement. This approach is more likely to be applied where the DNO anticipates general growth in electricity use through existing connections.

A DNO can also invest in reinforcement work in advance of new connections. In practice, this should apply when the cost of the reinforcement work to DUoS customers would be less if the work was carried out in advance, rather than in response to connections coming forward. The cost saving would need to be significant as under this arrangement the DNO would not receive any contribution from connecting customers for the reinforcement (as they would be investing prior to receiving a connection request).

Forecasting future connections demand can be very difficult. A range of external factors can have a profound impact on what needs to connect, as well as where and when the connection is required. Uncertainty about future connections may discourage DNOs from investing in advance of a connection being requested. If the connection does not materialise then the DNO, and ultimately consumers will be left paying for assets that were not needed.

A DNO which takes this approach may also risk appearing to spend more and be less efficient than one who holds back expenditure until new connections emerge. Demonstrating the long-term efficiency of earlier investment can therefore be challenging.

DNOs may be more prepared to undertake this approach if third parties – such as developers or local authorities - could provide them with sufficient assurance that growth is highly likely to materialise. This could include evidence that the scheme is part of a regional government/local authority's development strategy and that investment in any associated infrastructure (transport, housing, other utilities) necessary to support growth is also being progressed.

This type of evidence could help the DNO demonstrate the cost savings to be made by investing upfront, rather than on an incremental basis.

Connecting to the network

New developments with a new or increased demand for electricity, and distributed generators, require a suitable connection to the local distribution network. It is helpful to understand the connection process, since the cost and timescale associated with a connection can be a major hurdle to new urban developments and renewable generation, and impact economic growth and the achievement of low carbon targets.

A suitable connection to the network can be arranged by contacting the local DNO with details of the requirements. They will provide a quotation for doing the work within three months of receiving all of the information which they need. There is no upfront charge for this quotation, however the costs associated with providing connection quotations are recovered from all customers who accept a connection offer.

The DNO will work out the connection cost using their 'Connection Charging Methodology' which is published on their website. The price will include the cost of the new infrastructure required to connect the new demand or distributed generation to the network, plus a share of the cost of upgrading the existing network, if this is required.

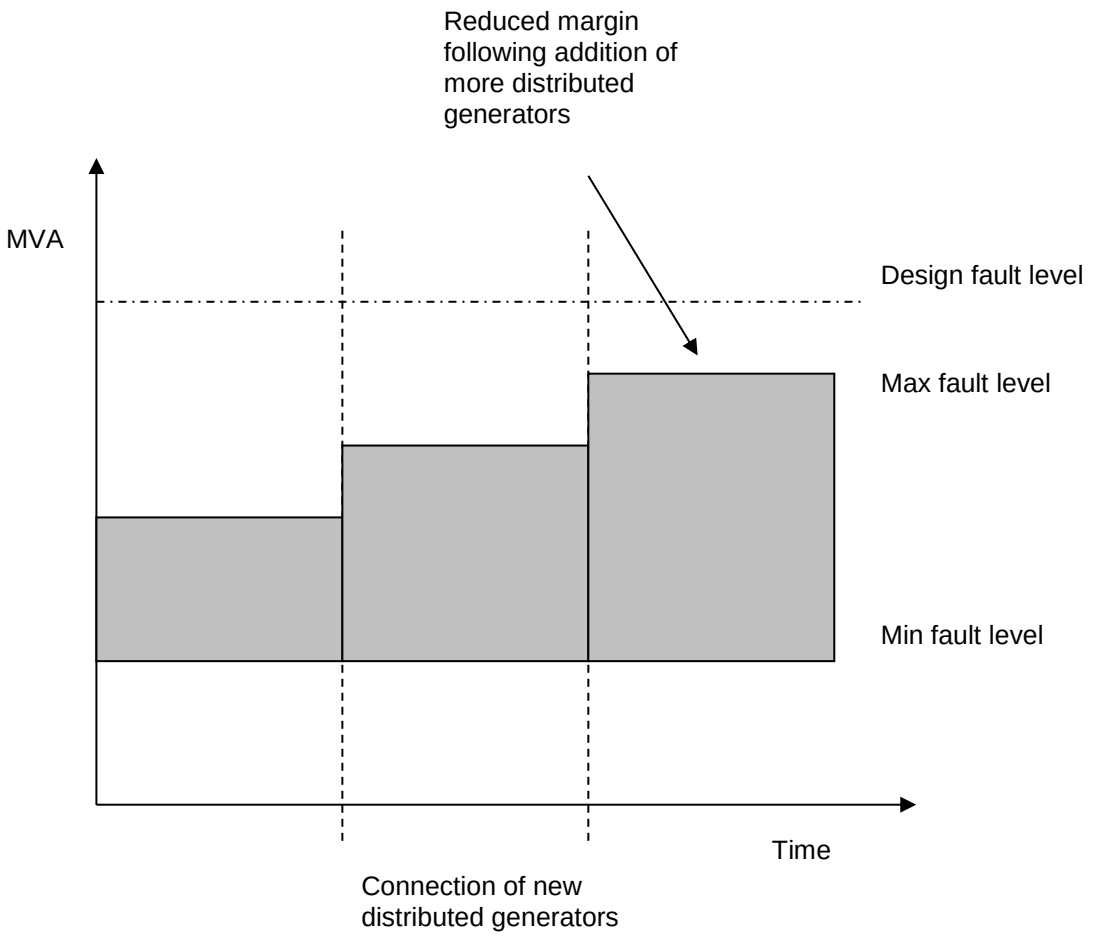
The cost of a connection will vary between projects. It depends on the size of the connection, where the connection is, the distance from the existing network and whether the network can accommodate the capacity needed.

Whether the existing network will need upgrading will depend upon the extent to which a new connection adds to the peak demand on the network and whether this exceeds the remaining capacity.

DNOs can offer flexible connections, these allow new customers to connect to the network, without reinforcement, even when the capacity requested by that customer exceeds the peak limits. DNOs do this on the basis that the customer agrees to being constrained off when the network approaches its capacity limits. These types of 'flexible' connection agreements (also known as non-firm connections, constrained connections or active network management schemes), enable customers to be connected more quickly and cheaply, but will not be suitable for all customers.

The network may also need upgrading if the new connection contributes fault current when there is a short circuit on the network, and the existing network is already operating close to its short circuit capability.

Changes to the network, such as the connection of new generators or loads, can result in an increase in fault levels. However, the rating of existing switching devices and equipment places an upper limit on the fault level which can be permitted in a particular part of the network. This upper limit is sometime referred to as the design fault level in that part of the network. Design fault levels in distribution networks can sometimes be a limiting factor in the connection of new generators or loads, as illustrated below. The estimated maximum fault level would ideally be no more than 95% of the design fault level to allow for inaccuracies in calculations and thereby providing a safety margin of 5%.



The share of the upgrade cost payable by the connecting customer is calculated based on the proportion of new capacity created that will be used by them. Generally the connecting customer will only pay for upgrades at the voltage level it is connecting to and one voltage level above. Customers connecting generation equipment to the network will also have to pay for network upgrades in excess of £200/kW.

Where the new connection uses network assets that were installed and paid for by a previous connection in the previous five years, the connecting customer will also need to pay a rebate to the

DNO or a previously connected customer under the Electricity (Connection Charges) Regulations 2002 (often referred to as the 'Second Comer' rules).

The remainder of any upgrading cost is recovered on an ongoing basis from all users of the network through their electricity bills.

Not all connections work has to be carried out by the DNO. Competition exists for some work. A customer can choose to use an alternative provider for some connections work known as "contestable work". Contestable work can be carried out by:

- a DNO
- an Independent Network Operator (IDNO)
- an Independent Connection Provider (ICP)

IDNOs build, own and operate smaller networks located within the areas covered by DNOs. They are usually extensions to the DNO networks, serving new housing and commercial developments. There are currently eight licensed IDNOs in the UK and they are regulated in much the same way as DNOs, apart from not being subject to all of the same conditions.

The idea of an IDNO is to increase competition in network connections, providing an alternative choice for developers. After a relatively slow start in 2005, the growth of IDNOS has improved with an increasing percentage of new connections now being delivered, and the ENA estimates that competition has doubled in recent years. However, many think that more could be done to increase competition and the fact remains that they are also subject to the same technical challenges as full DNOs when it comes to the increasingly dynamic nature of consumption and generation.

Appendix B

PESTLE WORKSHOP OUTPUTS

Pestle Analysis

This section of the paper presents a ‘PESTLE’ analysis to identify the key changes in the external environment which affect the future of electricity networks and which affect the ability of a local authority to influence this future.

It incorporates views and experiences from a range of local and national stakeholders who, in the early stages of the project, attended a ‘PESTLE’ workshop to look at Political, Economic, Social and Technological Legal and Environmental factors. They considered a number of key questions:-

- *What factors in the external environment will affect the future direction of travel of electricity networks?*
- *What factors in the external environment will affect the role which local authorities could play to ensure that local electricity networks do not constrain growth and development?*
- *Have you come across any other examples of best practice or trials on the role which local authorities could play to ensure that local electricity networks do not constrain growth and development*
- *What ideas and views do you have on the role which local authorities could play to ensure that local electricity networks do not constrain growth and development*

Appendix A captures all of the information gathered from stakeholders at the PESTLE workshop. This section captures the key points made at the workshop, as well as our own views, and developments since the stakeholder workshop

APPENDIX B-1

POLITICAL CONTEXT

POLITICAL CONTEXT

The political mood and momentum can change very quickly, and there are significant external factors such as changes in the market environment and market confidence, which are largely outside of the control of central and local Government. This has been evidenced since the stakeholder workshop by the UK Brexit vote, and the resulting changes in prime minister and key government ministers. There is a degree of uncertainty now in:-

- Local Authority devolution progress
- EU funding
- Future LA budgets (which were already reduced)
- The power of the National Infrastructure Commission, with plans for its independence and empowerment shelved in September 2016

Any political uncertainties which affect the LA's future empowerment, budgets and potential revenue streams will affect the ability of the LA to influence the future direction of electricity networks.

The political environment will also affect the future of electricity networks, in that the future generation mix and uptake of low carbon technologies such as electric vehicles are very strongly influenced by government policy and incentives. These can change very quickly with a change in Government ministers.

APPENDIX B-2

LEGAL AND REGULATORY REGIME

LEGAL AND REGULATORY REGIME

The stakeholder workshop identified a number of changes coming in the legal and regulatory environment, including:

- the secondary legislation (statutory instrument) relating to second comers (Electricity (Connection Charges) Regulations) is due to be revised in October 2016

- actions coming out from the Ofgem consultation on 'Quicker and More Efficient Connections' consultation exercise, including better use of existing assets, and anticipatory reinforcement

These are looked at in more detail in section 6.4 of this report.

APPENDIX B-3

TECHNOLOGICAL CHANGES

TECHNOLOGICAL CHANGES

Technological innovations could be deployed by DNOs to relieve network constraints, for example to:

- reduce peak load
- intelligent charging of electric vehicles
- apply half hourly charging based on smart meter data (time of use tariffs already substantially used in industry, e.g. steel works, to penalise / discourage consumption at times of peak demand), but this poses a risk of increasing fuel poverty

Network innovations are discussed further in section 6.2 of this report.

Stakeholders commented that LAs could encourage their populations to adopt new technologies which could relieve network constraints, for example:-

- Demand Side Management at the household level;
- Heat and energy storage at demand and generation sites;

Facilitation of investment in community energy schemes where appropriate.

APPENDIX B-4

SOCIAL FACTORS AND SOCIAL EFFECTS OF TECHNICAL CHANGE

SOCIAL FACTORS AND SOCIAL EFFECTS OF TECHNICAL CHANGE

The workshop identified that there are particular social issues relating to fuel poverty and the cost of energy to consumers. This is affected by the pricing structures currently in place. Smart metering may change this, if more tariffs become available and are easier to use and understand, but the stakeholders felt that fuel prices would have to be much higher than they are now to achieve a significant impact in this area.

Smart meter trials in other countries have highlighted potential concerns around data protection, and concerns by consumers around smart meter data revealing when they are at home and when they are out.

The social trend of greater numbers of people living in city centres, and the resulting change of use in city centres has an effect on the requirements of the electricity network. High rise buildings with high density [occupation] and electrical heating are putting a heavier demand on city centre networks.

APPENDIX B-5

ECONOMICS

ECONOMICS

Economically, the cost to connect is a barrier when the network is constrained, especially for small businesses. Those small businesses may locate themselves where there is a cheaper connection, outside of the LA area, and no longer bring economic benefit to the local region.

High connection charges can also stop a project from happening, especially for lower value developments and embedded generation investments.

SPEN consider that they have a duty under their licence to provide connections when requested (whether or not through Independent Connection Providers). Connections form an inevitable part of a larger networks business, but are not generally profitable. In practice, SPEN believe that the introduction of competition in the area of connections is making SPEN less competitive, since they are delivering the less profitable connections. The stakeholder workshop identified that there are challenges in getting DNOs and IDNOs to work together to ensure efficient network development, and this requires a change of culture. IDNOs want to protect commercial information in a competitive environment

APPENDIX B-6

ENVIRONMENTAL

ENVIRONMENTAL

The stakeholder workshop identified that the environmental agenda influences the LA, particularly the environmental concerns of communities and end users. All unified local authorities have energy efficiency on their agenda. One example given was air quality, which is becoming an issue, with the link to the bigger agenda around health issues such as asthma. Investment in energising electric vehicles is an indirect consequence of the air-quality agenda.
It is expected that the UK Brexit vote will change very little for the UK in terms of the policy it has in place for climate change. This is predominantly because the UK led the way on environmental legislation and proposed many of the steps that Europe subsequently adopted.

The environmental agenda has a very direct influence on the future direction of travel of electricity networks, with the predicted move to electric heating and electric cars in the future increasing the overall demand for electricity. Government incentives and the withdrawal of such incentives for different types of renewable generation technologies have a significant impact on the uptake of distributed renewable generation, and hence on distribution networks.

APPENDIX B-7

THE ROLE OF LOCAL AUTHORITIES AND THEIR DRIVERS

THE ROLE OF LOCAL AUTHORITIES AND THEIR DRIVERS

There are four issues that Local Authorities want to influence:

- Spatial developments – do not want buildings discouraged;
- Fuel poverty;
- Carbon planning (sustainability); and
- Energy Efficiency – encouraging and motivating people to get involved with this.

There is a disconnect between these issues and the ability of Local Authorities to influence them – as well as the rate/speed at which investment in these areas is delivered. It was commented that there is a fundamental conflict in the role of LAs to keep the city going as it is (with all existing stakeholders) as well as to attract investment to develop and grow.

There is a view that there is a role for LAs to ask the right questions of developers/landowners/DNOs in order to avoid delay or loss of potential investment. This may include collating of information. There was a comment from LCC that they do not receive details of plans from SPEN, but previously carried out manual work to pick out data from planning requests so that energy data could be added (UMP tool).
It was emphasised that, despite not having any technical expertise in these areas, LAs are paramount in decision making when it comes to planning of utilities as they are the most aware of: the end-effects; what is needed; the best interests of the consumer; and unintended consequences. LAs should be allowed to consider the end result and final deliverables, e.g. what are the effects of the end deliverables not happening.

There is a view that LAs should engage with Ofgem. However, LAs are frequently unable to assess and respond to Ofgem consultations for upcoming infrastructure projects as they don't have the necessary expertise. LAs are frustratingly aware that the consultations cover key issues.

Examples were given of what other local authorities are doing.

Appendix C

FUTURE UNIT COST OF ENERGY – SUBSTANTIATED ESTIMATE

Unit cost of energy

Due to the constraints of this study, it should be noted that WSP | Parsons Brinckerhoff has not used a bottom up approach for calculating the predicted unit cost of energy. Instead the unit cost estimates are based on work available in the public domain. Projections for the unit cost of energy in GB are very commercially sensitive, and therefore there is a minimal amount of public domain data that gives consumer level price projections for the next 20 years. The main published conclusions draw upon general trends and the direction of prices, based on numerous factors that impact energy costs, and do not identify specific costs.

GB Electricity Market

The GB electricity market is currently going through significant reform due to a shift to low carbon energy sources, coupled with the closure of some existing coal and nuclear assets and increasingly onerous emissions regulation.

The Electricity Market Reform Bill has facilitated many of these changes to the market by implementing Contracts for Difference and introducing a Capacity Mechanism. This mechanism has been designed to secure electricity supply in an environment of increasing intermittent generation and decreasing capacity margins.

Figure C-1 below shows the GB supply profile, reflective of the typical demand profile, for the peak day during 2015, based on WSP | Parsons Brinckerhoff analysis. A low overnight demand can be observed, which ramps up early in the morning, before increasing further to a daily peak between 4pm and 8pm. The maximum demand on this day was 53.5 GW and the minimum demand was 31.1 GW (58% of the maximum). The annual minimum demand of 18.0 GW was observed on 12 July 2015 (34% of the annual maximum).

Smart technology and metering is being introduced to provide greater transparency and availability of data, and ultimately reduce the variance between the peaks and troughs in the demand profile through the likely application of variable electricity pricing.

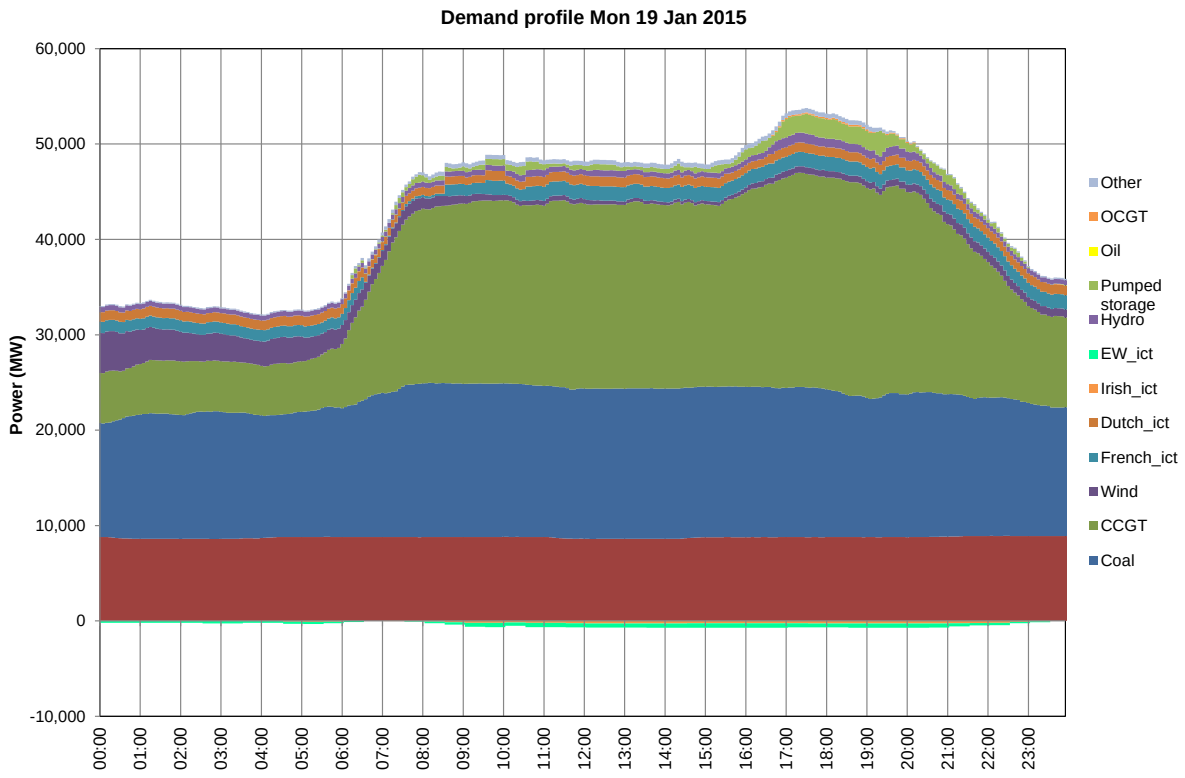


Figure C-1: UK electricity supply 19 January 2015

Competition reviews of the GB Electricity Market

In 2008 Ofgem launched the Energy Supply Probe into the electricity and gas supply markets for households and small businesses. That resulted in a package of measures to improve the functioning of the market including new licence conditions which became part of suppliers' licences in September-October 2009. Subsequently, Ofgem launched the Retail Market Review in late 2010 due to concerns that the energy market was not working effectively for consumers, and barriers to effective consumer engagement remained.

In response to the Energy and Climate Change Committee Fifth Report of Session 2013–14 on Energy Prices, Profits and Poverty[38] (16 July 2013), Ofgem took on a commitment to work with the Office of Fair Trading (OFT) and Competition and Markets Authority (CMA), as appropriate, to report annually on the impact of its retail energy market reforms, including on competition (Ofgem response[39] dated 5 November 2013). This resulted in publication by Ofgem on 27 March 2014 of a state of the market assessment[40], carried out with the OFT and CMA. It was as a result of the findings of this work that Ofgem referred the energy market to the CMA for a full competition investigation on 26 June 2014, with the final report of that investigation published on 24 June 2016[41].

Some of the summary conclusions of the CMA Energy Market investigation include:

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[38] http://www.publications.parliament.uk/pa/cm201314/cmselect/cmenergy/108/108.pdf
[39] https://www.ofgem.gov.uk/ofgem-publications/84642/ofgemoftandcmatosecretaryofstatecompetitioninenergymarkets.pdf
[40] https://www.ofgem.gov.uk/sites/default/files/docs/2014/03/assessment_document_published_1.pdf
[41] https://www.gov.uk/cma-cases/energy-market-investigation

- *'The costs of producing electricity can vary substantially depending on which types of generating plant are required to meet demand at any one point in time. Nuclear and many renewables have near-zero short-run marginal costs, while oil-fired plants have high short-run marginal costs, for example. Coal- and gas-fired plant costs lie between these two extremes, with their relative positions depending on the prices of the input fuels, which are themselves variable. In addition, wind generators only generate when the wind is blowing. The eight largest owners of generating capacity have very different portfolios of technologies. EDF Energy is currently the largest generator with a 26% share of generation output.*

  → *We have considered to what extent any generating company can exercise market power to raise wholesale spot prices and developed a model to test this. We found that, reviewing the period 2012 and 2013, no single generator had the incentive to increase the wholesale price by a significant amount in a significant number of half-hour periods.*

  → *…The profitability analysis does not therefore provide evidence that overall, the Six Large Energy Firms earned excessive profits from their generation businesses over the period or that wholesale market prices were above competitive levels. This evidence is consistent with our conclusion that generators do not have unilateral market power.'*

  → *...government policies are having an increasing impact on energy bills and yet we have found that there is a lack of effective communication concerning the forecast and actual impact of government and regulatory policies on energy prices and bills. This has led to a lack of trust between stakeholders and is one of the features contributing to an overarching feature of a lack of robustness and transparency in regulatory decision-making.*

  → *To help address this, we recommend to Ofgem that it publishes annually a state of the market report which would provide analysis regarding issues such as the evolution of energy prices and bills over time; the profitability of key players in the markets; the social costs of policies and distributional impacts arising from them; and the impact of initiatives relating to decarbonisation and security of supply. We are also recommending the creation of a team within Ofgem to take this work forward.'*

Wholesale and Retail Price Trends

Ofgem published a 'Supply Market Indicator' (SMI) paper in April 2015[42] that was designed to help consumers and other stakeholders to understand pricing trends in the domestic energy supply market. The report provides information on recent and possible future cost trends by estimating average costs and margins for a representative large supplier, using publically available data.

The paper was designed to improve the understanding of the relationship between retail prices and wholesale costs. There had previously been concerns relating to falls in wholesale energy prices not translating into lower retail prices as quickly as increases were leading to higher retail prices. These

[42] https://www.ofgem.gov.uk/electricity/retail-market/retail-market-monitoring/understanding-trends-energy-prices-supply-market-indicator

concerns were reflected in Ofgem's March 2014 state of the market assessment report. The results of the study into these concerns found that there was a lag between wholesale and retail price changes which largely result from suppliers' hedging their wholesale market exposures, and to a lesser degree the effect of administrative lags.

Additionally, as stated above, the subsequent CMA report concluded that '*no single generator had the incentive to increase the wholesale price by a significant amount in a significant number of half-hour periods' and 'generators do not have unilateral market power.'*

It should be noted that Ofgem provide a statement to say that 'In May 2015 we suspended our monthly SMI publication to carry out a review of our approach. Following this review, we have now published a consultation on how the SMI should be replaced[43]. We are seeking views on the proposal described in that document, before making a decision on how to replace the SMI later this year.'

Figure C-2 from Ofgem's 2015 SMI paper, shows that the wholesale cost of electricity is the largest component of the average annual electricity bill, hence it is important to look at the wholesale cost when predicting future price trends in the retail market. The figure also shows a year on year fall in wholesale costs between 2009 and 2014, and flat projections beyond. Network and environmental costs are projected to make up a larger proportion of consumers' bills, whilst operating costs and VAT are expected to remain relatively constant.

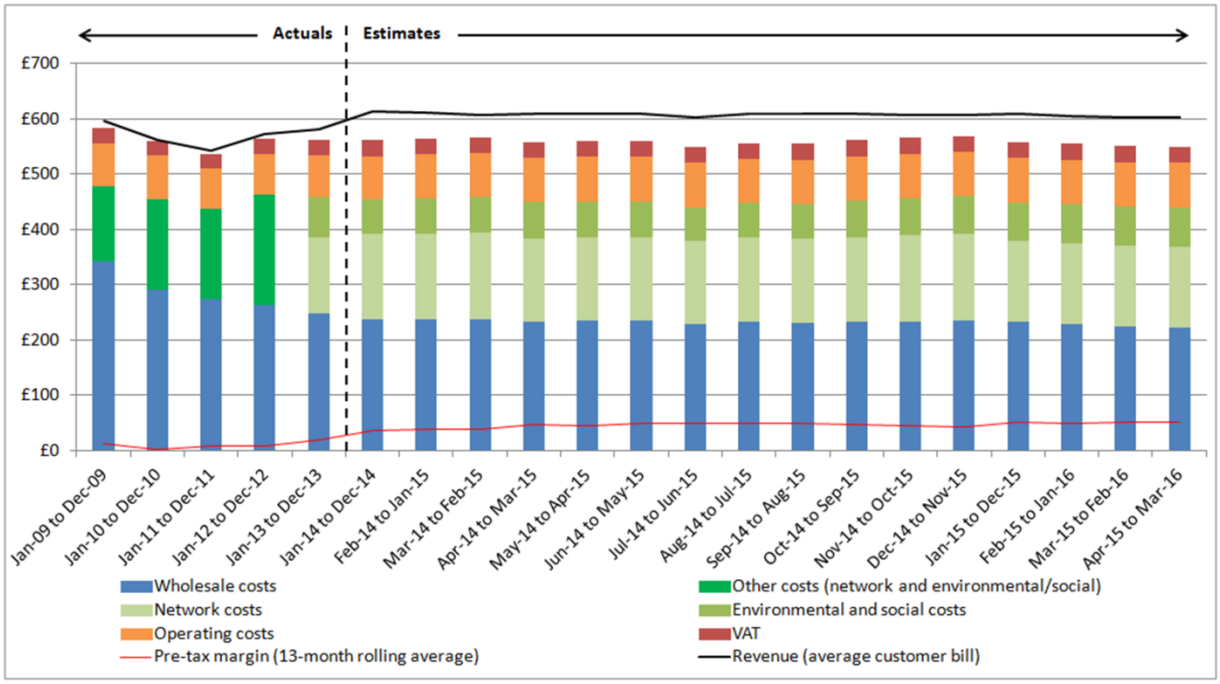

Figure C-2: Breakdown of Electricity Bill over Time

Note that subsequent to the suspension of the publication of the SMI, information continues to be published under the heading 'understanding the profits of the large energy suppliers'. The latest

[43] https://www.ofgem.gov.uk/publications-and-updates/monitoring-trends-suppliers-expected-costs

published breakdown of an electricity bill is shown in Figure C-3[44]. There is a significant difference in the level of the supplier pre-tax margin between the two publications, suggesting that there may have been a change to the definition of the categories.

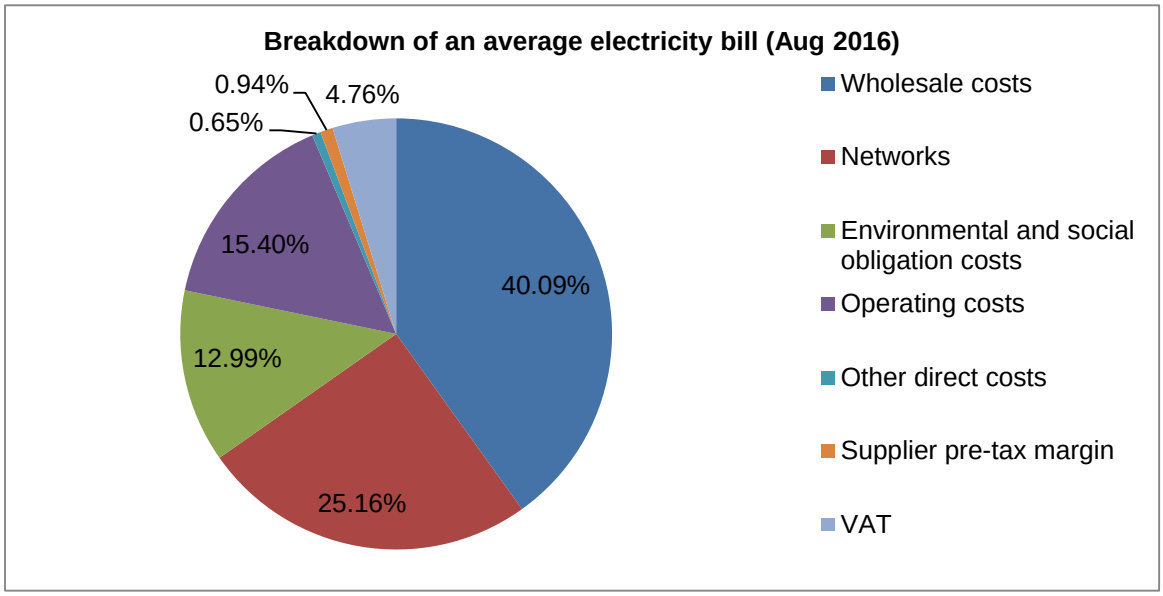

Figure C-3: Breakdown of an electricity bill (August 2016)

National Grid published base load (wholesale) electricity price projections up to 2040, in real 2016 prices, in their 2016 Future Energy Scenarios[45] presented in Figure C-4 below. The wholesale market is where power is bought and sold by several different types of participants. Companies that either produce or import energy, such as generators, sell their energy in the wholesale market. Companies that consume energy, such as large industrial companies or retail suppliers, buy energy from the wholesale market.

Electricity prices in GB have followed a similar trend to gas prices. This is because in the UK gas-fired power plants often set the electricity price. The last decade has seen gas prices rise significantly as the amount of GB gas production declined, resulting in an increased reliance on imports. In recent years gas prices have fallen, reversing some of the increase in previous years. This is because of a link to the falling price of oil, lower global gas price and milder weather.

The projection of baseload electricity prices in the FES 2016 shows that prices will increase or remain relatively flat in the short term, depending on the future scenario.

The projections follow steady increasing trends resulting from increases of the cost of fuel and low carbon or renewable generation increasingly influencing generation costs. The difference in the ranges low, base and high reflect uncertainties in:

- The cost of generation required to maintain margins

[44] https://www.ofgem.gov.uk/gas/retail-market/monitoring-data-and-statistics/understanding-profits-large-energy-suppliers
[45] http://fes.nationalgrid.com/fes-document/

- The timelines of new nuclear generation in GB
- Wholesale fuel prices for thermal power generation

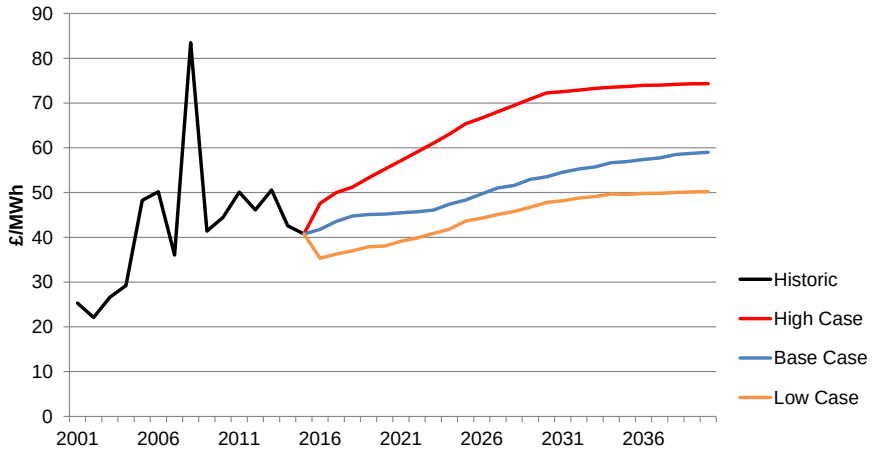

Figure C-4: Base Load Electricity Prices

Distribution Network Charges

The second most significant area that makes up consumers' electricity bills is distribution charges. This is the cost of building, maintaining and operating the local electricity network, which delivers electricity directly into homes. These are costs passed onto the consumer by the energy supplier. Distribution charges, as well as transmission charges, are regulated via price controls that limit the amount of revenue these companies can earn, delivering best value to the consumer.

Scottish Power published their most recent business plan in 2014 for the regulatory period RIIO ED1[46]. Ofgem required all DNOs to provide the predicted impact on bills relative to typical 2014/15 charges, using an average UK consumption level of 3,300kWh. Consumers in the Manweb region will see a 12% reduction in the distribution charges portion of their bill, from £126 to £111 p.a. across the regulatory period 2015 – 2023. This amount is expressed in 2012/13 prices and will vary depending on actual outturn inflation and consumption. This is shown graphically in Figure C-**5**.

[46] http://www.spenergynetworks.co.uk/pages/distribution_business_plan.asp

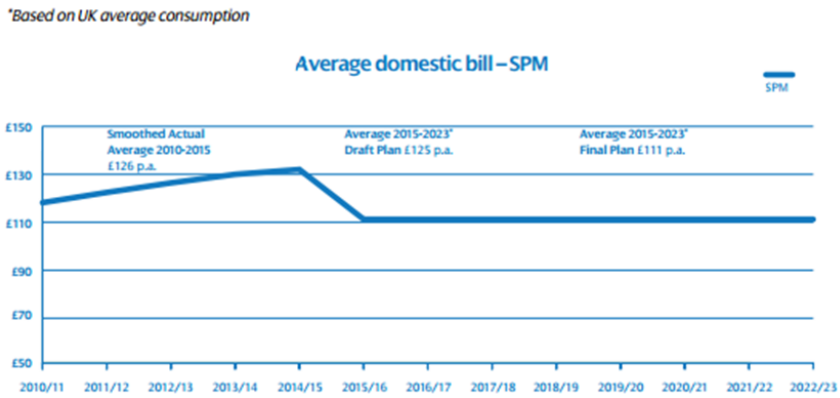

Figure C-5: Average Domestic Bill - SPM

Another significant cost is Environmental Charges associated with Government programmes to save energy, reduce emissions and tackle climate change. They also include social programmes like the Energy Company Obligation. Environmental and social programmes also affect consumers' bills in a more indirect way via their impact on things such as the amount of energy which households use, and wholesale electricity prices.

Future Tariffs

Future energy bills paid by UK households have been estimated by DECC for 2020 and 2030, in comparison with 2014 and based on an average consumption level of 3,700 kWh for electricity and 15,000 kWh for gas, in a 'Policy Impacts on Prices and Bills' paper published in November 2014[47]. This includes the impact of energy and climate change policies in each of the years analysed. On average, DECC's calculations show that the bill savings delivered through policies are expected to more than offset the costs of investing in energy efficiency and decarbonising the electricity sector. DECC has estimated that current energy and climate change policies have reduced typical consumers' combined gas and electricity bills by around £90 in 2014 compared to the modelled case where no policies had been implemented. This is a 6% reduction. They also forecast that households will be consuming 29% less electricity in 2020, with the overall bill £92 less in 2020 than it would otherwise have been if no policies were introduced. **Figure C-6** and **Table C-1** below show the estimated average energy bills paid by UK households in 2014, 2020 and 2030 and the impact of energy and climate change policies in each year.

The energy efficiency savings delivered through policies such as Smart Meters, ECO and the Green Deal, Products Policy, and Building Regulations are expected to increase to 2020, continuing to more than offset the costs of policies on bills, on average. Policy costs on household energy bills are estimated to increase to an average of around £188, of which £92 is support for low-carbon generation (small-scale feed-in Tariffs (FITs), the Renewables Obligation (RO) and the Contracts for Difference (CfD)), the costs of which are controlled by the Levy Control Framework (LCF). However,

47 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384404/Prices__Bills_report_2014.pdf

according to the DECC calculations, these are more than offset by the savings from policies in 2020 (£276), leading to the overall savings of £92.

The estimated bill savings are lower in 2030 because the analysis does not include any new or continued energy efficiency policies that may be needed in order to meet future carbon budgets. However, the full costs of policies to decarbonise electricity supplies (such as Electricity Market Reform (EMR)) out to 2030 are included. To meet longer-term emissions goals it is envisaged that further energy efficiency policies would need to be introduced to help households to make greater savings.

Real 2014 prices	2014	2020	2030[32] (See footnote)
Average **gas bill** without policies	£832	£778	£897
Average **gas bill** with policies	£783	£713	£795
Impact of policies on average **gas bill**	-£49 (-6%)	-£65 (-8%)	-£102 (-11%)
Average **electricity bill** without policies	£627	£633	£689
Average **electricity bill** with policies	£586	£606	£729
Impact of policies on average **electricity bill**	-£41 (-7%)	-£27 (-4%)	£40 (6%)
Average energy bill without policies	**£1,459**	**£1,411**	**£1,586**
Average energy bill with policies	**£1,369**	**£1,319**	**£1,524**
Impact of policies on average energy (gas plus electricity) bill	**-£90 (-6%)**	**-£92 (-7%)**	**-£62 (-4%)**

Table C-1: Summary of estimated average impact of policies on household gas and electricity bills (inc. VAT)

Figure C-6 : Estimated household energy bills with and without policies

The DECC calculations should be treated with caution, since in practice, ECO and other energy efficiency measures have been shown to deliver vastly lower than predicted savings[48].

In addition to the above analysis from DECC, WSP | Parsons Brinckerhoff has carried out some high level analysis to determine approximate projections of the domestic retail price of electricity. This analysis builds upon the published wholesale electricity price projections in the National Grid 2016 Future Energy Scenarios document, along with the limited Ofgem analyses and the bill impact for the Manweb area that was presented by SP Energy Networks in its 2015-2023 Business Plan. The wholesale costs have been increased according to the 2016 FES projections, with the network, environmental and operating cost elements kept constant. The VAT and pre-tax margin elements were each fixed at 5%. The results of this analysis, in 2014 prices, are presented in Figure C-7 for National Grid's base case wholesale price projection. The increase of the wholesale costs from £232 in 2015 to £336 in 2040 results in an increase of the electricity bill from £609 to £698. For the low and high wholesale price projections the electricity bill increased to £651 and £806, respectively, in 2040.

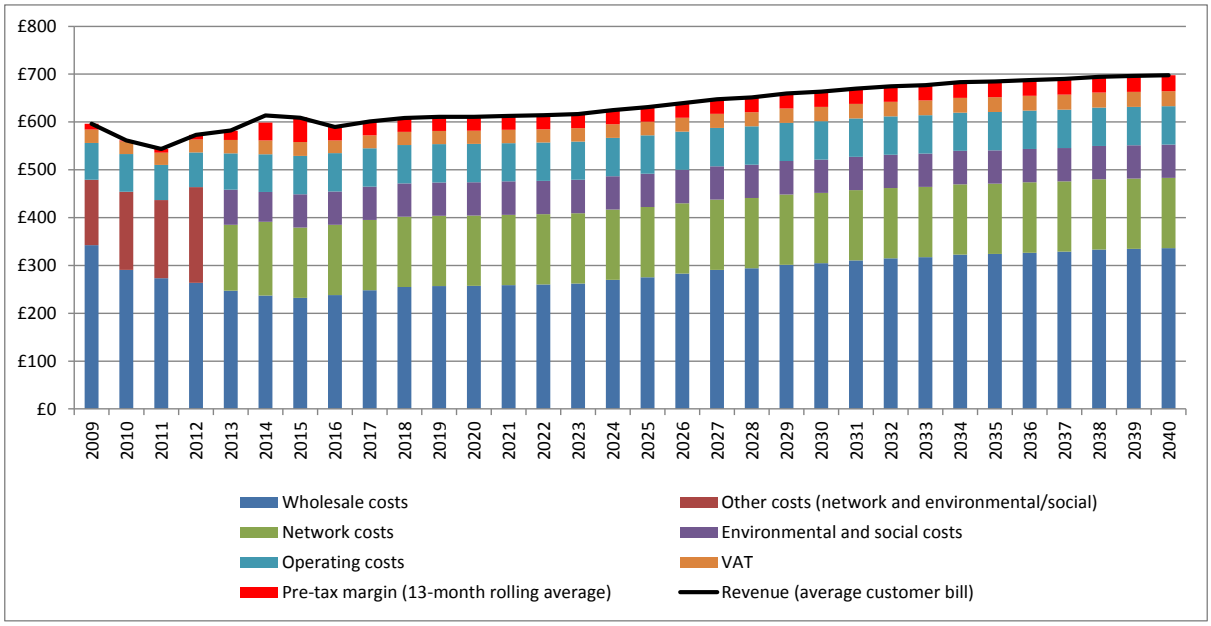

Figure C-7: WSP | Parsons Brinckerhoff projected breakdown of domestic electricity bills over time

48 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/260040/National_Energy_Efficiency_Data-Framework_November_2013_Part_II.pdf

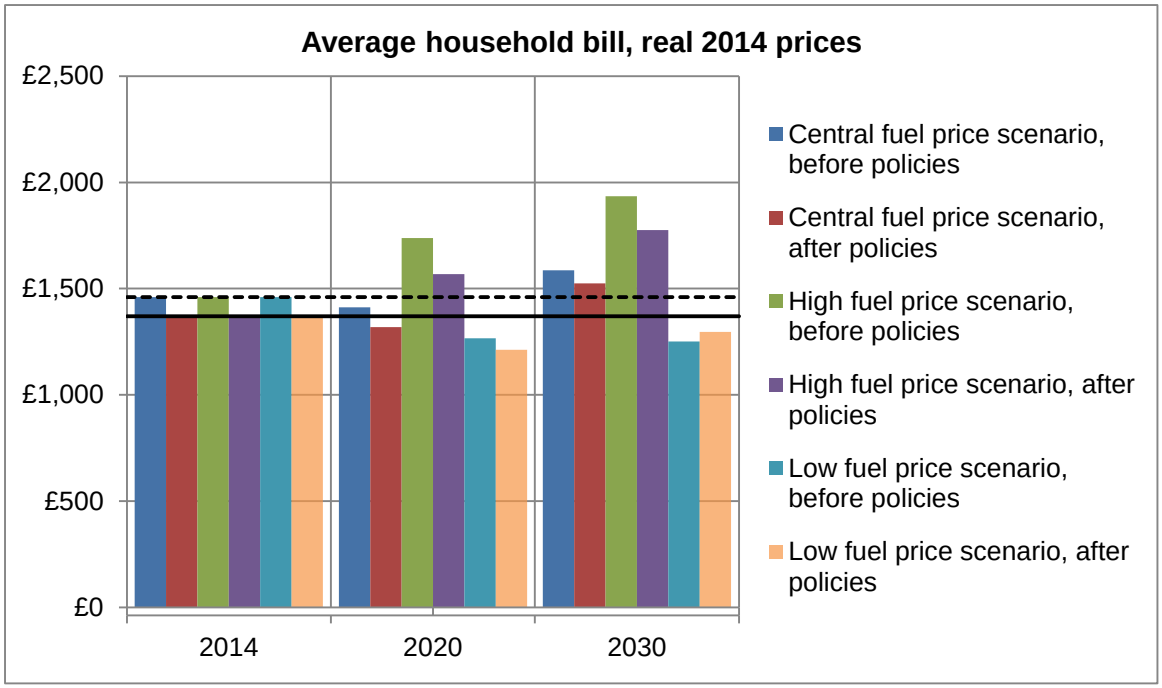

Figure C-8: Household bills for different scenarios

The DECC 'Policy Impacts on Prices and Bills' paper also presents analysis of the impact on business users in the following categories:

- Small business users
- Medium-sized business users in the CRC
- Large energy intensive industrial users eligible for the full package of support
- Large energy intensive industrial users not eligible for any support measures other than the CCA discount on the CCL and reduced CPS rate

In summary, for medium-sized businesses presented in Table C-2, DECC policies are expected to increase electricity bills by 35% on average in 2014, 50% in 2020 and 59% in 2035. It can be seen that DECC policies could have a significant impact on business user electricity prices. It should be noted that this is the underlying trend for the effect of national policies, and is not expected to discriminate against businesses in Liverpool.

The table also gives an indication of how DECC envisaged in 2014 that electricity prices for medium size business users would increase, however this should be treated with care, given that predictions for wholesale prices have changed.[49]

49 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384404/Prices__Bills_report_2014.pdf

Real 2014 prices, £	2014	2020	2030[78] (See footnote)
Average **gas bill** without policies	420,000	460,000	550,000
Average **gas bill** with policies	480,000	450,000	560,000
Impact of policies on average **gas bill**[79]	60,000 15%	-10,000 -1%	10,000 2%
Average **electricity bill** without policies	820,000	900,000	1,020,000
Average **electricity bill** with policies	1,100,000	1,350,000	1,620,000
Impact of policies on average **electricity bill**	290,000 35%	450,000 50%	600,000 59%
Average energy bill without policies	**1,240,000**	**1,360,000**	**1,570,000**
Average energy bill with policies	**1,580,000**	**1,800,000**	**2,180,000**
Impact of policies on average energy (gas plus electricity) bill	**350,000** **28%**	**450,000** **33%**	**610,000** **39%**

Table C-2: Summary of estimated average impact of policies on gas and electricity bills (inc. VAT) for medium-sized business users

Conclusion on Unit Cost of Energy

In the short term, domestic energy suppliers are under pressure to cut prices in response to drops in wholesale prices. SP Energy Networks indicates that these are coupled with constant infrastructure costs for transmission and distribution network operators over the same period.

In the medium to long term, electricity prices are set to adopt a steady increasing trend. This reflects the fact that there are many cost components that make up consumer bills that are outside of the control of the supplier and likely to rise in the long term. Analysis based on 2016 FES projected wholesale electricity prices, and assuming no change to other elements such as network costs in real terms, indicates that the average domestic electricity bill may increase to between £651 and £806 in 2040 (in 2014 prices).

Projected increases in the wholesale cost of electricity are partly due to much of the UK's electricity generation being closed down due to the EU's Large Combustion Plant Directive. This directive targets coal fired power stations due to a focus on reducing emissions in energy generation.

There is uncertainty involving the effects of the UK Brexit vote on EU energy policy adopted by the UK. It is expected however, that very little will change for the UK in terms of the EU policy it has in place for climate change. This is predominantly because the UK led the way on environmental legislation and proposed many of the steps that Europe subsequently adopted. There are still many issues remaining in Britain and other European countries but it is expected that Brexit in itself would have very little effect.

The most effective way for consumers to guarantee a reduction in bills is through energy efficiency improvements. It is important to consider the energy trilemma here, by considering the balance between security of supply, affordability and sustainable energy targets. Rollout of smart metering will make information available to customers about their consumption of electricity and potential savings that may be within their control from shifts of usage patterns in the future.