Future Heat Series
Part 2

Policy for Heat: Transforming the System

A report by
Carbon Connect

Written by Owain Mortimer & Michael Boyle.
With special thanks to Fabrice Leveque.
October 2015

THIS REPORT CALLS ON THE GOVERNMENT TO SET OUT POLICIES TO DECARBONISE THE HEAT SECTOR.

Jonathan Reynolds MP and Rebecca Pow MP, Policy for Heat Co-chairs [October 2015]

CONTENTS

FOREWORD

This report calls on the new Government to set out the policies it will use to decarbonise the heat sector over the coming decades. Building on the conclusions and recommendations of the first report in the Future Heat Series, *Pathways for Heat*, *Policy for Heat* considers the different policy options open to the Government for pursuing low-carbon heat, including enhanced energy efficiency in existing buildings, the expansion of district heating networks, the decarbonisation of the gas network and the devolution of responsibility and control for heat networks to local authorities.

Policy for Heat considers these policy options in the context of the Climate Change Act's legally binding carbon targets. The Committee on Climate Change's 2015 Report to Parliament concluded that 'significant action' is needed for the UK to meet the necessary emissions reductions of the Fourth Carbon Budget. This report supports the Committee's findings and argues that decarbonising heat for buildings through a multitude of technologies presents the UK with an exciting opportunity to help close the 'carbon gap' at least cost to the taxpayer. Committing now to a dedicated programme of decarbonisation will help lower energy bills for families, kick start innovative new sectors of the economy and support vital progress in meeting the Government's fuel poverty reduction targets for England.

Heating the nation is a complex task, with many local geographical and economic factors determining what can and cannot work in different locations. The report therefore recognises that any national heat strategy must be supported by a diverse range of local plans and that there may be an argument to be made in favour of local authorities being given the powers and resources to begin to implement low-carbon roadmaps tailored to local needs. This fits well within the Government's broader drive for more extensive devolution and could result in the development of new, innovative and world leading solutions to the challenges of low carbon heat.

Following the Government's recent policy changes at the Department of Energy and Climate Change there is a real opportunity for a fresh start in this area, learning the lessons from the last Parliament and retaining what is best while leaving behind models which did not return best value for public expenditure or the environment. This report strongly concludes that there are valuable lessons to be learnt from the experience of the last five years and that there remains merit in many of the ideas experimented with in that period, such as the establishment of a Pay-as-you-Save architecture for retrofit energy efficiency home improvements. The Autumn Spending Review, coming at the start of a new Parliament, gives the Government a chance to establish an affordable, long-term roadmap for decarbonisation and set the tone of policy for the next decade, further establishing the UK as a world leader on climate change and low carbon policies ahead of the COP21 in Paris this December.

A key lesson learnt from the passing of the Climate Change Act is that the UK can make remarkable progress when political leaders join together across party lines and commit to long-term goals vital to the country's national interest. We believe that a resilient, affordable and sustainable heat sector is one of these vital interests and call on all political leaders to follow up on the example of the pre-election Joint Climate Change Agreement by engaging

with industry to develop a clear roadmap that can guide heat policy until at least the end of the fourth carbon budget in 2027.

Input, evidence and opinion has been sought from industry professionals, academics, Parliamentarians and civil servants, through a series of discussion events, interviews and written submissions. We are grateful to all those who contributed their time and expertise to this inquiry and in particular we thank IGEM and Energy and Utilities Alliance for the support they have provided, without which this report would not have been possible.

Future Heat Series Co-Chairs

Jonathan Reynolds MP

Rebecca Pow MP

EXECUTIVE SUMMARY

Across most pathways, mass deployment of low carbon heat solutions ramps up from 2025-2030. We need to spend the next decade preparing for mass deployment by developing a robust strategy whilst testing and scaling up delivery models. This report calls for the next Government to prioritise these preparations in the same way that preparing for power sector decarbonisation has been the overriding focus of energy policy in the past decade. Carbon Connect advocates an "all of the above" approach to decarbonising heat, which will provide real flexibility to decarbonisation in a cost effective way.

Roadmap

Currently there is no visibility of specific policies driving low carbon heat supply and energy efficiency retrofit beyond the next 1-2 years. There are long-term targets in place for carbon and fuel poverty reduction, and the Government must show greater ambition and leadership to achieve these. It takes time to design and implement new policies and legislation as well as building up supply chains and changing consumer attitudes, meaning long-term planning is essential to success. This Parliament will be a crucial period in which to prepare policies, regulation, industry and consumers for the more rapid decarbonisation of heat that will need to take place in the 2020s.

The Committee on Climate Change has stated that the Government's current low carbon policy framework will not deliver the carbon savings that will be required beyond 2020. Extending current policies into the 2020s will not deliver the emissions savings required to meet the fourth carbon budget period (2023 – 2027), as annual emissions are estimated to be around 45 million tonnes CO_2 (or 18 per cent) above the level of the budget. A greater driver for change is needed, one which provides clarity over the long-term direction of travel and contains clear timescales and objectives for the testing of new policies, delivery models and the deployment of solutions.

Decarbonising heat will require greater involvement of local authorities, who have access to much of the information, and some of the powers, required to execute local heat decarbonisation strategies more accurately. There is also a significant gap between what existing funded policies are expected to deliver and the Government's 2020-2027 policy targets for reducing carbon emissions and increasing the use of renewable energy.

A significant increase in activity within this Parliament is needed to ensure that ambitious policies and frameworks are in place as soon as possible

Energy Efficiency

The UK must reduce its energy consumption and one of the most cost effective ways of doing this is by improving the energy efficiency of the nation's building stock. Improving energy efficiency helps increase the sustainability, resilience and affordability of the energy system and can help bring down carbon emissions and reduce fuel poverty. However, despite the legislative efforts of the Climate Change Act (2008) and the Energy Act (2013), the UK has a relatively low installation rate of retrofit energy efficiency measures and struggles at assessing the efficacy of its policies. Partly as a result of this, an estimated four million

households in the UK in 2011 were unable to afford to heat their homes[1]. According to the Government's own figures and definition of fuel poverty, this figure was 2.3 million households in England alone in 2012[2]. It is clear more needs to be done to target energy efficiency spending at fuel poor households.

Retrofit energy efficiency in buildings is a key part of many low carbon, low fuel poverty pathways and it is an essential part of the UK's future heat and electrical infrastructure mix.

There has been some progress in recent years with energy saving in retrofits, such as developments in the skills of the UK energy efficiency workforce, the drafting of the Private Rented Sector Regulations and mortgage providers beginning to take a greater interest in energy efficiency. There is still debate about what impact the coming roll-out of smart meters will have. However, there remain challenges; recently (2015) there have been two huge setbacks in energy efficiency of UK buildings, first being the announcement of the ending of the pay-as-you-save finance mechanism for consumers, in the form of the Green Deal; and secondly the removal of the Zero Carbon Homes Standard.

Part of the retrofit challenge is the large range of options for what can be done to each property, and mandated performance checking could help establish the best options and technologies for different situations. It would allow much better targeting of energy efficiency measures and would also allow mechanisms to be considered to encourage householder action. The Health Economic Evaluations Database (HEED) attempts to record that information, but not enough research is being done on why technologies give the results they do, with the Government having little willingness to conduct research beyond a basic assessment of whether measures work. This prevents the learning cycle from being completed. The Government should instead look to set out an energy efficiency roadmap, with a scheme for the able to pay sector and a separate focus on fuel poor households.

The deployment of energy efficiency retrofit programmes is another issue that needs to be revisited, especially in the case of fuel poor households. The ECO has been shown to be failing when it comes to targeting fuel poverty. Local authorities, working with utility companies, could be the central player in the provision of retrofit schemes. They could be an effective hub of collaboration and project management due to the access to certain data they possess. Also the link between energy efficient homes that are warm and comfortable, and the health and well-being of the occupants is well proven, and represents another reason why local authorities need to take the lead in heat. Carbon Connect advocates local authorities being given control of fuel poverty energy efficiency projects, with the ECO after 2017 being used as a central, pot funded by a fixed levy on utility bills, and accessed by local authorities.

Energy efficiency needs to be part of the infrastructure debate, with emphasis on retrofit energy efficiency. The scrapping of the Code for Zero Carbon Homes has also created a need to revisit the new build sector as well. When it comes to heating buildings, investments in nuclear, renewables and other low carbon energy systems have increased viability when combined with a strong and effective energy efficiency programme. New energy efficiency policies should also be better integrated with renewable heat policies and this could be through multi-skilling and training for installers, improved information sharing between the energy efficiency and renewable heat industries, and integrated supply chains. The Government should do more to improve feedback and performance checking on work that is done to help establish the best use of public funds, which could inform an effective, integrated energy efficiency and renewable heat policy in the future.

[1] Friends of the Earth (2011) Cold homes, health, carbon emissions and fuel poverty
[2] DECC (2014) Annual Fuel Poverty Statistics Report, 2014

The energy efficiency sector currently faces many challenges. Policy uncertainty and lack of direction is causing problems for industry. There are many other issues that need to be considered when looking at the future of energy efficiency policy as well, such as the role of local authorities; the need to treat energy efficiency as an infrastructure priority; the implications of smart meters; and the role of regulation. These will all have a big impact on the type and efficacy of any energy efficiency schemes the Government introduces, and the potential impact private sector incentives will have on energy efficiency improvements.

RHI

One of the key questions facing future heat policy is how best to encourage and support the deployment of low carbon heat supply. The Government has made a good start with the introduction of the Renewable Heat Incentive (RHI) but much remains to be done to increase uptake of low carbon heating in both non-domestic and domestic buildings. Carbon Connect calls on the Government to prioritise the increase in renewable heat, and to extend the RHI beyond 2016 to 2020. It is also necessary to have a long-term strategy in place beyond 2020. This is crucial in order for the UK to meet the 2050 carbon targets.

The RHI has not realised the uptake figures originally projected. At current levels, the RHI is not effectively driving low carbon heat. The recent scrapping of the zero carbon homes standard and the Green Deal energy efficiency scheme has created even greater pressure for the RHI to deliver. However, as currently constituted, the RHI is not designed to encourage a widespread deployment of low carbon heat technologies but rather is designed to foster more practical experiences of renewable heat options.

Changes are therefore essential for the RHI to be an effective tool for growing renewable heat options and decarbonising the gas system. Should the Government keep the RHI as currently structured the legislation behind it has to change, otherwise the market will not grow. Success will require a successful balance of incentive and regulation. It is important to incentivise individual households, businesses and organizations to invest in the technologies on offer. The incentive could either be in the form of tariff payments or upfront costs, or a combination of both. Further Government efforts would likely need to be supported by new revenue streams, such as a carbon tax. A carbon tax would face political difficulty, but organisations such as the Committee on Climate Change[3] have argued some form of a uniform carbon price across fuels introduced to the UK economy may become an unavoidable part of the UK's carbon reduction efforts as carbon budgets get tighter, and an early introduction could allow the Government to mitigate long-term economic impacts. This could be coupled with regulations to provide quality controls and market interventions, for example banning a certain technology from being installed after a certain time, like in the case of condensing boilers.

The RHI is a positive policy action which if it were to continue, with some alterations and improvement, could become a more effective policy. Any renewable heat policy the Government chooses to implement will need to encourage a more diverse set of technologies while continuing to support the technologies currently able to provide carbon savings. We call on the Government to confirm the RHI, or a replacement low carbon heat policy, to 2020 at the earliest, and for plans to be put in place for the post-2020 period in order for the UK to decarbonise heat for buildings, and keep the UK on track to meet the 2050 carbon targets.

[3] The CCC (2015) Progress Report to parliament

District Heating

District heat networks currently have a market penetration of 2 per cent in the UK. This figure has changed little over the last 44 years. The development of district heat networks has been too slow in the UK, with a lack of an overarching strategy from the Government. Decision makers are still reinventing procedures and trying to overcome obstacles, when it should have possible for networks to have been developed earlier and faster. There have been some signs of the situation improving in recent years, partly due to the increasing obviousness of the benefits of district heat networks and their associated add-ons for local authorities, as well as district heat's relevance to the debate on decarbonisation. These factors have seen the development of the Heat Network Delivery Unit (HNDU). A crucial short-term goal for developing district heating has got to be encouraging growth in the market more effectively with more private investment and reduction in capital costs. This could be helped by developing a district heating strategy for the country, and developing more feasibility and capacity studies.

With devolution still a key political aim of the Government, local authorities again could have a key role in developing and leading district heating projects. Carbon Connect believes the extending of the HNDU's remit to include support past feasibility stage of projects and up to the point of purchase could help bridge the skills gap in LAs and help develop capacity. There is still considerable opportunity for district heating to supply heat economically to many areas of the country. But this will require improved feasibility, design, construction and operation to achieve real costs and carbon reductions in practice. The potential role for local authorities goes beyond financial support. They are well placed to act as facilitators for district heat development, through identifying potential anchor loads and low-carbon heat sources for future networks, establishing bespoke finance mechanisms for private investors and require developers to work with each other to create integrated, efficient networks.

District heat faces the challenge of getting new infrastructure built as well as switching consumers from incumbent technologies. As heat networks grow, policies will also need to ensure that sources of low carbon heat are available to supply them. There needs to be better coordination of the rollout of district heating, and specifically of the anchor loads and sources of heat. There needs to be a strategic plan for the development and use of Combined Heat and Power (CHP) generation and other heat sources and more should be done to develop the possibilities remaining for the use of waste heat.

The reintroduction of targets for the roll-out of district heat networks is recommended. It was argued that clear-goals were necessary to measure the success of Government initiatives and that progress has been slowed by the lack of a clear Government target and timeline for implementation. This would need to be coordinated with any renewable/low carbon heat policy.

The role of regulation on district heating is unclear at the moment. Many in the industry have cautioned the Government against introducing top down regulation at this stage, suggesting that excess regulation would have a negative effect on the still small market at present. There is a need to improve standards in the sector through better training and guidance. Local authorities could facilitate this by incorporating guidance and accreditation into their contracts with network suppliers. Positive developments in this area include the recent publication of the Chartered Institution of Building Services Engineers (CIBSE) voluntary Heat Networks Code of Practice which aims to ensure heat networks are well designed to a set of common standards.

Networks

With changes needed in the heat systems, the role of the electricity and gas networks will be changed. The gas networks play a vital role at present, but in many pathways face a reduced role in a decarbonised heat system. Being re-purposed to carry low carbon gases such as SNG, hydrogen or bio-methane is seen as the main option to remain a vital part of the system in the long-term. It could also provide crucial support to the electricity network in terms of decarbonisation, if it were able to adapt relatively quickly.

The significant uncertainties regarding the availability and costs of the different low carbon gas energy solutions in the future, as well as their best uses in the energy system justifies more investment to understand the cost of producing and distributing alternative low carbon solutions. This has big implications for the role of CCS in the UK, where urgent progress is needed, particularly if SMR technology is to be used.

More funding innovation is needed to encourage progress in low carbon gas deployment. One option could be to require gas suppliers to contribute funding and research and development, rather than just the distributors. There is a need for innovative policy frameworks and regime changes, such as differing policy regulation regimes for different green gases based on their needs.

There needs to be a better link between research and innovation in low carbon gases and long-term investment in the gas network, to ensure decisions taken now are compatible with future strategies. This should also mean increased coordination with local authorities when it comes to planning network investment, as locally planned heat strategies are able to be more accurate and reflect the true need of communities by integrating the appropriate solutions.

With many future energy pathways in the UK relying heavily on the electrification of heat, there is a need to re-inforce the electricity networks. Local energy plans will need to take into account information regarding the costs and feasibility of upgrading electricity networks, requiring coordination between local authorities and network operators. Smart-grid technologies will help manage impacts on electricity networks as well as unlock other benefits such as demand side response and distributed energy storage. Innovation activity should also be coordinated with local plans to ensure that information and learning is captured and reflected in local strategies. Managing demand will also be a high priority.

Better modelling on the economic value of gas storage capability for UK plc is needed. Assessments of gas' future role in the energy mix must utilise a 'whole model system' which takes into consideration energy storage value. This could result in more information and education for the public as well as increasing consumer engagement around technologies such as hydrogen gas, enabling an 'all of the above' approach to decarbonisation where the gas network is working alongside other systems.

Coordination

Any successful decarbonisation strategy will need to be coordinated between local and national levels. There needs to be greater integration between approaches to energy efficiency, fuel poverty and renewable heat plans. With clear targets from central Government, local authorities could be well-placed to coordinate and collaborate with others to develop local strategies and plans. Narrowing geographical scope makes it easier to increase the level of detail in other areas, such as spatial, energy network and building stock information. This can help ensure that the important interactions between energy efficiency

improvements, deployment of low carbon heat and their impact on energy networks are captured within decarbonisation plans.

Local authorities are well placed to develop local strategies and plans, with access to information, an existing base of expertise in relevant areas and control over important levers such as planning, and business rate and council tax setting powers. They can work across policy agendas including fuel poverty, health and economic growth to produce holistic local plans.

Devolving responsibility for policies to tackle fuel poverty to local authorities could improve delivery, as explored in Chapter 2 on energy efficiency, and drive a more integrated application of heat supply and energy efficiency schemes. This would help build capacity within local authorities as well as local supply chains, enabling more ambitious programmes in the 2020s.

A locally focussed approach to fuel poverty could be designed to include low carbon heat supply. Placing greater responsibility for local heat policy on local authorities would mirror current moves to devolve power away from central Government, for example the recently agreed deal to hand greater control over transport, housing, planning and policing to the Greater Manchester Authority. Statutory responsibility for delivering fuel poverty and carbon targets could be placed with local authorities to ensure that there is a driver to accompany new powers. Many local authorities have already set their own carbon reduction targets, but these are not currently coordinated with national carbon budgets and they should be.

Low carbon 'heat zones' are one possibility for trialling the design and delivery of a comprehensive heat decarbonisation plan covering heat supply and energy efficiency of publicly and privately owned buildings both new and existing.

Central Government will have an important role to play in ensuring that local authorities are supported with the adequate skills, knowledge and resources to plan and implement local heat strategies. Take up of this option would be encouraged by extending the remit of the HNDU beyond the feasibility stage of district heat projects to ensure local authorities have the support necessary to implement plans.

Central coordination would ensure that knowledge is shared between projects and help authorities to avoid duplication, reduce costs and to provide strategic direction. Better coordination of the funding opportunities available for developing innovative low carbon solutions is also needed.

Control over certain elements of a strategy for heat will always best remain with central Government. These include the wider impacts of local strategies on energy networks, funding for innovation and market frameworks. Central Government may also have an important role ensuring the best strategic use of limited but flexible resources such as biomass and bio-methane across the energy system.

Funding and Finance

The Government is currently moving in the wrong direction for low carbon investment and financing. With the cancelling of the Green Deal, the Zero Carbon Homes Standard, and changes to renewable power funding, the UK has too much uncertainty for investment in the renewable heat, and energy efficiency markets to grow effectively, thereby blunting the UK's ability to meet 2050 carbon targets.

Whatever replaces the ECO will have to be more ambitious and more effective at targeting fuel poor households if the Government is to achieve its fuel poverty targets.

Alternative funding streams which are more adaptive to changes in the energy market need to be established for the future. For instance, the IEA has proposed an automatic mechanism that reallocates funding from fossil fuel subsidies to renewable sources when the oil price falls. Longer term financing frameworks to encourage the take-up of low carbon heating will also need to be considered over the next Parliament, for instance for low carbon gas deployment, district heat networks and electric heating solutions.

Ensuring decarbonisation of heat for buildings is achieved at least cost to the taxpayer and consumers requires the various costs of low-carbon heat options to be considered alongside the cost of decarbonising electricity sources and network maintenance. Further comparisons are needed on the relative costs and benefits of funding energy efficiency and funding low carbon heat technology. The comparative abundance of work done on the abatement costs of energy efficiency products contrasts with the relatively small amount of research undertaken on abatement costs of decarbonising heat generation at source. In order to effectively decarbonise buildings 'at least cost' the Government must show a degree of leadership and commitment to a clear, long-term decarbonisation pathway, as it is this commitment that will encourage industry to do the work needed to find cost-savings.

New, innovative funding methods are needed if the Government is going to encourage the uptake of low carbon heating solutions in the UK, grow markets and achieve cost-effectiveness and financial sustainability in the long-term. Lowering interest rates on a pay-as-you-save financing system and revenue decoupling for energy companies are two such suggestions.

Local authorities could be required to introduce and deliver low-carbon heat strategies from 2017 as part of a replacement for the ECO. Any new duty placed upon local authorities would likely have to be supported financially, either directly from central government or from some other source, such as a continued levy on energy bills.

Innovative methods of deployment are also required. There are opportunities for the community energy model to be applied to domestic heat, particularly for district heating and 'whole-community' retrofits. The Government could accelerate this by introducing a requirement for all mortgages taken on properties below a minimum EPC rating to be accompanied by an energy efficiency improvement plan. The Government could support this by expanding the Help to Buy scheme to include these improvements or by offering Stamp Duty relief on more energy efficient properties, allowing lenders to develop their own practices for improving energy efficiency.

Finally, further comparisons are needed on the relative costs and benefits of funding on energy efficiency and funding for low carbon heat technology.

Progressively cutting carbon emissions whilst keeping energy affordable and secure will require a drive towards a wholesale transformation in the way we heat our homes and buildings. There is no single-technology solution to cutting emissions from building heat. Energy efficiency, gas, electricity and district heat all have something to offer on the journey to a future with warmer, more comfortable and lower carbon homes and buildings.

RECOMMENDATIONS

1. The Government must urgently develop a cross-party, low-carbon heat roadmap to 2050, outlining a strategy and timeline for policy and phased regulation.

2. The replacement for the ECO must be announced before the obligation's expiration in 2017, in order to prevent a damaging hiatus for the energy efficiency industry.

3. The Government must confirm the extension of the RHI to 2020 at the earliest possible opportunity. Heat for buildings needs to be tackled, and cannot be ignored.

4. The Government should extend the remit of the HNDU beyond the feasibility stage and set clear targets for district heating deployment.

5. The Government ought to develop a long-term strategic plan which increases its understanding of the capabilities of low carbon gases like hydrogen and supports new developments in their use.

6. Local Authorities need to be more involved with the planning of low carbon heat and energy efficiency delivery programmes.

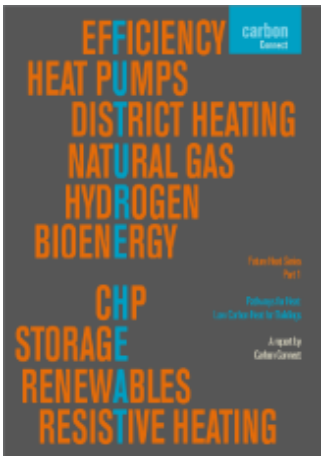
7. Greater imagination is needed from decision makers on how decarbonisation will be financed, with multiple approaches and opportunities ready to be exploited.

8. The regulatory requirements of district heating ought to be reviewed to ensure they are striking the right balance and not unnecessarily constraining growth, particularly in the areas of finance, customer protection and supply competition.

9. Further comparisons are needed on the relative costs and benefits of funding energy efficiency and funding low carbon heat technology. There are big variations in carbon savings resulting from different renewable technologies, and the ones with the highest benefit should be exploited first.

INTRODUCTION

Policy for Heat: Transforming the System



This report looks at the policies needed for the UK to decarbonise the way it heats homes and buildings. Electricity has dominated energy policy, but around half of all energy consumed in the UK is for heat, which is predominantly fuelled using gas. The series will set heat policy as a priority for the next Government, raising awareness of the relative importance of heat, the huge challenge of decarbonising heat whilst keeping bills affordable and the current 'gap' in energy policy. It is the second report in the Future Heat Series, a series of independent inquiries exploring how heat for buildings could be decarbonised and the policy options to achieve this.

The first inquiry of the series reported in November 2014. Pathways for Heat: Low carbon heat for buildings, compares different decarbonisation pathways for the sector by six organisations (DECC, the CCC, ETI, National Grid, UKERC, Delta EE), exploring the role of different solutions and identifying the key transformations needed to decarbonise the sector.

Having identified some of the key transitions that will be needed in the previous report, *Policy for Heat* explores the implied policy challenges, where existing policy is taking us and what options there are for new policy for the Government in order to move towards decarbonising heat for buildings in the UK. Lowering the carbon intensity of the heat sector is crucial if the UK is to meet its 2050 carbon target, with 46 per cent of the final energy consumed in the UK is used to provide heat. Of this heat, around three quarters is used by residential households and in commercial and public buildings. There are significant gains to be made in implementing policies to reduce the carbon emissions of heating for buildings in the UK beyond the carbon targets.

Heat is still an underdeveloped area of energy but the amount of new analysis from Government, academia and industry is growing. *Pathways for Heat* reviewed these and provided a policy-focused overview and assessment, highlighting areas of consensus and uncertainty. It identified and analysed the key areas the Government should be focusing on in order to provide the most cost-effective carbon reductions in heat for buildings. These include energy efficiency, district heating, decarbonisation of the gas system, and the Renewable Heat Incentive (RHI). This was the first step in debating and developing policies that meet the challenge of a wholesale transformation of heating in homes and buildings by 2050, and we will look to continue this work and tie the key areas into a coherent policy strategy, whilst considering the fundamental questions around coordination and possible funding and finance options.

A major focus of our previous work programme, the Future Electricity Series, was building political consensus and highlighting its value for securing investment. With policy to support decarbonisation of heat at a much earlier stage than for electricity, the Future Heat Series aims to build consensus from the start of the process, politically and across industry.

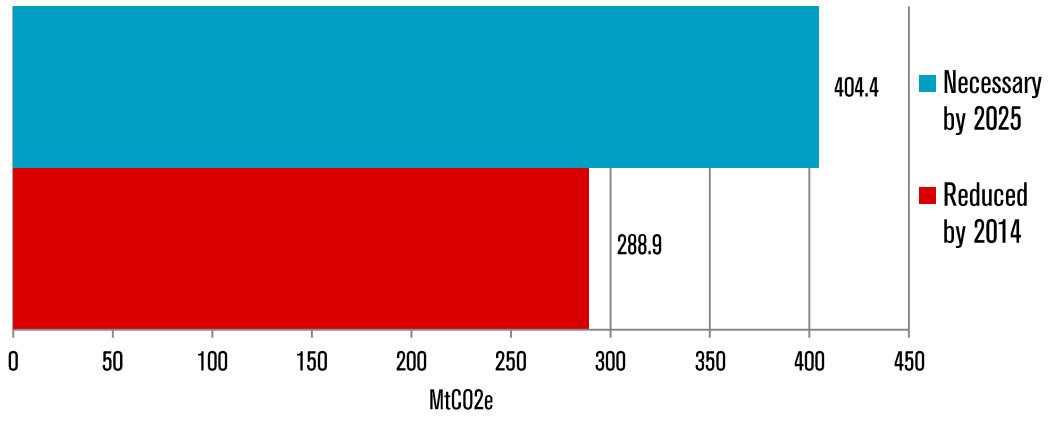
1. ROADMAP

Although good progress has been made in recent years on gaining a better understanding of the challenges involved in decarbonising heat, there is little clarity from Government regarding the medium and long-term direction of travel for the sector. There is currently no visibility of specific policies driving low carbon heat supply and energy efficiency retrofit beyond the next 1-2 years. The RHI has guaranteed funding until only March 2016 (£430 million budget cap for 2015/16[4]), and the Energy Companies Obligation (ECO), is currently only guaranteed to run until March 2017 (levy funded, costing around £1.3 billion each year[5]). Delivery of these schemes has also been below expectation, with slow insulation rates under ECO and the Green Deal, and slow delivery of low carbon heat under the RHI[6].

There are long-term targets in place for carbon and fuel poverty reduction, and the Government must show greater ambition and leadership to achieve these. It takes time to design and implement new policies and legislation, to build up supply chains and change consumer attitudes. This new Parliament will be a crucial period in which to prepare policies, regulation, industry and consumers for the more rapid decarbonisation of heat that will need to take place in the 2020s.

Carbon Budgets

Figure 1: The 'Carbon Gap' between current and necessary greenhouse gas reductions



Source: DECC (2014) 2014 UK Greenhouse Gas Emissions, Provisional Figures

As Figure 1 above demonstrates, the Government's current low carbon policy framework is inadequate to deliver the carbon savings that will be required beyond 2020. According to the Committee on Climate Change (The CCC), extending current policies into the 2020s will not deliver the emissions savings required to meet the fourth carbon budget period (2023 – 2027), with annual emissions around 45 million tonnes CO_2 (or 18 per cent) above the level

[4] HM Treasury (2013) Spending Round 2013
[5] https://www.gov.uk/government/news/homes-and-economy-to-benefit-from-energy-and-climate-policies-huhne
[6] CCC (2014) Progress report to Parliament

of the budget. The Committee has identified buildings as one of the most cost effective sectors in which to deliver these additional reductions[7].

A new roadmap for the sector should show how carbon savings under the fourth carbon budget will be delivered, and ensure that sufficient resources are allocated commensurate to the role that heat will play in delivering carbon budgets in the 2020s and beyond. As a minimum, the RHI will need to be extended to 2020, with possible alterations to improve its effectiveness, and a strategy should be put in place post-2017 to deliver the fuel poverty targets recently introduced in England.

Priorities for a roadmap include:

Provide long-term clarity

Greater clarity over the long-term direction of travel, and timescales and objectives for the testing of new policies, delivery models and the deployment of different solutions would provide a greater driver for change than currently exists.

Targeting deployment

There is an urgent need to establish mature supply chains for key low carbon heat technologies such as heat pumps and district heat networks as this will reduce costs and test the feasibility of a wider roll-out. Targeting minimum levels of deployment for key technologies would generate confidence in the supply chain and ensure that the Government's strategy is focussed on trialling and establishing new technologies and delivery models, rather than the current narrow focus on meeting the EU Renewable Energy Directive.

More ambition on energy efficiency

Longer term clarity over funding and ambition is essential for local authority led solutions to tackling fuel poverty and for stimulating greater uptake in the able to pay sector. Feedback from local authority-led projects under the ECO scheme suggests that the short timescales of the policy prevents continuity between projects, which is needed to maintain and build on acquired skills and expertise. Going forward, there may be a case for a continuous funding stream to help local authorities develop their involvement in energy efficiency.

There is a need for the UK Government to follow the example set by their Scottish counterpart and designate energy efficiency as a national infrastructure priority with the targets, milestones and funding necessary for improving efficiency being comparable to that of other infrastructure projects such as the 2012 Olympics or Cross Rail. Retrofit energy efficiency schemes over the past decade have typically lasted only a few years, creating uneven delivery which impacts the supply chain and provides few consistent policy ambitions. Putting in place a longer term framework would provide greater assurance of continuity between policies and administrations, and reduce the potential for disruptive short-term policy changes and interruptions to projects and the supply chain that can lead to a loss of skills.

[7] CCC (2014) Progress report to Parliament

Develop a locally led approach

As section six of this report sets out, decarbonising heat will likely require the increased involvement of local authorities, who have access to much of the information, and some of the powers, required to execute local heat decarbonisation strategies. They are also in a great position to work and coordinate with the private sector, national government and community groups. Significant activity is already being undertaken by some local authorities and the Government should provide greater strategic direction, coordination and support to trial the feasibility of a more locally led approach. This could be initiated by transferring responsibility for fuel poverty targets to these authorities, providing a greater driver for action. The Government should also investigate how such a strategy could be rolled out at a national level, should trials prove successful.

It is crucial that the information gathered from the trials is used as it is currently too early to tell what the most cost effective route to decarbonising heat for buildings will be. There are a number of feasibility studies and trials that are being planned and conducted over the next few years, for example the Department for Energy and Climate Change (DECC) Local Authority Fuel Poverty competition. It would be useful to place these and future planned trials on a timeline with clear structures in place to ensure lessons are learnt and shared, and providing greater certainty for investors that successful trials may lead to further programmes and opportunities. Monitoring the data and learning from the results is a vital step to help establish the best use of public funds and also develop the best option and technologies for different situations.

FINDING 1

A national road map should work in conjunction with local roadmaps drafted by local authorities, with central government setting funding and targets and local authorities determining how to implement solutions that take consideration of local factors.

Renewable Energy Directive

There is also a significant gap between what existing funded policies are expected to deliver and the Government's 2020-2027 policy targets for reducing carbon emissions and increasing the use of renewable energy. The UK is committed to sourcing 15 per cent from renewable sources by 2020, which translates to an ambition for 12 per cent of heat to come from renewable sources by 2020. However, the RHI only has funding committed until March 2016.

Urgency in this Parliament

There is an urgent need to introduce phased regulation, along with a need to think about timelines for decarbonising heat in the UK. If the Government intends to phase out the carbon intensity of heating appliances starting in 2030, there is a need for regulations to stop their installation from 2020 onwards providing a 10 year lifespan. This would require legislation to be introduced in this Parliament.

Roadmap

A roadmap for the policy ideas presented in the report and how they can be implemented alongside/following policies like the RHI, energy efficiency policy (formerly the Green Deal), ECO and new build policy (formerly Zero Carbon Homes) will be developed. This roadmap

will also include suggestions on Government actions to support innovation, consumer demand and supply chain engagement.

Example:

2015-2020	Extend RHI to deliver 12 per cent renewable heat by 2020. Pilot local authority led approach to fuel poverty. Pilot Low carbon heat zones to test local authority delivery of whole area strategies. Set up Heat Network Delivery Taskforce Investigate policies to move on-gas homes to low carbon supply (RHI or other).
2020-2025	Introduce policies to move on-gas homes to low carbon supply. Introduce local approach to fuel poverty. Phase in stricter energy performance standards for Private Rented Sector.

FINDING 2

The Government must urgently develop a cross-party, low-carbon heat roadmap to 2030 and beyond, outlining how funding will be provided and targeted, who will be responsible for carrying out decarbonisation efforts and a timeline for phased regulation. This roadmap should also provide a timeline for moving away from carbon emitting gas to provide certainty to the heat industry. This should help bridge the gap between the delivery rates of existing policy and the UK's long-term decarbonisation and fuel poverty targets.

2. ENERGY EFFICIENCY

Background

There is significant potential to reduce the energy consumption of the UK's existing building stock through improvements to energy efficiency. Total annual emissions from the UK's domestic building stock could be reduced by up to 65 per cent if the full remaining potential to install energy efficiency measures were realised[8].

Much of the 2050 building stock is already standing. On average, residential buildings last longer than service sector buildings, and homes that are standing today are expected to make up around 80 per cent of the housing stock by mid-century. Retrofitting energy efficiency measures is therefore particularly important to reduce heat demand from the residential sector. Only a third of the 2050 service sector building stock is expected to be made up of existing buildings. Therefore driving up energy performance standards for new buildings through regulations will be particularly important in this sector. Given significant uncertainties regarding the feasibility and costs of decarbonising heat supply, reducing heat demand is a low risk strategy. This makes the Government's moves to scrap the Zero Carbon Homes standard and the Green Deal even more disappointing.

Retrofit energy efficiency

Policies targeting retrofit energy efficiency were overhauled during the last Parliament, with the introduction of ECO (Energy Company Obligation), a redesigned supplier obligation and the Green Deal, a pay as you save finance mechanism. Delivery under the Green Deal was disappointing before it was cancelled, and delivery under ECO has also continued to be lower than expected. Installation rates for low cost measures (loft and cavity wall insulation) have slowed in the able-to-pay sector as measures that were previously subsidised were later supported by the Green Deal, which only provided access to finance. Delivery of low cost measures to fuel poor households has also slowed since the transition to the ECO and the subsequent reduction of ambition for the policy. The Government needs to ensure that there is also a focus on the able-to-pay households, which according to DECC official figures make up around 90 per cent of the UK housing stock.

Ambition and strategy beyond 2017

With the Energy Company Obligation (ECO) currently set to end in 2017, and funding to the Green Deal Finance Company (GDFC) already cancelled, effectively ending the Green Deal, there is an important opportunity to reset the UK's strategy for retrofit energy efficiency beyond this period. In the near term there is an urgent need to improve the delivery of highly cost-effective, low cost measures to return to rates achieved under previous policies. Looking further ahead, future carbon and fuel poverty targets imply greater deployment than under current policies.

[8] Element Energy & EST (2013) Review of potential for carbon savings from residential energy Efficiency; Report for CCC

Carbon budgets

Policies beyond 2017 will need to deliver greater carbon savings than current policies in order to meet the Fourth Carbon Budget, running from 2023 to 2027[9]. Analysis by the CCC suggests that energy efficiency measures are amongst the most cost-effective measures to achieve these savings, but that these will not be achieved if current policies are simply extended to 2020[10]. Measures such as solid wall insulation could help deliver a significant proportion of the additional savings required to meet the fourth carbon budget, and there is an urgent need to pilot new approaches to delivering this measure to reduced costs and to establish the feasibility of a larger scale roll-out.

Fuel poverty targets

Meeting the recently introduced fuel poverty target for England[11] will require policies with increased ambition and greater funding than the under the present policy, the ECO[12]. Funding for retrofit energy efficiency through ECO could in future be prioritised on the fuel poor, combining the delivery of both carbon and fuel poverty targets. With the ECO currently due to end in 2017 there is an opportunity to increase the focus on fuel poor households. There is evidence to suggest that the ECO scheme is failing to effectively target and reach households in fuel poverty. Some estimates suggest that the elements of the ECO specifically designed to alleviate fuel poverty has failed to do so, with only small percentages of measures under the Carbon Saving Community Obligation (CSCO), 12 per cent, and Home Heating Cost Reduction Obligation (HHCRO), 30 per cent, being estimated to reach the fuel poor[13].

The figures of loft and wall cavity measures installed under the ECO have held up reasonably well, in part due to the amendment to the obligation in 2014, only a year after it was launched. The total funding and ambitions for the scheme were reduced, whilst the focus was re-directed at providing more low-cost measures. This has meant that the ECO has not done well in the more complex project areas such as solid wall insulation or in the fuel poor households.

Local authority led?

There is a strong case for making Local Authorities responsible for delivering energy efficiency to fuel poor households, rather than energy suppliers as is the case at present. This could be achieved by requiring local authorities to develop affordable warmth strategies if the ECO's existing policy framework is extended beyond 2017.

The current approach under the ECO has created a long and complex supply chain where local programmes are delivered via national energy suppliers, with a lack of transparency around costs[14] and significant administrative burdens. There has been a failure to ensure greater scrutiny of how the money drawn from consumers' bills is spent. This may be further exacerbated as the energy supply market is opened up to greater number of companies. Evidence from recent programs suggests that area based and street-by-street programs can reduce installation costs and help drive consumer uptake. Local authorities have access to the information needed to target the fuel poor, such as council tax bands and Work and Pensions information. They are therefore well placed to coordinate such programs. Local authorities also benefit from greater levels of trust from the public than energy suppliers, with consumer trust being very important for uptake. Moving responsibility for taxpayer

[9] See section 1
[10] CCC (2014) Progress report to Parliament
[11] To make as many fuel poor homes as reasonably practicable to achieve an energy efficiency standard of Band C by 2030
[12] CCC (2014) Fuel Poverty Strategy Consultation Letter
[13] CCC (2015) Progress report to Parliament
[14] Which (2015) A Local Approach to Energy Efficiency

funded fuel poverty programs to local authorities would reduce the scope for a supplier-based obligation, which could instead be focussed on higher cost measures or phased out. The role that local authorities could provide is one of setting structures and frameworks, allowing them to coordinate and facilitate contracts and partnerships with the private sector. Local authorities are well placed to provide guidance to the energy efficiency industry that has the necessary expertise needed, which local authorities do not have.

Early indications from the Green Deal Communities scheme and programmes being currently run in Wales and Scotland signal local authority-led delivery of energy efficiency schemes may be more successful[15]. Another benefit of such an approach is the increased ability to integrate different schemes and targets, such as fuel poverty, low carbon heating, and energy efficiency. There are many mechanisms that could be considered for funding greater local authority involvement in community energy, such as a council tax surcharge.

FINDING 3

The replacement for the ECO ought to be announced before the obligation's expiration in 2017, in order to prevent a damaging hiatus for the energy efficiency industry. Local authorities are well placed to lead on improving energy efficiency in domestic buildings, but any duty placed local authorities to improve standards must be well supported both financially and in terms of skills.

Long-term clarity

The confidence and certainty of consumers and industry would be improved by greater long-term clarity regarding the policies and funding for retrofit energy efficiency. This will especially be the case should local authorities play a greater role in future, as the stop start nature of past policies has hampered continuity and the transfer of knowledge and expertise between projects.

The following section outlines the key priorities for a strategy beyond 2017:

Low cost measures

A significant proportion of the remaining potential to install low cost energy efficiency measures is in privately owned or rented accommodation. Take-up by non-fuel-poor households has been encouraged through the Green Deal, although take-up of Green Deal finance was disappointing, likely due to relatively high and therefore unattractive rates of interest.

A proportion of households undertaking Green Deal assessments have gone on to fund the installation of measures themselves, suggesting that there is a potentially significant number of 'able-to-pay' households that could be stimulated to make improvements through wider provision of Green Deal-style energy assessments. The Government introduced cashback incentives to encourage uptake through the Green Deal in 2014. The Green Deal Home Improvement Fund (GDHIF) has helped increase insulation activity; although it is unclear whether the continuation of this policy would ensure that the remaining potential is achieved in a timely fashion.

The introduction of minimum energy efficiency standards in the rented sector from 2018 could help drive uptake of energy efficiency measures in these homes, although the

[15] CCC (2015) Progress report to Parliament

limitations of Green Deal finance as was and lack of enforcement are risks to the effectiveness of this policy. Better engagement with any Green Deal replacement by the heating supply chain could help stimulate uptake in both able and unable to pay sectors.

Alternative approaches could target incentives at times when householders are more likely to consider investments, such as at purchase or major renovations, or tax relief through stamp duty or council tax reductions. Lowering the rate of interest on any Green Deal replacement finance could also stimulate uptake, especially amongst those who do not qualify as officially fuel poor but have limited access to finance.

High cost measures

Measures such as solid wall insulation and replacing single with double glazing have the largest remaining energy saving potential but are higher cost[16]. At present these are subsidised in low income and able-to-pay homes through the ECO, and formerly the Green Deal.

Solid wall insulation

The UK has around 7 million solid walled homes, thus solid wall insulation has a particularly large energy reduction potential. Cost reduction is a priority, which could be achieved by installing at scale, for example through street by street programmes.

Past and current policies have failed to establish a mature supply chain for solid wall insulation[17], which is needed to reduce costs and establish the feasibility of a large-scale roll out. If installation costs are reduced, consideration will need to be given to the tools (incentives or regulation, or a combination of the two) used to deploy solid wall insulation at scale. Low interest loans could also help drive uptake at lower cost than direct subsidy. Should installation costs fail to fall, an alternative strategy to decarbonise heat supply into solid wall homes will be needed as many homes will remain unsuitable for heat pumps due to high levels of heat loss.

Heat system efficiency

Replacing gas boilers with more efficient condensing gas boilers will continue to provide cost effective emissions reductions. Boiler replacements were previously subsidised in the able-to-pay sector through the Green Deal Home Improvement Fund. Regulations are in place to ensure that old boilers are replaced with condensing units and removing these subsidies could help make better use of limited funds, with little risk to delivery.

Heating controls

There is further scope for efficiency savings through installation of manual heating controls, or by replacing manual heating controls with ‘smart’ heating controls, which could lead to more efficient use of heating systems. The heating controls industry and government have not yet been able to agree upon evidence that demonstrates the impact of installing heating controls upon the behaviour of consumers and their use of heating systems. How to realise energy savings through influencing consumer behaviour is an area of significant potential and should be a priority area for further research.

[16] Element Energy & EST (2013) Review of potential for carbon savings from residential energy Efficiency; Report for CCC
[17] CSE (2014) The ECO: an evaluation of year 1; Final report to Energy UK

FINDING 4

Greater feedback and performance checking should be incorporated in any future energy efficiency policy, enabling more comprehensive analysis of how different technologies perform in different scenarios.

Whole house approach

Future policies could be designed to encourage the installation of multiple measures simultaneously, to reduce installation costs and avoid the need for repeat visits. Applying this approach to fuel poverty schemes would increase spending per house and result in fewer houses being treated every year, so a balance needs to be struck between the number of measures installed and the number of homes treated. Designing schemes in such a way could help transfer skills across the various supply chains that deliver home heating and efficiency, for example gas heating engineers and insulation fitters and low carbon heating installers. Government support for training would be required for this approach to be successful. There is a need to open a debate on cross-skilling or multi-skilling, as research has suggested that it has the potential to unlock progress in particular markets such as energy efficiency retrofit and new builds.

Non-financial barriers

A variety of non-financial barriers such as access to information and time act to reduce household investment in energy efficiency remain. These could be addressed by, for example, requiring energy suppliers to provide a comparison of households' energy consumption with similar properties in the local area, or by embedding energy efficiency in home transactions such as mortgage lending and insurance. More could also be done to publicise Government schemes such as the ECO and any future Government retrofit energy efficiency policy, with a change of emphasis from environmental benefits to warmth and comfort likely to appeal to a wider audience.

New homes

It is cheaper to build new buildings to high standards of thermal efficiency and with low carbon heating systems than it is to retrofit these measures into existing buildings. New homes and buildings present an excellent opportunity to make cost effective carbon savings, and support the development of supply chains for these technologies.

Carbon Connect calls on the Government to reintroduce the Zero Carbon Homes standard which was due to be implemented from 2016, but has now been dropped. Alternatively the Government could introduce an equivalent emissions saving scheme for construction projects and new build properties, without the changes introduced via the Infrastructure Bill (2015), such as an exemption for small sites. There is a desperate need to improve the thermal efficiency of new homes built in the UK, especially if the Government is to meet the level of house building promised before the election.

FINDING 5

The Government ought to reintroduce the Zero Carbon Homes standard or make clear how it will find the carbon reductions needed to compensate for more carbon intensive new buildings.

3. POLICY LEVERS FOR LOW CARBON HEAT

The UK will need to substantially increase the use of low carbon heating in order to meet the 2050 carbon target, with sector pathways evaluated in the first report of the *Future Heat Series*[18] indicating that up to 95 per cent of heat will need to come from low carbon sources by 2050. Shifting the UK's heat supply from its current reliance on natural gas to low carbon sources is arguably the most significant challenge facing future heat policy. Today, around 70 per cent of the UK's heat demand is provided by gas, with just 2.8 per cent coming from low carbon sources[19] [20].

The Government has made good progress with the introduction of the Renewable Heat Incentive (RHI), designed to increase the share of renewable heating to help meet the UK's obligations under the EU Renewable Energy Directive. However, funding is currently only committed until March 2016. The Government must ensure that there will be a mechanism in place to support low carbon heat in the long-term and thought should be given to what the appropriate policy tools should be in the long-term. Having a long-term policy framework in place would ensure the UK meets the carbon targets, by allowing supply chain growth to accelerate uptake.

The Renewable Heat Incentive

The Government introduced the RHI in 2011 to support take up of renewable heat, with the ambition of increasing renewables' contribution to 12 per cent of total heat demand by 2020. The RHI incentivises individual building scale heating technologies as well as larger scale heat generation (biomass, energy from waste and geothermal) for on-site use or distribution to buildings through heat networks, and the production of bio-methane for injection into the gas grid. A scheme for the non-domestic sector was introduced in 2011, with a scheme for the domestic sector having started in April 2014.

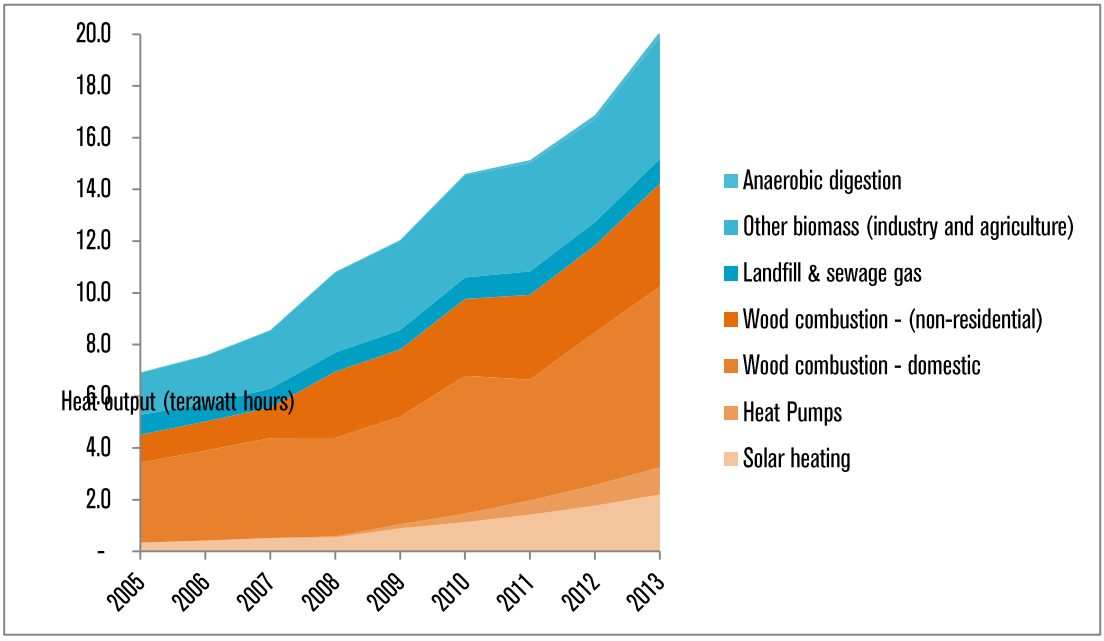
In total, RHI heat delivery by 2015/16 is expected to be above initial forecasts and spending is projected to be within the £424m budget cap. Although the non-domestic scheme has delivered more heat than anticipated, there has been a poor diversity of uptake, with small and medium biomass boilers accounting for 95 per cent of installations. It is important, however, to bear in mind that biomass has accounted for much of the heat elsewhere in the EU – 89.9 per cent according to figures provided by the European Biomass Association (AEBIOM) and Eurostat – meaning its role in the UK should not necessarily come as a surprise, nor be discouraged. We welcome the success in incentivising biomass, but argue that other forms of renewable heat need a different kind of support to succeed alongside biomass. The market should regulate itself over time as the tariff degression mechanism

[18] Carbon Connect (2014) Pathways for Heat: Low Carbon Heat for Buildings
[19] DECC (2013) The Future of Heating
[20] Solar thermal, heat pumps, bioenergy, geothermal. 'Renewables' is used as a proxy for low carbon throughout this chapter.

comes into play, although this might not necessarily lead to the uptake of more heat pumps, for example in cases where upfront costs are currently prohibitive. Uptake in the domestic scheme has been spread more evenly between technologies, although the recent fall in oil prices may adversely affect take-up by oil heated households.

The Government needs to design a delivery plan which commits to financial incentives, followed by long-term phased regulation and increased integration with any new Government energy efficiency scheme and fuel poverty targets. This should also include a focus on new build standards as a replacement of the zero carbon homes standard, and district heat network infrastructure.

Figure 2: Annual heat demand met by renewable technologies 2005 - 13, TWh



Source: DECC (2013) Energy Consumption in the UK (Space and water heating)

Figure 2 above illustrates the heat demand met by renewable technologies since 2005. Technologies likely to be used to provide heat in buildings are shaded orange; those most likely to be used in agricultural or industrial processes are shaded blue. Since 2005, the majority of new renewable heat has come from the use of biomass boilers, burning wood, other biomass and waste, with a notable upswing in wood fired heating following the introduction of the RHI in 2011. There has been slower growth in solar heating and heat pumps. In 2013, approximately 14 TWh of heat demand from buildings were met using renewable sources, of a total demand for heat of 561 TWh[21].

The RHI has not realised the uptake figures originally projected. At current levels, the RHI is not fulfilling its intended purpose of driving low carbon heat and in 2013 it supported only 0.6 TWh[22], comprising 3 per cent of the low carbon heat in the economy. Industrial and domestic biomass make up the largest parts of low-carbon heat, at 5.9 and 5.2 TWh in 2013 respectively, and in both cases over 80 per cent of update precedes the introduction of the

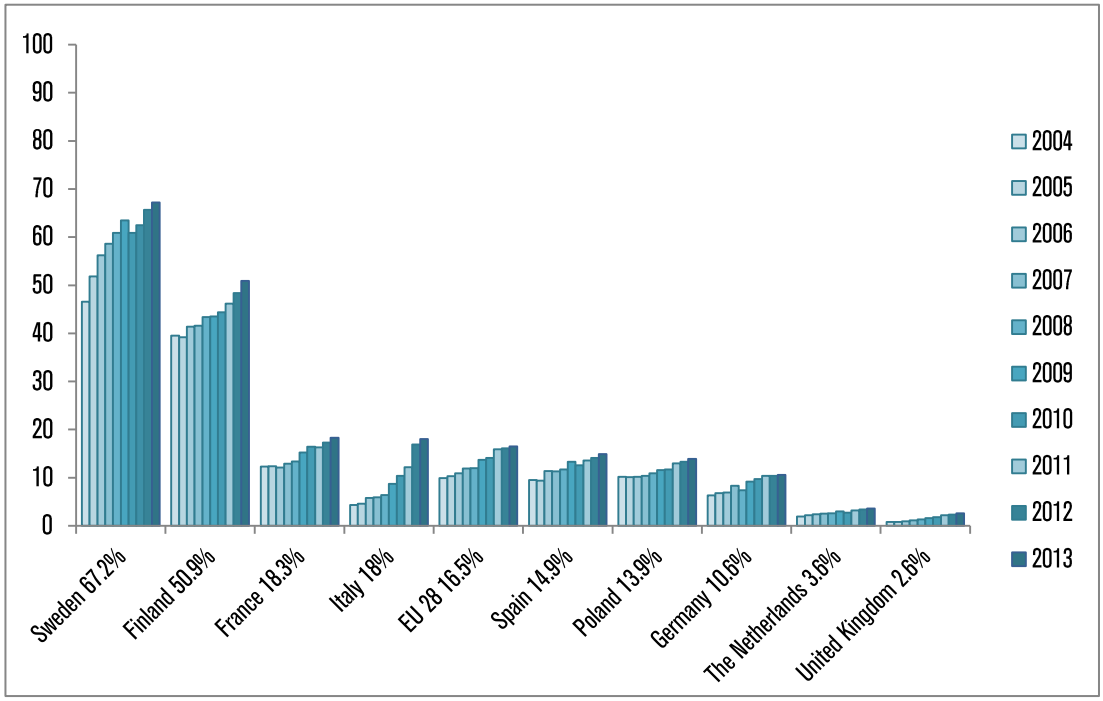
[21] DECC (2013) Energy Consumption in the UK (Space and water heating)
[22] CCC (2015) Progress report to Parliament.

RHI. It is possible that for the largest schemes, concerns around the 'bankability' of the RHI remain a disincentive. With the recent scrapping of the zero carbon homes standard and the Green Deal energy efficiency scheme, there is an even greater pressure on the RHI to deliver.

RHI to 2020

An immediate priority for the Government will be to confirm funding for the RHI up to 2020 [23]. Long-term clarity is essential to encourage the development of emerging technologies, and it would therefore be unwise to seek to replace the policy during the current Parliament. However, if this happens, it is vital that the lessons are learnt from the Green Deal and that any positive developments and infrastructure are used. However, a number of issues must still be addressed if the scheme is to put delivery of low carbon heat on track to meet carbon budgets in the 2020s.

Figure 3: Percentage share of Energy from Renewable Heat for Heating and Cooling, 2004-2013



Source: Eurostat; Percentage displayed reflects 2013 level.
Notes: Other countries provided for reference

Current DECC projections suggest that the RHI will not succeed in delivering the desired share of at least 12 per cent for renewable heat. Based on March 2015 Eurostat data, the UK is now further behind its renewable energy targets than any other EU state[24]. We are 9.9 per cent short of our 15 per cent 2020 target with a 5.1 per cent share in 2013. The UK needs a growth rate of over 16 per cent per annum in order to achieve our 2020 targets, one of the highest growth rates in the EU. The non-domestic scheme has been unsuccessful at driving uptake of non-biomass technologies, and biomass boilers continue to dominate despite numerous tariff degressions. It also remains unclear whether current growth rates for this

[23] For clarity purposes, we will use the term RHI when referring to current and future low carbon heat policy
[24] Eurostat (2015) Energy from renewable sources

technology are compatible with the wider uses of biomass in the energy system. Although it is high, this high use of biomass is not out of line with the rest of Europe, so more work needs to be done to clarify this. One issue that has been highlighted in an upcoming study by Wales & West Utilities (W&WU) is the currently prohibitive cost of heat pumps. Heat pumps would require a far higher subsidy to be implemented in households which are not in a position to invest in lower carbon heating. This is estimated to apply to around 80 per cent of all consumers. This subsidy could approach 70p/kwh, with operating costs going up due to the use of potentially expensive electricity. Additionally, any additional use of fossil generated electricity as a result of greater heat pump use would have the unintended effect of increasing carbon emissions[25]. Therefore the use of heat pumps to displace gas usage must be considered alongside the timeline and practicality of moving towards a majority to entire low carbon renewable energy mix.

There is a requirement for the Government to introduce a mandated renewable heat market share target, rather than an ambition, as this current ambition is well off being reached. An extension of the RHI would give DECC the certainty to plan and make any amendments needed to re-balance the funding system.

The role of biomass

Biomass is a versatile low carbon fuel, and analyses indicate that it has multiple uses across the energy system. The CCC suggests that potential limitations to biomass resource availability will constrain renewable heat at 50TWh in 2020, of which up to 40 TWh is likely to be required in industry, where options are limited due to the need for high temperature process heat[26]. But this is still unsettled, as the UK Bioenergy Strategy asserts higher resource availability, and the assessments of other organisations such as International Energy Agency, Intergovernmental Panel on Climate Change, and AEA UK suggest a much greater potential for biomass heat. The RHI requires all biomass heating to demonstrate a minimum 60 per cent carbon saving, and all fuel must comply with the land criteria to ensure no changes in land use or deforestation. The sustainability regulations also guarantee the protection of forest health, ecosystems and soil, water and biodiversity. The UK is currently using around 11 TWh per year to heat buildings via biomass[27]. According to DECC policy projections, the RHI could be supporting around 27.5 TWh of biomass heat in buildings by 2020[28] [29]. This level of use may raise sustainability concerns as well as stifle investment in alternative low carbon heating technologies, yet there are requirements now in place to ensure that biomass fuel is sourced sustainability with the Biomass Suppliers List (BSL). There is also a requirement that the biomass fuel used by RHI participants must meet a lifecycle greenhouse gas (GHG) emissions target of 34.8g CO_2 equivalent per Megajoule (MJ) of heat, or 60 per cent GHG savings against the EU fossil fuel average[30]. When taking the logic of cumulative emissions into account, emission reductions that are achievable in the short-term are more valuable than reductions attainable between 2020 and 2030. This is where biomass is seen as important – it is available immediately and it can deliver carbon savings today.

But this must be done without locking out other emerging technologies that might be better placed to deliver carbon savings in other areas, such as dense urban communities. As the RHI is optimised to improve cost effectiveness it is essential that there must be a focus on

[25] Wales & West Utilities (2015) Future of energy & investments in gas networks Phase 3 – Understanding the home energy policy needed to satisfy consumer willingness to pay to change
[26] CCC (2014) Progress report to Parliament.
[27] ECUK 2013 (wood consumption only).
[28] DECC (2013) RHI Tariff Review, Scheme Extensions and Budget Management; Impact Assessment.
[29] DECC (2013) Domestic RHI Impact Assessment (includes legacy).
[30] DECC (2015) New biomass sustainability requirements for the Renewable Heat Incentive.

striking a balance between encouraging a more diverse mix of technologies, and ensuring that the rollout of successful technologies, such as biomass, is not hampered.

The Government needs to do more on targeting best use for the various technologies, in the form of a national low carbon-heating technology deployment feasibility study/strategy. So far there is still not much clarity on this for industry and consumers to make the best decisions available. This would require greater integration and coordination between the industries working on renewable power, heating and energy efficiency solutions for buildings. For example, the role of biomass for CHP would rely closely on a greater deployment of district heat networks, as they are the most effective way of using the heat produced from this method at scale. There could be a role to play in non-densely populated urban areas for this type of heating and power solution, taking the place of coal in the short to medium-term[31].

The Government may need to do a fundamental review of the UK's biomass capacity, as some in the industry argue that the figures used are too low, and that biomass could provide a larger proportion of low carbon heat than previously stated.

Increasing uptake of other technologies

The aim of the RHI should be to incentivise and deploy low carbon heat and, to a lesser extent, support a diverse set of energy efficiency technologies, establish the feasibility of wider roll-out, grow supply chains and reduce costs. It is therefore important to address the low uptake of non-biomass technologies. Tariffs were increased in the non-domestic scheme for struggling technologies (large biomass, ground source heat pumps, and solar thermal) in spring 2014. Having a wider mix of economically viable technologies to use in the decarbonisation of the gas sector is crucial to effectively deploy the right technologies for different contexts and increase supply security, while picking 'winners and losers' should be avoided. The future is uncertain so relying on one technology presents risks; therefore, the technologies that currently hold a smaller share of the market should be given more support.

The Energy Technologies Institute (ETI) estimates that the failure to deploy electric heating options could lead to a 30 per cent increase in abatement costs to 2050. Despite its success in improving uptake in bioenergy, the non-domestic RHI has so far failed to drive the uptake in heat pumps currently believed to be needed in order to meet the 2050 carbon targets, as seen in many of the pathways analysed in our previous report. If the heat pump market were to grow at an optimistic rate of 30 per cent year-on-year, the total number of heat pumps installed would reach 3.2 million, still below the 4 million that the Committee on Climate Change believe is needed by 2030. One of the main challenges that the RHI faces in driving the uptake of heat pumps in domestic and non-domestic markets is its close relationship with the energy performance of buildings. With uncertainty around Government energy efficiency policy, this could blunt any growth in the heat pump market due to heat pumps requiring well insulated buildings to perform to a high standard. This is another example of where more integration between heat pump deployment strategy and energy efficiency policy is required.

It is also important that the Government considers supporting emerging technologies, such as hybrid gas and electric heat pumps, if and when the RHI is extended. Sector pathways indicate that this technology could facilitate the early deployment of heat pumps, and potentially provide a long-term solution for providing top-up heat during prolonged cold spells. Gas heat pumps for domestic buildings are currently being developed by industry and could provide further carbon savings relative to condensing gas boilers.

[31] Deloitte (2012) Knock on Wood: Is biomass the answer to 2020?

FINDING 6

The Government must confirm the extension of the RHI to 2020 at the earliest possible opportunity. Heat for buildings needs to be tackled and it cannot be ignored.

A strategy beyond 2020

A significant ramp-up in the delivery of low carbon heat is likely to be required to meet carbon budgets in the 2020s, with the CCC recommending that around 40 per cent of heat for buildings will need to be supplied from low carbon sources by 2030 if the UK is to be on track to meet the 2050 carbon target cost effectively[32].The most critical issue for policy in the 2020s will be to encourage the adoption of low carbon heating in on-gas buildings. It could be that different policy approaches will be taken in different sectors and geographical areas in order to achieve these targets.

Alternative approaches to funding to the ones currently in use are needed for the RHI to move towards long-term affordability. The policy package needs to include a combination of regulations, in the form of phased regulation, and alternative forms of financing, such as a carbon tax. These should be coupled with more powers for local authorities to control energy planning giving them increased ability to bring in private finance. Wales & West Utilities created an option of a carbon tax of £70/tonne, which (with an alternative pathway than DECC) was sufficient to achieve 40 per cent carbon savings using the resultant tax to fund lower carbon investment, but the £70/tonne price had a big impact on the fuel poor, commercial business and manufacturing[33].

Reducing the cost of capital factored in to the tariffs is also essential. Financial incentives are necessary to drive uptake of low-carbon heat. This could be done through extending the Green Deal replacement or low-cost finance options to cover low-carbon heat.

Addressing non-financial barriers

Non-financial barriers to the take up of low carbon heat should also be addressed. Awareness of these technologies amongst consumers is low, with only 21 per cent of people surveyed having heard of the non-domestic scheme, and an even lower anecdotal figure available for the domestic scheme[34], with knock-on impacts for industry confidence and investment. Information schemes and marketing campaigns to raise awareness amongst both consumers and supply chains would help drive demand. The Government should also consider the way in which it engages consumers, with decarbonising heat being an opportunity to improve the warmth and comfort of homes and buildings, messages that may appeal to a wider audience than framing interventions as simply 'green'. The Government has successfully launched a similar scheme to promote uptake of electric vehicles (the website www.goultralow.com aims to increase consumer awareness, and is jointly funded by industry and Government) and a similar scheme could be put in place for the uptake of low carbon heat.

The poorly insulated housing stock is another reason why the take-up of low carbon heat has been slow. It is often seen as a choice between energy efficiency or renewable heat technologies, and more needs to be done to coordinate and integrate the roll out of both in the future. The Government needs to provide more support to offset the risk premium faced by consumers on many lesser known, newer technologies. This lack of confidence could be

[32] CCC (2014) Progress report to Parliament
[33] Wales & West Utilities (2015) Future of energy & investments in gas networks Phase 3 – Understanding the home energy policy needed to satisfy consumer willingness to pay to change
[34] The CCC (2015) 2015 Progress Report to Parliament

addressed by the provision of more public awareness building of the domestic and non-domestic RHI schemes, through more information and education being provided to consumers, alongside more training for installers.

Domestic RHI

The Government will need to monitor delivery of the domestic RHI to established supply chains capable of ramping up installation rates during the 2020s. Setting targets for minimum levels of installations would generate confidence in the supply chain and ensure that Government strategy is focussed on trialling and establishing new technologies rather than simply achieving the Renewable Energy Directive, as at present.

In the long-term the Government should set formal, clear and legally binding targets on levels of heat produced from renewable sources for both the domestic and non-domestic RHI, replacing the non-binding 12 per cent 'ambition' currently in place. The 12 per cent ambition looks very unlikely to be met, as low-carbon heat made up only 1.6 per cent (2.1 per cent if agricultural buildings are included) of all heat used in buildings in 2014. The ambition always looked unlikely given the low starting position, and the slow rate of growth seen in the last decade[35]. Moving away from non-committal 'ambitions' and towards formal and legally binding targets would ensure that successive governments would have to provide long-term, transparent strategies on how to meet this target tied to the carbon targets currently in place.

Fuel poverty

Coordinating RHI deployment with fuel poverty schemes could provide an additional driver for deployment, as well as help trial a more coordinated approach to supply and demand policies. Deploying low carbon heating in these homes would help them reach Energy Performance Certificate (EPC) targets that have been set for the fuel poor in England. Part of the RHI budget could be ring-fenced to provide support with upfront capital costs to fuel poor households[36]. In January, DECC launched a call for evidence on increasing the flexibility of finance options in the domestic and non-domestic RHI, which included a focus on third-party financing to increase access to renewable heating systems for fuel poor households[37]. Households off the gas grid (currently 73 per cent of applications in DRHI) are more likely to experience fuel poverty, in part due to higher fuel costs of electric, liquefied natural gas (LNG) and oil heating. Extending third-party financing options to fuel poor households, could make renewable heating systems that would otherwise be too expensive, accessible and therefore improving the heating quality of the property and lowering fuel costs[38].

Policy tools

A number of alternative policy tools could reinforce the RHI after 2020. These include:

- Providing capital grants to subsidise the upfront capital cost.
- Phased regulations.
- Carbon pricing on fossil fuels or heat, to increase the operating cost of higher carbon heating.
- Providing a focus for the use of district heating schemes.

[35] CCC (2015) 2015 Progress Report to Parliament
[36] CCC (2014) Progress report to Parliament.
[37] DECC (2015) Renewable Heat Incentive Call for Evidence.
[38] REA & WHA (2015) Response to DECC Call for Evidence on Third Party Finance Options

A more ambitious framework to support low carbon heat will be required beyond 2020 to meet the fourth carbon budget and legislation will need to be passed during the current Parliament to ensure that a framework is in place after 2020. The Government committed to using the National Household Model to evaluate options for the long-term transformation of the heat market in its 2013 update to the heat strategy[39]. This work must be carried out urgently.

Energy Service Contracting

An alternative model to drive uptake could be to encourage the growth of Energy Service Companies (ESCO's) that sell consumers heat, rather than fuel. This approach could harness economies of scale, encourage consideration of both supply and demand options and reduce the number of actors involved in the heat transition. It could also facilitate coordination with local authorities and energy networks. Ensuring that larger companies specify whole house solutions could also be more effective than the current model where consumers decide on solutions based on advice from a number of suppliers (for example heating engineers, energy assessors, and insulation installers). This contracting model is already present in the commercial sector and further research could identify ways to grow the use of this business model and its potential applications in the domestic sector.

The RHI will only succeed if there is a successful balance of incentive and regulation. It is therefore important to incentivise individual households, businesses and organizations into investing in the technologies on offer. The incentive could either be in the form of tariff payments or upfront costs, or a combination of both. There would need to be some revenue for the Government, which could be covered by a carbon tax, alongside regulations to provide quality controls and market interventions, for example banning a certain technology from being installed after a certain time, like in the case of condensing boilers. Linking the existence of low carbon heat technologies in a building, along with the EPC, to property prices and rent could also be an incentive for people to invest.

FINDING 7

The Government should produce a revised, detailed, long-term low carbon heat strategy and roadmap (to 2030/2050), following the end of the Green Deal and the Zero Carbon Homes standard. This should show the steps that the Government intends to take in order for heat to play a role in the achievement of UK carbon targets.

FINDING 8

The Government should make technologies under the RHI available for funding under the successor policy for the Green Deal, providing more support for upfront capital costs and integrating energy efficiency, fuel poverty and renewable heat.

[39] DECC (2013) The Future of Heating: Meeting the Challenge

4. DEVELOPING DISTRICT HEAT NETWORKS

District heat faces the challenge of getting new infrastructure built as well as switching consumers from incumbent technologies. Additionally as heat networks grow, policies will also need to ensure that sources of low carbon heat are available to supply them.

Near-term priorities

Resolve current issues

In the near-term, there are important issues around metering, contracting and consumer protection that must be addressed before a large scale roll out can be undertaken. There is currently a lack of consumer protection for district heating customers, and research has identified inconsistent and uncompetitive pricing between schemes[40]. Looking further ahead, clarity will be needed regarding how district heating could be aligned with the existing regulatory framework and its emphasis on competition.

The Heat Trust is one example of where work is being done to help establish common standards in the quality and level of protection given by heat supply contracts. It also aims to offer heat network customers an independent process for settling of any disputes with providers. Other significant criteria for suppliers to become accredited by the scheme include: requiring suppliers to not disconnect vulnerable customers during the winter and to ensure that these households are warm and have access to hot water during any supply interruptions; guaranteeing service payments to customers when suppliers fail to meet performance standards; and the development of a heat price comparator to help consumers establish how their heating costs compare to other forms of heating. The Heat Trust aims to replicate "where appropriate" the statutory requirements of the regulated gas and electricity markets and will be open to district heat suppliers in England, Scotland and Wales. Although a voluntary scheme, it is hoped that this will drive minimum standards.

Another crucial short-term goal for developing district heating has got to be encouraging growth in the market more effectively. Although ensuring there is enough low carbon heat available is important, district heating will likely be shaped by the availability of low cost capital and building capacity in local authorities. Local authorities could play a crucial role in

[40] Which (2015) Turning up the Heat: Getting a fair Deal for District Heating Users.

coordinating projects, by providing the information and data for suitable anchor loads for networks, which could help to utilise waste heat as a heating source.

Attract investment

To date most new heat networks in the UK have been installed in new build developments. The Government has funded feasibility studies for local authority led schemes through the Heat Network Delivery Unit (HNDU) and the next challenge for these projects will be finding capital to fund construction. Recent estimates by DECC suggest that if 25 to 30 per cent of these projects are built they would require between £400 and £800 million of investment over the next 10 years[41]. There is limited scope for local authorities to fund this construction themselves, so attracting private finance will be crucial in moving projects from feasibility to implementation. An important next step for Government will be to follow up the work of the Heat Network Delivery Unit (HNDU) with support (legal, technical, business) for local authorities as projects move from feasibility to implementation. This could either be done by extending the remit of the HNDU beyond the feasibility stage, and possibly to implementation stage. There are numerous ways local authorities can do this, such as identifying potential anchor loads and low-carbon heat sources for future networks, establishing bespoke finance mechanisms for private investors and requiring developers to work with each other to create integrated, efficient networks.

FINDING 9

The Government should extend the remit of the HNDU beyond the feasibility stage of district heat projects, to ensure that local authorities have the support necessary to implement the plans.

Long-term priorities

Several issues will need to be resolved if heat networks are to play a major role in decarbonising heat for buildings in the long-term.

Coordination

There are currently few requirements for private developers of heat networks to ensure that the networks are designed in a manner that allows future expansion. This will need to be addressed to ensure that networks can be both expanded and interconnected in future. Similarly, scenarios with a high penetration of heat networks imply the connection of existing privately owned homes. Careful consideration will need to be given as to how to plan and implement retrofit connections, with heat network economics likely to require that whole areas of housing are connected rather than incrementally.

Handing new networks over to private owners may limit their long-term growth and there may be a need for continued local authority involvement to ensure networks are expanded and interconnected as they control two key drivers: publically owned building stock and planning permission. Most new projects are developed around local authority owned building stock, so local authorities can also use their planning powers to ensure that private developments are suitable for connection to nearby heat networks. At present there is a lack of broad energy planning in the UK, resulting in practitioners failing to see opportunities that might lie nearby. Local authorities have the ability to facilitate or even require engagement between developers without necessarily financing pipework.

[41] DECC (2015) Delivering UK Energy Investment: Networks 2014

District heating scheme development is stimulated by anchor loads rather than supply sources looking for customers. Infrastructure support is as, if not more, important for the continued growth and coordination of district heating. Local authorities can help by identifying low carbon sources of heat generation and by standardising and commodifying these sources, whilst also identifying the natural heat network opportunities in particular areas alongside the potential anchor loads, as Southampton is already doing.

Local authorities can play a coordinating role, pulling together resources and opportunities in an area and helping to get district heating schemes through the 'valley of death' to financing equity. Local authorities can also help with the cost of the infrastructure and the cost of making the infrastructure commercial, with support from central Government.

The Government must work with local authorities and the district heat industry to identify the most receptive and suitable areas for district heat networks. Factors around property ownership, geographic features and local markets mean that high heat demand alone is not always a helpful measure to indicate the economic attractiveness of district heat. A better understanding of effective deployment is essential, and this can be achieved through more energy planning and whole-system trials. An area of high heat density might be accompanied by high network cost due to issues like the cost of excavating trenches for pipework or the construction cost of heat substations, whilst an area of low heat density might have much lower network costs.

Heat supply

Growing heat networks will require adequate sources of low carbon heat supply. This will require coordination with policies incentivising large scale combined heat and power generation, especially using waste and biomass, and policies may be needed to ensure that sources of waste heat are made available as input to heat networks. With thermal generation likely to require carbon capture and storage technology beyond 2030, district heat network planning will also need to take into account the development and location of carbon capture and storage networks.

District heat networks provide an opportunity for cost effective energy storage (which is looked at in more detail later in the report), which will become increasingly valuable as the energy system evolves to contain greater volumes of varying renewable generation. Existing incentives such as the Capacity Mechanism are not appropriately designed to encourage the development of district heat level storage, and a key challenge in future will be ensuring that storage is adequately encouraged on new district heating networks.

Reducing capital costs

Heat networks are capital intensive projects and the cost at which capital is provided has a major bearing on project economics. Heat networks currently carry high risks to private investors, resulting in high capital costs. Reducing these costs will help ensure that more projects are financeable in future. In addition, reducing risks to investors could also alleviate the concerns that, at present, very long-term contracts are being agreed without adequate safeguards in place to protect consumers. It could be beneficial to focus private investment in construction of the pipework at a larger scale. Improving this system will require thought on who gets the benefit of the pipework in the long-term. The Government can establish terms for financing to help overcome the problem that heat networks are 40 year assets with heat demand risks and a 20 year payback schedule. A certainty of return could improve heat networks' appeal to investors.

District heating is often cheaper, when the cost of connection is shared between the Energy Service Company and the developer. Local authorities can help by giving this information to developers, making the economy of heat networks clear. They can also help by using pump-prime finance to make developers engage with each other, and avoid the issue with developers being happy to bear extra costs to avoid having to work with each other.

The introduction of long-term legacy monitoring, which would provide feedback on the successes and failures of different projects and enable innovations and improvements is necessary for the costs of future projects to be lowered.

Regulated assets

Treating district heat networks as regulated assets would reduce risks to investors, lowering the cost of capital and providing a framework to ensure that heat networks are built in a way that is compatible with future expansion. This could also encourage investment by gas networks companies, as a way of future proofing their businesses in a carbon constrained future. Disadvantages of this approach include reduced competition and squeezing out the smaller utility providers who are currently investing in heat networks. A key question is therefore how and when such an approach could be implemented. If a key priority should be to grow the district heat network market, making it more attractive to private investment and reducing the cost of capital, what role will regulation play? Some organizations believe that the industry is at too early a stage for heavy regulation, and advocate 'light-touch' regulation, or pseudo-regulation, as seen with the CIBSE and the Association for Decentralised Energy's (ADE) Code of Practice. Key principles that could guide a regulated approach include the introduction of competition into heat supply, third-party access and consumer switching. Regulation will play an increasingly essential role in the development of effective district heating in the future, particularly when it comes to financing heat networks. However, it would be inappropriate in many cases to apply the regulatory regime used for other networks, such as electricity, gas, water, etc. This is because these assets existed prior to regulation with incremental levels of new investment. This is not the case for heat networks where there are no assets and all investment is new investment. Urgent consideration must be given to how heat networks will compete with regulated assets and how they can be supported through bespoke regulation and other measures.

FINDING 10

The Government should introduce a set of clear targets for district heat development.

5. NETWORKS

Changing heat systems will impact on both electricity and gas networks, with the former requiring reinforcement in the case of high electrification and the latter facing a reduced long-term role unless they can be re-purposed. Many pathway analyses also see a cost effective role for the development of heat networks to carry heat to buildings, to diversify low carbon supply options and to reduce the reliance on electricity networks, as well as providing energy storage.

Gas networks

The UK uses 8.5 billion standard cubic meters (3 trillion standard cubic feet) of gas a year, and the gas networks play an important role in today's energy system by storing and delivering energy at volume to meet peak heat demands. However, they face a reduced long-term role in a decarbonised energy system unless they can be re-purposed to carry low carbon gases such as bio-methane, hydrogen or synthetic natural gas. Whilst biomass has become the dominant low carbon heating system, electrification of heat is still seen as the most robust option due to the volume of evidence currently available. Although feasible, the costs of meeting peak heat demands through electricity and heat networks are currently uncertain, justifying further investment to understand the feasibility and costs of low carbon options for the gas networks.

Low carbon gas

In future, gas networks could be used to carry low carbon gases such as bio-methane, synthetic natural gas or hydrogen, with the latter requiring heating appliances to be replaced with hydrogen compatible models. There are significant uncertainties regarding the availability and costs of these energy vectors in future, as well as their best uses in the energy system. For example, energy system pathways suggest that hydrogen may be most cost effectively used in industry and transport. However, the potential value of retaining gas networks to meet peak demand justifies greater investment to understand the feasibility and costs of producing and distributing these alternative low carbon vectors. A government roadmap for heat decarbonisation could distinguish between the stages of blending hydrogen and natural gas, and the use of pure hydrogen. The former could be used as a transition option and is limited in terms of impact. The latter has the potential to be an enduring low carbon option but would require repurposing of the gas network, with there being many other issues that would need to be considered. It is important the Government is in a position to take effective decisions on the role of hydrogen in heat in the 2020s, and that will require strategic planning in this Parliament.

Whilst good progress has been made in supporting bio-methane production under the RHI, relatively little funding is currently directed at the potential production and use of synthetic natural gas or hydrogen. Production of these gases will require carbon capture and storage (CCS) technology to remove their carbon emissions, unless they are produced from biomass or waste. Development of these fuels and technologies for heating could support the Government's current strategy to develop a UK carbon capture and storage industry.

CCS could have a vital role to play, although due to the uncertainty of CCS rollout across the EU, this report does not focus deeply on its potential impact on decarbonisation, as any possible developments will now take a number of years before they are operational, limiting its impact to 2020-2030. However, regardless of how CCS is applied to heat, it is clear that the UK needs to develop its understanding of CCS' potential viability urgently, in both the heat sector and more broadly.

The requirements of hydrogen, along with other low carbon gas sources, need to be considered and integrated into current planning on gas networks. Promisingly, conversion to hydrogen-supportive Polyethylene Piping (PE) constitutes 'business as normal for the industry', as gas distribution networks (GDNs) upgrade old iron pipe networks, with the current REPEX gas pipe replacement programme prioritising piping laid within 30m of a building. This covers most piping in urban areas and many of the areas that fall outside the 30m parameter will nonetheless be upgraded near the end of the REPEX programme as part of 'build efficient projects'. The consequence of this is that most of the additional spend needed for the adoption of hydrogen will be for the construction of steam methane reformer (SMR) plants. For large urban areas the cost of these plants could be significant and consideration is need on where they would be placed. It has been suggested that the development of infrastructure for hydrogen transport systems could be a significant ancillary benefit to a hydrogen gas based heat networks.

Changes to the gas make-up of the UK system would usually require changes to appliances, and pipe networks. Gas networks no longer have the power to enforce changes to boilers in private households without the support of Government, and restoring this would require legislative action beyond changes to the Gas Safety Management Regulations (GSMRs). It would be valuable for the Government to understand the different costings entailed by different low carbon gases. Coupled with other technologies like district heating, air-source heat-pumps, Synthetic Natural Gas (SNG) and bio-methane, hydrogen gas could work to deliver a low carbon future for the UK and decarbonising gas at a price economically competitive with other fossil fuels would bring many benefits.

There are opportunities for innovative approaches to the mix of gas used in the system. There are trials being run using three specifications of gas outside the GSMR range in a safe and isolated environment, assessing whether appliances can be run safely outside the current regulatory specification. The trial will run from July 2015 to July 2016 and the results will be used to inform Ofgem on the need for any changes, which would then be given to DECC. The GSMR was last reviewed in 2008, with no evidence to justify change found. It was highlighted that there are other European models where the same appliances are being used safely outside the GSMR specifications, but it was also noted that the GSMR enables appliances like condensing boilers to be used more efficiently. Current GSMRs contain 0.1 per cent (high reading) hydrogen content, and the Government should fund more research into the viability of the possibility of increasing the hydrogen content in order to achieve cost effective carbon savings. Literature suggests that the UK gas system could be able to support increased levels of hydrogen levels ranging from 3 per cent to as high 20 per cent, possibly providing good carbon savings with relative ease[42].

Potential benefits to converting the gas grid to grid compliant low carbon gases could be: maintaining the asset value of the existing gas grid; retaining the use of the existing gas storage and dispatch system and supporting progressive cost effective incremental change without having to repeat the conversion from Town Gas to Natural Gas.

Funding innovation

Developing all of the above solutions would keep future options open and provide a way to future proof gas supply and distribution businesses whose activities would otherwise decline

[42] HSE (2015) Injecting hydrogen into the gas network – a literature search

in a decarbonised energy system. At present, some funding for low carbon gas is provided through gas distribution network innovation funds, for example through the Low Carbon Networks Fund. These fuels may have long-term strategic value across the energy system, however, and more funding could be obtained by requiring gas suppliers, rather than solely distributors, to contribute funding for research and development.

More needs to be done to inform policy-makers and help them to understand the relationship between the different possibilities, and the geographical contexts of those options. There may not be a standard or generalised solution to decarbonising the gas system. Although electrification is the most robust pathway, more consideration should be given to exploring the future of gas in the UK. The gas industry could still have a pivotal role in decarbonising heat, particularly while the electricity sector transitions from high to low carbon intensity. Similar considerations also apply to meeting the fuel poverty targets, with low carbon gas potentially being more affordable in the period that electricity transitions to cheaper, renewable energy sources.

Under existing policies there will be limited change to the gas network beyond the existing pipework replacement programme. To produce change there must be some quite radical policy developments, but it is unknown how the consumer would react to these. Gas demand could be increased in the medium-term, with modern low carbon networks potentially being compatible with all pathways and enabling different decarbonisation options in different areas. For this to become a feasible option, additional funding is needed to support green gas deployment at local levels. Innovation is also about regulatory regime changes, and new ways of ensuring these markets can grow, for instance shale gas, hydrogen and bio-methane might all need their own regulatory regimes. The Government should work with industry and academia to produce a bottom up analysis of all the options in the industry to allow decision makers to develop more innovative policies that better reflects the realities of the UK gas system.

Coordination and planning

There may be a need for a better link between research and innovation in low carbon gases as well as long-term investment in the gas networks, to ensure that decisions taken now are compatible with future strategies. This would ensure that current maintenance and upgrade programmes are compatible with future low carbon options such as hydrogen. Similarly, the planning of network investments could in future be coordinated with local authorities, to avoid, for example, major investment in areas where district heating might subsequently be deployed. A coordinated effort to enhance understanding of options for re-purposing gas networks will help these be integrated to local energy plans. Low carbon gases may have a valuable role to play in areas with limited alternative options, for example where the deployment district heat networks and electric heating is costly or impractical.

Greater integration between different technological approaches is also something that requires more understanding. For instance, district heating and the gas network are sometimes thought of as completely separate, conflicting options for low carbon heat. The gas industry has 200 years of experience in building pipe networks. With greater cross-industry innovation and information sharing, a modern, flexible, low carbon heat sector would be possible. For example a low carbon gas like hydrogen could be compatible with district heat networks. The technologies could complement each other if industries worked together. In order to achieve an “all of the above” approach to decarbonising heat, only a gas grid re-purposed to deliver low carbon gas can ensure the benefits of the gas grid are maintained, whilst making the necessary carbon savings.

FINDING 11

Legislation limiting how gas networks can invest should be broadened to allow investment in low-carbon forms of low carbon heat.

Electricity networks

A substantial increase in electric heat will have a significant impact on electricity networks and especially local distribution grids. Local energy plans will need to take into account information regarding the costs and feasibility of upgrading electricity networks, requiring coordination between local authorities and network operators. Smart-grid technologies will help manage impacts on electricity networks as well as unlock the benefits such as demand side response and distributed energy storage. Innovation activity should also be coordinated with local plans to ensure that information and learning is captured and reflected in local strategies.

The issue for electricity networks is that they cannot provide the storage currently available from gas and the scope for demand side management (DSM) with heat pumps is not great without very large thermal storage, for example 500 litres. Heat pumps have a significant peaking duty and that will have repercussions in terms of capacity (generation, demand management) and also, possibly more, significantly on the electricity networks. Hybrid heat pumps could be a solution to this situation, particularly in the short to medium-term. For instance a gas boiler paired with a heat pump could be upgraded to be compatible with hydrogen in the future. For this to happen however some form of regulation pushing the development of hybrid technology boilers might be needed.

A balance of alternative options, such as hybrid boiler/heat pump technologies or 'super-efficient' gas boilers could help drive a faster uptake among consumers and make new regulation on consumer behaviour less onerous. Hybrid technologies could be seen as an important step to be taken that could bridge the divide between consumer reluctance to replace their current boilers and the need to decarbonise. Another example could be for hybrid pumps that work as air source heat pumps with gas boilers for peak loads. However it is also worth noting that there may be non-financial barriers to the deployment of these options due to aesthetic concerns, which ought to be considered at the design and implementation stages of any new hybrid technologies.

Energy storage

The existing UK gas and electricity storage systems have taken many decades to develop, and has resulted in a system very resilient to 'black swan' events, such as bankruptcies or industrial action. New infrastructure takes a long time to develop, is costly, and can be socially and environmentally disruptive. To date, the Government has not given enough consideration to the energy storage value of gas, possibly because the storage value does not carry a financial cost. However, alternatives to gas storage could cost much more and this difference is not sufficiently modelled. Currently there isn't an alternative to the volume of storage that the gas system provides to the UK. Similarly, the 'no cost' capacity of the system is not sufficiently considered, and energy policy needs to be firmed up to affect the decarbonisation options in the future. A 'whole model system' for energy storage value is needed, as there is no clear modelling that outlines the economic value of gas storage capability for UK plc. This could result in more information and education for the public, helping increase consumer engagement around technologies such as the use of hydrogen, enabling an 'all of the above' approach to decarbonisation where the gas networks work alongside other systems.

With the proportion of power from intermittent generation sources expected to increase, there are risks that without robust electricity storage infrastructure, low generation activity and high demand could result in incidents where demand exceeds supply. A solution being pursued by industry to combat the issues around storing this energy is to use the gas networks for energy storage, using 'power-to-gas', which could inject small amounts of hydrogen into the natural gas. One possibility to combat the issue of storage and demand is for the gas infrastructure to be used as a peak heat solution. These factors, combined with the use of gas turbines to backup intermittent generation sources, could result in the gas and electricity networks becoming increasingly interdependent systems in coming decades[43].

FINDING 12

The Government needs to develop its understanding of the economic value of gas storage capability for UK plc, by creating a national 'whole model system' for energy storage.

FINDING 13

The Government should conduct detail investigations into the consequences of electricity network reinforcement, heat network construction and gas network reinforcement. These investigations should examine the impact of large scale deployment of network options from a practical perspective, ideally using a case study approach. The investigations should focus on the deployment challenges as well as cost.

[43] UKERC (2013) Future of the gas networks: Research agenda

6. CO-ORDINATION

There needs to be a policy in place that will lead a market transformation in heat. Local knowledge will be key to designing, coordinating and delivering a robust and effective decarbonisation strategy. Policies aiming to change how we heat our homes and buildings will need to engage with millions of consumers, across a range of areas with differing patterns of heat demand and supply. Although it is not yet clear who is best to lead an ambitious decarbonisation programme for the sector, any successful strategy will need to be coordinated between local and national levels. There will also need to be greater integration between approaches to energy efficiency, fuel poverty, and renewable heat. This would require cross-departmental agreement within Government from the likes of the Department for Energy and Climate Change (DECC), the Department for Communities and Local Government (DCLG), the Department for the Environment, Food and Rural Affairs (DEFRA), the Department for Health (DfH), and the Treasury.

Local strategies

Carbon Connect's *Pathways for Heat* report highlighted the complexity and interconnectedness of developing effective solutions to decarbonise heat for buildings. The inquiry found significant limitations in considering the transition at a primarily national level and advocated more work on local approaches. Given additional resources, local authorities could be well-placed to coordinate and collaborate with others and develop local strategies and plans. Clear targets would need to be set by Government, along with a detailed strategy on how to meet them in order to provide local authorities with the necessary policy certainty to drive low carbon heat provision effectively. At this moment in time there are no targets for low carbon heat provision[44], and the focus in this decade on energy efficiency is yet to yield the desired results in terms of take-up of retrofit installations[45].

Coordination demand, supply and networks

Narrowing the geographical scope makes it easier to increase the level of detail in other areas, such as spatial, energy network and building stock information. This can help ensure that the important interactions between energy efficiency improvements, deployment of low carbon heat and their impact on energy networks are captured within decarbonisation plans. For example, improving buildings' energy efficiency can make district heating less costly to install in both new and existing buildings. In areas where options for low carbon heating are limited (eg: expensive electricity network upgrades, no heat networks), greater effort on retrofit energy efficiency or options to repurpose local gas grids may be justified.

The data that could be gathered from smart meters is also something that could help coordinate the balance of demand and supply which would help to design more effective projects and schemes. Smart meters could prove to be an incredibly useful tool for local authorities and energy companies in this area, as long as issues around access to and protection of data privacy can be dealt with.

[44] Which? (2015) A Local Approach to Energy Efficiency
[45] HM Government (2011) The Carbon Plan: Delivering our low carbon future

Put local authorities in control

Local authorities are well placed to develop local strategies and plans, with access to information, an existing base of expertise in relevant areas and control over important levers such as planning. They can work across policy agendas including fuel poverty, health and economic growth to produce holistic local plans. Although many local authorities do not have the capacity or skill to currently do the work alone, they occupy a space ideally situated to work with utilities that have access to essential data, such as detailed supply and demand information.

Information will be key to designing cost effective and practical decarbonisation strategies, and local authorities hold information about their local building stock, and increasingly, sources of heat supply and demand through the development of local energy masterplans. Although these were initially developed to help identify areas suitable for district heating, they are now being expanded to consider retrofit energy efficiency. Similarly, the Home Energy Conservation Act (HECA) 1995 requires authorities to assess the potential to improve the energy efficiency of residential accommodation in their areas. Local authorities also hold information about vulnerable and low income residents that is crucial in targeting policies to tackle fuel poverty. This could be a key driver of retrofit energy efficiency installations.

Many local authorities already have expertise in managing energy supply and demand in their own building stock and through their planning activities. A locally focused plan for heat could therefore build on an existing skills base, although resources would be needed to expand this capacity.

Finally, planning is already being used by local authorities to stimulate the development of district heat networks, for example by ensuring that new developments either connect to existing local heat networks or are able to do so in the future. This would require more stringent monitoring of progress of district heat networks, and reviewing of systems completed, to ensure that this is being done to the highest possible standard. This is necessary to safeguard against a failure to meet these aims due to the financial tensions within local authorities. Local authorities could also use their tax setting powers to benefit more energy efficient properties and create a further driver for uptake. In addition, local authorities are able to access low cost capital to help develop large infrastructure projects such as heat networks.

Benefits

Giving local authorities' responsibility for coordinating local heat strategies could bring numerous benefits. They are well placed to engage with local supply chains, to ensure that economic activity benefits local businesses and communities, helping to build local capacity as well as building public and political support. There are a number of criticisms of ECO as a delivery tool for low carbon heat. It is claimed that it doesn't effectively deliver enough installations overall, that it hasn't delivered enough to the poorest in society and that it is it's not clear whether it actually cuts fuel poverty. The cost-effectiveness of the scheme has also been questioned, as well as a lack of transparency on cost. This means that delivery under ECO has a long and complex supply chain that begins with national energy suppliers and ends with local installers who carry out the work. Coordinating heat policies at the local level could also facilitate the growth of 'warmth on prescription' schemes, whereby local health practitioners refer vulnerable patients, whose health could benefit from improvements to the energy efficiency of their homes, to local efficiency schemes. This also allows the ability to integrate and coordinate different budgets providing more effective use of resources, as has previously been advocated in this report.

Fuel poverty as a pilot

The current obligations placed on local authorities, such as the Home Energy Conservation Act 1995 (HECA), are unlikely to stimulate activity on the scale that is required[46]. Devolving responsibility for policies to tackle fuel poverty to local authorities could improve delivery (see energy efficiency section), and drive a more integrated application of heat supply and energy efficiency schemes. This would help build capacity within local authorities as well as local supply chains for more ambitious programmes in the 2020s.

A locally focussed approach to fuel poverty could be designed to include low carbon heat supply. There are some 600,000 fuel poor homes that do not currently have gas mains heating[47]. Ofgem currently operates the Fuel Poor Network Extension Scheme (FPNES) which aims to enable vulnerable domestic customers to switch to natural gas to heat their homes by helping towards the cost of connecting to the gas network. It is for use in existing houses that have no gas supply at present. Recommendations from Ofgem's consultation on changes to the FPNES suggested that the eligibility criteria be adjusted to adopt the UK Government's new definition of fuel poverty in England, meaning that a large proportion of people struggling with fuel poverty were no longer eligible for this support. It was also recommended that the scheme could be amended to facilitate gas connections for district heating[48]. With this in mind it is important that there is greater co-ordination between this scheme and the RHI to ensure that all parts of society are given the opportunity to access renewable heat. Part of the ECO budget could be used, in conjunction with the FPNES, to provide capital support to these households, helping to ensure that a diverse set of technologies is deployed under this scheme during the rest of this decade. As the FPNES is about connecting fuel-poor households to the gas grid, it is important to ensure that there is a low-carbon focus to this as well. Having to connect a property to the gas grid, and then provide energy efficiency upgrades at a later date could cause decarbonisation efforts to become cumbersome and no longer cost-effective.

Placing greater responsibility for local heat policy would mirror current moves to devolve power away from central Government, for example the recently agreed deal to hand greater control over transport, housing, planning and policing to the Greater Manchester Authority. Statutory responsibility for delivering fuel poverty and carbon targets could be placed with local authorities to ensure that there is a driver to accompany new powers. Many local authorities have already set their own carbon reduction targets, but these are not currently coordinated with national carbon budgets.

Low carbon heat zones

Devolving power to local authorities over fuel poverty schemes will help encourage an integrated approach to low carbon heat supply and demand. Local plans will ultimately need to take into account both publicly and privately owned building stock, and a narrow focus on the fuel poor will miss opportunities to trial approaches and solutions to decarbonising heat in privately owned buildings. Low carbon 'heat zones' could be established in contrasting local areas, where the design and delivery of a comprehensive heat decarbonisation plan covering heat supply and energy efficiency of both publicly and privately owned buildings, and new and existing buildings, could be tested. This would trial the costs, benefits and feasibility of such a model, exploiting the greater role that some local authorities are playing in local energy planning and providing an example of a more integrated approach to others.

[46] CCC (2012) How local authorities can reduce emissions and manage climate risk
[47] CCC (2014) Progress report to Parliament
[48] Ofgem (2015) The findings of our review of the Fuel Poor Network Extension Scheme

A similar example can be seen in the Danish 'green building zones', where Danish municipalities have legal tools available to them to encourage green urbanization, under the Energy Agreement (2012) initiatives aimed at lowering heat and energy demand in buildings[49].

FINDING 14

The Government should trial the use of low carbon heat zones in certain areas and monitor the results.

Coordination local and central Government

Whilst many aspects of delivering heat decarbonisation might be better planned and delivered locally, there will be a need for central coordination to provide support, coordinate activities to avoid duplication and ensure that knowledge and expertise is shared. The wider energy network impacts of local heat strategies will need to be considered, and central Government will have a key role in setting the legislative and regulatory framework to ensure local heat strategies can be achieved. This would require clear targets and guidelines for local authorities, along with increased support and guidance from central government.

Support

Central Government will have an important role to play in ensuring that local authorities are supported with the adequate skills, knowledge and resources to plan and implement local heat strategies. The Heat Networks Delivery Unit (HNDU) has provided a useful model of how such an approach could work. Extending the remit of the HNDU beyond the feasibility stage of district heat projects to ensure that local authorities have the support necessary to implement the plans would encourage take up of this option. Similarly in Scotland, the District Heating Loan Fund and Warm Homes Fund are providing centralised funding to support heat mapping, feasibility studies and design costs. Central Government can also provide guidance on accessing funding and finance, including European funding, as well as technical, legal and commercial support.

Central guidance

Central coordination would ensure that knowledge is shared between projects and authorities to avoid duplication, reduce costs and to provide strategic direction. A number of low carbon heat trials have taken place in recent years, funded from a variety of sources including central Government (via City Deals) or from other sources such as the Low Carbon Networks Fund. However, at present there is no mechanism to ensure that knowledge gained from these programmes is shared widely amongst local authorities, only a number of relatively uncoordinated platforms for local authority staff to share best practice currently exists, such as the low carbon energy programme of the Cabinet of Core Cities and work by the Association for Public Service Excellence (APSE). There is a role for central Government to better coordinate research, trials and training relevant to local heat policy design and implementation.

Better coordination of the funding opportunities available for developing innovative low carbon solutions is also needed, and there have been developments in this area with the replacement of the Low Carbon Network Fund (LCNF) with the Network Innovation Competition (NIC), which has been confirmed over a 10 year period. The provision of each

[49] Danish Energy Agency (2014) Green Urban Denmark

funding opportunity is also clearly stated, allowing businesses to plan more effectively. Despite these positive developments, the fund is, per year, smaller than the LCNF[50].

One stop shop for consumers

Central Government should look to further coordinate its policies and incentives on energy efficiency and low carbon heat to provide a 'one-stop' shop to consumers. Although energy performance certificates and the recently ended Green Deal assessments provide information on both heat supply and demand options, application to these schemes is administered separately and their solutions are provided by different supply chains. Consumers considering their options may potentially be eligible for a range of schemes and there is currently no means by which to navigate these in a coordinated way.

Overarching strategy

Control over certain elements of a strategy for heat will always best remain with central Government. These include the wider impacts of local strategies on energy networks, funding for innovation and market frameworks. Central Government may also have an important role ensuring the best strategic use of limited but flexible resources such as biomass and bio-methane across the energy system. It is also important that Government drive forward the implementation of time of use energy tariffs, to exploit the full potential of smart meters, and ensure that policies adequately incentivise new markets in demand side response and energy storage.

FINDING 15

The Government should coordinate and support local authorities' local strategies, pathways and reviewing processes for renewable heat, and help share information on best practice and project development amongst local authorities.

[50] OFGEM (2015) VERSION 2.1 OF THE NETWORK INNOVATION COMPETITION GOVERNANCE DOCUMENTS

7. FUNDING & FINANCING

Despite the promising commitments made in during the last Parliament, the Government is currently moving in the wrong direction for low carbon investment and financing, following the removal of the Climate Change Levy exemption for renewable power generation and the scrapping of the Green Deal. Alongside the RHI, these both have a huge impact on the finance options for low carbon heat for buildings and have undermined the certainty over the Government's commitment to supporting decarbonisation and financing the long-term work necessary for the UK to meet the requirements of the Fourth Carbon Budget. Similarly, we appear to be no closer to the introduction of a carbon price than we were at the start of the last Parliament, meaning the long-term costs of carbon emissions are still not being reflected in the costs facing consumers. Articulating how finance and funding will be implemented and structured until 2030 is an essential part of any low-carbon heat policy from the Government, particularly following a period of growing concern within the energy efficiency and low-carbon heat sectors.

A transition to low carbon heating could increase heating costs for some consumers, depending on the kind of low carbon heat technology that is implemented, although these costs still remain lower than the long-term cost of taking no action at this stage.[51] The relative costs and comparative value of different low carbon heat options will vary as markets, supply chains and technology develop, yet it in all circumstances the addition of a stable carbon price would help improve the price parity of higher and lower carbon-intensity technologies. If the Government is not willing to put a price on carbon, funding may need to be found to bridge the gap between the cost of fossil fuel and low carbon technologies. This could take the shape of market creation through incentive-focused grants and loans to consumers or alternatively could be in the form of cost-mitigation to consumers impacted by new regulations. In the case of technologies with higher upfront costs but lower running costs, the Government may need to provide more attractive financial incentives, such as some form of initial capital support. A new Wales & West Utilities study has found that increases in heating costs could be very substantial, in the case study area of Bridgend with either; a doubling of heating bills for a heat pump, or an upfront cost of £10,000 for a heat network, but the limited savings meant a long payback of 35 years[52].

The RHI has an annually increasing budget cap which will reach £430 million for 2015/16, funded through general taxation or a carbon price. Estimates suggest that to meet the Government's ambition of sourcing 12 per cent of the UK's heat demand from renewable sources by 2020 to meet the Renewable Energy Directive, spending on the RHI would need to reach nearly £1-2 billion annually by 2020[53]. Future alternative funding streams could be established that are more adaptive to changes in the energy market. For instance, the IEA

[51] CCEP(2015) Nationally Self-interested Climate Change Mitigation: a unified conceptual framework
[52] Wales & West (2015) Future of energy & investments in gas networks Phase 3 – Understanding the home energy policy needed to satisfy consumer willingness to pay to change
[53] DECC (2013) Domestic RHI Impact Assessment

has proposed an automatic mechanism that reallocates funding from fossil fuel subsidies to renewable sources when the oil price falls. A benefit of this approach is it would help balance out the disincentive that lower oil prices have been shown to create for the uptake of low carbon heat technologies like district heating.

In comparison, Government has agreed that up to £7.6 billion (2012 prices) will be spent on support for low carbon power generation annually by 2020, potentially peaking at £11.6 billion in 2025 to decarbonise the sector as recommended by the CCC[54]. Current annual spending on energy efficiency policy (ECO) is estimated at around £850 million per year. The costs of both these policies are at present levied on electricity bills.

There is uncertainty over how Government will replace the ECO after it comes to an end in March 2017 and how further installations will be incentivised should the ECO reach its target ahead of the programme's end date. Further uncertainty has been created by the Government's decision to discontinue funding for the Green Deal Finance Company. Confirming continued support for energy efficiency installations beyond 2017 will be an urgent priority for the new Government. Many technologies are at an early stage of development in the UK and will require additional deployment to establish supply chains and to bring down costs. Whatever replaces the ECO will have to be more ambitious if the Government is to achieve its fuel poverty targets, with the existing ECO having delivered approximately a little over 1 measure per household targeted, whereas it is estimated that 3.2 measures per household will be needed in low-income households to meet the target of ensuring that as many fuel poor homes as reasonably practicable achieve a Band C energy efficiency standard by 2030. ECO's replacement will also have to be more targeted, with the existing scheme having failed to reach fuel-poor households effectively[55], with percentage of households in fuel poverty having changed little over the last decade.

Longer term options to encourage the take-up of low carbon heating will also need to be considered over the next Parliament. Phased regulation to require consumers to install lower carbon heating systems would reduce policy costs, with compulsory requirements making a premium-incentive unnecessary. New regulation would nevertheless require careful consideration of the costs imposed on consumers, especially the fuel poor, and how to mitigate these, as well as how to avoid the stranding of assets bought before new regulations come into effect.

The impact on network costs will also need to be considered. For example, many pathway analyses for the sector indicate that electric heat will play a growing role beyond 2020, potentially adding to network costs by requiring reinforcement of local distribution networks. The recent removal of renewable energy production from the Climate Change Levy, and subsidies for onshore wind farms and potentially large scale solar farms has caused some concern as to whether the UK will meet electricity decarbonisation targets. However, for the moment, electrification of heating remains among the most robustly considered in terms of research undertaken by Government and industry. Despite this, more work needs to be done to address how loading additional pressure onto the electricity network could affect costs and temporarily increase carbon emissions. The impact of the lower energy efficiency of existing buildings must also be considered, given that 80 per cent of buildings in 2050 are likely to have already been constructed. More broadly, more research needs to be done on technologies that can be implemented alongside greater electrification, for example hydrogen, with the H21 Leeds Citygate project run by the Northern Gas Networks serving as a good example[56].

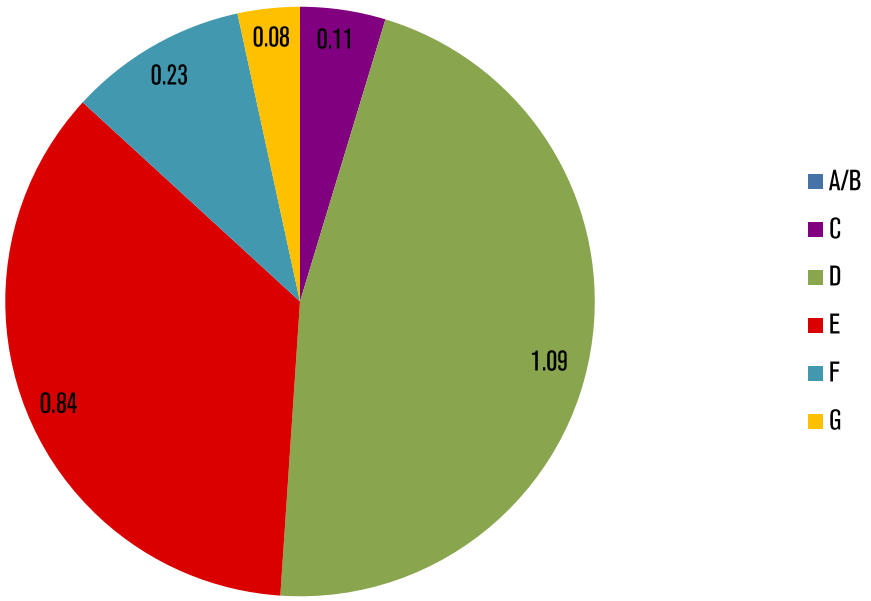
[54] CCC (2013) Next Steps on EMR Reform
[55] Committee on Climate Change: Progress Report to Parliament (2015)
[56] Northern Gas Networks (2015) Network Innovation Allowance Progress Report

In terms of encouraging finance for district heating, the relatively low penetration of district heat networks in the UK (2 per cent of households) compared with other European countries could present an appealing growth opportunity for European companies experienced in their domestic sector. However, foreign investment is discouraged by the perception that the UK Government is not sincere in its desire to encourage and support the rollout of district heat in the UK. British companies also have been discouraged by the lack of firm commitment to district heat, with British companies having the funds available to fund initial work but being unwilling to make projects financially viable due to high capital costs coupled with long-term uncertainty. Capital expenditure remains a barrier despite revenue and operational expenditure being relatively certain for district heat networks.

FINDING 16

The Government must set out a long-term plan detailing how it will support the low carbon investment necessary to bridge the 'carbon gap' of the Fourth Carbon Budget. This should include details on what will replace the Green Deal and the ECO. Future policy ought to have long-term finance support and targets.

Figure 4: Fuel Poor households by the Fuel Poverty Energy Efficiency Rating (millions) 2013



Source: DECC (2015) STATISTICAL PRESS RELEASE Fuel Poverty, England 2013

Notes: Statistics for households in England only

Spending compared: determining 'least cost'

As stated in the introduction, it is likely that to meet the 2050 carbon targets the decarbonisation of heat for buildings will play a large role. However, ensuring this is achieved at least cost to the taxpayer and consumers requires the various costs of low-carbon

heat options to be considered alongside the cost of decarbonising electricity sources and network maintenance.

Further comparisons are needed on the relative costs and benefits of funding on energy efficiency and funding on low carbon heat technology. The Technical Report on the Fourth Carbon Budget, published by the CCC, revised down the cost effectiveness of some abatement measures. Insulation measures were revised down by 22 per cent to 7 $MtCO_2$ of abatement by 2030, due to new evidence on energy use in homes and the energy performance of solid walls. Heat pumps were found to be less cost-effective than previously expected, due to their 'capital cost, performance and durability', leading the estimate of carbon abatement being reduced to 14 $MtCO_2$ by 2030. This could reflect the close relationship between heat pump effectiveness and the quality of household insulation. This dependence on insulation means that heat pump installation should primarily be focused on new build households and buildings that have undergone a high-quality retrofit. These requirements should be reflected in any finance mechanism introduced by the Government.

The CCC estimates that insulating all potential cavity walls would provide 2 $MtCo_2$, however, this includes 1.6 million 'easy-to-treat' cavities, which DECC estimates cost on average £376 to treat and 2.9 million 'hard to treat', which are considerably more expensive, with DECC estimating treatment costs at £1,600. This is reflected in the different tonnes per carbon estimate the CCC gives easy and hard to treat cavity walls, with easy to treat walls being estimated to cost less than £100 per tCO_2 and hart to treat estimated in the range of £106-1,290 tCO_2.

Solid wall insulation is estimated at a range of £88 to £2,000 per tCO_2 for external walls and £70-890 per tCO_2 for internal walls, with the wide range reflecting the potential economies that can be found in practice, such as combining insulation with other renovations. Lost insulation is estimated at costing less than £22 per tCO_2.

The CCC has also estimated[57] the cost of solar PV deployed on existing UK residential buildings to be around £260 per tCO_2, although this will be influenced by contextual regional factors and installation costs. Solar water heating systems have been found to have higher abatement costs, estimated at around £600 per tCO_2.

The comparative abundance of work done on the abatement costs of energy efficiency products contrasts with the relatively small amount of research undertaken on abatement costs of decarbonising heat generation at source. A lack of research in this area has been commended on previously in DECC literature[58], and further research is needed to directly compare the abatement costs of different heating options for domestic buildings. Potentially increased network costs will be a necessary part of this calculation.

In terms of assessing the cost of low carbon pathways that rely on decarbonisation at source (either through low carbon electricity generation or CSS), the calculation of carbon abatement costs will need to consider both the cost of decarbonising at source, the levelised network cost of meeting great electricity demand and the cost of installing electric heat pumps in households. More research is required in this area to create a better understanding of the relative value of different pathways, although it worth noting that decarbonising electricity generation at source will clearly have benefits impacts beyond heat, meaning the cost comparison is not wholly like for like.

[57] Grantham Institute for Climate Change (2014) Solar power for CO2 mitigation
[58] DECC(2012) Decarbonisation of heat in industry

One clear implication from the CCC's 2015 Progress Report to Parliament, particularly the revisions regarding district heat, is that public policy has a direct impact on the costs and relative value of different technologies, with supply chain development and innovation being catalysed by clear Government commitment. This suggests that in order to effectively decarbonise buildings 'at least cost' the Government must show a degree of leadership and commitment to a clear, long-term decarbonisation pathway, as it is this commitment that will encourage industry to do the work needed to find cost-savings. This will require acceptance that 'least cost' does not necessarily mean 'no cost' and Government-willingness to allocate funds for long-term energy benefit, as it has already done with the construction of new nuclear power sites.

Hybrid system

Hybrid systems could work as a transitional tool that offers security to the consumer whilst still seizing on the opportunity to decarbonise. The installation of combi gas and electric hybrid boilers have a lower upfront capital cost than some other technologies and would enable consumers to make greater use of electrical heat as it becomes more economical and less carbon intensive to do so. The retention of a more traditional gas-heating element may also make hybrid systems more attractive to consumers. A danger of a widespread hybrid approach is that hybrid systems become 'locked-in' as the technology of choice in for the long-term, rather than being used as a truly transitional technology.

Despite these concerns, hybrid technology could be useful in decarbonising otherwise hard to treat households, such as listed buildings or remote households. Regulation could at least require that all gas boilers sold after a certain date, contain some form of hybrid technology.

Financial innovation

Revenue decoupling has been suggested as an innovative finance practice the UK could adopt. Revenue decoupling seeks to remove the link between an energy supplier's level of sales and their level of profit, thereby removing the disincentive energy suppliers have to support great energy efficiency. The system operates as a form of compensation scheme, with the money provided to utility suppliers being set in line with various fixed and variable costs, such as commodity, infrastructure and labour costs. Fixed prices creative an incentive for suppliers to provide as little energy as is necessary, thereby making it more economical for suppliers to support energy efficiency improvements among their customers.

The approach has been adopted for at least one utility in a number of American states, including California, with others currently investigating how a decoupling system could be implemented. In the US, decoupling has been more frequently implemented for natural gas than electricity suppliers. Even if this system was not implemented among the UK's larger suppliers, the fixed income for suppliers offered by a decoupling-based system could be well applied to supporting smaller energy suppliers, who are particularly vulnerable to irregular income streams. Adopting a voluntary 'decoupled approach' for smaller suppliers would help improve energy efficiency whilst continuing to diversify the UK's energy market.

Other European countries, such as Italy, have adopted 0-0.5 per cent rates of interest for loans made under pay as you save energy efficiency schemes. Adopting a lower rate of interest for any future pay as you save mechanism may result in more success than the 7 per cent rate of interest used for the Green Deal, which was found to be uncompetitive with loans offered by the private sector.

Retrofit energy efficiency and the discontinuation of the Green Deal

The decision to discontinue funding for the Green Deal Finance Company has created a high level of uncertainty over how the Government intends to facilitate energy efficiency uptake in able-to-pay households. This uncertainty is worsened by the European Court of Justice's decision that the reduced 5 per cent VAT rate for energy efficiency products is not in compliance with EU law. These developments will have a negative impact on the energy efficiency industry and postpone the development of a mature domestic supply chain.

While the Green Deal was not without flaws, it is regrettable that a settled infrastructure for supporting energy efficiency has been removed with no replacement being provided, especially given the time it took to establish the framework initially. However, there are still lessons that can be learned from the experience of the Green Deal that could help inform any future scheme designed by the Government. Any future pay-as-you save mechanism (PAYS) would benefit from a more relaxed version of the Golden Rule, a lower, more competitive rate of interest and a simplified process for the consumer. It is vital for industry confidence that the replacement for the previous Green Deal system be announced and ideally introduced before the expiration of the ECO in March 2017.

Modelling produced by Cambridge Econometrics in association with the Energy Bill Revolution campaign has found that, even with a per-household cap set at £10,000 it will still not be possible to bring 15 per cent of households to at least band C on the EPG ratings. This suggests that the Government will have to consider how more funding can be secured to improve very hard to treat homes or whether it would be more economic to install electric heating in these homes and decarbonise the heating through the broader increase in low carbon electricity generation.

Local strategies

Local authorities could be required to introduce and deliver low-carbon heat strategies from 2017 as part of a replacement for the ECO. Any new duty placed upon local authorities would likely have to be supported financially, either directly from central government or some other source, such as a continued levy on energy bills. Beyond 2017, ECO could be used as a central fund that local authorities are able to bid into, funded by a fixed levy on energy bills, rather than the open ended mechanism currently in use, providing greater cost certainty. The levy should be combined with public funding, at the level of existing spend, and paid into a centrally-overseen fund that would be allocated to local authorities to take forward energy efficiency and fuel poverty schemes in their area.

It would be possible to allocate this funding in a way that encourages innovation and best practice, with central Government allocating a standard fund for all local authorities and establishing a second fund to be awarded in recognition of good practice. The £25 million Central Heating Fund (CHF) launched by DECC this year operates in a similar way to this, the applications to the fund being judged on a number of pertinent factors, such as the number of fuel poor households supported by a proposed scheme and the benefit of local authority intervention. While the CHF allows energy efficiency improvements to be considered in the assessment of the benefits of public intervention, greater emphasis on energy efficiency could encourage better outcomes. A central fund with a focus on decarbonisation and the fuel poor would constitute a triple win for the Government, furthering its goals for eliminating fuel poverty, reducing carbon emission and increasing localism. If a new central fund is decided against, benefits could still be accrued if the CHP was relaunched with greater emphasis on decarbonisation.

Local authorities can also enable private investment at a local level by creating exclusive, long-term contracts with private developers, as has been attempted in Newcastle, where a private developer was awarded a 50 year license. This approach would have to include safeguards that protect consumer choice and could stipulate the consequences of poor performance, but would nonetheless help de-risk investment for private developers. Bespoke investment mechanisms could also be crafted by local authorities to capitalise on their local knowledge of heat demand. A facilitating role in securing finance may be the most effective role for many local authorities, reflecting both the spending constraints at a local government level and the relatively low numbers of domestic properties that remain in public ownership.

During the last Parliament, a locally organised 'warmth-on-prescription' scheme was trialled, with DECC allocating a £1 million fund to support nine local authorities boost their efforts to improve energy efficiency in fuel-poor households, with the goal of improving the health of the inhabitants. With the National Energy Action charity estimating that cold-related illnesses cost the NHS £1.5 billion per year there are clearly financial savings that could be made through the preventative impact of warmer households. This approach could be taken on by Clinical Commission Groups, who could either fully fund improvements or cost share with local authorities or central Departments.

Community Energy

There are opportunities for the community energy model to be applied to domestic heat, particularly for district heating and 'whole-community' retrofits. Government statistics state that there are over 5,000 community energy groups currently operating in the UK, with the Rural and Urban Community Energy Fund having already provided a combined total of £25 million for urban and rural community groups. Local authorities could follow this example and take a more active role in identifying investment opportunities for community groups. Steps have already been made through DECC's Heat network Delivery Unit (HNDU) to provide technical guidance to community groups and it is vital this is allowed to continue.

Mortgage finance

A largely untapped source of potential finance comes from the mortgage lending market. The ONS estimates that on average 16 per cent of disposal household income is spent on energy bills, suggesting that household energy efficiency and long-term heating supply ought to be a concern for mortgage lenders. It has been reported that banks are already independently seeking improved modelling of energy costs as part of their decision making process on lending. The Government could accelerate this by introducing a requirement for all mortgages taken on properties below a minimum EPC rating to be accompanied by an energy efficiency improvement plan. The Government could support this by expanding the Help to Buy scheme to include these improvements or by offering Stamp Duty relief on more energy efficient properties. This would enable lenders to develop their own practices for improving energy efficiency, benefiting first-time buyers by raising the ceiling on borrowing. A mortgage-led policy could constitute a market-driven, private-sector focused replacement to the Green Deal and the Zero Carbon Homes Standard at a relatively low cost to the taxpayer.

The Government ought to recognise that decarbonising at 'least cost' is not synonymous with decarbonisation at no cost, as well showing an awareness how of impact public policy impacts the relative value of different technologies and pathways.

FINDING 17

Local authority-led finance approaches should be considered as part of the replacement for ECO and the Green Deal, however any further duties placed on local authorities must be fully resourced if they are to prove effective.

FINDING 18

Greater imagination is needed from decision makers on how decarbonisation will be financed, with multiple approaches and opportunities ready to be exploited. The UK could adopt approaches tried in other countries, such as revenue decoupling or 0 per cent loans, or it could attempt to bring in new areas of the private sector, such as mortgage lenders, to the decarbonisation debate.

METHODOLOGY AND STEERING GROUP

Carbon Connect carried out this inquiry between January and September 2015. Evidence was gathered by a conference held in Westminster on the 12th of January 2015. This was supported by a series of evidence gathering sessions held in partnership with Arup between March and June, interviews with those working in and around the sector, written submissions, desk-based research and input from our steering group of industry and academic experts. The views in this report are those of Carbon Connect. Whilst they were informed by the steering group and listed contributors, they do not necessarily reflect the opinions of individuals, organisations, steering group members or Carbon Connect members. All mistakes are those of the authors, not the Chairs, Steering Group or contributors.

Chairs

Jonathan Reynolds MP
Dan Byles MP/Rebecca Pow MP

Steering Group

Kelly Butler	Beama
Florian Gerbier	Veolia
Dr Jeff Hardy	Ofgem
Jenny Hill	Committee on Climate Change
Phil Kirby	Policy Connect Board
Stephen Marland	National Grid
Jenni McDonnell	Knowledge Transfer Network
Keith Needham	Institution of Gas Engineers & Managers
Isaac Occhipinti	Energy & Utilities Alliance
John Raspin	Frost & Sullivan
Robert Sansom	Imperial College London
Neil Schofield	Worcester Bosch
Matthew Aylott	Which?
Dr Vincent Thornley	Siemens

CONTRIBUTORS

Adam Bell	Senior Policy Advisor, DECC
Allen Jones	Energy Masterplanner, Newcastle City Council
Angela Murphy	Sustainability Strategy Team Leader, Camden Council
Brian Tilley	Head of Policy and Energy Strategy, E.On
Chris Clarke	Director of Asset Management, Wales & West Utilities
Chris Miles	Renewable Energy Association
Dan Sadler	Head of Energy Futures, Northern Gas Networks
David Adams	Technical Director, Energy Services, Willmott Dixon
Florian Gerbier	Energy Analyst, Veolia Environmental Services UK
Hanae Chauvaud de Rochefort	Policy Manager, the ADE
Jeff Hardy	Head of Future Consumers and Sustainability, Ofgem
Jenny Hill	Senior Analyst, The Committee on Climate Change
Jonathan Graham	Head of Policy, The ADE
Keith MacLean	Independent Expert
Kelly Butler	Marketing Director, BEAMA
Matthew Gordon	Government Relations Director, Honewell
Neil Schofield	Head of Sustainable Development, Bosch
Peter Connor	Senior Lecturer in Renewable Energy Policy, University of Exeter
Peter North	Senior Manager Programme Delivery, Sustainable Energy, GLA
Tony Day	Director, Low Carbon Gas Ltd.
Simon Woodward	Chairman, UKDEA
Simon Wyke	Environment Programme Officer, GLA
Vincent Thornley	[Formerly] Portfolio and Technology Manager – Energy Management Division, Siemens

ABOUT CARBON CONNECT

Carbon Connect is the independent forum that facilitates discussion and debate between business, government and parliament to bring about a low carbon transformation underpinned by sustainable energy.

In addition to around 40 member organisations, Carbon Connect works with a wide range of parliamentarians, academics, civil servants and business leaders who give their time and expertise to support our work. For our member organisations we provide a varied programme of parliamentary events and policy research. As well as benefitting from our own independent analysis, members engage in a lively dialogue with government, parliament and other leading businesses. Together, we discuss and debate the opportunities and challenges presented by a low carbon transformation underpinned by sustainable energy.

Cover designed by Richard P Chapman Design Associates

For further information, please contact
Owain Mortimer (Manager, Carbon Connect)

Carbon Connect
Policy Connect
CAN Mezzanine
32-36 Loman Street
London SE1 0EH

020 7202 8571
carbonconnect@policyconnect.org.uk

www.policyconnect.org.uk/cc
www.policyconnect.org.uk

Printed on recycled paper

Future Heat Series Sponsor

IGEM
Institution of
Gas Engineers & Managers

Pathways for Heat Sponsor

EUA
energy&utilities alliance

A Policy Connect Activity

policy connect