Strategic Framework for Low Carbon Heat in the UK: Summary of responses

Introduction

On 29 March the Government published the heat strategy document, titled: *'The Future of Heating: A strategic framework for low carbon heat in the UK'.* The document set out the possible ways in which the supply of heat can be decarbonised to meet our renewables and emissions reduction targets. Throughout the document we asked for views and evidence of the barriers and opportunities to decarbonising heat and about the future policy options which the Government may need to consider.

The heat strategy publication received 167 responses. 160 of these were from organisations. 7 responses were from individuals. These included most of the large energy companies, trade associations, local authorities, academics, professional bodies, manufacturers, and consumer groups. There were 40 identical responses from wood stove manufacturers. A full list of those organisations that submitted responses can be found at the end of this paper. This summary records the main themes in the responses received to each question. It does not provide a Government commentary on the points raised.

The Heat Strategy and Policy Team in DECC is using the additional evidence provided in the returns to develop our evidence base. This will be combined with more developed internal modelling and analysis to enable the team to develop and test specific policy proposals with the aim of producing policy proposals by March 2013, as stated in the strategic framework document. The team will continue its dialogue with external stakeholders to assist the development of this work.

A summary of the range of responses to each question follows:

THE HEAT CHALLENGE

There were 144 responses to either all or some of the questions in this chapter

Q1: Do you agree with the nature of the challenge described for reducing emissions from heating and cooling across the UK?

Main themes

There was broad agreement to the nature of the challenge as set out in the strategic framework for heat. The main concerns expressed below were the dominant challenges to the strategy that were picked up throughout the document:

The first of these was the emphasis in the strategy on some specific technologies. A number of respondents commented that there should be less emphasis on the exact technologies that could be used to meet the 2050 targets. They would rather the Government established a strong market which encouraged decarbonisation, and provided enough flexibility to allow the market to decide the best mechanism or technology. Linking existing technology to future plans risked limiting research and development.

The above point also tied in with concerns about the assumption that electricity supply would have the capacity to meet future heat demand, particularly to meet winter peak demand, and that it would be zero carbon. Also on networks, a number of respondents commented suggesting that maintaining the gas grid in some form should be part of the long-term solution, to meet this peak demand, and to ensure alternative long term options for the grid, such as hydrogen, were not closed off.

The consumer angle was also another dominant theme in the responses. Consumer awareness and acceptance of the transition to new technologies, and the possible impacts would be a major obstacle. It would be important that Government policies were consistent and not subject to change. Consumer organisations expressed concern that the transition had the potential to impact negatively on the fuel poor.

The strategy would need to take account of the three imperatives of carbon, costs and security of supply and would need a balanced solution to heating for the 2020 and 2050 targets, considering sustainability, affordability and security and also take account our existing situation. There was broad welcome to the strategy's long-term outlook and that a gradual transition was proposed - forcing change too soon would meet resistance from consumers.

A better understanding was needed of the potential of storage and demand response. The strategy appeared to downplay the role of biomass space heating, including wood burning stoves, biomethane injection to the grid, bio-liquids and other options such as deep geothermal. There were also other technologies such as micro-CHP which should be considered. More should be done to encourage the uptake of high efficiency boilers and better heating and hot water controls.

Q2: Do you have evidence that we should be taking account of as we develop our view of this challenge?

<u>Main themes</u>

A large number of evidence sources were suggested or provided which ranged from areas of work underway to existing pieces of research. The former included evaluating the impact on customers of schemes such as the Renewable Heat Premium Payments scheme and the need to take into account new cost optimisation models. Existing pieces of research

included technology performance trials, demand side response reports, the need to review earlier relevant industry reports and data about current technology deployment.

Q3: Are there other dimensions that we should be factoring in as we pursue our responses to this challenge?

Main themes

Infrastructure

Many respondents commented that they were uncertain about the pace and scale of electricity decarbonisation. They would like to see more direct evidence on how electricity would be decarbonised, by when and how this would affect heat. An overall assessment of the energy strategy for heating toward 2050 should not disregard the overall cost of infrastructural investments. A comprehensive approach was needed that included demand reduction and total energy efficient, low carbon generation.

The strategy should identify and consider opportunities to decarbonise on gas grid heating with more efficient gas appliances that may prove easier to deliver than depending on end to end system solutions. The commercial, regulatory, financial and practical considerations of decommissioning all or part of the gas network would be considerable. In relation to the gas grid, it was important to understand the relationship between Industry and building heat demand, both were supplied off the same gas network e.g. 80% of industry load is connected to the low pressure tiers of the network and therefore could not necessarily be considered in isolation. The gas grid should be maintained for the longer term to keep open the option and safety net that the gas network provided should electricity not be decarbonised in time, and this would also leave open the potential transition to hydrogen networks.

Policies

Other issues that would need to be considered would be the strategy's links to electricity balancing strategy, gas generation strategy, Electricity Market Reform, transport strategy, smart metering and smart networks, electricity and gas distribution, and transmission price controls

Government policy must also be aligned. Recent confusion over building regulation changes and the role of the Green Deal had highlighted the need for greater policy harmony. Also, the role of incentives and how they may complement each other should be addressed.

The ability of central Government to set policy for local government to follow was not strongly addressed in the strategy.

It was important to set out a clear outline timetable on when Government hoped to achieve certain energy consumption reduction targets in the domestic, commercial and industrial sectors.

There were no policies that put a price on the carbon emissions of fuels used for non-electrical domestic heating. If electricity prices reflected the cost of carbon and the additional costs of investment in low carbon generation, but the cost of heating fuels reflected neither of these costs, there would be little incentive for increased use of low carbon electricity in heating.

In terms of fabric energy efficiency, it would be important that the Low Carbon Heat Strategy and related initiatives evaluated the performance of different options on a whole life performance basis.

Demand and consumers

Consumer behaviour and their willingness to change should be addressed. Reducing the demand for heat through advanced controls and insulation might be a more cost effective way of meeting our targets.

Cooling requirements in buildings were not given as much attention as heating requirements in the strategy, yet were likely to become more important over the coming decades.

Fuel poverty affected more than 6.5 million households across the UK. This total may increase further as a result of continuing high global energy prices and Government proposals for a low-carbon energy industry. Addressing this issue should also be a primary policy focus.

Specific technologies

Research shows that there were currently 3.5 million G or worse rated gas boilers in use today. By 2020 there would be 1.5million and in 2030 around 400,000. The strategy needed to factor in the lifetime of technologies. If high efficiency boilers were still the preferred option in 2019, they would still be in place in 2030, which would reduce the ability to roll out low carbon heating systems to those properties in the next two decades.

The full potential of biomass for heating, especially at small and medium commercial scale (for rural properties, or heat networks for blocks of flats) had not been fully recognised.

Ease of storage of the energy vectors was not given adequate weight in the strategy. Fuels that could be readily stored provided greater flexibility in matching the wide variation in seasonal heat demand than energy vectors that were more difficult to store.

DECC should consider the benefits of storage heating in more detail because of the simplicity it offered as well as the network benefits. Storage heating was currently missing

from a number of Government energy models where only instantaneous electric heating was considered.

There was a need for continuing Research and Development in the low-carbon heat sector as many technologies were relatively new and needed further development or application in the UK. Financial incentives alone might not deliver all of the required innovation. A key dimension which should be considered was the time that it would take to make real market change, which should not be underestimated. Many of the technologies on which we would eventually rely to efficiently and cleanly heat our homes and serve industry are new technologies which are still at market creation stage.

In addition, ultra low temperature heat distribution with heat pumps to upgrade the temperatures in buildings has been used in many inter-seasonal thermal storage systems in the Netherlands, Scandinavia and USA, often as a retrofit solution.

Q4: Do you have evidence about the role that different technologies or approaches might play in our response to the challenge, or the key barriers that we will have to address?

Main themes

Micro CHP could play an important part in reducing carbon emissions from heat. It could replace condensing gas boilers and its ability to produce electricity at times of peak demand made it ideal for balancing. Other technology developments that were noted included electric/gas appliances such as fuel cell micro CHP, hybrid heat pumps and gas heat pumps. The growth in sales of batch fed wood burning appliances over the last few years had been reported at 26.6% per annum.

It was mentioned that there was work underway with DNOs on projects looking at the significant challenge presented by the transfer of heating load onto the electricity network, often in off-gas-grid areas where the electricity distribution networks were weakest.

The whole building structure over its whole life, including the heat use and carbon impacts of maintenance and disposal at end of life needed to be considered and not just the technologies that could generate or use heat more efficiently or use renewable energy. It was also recommended that more funding, combined with collaborative projects, needed to be directed towards greening the gas network in order to properly assess the challenge and improve understanding of what a sustainable gas network could look like.

The future role of CHP needed to be seen in the wider context, in particular the potential of combining district heating with heat storage to allowing CHP plant to meet electricity demand peaks. The heat strategy did not recognise CHP's role in the medium term but some respondents considered the technology would have a longer term role. In this vein, it would be important to consider electricity and heat provision as an integrated system.

MANAGING HEAT DEMAND IN BUILDINGS

There were 121 responses to either all or some of the questions in this chapter.

Q5: Do you agree with the barriers and opportunities set out in relation to managing demand for heat in buildings?

Main themes

Most respondents agreed with the barriers and opportunities set out in the strategy. There was broad agreement that managing and reducing heat demand in buildings was the most important part of any heat strategy. It would affect the performance of new technologies and therefore demand and generation options needed to be considered together.

For new buildings it would be important that the Government followed through its commitment to Zero Carbon Homes by 2016. However, the biggest challenge would be in retrofitting the UK housing stock and the responses covered a range of factors that would have an impact in achieving the change needed. Some respondents commented that, in addition to the Green Deal and Energy Company Obligation, further robust policies would be needed to support the uptake of insulation measures. Linking energy efficiency requirements with consequential improvements as proposed in the recent Building Regulations would be a positive step forward to encourage the uptake of energy efficiency measures. Significant reductions in residential heat demand had been made in the UK in the last decade. This had been largely as a result of regulatory policy, notably the energy company obligations and the requirement for condensing boilers at the point of replacement.. Some respondents would like to see a proper timeline of when homes should be insulated to help the gearing up of the energy efficiency and renewable heat markets.

Raising awareness and getting customers to engage and make the changes needed – both material to their homes and in the way the use and control heat - were common themes. This included solid wall insulation, making the changes necessary to the heat emitters (eg installing larger radiators, underfloor heating), resistance to the upfront capital expense, and a general apathy towards making the changes and dealing with the inevitable disruption during installation.

Respondents commented that they would have liked to see more in the strategy on the installation and use of heating controls. On reducing average internal temperatures, there was a note of caution that with an ageing population and improved levels of insulation temperatures might increase further. It was noted that heating requirements varied significantly across different building types, and therefore appliance solutions would vary accordingly. Further points included considering ways to avoiding the heating of unoccupied spaces, and ensuring that insulation measures did not cause over heating in buildings during warmer periods of the year.

The introduction of smart meters presented an opportunity for customers to engage with their use of energy and to improve the management of their heating systems.

Although many comments focused on the household sector, some would have liked the heat strategy to say more about heat for commercial buildings.

Q6: Do you have evidence from existing projects to demonstrate the costs and benefits of demand management solutions in reducing emissions

Main themes

A large number of evidence sources were highlighted or provided. An example of the information provided includes:

- A US study into the energy consumption reductions of real-time feedback of energy consumption

- Commercial projects utilising reversible air conditioning units with heat recovery to extract heat from areas of a building that require cooling and utilise that heat to other areas of the building or to heat hot water.

- How biofuels (including wood logs) have played an important role in replacing the use of gas in Sweden

- Evidence gathered over many years and published by BRE as Best Practice Guides

- The experience of City Councils in managing housing stock and the investment in measures to improve the energy performance and reduce energy consumption

- The potential role of gas absorption heat pumps

- Current Zero Carbon Homes projects

- The CALEBRE project which will provide useful information on the prospects for future improvement of "hard to treat" homes.

- Information from earlier energy efficiency programmes, including the Energy Conservation Demonstration scheme (and its successors), the Post Occupancy Reviews of Building Engineering (PROBE) studies, and the TSB Building Performance Evaluation programme has more recently invested in real monitoring and measurement of the effectiveness of a range of interventions in the energy

performance of existing buildings.

- Also, the costs and benefits of existing policies have been comprehensively assessed in the reviews of CERT for government.

Q7: If you have been practically involved in managing heat demand in buildings, what lessons can you share?

Main themes

Improvements in wood burning boiler technology had increased the amount of heat transferred - now typically 60% to water and 40% to the room. It was also easy to 'link' a batch fed wood burning boiler to other hot water producing appliances In the domestic stove sector.

New more accurate digital heating programmers might prove difficult for many householders (especially older people) to use. Controls that could be remotely accessed could solve this issue by an independent person setting the required controls on behalf of the householder.

Building owners needed to be made aware of the ventilation requirements for buildings constructed to have low thermal losses e.g. air tightness and specifically the negative effect this could have on buildings and building occupants if not addressed.

One respondent summarised the characteristics energy efficient heating should have: incorporate the most efficient primary plant to generate heat or hot water; ensure that heat or hot water was distributed (or generated) effectively and efficiently; include effective controls on primary plant and distribution systems to ensure that heat or hot water was only provided when and where needed and at the correct temperature; ensure the plant and controls were installed and commissioned correctly for efficient operation, and maintained effectively; be responsive to changes in climate, solar gains, occupancy, activity, and internal gains.

The scale of heat energy saving measures could be difficult to quantify. In many cases fabric, plant and control measures could show good cost effective savings but these could be masked by additional consumption by users – known as the 'rebound effect'.

Sub-metering of heat had become more common for individual buildings on multi–building sites, and was also more prevalent when monitoring CHP and heat pumps. This was an area where development of industry capability was required.

Q8: What policies should the Government pursue to promote or facilitate improvements in the management of heat use in buildings, both domestic and commercial?

Main themes

Existing Government policies

Many respondents commented on the need to align DECC and DCLG policies. The ambition of Zero Carbon Homes by 2016 must be maintained and non-domestic buildings should allow flexibility for decarbonised energy supplies. Greater clarity was needed on the remaining parts of the standard's definition in terms of permissible offsite allowable solutions to provide this flexibility. Setting an ambition for all new homes to be zero carbon by 2016 had given developers a clear signal of the policy direction. A similar approach was required within the retrofit market.

Some respondents commented that it would be important to direct investment to the most cost effective solutions for end consumers. A balance would need to be struck between improving the energy efficiency performance of buildings, and tackling emissions from energy usage, by decarbonising supplies and through other means such as behaviour change, heating and energy systems controls.

Government had to develop policies that gradually made uninsulated homes in the UK unviable. Part of this would require a robust and fully functioning Green Deal with good links to Building Regulations. The DCLG proposal to introduce consequential improvements was welcomed as it would create an opportunity to increase the efficiency of homes at a suitable time of disruption and help to engage consumers. If that market was being pushed towards gas boilers and current Green Deal provisions suggest this might be the case, we were likely to witness renewable heating technologies being sidelined. Policy integration was therefore vital to prevent a missed opportunity.

The measures eligible for use as consequential improvements should be the list in SAP which was used to generate Green Deal assessments and Energy Performance Certificate recommendations and to determine eligibility for the Green Deal. SAP and SBEM (official Part L energy compliance tools) should be revised so that it was easier to specify new products and systems.

There were a number of comments about linking DECC policies, in effect as a package for consumers so that they could access the Green Deal, Renewable Heat Incentive and Feed-In-Tariffs to enable providers to deliver whole-house solutions more efficiently. The improved customer experience should drive the uptake of measures. It was noted that all private sector buildings over a specific size should hold a display energy certificate.

Influencing consumers

A recurring theme of responses was the substantial effort that would be required by the Government to increase public awareness of the benefits energy efficiency measures could bring. The Smart Meter installation would provide a valuable opportunity to engage with

consumers on the management of their heat use. Similarly, the Government should seek opportunities to install room thermostats in the 8 million homes without such a devices. This could also be used an opportunity to educate consumers about energy efficiency measures.

A number of respondents thought there should be financial incentives to influence consumer behavior such as reduced VAT or tax credits for appropriate appliances. A robust accreditation framework to build trust in the Green Deal scheme might be useful measure. Incentivising the uptake of efficiency measures among householders might also include linking property performance to council tax valuations or stamp duty rebates. Future regulation that prevented homes being sold that were not adequately insulated might also be considered.

On protecting the fuel poor, comments included the need to enhance the scale of the Affordable Warmth element of ECO and provide a statement clarifying how hard-to-treat properties in low-income communities will be targeted for priority assistance.

TRANSFORMING BUILDING-LEVEL HEATING

There were 129 responses to either all or some of the questions in this chapter.

Q9: Do you agree with the barriers and opportunities set out in relation to heating and cooling solutions in homes and other buildings?

Main themes

General agreement to the barriers and opportunities set out in this chapter.

These included: consumer attitudes, relatively high upfront cost, risk of increased load on the electricity grid in the winter, the disruption caused by the installation of a new and different heating systems, space requirements and installation times.

There would be a significant infrastructure challenge to move to greater electric heating which would require substantial storage capacity to meet peaks in heat demand at times of low electricity generation. This broader theme was picked up in other responses about the need for a holisitic framework to ensure that decarbonisation achievements in one area of the economy would not compromise decarbonisation in other areas. Others also cautioned that a cost effective and efficient supply chain would need to be developed to manufacture and deliver the scale of transition. There were contrary views about the pace of change. Some thought the focus should be on growing and building a market for renewable and low carbon heating solutions at a faster pace than suggested to lead the way on innovation in these markets and harness the potential for green growth. Others thought the more gradual

transition, as set out in the strategy was the right approach, particularly to secure consumer confidence. There was also caution in being overly prescriptive about the technologies to be deployed and where.

A number of organisations pointed to the opportunities of particular technologies, comments included: the strategy underestimated the savings of replacing older boilers some of which were 35% less efficient than a condensing boiler; the need for the further development and wide commercial deployment of energy storage innovations; that the strategy underplays strength of the domestic wood burning stove market and its growth; the role that micro-CHP could play as a direct replacement for gas boilers; new generation electric storage heaters could create the additional benefit of complementing renewable generation by helping to balance the grid; there should be an increased role for solar thermal technologies, and the role that decentralised energy plant connected to district heating schemes could also support demand side management and support peak demand management on electrical networks.

A number of organisations stated that gas could continue to play a significant role in supplying cost effective heating beyond 2030, whilst ensuring the UK met its carbon and renewable targets.

Q10: Do you have evidence from existing projects to demonstrate the costs and benefits of heating and cooling solutions in reducing emissions in homes and other buildings?

Main themes

A large number of evidence sources were highlighted or provided. An example of the range includes:

- Data from the RHPP scheme.
- Heat pump customer satisfaction survey.
- Monitoring of heat pump performance on an hourly basis.
- The performance of large biomass plants .
- Cost optimisation work and the potential role of gas/electric hybrid heat pump technologies.
- impact of heat pumps on domestic load profiles and smarter ways of accommodating clusters of heat pumps on the network.

- Surveys investigating SAP predictions of how much energy households use against actual usage.

- integrated local solutions to link electricity storage facilities and an active network management system to enable small and medium scale renewables to connect to the grid.

- Housing report assessing the need for better recognition of thermal mass and passive design.

Q11: If you have been practically involved in installing heating and cooling solutions, what lessons can you share?

Main themes

The following provides an example of the range of responses received:

- Commissioning was important to achieve heat pump efficiency and ensuring the installers gave the customer a short handover discussion, improved the performance of the technology and the customer's satisfaction.

- It was important to consider the temperature of the emission system and not to underestimate the energy used up by auxiliaries (such as circulation pumps, fans, electric back-ups)

- It was found that an intensive programme of consultation and education was needed with key stakeholders to inform them of the benefits of biomass - with heat networks originating outside of high density urban areas

- The installation of an absorption chiller system had meant extra demand was not placed on a building's electrical load.

- One issue with the metering of heat pumps under the RHPP scheme was the reliance on mobile phone signal in order to transmit the data. This had been a big problem, especially in rural areas

- Where heating and cooling were provided to buildings the cooling energy required over the year could exceed the heating by a factor greater than 2. This would be exacerbated by better insulated and more air tight buildings.

- Hot water cylinders or accumulators were a vital component in any installation of a wood/biomass burning heating and hot water system. The building industry should be encouraged to include a suitable airing cupboard or space in every new build property. This would enable the fitting of a carbon neutral heating system and link-up systems.

Q12: What policies should the Government pursue to promote or facilitate low carbon heating and cooling solutions in homes and other buildings?

Main themes

Existing incentives and policy mechanisms

One of the most common themes in responses to this question was that the Green Deal and RHI should work together more closely.

There were a number of specific points about the RHI scheme, the most common point being about the need for support for commercial air-to-water heat pumps. There were several comments about incentivising cooling technologies, including through the RHI. There was also interest in the support offered to green gas injection projects being maintained and developed further. There was currently no RHI tariff for landfill gas upgrade and injection despite this use being lower carbon, more efficient and potentially more cost effective than if used for electricity generation. Clear support from Government for hydrogen grid injection would also help to develop this technology.

Introducing a Feed-In-Tariff for micro-CHP of at least 15p/kWh guaranteed for the first 30,000 installations would bring investor certainty.

The Energy Company Obligation could be utilised to support the roll out of low carbon/renewable heating technologies in vulnerable households.

DCLG and DECC polices needed to be aligned. This would include Permitted Development – particularly raising the noise threshold for air source heat pumps, Building Regulations and the path towards zero-carbon homes. We would also need to address the barriers currently posed by the Standard Assessment Procedure (SAP), including how it relates to the Microgeneration Certification Scheme (MCS), relevant EU schemes like the Ecodesign as well as its technical assumptions and the accessibility of its model.

One type of product currently excluded from SAP was the hybrid heat pump systems. Hybrids could deliver a significant part of initial heat pump uptake, especially in off-grid areas in combination with, for example, oil boilers. As SAP does not recognise hybrids, it hindered the deployment of this technology.

Regulatory certainty would be key to avoid stop-start investment cycles and provide confidence to supply chain investors of a long-term business opportunity beyond the next decade.

Microgeneration Certification Scheme (MCS) should be properly funded and resourced to enable the robust accreditation processes for products and technologies under Feed-In Tariff and RHI.

There should be greater recognition of passive design measures in the Building Regulations as a means to promote and facilitate low carbon heating in homes. And more attention needed to be paid to the overheating issue, and the SAP overheating check needed to be more should factor in climate change.

On commercial buildings, a simpler and faster way of getting new and innovative low carbon heating and cooling systems recognised in Part L2 of the Building Regulations would be welcomed.

New policy considerations

A strategy to replace the remaining non-condensing boilers in the UK was needed

An integrated policy to educate the public should be implemented. This should focus on the measures needed at each step in the strategy. In the short term this would focus on educating consumers on the need to insulate their homes.

Introduction of an emissions performance standard to drive the decarbonising of residential heating systems to new levels towards the end of the decade so that a range of low carbon heating technologies, including gas absorption heat pumps, could compete fairly with gas boilers would be crucial.

Financial incentives to influence consumer behaviour such as reduced VAT or tax credits for appropriate appliances should be considered.

introduction of an emissions performance standard to allow alternative heat technologies to compete fairly to move the UK's heating stock beyond today's default option of high efficiency gas boilers would be crucial.

Other areas for consideration

Government policy should also look at encouraging innovation, including into the benefits of dual fuel solutions.

Flue gas heat recovery and waste water heat recovery were emerging technologies that could play a significant part in the future but were not included in the strategy.

Enhance the scale of the Affordable Warmth element of ECO to ensure the Government honours its commitment that low-income and vulnerable households would benefit from enhanced resources to fund the installation of energy efficiency measures, and are provided with adequate upfront support (through ECO, not the Green Deal Finance Mechanism). Provide a statement clarifying how hard-to-treat properties in low-income communities would be targeted for priority assistance.

Q13: What are challenges to skills development and capacity building to significantly increase the number of domestic renewable heating installations?

Main themes

There were over 120,000 trained heating engineers currently working in the UK. Currently there is low demand and high entry costs to renewable technology training and accreditation. The desire to up skill and train will follow customer demand, which should follow with the introduction of policies such as the RHI.

Training

Subsidised training should be encouraged to make training for renewable technologies more accessible. The previous Energy Efficiency Best Practice Programme could provide a useful model. A great number of installer businesses were SMEs which struggled to afford the time and capital resources necessary to gain the necessary skills.

National occupational standards needed to be implemented so that there was standardisation across the UK and so that colleges and other training providers know what courses to provide. This should be resolved quickly as renewables training was now part of the modern apprenticeship scheme.

Microgeneration Certification Scheme (MCS)

Currently MCS was an expensive registration requirement and a significant barrier to entry - the entry and training costs could be modelled on a system similar to the University loans scheme.

The UK would be a more attractive market place for many manufacturers if European standards (that met the specified criteria) were seen as being equivalent to MCS, and thus were eligible for RHI.

The creation of an easy to use tool to show installers the skills, qualifications, competencies they would need, currently being undertaken by MCS to put on their website would be useful.

Installers face confusion, cost and complexity as there were three installer schemes. (1) Competent Persons self-certification schemes (2) MCS and (3) Green Deal. It would be important to integrate national skills and practices into the MCS program so that it was not over burdensome for small and medium enterprises.

It was noted that there were other areas of skills training on the design of building form, fabric and orientation to promote optimal passive performance which could also be supported.

Q14: Do you have evidence on the viability, economics and performance of hydrogen in building heating applications, including distribution through existing gas pipes?

A number of respondents thought that hydrogen had huge potential as it created opportunities for different sectors including the potential for storage, meaning that it complemented renewable generation. Hydrogen's potential should be a priority for further research and development.

Examples were provided of use of hydrogen in other countries, including networks in Singapore and Hong Kong that operated with significant levels of hydrogen (at around 60% blends). These networks made use of similar pipeline standards to those used in Great Britain. It was also noted that the UK's town gas included 50% hydrogen.

There was on-going activity in Europe to research hydrogen's potential. The Dutch Government was running a € 40 million green gas programme to investigate the addition of hydrogen and biogas to the gas network. Research by the European Gas Research Group was focused on risk and safety implications, assessed against natural gas. Results recommended volume blends should be limited to 10% to avoid any risks associated with downstream appliances. Appliances would need to be replaced for higher blends. The evidence from Holland was that gas quality issues were too complex and multi-dimensional for industry to face alone, and strong government leadership would be required. Several projects were under review elsewhere in Europe. There was also mention of a project in the UK that planned to produce hydrogen from wind generation constrained by the network and to use this hydrogen for a variety of uses, including transport and heat.

One academic institution mentioned a revised UK MARKAL model which included options for using hydrogen to produce heat. One new option in the model was to inject hydrogen into the natural gas distribution grids, such that up to 20% of the volume of gas delivered was hydrogen (this was the maximum proportion on the basis of evidence from engineering studies and field trials). It was found that the model did inject hydrogen into natural gas distribution networks as a cost-effective means of reducing the carbon intensity of heating in the residential and service sectors, with injection beginning between 2025 and 2035

depending on the overall rate of decarbonisation. The results suggest that the option of injecting hydrogen into gas distribution networks was worthy of further analysis.

It should be noted, however, that some respondents commented that the use of hydrogen in domestic properties would appear to be an expensive, unnecessary and potentially high risk strategy.

DEVELOPING HEAT NETWORKS IN THE UK

There were 70 responses to either all or some of the questions in this chapter.

Q15: Do you agree with the barriers and opportunities set out in relation to heat networks?

Main themes

Broadly speaking there was agreement with the barriers set out in the Strategy paper.

The specific barriers to deployment of district heating networks highlighted in responses were:

Capital costs : District heating networks were complex projects, with long lead-in times coupled with lengthy payback periods. One of the largest costs for heat networks was financing the pipe network, especially when linking existing buildings. The significant upfront investment required increased the financial risk associated with such schemes.

Securing anchor loads : A constant, but diverse demand for heat was needed to support a viable heat network, limiting their suitability to specific locations. These schemes typically started small and expanded over time as demand for the service grew. This presented issues for the development of business cases.

Piecemeal development: Compared to other European counterparts, the market for district heating was confined to existing networks (often on housing estates) and new build developments, both usually confined to the development only. There was some concern over the scale of ambition for heat networks in the heat strategy and the viability of these plans. Other countries did not seem to have taken such a radical approach to heat networks, preferring smaller, consumer led projects.

Political will and internal capacity was needed by Local Authorities to be able to deliver complex schemes involving a high degree of risk.

One commonly occurring theme was the potential risk of networks becoming dependent on gas for the long-term.

Several stakeholders raised concerns about the cost and disruption associated with pipe installation, which might involve digging up roads and other public spaces. Others indicated that heat networks would fail due to people's lack of inclination to collaborate on projects.

An important issue which the consultation did not engage with was the range of different relationships local authorities had with commercial providers, and the different ownership and governance forms under which district heating had developed in different places in the UK.

A further challenge to mobilising the skills which a local authority did hold in-house was coordination and coordination between levels of government. There were also issues of policy coordination, within and across local, regional, devolved and central governments. Heat networks cut across policy areas and mechanisms including regeneration and local economic strategies, fuel poverty, spatial planning, building standards, waste management, climate change mitigation and energy security.

There were also issues about the ownership of the actual network, and complications around connecting two or more networks together, long term contracts with users and maintenance costs.

Local planning should be joined up with national strategies both for heat, business growth and regeneration to ensure new assets did not become stranded over coming decades as electricity became less carbon intensive.

There needed to be information about low carbon or recovered heat sources, the seasonal profiles of both supply and demand, and overall heat densities, in order to assess whether a particular location was suitable for a heat network.

Some respondents did not share the vision with regard to the potential for district heating and gas fired CHP as a transition technology. While appropriate for some locations with sufficient local demand for low grade heat load, CHP would not be suitable for all sites. Gas-fired CHP would in many cases struggle to achieve reductions in carbon emissions compared to a high efficiency boiler and grid electricity.

Q16: Do you have evidence from existing projects to demonstrate the costs and benefits of heat networks in reducing emissions, alleviating fuel poverty or reducing fuel consumption?

<u>Main themes</u>

Several respondents provided figures to demonstrate the cost/benefit of heat networks and consistently raised the point of using the appropriate counterfactual.

A number of projects were mentioned as useful sources of evidence, including:

- An example in Glasgow where air source heat pumps were to be used to heat six separate tower blocks. Two different bespoke solutions would be used: 112 heat pumps would be housed across communal balconies for two of the tower blocks;

and district heating systems using three large air source heat pumps would heat the remaining properties.

- In Sheffield where the origin of the City's network was to heat 995 Council dwellings at Park Hill flats in the 1970s as a response to the oil crisis and to address fuel poverty in the city. The project now ran as part of a 35-year integrated waste management contract.

- Further examples included schemes in Pimlico, Southampton, Birmingham, Exeter, Leicester, Nottingham, Newcastle, Woking, Sheffield, Shetland and Edinburgh. With many more small scale district heating networks on university campuses, multi building hospitals and large housing schemes.

- Others mentioned various feasibility studies underway to assess the potential of heat networks and offered to share this data with the Department.

Q17: If you have been practically involved in setting up heat networks, what lessons can you share?

Main themes

The themes identified were many and varied, and a large number built on themes that were included in the document:

- Sharing knowledge and co-ordination: there was a strong desire among Local Authorities engaged with heat networks to share experience with each other. Coordination within local authorities and externally was very important, as set out in Q15.

- Strategic spatial planning: Experienced Local Authority officers emphasised the importance of "thinking big, but starting small," taking a long-term view of the potential benefits of district heating, but recognising the large amount of work required to get "starter" networks off the ground. It was important to understand heat demand profiles and to create demand.

- Optimising financial models: As heat networks had long-paybacks and "starter" networks had less attractive cash-flow profiles than larger networks, the economics of heat networks could often be marginal (even when they offered the most attractive means of achieving policy goals). There were three general ways in which marginal financial models could be improved: i) Reducing the Internal Rate of Return that the project needed to achieve by using public borrowing; ii) Reducing the

Internal Rate of Return the project need to achieve by underwriting the commercial finance; iii) Making the cash flow profile more attractive by granting a capital contribution, justified by the benefits a viable project would create. Each of these approaches implied risks for the public sector. At present these were often borne by local authorities. However, each approach could also be taken on by national or devolved government, pooling the risk across initiatives.

- The practicalities of establishing network heat supply, particularly the connection of a large number of residential connections, presented another set of challenges. Where new heating systems were installed alongside heat networks connections (e.g. when electric heating was being replaced) each home had to be accessed several times, requiring skilled local officers who knew how to manage the interface with tenants. In this regard, heat network customers needed to understand how buying heat was different to buying gas. This would help to build confidence in the market.

Q18: What policies should the Government pursue to promote or facilitate heat networks?

Main themes

Funding

The most commonly occurring theme in responses to this question was for funding, either through grant, subsidies, tax breaks, a Renewable Heat Incentive uplift and/or further development of ECO. Government needed to ensure that heat networks were able to compete on a level playing field.

Many heat network initiatives in the UK had relied on grant funding. This had built pools of expertise, particularly within local authorities. In future, the Government could consider supporting those projects which encouraged investment in capacity and from which investors could learn.

The RHI only supported the generating unit and did not account for the overall cost of the network. Respondents recommended that the Government created a robust and long term finance policy to give certainty to developers and investors through an uplift for heat networks. The reduction in support for biomass with a capacity over 1MW to 1p/kWh to comply with state aid rules had resulted in a large number of projects becoming uneconomic. A 1MW – 5MW band and a 5MW – 20MW band should be introduced to make projects of these scales financially viable.

Establishing the means by which heat off-take risks could be reduced, particularly at the early stages of network establishment and growth would make a significant difference to future projects. This could take the form of a commitment across the public sector to connect to new networks, or by underwriting the risks associated with other heat subscribers. There should also be enhanced support for the retrofit of heat networks for example through the development of ECO. Supporting tariffs and incentives should be introduced to encourage the use of industrial low grade heat. Another opportunity to encourage investment would be through reduced VAT rates on heat networks and a rate of 0% was proposed to kick start investment. Through Zero Carbon Homes there may be opportunities for funding by channeling allowable solutions into Community Energy Funds. This could then support a range of larger scale low carbon projects as determined by the criteria set out in the Local Plan.

A greater emphasis on energy in the English City Deals and Scottish Agenda for Cities could be used to exploit local authorities' potential to take a strategic area-wide view of local energy development. This could take many forms, including making higher levels of Feed-in

Tariff or RHI available to local authorities or allowing these Local Authorities to keep the tax receipts from business rates.

Best Practice

Capacity support for local authorities looking to co-ordinate complex district heating schemes should be considered as should support for vanguard “pilots” to develop commercial/technical models which can be used as templates for other schemes.

Further development of the National Heat Map to provide developers with all economic and spatial information needed to build heat networks, including where there is load density and long term low carbon or waste heat is available.

District heating network developers did not enjoy the same statutory rights as other utilities (e.g. for excavating sections of roads and acquiring land). This added an extra degree of complication when trying to develop projects.

A one stop shop model should be developed to ensure Local Authorities benefit from clear and objective technical advice, toolkits, training in technical commercial planning for heat networks, potentially funded through levy on successful schemes or through grouped Local Authorities.

Strategy

A clear long term strategy and related policies on the future of energy supply to provide market confidence were needed. A clear, consistent and simplified policy/incentive regime which supported the development of viable local networks, including local powers around heat zoning where there would be an obligation to link in to the network. There would be a clear role for the financing of heat network schemes through the Green Investment Bank.

There was an opportunity through the ‘City Deals’ process led by Cabinet Office to consider how cities could include low carbon infrastructure of this kind within the scope of the City Deal negotiation.

Planning

Those involved in heat network projects advocated clear and standard best practice guidance on heat networks in planning policy terms and a consistent approach to their interpretation by the Inspectorate. There were references to the Scandinavian models of mandated connection that respondents thought merited further attention. With DCLG, DECC were encouraged to consider and determine what the appropriate planning intervention should be for heat networks.

Q19: Do you see the need to regulate the supply of heat through heat networks and, if so, how?

Main themes

Broadly speaking stakeholders were in favour of some form of regulation. However, the majority of respondents believed that some form of 'soft' regulation was appropriate at this stage of market development. The principle concerns revolved around consumer protection, monopoly markets and competition and the need for common standards of service and performance.

Individual schemes had developed codes of conduct for heat networks, but central regulation could reduce transaction costs and eliminate some forms of uncertainty. Regulation could take various forms. For example, this might mean consistent and transparent method for representing heat tariffs to consumers, through to more exacting end regulation which could determine overarching aspects of a heat networks business model (such as the Danish requirement that heat retail is organised as a non-profit business).

Appropriate regulation in the UK would need to balance consumer protection and investor confidence against flexibility and innovation in heat network business models. The Greater London Authority's design guidance might be an appropriate standard for the sector to work to on a voluntary basis. A loosely regulated model might apply at this stage to remove the risk of stifling development; regulation could be increased as further development occurred.

TRANSFORMING INDUSTRIAL HEAT

There were 62 responses to either all or some of the questions in the chapter.

Q20: What technical and financial barriers could prevent the switch to low carbon heating technologies on industrial sites?

The technical barriers that were mentioned in responses included:

The electrification of industrial heating processes would be a viable alternative to gas but would face significant barriers, on the cost of electricity because of the addition of generating capacity and grid reinforcement. There were concerns that the Heat Strategy might be over-estimating the speed with which UK electricity generation could be decarbonised.

Gas networks currently supplied both building and industrial heat and 80% of industrial connections to the gas network was fed from the lower pressure tiers. If building demand were to be completely removed from the gas networks, then there was a risk that the cost of providing the network to support just Industrial demand would be prohibitive. There would also be technical implications which would need further consideration.

The issue of technology 'lock in' needed to be addressed. Boilers and other combustion systems could have operational lifetimes of up to 40 years. Financial support would be needed to persuade users to undergo complete equipment replacement programmes.

There were issues about skills gaps. Innovative, large-scale projects needed highly-skilled specialised engineers. Existing codes and standards did not facilitate improved energy efficiency practice. While certain legislation was being developed, much of the working standards were out–dated.

Often locations which appeared most feasible were in remote areas making distribution of heat generated unfeasible. Local collaboration projects were embraced by industry such as district heating projects across business parks or a share in supply chain needs such as a wood mill providing waste materials to a biomass station in return for free electricity. These collaborations required extensive capital expenditure and the knowledge that all partners would remain operational long term.

<u>Financial barriers that were mentioned in responses included:</u>

Capital costs were the main barrier, with most industrial companies unwilling to invest in projects that were not directly linked to their process operations. With carbon at such a low cost there was also little incentive. Foreign-owned companies had to compete internationally for investment within their internal company structures. Therefore low carbon heat investments needed to have a rate of return that could compete with other capital investments.

Uncertainty about Government incentives was cited as a reason why projects failed to get sign off, as risks were perceived as too great. The reduced level of RHI tariff for biomass was causing projects to be shelved. Some industrial activities did not currently attract the RHI because the energy was not used to heat a heat transfer medium such as water or oil. Current biomass use in cement and lime production was under threat from incentive use in other sectors.

Most of the low-hanging fruit had already been picked – the remaining measures would be prohibitively expensive. Industrial companies were generally unwilling to invest in unfamiliar technologies to reduce energy use. Current investment criteria were a major barrier for a lot of companies. Typical paybacks of three to five years could not be achieved by renewable heating projects.

The strategy rightly identified the important role that CHP could play in the UK in the medium term. However, CHP was under-incentivised. LECs should be retained until 2017, and then replaced with a feed-in tariff. The fiscal changes announced in Budget 2012 undermined this objective by significantly increasing the cost of CHP from 2013 onwards. Deutsche Bank research highlighted that the UK was ranked fourth from bottom within EU member states in the contribution that CHP made to the percentage of power generation.

Q21: What scope is there for further reductions in emissions through energy efficiency in industrial processes?

Main themes

In the short-term, the scope for further energy efficiency gains was likely to be greater in the industrial building stock and non-energy intensive manufacturing processes than in the core processes of highly energy-intensive activities such as steelmaking. In many of these activities there was extremely limited short-term scope for significant energy efficiency improvements. The UK's energy-intensive industries tended to be highly energy-efficient and substantial further gains were likely to require major technological change requiring significant investment – e.g. CCS. There was some concern about the weight that the strategy placed on electrification versus the use of other fuels in some industrial processes.

There was considerable scope for the take up of CHP, and the exploitation of available industrial low grade heat. A report by Element Energy for the Committee on Climate Change found that 45 CHP sites (out of the 77 industrial sites) in 2008 were technically eligible for carbon capture.

Reducing the number of thermal cycles that existed in the supply chain by avoiding unnecessary heating and cooling, and through the capture and reuse of waste heat would be areas for further attention. But some industrial internal energy networks were complex and realising opportunities relied on maintaining a holistic view to help guide decision making and identify trade-offs. It was noted that there were skills gaps in some highly specialised roles which needed to be addressed through STEM education and vocational training.

Waste heat produced In industrial premises and heat recovery should be incentivised for use in-house or elsewhere, possibly by the incentivising local district schemes. Material substitution might prove to be an effective way to reduce energy consumption.

The challenge would be to decarbonise base heat demand. There had been some limited investments in biomass boilers, waste gasifiers, organic rankine cycling, and other industrial processes. Emissions could also be reduced through the use of waste and biomass to produce syngas as an alternative feedstock, and the use of Carbon Capture and Storage.

It was noted that further evidence on industrial energy efficiency had been submitted to the Energy Efficiency Deployment Office Call for Evidence.

Q22: Do you have evidence from existing projects to demonstrate the costs and benefits of approaches to reducing emissions from industrial heat, including combined heat and power?

Main themes

A number of high-level case studies were provided. A sample of responses follows:

- Energy transfer and recovery systems in commercial enterprises had long proved their value, in financial terms, to the businesses that utilised them.

- Tests had been carried out on the ability of industrial customers to provide demand response, including from combined heat and power, to manage the network more effectively. Results from this work should help in developing the low carbon electricity grid of the future.

- Cost effective carbon abatement had been demonstrated through implementation of industrial gas-fired CHP. However, without the constraints of the electricity market, a plant with higher power to heat ratio would have been constructed, delivering even greater carbon abatement benefits.

- The economics (and carbon footprint) of Bioethanol production for biofuel had been substantially improved through the use of gas-fired CHP.

- The energy consumption In the manufacture of polyurethanes could be substantially improved through process modifications to recover waste heat.

- The work of the University of Sheffield's Waste Incineration Centre and the Energy Technologies Institute was highlighted.

Q23: If you have been practically involved in projects that sought to reduce emissions from industrial heat, what lessons can you share?

Main themes

This question was mainly answered with high-level case studies and references to other work. A sample of these follows.

- CHP at an LNG terminal. This project would utilise the surplus heat via a heat pipe at an LNG terminal. The heat would be used in the re-gasification process and would reduce carbon emissions by up to 300,000 tonnes per annum.

- Projects tended to be very capital intensive. A recently commissioned distillation unit delivered significant carbon savings, but at high capital cost. The project could be replicated on other units, but progress was limited by the availability of capital, which in turn depended on business profitability to generate the cash required. Energy taxation was an important constraint on profitability, which limited progress in carbon abatement.

- Carbon Trust funded investigation into heat use and heat recovery in the canning sector provided some useful insights – many of which were more widely applicable across the sector.

- In the steel sector, research was ongoing on the transformation of materials into heat and electricity, in collaboration with the Centre for Process Innovation.

- Industrial baking heat recovery project under the Industrial Energy Efficiency Accelerator programme, though this work had effectively ceased due to funding cuts.

- To maximise the financial and environmental benefits of CHP over time, the plant needed to be sized to meet the heat demands of the industrial user.

- The use of heat and energy in industry was typically guided by processes and standards. Individuals' behaviour in industries also had a significant part to play.

- Measuring a baseline would be fundamental to any industrial efficiency project brief. Smart metering was slowly being implemented across industry because of the added value the information brought to specific processes and their efficiency.

Q24: What policies should the Government pursue to promote or facilitate reduction in emissions from industrial heat?

<u>Main themes</u>

Financial/Regulatory

CHP required stable long-term investment signals and required Government intervention to correct the market failure that did not reward it for the resulting carbon savings. A Premium Feed-in Tariff might be the most effective way to do this.

A Carbon Price Floor alongside the EU ETS might mean UK industry would be penalised more heavily than European competitors. It would be Important to safeguard the UK's industrial global competitiveness.

The current design of the RHI placed some constraints on opportunities to decarbonise industrial heat. These issues included the large scale biomass tariff; the current limit of biogas combustion which was too low to encourage the development of on-site combustion of biogas. Heat recovery should be incentivised by Introducing a scheme similar to the RHI to make capital investment attractive.

Schemes as the Industrial Energy Efficiency Accelerator, which until 2010 provided the very support industry needed to start making step changes in energy efficiency and low carbon technology, should be re-introduced.

The removal of the CCL exemption for electricity supplied indirectly from Good Quality CHP plants would harm investment. The reintroduction of equivalent levels of support would ensure this technology, which could contribute significantly to emissions reductions in industrial heat, continued to be an attractive investment.

If it were proved that the EU ETS carbon price was insufficient to stimulate investment in heat recovery or reduction technologies, the government should deliver a mechanism which rewarded investment in technologies which displaced high emissions with lower emission technologies, even if these were still based on hydrocarbon sources.

Government should allow industrial projects to compete for funding from DECC's CCS Commercialisation Programme. There was criticism that decarbonisation policies tended to be bias towards power generation.

Other

The key was to develop a stable policy for industrial decarbonisation as part of a competitive industrial strategy.

Government should encourage the development of ESCOs either as direct private financial institutions or by providing the basis for the Government to fund innovative emission reduction strategies in industry.

The identification of locations for clustering of both recovered heat and CCS should form part of DECC's long term strategy.

Rather than devising new policies, the heat agenda would be best served by creating a business environment that encouraged capital investment and removed barriers created by

existing energy policies: such as CCL and CCAs, but was included in energy targets, such as the CRC.

Government should promote medium to large scale on-site electricity generation in industry as this would lower the dependency on a small number of large electricity producers, enhance self-sufficiency and improve security of supply

Planning costs and time were deciding factors in capital projects. Recent changes to legislation allow relaxation of these criteria but the government should continue this pace of change. There would be a need to influence legislative decisions at a European level.

Q25: What policies should the Government pursue to promote or facilitate recovery of waste heat from industrial processes?

Main themes

Policy in this area must be informed by a realistic appraisal of the amount of waste heat which could be technically and economically recovered. This would vary by process and configuration of individual sites. Where scope existed, investment should be encouraged through positive incentives (including through the Green Investment Bank) , especially where the upfront cost was significant and the pay back periods relatively long (e.g. over five years) making the investment more difficult to finance.

The Government should develop an integrated low carbon approach to industrial development, with the sharing of heat and gases at its core. The provision for connecting to a heat network should be a requirement of all new builds and significant retrofits. This would include space on site for the necessary infrastructure. This would reduce the risks and costs to industry for any connection to a heat network in the future.

The main focus should be to ensure reliable and cost effective production processes, and the reliability of heat supply. There would inevitably be circumstances where interruption to heat generation would be required. Facilitating heat off-take from industry would also need to cover security of heat supplies to consumers, and should encompass how thermal storage and/or back-up generation should be deployed.

The Government should consider how it might facilitate dialogue between potential heat users and industries to encourage the uptake of industrial waste heat. Advice on potential mechanisms and commercial arrangements would be beneficial to organisations trying to facilitate heat sales. Government support for technical development could be a useful enabler.

Government could take a role to support the capture of waste heat for use within its own buildings and that of its agencies to pilot such an approach. Waste heat could be injected

into the ground and stored for use in winter. Government should seek to promote the uptake of this energy storage solution.

Annex: List of the organisations that responded to the heat strategy publication

A J Wells & Sons Ltd

A R Peet Stoves

Arada Ltd

ARUP

Austin Kelso

B&ES (Building & Engineering Services Association)

Batley Barless Fire Company

BEAMA

Black Mountain Wood Fuels

Bonk & Co Ltd

BRE Centre, Cardiff Univesity

British Ceramic Federation

British Gas

British Glass Manufacturers Confederation

BSW Timber

Calor Gas Limited

Carbon Capture and Storage Association

Carillion

Carrier Air Conditioning

Ceramic Glass

Certainly Wood

Charlton & Jenrick Ltd

Chesney's Ltd

CIBSE

Citywest Homes

Combined Heat and Power Association

Confederation of Paper Industries

ConocoPhillips European Power Ltd

Construction Performance Solutions Ltd

Consumer Focus

Cornwall Council

Croydon Council

Dalkia

District Heating Vanguard Local Authority Network

Docherty Chimney Group

Dunster Heat

EA Technology

EDF Energy

EEF

Eight MicroCHP developers (via Ecuity Consulting LLP)

Energy Advisory Associates

Energy Networks Association

Energy UK

EON

Esulation Technologies Ltd

ETC Ltd

Eurinco

European Solar Thermal Industry Federation

Exeter Stoves & Chimneys

Focus Stoves Ltd

Food and Drink Federation

Forest Fuels

Forever Fuels

Forth Energy

GDC Group Ltd

GHSPA

GLA

Grandisson Ltd

Green Heat Ltd

GTC

H V Skan Ltd

Haringey/Enfield/Waltham Forest

Heat Pump Association

HETAS

HHIC

Hi-Flame Fireplace UK Ltd

Hockerton Housing Project

Independent Components Ltd

INEOS

Institution of Civil Engineers

Institution of Mechanical Engineers

J Day Stoneworks Ltd

Jotul (UK) Ltd

Just Stoves Ltd

Kernow Fires

Kindle Stoves (Kindle Energy Ltd)

Kingsley Eco Solutions

KIWA Gastec at CRE

Marchland Stoves

Mark Group

Micropower Council

Mineral Products Association

Mitsubishi

MMF Ltd

Montpellier Marble T/A Firestyles

Morley Stove Co Ltd

National Energy Action

National Grid

New Forest Woodburning Centre

Newcastle City Council

NIBE Stoves

North East Process Industry Cluster

Northern Gas Networks

Northern Powergrid

NSG (Pilkington)

Ofgem

Oil and Gas UK

Oil Firing Technical Association

Old Flames of Beverley

Open Fire Centre

Peak Fire

Poujoulat

PRO-TEM Network

Pyroglass Ltd

R W Knight and Son

Rangemoors Ltd

Renewable Energy Association

Rexmore Marketing Ltd/ Dorking Stoves

RGF Industries Ltd

Robur (via Ecuity Consulting LLP)

Royal Academy of Engineering

RP Plumbing

RWE UK

SBGI Utility Networks

Scotch Whisky Association

Scottish Government

Scottish Hydrogen and Fuel Cell Association

Scottish Renewables

Sheffield City Council

SSE/Scotia Gas Networks

Stafford Fireplaces

Stoke-on-Trent City Council

Stove Industrial Alliance

Stove Yard UK Limited

Sure Fire Technical Services

Swindon Borough Council

Tata Chemicals Europe

TATA Steel

Tees Valley Unlimited

The Association for the Conservation of Energy

The Burning Question (Perth) Ltd

The Business Services Association

The Hot Spot (UK) Ltd

The Hydrogen Office

The Open University

Topstak Chimney Specialists Ltd

TSI Scotland

UCL

UK Green Building Council

UK Hydrogen and Fuel Cell Association

UKDEA

UKLPG

University of Cambridge

Wales & West Utilities Ltd

Welsh School of Architecture

Wendron Stoves Ltd

West Coast Stoves

West Sussex County Council

Wood Panel Industries Federation

Woodfuel Wales

Woodshure Ltd.

Woodstock Fires Ltd

Wyvern Fireplaces