

**TOWARDS DECARBONISING HEAT: MAXIMISING THE  
OPPORTUNITIES FOR SCOTLAND DRAFT HEAT GENERATION  
POLICY STATEMENT FOR CONSULTATION**

RESPONDENT INFORMATION FORM

**1. Name/Organisation**

Energy Technologies Institute

**2. Title**

**Mr**

**Surname**

Dicicco

Tony

**Forename**

**3. Postal Address**

6220 Bishops Court

Birmingham  
Business Park

Birmingham

<b>Postcode</b>	B37 7YB	<b>Phone</b>	0121 203 726	<b>Email</b>	tony.dicicco@eti.co.uk
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**4. Permissions - I am responding as an: Organisation**

**(c)** The name and address of your organisation **will be** made available to the public (in the Scottish Government library and/or on the Scottish Government web site). Are you content for your **response** to be made available?

**Yes**

**(d)** We will share your response internally with other Scottish Government policy teams who may be addressing the issues you discuss. They may wish to contact you again in the future, but we require your permission to do so. Are you content for Scottish Government to contact you again in relation to this consultation exercise?

**Yes**

## **ETI RESPONSE TO: *TOWARDS DECARBONISING HEAT - MAXIMISING THE OPPORTUNITIES FOR SCOTLAND***

### **Summary**

The ETI supports the heat vision and heat hierarchy for Scotland to reduce heat consumption, supply heat efficiently and at least cost to consumers and move to reduce reliance on fossil fuels by using more low carbon and renewable generation. Reducing the carbon intensity of heat is central to helping Scotland to reduce its greenhouse gas emissions, whilst using heat more efficiently will help to reduce fuel poverty and provide commercial opportunities both in Scotland and in other parts of the UK.

With over 80% of the energy we consume in our homes being used for heating (space and water), the importance of Government policies that support the take up of insulation measures cannot be underestimated. Home insulation can be one of the most cost-effective steps that households can take to manage their energy demand and keep the costs of their bills down. The ETI believes that whole-house retrofits undertaken as part of wider general housing refurbishment will be more effective than an approach based on individual measures for efficiency only.

District heating is part of the lowest cost solution with alternative heat supply sources (waste heat from power, marine heat pumps and biomass) and will require a community approach. Waste heat from power is likely to require some form of centralised incentive so is really neither solely a community-led nor a central solution – it will require both to come together. Providing a clear and consistent policy and regulatory framework is also key to the success of district heating projects.

The ETI's Macro Distributed Energy Project<sup>1</sup> found that there is a current economic case for building District Heating Networks (DHN) and this is likely to improve over time given forecasted energy price rises published by DECC. In the long-term (post 2030), DHN remain competitive in cost and CO<sub>2</sub> performance with individual ASHPs although the relative CO<sub>2</sub> benefit will depend on whether large-scale heat pumps to supply DHNs can access an elevated heat source such as industrial waste heat that would not be available for individual building heat pumps.

### **About the ETI**

The Energy Technologies Institute (ETI) is a public-private partnership between global energy and engineering firms and the UK Government. ETI carries out three primary activities:

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<sup>1</sup> ETI Macro Distributed Energy Project: Summary Report – November 2012

- modelling and strategic analysis of the UK energy system (power, heat, transport, infrastructure) to identify the key challenges and potential solutions to meeting the UK's 2020 and 2050 energy and climate change targets at the lowest cost,
- investing in major engineering and technology demonstration projects through targeted procurement to address these challenges with the aim of de-risking solutions – both in technology and in supply-chain development – for subsequent commercial investors
- providing support to enable the effective third party commercialisation of project outcomes.

Recognising the need to focus and target investments to ensure value for money and leverage from public sector support, the ETI's techno-economic modelling and strategic analysis of the UK energy system is a critical tool for supporting effective system planning and innovation delivery. The ETI modelling approach is termed 'ESME' (Energy System Modelling Environment) and is now used by DECC and the Committee on Climate Change to aid with policy development, planning and effective investment targeting.

Insights from ESME analysis have been reviewed with the European Commission and the JRC. With their support ETI have now developed a prototype tool for use in assessing energy system design for the European Union area using the same approach used for the UK. A local (urban area) energy system planning tool Energy Path is in development as part of the ETI Smart Systems and Heat programme.

The UK energy system development and decarbonisation priorities identified by ETI are:

- **Efficiency** – introducing systems and technologies to reduce cost and improve buildings and transport efficiency.
- **Nuclear** – establishing a new build programme based on new supply chain capacity and increased investor confidence.
- **Bioenergy** – informing the science, technology and business cases for decisions on how to optimise the use of sustainable bioenergy resources as solid, liquid and gaseous fuels.
- **Carbon Capture and Storage** – providing system demonstration and strategic insights for capture, transport and storage building investor confidence.
- **Gas** – enabling long-term use of a critical fuel for power, heat, storage and potentially transport ('gas' = natural gas, synthetic combustion gases, biogas and hydrogen).
- **Offshore renewables** – reducing cost and building investor confidence.

The ETI has invested more than £210m in projects across nine technology programme areas, including buildings, distributed energy and smart systems and heat. The work taking place in our Smart Systems and Heat (SSH) programme involves active communication with a number of local authorities across Scotland, England and Wales. Our aim is to identify local authorities with the capacity and capability to host a demonstration of "smart" cost-optimised local energy designs for heating domestic and light commercial buildings. To help us achieve this, we are working with local authorities to develop a software tool that will allow the design of practical, cost-effective local energy systems (both heat and power) for their areas. Importantly, the activity will prove that the capability and approach can be adopted nationally.

## Detailed Response to Questions 1 - 21

### Q1: Do you agree with the heat vision and heat hierarchy?

Yes  No  Don't know

#### Q1a: And why?

The ETI supports the heat vision and heat hierarchy to reduce heat consumption, supply heat efficiently and at least cost to consumers and move to reduce reliance on fossil fuels by using more low carbon and renewable generation. Our modelling of the least cost pathways for the UK across power, heat and transport sectors suggests by 2050 a 10TWh reduction of space heat demand, with only 20TWh of a total 360TWh heat demand being met by gas – the remainder being delivered by low carbon sources. ETI modelling also shows that the UK will have a hot water demand of around 90TWh by 2050 and this will be met mainly by Air Source Heat Pumps, electric resistive heating and district heating – gas-fired boilers will not play a role in meeting hot water needs.

### Q2: How can we ensure that Scottish businesses are best placed to take advantage of the new products and services which will be required to deliver low carbon heat?

This can be best achieved by supporting/stimulating the local supply chain. The UK Government has launched the Green Deal and Energy Company Obligation mechanisms to address energy efficiency in the building stock. The ETI sees the aim of the combination of these to stimulate innovation and capacity building in the supply chain for cost-effective building retrofits. However, stimulating innovation inevitably takes a longer time to be effective but also produces greater benefits than short term schemes. The design of these policies will need to be reviewed in the light of sufficient early experience to understand the reality of their implementation and how successful they have been in stimulating the local supply chain.

To carry out the new work required to achieve energy efficiency and install new equipment requires both training and accreditation. Accreditation of builders (including accreditation of energy efficient, renewable and low-carbon technologies installation) could lead to awareness raising, knowledge and demand among both builders and consumers, as happened with CORGI and then Gas Safe gas registration. Something akin to the *Code for Sustainable Homes* is needed for existing homes to create impetus for change. This should give all builders a clear signal of what standards are expected, to be reinforced by tightening building regulation and more stringent Energy Performance Certificates.

Training will play an important role in supporting the supply chain. There are considerable benefits from up-skilling the current workforce through training in the skills required for the future technological solutions. There is also the opportunity to influence the content of current academic and skills-focused courses to include the emerging technologies in order that the future workforce is prepared and equipped to deal with such technologies. The Scottish Government should look to demonstrate new technologies at scale in order to evaluate any barriers to effective implementation such as supply chain and skills gaps.

### Q3: Taking account of the cost of implementation, what policies should the Scottish Government pursue that will best ensure the impacts of heat decarbonisation to benefit consumers?

The ETI is developing the Energy Path modelling tool which develops a cost-effective approach to designing and implementing local energy solutions. Energy Path balances low carbon heat supply with demand measures, on an area by area basis – so the solution in Balloch may look

different to Glasgow city centre. This will allow carbon targets to be met in the most cost-effective way, ultimately benefiting all of Scotland's population. In addition, the ETI's national tool ESME shows that the lowest cost pathways to decarbonising heat require both District Heat Networks (DHN) and increased electrical heating, with heat offtake from power stations being a significant heat source for DHN. Policies that support power station DHN should be considered.

With over 80% of the energy we consume in our homes being used for heating (space and water), the importance of Government policies that support the take up of insulation measures cannot be underestimated. Home insulation can be one of the most cost-effective steps that households can take to manage their energy demand and keep the costs of their bills down - ESME shows that fitting effective insulation is cost-effective whether the primary objective is to meet climate change targets or not. In Scotland, progress has been made in fitting insulation but this needs to be continued.

According to the BRE<sup>2</sup>, Scotland has 2.3 million dwellings, of which c. 63% are owner-occupied. 85% of these dwellings have central heating with 13% of homes using electric storage heaters owing to the high proportion of purpose-built flats, which are more likely not to have a gas supply. Average SAP ratings are higher in Northern Ireland and Scotland than in England and Wales, but this is due mainly to the age and typology profile of the buildings. 27% of dwellings in Scotland, had lofts with less than 100 mm of insulation. For these dwellings, their energy efficiency rating would benefit considerably if insulation were topped up to the current recommended depth of approximately 250 mm.

The ETI believes that whole-house retrofits undertaken as part of wider general housing refurbishment will be more effective than an approach based on individual measures for efficiency only. The ETI is currently underrating a project to assess the potential energy and cost savings from five building archetypes. The ETI believes that a reduction of 30% in energy usage can be achieved across all archetypes for a ten day work programme costing £10,000. The task of renewing existing homes and communities should be carried out on an area by area basis. An example of this is the *Metropolitan Housing Trust*<sup>3</sup> which developed a programme for refurbishing harder-to-treat Victorian street properties in Haringey to a standard beyond the Decent Homes standard. The measures included insulation, more efficient boilers and heating controls. The refurbished homes have typically achieved more than a 45% reduction in their CO<sub>2</sub> emissions, and residents are now better able to reduce their fuel costs.

### **Q3a: What evidence do you have to support this?**

The ETI has carried out extensive modelling of the UK's space heating requirements using the ESME tool. ESME considers cost-effective approaches to meeting peak demand and the results show that there needs to be a significant move away from using gas for space heating in the 2030's if the 2050 climate change targets are to be met. By 2050, ESME shows that district heating is likely to be the main heat source in urban areas with heat pumps elsewhere – there is only a limited role for gas (around 20TWh in a total heat requirement of around 360TWh). These results are similar to the High GI/High Uptake scenario in the Arup analysis but there are differences most notably in the amount of biomass to be used in the Arup study. The ETI would be happy to share the ESME output with the Scottish Government.

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<sup>2</sup> "Housing in the UK, national comparison in typology, condition and cost of poor housing" – BRE, December 2013

<sup>3</sup> From "Housing futures: our homes and communities" – Anne Power, LSE, 2010.

**Q4: What do you think should be the balance and focus of government intervention, business innovation and individual action and why?**

The scenarios developed by Arup to model the effects of Government Intervention (GI) and Consumer Uptake show that decarbonisation of heat is greatest when high Uptake is combined with high GI. The ETI believes that government policy has an important role to play in promoting energy efficient interventions. However, there has to be scope for commercial innovation. As part of the Smart Systems and Heat (SSH) Programme, the ETI is working with a number of local authorities across Scotland, England and Wales. The aim is to identify local authorities with the capacity and capability to host a demonstration of “smart” cost-optimised local energy designs for heating domestic and light commercial buildings. The ETI is developing a software tool (EnergyPath) that will allow the design of practical, cost-effective local energy systems (both heat and power) for local authority areas. Importantly, the activity will prove that the capability and approach can be adopted nationally.

Individual action also has a part to play but this can be encouraged by government and local authority action.

**Q5: Given the existing financial incentives and policies in place, what other mechanisms do you think would result in significant behaviour change in both homes and non-domestic buildings and processes?**

The ETI believes that consumer engagement is key to effecting significant behaviour change in both homes and non-domestic buildings. The best way to do this is to demonstrate to consumers the benefits from new technologies in terms of increased comfort, energy efficiency and lower greenhouse gas emissions. The ETI is planning to undertake a large-scale demonstration, starting in 2016, retrofitting around 4,000 properties including installation of Home Energy Management Systems. This should help to demonstrate the benefits of these technologies to consumers. As part of this, a smaller scale demonstration of around 300 homes in 2015/16 will test the impact of HEMS on energy usage.

It may be appropriate to educate children in new heating technologies such as Air-Source and Ground Source Heat Pumps, district heating, solar PV and Home Energy Management Systems (HEMS). It is also important to ensure that potential users of new technology are not put off by concerns that new heating technologies are difficult to use.

**Q6: How do you think a national heat map could be used to support the development of a low carbon heat sector for Scotland?**

The ETI believes that the availability of dynamic data on electricity and heat usage is imperative to allow strategic models, such as ESME and Energy Path to identify the most cost-effective pathway to meet demand. The ETI supports heat map data being made available to local authorities. We would suggest some indicative data is published for use by the private sector to develop appropriate modelling tools that can most effectively use heat map data.

The ETI believes that there should be a framework in place which supports integrated local future planning to utilise waste heat from existing industrial plants and large thermal generating stations for community heat. A number of established distributed energy projects are already in operation in Scotland such as that in Lerwick – this plant utilises energy from waste as the primary heat source, normally in CHP mode. However this is still a largely untapped energy resource as there is still considerable waste going to landfill and many energy-from-waste projects are electricity-only plants recovering only around 30% of the available energy. There

is a need to assess the national resource available and relate it to the geographic match of heat demand – the national heat map for Scotland will allow this.

**Q7: Do you support the proposed unit of measure for the overall district heating target of 1.5 TWh by 2020?**

Yes  No  Don't know

**Q7a: And why?**

The ETI has no direct evidence to support the Scottish district heating target of 1.5 TWh by 2020.

**Q8: Do you support the level of ambition for the district heating target?**

Yes  No  Don't know

**Q8a: What evidence do you have to support your views?**

The ETI supports the introduction of district heating schemes where appropriate as part of the future approach to a practical, cost-effective and sustainable domestic heat supply. The ETI's peer-reviewed whole system energy model, ESME, has identified district heating as a significant technology in helping the UK meet its 2050 climate change targets. We believe that the appropriate measure will vary from location to location. For example, district heat networks in dense, urban areas and electric heating in rural areas. Furthermore, we believe providing heat at least cost to the consumer, in any one area, should consider an optimum of both supply-side and demand-side measures (including building retrofits).

District heating is part of the lowest cost solution with alternative heat supply sources (waste heat from power, marine heat pumps and biomass) and will require a community approach. Waste heat from power is likely to require some form of centralised incentive so is really neither solely a community-led nor a central solution – it will require both to come together. Providing a clear and consistent policy and regulatory framework is also key to the success of district heating projects.

**Q9: Do you support the level of ambition for the number of homes to be connected to district heating by 2020?**

Yes  No  Don't know

**Q9a: What evidence do you have to support your views?**

The ETI has no direct evidence to support the level of ambition for the number of homes to be connected to district heating by 2020.

**Q10: Do you have evidence of existing communal heating systems installed before 2000?**

Yes  No  Don't know

**Q10a: If so please provide details.**

N/A

**Q11: Do you believe further regulation of heat supply is required?**

Yes  No  Don't know

**Q11 a: What level of regulation would be appropriate?**

District Heating is not currently regulated but increasing adoption may lead to new regulation being introduced – but it is uncertain what this might be and this may delay/deter investment. This can be overcome by clear statements on regulatory intentions on DH networks, and by ensuring any regulation recognises the long payback periods associated with DH. It is not clear what level of regulation is appropriate at this stage but this could be explored through industry and government/regulatory forums to draw up proposals for a suitable regulatory regime for DH.

**Q12: Do proposed consumer protection schemes meet the needs of heat users and supply organisations?**

Yes  No  Don't know

**Q12a: And if not, what changes are needed or what more is needed?**

It is not clear whether current consumer protection schemes meet the needs of heat users and supply organisations. As the number of DH schemes and the number of consumers supplied by these schemes increases, safeguards will need to be put in place to ensure that consumers' rights are protected: for instance, what will happen if a consumer does not wish to be part of a local DH scheme and how can it switch suppliers? As with the regulation of heat networks, appropriate consumer protection schemes could be explored through industry and government/regulatory forums.

**Q13: Is there sufficient non-financial support for the development of heat networks?**

Yes  No  Don't know

The ETI believes that there is insufficient non-financial support for the development of heat networks. There are barriers related to lack of experience of district heating in the UK, for example, developers have identified a lack of accepted contract mechanisms as a barrier to development. There are also difficulties around planning approvals and a lack of local authority resources or expertise may also act as a barrier. There are also difficulties identifying the best locations for district heat networks e.g. where waste industrial heat could be available.

**Q13a: If not, please comment on priorities and timescales for support? Please provide evidence, where possible, based on practical examples of district heating development.**

Government intervention could help in the following areas by:

- Acting as an enabler by providing resources that could be used when developing the case for the community energy business model, or providing a platform to match developers with community groups who wish to install district heating schemes.

- Sponsoring work to provide the evidence to scope potential areas required for heating networks – the publication of the Scotland Heat Map is a good start. This Heat Map should show heat loads from different sectors (e.g. domestic, commercial offices) at a highly granular level as well as the location of major sources of waste heat. In addition to this, the Government could sponsor further feasibility work to identify the rates of return associated with different district heating projects to help developers identify viable locations for heating networks, and the scope for expansion.
- Sharing more specific information on best practice in developing and implementing district heat schemes, as has been done for London via the “*District Heating Manual for London*”, which includes guidance on planning and contracts.
- Supporting fast track planning for DH Networks.
- Supporting provision of standardised guidance and encouragement of information-sharing between local authorities on planning issues associated with heating networks.

Other barriers include gaining connection to the electricity distribution network for CHP-based district heating schemes: this can take a long time and involve high connection costs and may act as a barrier for CHP installations looking to export surplus electricity to the distribution network. Changes to the Distribution Charging Methodology may be required to speed up access to the network and give lower connection and use of system charges for district heating CHP plant.

**Q14: Are the many existing financial support mechanisms sufficient to support delivery of district heating systems?**

Yes  No  Don't know

**Q14a: If no, can you provide information and evidence to demonstrate the need for additional funding or finance mechanisms, indicating the type of funding or finance required, over what timescale and setting out why existing mechanisms do not meet your needs. We would be particularly interested in evidence based on practical experience of development of district heating projects.**

District heating fired by CHP can achieve a 30% primary fuel use reduction versus gas heating and electricity supplied centrally from power stations. However the lower operating costs are offset by higher capital costs. The technology is generally well known and well established, with some potential for improvements, but the main barriers are mostly financial and commercial:

- High upfront capital costs associated with building the distribution infrastructure. There is very little investment track record for this type of technology within the UK's market place which reduces investor confidence.
- The difficulty to raise capital funding due to the very long term returns on investment.
- The risk associated with consumer take-up, creating uncertainty of heat loads for developers and investors – whilst having to compete with retail gas prices.
- The risk and reliability associated with using new technologies such as biomass CHP to drive the heat and electricity outputs.
- The uncertainty of whether future heat networks will be regulated.

These barriers can be overcome by:

- Introducing an economy-wide carbon price or additional subsidies to encourage widespread uptake of district heating schemes;

- Increasing support through the Renewable Heat Incentive (RHI) where the heating network heat supply is from an eligible installation;
- Maintaining support through continued exemption from the Climate Change Levy (CCL), and through additional support from the Renewables Obligation for installations fired by biomass or waste.
- Providing tax-breaks to developers who may have difficulty accessing finance for viable heating networks due to long payback periods.

Typically infrastructure projects of a similar nature (such as water supply, waste treatment and electricity) have been originally developed by governments at very low costs of capital and or discount rates, making these projects more attractive. This is also comparable to other infrastructure projects such as railways, roads and airports.

**Q15: If the mechanism that you propose was in place, what additional specific outputs and outcomes for district heating would result from your own work and on what timescale?**

No answer

**Q16: Do you have any further evidence on thermal storage and consideration of how it might interact with other technologies and policy priorities?**

Where district heating is likely to be the best heating option for a group of dwellings in the long term, providing financial support for retaining or installing storage in individual buildings would be an unproductive use of social resources, with distribution-scale storage more appropriate. Given the current limited coverage of domestic heating networks, we will not make further comments, although large-scale geological heat storage has been the subject of preliminary ETI research, along with geological storage of hydrogen as the lowest cost seasonal low carbon energy store. Modelling work carried out by the ETI shows that district heat storage could make up around 50% of our heat and electricity storage needs post 2040 across all scenarios.

For domestic storage, space heating and hot water tanks are also substantial post 2030. Given the uncertainty around the timing of the introduction and the extent of district heating, the ETI would recommend that new build properties include sufficient hot water storage to avoid demand peaking for domestic water heating. This is on the grounds that it will be hard to retrofit these properties with heat stores later, once the requirements are clear. New build properties should have relatively low space heating demands and good design practise would include sufficient thermal mass to avoid temperature swings.

**Q17: Do you see heat recovery and information about excess heat available as a useful tool for industry to maximise the benefits of the heat it consumes?**

Yes  No  Don't know

**Q17a: Do you have any comments?**

The ETI believes that there should be a framework in place which supports integrated local future planning to utilise waste heat from existing industrial plants and large thermal generating stations for community heat.

**Q18: Are there any Scottish specific issues that should be dealt with in the review of the non-domestic RHI?**

Yes  No  Don't know

**What are they, and what evidence do you have to support your views?**

No answer

**Q19: Without interim milestones and taking into account the existing mechanisms to support uptake of renewable heat technologies, what non-financial mechanisms do you think are most effective in driving this uptake?**

No answer

**Q20: Do you support the approach to focus on three areas to support geothermal: demonstration projects; ownership issues; and development of our geothermal vision and a routemap?**

Yes  No  Don't know

**Q20a: If not, which recommendations should be prioritised and deprioritised?**

N/A

**Q21: How can the anaerobic digestion industry be best encouraged to avoid useful heat being wasted? We are interested in any evidence or practical experience to support your views.**

No answer.