Energy Systems Catapult Response to the BEIS Call for Evidence: *Clean Growth – Transforming Heating*

Introduction

The Energy Systems Catapult (ESC) was set up to help navigate the transformation of the UK's energy system. We work across the energy sector to ensure businesses and consumers grasp the opportunities of the shift to a low carbon economy. The ESC is an independent centre of excellence that bridges the gap between business, government, academia and research. We take a whole-systems view of energy markets, helping us to identify and address innovation priorities and market barriers, in order to accelerate the decarbonisation of the energy system at the lowest cost.

The ESC has a modelling capability at every level of the energy system, including:

- **National Energy System Modelling and Analysis** - internationally peer-reviewed Energy System Modelling Environment™ (ESME) tool, based on deep sector expertise. Developing additional tools such as the **Storage and Flexibility Model** and national datasets such as the Infrastructure Cost Calculator.
- **Local Energy System Modelling and Analysis** - drawing on the EnergyPath Networks™ local area energy planning tool, to inform and support local authorities and Local Enterprise Partnerships with a cost-effective low carbon energy transition.
- **Building Energy System Modelling and Analysis** - drawing on the Integrated Electric Heat tool to understand the interactions within a home, between different domestic heating systems, controls, building fabric, weather and consumer needs.

Our flagship Smart Systems and Heat (SSH) Programme works with Government, Local Authorities, businesses and consumers to identify the most effective means of decarbonising the UK's 27 million homes. As part of SSH, the ESC has worked with Newcastle City, Bridgend and Bury Councils to develop Local Area Energy Plans that define how each of these local authorities will transition to a low carbon future.

We would be happy to discuss this response in more detail if helpful. Please contact Tony Dicicco at: tony.dicicco@es.catapult.org.uk

Overview / Key Points

We welcome BEIS' initiative to publish an overview of the evidence on the heat decarbonization challenge facing the UK. We agree with many of the strategic inferences you draw. We set out below the main points of response to your overview of the evidence, drawing on the ESC's substantial body of analysis and practical work on new low carbon heat propositions.

No 'silver bullet' for heat decarbonization

- We agree that there is no single clear technology answer for low carbon heat. Current evidence suggests strongly that a portfolio of technology solutions (heat pumps, heat networks, hydrogen, biomass etc) is likely to be needed delivered through propositions tailored to the needs of different consumers, building types and local areas.
- This is strongly supported by whole energy system analysis, including the ETI's whole energy system scenarios work ('Options, Choices, Actions: UK scenarios for a low carbon energy transition') and Local Area Energy Planning analysis completed through the Smart Systems and Heat programme in a number of local authority areas.

Whole systems thinking is key

- Given the scale and importance of choices in heat decarbonization, they can only be really understood within a whole systems context. The right choices around balance between heat networks, heat pumps, hydrogen and electrification of heat will be context specific and influenced by wider developments and investments in the energy system. We have explored this in our work for the ETI on Future Networks Transitions Analysis[1] and in our work on Local Area Energy Planning[2].
- The approach to heat decarbonization will have important impacts on the expectations and role of other parts of the energy system. For example, heat electrification will impact on electricity network and generation requirements, while expanding the use of hydrogen significantly would likely require CCUS infrastructure development.

The importance of local area planning

- ESC work suggests that local area energy planning could be a key tool to enable the UKs transition to a low carbon future, by enabling local government to identify the most promising, cost effective options for decarbonisation whilst highlighting where investment is needed. There is a strong case for further funding and capability-building to equip local authorities to shape and realise local area energy plans.
- Local area energy planning builds on **Whole System Analysis approach** to model and **capabilities** in local area energy strategies and are a key stage towards building local partnerships capable of co-ordinating and delivering investment on the ground.
- Informed by key modelling results, local authorities can develop actionable ***Smart Energy Plans*** that define a series of innovation and deployment projects designed to deliver near and long-term carbon reduction objectives in their areas.
- A Smart Energy Plan helps local authority not only define a concrete **agenda** for decarbonisation aligned with the specific local infrastructure requirements, priorities and

[1] https://www.eti.co.uk/programmes/energy-storage-distribution/transition-analysis-project
[2] https://es.catapult.org.uk/news/6952/

emission reduction targets, but also establish engagement processes to find key **partners** for the delivery of projects.

- The experience in working with three local authorities (Newcastle, Bridgend and Great Manchester) has shown the value of planning at local level to identify the cost-effective technological options for decarbonisation in the specific area. Further work is therefore needed to consolidate evidence and establish formal decision-making framework, funding streams and planning processes, while ensuring that local actions meets regional and national priorities.

Understanding consumers and the potential role of digitalisation

- Successful low carbon solutions will have to meet consumers' needs. ESC work has explored the challenge of how to build deeper understanding of consumers' varied needs. Early trials under SSH2 confirmed that **digitally-enabled new energy service propositions** are capable of substantially improving mainstream **consumers' experience and control** of domestic heat.
- SSH2 has built a key capability known as the 'Living Lab' based on a growing panel of around 100 owner occupier households willing and able to test new energy products and propositions in their homes. This capability to build and run consumer trials is now established as an important asset for UK innovators, enabling sophisticated and realistic trials in mainstream consumers' homes.
- Consumer trial capabilities are underpinned by the skills and capabilities to build cloud-based digital platforms for integrating controls, devices and service propositions. This in turn enables collection and analysis of revealed preference data from a large number of connected sensors, and the option to extend and deepen this as required for larger-scale more ambitious trial designs
- The ESC has built the capability to scope, design and run sophisticated consumer trials, with the potential to extend the scale and sophistication of trials, as well as encompassing questions around market structures and incentives.

Future market design

- We set out a broad position last year on questions of future market design and policy in our response to your consultation on the Future Framework for Heat in Buildings.
- Our 'Rethinking Decarbonisation Incentives' project is also examining the current UK carbon policy landscape and developing thinking on options to improve the framework of carbon policy across the economy. Policy and incentives to decarbonize the heat market are clearly a significant component of that picture. Current incentives for emissions reduction from domestic heating are generally low, and will need to be strengthened to support and enable a transition to low carbon heating.
- We continue to believe that the evidence supports creating an enduring and broadly technology-neutral market framework to incentivize a balanced portfolio of solutions, (provided there are strong wider policy drivers for decarbonization).
- Ideally an enduring heat policy and market framework would be:
    - Aligned with broader decarbonization incentives across other sectors and parts of the energy system
    - As technology-neutral as possible and not dependent on subsidy.

- Promote market competition to drive a differentiated range of high-quality low carbon solutions.
- Empower consumers to stimulate demand for innovative low carbon solutions that deliver the value they are looking for
- Address the practical barriers and market failures that currently hinder the uptake of low carbon options.
- Be administratively practical, enabling coordination and synergies between local and national government; stable and predictable for investors, enabling the creation of a pipeline of investable projects.
- Enable consensus building based on unbiased information, for example derived from Local Area Energy Planning, where choices have collective characteristics (e.g. investment in shared network infrastructure).

Critical complementary elements of the framework should include:

- In order to fully harness the potential of digitalisation for decarbonising buildings, **the development of clear standards to govern smart home services/ devices** that rely on consumers' data will be necessary.; additionally, a regime to empower consumers with control of their energy usage data (which is likely to become increasingly valuable in future) will be required.
- **Inter-operability requirements and industry platforms to enable innovative digitalisation of home energy services**, and to promote open competition in consumer-friendly home energy controls and service propositions.
- **Improvements to building standards to ensure that new builds are appropriately 'future-proofed**'.
- **Initiatives to improve information, visibility and the salience of carbon-intensity in consumer decision-making on heat choices** (e.g. industry standards for labelling and carbon-related information/comparisons).
- **Targeted support for home energy innovation trials and experimentation (e.g. through the ISCF).** Large-scale integrated demonstrations can derisk and build consumer confidence in low carbon heating solutions. Demonstrating benefits will be key to overcoming the barriers to installing new heating technologies and encouraging uptake.
- Further experimentation and **development of integrated approaches to Local Area Energy Planning (LAEP)** to support consensus building and guide investment priorities at local level, where decisions have collective characteristics (e.g. decisions about shared infrastructure investments). LAEP is a key tool for meeting the UK's climate change targets, while supporting local ambitions/ priorities.

Integrated demonstrations are required to show how low-carbon measures can be financed, delivered and how they bring benefits to householders. These demonstrations should include:

- Development and demonstration of integrated low carbon electric heating solutions.

- Development of smart heat storage solutions at domestic and network levels.
- Demonstration of hybrid heating systems as a potential transitional technology, particularly for hard to heat homes.
- Investigation of the costs and impacts of low carbon gas, including hydrogen pathways, on local energy systems.
- Identification of sources of low carbon heat able to supply heat networks in local areas.
- Better understanding of the types and uses of non-domestic buildings and the options and costs to decarbonise them

Detailed Response to Questions:

Chapter 4: Discussion of the Evidence Base: Characteristics of Low Carbon Options

4.179 We welcome your views on the above discussion, in particular:

(a) Does this overview of the strategically important issues, as identified in the course of our review of the evidence, highlight the key issues? Are there important issues missing?

1. Yes, we believe that the overview of the strategically important issues for assessing the characteristics of low-carbon options, as identified in Chapter 4, highlights most of the key issues. The ETI's study[3]: '*Options, Choices, Actions: UK scenarios for a low carbon energy transition'* using the ESME and EPN models indicates that there is no single technological solution that can be used for cost-effective decarbonisation of heat. On the contrary, a portfolio of technologies (including, heat pumps, heat networks, hydrogen, biomass, etc.) and propositions tailored to the needs of different consumers, building types and local network requirements will be needed. A single decarbonisation pathway is considered a very high-risk strategy and unlikely to meet the UK's 2050 energy and climate change goals in a cost-effective way.

2. The characteristics of the heat decarbonisation challenge mean that future policies should ideally be both (a) enduring and stable over the long term to bring forward the required patient investment in innovation and supply chain development; and (b) as far as possible, technology-neutral to promote solutions that are specifically adapted to local circumstances and meet different consumer preferences.

3. Recent success in stimulating innovation and achieving cost reduction in low carbon technologies, such as offshore wind and solar point to the importance of policy stability and investable support mechanisms in enabling cost reduction. Cost reduction has tended to gather pace following early deployment, as supply chains have developed, matured and upscaled. In these cases, cost reduction was delivered through policies and reward mechanisms that were arguably not technology-neutral (i.e. policy and CfD allocation focused specifically on renewables investment).

4. Given the complexity of the decarbonisation challenge, some technologies may still need support to become commercially viable, such as Carbon Capture Usage and Storage (CCUS) and nuclear. Delivering a low-cost energy transition will require the removal of key market barriers and new frameworks that accelerate the development and deployment of technologies such as CCUS, bio-energy, electrification of heat, EVs and possibly hydrogen.

5. We agree that a balanced approach to decarbonisation should be adopted. Different solutions may be required in different parts of the UK. It is unlikely that hydrogen could be produced in high enough quantities to replace natural gas to any great extent – it may make better commercial sense to use hydrogen in specialist uses such as in industrial

[3] ETI (2018): '*Options, Choices, Actions - updated: UK scenarios for a low carbon energy transition'*

processes and transport. Therefore, Local Area Energy Planning constitutes an essential tool to identify the cost-optimal solutions for decarbonisation in different areas, by taking a tailored approach that matches local requirements with national climate change targets.

6. **Sustainably grown biomass has the potential to become a critical resource for the UK energy system.** It can be burned directly for heat and power or converted into low carbon gases and liquid fuels to decarbonise hard-to-treat sectors. **Bioenergy and CCUS are especially valuable in combination.** Together, they offer the potential for negative emissions to counterbalance the continued use of fossil fuels in difficult sectors like aviation.

7. **Nearly half of UK heat demand could be met by heat networks[4].** From a whole energy systems perspective, heat networks should play a much larger part in the UK's heat delivery system in 2050, especially in less efficient and higher density buildings. A key factor affecting the commercial viability of heat networks is capital cost. By targeting innovation in the sector at high cost areas, not only would capital cost and investment barriers be reduced, but in the longer term the size of the market would likely expand due to increased competitiveness with other methods of heat delivery.

8. **A coherent economic and governance framework is needed to shape choices around heat network development in ways that are socially optimal and serve consumers' broad long-term interests.** The heat network market is currently immature and lacks a coherent regulatory framework, which is key to unlocking its potential to deliver future consumer benefits as the UK moves to decarbonise its heat markets in the decades ahead. **It may be difficult for markets alone to deliver an efficient outcome for consumers because heat supply has some monopolistic characteristics as well as a range of social and environmental externalities** (e.g. enabling reductions in carbon emissions).

(b) Are there any important pieces of evidence that require further consideration?

9. It will be necessary to trial new solutions using derogations, sandboxes and larger scale integrated demonstration environments. The direction of future policies should aim at encouraging alternative heat solutionsthat provide the experience that consumers want, while ensuring fairnessand deep emissions reduction. Digitalisation has the potential to aid this process. ESC has explored the concept of ***'Connected Homes'*** – ahome where there is interconnection and interoperability of multiple smart/ digital devices, services and applications. For energy, this could be achieved through a smart Home Energy Management System that enables the control of multiple energy services, e.g. heating, energy storage and electrical vehicle charging. Connected Homes allow households to also trade energy between themselves and energy and flexibility services with the electricity system.

10. With Connected Homes and smart technologies, it is possible to provide a good customer experience to those who pay, and to do so in the lowest impact way (clearly though, there will need to be protections in place to ensure there is also a safety net for those unable to afford a basic level of energy service).

[4] ETI/ESC (2018): *"District Heat Networks in the UK: Potential, Barriers and Opportunities"*

11. Interoperability will be crucial to fully harness the benefits of digitalisation. Combining smart devices with new service-based propositions such as, Heat as a Service (HaaS), have the potential to provide increasingly consumer-specific offers, meeting the very specific heat requirements of individual consumers, in combination with other attributes of their homes that consumers value (e.g. space, lighting, interior design etc).. Full interoperability will allow for greater system integration of smart devices, but also service marketplaces, thus protecting consumers from lock-ins and boosting greater competition in the markets for the best offers.

(c) Do you agree with the set of strategic inferences we have drawn out?

12. Yes, we broadly agree with the set of strategic inferences drawn out in Chapter 4. The Energy System Catapult recently updated work carried out by the Energy Technologies Institute (ETI) on the *Clockwork & Patchwork – UK Energy System* scenarios[5]. This work found that *'a balanced multi-vector approach can deliver an affordable, low carbon UK energy transition, with costs rising to around 1% of GDP by 2050'*. What is likely to become more important is taking a whole-systems view.

13. **We believe that a 'Whole System' approach is vital to deliver an efficient UK energy transition**. By Whole System, we mean a broad definition that not only includes the energy transmission and distribution networks, but also encompasses the emergent 'smart' energy system on the customer's side of the meter (including activities such as integrated home generation, home energy storage and electric vehicle charging). We believe that a whole system perspective will discover the best value, most effective transition for society including the optimal allocation of resources and distribution of the costs and the efficient direction of incentives.

14. **Policy and regulatory reforms should enable the low-carbon transition by following plausible implementation pathways.** Market players and investors will take greater ownership of delivering societal goals (i.e. reliable and low carbon energy services) if there is a credible long-term framework providing a business case for their actions.

15. **New agile forms of governance, inter-operability standards and flexible consumer protection will also need to be developed, collaboratively by industry working with government and regulators.** Open interoperability ecosystems will be necessary to ensure consumers can use the data/control from multiple devices and multiple vendors at their choosing, with any third-party service provider. Without this, consumers risk being locked-in to proprietary ecosystems which inhibit competition, constrain the freedom to choose, and limit the breadth of innovative solutions. The existing industry governance arrangements are siloed, bureaucratic and exclude some participants. This can create a barrier to innovation, especially where a change affects multiple codes.

Chapter 5: Discussion of the Evidence Base: Achieving Change

[5] Energy Technologies Institute: *'Options, Choices, Actions: Updated'* (2018) https://www.eti.co.uk/options-choices-actions-2018/

5.36 We welcome your views on the above discussion, in particular:

(a) Does this overview of the strategically important issues, as identified in the course of our review of the evidence, highlight the key issues?

16. Yes, we believe that the overview of the strategically important issues for achieving the transformation to low-carbon heat, as identified in Chapter 5, highlights the key issues. The ETI's study[6]: '*Options, Choices, Actions: UK scenarios for a low carbon energy transition'* produced using the ESME and EPN models indicates that there is no single technology that can produce a cost-effective decarbonisation of heat: a portfolio of both technological solutions (heat pumps, heat networks, hydrogen, biomass etc) and commercial propositions tailored to the needs of different consumers, building types and local areas will be needed.

17. At a local level, local authorities, driven by statutory requirements, and a desire to deliver socio-economic benefits throughenergy related schemes, are increasingly involved in local energy planning. The problem they face is how to decide which options are most appropriate for their local area and in what order they should be prioritised.

18. Pilot studies (documented in the ETI/ESC report[7]*: 'Local Area Energy Planning: D11 Insight report 3: implications for government)* conducted by the ETI/ESC in Newcastle, Bridgend and Bury (using the EnergyPath™ Networks (EPN) modelling framework) have shown the potential of LAEP to provide the evidence, guidance and framework to enable the long-term transition to a low carbon energy system. LAEP considers the unique characteristics of the local area and its existing energy system to; aid decision making; prioritise resources; and support project and investment decisions, ensuring an efficient and effective transition.

19. **We believe that coordinated local energy plans can lead to a significant reduction in carbon emissions from heat in buildings, and that local authorities, working with commercial partners, are best-paced to take on responsibility for local area strategic planning.** LAEP will lead to lower transition costs than an uncoordinated, piecemeal approach to decarbonisation. The costs involved in providing energy services are substantial even under *'Business-As-Usual'* (BAU). For the 3 pilot areas, with total population of 620,000, just less than 1% of the UK population, the forecasted future BAU cost of providing energy services to homes, businesses, public buildings and industry is £24 billion over the period 2015-2050[2]. The increase between BAU and deep decarbonisation, to 95% below 1990 levels, is a further £3.4 billion.

20. Effective local area energy planning depends on the availability of appropriate data. This data is dispersed across a number of stakeholders, with network operators holding much of the data that is essential to good quality planning. We believe that network operators need to be incentivised to make this data readily available to enable an effective whole system planning process.

[6] ETI (2018): '*Options, Choices, Actions - updated: UK scenarios for a low carbon energy transition'*.
[7] ETI (2018*): 'Local Area Energy Planning: D11 Insight report 3: implications for government'.*

b) Are there any important pieces of evidence that require further consideration?

21. **Barriers to service-based energy propositions such as Energy-as-a-Service (EaaS) should be removed.** Service-based offerings such as EaaS involve consumers purchasing service bundles or outcomes, in place of 'commodity-only' tariffs and may require changes to energy supply licences and trading arrangements (e.g. allowing a move away from commodity-only tariff structures)**.**

22. The ESC's report[8]: *'SSH2 - Energy Services Design – Market Transformation (Final Report)*' indicates that service-based offerings could be a strategic enabler for innovation in the energy sector, enabling the efficient low-carbon transformation of the UK's heat supply infrastructure and building fabric, through improving the consumer experience and creating room for innovative new business models.

23. ETI/ESC evidence from field trials, (including a trial by 30 homeowners of a prototype Home Energy Management System (HEMS) in winter 2016-17, and a winter trial in 2017/18 with 100 homeowners of a prototype Home Energy Services Gateway (HESG)[6] has shown that people care more about their experiences using energy, than the systems that deliver those experiences – and most people would value improved control of heat in their homes. These trials also showed a majority of people hardly consider cost when using heat on a day-to-day basis at home and most people find it difficult to control current heating systems.

24. Integrated demonstrations of not just the technologies, but also wider commercial, regulatory and policy frameworks, are required to show how new approaches can be financed, delivered and how they bring benefits to householders. There is currently no compelling reason for consumer to adopt lower carbon solutions. In today's market, there is little incentive for incumbent businesses to develop new propositions, and the dominant gas boiler technology generally remains the most compelling option. The customer needs to be informed and confident that any new propositions being offered will meet their needs at a cost that is acceptable to them.

25. **The ESC has developed the Living Lab to test new products, services and business models in 100 real homes**. The Living Lab is being used to understand consumer preferences and usage habits, testing new products such as Energy-as-a-Service (EaaS) heat plans which provide consumers with a number of 'warm hours' rather than units of fuel. We are helping consumers discover and choose what level of service they can have in their home. Consumers discover how warm they like their rooms at different times, what limits their experience (e.g. time to warm), what shapes the cost and what is excluded from their heat plan (i.e. extras).

26. The transition to a low-carbon, consumer orientated heat industry, will require further research into technologies and business plans, and understanding of consumer preferences and actions. The future work required could utilise the Living Lab to:

[8] ESC (2018): *'SSH2 - Energy Services Design – Market Transformation (Final Report)'.*

- Allow companies to innovate by trialling new technologies, devices, business plans and propositions in a real-world environment.
- Discover if consumers can get the same level of comfort from a heat pump as a gas boiler (by installing heat pumps in five homes).
- Explore ways to improve business propositions for example, heat plans including options such as hot water and a Pay-As-You-Go offer.

(c) Do you agree with the set of strategic inferences we have drawn out?

27. Yes, we broadly agree with the set of strategic inferences drawn out in Chapter 5. **We believe that a whole system perspective is essential to deliver an efficient UK energy transition**. We believe that a whole system perspective will return the best value, transition for society by creating efficient incentives which ensure the optimal allocation of resources and distribution of costs

Chapter 6: Developing a New Policy Framework

6.68 We welcome your views on the above next steps, in particular:

(a) Do you agree that we have identified the most important issues to be addressed as we develop our thinking? Do you consider that there are important omissions?

28. Yes, we agree that you have identified the most important issues to be addressed. The 'right' solution for low carbon heat is likely to be locality, and potentially property, specific. With digitalisation and connected homes, service propositions could become increasingly consumer-specific, with potential for systems (and building fabric improvements) to be integrated and operated together 'intelligently' to meet the specific heat requirements of individual consumers in combination with other valued attributes of a consumer's home (e.g. space, lighting and interior design).

29. A number of studies have been carried out on heat decarbonisation in a range of countries, including that by Frontier Economics in its report for the *Committee on Climate Change*[9] in November 2015, by Oxera and more recently by Vivid Economics[10]. The study by Vivid Economics looks at analogous transitions in several international markets. One of the main conclusions from this study is that **effective transitions to low carbon heating are** "**supported by a package of policies which span regulation, information, standards, research and development and long-term targets". Best results are delivered when this policy support is sustained over time and addresses the investment case as well as a range of barriers** (technical, information, innovation). The interaction with other

[9] Frontier Economics (November 2015): "*Research on district heating and local approaches to heat decarbonisation - Annex 1: Overcoming barriers to district heating".*

[10] Vivid Economics (September 2017), "*International Comparisons of Heating, Cooling and Heat Decarbonisation Policies"* - report prepared for the Department of Business, Energy and Industrial Strategy.

areas of policy such as building codes and the development of new infrastructure is also important.

(b) Do you have any comments on the types of actions identified to meet these challenges? Do you have other suggestions?

30. ESC believes that coordinated local energy plans can lead to the required significant decarbonisation of heat. We therefore envisage the need for a whole system strategic planning structure to drive the national low-carbon transition. Specifically, the ESC believes that this can be best achieved through strategic Local Area Energy Planning (LAEP)
31. Radical change in the way we heat buildings is also likely to require substantial adaptation of existing industry regulatory frameworks and codes. This process itself needs to be informed by experimentation and demonstration environments, such as those being supported through the industrial strategy challenge fund.

(c) Do you have views on which parties are best placed to deliver actions to address the key issues?

32. Local authorities, working with commercial partners, are best-paced to take on responsibility for local area strategic planning. The problem they face is how to decide which options are most appropriate for their local area and in what order they should be prioritised.

(d) Do you have any views on priorities for further development and proving of emerging technologies with clear potential to provide strategically important options and benefits in relation to decarbonising heating? Please provide supporting argument for your views.

33. Open interoperability ecosystems will be necessary to ensure consumers can use the data/control from multiple devices and multiple vendors at their choosing, with any third-party service provider. Without this, consumers risk being locked-in to proprietary ecosystems which inhibit competition, constrain the freedom to choose, and limit the breadth of innovative solutions. There is some debate how much control the UK has over interoperability – the development of equipment standards may be driven by international standards organisations. We believe that it is important that the UK takes an active role in helping to develop these standards.
34. The results from ESME model analysis suggest hybrid heat pumps could have a key role to play and could be used until the electricity grid is fully decarbonised. They could also be an important bridge between current gas and oil-fired central heating systems and fully electric systems such as heat pumps. This can help the consumer transition to a new way of heating their homes, experiencing the different performance characteristics of heat pumps versus gas/oil-fired boilers. It is important that this option is explored in localities, and for individual properties, where it could provide system benefits.

35. Analysis using the EnergyPath™ Networks (EPN) modelling framework shows that hybrids can also be valuable to heat large, inefficient homes where standard heat pumps cannot produce enough power to meet heating demand on the coldest days. However, careful control is required to ensure that they do not operate in gas mode for longer than necessary. Hybrids could also reduce the peak electrical load on the electricity networks, allowing more time for new network capacity to be built.

(e) Do you have views on how co-ordination and prioritisation of relevant initiatives across industry, academia and the public sector could be improved?

36. TBC

(f) Do you have views on ways in which the Government, and other actors, could seek to engage stakeholders and stimulate a wider public debate?

37. TBC

(g) Are there practicable ways in which we could facilitate greater transparency in the exchange of views and analysis on relevant issues?

38. TBC