A future framework for heat in buildings: call for evidence

Northern Powergrid's response to the Department for Business, Energy and Industrial Strategy (BEIS) call for evidence

KEY POINTS

The delivery of heat is arguably the most challenging issue facing the UK on its path to decarbonisation. For heating policy to be effective, it is crucial for it to be a part of a coherent energy policy framework that optimises the UK energy system as a whole – addressing the synergies between, and the issues faced by, transport, heat, and power sectors alike, and not in isolation.

- It is **important that low-regrets and cost-effective transition to low carbon heating happens promptly** in order to start addressing 2050 targets. There is scope for introducing a step change improvement under some scenarios. A clear policy timeline and the introduction of stepping stones for heat decarbonisation would enable supply chain development and allow for a systematic approach to fill the skills gaps to deliver the change.
- **Low carbon electricity has a central role to play** in the future energy mix. We expect that the carbon intensity of electricity will continue to fall substantially over the next 10 to 20 years.
- **Tightening the building standards for energy efficiency** to meet the standards of zero carbon buildings or above is a vital action for driving the decarbonisation of heat. The UK offers significant potential to increase the building energy efficiency standards for both new build and existing properties.
- A **level playing field is needed for all fuels**, and fiscal distortions/market failures should be avoided. At present, there is a disproportionate fiscal burden on electricity compared to gas. Furthermore, high carbon content fossil fuels are not subject to Climate Change Levy (CCL) and are taxed disproportionately to their carbon content. The price of a fuel needs to be reflective of its carbon content.
- **Heat policy needs to deliver a positive social impact**. There is a high likelihood of a price increase for the most commonly used fuels as a result of any fiscal changes which could create negative externalities for the fuel poor and vulnerable consumers. There is scope to introduce support mechanisms to ensure fairness and to avoid adverse impacts for these customers as a perverse outcome of achieving heat decarbonisation objectives.
- **Electrification of heat is likely to result in an increased electricity peak demand and an associated opportunity to use the power required when it is being generated.** Smart technologies like heat pumps, storage heaters, batteries and smart appliances enable shifting the electricity demand outside the peak. With the introduction of smart grid and grid flexibility services, we will be able to mitigate much of the negative effect from increased peak demand.
- A **whole-system approach** in achieving the decarbonisation targets supports load shifting. Our response to the consultation on *Proposals regarding Smart Appliances* should also be viewed in this context.

Detailed responses to BEIS consultation questions

We have answered those questions where as a local network operator we have the most evidence to provide.

Question 1: Do you agree that the policy framework should focus initially on enabling the market to drive the transition away from high carbon fossil fuels, and in the longer term on helping consumers and industry to comply with regulations?

1. Northern Powergrid is supportive of the Government's intentions to reduce the use of fossil fuel heating and recognises the importance of decarbonisation of heat set out in the Clean Growth Strategy.
2. We believe that, in order to effectively achieve decarbonisation targets, heating policy must be part of a coherent energy policy that looks at optimising the UK energy system as a whole, focussing on an integrated policy that looks to both the short term (increasing energy efficiency) and long term (decarbonisation and whole-system approach).
3. It is important that no-regrets and low-regrets opportunities are first identified to ensure a cost-effective and prompt transition to low carbon heating; while keeping the consumer's needs at the centre of the policy in order to deliver a positive social impact.

Question 2: How should government best engage with existing and emerging heating markets, consumers and other stakeholders, to ensure regulations are designed in a way that works for everyone?

4. It is important that Government evaluates different perspectives and sets out a high level policy confirming the direction of travel in order to achieve the best outcomes.
5. The policy needs to recognise that there are a variety of options available and the engagement should focus on understanding the criteria to be applied to determine which heating solutions are appropriate for each use case.

Question 4: What is the potential for non-domestic buildings to transition away from the use of high carbon of fossil fuel heating? Is the use of high carbon forms of fossil fuel driven by process heating requirements, with space and water heating requirements secondary to this? Are different solutions required for different heat uses and are there cleaner alternatives?

6. We agree that the use of high carbon forms of fossil fuel are driven by process heating requirements; with space and water heating requirements secondary to this. Still, we believe that there are different approaches to take based on building tenancy.
7. It is important to identify sectors that are dependent on the use of fossil fuels or high grade heat for their core activities, and it would be appropriate to create a bespoke heating policy in these cases. This is a proportionate approach to determining policy.
8. We agree that decarbonisation potential is more readily achievable in cases where low grade heat is required. For example, we believe it would be feasible to fully electrify the heat in commercial office

buildings, so that the space heating and hot water demand would subsequently be met through the use of low carbon electricity. This, in turn, could be partially achieved or mitigated with higher standards for building energy efficiency.

Question 5: What do you think are the main technology choices for reducing heating emissions from off gas grid households, businesses and public sector organisations (eg transitional technologies)?

9. For new buildings, a low-regrets pathway is increased energy efficiency standards and the electrification of heat. This would allow reducing the final energy demand at the least cost. Installing an energy-efficient heating system in new buildings would likewise avoid the additional costs[1], including hassle costs[2], associated with retrofitting a heating system.

10. Retrofitting heating systems to existing building stock can make the new low-carbon heat very unappealing from a customer perspective. The Northern Powergrid Customer-Led Network Revolution project[3] involved trials with 380 heat pump customers; providing experience of retrofit. It demonstrated the difficulties in adopting this new technology when the customer disruption is factored into the decision.

11. Fossil fuel heating (including natural gas), although it currently provides a competitive fuel cost, is not a feasible option for any off-gas-grid new-build. There are high costs associated with installing gas connections' infrastructure in terms of pounds per units of heat required.

12. We believe there is a combination of approaches needed to address the carbon emissions produced from heating current building stock. More than 80% of the current building stock is predicted to still be standing in 2050[4].

[1] Cambridge Econometrics, 2014. Building the Future: The economic and fiscal impacts of making homes energy efficient.

Available from: http://www.energybillrevolution.org/wp-content/uploads/2014/10/Building-the-Future-The-Economic-and-Fiscal-impacts-of-making-homes-energy-efficient.pdf

[2] For illustration, please see the negative *willingness to pay* associated with perceived 'hassle', such as digging up garden, requirements for space and/or a hot water storage cylinder, demonstrated in Figure 5 of Element Energy, 2008. The growth potential for Microgeneration in England, Wales and Scotland.

Available from: http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file46003.pdf

[3] CLNR, 2015. High Level Summary of Learning. Heat Pump Customers. Document number CLNR-L254. Available from: http://www.networkrevolution.co.uk/wp-content/uploads/2015/01/CLNR-L245-High-Level-Learning-Heat-Pump-Customers.pdf

CLNR, 2015. Insight Report: Domestic Heat Pumps. Document number CLNR-L091. Available from: http://www.networkrevolution.co.uk/wp-content/uploads/2015/01/CLNR-L091-Insight-Report-Domestic-Heat-Pumps.pdf

CLNR, 2014. Heat Pump Survey Results. July 2014 Social Science Team Report. Document number CLNR-L104. Available from: http://www.networkrevolution.co.uk/wp-content/uploads/2014/12/CLNR-2014-Heat-Pump-Survey-Report.pdf

[4] Kelly, M.J. 2008. Britain's building stock - a Carbon Challenge. Ministry of Housing, Communities & Local Government.

Question 6: What do you think are the main technology choices for achieving near zero emissions from off gas grid heating (technologies which are consistent with our 2050 targets)?

13. Building on the answer provided in response to Question 5, we believe that the use of low carbon electricity predominantly through heat pumps and resistive heating (when heat pump installation is not feasible) should be the key technology for decarbonisation of heat on a wider scale.

14. Although the use of hydrogen gas is not able to provide a 'silver bullet' solution to all of the challenges posed by heat decarbonisation targets, it should be explored as hydrogen might have an important role to play in the future energy mix. Indeed, hydrogen is arguably a better solution for decarbonisation of the existing gas grid as opposed to providing a viable off-gas-grid solution.

15. Northern Powergrid is working in partnership with Northern Gas Networks and Newcastle University at the Integrated Transport Electricity and Gas Research Laboratory (IntEGRel)[5] to explore how the gas system may be used to store energy as an alternative to electrical energy storage or customer flexibility.

16. This whole energy demonstrator is exploring the use cases and new technologies to provide customer value from integrated systems development and operation. By comparing different technologies side-by-side or in combination it is possible to produce evidence to inform decarbonisation pathways.

Question 10: Are there any oil and heat pump hybrids currently on the market (in the UK or elsewhere), and if so how does the cost compare with conventional systems or with a heat pump? Could they be used with bioliquids? What impacts do they have for domestic and business consumers, for example in terms of ease of use and comfort levels?

17. We expect there will be learning offered from the Freedom Project[6], carried out by Western Power Distribution and Wales & West Utilities and trialling hybrid heating systems in 75 homes in Bridgend.

Question 12: What role might hybrids have in the short term to facilitate the longer term transition to clean heating off the gas grid?

18. We believe that hybrid systems have the potential for facilitating a step in the right direction - from a heating system using fossil fuels to lower carbon heating; where the additional requirements to meet the building energy efficiency standards required for an installation of a purely electric heat pump are impracticable and difficult to meet at a reasonable cost, or the property is not located on the electricity grid.

[5] Northern Powergrid, 2017. Northern Powergrid part of industry-leading collaboration to explore future energy systems.

Available from: https://www.northernpowergrid.com/innovation/news/northern-powergrid-part-of-industry-leading-collaboration-to-explore-future-energy-systems

More information available at: http://www.integrel.co.uk/

[6] Western Power Distribution, 2016. FREEDOM (Flexible Residential Energy Efficiency Demand Optimisation and Management).

Available from: https://www.westernpower.co.uk/Innovation/Projects/Current-Projects/FREEDOM.aspx

19. Still, it is important to recognise that a new heat pump can be operational for the next 10 to 20 years. Although installing hybrid heat pumps promises a reduction of demand for fossil fuels and thus a reduction in emissions, the comparative advantage of this technology lessens as electricity carbon content decreases[7]. Because it is unlikely that a heating installation will be upgraded if it is in a working condition, the installation of hybrid heat pumps fuelled by, for example, kerosene or liquid petroleum gas might deter meeting the long-term carbon reduction targets.

20. Using the same logic, we believe that hybrid heat pumps should not be installed where it is possible to make the necessary improvements to the building fabric and the property is on the electricity grid.

21. A clear policy timeline and the introduction of stepping stones for heat decarbonisation would enable supply chain development and allow for a systematic approach to filling in the skills gaps.

22. ***Question 15: Are there any drawbacks of smart/more efficient storage heaters, vs other types of electric heating? And, if so, how are these to be overcome? What are the benefits of smart and more efficient storage heater products compared to traditional storage heaters? In which types and tenure of buildings are storage heaters most likely to be useful? Would storage heaters be a likely solution where electric heating is not currently used? How about where electric heating is currently the secondary heating source?***

23. Modern smart storage heaters are a viable source of load shifting that can return value to customers in the form of improved heat or lower bills. Evidence from the V-Charge/OVO Energy trials in Newcastle and Glasgow will be useful in answering these questions.

24. One of the main barriers for the uptake of electric heating currently is that electricity is not comparatively priced, when compared to other fuels. Electricity to natural gas price (BEIS central estimate[8]) ratio, depending on sector, is 4.1:1 (domestic), 4.6:1 (commercial/public sector) and 4.9:1 (industrial). When electricity is compared to burning oil (kerosene), these ratios are 5.4:1, 2.9:1, and 2.8:1 respectively. To meet decarbonisation targets, it is important that not only *technology*, but also *fuel* price near-parity is achieved with the conventionally used fossil fuels.

25. Consistent with the prior call for evidence for 'A smart flexible energy system'[9], we recognise that customer engagement will be guided by energy services (buying and selling energy) as well as network services (customer flexibility offered to balance the system). The active distribution system means that the demand side and supply market cannot be considered in isolation of networks (and *vice versa*).

[7] Element Energy, 2017. Hybrid Heat Pumps. Final report for Department for Business, Energy & Industrial Strategy. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700572/Hybrid_heat_pumps_Final_report-.pdf

[8] BEIS, 2018. Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions. Data tables 1-19 supporting the toolkit and the guidance.

[9] Ofgem/BEIS, 2016. A Smart flexible energy system: call for evidence. Available from: https://www.gov.uk/government/consultations/call-for-evidence-a-smart-flexible-energy-system

26. Through the Energy Networks Association Open Networks project[10], electricity distribution and transmission companies are collaborating to consider the future role of a Distribution System Operator (DSO) and what this would entail. We consider that the DSO will be central to enabling customers' participation in both energy and networks services markets.

27. Our view is that network operators can and should modestly expand their roles as simplifying forces in the energy system. DSOs can be the key enablers of the energy system of the future, by providing the smart common infrastructure centred around the customer, upon which a competitive energy services model may operate locally. This can be designed to offer high standards of stability, security, and transparency to all market participants; and to align with the true cost structure of new technologies. In other words DSOs form stable and secure platforms for the wider systems and markets to operate on.

28. Our belief is that DSOs should be required to solve network constraints with non-reinforcement solutions (such as energy efficiency) wherever doing so is the cheapest reliable and secure solution. But this should be technology neutral and we should avoid prescribing specific technologies and approaches and let the options compete on their merits.

29. DSOs could be regulated such that they are only allowed to reinforce the network when they can demonstrate that either other non-network market solutions cannot reliably and securely deliver or that measures being procured have reached the point that their cost exceeds the costs of a network solution paid for over 45 years.

30. In such ways, DSOs may not directly deliver energy efficiency improvement measures, but they will help target delivery where it is most useful for the system. We believe that smart appliances are one of the enablers for DSO.

Question 19: What is the role of the heating industry in delivering cost reduction through innovation? What steps is the industry already taking and what more could be done?

31. There is a well-documented discrepancy between the peak of energy generation (in the summer) and the peak demand of energy (in the winter). Capturing and storing heat to mitigate for the seasonal discrepancies could offer a solution for using renewable, low-carbon heat throughout the year. We are aware of the research in this area lead by Professor Tony Roskilly at Newcastle University.

Question 21: What can government do to ensure that future policy encourages and supports future innovations and cost reductions in technologies?

32. We believe that having a clear long-term energy policy is key for driving innovation and cost reduction in technologies. As evidenced with technologies such as solar PV, a clearly expressed support can act as a strong signal for further innovation, driving the technology performance and

[10] Energy Networks Association , 2018. Open Networks Project. Available from: www.energynetworks.org/electricity/futures/open-networks-project/

efficiency[11]. The support for installation of solar PV has facilitated the uptake of the technology, and resulted in a cost reduction of 12-23% between 2013/14 and 2017/18[12].

33. To address the overall cost of the technology (i.e. capital and operational cost), the current fiscal distortions affecting fuel prices need to be addressed. There is a market failure stemming from different, inconsistent taxation of different fuels and fuel prices not being reflective of externalities, such as the abatement cost of greenhouse gas emissions.

34. Currently, policy costs are disproportionally levied on electricity bills, making up 15% of an electricity bill; this has created significant distortions in the market and is leading to inefficiency and perverse outcomes as bill payers are seeking ways to avoid these costs such as generating behind the meter and setting up inefficient private networks.

    a. On occasions, the interaction of the fiscal / levy regime with the current supplier hub model has led to some far-reaching implications with perverse outcomes and inefficiencies and undermined the original vision for a fair whole energy system. These should be designed out of any new structure and not be allowed to perpetuate or be replicated.

    b. As they seek to maximise the revenue stream from the combined heat and power (CHP) system installed, a number of bodies in the Northern Powergrid region are implementing or considering the option to act as unlicensed energy suppliers over private wires.

        i) The private wire option is currently the easiest in the current licensing framework and the most appealing because it deducts from the electricity price the cost of the regulatory overhead and policy costs that would otherwise be levied (i.e. avoiding a 'tax' that is then paid by other customers). The effect of this is for the electricity system (and electricity bill payers) to cross-subsidise heat networks from which they do not benefit – in effect a hidden form of regressive tax.

        ii) In private wire networks the development of the heating and electrical infrastructure takes place 'behind the meter' optimising for nominal cost within the private network (driven in large part by fiscal interventions) rather than overall value. As such, an inefficient system is created potentially with duplication of electricity networks in the same streets and the cost recovery for existing DNO network assets then being avoided by those customers and increasing the costs for the remainder of the DNO customer base. This works to the disadvantage of the generality of customers and imposes wider societal and environmental costs.

        iii) Domestic customers are often left out from the benefits of this model but bear the cost of it: they carry their own share of costs plus the share of parties able to avoid environmental costs and network charges.

[11] US National Renewable Energy Lab. Best Research-Cell Efficiencies. Available from: https://www.nrel.gov/pv/assets/images/efficiency-chart.png

[12] Northern Powergrid's calculations, based on BEIS, 2018. Solar photovoltaic (PV) cost data. Official Statistics.

Available from: https://www.gov.uk/government/statistics/solar-pv-cost-data

iv) Building a private wire to maximise income, and to bypass the current supply licence framework (and in doing so environmental and social levies/taxes), is an infrastructure solution to a commercial and regulatory issue. We believe that customers deserve a commercial solution to a commercial issue.

c. More widely, there are also potential issues of customer protection and service levels, as the distribution service ends up being delivered by independent distribution network operators (IDNOs) or licence-exempt network operators whose service standards are not as well scrutinised (and potentially not as well provided) as the regional DNO. IDNOs and private wire networks are subject to lower obligations (for example, requirements for efficient electrical design to limit losses) and have no incentive to optimise across the system which is important when we need to increase system flexibility. Commercially, by picking customers with lower costs to connect, the IDNO is able to provide a discounted cost to the developer without there necessarily being a benefit to the end customer who occupies the premises. This charging distortion that allows cherry picking of lower-than-average cost-to-serve customers and applying tariff support is to the disadvantage of the generality of customers. Inherently, this incentivises IDNOs to operate a cash-flow focused, more short-term business model that is not in customers' or society's long-term interests.

35. Working with Ofgem, BEIS should evaluate the problems that are being created by the application of environmental levies and taxes to energy bills with the aim of applying taxes in a way that creates fewer perverse incentives. The inefficient development of networks (driven by customers seeking to avoid taxes) is just one such example, and we would encourage policy makers to carefully consider the pros and cons of where they apply environmental social levies/taxes in the context of wider regulatory structures.

Question 22: Please provide views and evidence on how different obligation approaches could be used to drive the transition to clean heating during the early 2020s? Are there any areas worth specifically targeting? Are there situations in which obligations would be counter-productive? Do you have any views on other short term regulatory options that could be pursued, besides those considered above?

36. As discussed above, the fiscal distortions found in fuel pricing is one of the main issues that, if addressed, could act as an enabler for transition to clean heating.

37. In the shorter term, the involvement of the DNO in energy efficiency and solving network constraints could be facilitated through a devolution model led by combined authorities.

38. In the longer term, capital investment in home energy efficiency may be part of the DSO's toolbox but this is yet to be proven.

39. In the future, DSOs should be required to solve network constraints with non-reinforcement solutions (including energy efficiency) when doing so is the cheapest reliable and secure solution. But this should be technology neutral and we should avoid prescribing specific technologies and approaches and let the options compete on their merits.

Question 23: What do you think about the options set out above for an obligation? Do you have any evidence as to potential impacts, burdens or unintended consequences?

40. Please see the answer to Question 22 above.

41. To minimise the unwanted impacts, burdens or unintended consequences, it is important that any respective duties are linked to appropriate powers and appropriate funding mechanisms.

Question 25: How can DNOs or GDNs take a leading role in deploying clean heating?

42. RIIO2 is a potential opportunity for the DNOs or GDNs to take on the additional role of deploying clean heating; however, it is important that the duties and obligations are linked to appropriate powers and funding mechanisms.

43. Heat is today predominantly fuelled by gas[13] such that there may be as many savings in synergies with gas networks as there are with savings in reinforcing electricity networks.

44. The Northern Powergrid Alternative Investment Strategy (AIS) report[14] investigated the idea that improved energy efficiency (EE) may lead to permanent demand reduction, which ***may*** in turn lead to reduced peak demand, which may then offset the need for network reinforcement. Based on this premise, the report asked if there was a possibility for DNOs to divert any part of the budget allocated to load-related network upgrade schemes, into local schemes that improve energy efficiency for those who need it the most. This idea had been promoted by the charity National Energy Action, and this research was done in partnership with them to move from the abstract concept to the factual.

    a) It concluded that for energy efficiency to be in the DNO's toolbox and to compete with reinforcement, smart grid solutions, or flexibility it faces the following challenges:

        i. Home insulation is expensive: its cost-competiveness is low when compared to networks reinforcement in terms of £/kW, especially when you start looking at the scale of required deployment to achieve results at a scale that is meaningful at the local network level (i.e. is capable of materially affecting peak demand).

        ii. Duration: the energy savings delivered should be maintained over time (network assets deliver results for 45 years), whereas the rebound effect is known to be an issue for energy efficiency performance (for example, where people take 'savings' as comfort and warm their homes more)[15].

[13] Ofgem, 2015. Insights paper on households with electric and other non-gas heating. Available from: https://www.ofgem.gov.uk/ofgem-publications/98027/insightspaperonhouseholdswithelectricandothernon-gasheating-pdf

[14] The report was commissioned by Northern Powergrid and produced by Agility Eco in partnership with National Energy Action.

Available from: www.northernpowergrid.com/news/new-research-highlights-potential-for-energy-system-win-win-win

[15] For example see Rosenow, J. & Galvin, R. 2013. Evaluating the evaluations: evidence from energy efficiency programmes in Germany and the UK. Available from: http://eng.janrosenow.com/uploads/4/7/1/2/4712328/rosenow_galvin_2013_evaluating_the_evaluations-_evidence_from_energy_efficiency_programmes_in_germany_and_the_uk.pdf

iii. Certainty of result: what matters for the power network is peak power flow reduction, and the correlation between reduction in general and reduction at peak is not established to a degree where results can be forecasted to a level of certainty that supports our concern for the reliability of our network.

iv. Coincidence in place and in time: the need (and the potential) for better energy efficiency would need to coincide in time and location with planned network reinforcement.

b) Encouraging conclusions were:

i. A proportion of our costs is indeed driven purely by local load growth, albeit a small proportion only: £4m per year between 2015 and 2023, compared with an average yearly cost of ECO of £460m[16].

ii. At present, there is no regulatory barrier for DNOs to invest in energy efficiency (although regulatory incentives may be missing: such as placing energy efficiency investment on the regulated asset value).

iii. Anecdotal evidence suggests that historical energy efficiency improvement works and load-related network reinforcement projects seem to coincide in location (based on historical analysis).

Question 27: If there was some targeted subsidy, such as for low income or vulnerable households or for building local supply chains, what would this need to look like? Do you have any evidence that subsidy is necessary?

45. Approaches such as scrappage schemes are only effective if there is a scheme in place to support and facilitate the adoption of new technology, and enough information available to installers and customers. Please also see our response to Question 32.

46. Norway has successfully demonstrated how, with low electricity prices, carbon tax on kerosene, kerosene boiler scrappage scheme and subsidy for low carbon heating technology, it is possible to significantly cut kerosene use.

47. To properly address the issues raised, Ofgem and Government must together, fundamentally review and decide what and who is being targeted with fiscal interventions, regulations and market structures. Specifically:

a. which costs to socialise to deliver acceptable social outcomes and who pays for desired environmental policies, through which route;

b. whether to maintain or change universal service obligations;

c. which parts of the market to subsidise to promote security of supply and decarbonisation; and

d. what balance of public and private operations will best deliver efficient investment and drive service improvements for customers.

[16] BEIS, 2017. Average over the last two years, from: 'Household Energy Efficiency National Statistics, headline release October 2017'.

48. In particular, a solution is required to the regulatory distortions leading to behind the meter schemes where self-supply causes inequitable social outcomes. The driver has been the ability to avoid policy costs in electricity bills – creating lower costs for those participating and higher bills for the customers unable to take advantage. A key challenge is how the costs of regulatory interventions are distributed amongst energy bill payers.

    a. It is inequitable if the entire customer base (including the fuel poor) pay for improvements that benefit those that are able to pay.

    b. This would be a regressive policy that repeats some existing failings of the current energy system (e.g. the avoidance of taxes by those customers that join private wire combined heat and power projects 'behind the meter').

Question 28: Novel business models for selling clean heating have not taken off in the UK market, why is this? What is needed to stimulate the development of this market in the UK?

49. We believe that the biggest obstacle facing clean heating in the UK has been the political uncertainty and the associated risk.

50. We recognise that the heating sector faced a significant setback when the plans to introduce a zero carbon homes policy in 2016 were cancelled[17]. We believe that more certainty of the future direction and trust in the market could be achieved by setting out a clear energy policy.

Question 30: What could be done to support a whole-house approach of combining interventions and technologies?

51. In line with our responses provided to the *Proposals for smart appliances* consultation, we believe that interoperability might be a practical way to address several issues pertaining to consumer protection.

52. The volume and types of data from smart meters and other connected devices create both vulnerabilities and opportunities that any revised arrangements will need to manage.

53. The threat to cyber security (often combined with physical building security) is one of the fastest accelerating business risks to all sectors of the economy. The interconnectivity of the future smart energy supply chain introduces a new level of exposure to cyber-attacks. However, the industry is taking the right steps to mitigate these risks through the application of expertise and collaboration (including with the Government). Our approach must be to realise the benefits from interconnectivity while also putting in place 'fire breaks' and other mitigations to compartmentalise the impact of attacks when they occur.

54. Smart thermostats offer a view of the future as they are able to dynamically adjust the settings of the heating system and communicate with other devices. For example, a smart home heating system might have smart radiator control valves, a boiler control, and several room thermostats

[17] Oldfield, P. UK scraps zero carbon homes plan. The Guardian. Published on 10 July 2015.

Available from: https://www.theguardian.com/environment/2015/jul/10/uk-scraps-zero-carbon-home-target

communicating through a hub (commonly operated by e.g. Google Home, Alexa, or a set of IFTTT[18] conditional statements).

55. We believe that aggregation at the lowest level, such as a smart appliance hub, is potentially a more cyber-secure method than each appliance communicating to the central system individually. This creates fewer data pathways to protect and fewer common causes of failure. In this manner, it would be possible to create an architecture that is capable of fragmenting and surviving, if exposed to a cyber-attack. Consequently, there might be scope for introducing a trusted intermediate system (and standards thereof) to derive cyber-security benefits.

Question 31: How can government best tap into and support community and local authority efforts? Are there any successful examples that can be built upon?

56. We believe that reaching near-cost parity to fossil fuel systems is key enabler for low carbon heating uptake. There are multiple options for achieving this: introducing economies of scale, subsidies (please also see our answer to Question 27), scrappage schemes, tax breaks, community energy projects, heat networks, and others.

57. A major challenge is presented by the fact that customers do not engage with their energy consumption frequently, and often their awareness of new energy efficiency opportunities is limited. We consider that the information on a range of low carbon heating systems and the opportunities presented thereof should be made widely available through the local authorities, energy suppliers, installers, community energy groups, consultative bodies, such as Citizens' Advice.

Question 32: What could be done to drive action from local planning? What are the pros and cons of approaches that rely on local planning? What evidence is there that such approaches produce desired outcomes?

58. There is scope to allow and encourage local authorities in setting higher building energy efficiency standards, setting up local schemes for decarbonisation, as well as prohibiting new-build properties to be built with fossil fuel heating.

59. The precedent set by Greater London Authority[19] in keeping zero carbon buildings serves as a positive example of such an approach.

Question 39: What other options should we be considering to target key barriers to taking up clean heating?

60. It is widely recognised that the high upfront cost is the main barrier to wider uptake of heat pumps, insulation, and other energy efficiency measures. No policy currently exists to facilitate this transition in *able to pay* households.

[18] *If this, then that (IFTTT)* – a web-based service to create chains of simple conditional statements, called applets, to enable communication between devices.

[19] London Plan, 2016. Greater London Authority. Policy 5.2. Minimising Carbon Dioxide emissions.

Available from: https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-chapter-five-londons-response/policy

61. Northern Powergrid is supportive of introduction of higher building energy efficiency standards that meet the standards of zero carbon buildings or above which would enable incorporating the costs of decarbonisation in a mortgage and achieve the heat decarbonisation objectives at a lesser cost when compared to a retrofit or gradual building improvements.

62. However, we recognise the challenge posed by decarbonising heat across the current building stock. Wider availability of options such as *green* mortgages, *green* loans, *heat as a service* are needed to facilitate uptake of clean heating systems are the next logical step to achieve deployment at scale across all households independent of their income.

63. Northern Powergrid sees the lack of a clear and coherent up to date energy policy is a key barrier for further uptake of clean heating. As referenced in Question 1, having a whole-system approach in setting out the future energy policy is crucial in order to overcome this barrier.

Question 40: What intervention would make the biggest difference ahead of any regulation?

64. We believe that a clear, coherent, and up-to-date energy policy is the single, most effective way to address the decarbonisation of heat and setting out a clear policy pathway.

Question 43: What are the relative costs and benefits of installing clean heating systems in new build compared to installing futureproofing measures?

65. We believe that installing clean heating systems and installing future-proofing measures are both fair solutions to the difficult problem of decarbonising cost-effectively and quickly.

66. However, it is important to recognise that delaying the installation of clean heating systems has an inherent risk of delaying the timeline for the decarbonisation of heat.

Question 44: What would be the most cost-effective and affordable measures to decarbonise new buildings? Please make reference to specific forms of clean heating or future-proofing measures.

67. The least-regrets option to achieve heat decarbonisation is to increase building energy efficiency standards to the level of Zero Carbon Homes or higher to reduce the overall energy demand. When a building life cycle is considered, this approach ultimately offers a range of benefits such as increased comfort and lower energy bills to the homeowner.

68. Having a lower energy demand initially, and consequently meeting this demand with a low carbon technology, has a higher potential to reduce the overall emissions from heating, when compared to using low carbon technologies to meet the energy demand stemming from the current energy efficiency standards.

69. As set out in Question 5, we believe that fossil fuels, especially high carbon fossil fuels, should be made unavailable as an option to provide heat in new buildings. This could be done by, for example, further reducing the Target Emissions Rate stipulated in Part L (Conservation of fuel and power) to the Building Regulations.

70. In line with our responses provided to the *Proposals for smart appliances* consultation, we believe that efficient and smart systems can regulate the amount and time of consumption, creating a benefit for customers and the distribution system operator.

71. The electrification of heating within a multi-occupancy building would fall under the principles set out in *Distribution Connection and Use of System Agreement (DCUSA) DCP205 and DCP205A – Recovery of costs due to load and generation increases from existing customers in RIIO-ED1*. The costs of any reinforcement caused by load or generation growth by domestic and small business customers would therefore be recovered through distribution use of system charges (DUoS) charges i.e. we will fund the work through our capital reinforcement programme.

72. Northern Powergrid is embarking on a programme of refurbishment and replacement of the rising mains within high-rise properties which run through the internal fabric of buildings. In instances where we have to replace the riser we will size the cable appropriately for the current and future needs of the customers and therefore should be capable of supply the power to electrically heat the properties if required.

73. However, the wider network may not be able to service the additional load generated by wholesale electrification of a high-rise building and would need to be reinforced upon notification from the council/building owner/building operator of their intention to install electric heating. Under the principles of DCP205 we would also fund this wider reinforcement work and recover the cost via DUoS charges. (We will be liaising with the building operators as we plan the work so will make sure that we are not going back to reinforce the rising mains after we have just replaced them.)