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Heating our homes – CREDS Response to ESNZ Select Committee Inquiry

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Introduction

This is the written evidence from the Centre for Research into Energy Demand Solutions (CREDS) to the Committee's inquiry into 'Heating our Homes'.

CREDS was established in 2018 as UK Research and Innovation's hub investment in energy demand research. Over the last 5 years, we have established a large [evidence base](#), now structured it to provide easy access to non-academic stakeholders.

In this document we address the questions raised by the Committee to which our research is relevant. Inevitably this involves some loss of detail and nuance on complex issues. We would be happy to supplement this with oral evidence.

1. What policy changes are needed to deliver energy efficient homes across the UK?

There is strong evidence on the effectiveness of energy efficiency policy in the UK and globally. Since 1990, energy efficiency improvement has been the largest contributor to UK carbon emissions reductions (Lees and Eyre, 2021). Improvements in homes have contributed a very large part of this, notably through the installation of condensing boilers (Elwell et al, 2015) and low cost insulation measures (Hamilton et al, 2014).

The majority of the progress was made in the decade 2003 to 2012 (Mallaburn and Eyre, 2014), in which there was strong policy intervention. Since 2013, the rate of improvement has slowed substantially (Rosenow and Eyre, 2013). If UK home energy efficiency programmes had been maintained at 2012 levels, home energy bills and the incidence of fuel poverty would now be much lower.

As a result, some UK homes are still too cold, too hot or too damp. In planning for net-zero, emphasis needs to be on improving our housing stock and reducing its energy bills. Substantial potential for improvement remains, much of which is cost effective, especially at current retail prices. The potential is estimated to be about 50% using available technology (Barrett et al, 2022; Rosenow et al, 2018). Over time the main potential has shifted from insulation improvement to heating system change.

UK residential space heating demand is ~300 TWh/year, almost as much as electricity demand across all sectors and end uses. Switching away from fossil fuels for heating therefore has huge implications for the whole energy system, and therefore a UK strategy is needed.

In the context of net zero goals, attention needs to shift to supporting technologies that do not use fossil fuels and to regulating those technologies to be more efficient. By 2050, heat in buildings will need to be decarbonised. The three major potential routes are hydrogen, individual heat pumps and district heat. All are technically possible, although 'high hydrogen' systems are implausible, due to their poorer energy efficiency, lower cost-effectiveness and the higher value of hydrogen in other applications.

We expect heat pumps, in individual dwellings and on heat networks, to be the dominant technology in home heating. This will make a major contribution to improving energy efficiency, as well as reducing carbon emissions. Getting heat pumps to work even more efficiently is also a huge opportunity - improving their efficiency, particularly during cold weather, could save as much energy as insulating all solid walls (Lowe and Oreszczyn, 2020).

Government target deployment rates for heat pumps of 600,000 per annum by 2028 will not be achieved without major policy interventions.

Successful policy approaches are well understood. Packages of policies are most likely to be successful, combining regulation, financial support where needed, energy advice, and support for skills and training.

We conclude that the policy package needed should include early action on fuel poverty, for example through:

- a major programme of evidence-based public information and advice,
- measures to reduce energy demand in public buildings,
- a boost to projects supporting basic housing fitness and low-cost energy efficiency,
- funding for local authorities, charities etc. already working to address fuel poverty;

and a longer-term policy package to drive investment, innovation and engagement, including:

- a detailed framework and targets for heat decarbonisation and demand reduction,
- early adoption of net zero requirements for new housing,
- a major increase in skills investment in building energy efficiency,
- support for local area planning and 'one-stop shop' advice services,
- better data on individual building improvements, e.g. via building renovation passports,
- a long-term commitment to minimum energy standards for existing homes,
- increases in the energy supplier energy saving obligations (ECO),
- a reduction in the electricity/gas price ratio through rebalancing of policy costs and electricity wholesale market reform,
- capital support for heat pumps, e.g. through the proposed "Clean Heat Market Mechanism",
- reform of building performance metrics and Energy Performance Certificates (EPCs) to be consistent with the goals of decarbonisation,
- a review of the way retail energy markets are regulated to encourage business models that promote energy saving.

2. What are the key factors contributing to the under-delivery of the UK's government-backed retrofit schemes?

The failure of the Green Deal has been analysed in the academic literature (Rosenow and Eyre, 2016) and by the National Audit Office (NAO, 2016). They identify the importance of the decision to focus new energy supplier obligations (ECO) on high cost measures and to replace public expenditure funded fuel poverty programmes. This involved ending the previous supplier obligations (CERT) that had effectively supported a wide range of customers to install low cost energy efficiency improvements. It was hoped that the loan-based approach of the Green Deal could then support energy efficiency in 'able to pay' households. However, the 'Golden Rule' of the Green Deal ensured it only supported low cost measures, for which most households do not wish to take a loan, and prevented use of loans for higher cost measures.

There was never any evidence to justify this change. Expert advice and government officials' projections both pointed to a major reduction in energy efficiency activity, which then

happened and that has persisted. The failure of the Green Deal was not 'under-delivery' in the usual sense, but rather a deliberate policy choice.

The Green Homes Grant Voucher Scheme has also been analysed by the National Audit Office (NAO, 2021). It was the consumer facing part of the Green Homes Grant package and was unsuccessful for rather different reasons. The driver was macroeconomic – to boost the UK economy after the Covid pandemic. The potential for infrastructure investment to support economic recovery is well-established. However, the assumption that home energy efficiency programmes could be rapidly introduced and scaled up neglected evidence to the contrary. Scheme design was done within a few months, despite advice that this was too rapid to address the relevant issues. Scheme management was provided by a US-based company who agreed to very tight timescales, but failed to deliver effectively. Most importantly, the aim of scaling up relied on the insulation sector ramping up activity within weeks, after a prolonged reduction in activity, and with no guarantee of a long term approach. The main similarity with the Green Deal is that advice from experts within and outside government was rejected.

3. Which standards and assessment frameworks are needed to deliver a reliable, skilled workforce capable of transitioning UK homes to modern heating solutions?

The energy transition has profound implications for the types and skills of jobs in construction. Across the sector, improving skills will require higher levels of accreditation and professionalisation. The largest changes are needed in the part of the sector focussing on repair, maintenance and improvement (RMI) of homes, which is dominated by small, local SMEs. It currently operates in a low-skills equilibrium which makes it difficult to retrofit to the depth and quality needed (Killip et al, 2021).

Policy needs ultimately to deliver a cultural shift in construction to value low carbon and energy efficient performance (Fawcett and Topouzi, 2019), enabling high-quality retrofit to become a normal activity, sought by customers, delivered by competent installers, and supported by supply chains, trade bodies, and other stakeholders, creating significant numbers of new jobs. Delivering this will require the broader policy package set out above to increase demand for retrofit, as well as

- early place-based demonstrator projects to develop the market,
- minimum standards for retrofit which improve over time,
- higher occupational standards,
- a 'licence to trade' for companies in the construction sector,
- Building Regulations on a regular cycle of revisions and tightened over time,
- Local Authority Building Control to be better resourced, and
- strategic use of public sector investment to pump-prime market change.

4. How might the Government support innovation in delivering local solutions?

National frameworks of regulation, incentives, information, skills and training are essential, but the demand, delivery and day-to-day regulation of buildings and their retrofit are local, and therefore local governance arrangements will be needed.

Most local authorities have declared a climate emergency and set targets for their own operation and/or their Council area. However, there is huge heterogeneity within the sector. In

many cases, there is a genuine intention to do much more, but many ambitious targets are not supported by coherent plans. Local authorities already have some relevant powers, notably in strategic planning, development control, social housing, building control and trading standards, and generally have a good understanding of local public opinion and ‘what works’ locally, making them essential stakeholders in efficient and decarbonised heating (Tingey and Webb, 2020).

In some cases, local authorities are already leading local initiatives (Tingey et al, 2021), but generally without a joined up approach (Smith et al, 2021), due to the lack of clarity about local authorities’ duties, powers and roles. Policy changes and funding increases will be needed if local authorities are to contribute more systematically. In the medium-term, a comprehensive framework of local area energy planning is required (see response to question 8). In the short-term, the goal should be to promote innovation in those authorities where the capacity and interest already exists, but also to develop that capacity in others.

Most existing innovation projects, as well as mainstream decarbonisation funding, rely on competitive funding. Some local authorities are well-equipped to seek this type of funding, but many are not. More non-competitive funding, linked to greater clarity on powers and duties, is needed, if local action is to extend beyond ‘the usual suspects’.

5. What role should customer choice play in the future planning of energy networks for home heating?

Consumer choice with respect to heating is limited by network infrastructures, which are natural monopolies. Networks have high capital costs, which are ultimately paid for by consumers, and therefore full national coverage by all infrastructures is not in their interests. Nor does it currently exist, as 99% of UK households do not have the option of district heating, and most rural households do not have the option of mains gas.

Most households with access to mains gas use it for heating. This is because it has been the most economic option for the last 50 years, and the heating installation industry has developed accordingly. In practice, most heating investments are distress purchases, and households are highly reliant on what installers advise and can easily provide.

We expect most households and their installers will continue to choose the most economic option. The available options will change, because fossil-carbon based systems become environmentally unacceptable, and the economics are also likely to change, as carbon-free technologies become more economic and policy uses economic instruments to affect consumer choice.

The constraints on consumer choice emphasise the importance of citizen engagement through democratic institutions. In this case, that points to local area energy planning (see response to question 8).

6. Does the current state of consumer protections for low-carbon home technologies represent a barrier to uptake of these products?

No response.

7. How will the public be able to afford the switch to decarbonised heating?

There are two issues here – capital costs and running costs.

Running costs depend on the relative prices of gas and electricity. Under the current price cap, electricity (at 30p/kWh) is 3.7 times as expensive as gas (at 8p/kWh). But a typical heat pump has an efficiency more than 3 times higher than a gas boiler, so operational costs are similar. As electricity generation costs fall and begin to decouple from gas, we expect the efficiency differential to more than offset than price differential.

Capital costs are a greater concern. Whilst upscaling of heat pump installations is expected to reduce costs, they will exceed boiler costs for the foreseeable future. This is why policy support on installation costs, via the existing Boiler Upgrade Scheme and the proposed Clean Heat Market Mechanism, is critical.

8. How will decarbonisation plans be drawn up in each area?

We argue above that a national strategy is needed, but this will involve local variation in delivery, both in approach and timing. The investments needed in electricity networks will be large and location dependent; district heating will be economic in some areas, but not others; some gas networks may be converted to hydrogen or biogas, but most will probably need to be decommissioned. A high granularity of decision-making is needed.

Most importantly, if the net zero transition is to have public support, local democratic input is needed. This implies a clear process for Local Area Energy Planning. It seems unlikely that this can be achieved within existing institutional structures or without additional powers and capacity in local government.

9. Do the current EPC frameworks help consumers make informed decisions on transition?

Existing EPCs are based on the SAP methodology, using estimates of energy use based on home area and building heat permeability (heat transfer coefficient, HTC). Approximations used by EPC assessors do not always provide a good estimate of actual energy use (Few et al, 2023), and therefore it is inadequate for future purposes.

Colleagues within the CREDS consortium have developed methods to calculate the HTC from measurements of temperature, other building data and smart meter data (Crawley et al, 2020). This could significantly improve the accuracy of EPCs, allow characterization of buildings' real performance and prediction of the energy, cost and comfort implications of building and heating system retrofit. This work has been shared with DESNZ.

The EPC metric is also problematic in using estimates of energy costs (based on dated prices), rather than energy use or carbon emissions. The result is that EPCs never recommend the installation of heat pumps, despite their importance for delivery of home decarbonisation. A different metric is needed for home energy performance.

10. Do standards need to differ for different types of housing?

Yes. New build standards can be tighter than those for retrofitting old buildings.

11. What is the role of different levels of government in developing, funding and implementing schemes?

Based on the evidence provided in the response to question 8, national governments (UK and devolved) have a key overarching role for funding and strategy, but policy also needs a stronger local focus with a better defined role for local government.

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