Written evidence from the BRE Group

About BRE

BRE (Building Research Establishment) is here to contribute to a thriving and sustainable world, by developing science-led solutions to built environment challenges. We have played a vital role in supporting the development of the built environment for one hundred years; this includes a rigorous programme of testing products for safety and performance which contributes to the formulation of building regulations, measuring and reporting on issues including energy efficiency, and operating assessment frameworks for the sustainability of buildings.

The UK has a proud track record at the forefront of research and development in the built environment sector which is exported globally. BRE has been working with developers and owners for many years to reduce the environmental impact of construction processes, materials and operations, as well as providing information and advice on all aspects of the sustainability of buildings throughout their lifecycle.

As we mark our centenary this year, BRE stands ready to work more closely with all interested parties, including this important Committee, to fulfil the nation's future requirements across buildings, infrastructure and construction, at a time when sustainability, quality and safety have never been more important. When Covid restrictions allow, we would like to invite the Committee to visit our campus outside Watford, including our Innovation Park which hosts several buildings constructed to demonstrate sustainable technologies and principles.

Summary of Key Points

BRE welcomes the increased focus from all levels of Government on the importance of maximising the built environment's contribution to sustainability. In our submission, we have identified the following key measures and policy interventions required by the Government, or where Government can best support industry, to help deliver this:

- The fostering of a planning and development system, at a national and local level, which puts an emphasis on embedding sustainable and low carbon approaches in all future construction and retrofit through all possible levers including building regulations, procurement requirements and planning guidance.
- Support and require zero/low carbon materials, technologies and processes in the construction of new buildings and the retrofit of existing buildings, particularly on embodied carbon. Some of the standards which could be used to specify low/zero carbon construction and retrofit already exist and are recognised internationally; UK government recognition and guidance on their application could help make their use more widespread.
- An explicit commitment at a Ministerial and Departmental level to ensuring that a whole life approach to carbon is embedded across all relevant Government policies.
- Considering how to incentivise investors and developers to prioritise the environmental impact of their developments.

BRE can support the Government to ensure that we both deliver new buildings which contribute to a sustainable built environment and ensure the decarbonisation of existing buildings.

Introduction

Buildings are the second largest source of greenhouse gas emissions in the UK (Energy White Paper, BEIS, 2020) and must therefore play a significant part in supporting carbon reduction and energy transition. We support the Government's commitment to net zero by 2050 and we stand ready to support these efforts.

This inquiry comes at an important juncture as we consider how to "build back better" from the pandemic and adapt our homes and workplaces to changes accelerated by this most unusual year. When this is combined with the important lessons about safety, processes and accountability to be learned after the Grenfell Tower fire, and advances in technology and modern methods of construction, it is clear that the coming years will see major changes in almost all aspects of the built environment. The forthcoming COP26 summit, and the Government's recent announcement of an interim target of a 78 per cent carbon reduction by 2035 have further sharpened focus on the net zero imperative.

Our full response to the questions set out by the Select Committee are detailed below but we also set out some background on the work BRE does to deliver sustainability in the built environment.

BRE was established by Government a century ago as the expert organisation on improving the building stock. BRE's ambition is to be the world's leading innovation, science and data hub for the built environment.

The pace of improvement to buildings that we need today - changing the way we construct and refurbish our buildings to cut carbon - is unprecedented. To achieve that pace of change Government needs to employ the full range of policy levers:

- Regulation (through building regulations, planning and minimum energy efficiency standards).
- Setting standards across all elements of the built environment – we have set out further thinking on this below.
- Grants, subsidies and other incentives to bring down the costs of new technologies and to support low-income homeowners.
- Fiscal reforms, for example to the balance of costs and levies on electricity and gas bills, to speed heat pump adoption.
- Support for innovation and roll out of new technologies – including modern methods of construction (see below).
- Advice, engagement and training programmes for homeowners, the property industry and the construction and refurbishment supply chain.

An area of particular importance to BRE is standard setting. Effective standards underpin low carbon regulations set at national or local level. They also provide a clear language for the property industry, home buyers and developers to go further than minimum regulatory standards in actively choosing low carbon buildings. Effective standards frameworks consider more than just carbon to reassure industry and consumers that every aspect of a project has been considered carefully, including the energy system installed, the life cycle of the materials used and the safety of the finished building.

BRE has extensive experience of developing schemes of this kind, including BREEAM, the world's leading sustainability assessment method for projects and buildings, which has registered over 2 million non-domestic buildings in nearly ninety countries, and CEEQUAL, the leading global assessment and rating method for sustainability in civil engineering, infrastructure, landscaping, and public realm projects. To date, it has been used to assess over £54bn worth of infrastructure assets. Home Quality Mark provides similar assurance for new homes.

Meeting net zero and beyond

As the UK works towards net zero in 2050, the industry increasingly recognises that the built environment must make a significant and ongoing contribution to reducing the country's carbon footprint.

There must be the explicit adoption of a whole-life approach to reducing carbon and all tiers of government – including Westminster, the devolved administrations and local authorities – must commit to promoting it and advancing it through their efforts.

Driving the development of more high quality, truly sustainable new homes and buildings will also encourage greater improvements in our existing housing stock, potentially using similar mechanisms, financial drivers and frameworks.

Building for the future

A key area of innovation for low carbon buildings where BRE has extensive expertise is modern methods of construction (MMC). MMC offers new ways of building sustainably, productively and efficiently. The well-rehearsed benefits of modular construction across the supply chain cover a range of issues from faster construction, to more consistent high quality, reduced waste and a more environmentally friendly building process. The Construction Innovation Hub, in which BRE is a partner, is exploring how to apply these techniques to public sector buildings like hospitals and schools.

With greater assurance about the quality and longevity, as well as safety and security, of living in MMC properties, consumers could potentially be persuaded to adopt them in enough volume to make greater investment in it commercially viable. Working with stakeholders across the construction and manufacturing sectors, as well as in the finance and insurance industries, BRE is developing a standard which would provide assurance about the quality and safety of MMC dwellings. Government support of standards like BRE's, as well as a concerted programme to shift consumer views, could make a significant impact on uptake of MMC.

Detailed responses to questions

Question 1. To what extent have the Climate Change Committee's recommendations on decarbonising the structural fabric of new homes been met?

We believe, based on the available evidence, that it is a reasonable assumption that it is unlikely that these targets will be met. One reason may be that the Future Homes Standard is due to come into force from 2025, and developers are waiting for the details to be finalised before making major changes to the structural fabric of new homes.

Another reason is likely to be that this is not being widely measured. Structural fabric should be included within a whole life embodied carbon assessment to the standard EN15978, which could be more widely used. This holistic assessment ensures that perverse outcomes are avoided, for example when a structural option has low initial impacts but results in other parts of the building having much higher whole life impacts.

Question 2. How can materials be employed to reduce the carbon impact of new buildings, including efficient heating and cooling, and which materials are most effective at reducing embodied carbon?

The current carbon impact of buildings is primarily in operational use – i.e. from the energy used in heating and powering the building through its life. However, as buildings become more energy efficient and switch to using low carbon heating systems, the relative importance of the carbon associated with construction/retrofit process and materials increases.

BRE has been working with developers and owners for many years to reduce the environmental impact of construction processes, materials and operations, as well as providing information and advice on all aspects of the sustainability of buildings throughout their lifecycle.

Materials, and their use, need to be considered at every stage of the life cycle of a building. Buildings are complex systems which need to have a number of criteria taken into account when assessing their carbon impact. It is essential to assess the performance of the whole building over its life, rather than selecting certain materials in isolation to focus solely on operational performance. For example, measures that could be taken to reduce embodied carbon include:

- Selecting materials that are low/zero carbon at the design phase and then ensuring these are the materials which are installed, as well as considering the end of life of products (i.e. if a product requires high levels of maintenance, early replacement, or cannot be recycled at the end of its life, then its overall impact on the environment may be greater);
- Reducing the quantity of materials used during construction;
- Reusing structures/materials instead of drawing on new/virgin sources;
- Exploring the use of biomaterials which can sequester carbon;
- Designing for disassembly and reuse to reduce future consumption of virgin sources;
- Ensure that the design meets current and future needs of the building occupiers to minimise future retrofit – for example, accessibility needs for young families and older people can be quite similar.

Embodied carbon

It is important to be aware that the use of the material in a specific building and its other technical characteristics dictate how effectively carbon can be reduced. A whole life carbon approach must be taken in order to avoid displacing the carbon impact rather than reducing it. For example, biogenic materials such as timber are often carbon negative; however, if they require large amounts of glues and/or steel framing then a low carbon masonry product may reduce carbon consumption more overall (see further discussion under Q3).

Carbon should not be assessed in isolation. Building level Life Cycle Assessments follow the EN15978 standard, and look at 25 other environmental indicators at the building level, including ozone depletion, resource depletion and hazardous waste. These can be combined to a single score. Design teams assess options based on their environmental benefit alongside the various other technical characteristics.

In many parts of Europe, such as France, Netherlands, Sweden, Denmark and Finland, construction materials now need to disclose their embodied carbon performance (alongside 25 other environmental indicators) in an environmental product declaration (EPD) completed to the international construction Life Cycle Assessment standard EN15804. We suggest that the UK Government should consider making these assessments mandatory through, for example, requiring them in planning applications. The Planning Bill, proposed in the recent Queen's Speech, is the obvious opportunity to enshrine this through legislation and would encourage the devolved administrations to pursue a similar course.

Reducing operational energy use in buildings

When it comes to the ongoing heating and cooling energy demand of a building, materials are also key. Insulation is an ongoing and vital part of the solution, since reducing heat demand is the most effective way of decarbonising heat and makes each of the heating solutions above easier. Large scale improvements in insulation and wider energy efficiency are a key part of delivering a cost-effective heat transition whatever heating technology is used.

Heat loss can also be reduced through good building design, taking advantage of improved thermal mass (e.g. using thick walls which can retain heat) and other passive factors in order to reduce operational energy demand.

Question 3. What role can nature-based materials can play in achieving the Government's net zero ambition?

Natural materials, such as timber, can have an important role to play in the wider ecosystem of delivering the Government's net-zero ambitions. The contribution biomaterials like timber make to reducing atmospheric carbon depends on the same number of, or more, trees or crops being planted after felling.

All materials have carbon impacts from cradle to grave: in extraction, transport, manufacturing, assembly, in-use and at end-of-life. Nature-based materials can have low impacts at raw material extraction stage, but this must be assessed alongside the other stages of the products life cycle. A bio-based paint might have very small manufacturing impacts but if its life span is shorter than an oil-based product the latter may be the more sustainable choice.

Requiring full disclosure of the impact of construction products through EPDs would make it easier to conduct an assessment at building level of their suitability for each design. EPDs have been the industry standard in quantifying environmental impacts for over 10 years and are completed following an internationally recognised methodology specific for construction products – EN15804, which was published by the CEN Technical Committee for the sustainability of construction works (CEN TC350) in 2012. EPDs are generated based on data obtained through Life Cycle Assessments (LCA). An LCA is performed using a peer reviewed Product Category Rules document (PCR) in line with EN15804, ISO14025, and other related international standards. BRE has been completing Life Cycle Assessments on construction products for over 20 years. To date there are over 15,000 products in Europe which have declared their embodied carbon in kgCO2e alongside a range of other environmental indicators in an EPD.

In Europe discussions are already underway to incorporate EPDs within the Construction Product Regulations. They are currently mandated in France, where the government has driven an initiative to create a consistent approach to measure the LCA of a whole building/asset. They are also used for government procurement in many countries.

Alongside EPDs, responsible sourcing has an important role to play. Standards to monitor this include FSC or PEFC for timber products or BES6001 for all other products.

Alongside sustainability, safety has to be given the utmost priority. All construction materials must be used within the parameters of a robust, sustainable and safe framework. We have argued elsewhere that the future building safety regime currently in development should include mandatory independent certification for building materials, products, and systems before they are able to be used in the construction of a building, and that this information should be accessible through a resource like BRE's Red Book alongside the environmental performance data through resources such as BRE Green Book. This would ensure that there is consistency in the reporting performance of the materials, products and systems when used in buildings.

Question 4. What role can the planning system, permitted development and building regulations play in delivering a sustainable built environment? How can these policies incentivise developers to use low carbon materials and sustainable design?

In our response to the Housing, Communities and Local Government Committee inquiry into the future of the planning system in England, we set out our thinking on how the planning and development system should be used to maximise and incentivise sustainability. We identified the following priorities:

- **Meeting net zero**: Making the link between building homes and meeting the UK's net zero target more explicit would ensure that all future design and construction and retrofit considers the need to eliminate net carbon emissions throughout the life cycle of a home.
- **Building for the future**: The planning system must consider the imperative to plan for resilience in our homes, both to external threats like climate change and flooding, and to evolving demographic and social issues like ageing, disability, mental health and the natural environment. An important part of delivering the volume of homes needed will be ensuring consumer confidence in modern methods of construction.
- **Building safely as well as sustainably**: Standards for safety must be built in alongside design and beauty, to ensure that all consumers can trust in the comfort and quality of their homes. We cannot compromise on issues like fire safety.

Streamlining the planning system could contribute to building significant numbers of additional and much needed homes, especially if more sustainable developments are eligible to be fast tracked. However, streamlining must not lead to lower standards when it comes to building safety and adherence to building regulations, or improving the performance of homes on issues like energy efficiency, carbon reduction, daylighting or noise prevention. We also suggest that this should be made explicit in future planning guidance to ensure that all those involved in the planning system, from architects to planners to builders, are clear that standards around issues like fire safety, noise reduction and wind mitigation remain.

Future Homes and Buildings Standards

The shift to low and zero carbon buildings requires government departments to work together closely, given that energy policy sits in BEIS while building regulations are the responsibility of MHCLG. For new buildings, the UK Government is planning, in England, for a Future Homes Standard and a Future (non-domestic) Building Standard to take effect from 2025. Similar policies and timelines are planned in other nations of the UK. To prepare for the Future Homes/Building Standards, the Government has announced interim changes to the energy standards of building regulations to take effect in 2021/22. This interim uplift will cut carbon emissions from new homes by 31% and from new non-domestic buildings by 22-27%.

Nonetheless the Future Homes Standard must not be the end of the road in terms of the contribution building regulations can make to decarbonising new homes. Building regulations should – beyond 2025 - address embodied carbon, modern methods of construction and control of energy in the home, as well as allowing for future innovation. The scope of building regulations is set in primary legislation and legislative change is likely to be needed to make these further steps possible. It is also vital that parallel policy measures enable local authorities, agencies and investors to require and encourage higher standards.

Assessment frameworks

Using an approach based on holistic assessment frameworks can both help ensure better outcomes for homeowners and residents and contribute to simplifying and shortening a local plan. By specifying that a building or development should reach a particular rating, local authorities can have confidence that all the assessment criteria will be considered, from energy efficiency to placemaking. BRE has extensive experience of designing assessment frameworks that not only ensure that priorities like energy efficiency and comfort are considered at the design stage, but, through the certification process, and provide assurance that these have been delivered in the completed building. In the finished developments outcomes include lower energy and water use, better integration with transport links, improved sound and thermal insulation, improved biodiversity and less waste from the construction process. We would be happy to share further information if the Committee would find that useful.

Incentives for building owners

There are a range of fiscal incentives for building owners to invest in building and renovating buildings to a higher environmental standard (e.g. ECO, the social housing decarbonisation fund, the Green Homes Grant Local Authority Delivery scheme) although there remains a gap for domestic owner occupiers. The Treasury Net Zero Review due for publication this year may well explore these issues. We suggest as a minimum that government consider how property taxes like stamp duty, council tax and business rates could reward those who invest in making their buildings net zero ready, making significant performance improvements. Government could also consider other measures similar to the VAT reduction on structural renovations to properties which have been empty for at least two years to encourage the re-use of existing buildings.

Standards in conversions

Government planning policy is to allow a substantial and growing number of conversions from non-domestic to domestic buildings – as the internet (and now Covid) change the way we work, shop and live. This is in many ways welcome from a carbon point of view as conserving the embodied carbon in these buildings may be better than demolition and new build. However, it is important to note that:

1) Non-domestic buildings that are converted to residential do not have to meet the same standards as new homes built from scratch. Instead, they have to meet the energy and carbon standards set in Part L of the Building Regulations covering works to elements in existing dwellings. That means they need to meet minimum performance standards for new heating systems and insulation etc, but do not have to meet an overall carbon and primary energy target for the whole dwelling.
2) Where non-domestic buildings are converted to residential use under permitted development rights, local authorities will be unable to apply higher energy performance standards beyond building regulations which are set in planning requirements, and which are applied to new homes built from scratch.
3) Poor quality conversions can have negative effects on the health and wellbeing of their occupants, and may also fall into disrepair quickly, therefore needing further renovation work or ultimately demolition.

The Planning Bill, proposed in the Queen's Speech, is as we stated previously an opportunity to embed these requirements into the system.

Question 5. What methods account for embodied carbon in buildings and how can this be consistently applied across the sector?

Buildings are the second largest source of greenhouse gas emissions in the UK (Energy White Paper, BEIS, 2020). Considering the potential for carbon reduction in construction and retrofit industry, we can distinguish between:

(a) **operational carbon emissions:** the potential for construction and retrofit to deliver buildings which, as they are used for residential or business purposes, have low or net zero carbon emissions
(b) the potential to reduce carbon emissions associated with the materials and processes used in construction and renovation. These process emissions are referred to as the **embodied carbon** of buildings.

For individual buildings, changes to materials and processes are claimed to have delivered savings of up to 30% on embodied carbon.[1] Several organisations, including BRE, have developed guidance to calculate and reduce carbon emissions from new build construction and (more rarely) renovation. There have been calls for these sort of tools and standards to be integrated into regulation, with embodied carbon included as part of the calculation of compliance with building regulations (energy and carbon standards for building regulations currently focus only on operational energy/carbon).

The method currently being widely adopted internationally (including in France, Sweden, Holland, Finland and Denmark) and locally (within BREEAM and Greater London Authority) is building level LCA completed to internationally recognised standard EN15978. There are numerous software tools compliant with this standard and applied by design teams on thousands of building projects globally.

In BREEAM over 500 LCAs have been completed to EN15978, and we have created benchmarks for the environmental impact of a number of building types. BREEAM requires LCA tools to meet certain criteria in terms of outputs and data quality which is certified for compliance. This ensures a consistent application of LCA so that projects can be benchmarked and compared. Further guidelines such as BRE's IMPACT specification[2], RICS's Professional Statement on Whole life Carbon and LETI's Embodied Carbon Primer provide guidance to consultants with best practice modelling approaches and LCA analysis.

BRE suggests that local and national government in the UK should consider how best to incentivise building level LCAs and material EPDs, and make them standard practice throughout the sector, for example by incorporating them within building regulations like Part L. The creation of an industry materials database to provide a central store of EPDs is also key – this would support the modelling of whole buildings.

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[1] Embodied Carbon in Construction Calculator hopes to tackle emissions (dezeen.com)
[2] BRE's IMPACT allows construction professionals to measure the embodied carbon, life cycle environmental (LCA) and life cycle cost (LCC) performance of buildings.

Question 6. Should the embodied carbon impact of alternative building materials take into account the carbon cost of manufacture and delivery to site, enabling customers to assess the relative impact of imported versus domestically sourced materials?

Yes. The carbon impact must be assessed following international standards EN15804 to ensure quality and comparability – and that includes the carbon cost of manufacture and delivery. The materials should not be assessed in isolation but combined in a building level LCA to ensure their influence on other building characteristics (such as structural integrity, fabric efficiency, durability) is taken into account.

Certain materials such as aggregates can have very significant carbon impacts attributed to transport. For example, recycled aggregate sourced more than 50km away from the site may have higher carbon impacts than local aggregate sourced no more than 10km from the site. For other materials it is not so significant.

Question 7. How well is green infrastructure being incorporated into building design and developments to achieve climate resilience and other benefits?

Green infrastructure (GI) is often considered at the master planning stage for community developments. Also known as nature-based solutions, it can include green roofs, green walls, sustainable drainage systems, urban parks and green spaces and street trees. These elements are utilised to provide benefits such as climate change mitigation and adaptation, socio-economic improvements, increased health and wellbeing, and biodiversity enhancements.

Larger projects tend to have the opportunity to provide a wider range of green infrastructure features; communal heating systems or sustainable drainage systems are perhaps the more commonly deployed systems. Green roofs and the novel use of limited space on top of buildings have often led to enhanced biodiversity and social benefits for the users of the buildings.

However, only a small number of developments currently incorporate green infrastructure successfully. One challenge is that the correct maintenance procedures are not always followed once the GI has been installed, meaning that it does not survive or is ineffective. BREEAM has non-mandatory requirements for measuring and supporting GI and goes one step further to ensure that anything specified is properly managed and maintained once handover has occurred, in line with best practice guidance.

As referenced in our answer to Question 4, the planning system could do more to provide guidance and support for existing assurance frameworks which ensure that individual developments benefit from a larger scale use and adoption of green infrastructure. Adoption this far has been led by organisations wanting to go well beyond minimum requirements to demonstrate the highest sustainable outcomes; this approach needs to become more mainstream and Government has the means to enable this transition.

Question 8. How should we take into account the use of materials to minimise carbon footprint, such as use of water harvesting from the roof, grey water circulation, porous surfaces for hardstanding, energy generation systems such as solar panels?

This is a complex question to answer as, currently, the diverse technologies you refer to in the question are treated differently and at different points in the regulatory framework, and there are different levels of data available on different ones. We give a couple of examples below.

For new buildings, the use of solar photovoltaic (PV) panels will be taken into account in the assessment of carbon and energy performance required under part L of the building regulations. For existing buildings, the solar panels will be assessed as part of the calculation to produce an energy performance certificate (EPC) rating for the building and the EPC rating is used in, for example Minimum Energy Efficiency Standards for rented homes.

Meanwhile, requirements for porous surfaces for hardstanding are set under a completely different regulatory regime: the requirements for Sustainable Drainage Systems (SuDS) set by the Local Planning Authority.

However, both of these measures have manufacturing impacts that are currently rarely taken into account: PV can be very intensive to manufacture as can different SuDS solutions, which may incorporate elements

like permeable paving concrete tanks. The benefits of their use should always be weighed up against their manufacturing and maintenance impacts, using an LCA to ensure the best outcome is realised.

The point is not that everything that affects the carbon impact of a home should be assessed under a single regulatory framework. However, government should be working to encourage the development and adoption of a whole life carbon approach, and of standards that go beyond the regulatory minimum to promote an over-arching view of environmental performance of buildings, as we set out in Question 4. These can be used by property industry, developers and consumers.

As mentioned earlier, government should also consider how to reward rather than penalise the use of these technologies in the business rates and council system.

Question 9. How should re-use and refurbishment of buildings be balanced with new developments?

Refurbishment is an essential part of the mix – most of the buildings that will exist in 2050 have already been built. Greater awareness of embodied carbon in already existing buildings could potentially lead to a presumption to refurbish where it is economic, environmentally beneficial and appropriate to do so. When it comes to housing, the social and health impacts of older buildings must also be considered.

Question 10. What can the Government do to incentivise more repair, maintenance and retrofit of existing buildings?

Only a holistic approach which emphasises sustainability across existing and new builds will help deliver net zero. This needs to be embedded throughout the planning and tax systems, at local and national government levels, and throughout building regulations. We hope that the forthcoming Heat and Buildings Strategy will set out dynamic policy proposals to support the wider adoption of retrofitting alongside repairs and maintenance.

Regulation

The most direct route would be regulation. The government's proposals are that Minimum Energy Efficiency Standards will – from 2028 – require landlords of private rented homes to spend up to £10,000 with the aim of meeting an Energy Performance Certificate standard of C. Similar regulations are planned for rented non-domestic buildings. This will require retrofit of most private rented buildings in England.

Such an approach could be extended to owner occupier homes: the Scottish Government has proposed that owner occupiers could be required to meet an EPC C standard at point of home sale, or of major renovation. The UK Government indicated in the Energy White Paper that they will explore regulatory measures to improve energy performance for owner occupied homes later this year.

Financial incentives

Alongside creating stable supply and demand for green buildings, getting the funding and financing right is key. This is a responsibility that rests with central government.

There must be adequate financial support to allow householders and property owners to engage in this process. For example, there is currently a tax incentive for building new (0% VAT) while most refurbishment work is charged at the full 20%. This could be equalised, or even rebalanced, to support refurbishment and retrofit. A financial incentive for more energy efficient buildings and green technologies linked to council tax, stamp duty or business rates has also been repeatedly proposed by stakeholders but never taken forward by government.

Fairly significant funding is now available to improve the energy efficiency of homes occupied by low income households. The announcement of an increase in the ECO budget from £640m to £1bn a year (undoing the Coalition Government's cuts to this scheme in 2013) is particularly important. ECO is entirely targeted at low income homes.

However, the big policy gap is around promoting energy efficiency in mainstream (not fuel poor) owner occupier homes. The early closure of the Green Homes Grant voucher programme (repeating the 2014/15 Green Deal policy failure) shows the difficulty of building an effective national support mechanism to target this sector. The GHG's problems were particularly in delivery as the government rapidly set up new systems

to allocate high levels of funding in a short period. We hope that the forthcoming Heat and Buildings Strategy will propose new solutions to this challenge.

The role of local authorities

As we have also set out in our response to the HCLG Select Committee's Inquiry into *Local authorities and net zero*, to overcome these problems in future, government should be giving local authorities the central role in building long term stable demand for retrofit from private households, and establishing quality assured local supply chains. Local authorities should be enabled to engage and advise households on the retrofit opportunity. This then builds a pipeline of retrofit projects for local businesses and around which councils can help to bring in funding and private financing.

Local authorities are best placed to deliver that advice and engagement: they are trusted and know their local areas. They have contact with homeowners and builders and installers at key trigger points for retrofit such as planning and building control.

Ideally such an approach can take account of the different needs, interests and resources of homeowners in the area. While the baseline should be to bring all homes to an EPC "C" by 2030, local authorities should also be able to provide advice and support to homeowners who want to be early adopters in upgrading to highly efficient home. This also builds the capacity of local businesses to do this type of work.

This is a one stop shop model, bringing together supply and demand for retrofit at the local level. It is the model being taken forward in Europe and is similar to the approach in Scotland. To make it possible government needs to develop the skills, training and resources for councils. Technical advice resources to support such an approach could be developed centrally from organisations that have capacity to do this, like BRE.

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