

Energy Systems Catapult: Evidence Submission

Sustainability of the built environment

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The Committee is inviting written submissions on:

- To what extent have the Climate Change Committee's recommendations on decarbonising the structural fabric of new homes been met?
- 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?
- What role can nature-based materials play in achieving the Government's net zero ambition?
- **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?
- What methods account for embodied carbon in buildings and how can this be consistently applied across the sector?
- 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?
- **How well is green infrastructure being incorporated into building design and developments to achieve climate resilience and other benefits?**
- 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?
- How should re-use and refurbishment of buildings be balanced with new developments?
- What can the Government do to incentivise more repair, maintenance and retrofit of existing buildings?

About Energy Systems Catapult

Energy Systems Catapult (ESC) was set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth. The Catapult is an independent, not-for-profit technology and innovation centre that bridges the gap between industry, government, academia and research. We take a whole-system view of the energy sector, helping us to identify and address innovation priorities and market barriers, in order to decarbonise the energy system at the lowest cost.

We welcome the opportunity to comment on the Sustainability of the built environment inquiry.

Summary

Embodied carbon will play a much more significant role in the heat decarbonisation debate as we reap the benefits of grid decarbonisation. Carbon emitted in the manufacture, transport, and construction of building materials and the assessment of whole life carbon is not currently within remit of the Building Regulations and we would urge government to consider how tighter fabric and energy efficiency standards – alongside changes to the planning system – can be used to drive the increased use of alternative construction methods for more sustainable housing in line with net zero.

We would also encourage proposals to help develop policies to minimise the whole life carbon impacts of the UK's buildings, incorporating energy planning into the spatial planning picture, and creating a mix of incentives, standards and obligations to address building decarbonisation.

Improved arrangements for MRV of carbon emissions throughout value chains can also play a key role in driving the use of more sustainable materials in the built environment.

Creating a Framework for Zero Carbon Buildings

Decarbonising heat in the UK will need a coordinated effort across all stakeholders in the UK and will require a long-term, enduring strategy. The next phase of decarbonisation will require thousands of individual interventions coordinated across the country, with Heat Pumps, low carbon heat networks and hydrogen all playing important roles in the heating debate in the forthcoming years. Energy Systems Catapult have laid out a proposed [framework](#) in its '[Six Steps to Zero Carbon Buildings](#),' which aims to create a mix of new planning processes, standards, obligations, subsidies and market incentives that can combine to drive action throughout the supply chain.

It is vital that local government pursues a whole energy systems approach to buildings, industry, power, and transport by following a strategy that gives confidence to innovators and investors towards a clear path to net zero.

Local Area Energy Planning

Buildings are intrinsically local, meaning that local authorities will be key to shaping the next wave of decarbonisation. ESC's extensive work on [Local Area Energy Planning \(LAEP\)](#) provides a data-driven approach to analysing the cost-optimal, low-carbon solutions for a local area and can be a critical enabler of both heat and transport decarbonisation, helping to guide decision-making to transform local energy systems as a whole.

There is considerable scope to build on the proposals set out in both the Future Homes Standard and Planning for the Future White Paper to strengthen the role of local authorities in delivering net zero, while also enabling housing and development needs to be met. LAEP could become a statutory obligation in future, as currently, energy planning and spatial planning are not considered together. A 'fully integrated' view would combine aspects

including waste, green spaces and transport alongside heat in buildings for maximum impact, which could include elements such as permitted development areas.

Training, Skills and Supply Chain

There is a crucial skills gap in specifying and delivering high quality outcomes to decarbonise the UK's homes, which must be addressed as part of wider reforms to the sector and is a consistent problem across the country. The UK requires the development and implementation of a 'whole systems' training programme, along with the necessary tools to train tomorrow's zero carbon professionals. This is true not only for the installation of low carbon technologies, but also requires an understanding of the whole life carbon impact of buildings and materials.

The UK's ambitious Net Zero targets require retraining and upskilling of the current workforce, but also identifying programmes and accreditations for a new generation of tradespeople. Without suitable programmes for assessment, advice, integration and evaluation of low carbon technologies, the UK will continue to fall behind what is needed to drive the net zero building transition. Education should significantly focus on aspects such as the whole life carbon impact of buildings, selecting suitable building materials, and advising consumers on the most appropriate solutions for their homes.

Additionally, the supply chain capacity required is nowhere near the level it needs to be to meet our targets. Government must endeavour to create the conditions to allow markets to make it easier for people to find good quality assessors, advisors, installers, coordinators, and also work to enforce requirements.

Our Position

MHCLG's flagship policy for new homes, The Future Homes Standard focuses entirely on the operational emissions of buildings; however, the embodied carbon of a new build home is estimated at around 50 tCO₂¹. As operational carbon emissions decrease, embodied emissions account for an increasingly larger proportion of the lifetime emissions of a home.

As suggested in our [consultation response](#), consideration should be given as to how lifetime emissions can be taken into account - if not immediately, then certainly in future specifications of the carbon metric design (e.g. from 2025).

New homes should not be built only for future costly retrofit further down the line. The interim changes to Part L of the Building Regulations as a positive step before implementation of the full standard in 2025, but we were disappointed not to see any detail on embodied carbon in this consultation.

As outlined in the proposals, the interim 31% reduction in CO₂ for new builds signals good intention however, new homes built in the UK should now be being designed and constructed with net zero at the forefront of thinking – in order to meet the pressing challenge of building decarbonisation.

Energy planning and spatial planning are not completely integrated currently, and whilst local authorities may have their own house building targets, in order to place the UK on track to meet its ambition of building 300,000 new homes per year, there is concern that net zero objectives may not be given the same importance.

There must be enough ambition on fabric requirements, suitable material assessment and embodied carbon standards – which should all be net zero compliant. We must ensure that standards, both in energy efficiency and in overheating, as determined by the Building Regulations and the planning framework are ambitious enough to put us on the right track to meet the 2050 target and to adapt to rising temperatures over the coming years.

Creating a Framework for Zero Carbon Buildings

ESC's [Six Steps to Zero Carbon Buildings](#) is our thought leadership work on the package of policies required to build an enduring policy framework to drive building decarbonisation in line with net zero. We have identified six key policy levers to develop a mix of new planning processes, standards, obligations, subsidies and market incentives to drive action and restructuring throughout the supply chain, as noted below.

- 1) **Funding a new wave of place-based programmes** – investing strategically in energy improvement, retrofit and skills development could hold the key to building up demand and driving long term market competitiveness for low carbon solutions by region or area. This could involve a mix of public investment, coordinated by local authorities (e.g. from post-Brexit regional 'prosperity' funds)

¹ Citu (2019) What is the carbon footprint of a house? [Online] Available from: <https://citu.co.uk/citu-live/what-is-the-carbon-footprint-of-a-house>

as well as private sector partners and contributions from existing funding programmes

- 2) **Rolling out Local Area Energy Planning (LAEP)** – by using robust data analysis to create integrated local energy plans, decarbonisation can be driven through coordinated investment in energy infrastructure from a whole systems perspective. LAEP is a critical enabler of decarbonisation and is a method for analysing cost-effective, low carbon solutions for a local area and its energy systems.
- 3) **Making energy networks invest to reach Net Zero carbon** – with Ofgem re-engineering its RIIO processes and guidance, ESC have been advising and supporting the regulator with the future development of the RIIO2 price control framework, with LAEP put forward as a possible model to guide strategic investment for electricity distribution networks (DNOs)²
- 4) **Phasing in carbon performance requirements across all buildings** – akin to an MOT required by car owners, minimum standards based on carbon emissions could be phased in to address building carbon performance, perhaps introduced at the point of sale, or when a property changes hands. Over time, markets could open up and competition could help tip the balance for property owners in favour of low carbon technologies.
- 5) **Rewarding low carbon choices through energy bills** – a new carbon credits scheme could reward consumers to reduce their actual carbon emissions through their energy bills. Working alongside Step 4, suppliers could measure actual usage against a carbon performance benchmark which tightens over time. When a property's emissions fall below or above that benchmark, the property owner is then given a respective bill reduction or surcharge.
- 6) **Building markets for new finance products for low carbon solutions** – helping people to afford the upfront cost of low carbon solutions will be key to heat decarbonisation. As well as public grants and funding, government could encourage private markets to develop and offer green mortgage-style services to encourage uptake of low carbon products.

Local Area Energy Planning and Whole Systems Thinking

Cities and Local Authorities are best placed to understand the needs of their respective areas and as such would need to take a strong leadership role in any future planning reforms, crucially this would need to be married up both with development control in the planning system and central government investment in local capacity & capability development.

Currently, energy planning and spatial planning are not integrated. Net Zero objectives and planning objectives may not always correspond, and as policies across local areas differ, different areas may prioritise new house building at the expense of low carbon initiatives – leading to disparities across the UK.

² <https://es.catapult.org.uk/reports/local-area-energy-planning-the-method/>

In the local context, spatial planning may present one of the biggest opportunities for local authorities to deliver net zero, however the National Planning Policy Framework - the method of calculating housing targets and viability rules - may undermine local authorities' ability to require developers to build high quality low-carbon developments in sustainable locations, using sustainable materials.

As part of local plans, local authorities may seek to action policy levers to ensure that initiatives on energy efficiency and low carbon heating are complementary, however many are faced with resourcing and funding issues. There are growing calls to increase local authority powers to enable whole systems approaches to delivering a sustainable built environment, and we would encourage proposals which advocate for such measures.

[Local Area Energy Planning \(LAEP\)](#) as developed by ESC encourages a powerful case for Local Authority powers and resourcing, which would encourage holistic delivery of energy systems where suitable for local areas. There is significant interest in LAEP, with the Association for Decentralised Energy³ and the Committee on Climate Change⁴ citing it as an important factor in the Net Zero transition, and Ofgem expressing interest by recently commissioning methodology guidance on it.⁵

The planning system can influence opportunities for recovering and using elements such as waste heat from industrial installations to be located close to existing or potential users of that heat for example, however without net zero at the forefront of thinking, such opportunities could be missed. LAEP provides a structured approach to analysing the optimal, cost-effective, low-carbon solutions for a local area and its energy systems. Using a data-driven, collaborative process, the planning for cities, regions and towns can be viewed holistically, incorporating aspects such as waste, transport and heat together.

Given the importance of net zero and sustainable development, government may want to consider the case for making Local Area Energy Planning a statutory obligation. Introducing (or mandating) LAEP would recognise the stronger role for Local Authorities, (including Greater Authorities and Combined Authorities) in delivering Net Zero, with such processes playing a key role in informing future planning strategies.

Revised guidance or requirements should be subject to agreement and discussions between MHCLG, BEIS and possibly DfT but could ultimately be the modus operandi for supporting Climate Change and Net Zero ambitions of local authorities. The use of LAEP to identify types of technologies and suitable development sites as directed through national planning policy and guidance would encourage local market and skills development activity through the preparation of Local Authorities' planning policy documents.

Whilst conscious that there may be multiple pressures on local authorities stemming from different sides of the housing debate, ESC supports the growing calls to increase local

³ The Association for Decentralised Energy (2020) [Heat and Energy Efficiency Zoning](#)

⁴ The Committee on Climate Change (2020) [Reducing UK Emissions Progress Report to Parliament](#)

⁵ ESC (2020) [LAEP: The Method](#)

authority powers to enable whole systems thinking and drive the building decarbonisation challenge.

Training, Skills and Supply Chain

As mentioned, local government is likely to have a vital role in developing the skills programmes needed for different areas, particularly around building decarbonisation.

The interim standard proposed in the government's response to the Future Homes Standard can act as an important catalyst for building the necessary skills and supply chain required for net zero, as the UK does not currently have either the quantity or quality of skills required to meet the government's net zero targets.

Our work on the Home Decarbonisation Academy highlights the need for post-installation measurement and feedback after energy efficiency solutions are installed. Whilst this is directly applicable to retrofitting existing buildings, assessment and feedback of measures in new homes should also be monitored once constructed.

This will be particularly true as embodied carbon becomes a more significant proportion of overall carbon emissions as the grid decarbonises. More stringent fabric standards and adoption of innovative technologies such as occupancy-based controls can help provide efficient outcomes for consumers whilst addressing the well documented performance gap, between design and construction.

Working alongside the University of Birmingham, ESC have put forward proposals for a National Centre for the Decarbonisation of Heat (NCDH), which would enable the rapid scale-up of manufacturing, skills and deployment of low carbon heat solutions, and would aim to fuel skills growth and job creation by spearheading promising technologies and business models in the heat and buildings space.⁶

It is important to consider how improvements to fabric standards and lifecycle carbon analysis will affect performance metrics; digital technology can help provide a low-cost way of checking that new buildings and retrofits are delivered to the standards claimed. Currently, many standards around the efficiency of the building are missed because of poor practice; innovative digital technology can help identify where standards have not been met simply, and cost-effectively.

Additionally, supply chain capacity could be accelerated through identifying 'Net Zero Pathfinders' – cities, towns or industrial clusters that are funded and supported to try and reach net zero earlier – which could be an important approach to driving the energy transition. Such projects could provide hubs for ensuring energy and transport systems work together, providing a place for innovative business models and ideas. This could in turn drive the market for local skills and supply chains to develop quickly, and provide an evidential basis for replication across the country.

⁶ <https://www.birmingham.ac.uk/research/energy/national-centre-decarbonisation-of-heat.aspx>

The role of improved arrangements for Monitoring, Reporting and Verification (MRV) of carbon emissions

Improving the sustainability of the built environment – including minimising the whole life carbon impact of new buildings will ultimately require significant improvements in monitoring, reporting and verification of emissions through value chains.

Energy Systems Catapult has recently published a report⁷ examining the case for the creation of an economy-wide 'Carbon Regulator' to oversee monitoring, reporting, and verification (MRV) of greenhouse gas emissions reduction and removal across the economy.

A new regulator to oversee carbon accounting and MRV could play a pivotal role in ensuring:

- Robust empirical and scientific methods for measuring or accurately estimating emissions.
- Emissions reduction actually occurs in line with Carbon Budgets and the Paris Agreement.
- Reductions in, and removals of, emissions are counted and rewarded appropriately by policy support measures and other incentives.

Verifying carbon emissions can be straight forward when measured directly from a factory flue or when proxied through energy use, but challenges arise for sectors such as agriculture and land use where such measurements are not possible. Consumption-based emissions, such as those embodied in imported goods and services yield additional complexity due to the supply chain life cycle analysis required.

Currently, investor confidence is dampened – in part – by uncertain shifts in policy and incoherent practices domestically and internationally in monitoring, reporting, and verification of emissions. A suitably empowered carbon regulator that implements robust, economy-wide practices can improve this, removing barriers to innovation, and ensuring that incentives drive technologies and processes that genuinely reduce emissions across all major emitting sectors – including in the choice of materials for new buildings.

This in turn can provide a robust basis for policy design, standard setting and reporting, and incentive mechanisms to drive investment and operational decisions aligned with Carbon Budgets and Net Zero.

⁷ <https://es.catapult.org.uk/news/the-case-for-a-carbon-regulator/>