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Environmental Audit Committee

Building to net zero: costing carbon in construction

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Environmental Audit Committee

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Summary

The UK built environment is responsible for approximately 25% of total UK greenhouse gas emissions. The UK has a legally binding target to reach net zero by 2050 and at COP26 the Government committed to achieving 68% reductions in carbon emissions by 2030. This is only eight years away. There is little government guidance as to how these targets are to be met by the built environment industry.

This report examines how to improve sustainability of the built environment in the UK. Five broad themes are addressed: 1) accounting methods for embodied and whole-life carbon; 2) the use of low-carbon building materials; 3) government procurement of buildings; 4) issues surrounding retrofit and reuse; and 5) the skills and training required to delivered sustainable construction.

- Firstly, to date, policy has focused entirely on operational emissions, namely how to make buildings more energy efficient. The embodied carbon cost of the construction is not required by current policy to be assessed or controlled, other than on a voluntary basis. As a result, no progress has been made in reducing these emissions within the built environment. The construction industry is willing and able to undertake whole-life carbon assessments to measure the operational and embodied carbon cost of construction. The standards, methodology and reporting framework exists although it needs standardising, and the cost of undertaking assessments can be minimal. Other countries and some UK local authorities are already requiring whole-life carbon assessments to be undertaken. This leaves the UK slipping behind comparator countries in Europe in monitoring and controlling the embodied carbon in construction. If the UK continues to drag its feet on embodied carbon, it will not meet net zero or its carbon budgets.

- Secondly, there is availability of low-carbon building products to meet current demand, however there are insufficient incentives to develop and use these materials. Obstacles remain preventing the uptake of timber products in construction. This includes issues regarding fire risk and insurance, price volatility, securing sustainable and local supply chains, and addressing skills gaps in the use of timber. The Government has made little progress addressing these barriers in the last three years.

- Thirdly, the Government states it is promoting the benefits of re-using and retrofitting buildings ahead of demolition, but we have seen insufficient evidence of this being the case. The expansion of permitted development rights to allow for demolitions was introduced without proper consideration of its potential impact on carbon emissions and is resulting in buildings being demolished without understanding the whole-life carbon impact.

To address these issues, the single most significant policy the Government could introduce is a mandatory requirement to undertake whole-life carbon assessments for buildings. This requirement should be set within building regulations and the planning system. Following introduction of whole-life carbon assessments, the Government should develop progressively ratcheting carbon targets for buildings, to match the

pathway to net zero. A clear timeline for introducing this should be set by the end of 2022. This policy will incentivise greater retrofitting, the development and use of low-carbon materials, and investment in low-carbon construction skills.

Alongside this key recommendation, there are a series of supporting policy changes that can further enhance the sustainability of the built environment. In particular, the Government should urgently undertake a full investigation into the impact extensions to permitted development rights (PDRs) has had on incentives to retrofit existing properties. PDRs should then be reformed to align with the Government commitment to promote reuse and retrofit ahead of demolition, if needs be.

The Government must also develop a coherent, joined-up policy to meet afforestation commitments and the need for commercial plantations to meet the demand for domestic timber in construction. The Government must invest now in further research and safety testing on the use of structural timber.

Ultimately, the carbon emissions associated with construction must be significantly and rapidly reduced if the Government is to meet its net zero goals. Introducing whole-life carbon assessments is a proven and widely supported way to transition to a low-carbon built environment. The Government must set out plans this year to make this a reality.

1 Introduction

1. 25 per cent of the UK's total greenhouse gas emissions are attributable to the built environment.[1] Greenhouse gases are emitted at every stage of the construction and use cycle, from the manufacture of materials through construction and maintenance to eventual demolition. Emissions from the built environment must be reduced if the UK is to meet net zero by 2050. More pressingly, the UK's Sixth Carbon Budget requires carbon emissions to be reduced by 78 per cent by 2035, compared to 1990 levels.[2] At COP26 the UK Government committed the UK to achieving a 68 per cent reduction in the UK's carbon emissions by 2030, compared to 1990 levels.[3] This is only eight years away.

2. There is little government guidance as to how these targets are to be met by the built environment industry. Moreover, to date, policy has focused entirely on operational emissions; emissions resulting from energy consumption in the day-to-day running of a property, like heating. In comparison, emissions from the construction process, maintenance and demolition of buildings, known as embodied emissions, have been ignored. Embodied carbon emissions are not required by current policy to be assessed or controlled, other than on a voluntary basis.[4] These emissions amount to some 40 to 50 million tonnes of CO_2 annually, more than emissions from aviation and shipping combined.[5] We have been struck by the lack of evidence of overall planning for how the built environment will contribute to the net zero target. In this report we examine how best to reduce emissions from the built environment, so that the UK Government can start to meet its pressing and numerous carbon targets in relation to this sector.

3. The Government has set itself the ambition of building 300,000 homes a year by the mid-2020s.[6] Construction of these homes is required to meet housing needs, but will have significant carbon impacts: firstly, in terms of the up-front embodied carbon used to construct buildings, and secondly in how the fabric and energy efficiency of these buildings affects energy use, and how much repair and maintenance is required over the buildings' lifetime. The housing sector is lagging behind other sectors in reducing these carbon emissions; housing emissions were cut by 1 million tonnes CO_2 equivalent from 2018 to 2019 compared with cuts of 8.5 million tonnes from energy supply, 2.2 million from transport and 2.5 million by businesses.[7]

4. Finding the appropriate balance between demolition and new build versus reuse and retrofitting of existing buildings is crucial to a built environment policy which delivers sustainable outcomes. Changes have recently been made to permitted development rights to help stimulate housing delivery by making it easier to demolish or repurpose vacant and redundant buildings and rebuild them as domestic properties. Considerable emissions are

1 UK Green Building Council (UKGBC), Net Zero Whole Life Carbon Roadmap Technical Report (November 2021) p 10. Note: This figure includes buildings and infrastructure and relates to consumption emissions (i.e. the figure includes emissions from imported materials)

2 "UK enshrines new target in law to slash emissions by 78% by 2035", Department for Business, Energy & Industrial Strategy press release, 20 April 2021

3 Department for Business, Energy & Industrial Strategy, The UK's Nationally Determined Contribution under the Paris Agreement (December 2020)

4 UCL, 'Embodied carbon factsheet', accessed 16 September 2021.

5 UK Green Building Council (UKGBC), Net Zero Whole Life Carbon Roadmap Technical Report (November 2021)

6 The Conservative and Unionist Party, The Conservative and Unionist Party Manifesto, 2019; House of Commons Library, Tackling the under-supply of housing, CBP-7671 (4 February 2022)

7 Department for Business, Energy & Industrial Strategy, Final UK greenhouse gas emissions national statistics: 1990 to 2019 (2 February 2021)

involved in demolition and rebuilding of properties, especially when measured under a whole-life carbon approach: under this approach, it becomes more debatable whether the replacement of properties is a sustainable approach to take.

5. In this report we consider the best routes to net zero for the UK's future building needs, from the use of low-carbon materials and retrofitting through to policies to minimise the whole-life carbon (WLC) impact of new buildings.

Background to the inquiry

6. We launched this inquiry in March 2020. Our aim was to examine the Government's progress on sustainable building measures since the Climate Change Committee's 2019 report on *UK Housing Fit for the Future*.[8] During the inquiry, we sought to examine:

- accounting methods for embodied and whole-life carbon in buildings;
- how materials can be employed to reduce the carbon impact of new buildings;
- the role of the planning system, permitted development and building regulations in delivering a sustainable built environment;
- the balance between reuse and retrofit of buildings versus demolition and new build; and
- Government action to incentivise greater sustainable construction, repair, and retrofit.

As local government, planning and housing policy is devolved, this report focuses principally on sustainability in construction policies in England promoted by the UK Government.

8 Committee on Climate Change, UK housing: Fit for the future? (February 2019)

7. We received 156 written submissions and held four public evidence sessions, hearing from 26 witnesses including academics, architects, developers, builders, professional bodies, construction and fire risk consultants, financial institutions, Government advisors and trade associations. To conclude the oral evidence to the inquiry, we heard from Eddie Hughes MP, Parliamentary Under-Secretary of State at the Department for Levelling Up, Housing and Communities, and Lord Callanan, Minister for Business, Energy and Corporate Responsibility at the Department for Business, Energy and Industrial Strategy. Simon Sturgis was appointed Specialist Adviser to this inquiry. We would like to thank him for his insight and technical expertise, which has been invaluable to this inquiry.[9]

8. This inquiry builds on the findings of our previous inquiry into *Energy Efficiency of Existing Homes*,[10] which focused on how to improve the operational energy efficiency of domestic properties. The current inquiry has therefore focused primarily on the embodied carbon in construction of domestic and commercial properties.

9. The five report chapters cover the five broad themes arising from the evidence we gathered: 1) accounting methods for embodied and whole-life carbon; 2) the use of low-carbon building materials; 3) government procurement of buildings; 4) issues surrounding retrofit and reuse; and 5) the skills and training required to delivered sustainable construction.

9 Simon Sturgis, Specialist Adviser for the inquiry into the Sustainability of the built environment, declared the following interests:

7 July 2021:

Currently seeking funding from BEIS for the WLCN 'Consistency Project' to update and improve the consistency of reporting in the RICS Whole Life Carbon Professional Statement.

Shortly submitting a fee proposal as part of The Embodied Carbon Group for Whole Life Carbon advice to the Department for Education.

Unpaid advisor to 'the Construction Carbon Footprint Scheme' which is developing a whole life carbon certification scheme for the UK.

Providing policy, strategy and delivery advice for various consultancies and client bodies.

19 January 2022:

Involved in an update to the RICS Professional Statement on Whole life carbon assessment for the built environment

10 Environmental Audit Committee, Fourth Report of Session 2019–21, Energy Efficiency of Existing Homes, HC 346

2 Whole-life carbon assessments

Current Government policies on decarbonising the built environment and addressing whole-life carbon

10. The Government states that decarbonising UK industry is a core part of its ambitions for a green industrial revolution.[11] The Government seeks to decarbonise industry in line with net zero, while remaining competitive and without pushing emissions abroad.[12] The Government states that it also understands the importance of properly accounting for carbon, which is why it is "working to ensure that the whole life of building materials is accounted for, including the impact of any embodied carbon." [13]

11. In March 2021 the Government published its Industrial Decarbonisation Strategy. The strategy considers new policy approaches which government could introduce to accelerate the market for low-carbon industrial materials, including construction products. The Strategy seeks to build upon the commitments in the Clean Growth Strategy and the 25 Year Environment Plan to increase the use of low-carbon materials in construction.

12. The Department for Levelling Up, Housing and Communities' role in the planning process and setting building regulations also offers levers to decrease the environmental impacts of construction. From 2019 to 2021 the Government ran a consultation on the Future Homes Standard and Future Building Standard.[14] These standards seek to deliver an uplift in energy efficiency standards for new homes and buildings, improve ventilation and mitigate overheating in residential buildings. Changes to certain building regulations including Part L (fuel and power) are coming into force in June 2022: these changes represent a stepping-stone towards the Future Homes Standard.[15]

11 HM Government, Industrial Decarbonisation Strategy (March 2021)
12 HM Government, Industrial Decarbonisation Strategy (March 2021)
13 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy and Department for Environment, Food and Rural Affairs (SBE0149)
14 Department for Levelling Up, Housing and Communities, The Future Buildings Standard (January 2021); Ministry of Housing, Communities & Local Government, The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings, (October 2019)
15 Department for Levelling Up, Housing and Communities. Statutory guidance Conservation of fuel and power: Approved Document L Building regulation in England setting standards for the energy performance of new and existing buildings. (25 February 2022)

Box 1: Definitions of embodied carbon, operational carbon and whole-life carbon and whole-life cycle

Embodied carbon: Embodied carbon emissions are all emissions associated with materials, construction, maintenance, repair, demolition, and disposal of a building.

Operational carbon: All emissions associated with use of energy within a building, for example energy used for heating or cooling.

Whole-life carbon: The combined total of embodied and operational emissions over the whole life cycle of a building.

Whole-life cycle: The entire life of a building from material sourcing, manufacture, construction, use over a given period, demolition and disposal, including transport emissions and waste disposal.[16]

Source: WLCN, LETI and RIBA (2021)

The Industrial Decarbonisation Strategy

13. The Industrial Decarbonisation Strategy, which the Department for Business, Energy, and Industrial Strategy issued in March 2021, sets out how the Government seeks to decarbonise the construction sector.[17] Under the Strategy, the Government has committed to:

- improve the transparency of embodied emissions data by launching a call for evidence on emissions reporting and defining low-carbon products between 2021–2022;
- develop a proposal by 2023 for how carbon reporting of industrial products could be achieved;
- develop proposals for new product standards and product labelling which may include assessment of the embodied carbon of industrial products: the Government states that this could be implemented from the mid-2020s onwards;
- test different methods of doing embodied carbon assessments, including examining the use of whole-life cycle assessments;
- consider whether existing certification systems such as Environmental Product Declarations, could be used or made mandatory to determine the environmental impact of intermediary industrial products; and
- develop a set of indicators for low-carbon materials which appropriately reflect relevant considerations such as embodied carbon and life cycle assessment.[18]

The Future Homes Standard

14. In January 2021 the Government published the response to its consultation on the Future Homes Standard which it launched in October 2019. The new standard will be

16 WLCN, LETI and RIBA, Improving Consistency in Whole Life Carbon Assessment and Reporting, (May 2021) The definition written above is a simplified plain English definition, derived from the definitions in this report.

17 HM Government, Industrial Decarbonisation Strategy (March 2021)

18 HM Government, Industrial Decarbonisation Strategy (March 2021)

introduced in 2025 and will set energy efficiency standards for new homes and extensions.[19] The standard will comprise a series of amendments to Part F (ventilation) and Part L (conservation of fuel and power) of the Building Regulations for new homes. The Standard establishes measures that seek to ensure that from 2025, an average home will produce at least 75% lower CO_2 emissions than one built to current energy efficiency requirements. It aims to achieve this through increasing energy efficiency requirements and promoting the installation of low-carbon heating systems (such as heat pumps). The Standard will require homes built from 2025 to be 'zero carbon ready': that is, they should not require further energy efficiency retrofit measures to become zero-carbon. The Standard is solely concerned with energy efficiency measures, thereby only addressing the in-use operational carbon of buildings.

15. Non-government organisations and industry groups have welcomed the Standard but have said it does not go far enough in decarbonising new homes. The UK Green Building Council (UKGBC) said it was:

> regrettable that the Standard won't be implemented until 2025, despite it being widely trailed that it would be brought forward to 2023.[20]

16. UKGBC recommended that the Government set out a trajectory for tightening Building Regulations to ensure that by 2030 all new buildings operate at net zero carbon for regulated and unregulated energy including embodied carbon. In a letter to the previous Secretary of State for Housing, Communities and Local Government, Robert Jenrick, the CCC issued a series of recommendations to address what they saw as deficiencies in the Future Homes Standard.[21] This included recommending that full definition of the policy should be set now and legislated before 2024 to give the market certainty. The letter pointed to the scrapped Zero Carbon Homes policy, which it said left many investments stranded and "weakened industry confidence". The CCC noted that Scotland would be introducing equivalent standards in 2024.

17. Despite publication of the Industrial Decarbonisation Strategy and the Future Homes Standard, there remains nothing in national policy that requires embodied carbon emissions to be measured, or controlled, other than on a voluntary basis.[22] The Government said that its engagement with industry on embodied and whole-life carbon to date suggests that for large and small developers measuring embodied carbon is unfamiliar territory.[23] The Government said that the methodology for the in-use and end-of-life embodied carbon emissions in construction is to be addressed in a cross-government working group on Government construction metrics run by the Infrastructure and Projects Authority (IPA).[24]

19 MHCLG, The Future Homes Standard, Summary of responses received and Government response (January 2021); MHCLG, The Future Buildings Standard (December2021)

20 UKGBC, PRESS RELEASE: UKGBC responds to Future Homes Standard consultation outcome, January 19, 2021

21 Climate Change Committee. Letter: Future Homes Standard and proposals for tightening Part L in 2020, February 2020

22 UK Green Building Council (SBE0144); Q7

23 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)

24 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)

Industry and stakeholder views on whole-life carbon

18. In 2019 the Climate Change Committee (CCC) published its report *UK Housing: Fit for the future?* This report made several recommendations to Government on sustainable building, including incentivising the use of wood in construction and developing policies to minimise the whole-life carbon impact of new buildings.

19. The CCC noted that there was no easily accessible source of 'whole-life' cost information to allow simple comparison between the costs of green infrastructure solutions (e.g. timber) and traditional grey infrastructure solutions (e.g. steel and concrete).[25] AECOM, in a report produced for the CCC, recommended that embodied and sequestered carbon be considered in the buildings standards framework. AECOM provided three options for this to be achieved:

(1) Government could monitor embodied carbon and lead with mandatory reporting and reduction through its own procurement;

(2) that "whole life carbon intensity limits" be set in Building Regulations for relevant elements, product types and materials; or

(3) a scheduled introduction of whole building lifecycle carbon intensity targets in building regulations could be considered.[26]

20. Many who made submissions to this inquiry observed that little to no progress had been made against the CCC's recommendations on sustainable new housing.[27] The School of Architecture and Built Environment (SoABE), University of Wolverhampton, summarised why action had been limited explaining that: decarbonising the structural fabric of new homes remains entirely voluntary within the construction industry; there was little evidence, outside of a specialist niche, that there was widespread awareness, understanding or skill to deliver a low-embodied carbon built environment; evidence suggested that the public's awareness, understanding, or demand for low embodied carbon products, including buildings, might be limited; and there was a need for further research and piloting in the field of decarbonising the structural fabric of buildings before policy and incentives were fixed. [28]

21. Dr Jannik Giesekam, Lecturer, Department of Civil and Environmental Engineering at the University of Strathclyde, suggested that there was no current trend towards any reduction of the total annual embodied carbon emissions associated with development of the UK built environment.[29] This is demonstrated by the dark orange line labelled 'capital carbon' in figure 1 below. In some sectors the term 'capital carbon' is used instead of 'embodied carbon'.

25 Climate Change Committee, UK housing: Fit for the future? (February 2019)

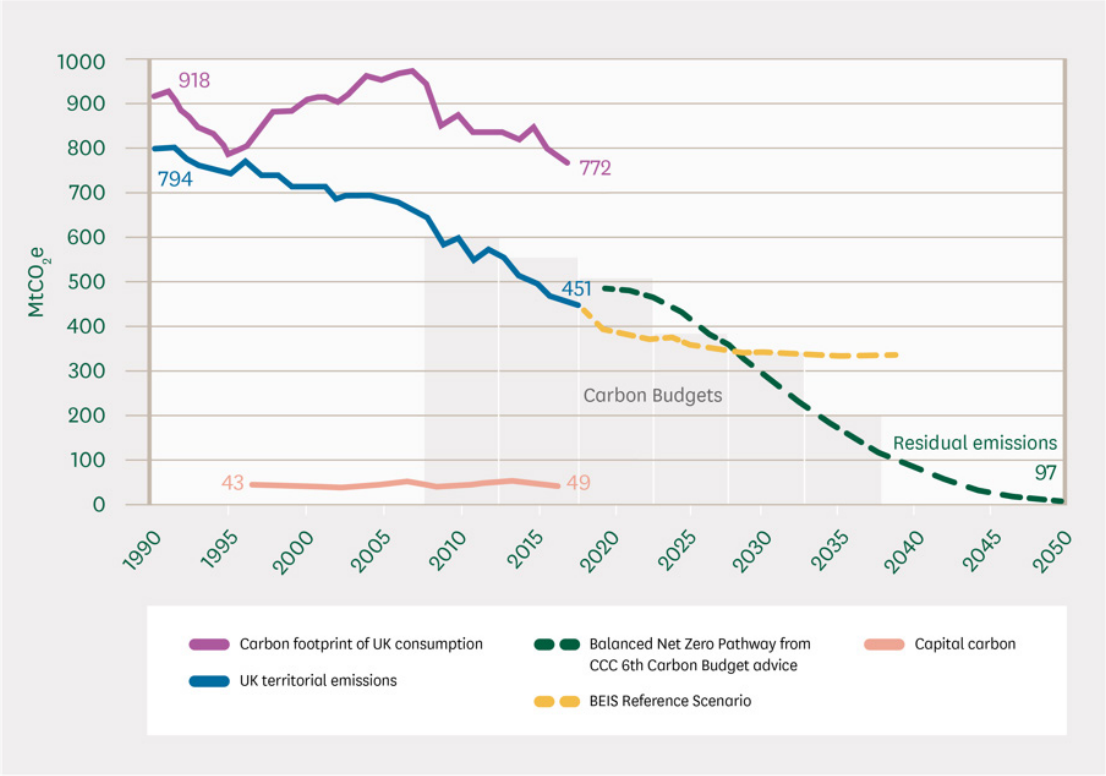
26 Aecom for the Committee on Climate Change, Options for incorporating embodied and sequestered carbon into the building standards framework (July, 2019)

27 For example: Architects' Climate Action Network (SBE0123); Chartered Institute of Building (SBE0063); Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106); Energy Systems Catapult (SBE0081)

28 University of Wolverhampton (SBE0071)

29 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075). Note: Dr Jannik Giesekam submitted written evidence to the Committee in May 2021 when he was a Research Fellow at the University of Leeds. By the time he provided oral evidence to the Committee in October 2021 he had moved to be a Lecturer at the University of Strathclyde.

Figure 1: Embodied/capital carbon emissions from the UK built environment relative to national accounts



Source: Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075)

22. In its recent assessment of the Government's Heat and Building Strategy, the CCC said that the Government's strategies gave no consideration to the issue of embodied carbon associated with constructing new buildings. In the CCC's view, this posed a specific risk in the Government's approach to newbuild homes.[30] The CCC recommended that the Government introduce practices which minimise the embodied carbon of new build homes.

23. Architects, academics, and industry bodies noted that positive action responding to the CCC's recommendations had been taken by local authorities and cities.[31] The Greater London Authority (GLA), the West Midlands Combined Authority and other local authorities have started to introduce planning policy on whole-life carbon emissions.[32] The GLA's guidance means that all projects referred to the Mayor must undertake whole-life carbon assessments.

24. We heard consistently that the construction industry was willing and able to conduct whole-life carbon (WLC) assessments, if the Government were to set a national

30 Climate Change Committee, Independent Assessment: The UK's Heat and Buildings Strategy (March 2022)
31 Rachael Owens (Architect at Buckley Gray Yeoman); Seb Laan Lomas (Head of Sustainability at Hopkins Architects) (SBE0095); Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106); UK Green Building Council (SBE0144)
32 Rachael Owens (Architect at Buckley Gray Yeoman); Seb Laan Lomas (Head of Sustainability at Hopkins Architects) (SBE0095); West Midlands Combined Authority, Five Year Plan 2021–29, (2021)

methodology for assessments and make tools for assessment freely available. Industry stakeholders said this would allow for consistent and comparable assessments to be made.[33] Currently, there is no standard software tool for the UK for measuring embodied carbon. Dr Joe Jack Williams, Associate, Researcher, Feilden Clegg Bradley Studios said:

> We are seeing a groundswell within the industry looking at the issue of whole life carbon and embodied carbon […] There are a number of different standards out there and we are trying our best to align them […] What would be helpful from Government is a line in the sand to say, "This is the standard approach" and that is what we are asking for in many ways.[34]

Views on costs associated with whole-life carbon assessments

25. Witnesses also indicated that conducting whole-life carbon (WLC) assessments and reducing the embodied carbon of projects need not cost more than traditional carbon-intensive construction methods.[35] Mesh Energy, an energy consultancy, assessed the embodied and whole-life carbon associated with a building project under scenarios using a range of materials. The study provided a range of outcomes in terms of carbon and cost, with the least and greatest impacts as shown in Figure 2 below. Mesh Energy's figures demonstrate that a steel frame is the most expensive and least carbon efficient choice over the project's lifecycle. On the basis of these figures, for a similar lifecycle cost, a form of timber material could be used in construction which would entail significantly less embodied carbon and whole-life carbon emissions.

Figure 2: Design variations, whole-life carbon and lifecycle costs

Design variation	Embodied Carbon ($kg\ CO_2e/m^2$)	Whole-Life Carbon ($kg\ CO_2e$)	Lifecycle cost
Cross Laminated Timber ASHP	409	1,110,815	£9,732,339
Steel Frame ASHP	759	1,705,555	£9,842,762
Concrete Frame ASHP	517	1,293,456	£9,763,475
Timber Frame ASHP	423	1,136,289	£9,706,344
Cross Laminated Timber Gas and Electricity	446	1,705,635	£9,632,480
Steel Frame Gas and Electricity	770	2,255,387	£9,734,667
Concrete Frame Gas and Electricity	529	1,842,964	£9,655,380
Cross Laminated Timber Biomass	409	1,075,704	£9,642,746
Steel Frame Biomass	733	1,625,455	£9,744,933
Concrete Frame Biomass	491	1,213,356	£9,665,646

Source: Mesh Energy (SBE0040)

33 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075); Sir Robert McAlpine (SBE0055);Grantham Institute - Climate Change and Environment at Imperial College London (SBE0059); The Embodied Carbon Group (SBE0062); Chartered Institute of Building (SBE0063) Q112

34 Q112

35 Mesh Energy (SBE0040); Q70

26. For small housing projects, we heard that WLC assessments were more expensive to undertake than energy performance certificate (EPC) assessments. The increased cost is understandable, given the scope of a WLC assessment compared with an EPC. Peter Conboy, Development Director, igloo Regeneration Ltd, a company focusing on developing low-carbon housing projects, said:

> [WLC assessments] are significantly more costly than an EPC. An EPC—12, 13 years after the introduction—is now down as low as £30 a home sometimes, depending on the house type […] We are not anywhere near that level [for WLC assessments […] We are talking £200 to £400 a property, minimum. It will come down but it will only come down when we standardise.[36]

27. For large-scale developments (10 housing units or more), Dr Giesekam said that costs for WLC assessments may be negligible. He also commented on the different factors affecting costs:

> First, the costs are really variable. What are you assessing, when is it being done and how? Are you paying external consultants to do it? Are you using tools to support your assessment? Are they free ones or are they licensed ones? Is it your first time doing an assessment, in which case it is going to be very time-consuming and costly? Or are you just updating the standard design that you already have?
>
> The other point is that you have to consider these costs relative to scale … . If you are doing large-scale developments such as this, the cost is relatively negligible compared to the overall cost of the scheme.[37]

He did not advise using WLC assessment for single properties, a requirement he considered to be "overly onerous".[38]

28. Dr Giesekam's analysis of the cost of whole-life carbon assessments was corroborated by Adam Mactavish of Currie & Brown, an asset management and construction consultancy. He said that the time taken to conduct assessments had greatly reduced over the last 20 years and that for simple structure building projects, conducting assessments was relatively straightforward.[39] He noted that the more routine these assessments were, the more standard solutions could be deployed to enable assessments to be even quicker and more efficient.[40]

29. When asked whether reducing embodied carbon leads to additional costs, Dr Alice Moncaster, Senior Lecturer at the School of Engineering and Innovation, The Open University said:

> It should not do. If you reduce embodied carbon there are two ways of doing it. You can choose to use less material, which should cost less. The other is to use a lower carbon material, which on the whole means it has used less energy in its manufacture so again should cost less. Once it becomes

36 Q70
37 *Ibid*
38 *Ibid.*
39 Q198
40 *Ibid.*

> normal, the costs of the low embodied carbon building should be lower than the cost of the high embodied carbon building, however it is obviously down to what is normal in industry and what skillsets people have.
>
> If we replace a concrete frame and all brick and block houses with timber-framed houses, then you can reduce embodied carbon by about half. However, if you do not have the skillset to do that, and if you do not have the supply chains to provide that, you will not realise those cost savings. In theory, it should be a cost saving.[41]

30. There was consensus in the evidence we heard that the standardisation of the WLC assessment process, through regulation, would substantially reduce costs. This in turn would reduce the costs of low-carbon construction.

Scheduling the introduction of whole-life carbon assessments

31. Government commitments to the introduction of WLC assessments have lacked a clear timeline for implementation, an issue consistently raised by our witnesses.[42] Dr Giesekam told us that while the Heat and Buildings Strategy and the Net Zero Strategy represented "a step forward on embodied carbon in terms of there being some future commitments around it", the timeline was "very vague". He said:

> In particular, in the net zero strategy, we had the statement that, "Government aims to support action in the construction sector by improving reporting on embodied carbon in buildings and infrastructure with a view to exploring a maximum level for new builds in the future."[…] We also saw, in the Government's response […] to the annual progress report from the Committee on Climate Change [for 2021], a commitment again around embodied carbon but, again, with no timeline stating when they intended to enact this or what the details of that would be.[43]

32. The architects who gave evidence to us consistently recommended that a clear timeline for the adoption of WLC assessment as a mandatory requirement for construction was needed to increase professional knowledge and capability in embodied carbon and provide the necessary signals for the construction industry to invest in managing it.[44] The Architects Climate Action Network have recommended that mandatory reporting be introduced in 2022, followed by the introduction of limit values in 2025, which will then be reduced over time.[45] The Part Z campaign, which seeks to introduce mandatory WLC assessments as part of building regulations recommends a similar timeline, with the introduction of mandatory assessments starting in 2023.[46]

41 Q74
42 Q9, Q14, Q59, Q172
43 Q59
44 Rachael Owens (Architect at Buckley Gray Yeoman); Seb Laan Lomas (Head of Sustainability at Hopkins Architects) (SBE0095); Joe Penn (Architect at Rock Townsend); Matteo Sarno (Architect at Boito Sarno) (SBE0126); Joe Giddings (Campaigns Coordinator & Project Director at Architects Climate Action Network & ASBP); Sophia Ceneda (Sustainability Lead at Glenn Howells Architects & Director at Carbogno Ceneda Architects) (SBE0119)
45 Rachael Owens (Architect at Buckley Gray Yeoman); Seb Laan Lomas (Head of Sustainability at Hopkins Architects) (SBE0095)
46 Will Arnold et al, Part Z Proposal, (July 2021)

33. Will Arnold, Head of Climate Action, The Institution of Structural Engineers, said the only remaining barrier to introducing whole-life carbon assessments in the UK, was the lack of a timeline for its implementation:

> [W]e have methodology; we have a way of reporting; we have the skillset throughout the industry. Not all of industry has upskilled yet. Those that have have typically done it in the last two years … In the last two years, everything you see today has happened in that period of time. In another two years, even without regulation you will probably see the same movement again. But with firm deadlines you will see more of that. To me that sort of time period is the only real barrier that needs to still be overcome. To overcome it you need to set dates in stone.[47]

Action on whole-life carbon in other countries

34. Internationally, whole-life carbon and embodied carbon regulations exist at a national level in some European countries and at a state level in the United States. For example:

- **The Netherlands**: since 2013, the 'Building Decree 2012' requires new residential and office buildings larger than 100m^2 to have whole-life carbon calculations and carbon mitigation cost estimates using a national methodology.[48]
- **France:** from early 2022 the new 'RE2020' will require whole-life carbon calculations for all new housing projects with an emphasis on the use of wood in construction.[49] Reduction targets will be set incrementally to achieve carbon neutrality by 2050. The scheme has been running since 2016 on a voluntary basis to build a database and upskill the sector.
- **California:** the 'Buy Clean California Act' applies to infrastructure projects and public buildings and sets out 'Carbon Intensity Limits' on certain construction materials.[50]

35. Figure 3 provides a high-level overview of embodied carbon policy developments in several comparator countries and states.

47 Q172
48 Government of the Netherlands, Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, *Bouwbesluit 2012*
49 ATIBT (2020). A look back at the new guidelines of the French Environmental Regulation (RE 2020).
50 Department of General Services, Procurement Division Buy Clean California Act, accessed 25 April 2022

Figure 3: Examples of international policy precedents

Location	Instrument	Policy owner	Brief description	Current status	Future development
Netherlands	Bouwbesluit (Building Act) 2012 Building Decree and subsequent amendments	Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (Ministry of the Interior and Kingdom Relations)	Mandatory Life Cycle Assessment (LCA) calculation for residential and office buildings over 100m² using national assessment method, database and approved tools. The combined monetised impacts of 11 LCA impact categories are capped.	Reporting in force since 2013. Cap in place since Jan 2018.	Cap will be tightened
Sweden	New act on climate declarations for new buildings is under development	Boverket (National Board of Housing, Building & Planning) (with assistance from Swedish Transport Administration and Environmental Protection Agency)	Will require buildings to make a 'climate declaration', using common database and methodology, depositing results in register with limits introduced after initial period of data gathering.	Since 2018 Boverket have been working on 5 subprojects on database; register; guidance; regulation drafting and next steps. Database launched in March 2021, in testing phase until May, with final version set for publication in June. Major information campaign scheduled for autumn 2021. Policy impact assessment under way. See here for overview.	Ordinance to be enacted from 01/01/22. From 2027 limit values will be introduced and then ratcheted (with proposed relative reduction steps to 2043 published in 2020).
Finland	Reform of the Land Use and Building Act due for completion by end 2021	Ministry of the Environment	Assessment of building footprint and handprint in accordance with national methodology will be required for building permit.	Methodology published in 2019, consultation completed in August 2020, database launched in March 2021, testing phase ongoing.	First limits to be introduced for public projects with limits for most buildings to be introduced by 2025.
Denmark	National Strategy for Sustainable Construction & building regulations	Ministry of Transport and Housing	Mandatory LCA calculation for new buildings, with impact limits for buildings over 1000m².	Political agreement in March 2021 plans introduction from 2023. Overview in English here.	Ratcheting down of limits in 2025, 2027 and 2029.
France	RE2020 (Environmental Regulations 2020)	Ministry of Ecological Transition	Introduces whole life dynamic LCA requirements followed by limits. Supported by national database (with its own associated requirements driven by regulations).	Testing phase of predecessor E+C- completed in 2019. Subsequent regulation developed for Jan 2021 but introduction delayed to summer 2021.	Due to apply from summer 2021. Requirements to be progressively strengthened in 2024, 2027 and 2030 (up to 30-40% reduction).
California[2]	Buy Clean California Act	Administered by Department of General Services	Public works undertaken by state agencies must submit Environmental Product Declarations (EPD) demonstrating compliance against Global Warming Potential (GWP) limits on 4 materials.	Limits published, awarding authorities will gauge compliance from 01/07/21.	3 year review cycle from 01/01/24 will revise limits, "likely" that other materials will be added.
United States	Recently proposed CLEAN Future Act (Title V Subtitle C Sec 521-524)	Administered by relevant federal agencies	Public works undertaken by federal agencies must submit EPD demonstrating compliance against GWP limits on set of up to 9 materials.	Draft introduced 03/02/21, now going through committees.	Would come into force 1 year after enactment with a 3 year review cycle.
EU	Level(s)	European Commission	Framework including set of indicators intended to harmonise metrics and language on sustainability performance of buildings across the EU.	Framework launched October 2020 after 5 years of development and testing on 130 projects. Initially voluntary and requires integration through policies or regulatory framework.	EC has proposed green public procurement criteria using Level(s) for offices and schools from June 2022.

Notes: 1. Others such as Norway, Belgium, Italy and Switzerland also currently have, or are developing, related policies.
2. Four other states have Buy Clean legislation in some stage of development whilst Minnesota and Oregon also have related orders in place.

Source: Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075)

36. In European countries where there is regulation at building level (for example, the Netherlands, France, Finland, Sweden), a national methodology is provided in line with European Standards for assessing life cycle carbon.[51] Many of these jurisdictions are engaged in multi-year programmes to develop policy targeting embodied or whole-life carbon assessment or reduction.[52] This typically takes the form of introducing a life cycle or carbon assessment requirement drawing upon common underpinning policy infrastructure such as a national methodology, product database and approved tools. Often an initial period of embedding reporting (typically 3-5 years) is followed by the introduction of targets and a long-term ratcheting down of target levels.

51 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075)
52 *Ibid.*

37. There is no standard assessment tool in the UK for measuring embodied carbon, as a result there can be variation between outputs depending on which tool is used, and inconsistency in assessments across industry. Dr Giesekam estimated that by the mid-2020s many of the UK's comparator countries would have introduced embodied carbon targets through policy instruments.[53] He said that if the UK did not follow suit it would be an outlier compared to typical comparator countries.

38. Dr Giesekam argued that there was scope for the UK to learn from emerging international best practice and the diverse range of policies that will be implemented in the short to medium term. He recommended that this be supported by a formal structure, for instance an Embodied Carbon Policy Observatory, which could also provide a platform for knowledge exchange, technical support and training, and independent assessment of policy effectiveness. In the absence of any formal structure, responsibility to monitor international developments ought to be allocated to officials in relevant Government departments.[54]

39. Dr Giesekam observed that many of the countries highlighted in Figure 3 had also introduced complementary policies requiring increased disclosure of product information, and incentives targeting related policy areas such as reduced waste, increased circularity or promotion of specific design options like timber construction.[55] He recommended that a similarly complementary package of policy measures be adopted by the UK.

40. Dr Alice Moncaster said that there was evidence that the introduction of regulations to reduce embodied carbon in countries such as France has had a rapid impact on industry behaviour and construction material supply chains, significantly reducing the carbon emissions from construction.[56]

Embodied carbon methodology, standards and tools

41. Since 2011, European Standards[57] have been provided to ensure a level of consistency in the assessment of life cycle carbon and other quantified environmental information. These formed the basis of British Standards that set out the structure for carbon assessments, such as BS EN 15978, for Buildings, and BS EN 15804 for Environmental Product Declarations.[58] In the evidence we received, the BS EN 15978 standard 'Sustainability of construction works: Assessment of environmental performance of buildings calculation method' was consistently identified as the accepted industry-leading standard for measuring

53 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075) .

54 *Ibid.*

55 *Ibid.*

56 Built Environment group, The Open University School of Engineering and Innovation (SBE0131)

57 European Standards (EN) are set by the European Committee for Standardization, a body representing the standards institutes of 34 European countries. It is not an EU body but is recognised in EU legislation and can develop standards at the request of the European Commission.

58 BS EN 15978:2011: Sustainability of construction works. Assessment of environmental Performance of buildings. Calculation method is the most recent iteration of BS EN 15978. BS EN 15804:2012+A2:2019. Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products is the most recent iteration of BS EN 15804.

and reporting the embodied carbon impacts of buildings in the UK.[59] This standard comprises the overarching framework under which additional items of guidance provide further detail and consistency in approach.

42. Additional guidance available includes the Royal Institution of Chartered Surveyors (RICS) Professional Statement on Whole Life Carbon. This was developed in response to the inconsistent application of BS EN 15978 in the UK, which many attribute to the lack of a mandatory national methodology.[60] It aims to provide principles and practical guidance for whole-life carbon assessment to be adopted across UK industry.[61]

43. In support of, and consistent with, the RICS Professional Statement methodology, increasing quantities of guidance on whole-life carbon good practice are being published by professional institutions in the built environment, including the Royal Institute of British Architects (RIBA), the Chartered Institution of Building Services Engineers (CIBSE), the Institution of Structural Engineers (IStructE), the London Energy Transformation Initiative (LETI), the UK Green Building Council: (UKGBC), the Architects Climate Action Network (ACAN) and others.

44. Alongside the RICS methodology and supplementary guidance, various software tools are available for professionals seeking to carry out embodied carbon assessments and life cycle assessments at both product and building level; some of these tools are free to use.[62] The variety of tools used in the UK market lead to variations in WLC assessment results, creating inconsistencies and reducing comparability of outputs. Inconsistencies largely arise from variations between the data sources used and assumptions made when undertaking WLC assessments.[63] Dr Giesekam observed that:

> The primary gap preventing consistent assessment across the sector is not a lack of underlying standards or guidance but the lack of prescriptive assessment boundaries and defaults that are typically prescribed within a national methodology.[64]

45. Although it is not officially the UK's prescribed methodology, we repeatedly heard from practitioners and academics that the RICS methodology was used by industry as the way to implement the British Standards for embodied carbon assessment. RIBA, LETI, ACAN and others recommended that the RICS methodology be adopted as the UK industry standard.[65] RIBA considered the RICS methodology to be the most

59 Grantham Institute - Climate Change and Environment at Imperial College London (SBE0059); Centre for Alternative Technology (SBE0068); Wood for Good (SBE0072); Mineral Wool Insulation Manufacturers Association (MIMA) (SBE0074)

60 RICS, RICS professional standards and guidance, UK: Whole life carbon assessment for the built environment (November, 2017) p4

61 RICS, RICS professional standards and guidance, UK: Whole life carbon assessment for the built environment (November, 2017) p4

62 Examples of software tools available include: Autodesk Revit, the Hawkins Brown Emissions Tool H\B:ERT, eTool, OnclickLCA, FCBS Carbon and EccoLab

63 Q37, Qq62–63

64 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075)

65 Royal Institute of British Architects (SBE0039); LETI (London Energy Transformation Initiative) (SBE0137); Architects' Climate Action Network (SBE0123); Make UK: Modular (SBE0051); Sir Robert McAlpine (SBE0055); The Embodied Carbon Group (SBE0062)

comprehensive and consistent approach available to UK industry.[66] This was supported by the UK Green Building Council, The Alliance for Sustainable Building Products (ASBP), academics from the University of Sheffield and others.[67]

46. The Greater London Authority's (GLA) new London Plan, introduced in March 2021, requires all developments over a certain size to calculate embodied impacts following the RICS methodology.[68] The GLA told us that the methodology had so far worked without any fundamental issues.[69]

47. The Concrete Block Association and Chartered Institution of Building Services Engineers voiced concerns over certain aspects of the RICS methodology. The Concrete Block Association, which is a trade association for UK producers of aggregate concrete blocks and their suppliers, recommended that the RICS methodology be updated to use "more realistic wastage rates" and "up to date EPDs for concrete blocks", to reflect the environmental performance of buildings more accurately. CIBSE argued that the RICS methodology could under-estimate operational carbon emissions from energy use because it only covered regulated energy uses. This could create a discrepancy between calculated and actual energy use in buildings. CIBSE said that aside from this concern it broadly supported the RICS methodology. Dr Giesekam summarised the status and accessibility of whole-life carbon methodology, standards, tools and regulation in the UK:

> What we have had over the last decade is essentially the development of the RICS methodology, and a huge body of guidance […] from all of the professional institutions, various voluntary initiatives and so on, that have attempted to put in place all of the key bits that you need to do this consistently. Fundamentally, they have been hindered by the fact that all of that has been done on a voluntary ad hoc basis. It has not been co-ordinated through some central policy or regulation that is driving it. It is much easier, if you are a practitioner in any of the other countries that have developed this, to do these assessments, because I have a standard national database I go to, I have a set of tools that are accredited to it, I have one standard in national methodology that I use. It is very simple. We do not have that in the UK and we are not going to develop that on a voluntary basis. That will only be done through regulation.[70]

We were told that the lack of a Government-approved methodology for, and requirement to, undertake assessments had led to a complex and uneven playing field, which was making WLC assessments less accessible and adding to the cost of assessment for those that did them. Jane Anderson, a board member of the Alliance for Sustainable Building Products (ASBP), told us that a common approach was "not as difficult as people [made] out":

66 Royal Institute of British Architects (SBE0039)

67 Qq36–37; LETI (London Energy Transformation Initiative) (SBE0137); Architects' Climate Action Network (SBE0123); Make UK: Modular (SBE0051); Sir Robert McAlpine (SBE0055); The Embodied Carbon Group (SBE0062); Chartered Institute of Building (SBE0063); MPA UK Concrete (SBE0069); Wood for Good (SBE0072); Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075); The Institution of Structural Engineers (SBE0080)

68 Built Environment group, The Open University School of Engineering and Innovation (SBE0131)

69 Qq167–170

70 Q64

> There is a willingness to take this on board. If everybody is doing it together there is a level playing field. Part of the problem is that a lot of organisations that are doing this are suffering […] because they have to pay to make these assessments, to invest in the staff and training, while lots of other people do not have to do that. They have been regulating this in the Netherlands since 2012 and we must up our game.[71]

Peter Conboy, Development Director, igloo Regeneration Ltd told us that costs of WLC assessments would only come down when the assessment methodology and tools are standardised. [72]

48. When we asked Ministers whether the RICS methodology could be adopted as the official national methodology for whole-life carbon assessments in the UK, Lord Callanan, Minister for Business, Energy and Corporate Responsibility at the Department for Business, Energy & Industrial Strategy responded:

> [The RICS methodology] is quite complicated. It would incorporate advances in carbon assessment methodolog[y] and reporting. It is one of the options that we are considering for taking forward, but there are alternative views as well and there is some opposition to that.[73]

49. Eddie Hughes MP, Parliamentary Under-Secretary of State at the Department for Levelling Up, Housing and Communities, summarised potential drawbacks in the use of RICS methodology:

> the RICS approach is fundamentally a paper-based approach where you have to fill in forms and calculations along the way, whereas in the 21st century we need some sort of online process that feeds into the data. But to get to that position you need all the constituent data that then feeds into the process to be available […] While RICS is the system that has been around the longest and has gathered momentum for that reason, it needs to be a bit slicker and a bit smarter.[74]

50. The Ministers' analysis of the RICS methodology ran counter to the weight of evidence we received which suggested widespread industry support, confidence and use of the RICS methodology and willingness for the methodology to be adopted as the UK standard. Jane Anderson noted that whilst the RICS methodology might be more complex, the software tools used by most firms actually to undertake WLC assessments based on the RICS methodology were easy to use.[75] Jane Anderson said that only larger firms with the appropriate funds and expertise tended to interface directly with the RICS methodology.

51. Lord Callanan did accept the requirement for a "standardised, widely accepted assessment methodology", which he said the Government was exploring.[76] The Department for Business, Energy and Industrial Strategy is also considering whether to fund an update of the RICS methodology to aid consistency of reporting, to make the

71 Q49
72 Q70
73 Q210
74 Q210
75 Jane Anderson (Director at ConstructionLCA Ltd) (SBE0155)
76 Q209

methodology more accessible and more transparent for use in housing, infrastructure and retrofit, and more suited to assisting the sector in delivering on the Government's net zero carbon commitments.[77] Damitha Adikaari, Director for Climate Science and Energy Innovation, Department for Business, Energy and Industrial Strategy, told us that the RICS update would also seek to address issues associated with the lack of consistent data sources and measurement metrics.[78]

Building regulations and whole-life carbon

52. Building Regulations control how buildings are to be designed or modified on the public policy grounds of health, safety, and environmental performance. They establish minimum standards for the design and construction of, and alterations to, virtually every building. The Building Regulations 2010[79] cover the construction and extension of buildings for England and Wales and these regulations are supported by Approved Documents.[80] Approved Documents set out detailed practical guidance on compliance with the regulations. Building regulation is generally a devolved matter.[81]

53. The detailed requirements of the Building Regulations in England and Wales are scheduled within 16 separate headings, each designated by a letter (Part A to Part S), and covering a discrete aspect of practice,[82] such as structure (Part A), fire safety (Part B), and conservation of fuel and power (Part L).

54. The England and Wales building regulations relevant to carbon emissions appear to focus exclusively on operational energy reductions: that is, improving energy efficiency in buildings. No building regulations address embodied carbon emissions from buildings or the embodied carbon costs of actions to reduce operational energy use. Decarbonising the structural fabric of newly built properties remains an entirely voluntary activity within the construction industry.[83]

55. The Future Homes Standard, due to be introduced in 2025, also does not include any measures to address embodied carbon emissions. During consultation on the Standard, some stakeholders raised concerns over the lack of provisions on measuring and reducing

77 RICS and WLCN, Consistency Project for Updating the RICS Professional Statement 'Whole life carbon assessment for the built environment – 2017' (August 2021)

78 Q211

79 The Building Regulations 2010 (2010/ 2214)

80 HM Government, The Building Regulations 2010, The Merged Approved Documents (July 2021)

81 Scotland and Northern Ireland have their own building regulations, and the administrations there are responsible for implementation of building regulations in their respective jurisdictions. While most primary and secondary legislation in this field made at Westminster applies to England and Wales only, the provisions of the Architects Act 1997, and legislative changes relating to construction product regulation, apply to the whole of the UK.

82 Parts A to S are listed as follows: Part A. Structure; Part B. Fire safety; Part C. Site preparation and resistance to contaminants and moisture; Part D. Toxic substances; Part E. Resistance to the passage of sound; Part F. Ventilation; Part G. Sanitation, hygiene and water efficiency; Part H. Drainage and waste disposal; Part J. Combustion appliances and fuel storage systems; Part K. Protection from falling, collision and impact; Part L. Conservation of fuel and power; Part L new requirements; Part M. Access to and use of buildings; Part N. Glazing – safety in relation to impact, opening and cleaning; Part P. Electrical safety – dwellings; Part Q. Security; Part R. Physical infrastructure for high speed electronic communications networks; Part S. Infrastructure for the charging of electric vehicles

83 University of Wolverhampton (SBE0071)

embodied carbon.[84] Architects Climate Action Network have called for whole-life carbon to be considered in amendments to the design aspects of building regulations for both new buildings and retrofitting of buildings.[85] IStructE have highlighted that using this approach to building design can help to ensure that low operational carbon design does not inadvertently increase embodied carbon and vice versa.[86]

56. In response, the Government said that it intends to carry out longer-term work to examine a wider scope around how new buildings can be designed and constructed to be fit for a zero-carbon future.[87]

57. In July 2021, whole-life carbon experts, with the support of representatives from the construction industry, published a report that proposed amendments to the Building Regulations 2010.[88] The proposals were described by the authors as a 'proof-of-concept', to demonstrate how embodied carbon could be incorporated into UK regulation and were termed 'Part Z'. The proposals outline requirements for the assessment of whole-life carbon emissions, and limiting of embodied carbon emissions, for all major building projects. The proposals seek to introduce mandatory assessments ahead of setting carbon limits, giving industry and policymakers time to converge on these limits by 2027.

58. The authors have provided a draft on an Approved Document to go alongside Part Z, which they state is aligned with the RICS WLC assessment methodology and guidance and recommendations from RIBA, IStructE, UKGBC and LETI on embodied carbon.[89] The staggered introduction dates for WLC assessments and then carbon targets are modelled on timescales set by other countries. The proposal has widespread industry support from over 130 firms, many operating internationally, spanning major construction companies, professional institutions, architectural firms, engineering firms, property developers, asset managers, and environmental consultants.[90] A Bill seeking to enact Part Z was recently introduced to the House of Commons.[91]

59. As we have set out above, some European countries and states of the United States have enacted building regulations that require mandatory assessment of the whole-life and embodied carbon emissions of buildings. The Green Construction Board[92] among

84 Ministry of Housing, Communities & Local Government, The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings: summary of responses, and government response (October 2019)
85 Architects Climate Action Network (2021). The Carbon Footprint of Construction.
86 The Institution of Structural Engineers, Climate Emergency Task Group: End of year report (December, 2020)
87 Ministry of Housing, Communities & Local Government, The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings: summary of responses, and government response (October 2019)
88 Arnold et al, A proposed amendment to The Building Regulations 2010, Whole life Carbon, Approved Document, Part Z (July 2021)
89 Arnold et al, A proposed amendment to The Building Regulations 2010, Whole life Carbon, Approved Document, Part Z (July 2021)
90 Arnold et al, 2021, Part Z, Industry Support, (July 2021)
91 HC Deb, 2 February 2022, col 346
92 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075)

several other witnesses recommended that the Building Regulations be updated to include mandatory whole-life carbon assessments, and progressive ratcheting up of carbon targets for buildings.[93] For example the UK GBC recommended that:

i) At the next uplift, the Government should phase in requirements for the assessment of whole-life carbon, starting with larger developments;

ii) In 2025, requirements should be introduced for all developments to assess and disclose whole-life carbon impacts, and targets for reductions should be phased in, starting with larger developments;

iii) In 2030, targets should be introduced for all developments to make reductions in whole-life carbon.[94]

The planning system and whole-life carbon

60. The application of Building Regulations is separate and distinct from 'Town Planning' and 'planning permission'; the Building Regulations control how buildings are to be designed or modified on the public grounds of health, safety and environmental performance, while 'planning permission' is concerned with appropriate development, architectural quality, the nature of land use, and the appearance of neighbourhoods. Therefore, both must be considered when building works are to be undertaken.

61. Some local authorities have gone beyond current national planning policies and regulations to consider whole-life and embodied carbon in their Local Plans. These plans set planning policies in a local authority area.

62. Under the Greater London Authority's London Plan, projects referred to the Mayor of London[95] are mandated to calculate whole-life carbon emissions through a nationally recognised methodology and to demonstrate actions taken to reduce emissions (Policy SI 2). WLC assessments are recommended for all other major buildings within the GLA's jurisdiction. Under the London Plan, current WLC assessments are conducted according to the British Standards Institution's BS EN 15978:2011, using the RICS methodology.

63. Rhian Williams, Principal Strategic Planner to the Greater London Authority, told us that there had been few barriers to the introduction of this policy:

> [T]here weren't a lot of real fundamental objections to us introducing policy on whole life carbon. [… I]t was something that was recognised in the industry and by a lot of the community that responded […] that this was something that was lacking and it wasn't something that the Government were sharing leadership on. It was a real opportunity for us to try to move things forward.[96]

93 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075); SBE0039 RIBA; UK Green Building Council (SBE0144);Price & Myers LLP (SBE0067); Wildlife and Countryside Link (SBE0073); Energy Systems Catapult (SBE0081); Royal Institution of Chartered Surveyors (SBE0083); Elliott Wood Partnership Ltd (SBE0092); Green Alliance (SBE0135); BRE Group (SBE0140); LETI (London Energy Transformation Initiative) (SBE0137)

94 UK Green Building Council (SBE0144)

95 'Referred projects' are projects of potential strategic importance to London, this includes residential units over 150, development over 30m heigh and development on Green Belt.

96 Q167

64. The inclusion of embodied carbon and whole-life carbon assessments have been introduced in the city plans of other local authorities, such as the West Midlands Combined Authority (2021),[97] Brighton & Hove City Council (2008),[98] and in draft form in Central Lincolnshire (2022).[99] Several submissions recommended that the GLA's approach to calculating whole-life carbon be adopted and rolled out as national policy. [100]

65. Will Arnold, of the Institution of Structural Engineers, explained that the planning system and building regulations were needed in tandem to reduce the embodied carbon of construction:

> By requiring teams to assess whole life carbon at concept stage, an early stage in the project, it means that when the design team is small, when strategic decisions are yet to be made, it elevates the importance of carbon and it puts it on a par with having to deliver this on time and on budget, which means people are talking about it early enough to make the right decisions.
>
> Without having that at planning stage, it is a can that gets kicked down the road. If it is a requirement, a regulation, you don't do that, so it is an important thing.[101]

66. When we asked Ministers whether mandatory whole-life carbon assessments could be expected within the proposed Planning Bill, Ministers acknowledged the work of local authorities in this area. Eddie Hughes said:

> you are absolutely right about the innovative work that other councils are doing and it will be good for us to see how they progress and how other people embrace it … . There is an obvious symbiotic relationship between planning and building reg[ulation]s and we need to work as Government to make sure that we maximise that.[102]

67. Catherine Adams, Director of Net Zero and Greener Building, Department for Levelling Up, Housing and Communities said:

> local authorities can go above and beyond [building regulations] for planning procurement. We see that happening in local authorities in specific areas where they have chosen to go further than the minimum standards and what they are expecting to see in their local area.[103]

68. The responses of the Minister and his official suggest that the Government does not currently intend to introduce mandatory whole-life carbon assessments as part of the planning system, but welcomes local authorities introducing whole-life carbon requirements within their Local Plans.

97 West Midlands Combined Authority, Five Year Plan 2021–29, (2021)
98 Brighton & Hove City Council, 'Materials', accessed 26 April 2022
99 Central Lincolnshire, Central Lincolnshire Local Plan Review - Proposed Submission Local Plan (March 2022)
100 Rachael Owens (Architect at Buckley Gray Yeoman); Seb Laan Lomas (Head of Sustainability at Hopkins Architects) (SBE0095); Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)
101 Q167
102 Q216
103 Q217

Our view on whole-life carbon assessments

69. **There is no Government policy requiring the assessment or control of embodied carbon emissions from buildings. As a result, no progress has been made in reducing these emissions within the built environment. This inaction remains despite the built environment making up 25 per cent of the UK's total greenhouse gas emissions and the UK's Nationally Determined Contribution, made at COP26, committing the UK to achieve a 68% reduction in the UK's carbon emissions by 2030. This is only eight years away. This is an extremely short time frame within which to start assessing and substantially reducing embodied carbon emissions. The first step must be a requirement to undertake whole-life carbon assessments for buildings so the industry can start measuring and then controlling for this carbon.**

70. **A broad cross-section of the construction industry is willing and able to undertake whole-life carbon assessments. In the absence of an approved UK national methodology, the RICS Professional Statement on WLC is used as the accepted industry methodology for WLC assessments. Alongside this, various further guidance and software tools have been developed. As a result of the lack of an approved national methodology, the variety of assessment tools and interpretations for WLC that have developed appear to have created inconsistency, have unnecessarily increased the cost of WLC assessments and have led to an uneven playing field in conducting assessments.**

71. **The Department for Business, Energy, and Industrial Strategy is currently considering the possibility of funding an update of the RICS methodology. This update is intended to make the methodology more accessible and more transparent thus addressing the concerns raised by Ministers to us about the RICS methodology. Once the national methodology and requirement to undertake whole-life carbon assessments is in place, the cost of undertaking assessments is likely to be minimal.**

72. **The UK is slipping behind comparator countries in Europe in monitoring and controlling the embodied carbon in construction. If the UK continues to drag its feet on embodied carbon, it will not meet net zero or its carbon budgets. There is significant opportunity for the UK to learn from emerging international best practice on how to introduce whole-life and embodied carbon regulations.**

73. **Local authorities are mandating WLC assessments of their own accord. Evidence so far shows that the policy is achievable and is working, with few barriers to its introduction. Introducing mandatory WLC assessments for buildings could be an easy way for the Government to dramatically reduce carbon in construction. The industry has repeatedly asked for an ambitious, clear timeframe for when whole-life carbon assessments will become mandatory. This timeline should align with the introduction of the Future Homes Standard, which should itself be brought forward to 2023. This will help bring together efforts to tackle operational and embodied carbon within the same timeframe.**

74. ***We recommend that Ministers immediately assign responsibility to the relevant member of the BEIS Departmental Board to monitor international policy developments in embodied carbon, with a remit to feed observations into the development of UK policy on embodied and whole-life carbon.***

75. ***We recommend that the Government introduce, not later than December 2023, regulations to mandate whole-life carbon assessments for buildings above a gross internal area of 1000m^2, or which create more than 10 dwellings. This requirement should be established in Building Regulations, and ought to be reflected in the planning system through national planning policy. Local authorities should be encouraged and supported to include this requirement within their Local Plans ahead of the introduction of national planning requirements.***

76. ***The timeline for the Future Homes Standard should be brought forward to December 2023 to align the timeframes for addressing operational and embodied carbon. This will help provide the industry with the confidence it requires to construct low-carbon, energy efficient buildings.***

77. ***We recommend that following the introduction of whole-life carbon assessments, the Government should develop progressively ratcheted carbon targets for the built environment, to match the pathway to net zero set out in periodic carbon budgets. These ratcheting targets should be reported on annually, and progress reports towards achieving these targets should be published annually as part of the Net Zero Strategy indicators.***

78. ***We recommend that a clear timeframe for the introduction of mandatory whole-life carbon assessments and ratcheting targets should be set by Government by the end of this year.***

79. ***In our view, the RICS Professional Statement on whole-life carbon assessments is fit for use and already familiar to UK industry. We recommend that, as soon as possible following promulgation of the planned update of the Statement, the Government should seek to establish the RICS methodology as the UK industry standard for whole-life carbon assessments.***

3 Building materials

80. To decarbonise the construction of new buildings, fewer materials need to be used more efficiently, and the carbon content of the construction materials that are used needs to be reduced. The construction industry currently relies principally on brick, concrete, steel, timber, diesel fuel and, increasingly, plastics.[104] Buildings must be fit for purpose, meet the necessary Building Regulations and be safe, so issues relating to structural performance, durability, integrity and safety are essential.[105]

81. Steel and concrete are the predominant building materials in the UK, chosen for their stability, longevity and resilience,[106] yet both are highly energy intensive to create.[107] During our inquiry into *Energy Efficiency of Existing Homes*, we heard that sustainable building materials were under-utilised in the UK, despite being well established in other major European countries.[108] Sustainable products include insulation made using natural fibres; breathable mineral, clay and lime-based plasters; renders, mortars, and paints; and structural components made predominantly from timber. Natural materials, such as wood, sequester carbon, while lime-based renders, plasters and mortars have lower embodied carbon compared to equivalent cementitious materials due to the lower energy inputs during manufacture.[109] The Alliance for Sustainable Building Products (ASBP) told us that interest in the use of natural materials had grown in the last 18 months, although progress in their use remained stubbornly slow.[110]

82. The Government has stated its commitment to increasing the use of low-carbon materials in construction, including timber.[111] In the Industrial Decarbonisation Strategy, Ministers have committed to exploring a range of policy options that can support this ambition, including improving the transparency of embodied emissions data, product labelling, product standards, and changes to public and private procurement approaches.[112] The Government also said that the National Model Design Code, published in July 2021, had been prepared with consideration of the role which well-designed places will play in reducing embodied carbon and environmental impact.[113]

104 Worshipful Company of Constructors (SBE0057)
105 Construction Products Association (SBE0134)
106 MPA UK Concrete (SBE0069)
107 Grantham Institute - Climate Change and Environment at Imperial College London (SBE0059); Steel-making is highly energy intensive to create and the majority of production worldwide is reliant on coking coal in the production process. Concrete relies on Portland cement clinker content, which is the reactive material in cement that makes it set, and is very carbon intensive to produce due to its inherent chemistry and high processing temperature.
108 Environmental Audit Committee, Fourth Report of Session 2019–21, Energy Efficiency of Existing Homes, HC 346
109 Eden Renewable Innovations Ltd (Thermafleece) (EEH0126)
110 The Alliance for Sustainable Building Products (ASBP) (SBE0027)
111 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)
112 HM Government, Industrial Decarbonisation Strategy (March 2021)
113 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)

The National Model Design Code

83. The National Model Design Code (NMDC) provides guidance on the production of design codes for developments.[114] The Government states that the NMDC encourages the careful selection of materials and construction techniques in improving efficiency and reducing their environmental impact.[115]

84. The emphasis in NMDC is on energy efficiency. It notes that codes may set standards for new developments to meet relating to embodied energy and whole-life carbon to improve the sustainability of the construction, but no supporting detail is provided. The Code twice mentions embodied carbon, which it refers to as "embodied energy";[116] but the text of the Code offers no explanation of how to assess embodied carbon, what the impact of embodied carbon is or how to mitigate these emissions.

85. Contributors to our inquiry broadly welcomed the Code but found that its content was not ambitious enough to address the climate and nature emergencies and that there were significant challenges to its implementation.[117] A frequent concern was the apparent lack of priority given in the Code to green infrastructure.[118] Green infrastructure refers to a network of multi-functional green space, which supports natural and ecological processes. Examples include parks, playing fields, woodland and green roofs. There was concern that the Code did not take a whole-area approach where the role of green infrastructure could be integrated into the built environment early in the planning process and within spatial plans.[119]

86. Wildlife and Countryside Link argued that designing for enhanced biodiversity should run "as a golden thread" throughout the Code, with the benefits of the integration of nature into development clearly cross-referenced throughout the Code and its supporting guidance.[120]

87. The Chartered Institution of Building Services Engineers (CIBSE) argued that under the proposed overhaul of the National Planning Policy Framework and the new NMDC, it was unclear how planning at the strategic local authority and regional scale would occur and what guidance and requirements would need to be followed.[121] CIBSE suggested that this could threaten the delivery of zero carbon infrastructure by local authorities.

88. Asked why there was no explanation of 'embodied energy' and little priority given to green infrastructure, Minister Hughes said:

> Government is there to set intentions, direction of travel, to give broad-brush guidance, and then it is for people to interpret locally to ensure that their interpretation and use of that code best suits their local circumstances. Sometimes I think less detail is better because that is less prescriptive and

114 Department for Levelling Up, Housing and Communities, Guidance National Model Design Code (July 2021)
115 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)
116 Section R.2.i. 'Embodied Energy' and R.2.ii. 'Sustainable Construction' both refer to 'embodied energy'
117 Landscape Institute (SBE0111); Wildlife and Countryside Link (SBE0073); CIBSE (Chartered Institution of Building Services Engineers) (SBE0090)
118 Landscape Institute (SBE0111); Wildlife and Countryside Link (SBE0073); CIBSE (Chartered Institution of Building Services Engineers) (SBE0090)
119 Landscape Institute (SBE0111)
120 Wildlife and Countryside Link (SBE0073)
121 CIBSE (Chartered Institution of Building Services Engineers) (SBE0090)

> allows for more innovation […] We are seeing some, but not all of the big product manufacturers who are listing embodied carbon elements in the products that they are producing, and so sometimes it is not necessary for the Government to be prescriptive about something.[122]

89. The Minister's assertion that detailed guidance on embodied carbon in construction was not necessary ran contrary to the majority of evidence we received from the construction industry, which consistently requested that the Government issue a national methodology, recommendations for tools and a requirement to undertake whole-life carbon assessments.[123]

Our view on the National Model Design Code

90. **The National Model Design Code represents a good start to the task of improving efficiency and reducing the environmental impact of materials used in construction. Regrettably, in its current form it does not provide the ambition or detailed guidance necessary if it is to make a meaningful contribution to addressing the climate and nature crises which the country faces. The code does not provide the supporting detail which design codes require to set standards related to whole-life carbon. The definition of 'embodied energy' it uses is confusing, and it offers no guidance on how to assess embodied carbon or how to mitigate these emissions.**

91. ***We recommend that the Government should change the term embodied energy to embodied carbon in the National Model Design Code and provide a clear definition of embodied carbon and whole-life carbon in the NMDC based on the WLCN, LETI and RIBA definitions.***[124] ***The Government should provide guidance on how to assess embodied carbon by setting a national methodology for whole-life carbon assessments, as we have recommended in Chapter 2 above.***

Using materials more efficiently

92. The carbon footprint of construction materials can be reduced by using materials in a resource efficient matter. LETI, the Embodied Carbon Group and UK Concrete all told us that that buildings often had redundancy in their design which could be reduced.[125] We heard that efficient, simpler configurations of structure and façade can dramatically decrease the embodied carbon of buildings, regardless of material.[126] Witnesses repeatedly stressed that if the Government were to mandate whole-life carbon reporting, and progressive carbon targets for building types, designers would follow by rationalising the design of buildings to conserve carbon.[127]

93. Professor Ramage explained why there were few current incentives to design efficiently:

122 Qq236–237
123 Dr Jannik Giesekam (Research Fellow in Industrial Climate Policy at University of Leeds) (SBE0075); Q112; Grantham Institute - Climate Change and Environment at Imperial College London (SBE0059); The Embodied Carbon Group (SBE0062); Chartered Institute of Building (SBE0063) Q112
124 These definitions are found here - WLCN, LETI and RIBA, Improving Consistency in Whole Life Carbon Assessment and Reporting, (May 2021).
125 Q120; Q140
126 The Embodied Carbon Group (SBE0062)
127 Q120

> One of the issues we have is the labour to design efficiently is far more expensive than the cost of the material when you design inefficiently. This is where Government regulation that has a penalty for inefficient design—that is, larger embodied carbon—will allow any infrastructure to be better designed.[128]

94. The Department for Environment, Food and Rural Affairs sought views on how to support greater resource efficiency in construction in its *Consultation on the draft Waste Prevention Programme for England: Towards a Resource-Efficient Economy*, issued in March 2021.[129] The Department's draft Programme proposed to:

- enable a shift in the design of construction products to encourage greater reuse and use of recycled materials;
- consult on Extended Producer Responsibility, for "certain materials in the construction & demolition sector", by the end of 2025;
- explore how embodied carbon can be reduced through waste prevention solutions; and
- use the planning process to promote sustainable resource use in new construction—which could include, for example, a preference for reuse and refurbishment of existing building stock or setting embodied carbon targets for new developments.[130]

95. The consultation closed in June 2021: the Government is yet to respond.

Concrete and cement

96. Concrete is a popular building material due to its longevity, fire, rot and flood resistance and low maintenance requirements.[131] Globally, concrete is the second most widely used commodity after water. The UK has around 1,000 concrete production facilities, providing 95 per cent of the UK's concrete demand.[132]

97. 90 per cent of construction and demolition waste is recovered or recycled[133] to produce materials such as concrete, brick and asphalt, but it is generally downcycled for use as aggregate.[134] The UK leads Europe on the market share of secondary and recycled aggregates, which make up 28 per cent of supply.[135]

98. Cement is one of the key ingredients of concrete: cement production is largely responsible for concrete's carbon footprint. The Mineral Products Association (MPA) reports that concrete and cement production contribute around 1.5% of the UK's total

128 Q144
129 Defra, Consultation on the Waste Prevention Programme for England: Towards a Resource-Efficient Economy, (June 2021)
130 Defra, Consultation on the Waste Prevention Programme for England: Towards a Resource-Efficient Economy, (June 2021)
131 MPA UK Concrete (SBE0069)
132 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
133 Department for the Environment, Food and Rural Affairs, UK Statistics on Waste. (July 2021)
134 Joe Penn (Architect at Rock Townsend); Matteo Sarno (Architect at Boito Sarno) (SBE0126)
135 MPA UK Concrete (SBE0069)

annual CO_2 emissions.[136] While some other construction materials (such as steel) have higher carbon footprints per unit mass,[137] the emissions per functional unit[138] and large amounts of cement consumed makes concrete a considerable contributor to CO_2 emissions and therefore a key focus for emissions reduction.[139]

99. The construction industry is trying to reduce emissions from the production of concrete through increasing energy efficiency, fuel switching and changing product formulations. The MPA told us that the industry had reduced its carbon emissions by 53 per cent since 1990.[140] Figures from the Office for National Statistics show that more recently, the emissions reductions trajectory has been less pronounced, with a 10 per cent reduction in total emissions from the manufacture of cement between 2008 and 2019.[141] In the MPA's net zero roadmap, carbon capture technology makes up 61 per cent of the sector's planned direct emissions reductions to 2050.[142]

100. Professor Ramage observed that future emission reductions for concrete might be limited because of the unavoidable CO_2 emissions (known as 'process emissions') which occur during the chemical reactions necessary to produce a cement binder called clinker.[143] He added that future reductions in energy efficiency per tonne of steel and cement were estimated to be limited to no greater than 24% and 13%, respectively.[144] Reductions in process emissions from concrete will require innovation in cement manufacture: this is already happening in the UK, where some manufacturers are blending different cementitious materials to reduce the need for high-carbon clinker.[145]

101. Chatham House research has highlighted that the use of clinker substitutes will be a significant challenge requiring regulatory and technical changes, as well as material and process innovation, particularly as the supply of certain substitutes is reliant on other industrial processes which are being phased out (in the case of coal) or replaced (steel).[146] There is also a limit to the proportion of clinker substitution that can be used.[147]

102. Chatham House noted that there was scope to increase the availability of traditional clinker substitutes in the short term through regulation.[148] For example, in the Netherlands, the use of clinker substitutes has been facilitated by bans on waste disposal for fly ash, sewage sludge and the disposal of concrete waste in landfills. This has encouraged coal and steel companies to find markets for their waste products as clinker substitutes. Chatham House recommended that regulations regarding waste products could include incentives

136 MPA UK Concrete (SBE0069)
137 Hammond, G. et al. (2011). Embodied Carbon. Inventory of Carbon & Energy V2.0. BSRIA (2011) ; Cambridge Architectural Research Ltd. LIFE Level(s): Supporting the Development of Quality Data. (2021)
138 Use of "functional units" allows for functionally equivalent structures to be compared.
139 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
140 Mineral Products Association, UK Concrete and Cement Industry Roadmap to Beyond Net Zero. (2020)
141 ONS, Atmospheric emissions: greenhouse gases by industry and gas. (September 2021)
142 Mineral Products Association, UK Concrete and Cement Industry Roadmap to Beyond Net Zero. (2020)
143 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)
144 Muller et al, Carbon Emissions of Infrastructure Development, Environmental Science & Technology (September 2013)
145 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
146 Chatham House, Making Concrete Change Innovation in Low-carbon Cement and Concrete (June 2018)
147 Buro Happold, Our Global Sustainability Report 2020: Innovating to meet net zero (2020)
148 Chatham House, Making Concrete Change Innovation in Low-carbon Cement and Concrete (June 2018) p44

to screen, test and reprocess fly ash and blast furnace slag from older disposal sites.[149] This could increase the availability of clinker substitutes in the short-term while addressing environmental concerns about these older disposal sites.

103. Other types of lower carbon cement are being developed. Some novel cements are now commercially available, though others are at earlier stages of development. Large-scale uptake has been limited.[150] Elaine Toogood, of UK Concrete, pointed out the need to share knowledge about the commercial availability of low-carbon concrete products more broadly across the construction industry to stimulate demand.[151] A further barrier to the development and use of low-carbon cements is that many of the standards, design codes and testing protocols for cement are based on traditional cement. The British Standards Institute has nevertheless indicated that niche cements under development could undergo rigorous UK-specific validation testing to provide the evidence base needed to approve them for general purpose applications.[152]

104. The Government acknowledges the challenges in the production of low-carbon cement in its Industrial Decarbonisation Strategy and has set itself actions to address these barriers.[153]

- Action 4.5 in the Strategy states that the Government will "work with the cement sector to explore options to decarbonise sites in dispersed locations".[154] As part of this, the construction sector is carrying out demonstrations of a 'zero carbon fuel mix' for cement kilns, funded by the BEIS fuel switching programme. Further research, funded by the BEIS Industrial Energy Efficiency Accelerator Programme, is enabling the sector to formulate and demonstrate new low carbon multi-component cements for the UK market;

- Action 6.5 states that Government will "support advancements in product innovation", including support for alternative cements;[155] and

- Action 6.1 states Government will "support innovation in fuel switching technologies, including low carbon electricity, hydrogen and biomass."[156]

105. The UK also co-leads the UN Industrial Deep Decarbonisation Initiative with India.[157] This initiative seeks to stimulate demand for low-carbon industrial materials by working to standardise carbon assessments, establish ambitious public and private sector procurement targets, incentivise investment into low-carbon product development and design industry guidelines. Under the initiative the UK wants to focus on how to use collective public procurement action to enhance the demand for green industrial products.[158]

149 *Ibid*, p45
150 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
151 Qq124–125
152 British Standards Institute, 'Masonry, Concrete and Cement Testing', accessed 25 April 2022
153 HM Government, Industrial Decarbonisation Strategy (March 2021) CP 399
154 *Ibid* p55
155 HM Government, Industrial Decarbonisation Strategy (March 2021) CP 399 p74
156 HM Government, Industrial Decarbonisation Strategy (March 2021) CP 399 p70
157 United Nations Industrial Development Organization (UNIDO), Industrial Deep Decarbonisation Initiative, accessed 11 May 2022
158 HM Government, Industrial Decarbonisation Strategy (March 2021) CP 399 p77

Our view on concrete and cement

106. **We welcome the Government's investment in the development of low-carbon cements as set out in the Industrial Decarbonisation Strategy. Alongside research and development, more needs to be done to raise awareness of low-carbon cements within the industry and amongst the public, to generate demand and increased investment in these products.**

107. ***The Department for Business, Energy, and Industrial Strategy should invest in raising awareness within the industry and amongst the public on the existence and benefits of low-carbon cement and continue to encourage research and development into new low-carbon products.***

108. ***We recommend that the Government investigate possible ways, beyond public procurement, to incentivise the use of low-carbon cement to ensure that these cement alternatives become the product type of choice by 2030. This should include an assessment of the feasibility of restricting the disposal of a range of waste products, so as to facilitate their use as clinker substitutes, as is the case in the Netherlands.***

Steel

109. In the UK, 95 per cent of all single-storey industrial buildings and 65 per cent of multi-storey non-residential buildings are framed in steel.[159] In 2019, the steel industry contributed to around 2.7 per cent of annual UK CO_2 emissions.[160] The integrated steel works in Scunthorpe and Port Talbot are the two largest industrial sources of UK carbon emissions. Together, they manufacture 78 per cent of UK-produced steel.[161]

110. In the EAC's inquiry on Technological Innovations for Climate Change: Green Steel, witnesses highlighted the construction sector provides an opportunity to support the decarbonisation of steel production, describing the sector as "an ideal vehicle to push net zero products through".[162]

111. Steel is typically produced by heating iron ore, coke and lime in a blast furnace.[163] The chemical reaction of reducing iron ore in the blast furnace leads to process emissions of CO_2. Most steel produced in the UK and globally is via the blast furnace technique.

112. Steel can also be produced in an electric arc furnace where scrap steel is used as the raw material and the furnace is heated using electricity.[164] This process does not produce process emissions of CO_2; therefore, it could be used as a low-carbon way to produce steel that does not require carbon capture. However, electric arc furnaces require large amounts of electrical power and water cooling, and their low-carbon credentials rely on decarbonisation of the electricity grid.

159 SteelConstruction.info, Sustainability, accessed 25 April 2022
160 Business Energy and Industrial Strategy Committee; written evidence from UK Steel (ETS0001)
161 Department for Business, Energy and Industrial Strategy, Final UK greenhouse gas emissions national statistics: 1990 to 2018, (February 2020)
162 Environmental Audit Committee, Oral evidence: Technological innovations and climate change: green steel, HC 1093, Q2
163 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
164 Ibid

113. There are a variety of ways to reduce emissions from steel production. These include:

- switching to lower carbon fuels as alternatives to coke (for example, hydrogen);
- using carbon capture technologies alongside blast furnace production to sequester emissions from continued coal use;
- improving the energy efficiency of both blast furnace and electric arc furnace steel production processes, and
- increasing the recycling rates of other steel products (for example steel packaging) to increase the availability of scrap metal.[165]

114. The Government's Industrial Decarbonisation Strategy cites carbon capture, usage and storage (CCUS) and the use of electric arc furnace as two of the major decarbonisation options for steel production sites.[166] In 2019 the Government released a consultation on the Clean Steel Fund with the aim of identifying barriers to decarbonising the steel sector and the technology options required for clean steel.[167] Responses to the consultation highlighted that one of the main barriers was the high cost of electricity. They also highlighted that the three main decarbonisation technologies (switching to lower carbon fuels such as hydrogen, use of carbon capture technologies and improving energy and material efficiency) all required further development to reduce the financial and technical risks. In the Government's response to the consultation, it concluded that in the short term, more immediate decarbonisation gains could be made by maximising recycling and reuse capabilities of steel, rather than attempting to fully decarbonise the primary production of steel.[168]

Steel recycling

115. Steel is one of the most recycled materials. In the UK, 94 per cent of steel is recycled when a building is demolished.[169] However, a 2018 OECD study predicted that the proportion of iron and steel produced through recycling would not change before 2060 globally, due to growth in overall demand for metals and growth in the amount of scrap metal available.[170]

116. During the Committee's inquiry into *Technological Innovations for Climate Change: Green Steel*, whilst the ability of recycled steel to meet future global demand was contested, written submissions generally agreed that there is room for the UK to make further use of its domestic scrap.[171] Scrap steel recycling uses electricity and decarbonisation of the

165 OECD, Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, (2019)
166 HM Government, Industrial Decarbonisation Strategy (March 2021) CP 399
167 Department for Business, Energy and Industrial Strategy, Clean steel fund call for evidence: summary of responses (December 2020)
168 BEIS, Creating a Clean Steel Fund: call for evidence (December 2020)
169 Tata Steel, Europe Sustainability Report 2019/2020 (2020)
170 OECD, Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, (2019)
171 Environmental Audit Committee, Technological Innovations and Climate Change: Green Steel, Publications, written evidence, Green Alliance (GST0008); UK FIRES - a UKRI-funded Research Programme of six universities and a subscribing consortium of industry partners (GST0002); Tata Steel UK Limited (GST0018); UK Steel (GST0011); European Metal Recycling Limited (GST0003)

electricity grid gives the potential for a virtually net zero steel recycling process.[172] The UK produces 11.3 million tonnes of scrap steel a year. Of this, 2.6 Mt is used in in domestic steel making, while the rest is exported.[173] In oral evidence, Professor Barbara Rossi argued:

> We are generating in the UK every year about 10 million tonnes of scrap and studies show that this is likely to increase to 20 million tonnes within the next decade. That is due to the fact that in the 1970s there was a boom in the construction sector… in the UK we are seeing that our needs for steel are stabilising at around 10 million tonnes to 12 million tonnes per annum … Studies also show that if we were to electrify all our current activities with what we have today, with the green electricity that we produce, we would possibly be able to get 70% of our steel made.[174]

117. The British Metals Recycling Association told us that the UK exports most of its steel scrap because it does not have the electric arc furnace capacity to use more. British Steel admitted that the UK had been slow to adopt electric arc furnace production.[175]

118. Industry experts have highlighted that the relatively high industrial price of electricity in the UK can deter greater use of scrap recycling.[176] Witnesses also noted that the steel market could be volatile by comparison with the concrete market, while the current low availability in the UK of electric arc furnace-produced steel often resulted in clients choosing European steel manufacturers.[177]

Steel reuse

119. Steel products can be designed for direct reuse. Since steel reuse involves minimal reprocessing, the resulting emissions are far lower than for steel recycling.[178] The concept of 'Design for Manufacture and Assembly' promotes the reuse of steel components, by using standardised parts and designing structures that can be dismantled and repurposed.

120. Steel reuse is not yet common practice in the UK.[179] The Department for Business, Energy and Industrial Strategy and the Infrastructure and Projects Authority are exploring how to increase steel reuse in the construction sector.

121. A principal barrier to greater steel reuse is the collection, storage, testing and certification of used steel components.[180] This was summarised by Dr Joe Jack Williams of Feilden Clegg Bradley Studios:

172 Allwood, J. et al. (2019). Absolute Zero. Apollo - University of Cambridge Repository.
173 Hall, R., Zhang, W., Li, Z. (2021) Domestic scrap steel recycling- economic, environmental and social opportunities. DEFRA Science and Research Projects (2021).
174 Environmental Audit Committee, Oral evidence: Technological innovations and climate change: green steel, HC 1093, Q13
175 Environmental Audit Committee, Oral evidence: Technological innovations and climate change: green steel, HC 1093, Q88
176 Department for Business, Energy and Industrial Strategy, Clean steel fund call for evidence: summary of responses (December 2020).
177 Q128
178 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
179 Densley Tingley, D. et al, "*Understanding and overcoming the barriers to structural steel reuse, a UK perspective.*" Journal of Cleaner Production, Vol 148, (2017) pp 642–652
180 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021; Q129

> One of the key issues of reusing steel […] is the reuse supply chain. Lining up buildings that need those steel beams at the same time is very rarely going to happen, so you need places to store them, which is cost intensive. Also there is warranty in building, so [there is a need to establish] that [a reused] steel member is still a valid steel member for the structural application that it will be used for.[181]

122. Dr Williams stated that performance verification and the insurance market needed to catch up with the ability to reuse steel in construction. Louisa Bowles, of LETI, suggested that storage and a cataloguing process could be made available at local authority level, so that steel could be stored properly, catalogued, checked, and warrantied for reuse.[182] Designers should then be made aware of what materials are available through "local area networks." Dr Williams saw a role for Government in the insurance and warranty aspects of steel reuse, through underwriting the risk of reused steel.[183]

123. There was consensus amongst witnesses that the most effective way to encourage development and use of low-carbon materials like reused steel, was to set a legal requirement to measure whole-life carbon and introduce progressively more stringent carbon targets on buildings.[184]

124. The Industrial Decarbonisation Strategy commits the Government to "considering the implications of the recommendation of the Climate Change Committee to set targets for ore-based steelmaking to reach near zero emissions by 2035."[185] In collaboration with the Steel Council, the Government seeks to address this action and consider the business environment necessary to support the transition. The Government has already set up demonstration funding for the £250 million Green Steel Fund which aims to enable the transition to lower carbon iron and steel production through supporting new technologies and processes. In response to the Clean Steel Fund Call for Evidence, the Department for Business, Energy and Industrial Strategy concluded that the Clean Steel Fund would not be released until 2023, to allow the sector to develop decarbonisation plans and to allow time to align the fund with the Industrial Energy Transformation Fund and Net Zero Hydrogen Fund.[186]

Our view on steel

125. **The reuse of steel components is not yet common practice in the UK. One of the main barriers to steel reuse is the collection, storage, testing and certification of used steel components. The Department for Business, Energy and Industrial Strategy and the Infrastructure and Projects Authority are already investing in how to better promote recycling and reuse of steel, alongside long-term investment in decarbonising the primary production of steel.**

181 Q129
182 Q133
183 Q135
184 Q126
185 HM Government, Industrial Decarbonisation Strategy (March 2021) CP 399 p53
186 Department for Business, Energy and Industrial Strategy, Summary of Responses to the Clean Steel Fund Call for Evidence. (December, 2020)

126. **Mandating whole-life carbon assessments for buildings, as we have already recommended, would be a simple, material neutral way of encouraging the greater reuse and recycling of steel components.**

127. ***The Government should work with local authorities to investigate effective and appropriate ways to store and catalogue steel components for reuse and to communicate the availability of components across local area networks of constructors prepared to reuse steel.***

128. We are making further recommendations to Ministers regarding green steel, following up on issues arising from our inquiry into *Technological Innovations and Climate Change: Green Steel*.[187]

Timber

129. 28 per cent of new build homes in the UK used timber frames in 2016.[188] There are large variations in timber uptake across the component nations of the UK. Timber use in Scotland is high (at 83 per cent in 2016), while its use in England, Wales, and Northern Ireland is comparatively low, at 23 per cent, 31 per cent, and 17 per cent, respectively.[189]

130. The CCC has recommended that the use of timber in UK construction increase to 40 per cent by 2050 and has called on the Government to introduce policy to support this.[190] Timber Development UK told us that in their view neither DLUHC or BEIS had developed or implemented any policies which incentivised the use of low-carbon materials to reduce the embodied carbon impact of construction.[191]

131. While materials need to be appropriately used and selected for their required purpose, many of the academics and architects we heard from recognised that the use of timber (subject to forestry management) in place of concrete, masonry and steel was one of the most successful strategies to reduce embodied carbon.[192] This conclusion is borne out by analysis from the International Energy Agency, which conducted a meta-analysis of over 80, mostly European, case studies of the embodied carbon in individual buildings.[193]

132. Significant obstacles remain and a lack of incentives persists preventing greater uptake of structural timber products. These include issues arising from fire risk and insurance, price volatility, securing sustainable and local supply chains, and addressing skills gaps in the use of timber.

187 Environmental Audit Committee, Technological Innovations and Climate Change: Green Steel, Publications, accessed 12 May 2022

188 Structural Timber Association (SBE0003)

189 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)

190 Climate Change Committee Biomass in a low-carbon economy (November 2018); Committee on Climate Change, UK Housing Fit for the Future (2019)

191 Timber Development UK, Timber Trade Federation, Timber Research and Development Association (SBE0042)

192 Built Environment group, The Open University School of Engineering and Innovation (SBE0131); SBE0052 Dr Danielle Densley Tingley et al; Q137; Wood for Good (SBE0072); Structural Timber Association (SBE0003); WSP UK (SBE0087); Marlene Cramer (Research Assistant at Edinburgh Napier University) (SBE0097); Historic England (SBE0098)

193 International Energy Agency, Evaluation of Embodied Energy and CO2eq for Building Construction (Annex 57), (September 2016)

The Government's position on timber

133. Both in the Government's Clean Growth Strategy[194] and its 25 Year Environment Plan[195] the Government has committed to increasing the use of timber in construction. In the England Tree Action Plan, Defra also committed to providing financial support to:

- develop innovative timber products through the Forestry Innovation Fund;
- develop a policy roadmap on the use of timber in construction;
- increase public demand for sustainably sourced timber;
- work with Homes England to increase timber use in the delivery of housing programmes; and
- encourage research into barriers to the uptake of timber.[196]

Despite these initiatives, contributors to the inquiry consistently told us that there were limited incentives and significant challenges to using timber in construction in the UK, not least in securing consistent quality sources of domestic supply.

Challenges associated with timber use in construction

Material safety and fire risk

134. In 2018, as a consequence of the Grenfell Tower fire in June 2017, a ban was introduced on the use of combustible materials in the external walls of residential buildings with a floor above 18 metres.[197] The ban restricts the use of structural timber in a building's external wall. Several contributors told us that this affected the use of timber in construction, as the ban did not differentiate between external cladding and a building's structural wall, causing technical specification problems.[198]

194 Department for Business, Energy & Industrial Strategy, Clean Growth Strategy. (October 2017)
195 Department for Environment, Food & Rural Affairs (2018). A Green Future: Our 25 Year Plan to Improve the Environment. (January 2018)
196 Department for Environment, Food & Rural Affairs, The England Trees Action Plan (May 2021)
197 Department for Levelling Up, Housing and Communities, Ban on combustible materials (November 2018)
198 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106); Joey Gardiner (2020). Architects campaign to stop CLT ban. Housing Today.

135. RIBA said that the implementation of the ban would have a detrimental effect on innovation in structural timber as development and testing might now not be undertaken. RIBA recommended that the ban should not include the building's primary structure, which is often used to limit carbon emissions.[199] Professor Michael Ramage, representing the Centre for Natural Material Innovation, University of Cambridge, said that the ban threatened to limit timber's application to residential and low-rise buildings and had already inhibited growth in the engineered timber industry.[200] Sam Liptrott, Director at OFR, a fire and risk consultancy, said that:

> The ban has effectively completely torpedoed any chance of using timber in high rise or medium-rise residential across the country. We have seen multiple schemes—10 or 15 timber residential schemes—that have died as a result of the ban.[201]

136. UKGBC, academics from Sheffield University and RIBA said that the Government must undertake further research into the use of structural timber within external walls to determine and quantify its performance when subjected to real fire loads.[202] Academics from Sheffield University also recommended that existing legislation be examined to identify any unnecessary restrictions on the use of mass timber.[203] Michael Ramage said that research has demonstrated that timber, used as a primary structural material, could provide sufficient fire protection when encapsulated in non-combustible material:[204]

> The combustible materials ban has had a disproportionate effect on timber construction and one government policy is making another government policy, [net zero], untenable. There needs to be a middle ground where we can acknowledge that combustible materials as cladding are a bad idea, but timber as a structural material can be built fire-safe and that should be independent of a combustible material ban on cladding.[205]

137. Will Arnold, Head of Climate Action at the Institution of Structural Engineers, told us that current building regulations did not contemplate the use of modern timber materials, creating further barriers to developers seeking to use timber:

> [W]ithin the building regulations and within the codes, the codes that deal with fire in buildings do not account for how timber behaves in fire in buildings. The codes also do not tell you what timber detailing will pass muster from a fire point of view and what will not.
>
> There is a bit of a gap here. It is filling that gap, either by the development of some kind of framework or standard or something that linked the existing fire codes back to how timber behaves in a fire, and/or standards for details, which is where a lot of the problems come from.[206]

199 Royal Institute of British Architects (SBE0039)
200 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)
201 Q153
202 UK Green Building Council (SBE0144); see also Royal Institute of British Architects (SBE0039); Dr Danielle Densley Tingley (Senior Lecturer at University of Sheffield) et al (SBE0052)
203 Dr Danielle Densley Tingley (Senior Lecturer at University of Sheffield) et al (SBE0052)
204 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)
205 Q155
206 Q163

138. In 2020, the Government launched a consultation on proposed amendments to the combustible materials ban, including expanding it to hotels, hostels and boarding houses, and lowering the height threshold of the ban to 11 metres.[207] The consultation closed in May 2020. The Government response is yet to be published.

139. In its 2021 Progress Report to Parliament, the CCC recommended that the Government clarify the position of structural timber in the ban on combustible materials, underpinned by further research where needed to ensure there are no barriers to the safe use of timber in buildings.[208] Michael Ramage recommended that the clarification and amendments were necessary to focus the ban of combustible materials on cladding panels only, so as to make a clear distinction between cladding and primary structure.[209]

140. On the subject of testing and research, Minister Eddie Hughes said that:

> Lord Goldsmith has convened a committee, across Government Departments and interacting with industry, to look at how we make best use of timber, what the blockers are to it being used and ensure that we work with the sector to develop that testing.[210]

Insurance against timber framed buildings

141. Materials safety perceptions have also affected the availability and cost of insurance for timber framed buildings. Architectural practice HTA Design LLP told us that insurers and asset managers were "either refusing to take over buildings with wooden construction or [were] increasing the insurance premiums."[211]

142. The evidence we received suggested that the cost of insurance was now playing a decisive role in material and building design choices and that there was a potential reluctance to use timber for construction, even in buildings not directly affected by the ban on combustible materials.[212] Sam Liptrott said that in the last 12 months alone he had worked on "six mass timber office buildings that have flipped from timber to steel and concrete because insurance could not be procured for those buildings."[213]

143. Minister Hughes told us that Government was aware of the issue and was working with insurance companies to develop a proportionate risk-based approach to timber products. [214]

Sustainable and local supply chains

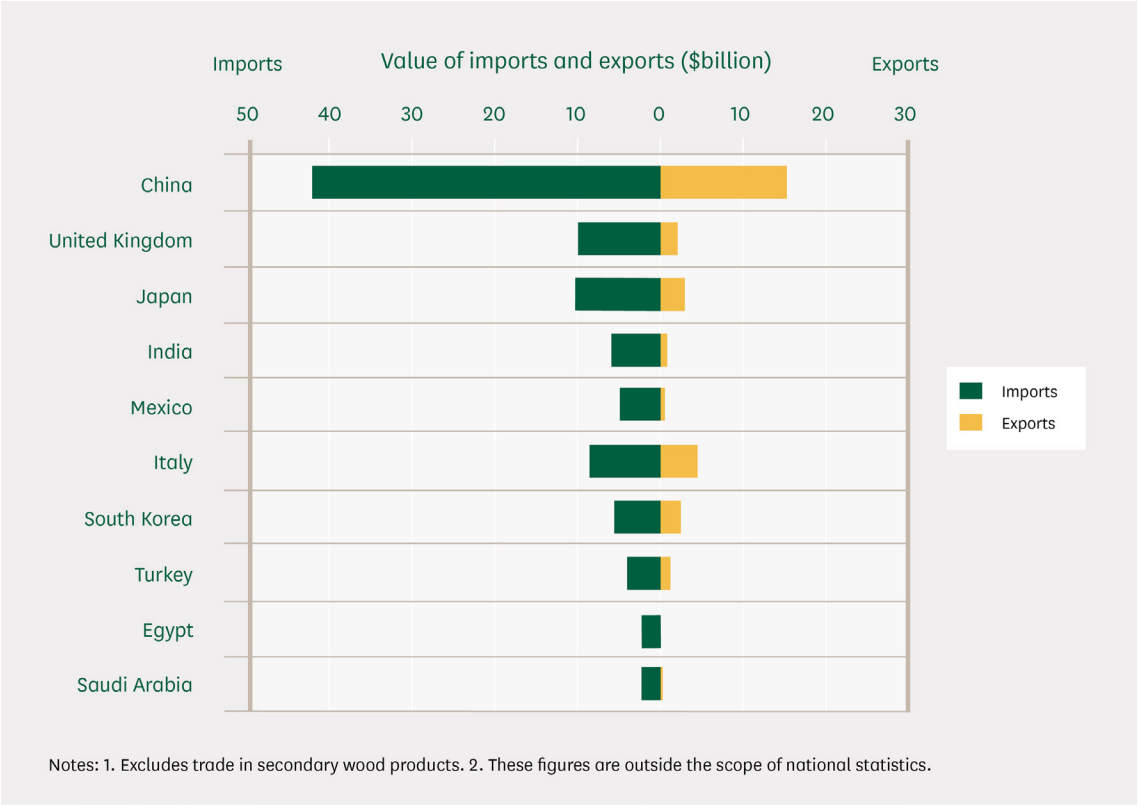
144. In 2020, the UK imported over 80 per cent of the timber it consumed.[215] The UK was the second largest net importer of forest products in 2016 (see Figure 4 below). Most global production of timber has come from North America, Russia, China and Brazil and global

207 Department for Levelling Up, Housing and Communities, Review of the ban on the use of combustible materials in and on the external walls of buildings (January 2020)
208 Climate Change Committee, 2021 Progress Report to Parliament. Progress in reducing emissions (June 2021)
209 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)
210 Q242
211 HTA Design LLP (SBE0044)
212 RICS, Whole Life Carbon Assessment for the Built Environment, 1st Edition, (November 2017)
213 Q158
214 Q243
215 Forest Research, Forestry Statistics 2021 Chapter 3: Trade, 30 September 2021

production is increasing over time to meet rising demand. The World Bank estimates that global timber demand will quadruple by 2050, which may create challenges for sustainable timber production and lead to greater land tenure disputes and biodiversity loss.[216] The recent sanctions on importing materials from Russia will exacerbate these pressures on supply from remaining timber exporting nations.[217]

145. The CCC has recommended that the Government develops a UK policy roadmap on the use of timber, including policies to support sustainable UK wood supply chains.[218] The CCC has also recommended the strengthening of governance over forest risk commodities, so as to manage land use and deforestation risks. The Environment Act 2021 introduced provisions to make it illegal for large businesses in the UK to use forest risk commodities produced on land illegally occupied or used.[219]

Figure 4: Largest net importers of forest products, 2016



Notes: 1. Excludes trade in secondary wood products. 2. These figures are outside the scope of national statistics.

Source: Forest Research (2016)[220]

216 World Bank Group, Forest Action Plan (April 2016) ; *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021

217 France24, EU adopts fresh sanctions against Russia including coal import ban, 8 April 2022

218 Climate Change Committee, 2021 Progress Report to Parliament. Progress in reducing emissions (June 2021)

219 Department for Environment, Food & Rural Affairs, Tackling illegal deforestation in UK supply chains (December 2021)

220 Forest Research, 'World trade in forest products', accessed 16 April 2022

Skills gaps

146. Structural engineers and construction teams have only recently been trained to design and build with modern timber products. National skills in the management of hardwood forest and forestry wood science are in decline due to increasing levels of imported timber.[221] This is creating skills gaps in the UK construction sector.

147. Sam Liptrott told us that:

> The issue we have with timber is there is a relative paucity of competence when it comes to the ability to design and build in timber. It is not a common building type. There are not very many timber buildings in the UK. We do not have a long history of building in timber in the same way, for example, as in Scandinavia or mainland Europe. That means when it comes to having some form of reliability and trust that the designer and constructors will do the right thing and understand what the right thing is, insurers are—somewhat understandably—a little bit reticent.[222]

Ways to support timber in construction

148. Primarily, witnesses and written evidence submissions recommended that the Government support greater research into the safe use of timber products so regulations and bans could be refined, and insurance markets opened. Witnesses who were more confident in the safety aspects of timber recommended policies which directly supported greater use of timber in construction.

149. Recommendations on how to support the timber industry included:

- **Investment in greater research and testing:** Will Arnold, of the Institution of Structural Engineers, recommended developing an evidence base and running more testing of how timber behaves in fire and how fire risks could be mitigated. He said that current knowledge was not on the same level as that of other materials and knowledge gaps needed to be filled so the blanket ban could be made more specific and nuanced.[223] Sam Liptrott told us that currently the private sector was providing the funds for research, but it was not being matched by Government funding. He said that whilst Government had been investing in research to underpin the next iteration of building regulations, none of this was focused on timber.[224] Minister Hughes agreed that the Government needed to support testing of new timber products and keep up with the pace of innovation in this sector.[225]

221 Department for Environment, Food & Rural Affairs, Independent Panel on Forestry: Final Report (July 2012)
222 Q158
223 Q157
224 Q160
225 Q241

- **Mandating whole life carbon assessments**: several witnesses recommended the mandating of whole-life carbon assessments, a measure which would give automatic incentives to the construction industry to start choosing lower-carbon materials, leading to greater timber use. [226]

- **Targets for use of low-carbon material:** these targets could either be for specific wood products or general embodied carbon targets for buildings.[227]

- **Public procurement**: for example mandating use of wood in public buildings. France has mandated that all new public buildings must contain 50% natural materials (timber, hemp, straw).[228] Professor Ramage recommended a similar policy be introduced for UK construction to create the demand volume and predictability needed to stimulate a domestic natural building materials industry in the UK.[229]

Our view on timber in construction

150. **Significant obstacles to the uptake of timber products in construction remain. These include issues regarding fire risk and insurance, price volatility, securing sustainable and local supply chains, and addressing skills gaps in the use of timber. The Government has made little progress in addressing these barriers since the Climate Change Committee's 2019 recommendation for an increase in the use of timber in construction.**

151. **The post-Grenfell prohibition on the use of combustible materials in external walls has had a disproportionate impact on the use, innovation and testing of structural timber. Material safety perceptions have also affected the availability and cost of insurance, making it near impossible for developers to use timber in high rise or medium-rise buildings. There has been a substantial delay in the Government's response to its consultation on amendments to the combustible materials ban, which closed in May 2020. This delay is unacceptable: it has left the construction industry without the guidance and confidence it needs to invest in timber structures.**

152. **Whilst timber is often the most appropriate material to use to lower the embodied carbon of a building project, it cannot be assumed that this will always be the case. Timber use, from appropriate sources, should be verified as the best whole-life carbon answer to a given construction project, in comparison to other alternatives. Timber use should be seen in the context of UK, European and global forestry resources. A major increase in the use of timber in UK construction will put pressure on existing timber resources.**

153. ***The Government must develop a coherent policy, joined up across Departments, to address the need for increased tree planting to address biodiversity and climate change concerns and the need for sustainable commercial plantations using appropriate***

226 Chartered Institute of Building (SBE0063); Green Alliance (SBE0135); Dr Niamh Murtagh et al (SBE0035); Royal Institute of British Architects (SBE0039); Royal Institution of Chartered Surveyors (SBE0083); The Institution of Structural Engineers (SBE0080); Historic England (SBE0098); UK Green Building Council (SBE0144)

227 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106); The Institution of Structural Engineers (SBE0080)

228 *Reducing the whole life carbon impact of buildings*, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021; Q129

229 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)

tree species to meet the demand for domestic timber in construction. Government has committed to developing a policy roadmap on use of timber in construction. This should be delivered by the end of 2022 at the latest: it must comprehensively address the afforestation commitments made in the England Tree Action Plan and the need for timber construction products.

154. ***In response to this report, Government should set out how its strategies to develop green jobs will address the need for skills in timber use in construction.***

155. ***The Government must invest now in further research and safety testing on the use of structural timber. The outcome of such research must inform a review of all relevant building regulations so as to render them properly applicable to modern timber materials and to ensure that fire safety regulations can take account of how modern timber materials behave in fire. The Government's response to the consultation on proposed amendments to the combustible materials ban must now include clarification of the Government's position of structural timber in the ban on combustible materials. The Government's response to the consultation should be issued at the latest before the House rises for the 2022 summer recess.***

Environmental Product Declarations

156. Throughout the inquiry we heard that a lack of Environmental Product Declarations for a wide range of materials was limiting developers' ability to choose low-carbon materials sourced in the UK.[230]

Box 2: Environmental Product Declarations

An Environmental Product Declaration (EPD) is a document which transparently communicates the environmental performance or impact of any product or material over its lifetime. Within the construction industry, EPDs support carbon emission reduction by making it possible to compare the impacts of different materials and products in order to select the most sustainable option. The British Standard BS EN 15804 sets out how EPDs should be undertaken.

Source: One Click LCA Ltd (2022)[231]

157. Elaine Toogood, of UK Concrete, said EPD data was needed so that designers could input it into whole-life carbon tools at an early stage and make informed decisions on low-carbon design.[232] She recommended that the Government provide incentives to collect this data and publish it transparently, by establishing a requirement in its own procurement practices.

158. Louisa Bowles, of LETI, told us that more companies and suppliers were realising that having an EPD to report their data gave them a competitive advantage.[233] The barrier her firm had encountered was the lack of a centralised national database of EPDs. Designers therefore had to call individual suppliers to seek the information, a time-consuming practice which was beyond the reach of smaller practices with less resource. The data and evidence ought to be collated in an accessible resource which would be free to use.

230 Q113; Q116; Q73; Qq77–78; Q64
231 One Click LCDA Ltd, A simple guide to Environmental Product Declarations, accessed 26 April 2022
232 Q113
233 Q116

EPD data on European products was more readily available than products and materials sourced in the UK, presenting a challenge to the construction of low-carbon buildings with locally sourced materials.

159. France[234], Germany[235] and the Netherlands[236] all have Government-funded EPD databases. In the absence of a similar UK Government initiative, Jane Anderson, Board Member, The Alliance for Sustainable Building Products (ASBP), said that RICS was currently developing a national database of generic data and embodied carbon data from EPDs.[237]

160. Dr Jannik Giesekam, of the University of Strathclyde, agreed with Louisa Bowles' analysis concerning the lack of EPDs in the UK:

> You only have a few hundred [EPDs] that were produced in the UK, compared to about 10,000 or so globally. Countries like France have much better data availability than we have in the UK at present, partly because of the requirements that they have had in place for a number of years now. Overcoming that barrier will require some degree of intervention[238].

161. Dr Giesekam noted that some countries had introduced complementary measures alongside mandating whole-life carbon assessments to address the issue of data availability.[239] Suppliers in France who wish to make an environmental claim about a product must produce an EPD to substantiate it. We heard that these practices were advancing the availability of data to inform carbon assessments of buildings. Some countries have provided subsidies or financial support to smaller manufacturers to enable them to produce EPDs for their materials.[240]

Our view on environmental product declarations

162. **There is a lack of Environmental Product Declaration (EPD) data for a wide range of materials, limiting the ability of developers to choose low-carbon materials. The UK is falling behind European counterparts where EPD data is far more widely available, resulting in developers choosing European materials over locally sourced UK products. The lack of EPD data makes conducting whole-life carbon assessments more laborious and expensive than necessary.**

163. ***The Government should encourage development of a centralised national database of EPDs and, through its own procurement practices require the collection and publication of EPDs. The EPD database should be digital, freely available to end users, and user-friendly.***

164. ***To limit 'greenwashing', the Government should introduce measures requiring suppliers who wish to make an environmental claim about a construction product to produce an EPD to substantiate it.***

234 Inies, 'Inies and its data', accessed 26 April 2022
235 The Federal Ministry for Housing, Urban Development and Building (BMWSB), Germany, 'ÖKOBAUDAT platform', accessed 26 April 2022
236 Nationale MilieuDATABASE, Netherlands 'An introduction to the NMD', accessed 26 April 2022
237 Q36
238 Q73
239 Q64; Q73
240 Q73 Qq77–78

165. ***The Government should conduct a cost-benefit analysis of whether to provide advice or financial support to smaller manufacturers to enable them to produce EPDs for their materials.***

Overall conclusions on building materials

166. **There is availability of low-carbon and recycled building products to meet current demand, however there are insufficient incentives for product manufacturers to develop new low-carbon materials and for developers and designers to use these products. The Government has invested in initiatives and programmes, set out in the Industrial Decarbonisation Strategy, to encourage the development and use of low-carbon materials. This is welcome; but as there is no requirement to conduct whole-life carbon assessments of building projects, there remain limited incentives to reduce the embodied carbon of building projects and thus develop and use low-carbon materials.**

167. **In our view, the most effective way overall to encourage resource efficiency and the development and use of low-carbon materials, whether low-carbon concrete, steel, timber, or any other material, is to establish a mandatory requirement to measure whole-life carbon and introduce progressively more stringent carbon targets on buildings.**

168. ***The Government should also issue its response to the consultation on the draft Waste Prevention Programme for England: Towards a Resource-Efficient Economy not later than the date the House rises for the 2022 summer recess. This will be over a year since the consultation closed. Industry and stakeholders require clear direction on future plans for waste prevention and resource efficiency now.***

4 Government procurement

169. As a significant buyer of industrial products for construction, the Government can directly increase demand for low-carbon products.[241] For instance in 2018/19, the UK Government spent at least £81 million on procuring UK-made steel.[242] In the March 2021 Industrial Decarbonisation Strategy, the Government committed itself to using public procurement to drive demand for low carbon industrial products.[243] The Government was expected to bring a Procurement Bill forward in the 2022–23 Session.[244] In the Government's green paper on transforming public procurement, it said that the Procurement Bill would encourage public authorities to have regard for wider economic, social and environmental outcomes of procurement throughout the procurement process.

170. We heard about clear opportunities for the Government to provide further leadership in the field of sustainable materials procurement by making changes to its policies and practices. A report commissioned by the CCC to consider options for incorporating embodied carbon into the building standards framework recommended that the Government could monitor embodied carbon and lead with mandatory reporting and reduction through its own procurement.[245] This recommendation was endorsed by the CCC in its own report into *Biomass in a low-carbon economy*.[246] The Alliance for Sustainable Building Products and the Mineral Products Association supported this recommendation, noting that this could stimulate development and demand for low-carbon materials, in turn creating demand, predictability and incentives for the industry to invest in these materials.[247]

171. Professor Michael Ramage, University of Cambridge, suggested three ways in which changes to government procurement practice could aid sustainable construction:

- Introduce a "low-carbon standard" as a requirement for government buildings;
- Require "independently certified responsible sourcing" for materials used for government buildings, as is required for timber; and
- Introduce a "natural materials building mandate" similar to France where government buildings must contain 50 per cent natural materials. [248]

172. Elaine Toogood of UK Concrete, representing the Minerals Product Association, observed that a current challenge in the low-carbon design field was a lack of generic environmental product data for materials across all sectors which was sufficient to inform the design stage.[249] A definition of Environmental Product Declarations (EPDs) is provided in Box 2 on page 45. Public procurement of low-carbon materials could incentivise firms to fill data gaps in the EPDs produced for materials.[250]

241 Department for Business, Energy and Industrial Strategy, Industrial Decarbonisation Strategy (March 2020) p 42
242 Department for Business, Energy and Industrial Strategy, Steel public procurement 2020 (October 2020)
243 Department for Business, Energy and Industrial Strategy, Industrial Decarbonisation Strategy (March 2020) p 42
244 House of Commons Library, Queen's Speech 2022, Number 9521 8 April 2022 ; the Bill was introduced to the House of Lords on 11 May 2022 as Bill 4 [HL].
245 AECOM on behalf of the Climate Change Committee, Options for incorporating embodied and sequestered carbon into the building standards framework (AECOM) (July 2019); Q11
246 Committee on Climate Change, Biomass in a low-carbon economy (November 2018) p139-140
247 The Alliance for Sustainable Building Products (ASBP) (SBE0027); Q113
248 Q149
249 Q113, Q149
250 Q113

Whole-life carbon assessments for Government projects

173. The Government's 2020 Construction Playbook expects whole-life carbon assessments to be undertaken for all public works projects and programmes (including buildings and transport infrastructure).[251] This applies to all contracting authorities within central Government departments and their arm's length bodies.

174. Assessments are to be undertaken on a on a 'comply or explain' basis: contracting authorities should provide whole-life carbon assessments or provide reasons for why this has not been done. Performance against this requirement remains unclear as data is not currently held centrally on the percentage of public projects that have undertaken whole life carbon (WLC) assessments.[252] We were told that the Infrastructure and Projects Authority (IPA) was leading work across government departments to develop and implement a common set of metrics to understand better construction performance across government and support organisations in improving delivery performance, including on whole-life carbon.[253] The focus of this work was currently on attaining high quality and consistent WLC reporting in the run up to the requirement for public projects disclosure of embodied carbon emissions by 2025, as part of the Industrial Deep Decarbonisation Initiative pledge supported by the UK at COP26.[254]

175. Stakeholders have raised several concerns about the provisions set out in the 2020 Playbook.[255] They argued that the 'comply or explain' basis for WLC assessments could give contracting authorities the leeway to forego an assessment on pain of making an explanation.[256] The Playbook currently stipulates that contracting authorities "should" undertake WLC assessments: it was suggested that this be made a mandatory requirement (by substituting "should" with "must").

176. We commented earlier on the lack of a common standard for whole-life carbon assessments: the diversity of assessment software tools currently on offer create inconsistencies in assessments and make like-for-like comparison of projects difficult. In July 2021 the Infrastructure and Projects Authority updated its Best Practice in Benchmarking Guidance to provide a structured approach for organisations introducing whole-life carbon assessments in their data collection and reporting practices.[257]

177. In June 2021 the Government published a National Procurement Policy Statement. The statement included a clause stating that contracting authorities should consider social value outcomes related to tackling climate change and reducing waste, alongside any additional local priorities when undertaking public procurement.[258]

251 Cabinet Office, The Construction Playbook (December 2020)
252 Cabinet Office, Department for Business, Energy and Industrial Strategy, Department for Levelling Up, Housing and Communities, Department for Environment, Food and Rural Affairs (SBE0156)
253 Cabinet Office, Department for Business, Energy and Industrial Strategy, Department for Levelling Up, Housing and Communities, Department for Environment, Food and Rural Affairs (SBE0156)
254 UNIDO, 'Industrial Deep Decarbonisation Initiative', accessed 26 April 2022
255 Reducing the whole life carbon impact of buildings, POSTbrief 44, Parliamentary Office of Science and Technology, 4 November 2021
256 Jane Anderson (Director at Construction LCA Ltd) (SBE0155)
257 Infrastructure and Projects Authority, Best Practice in Benchmarking. Government Project Delivery Framework (March 2019)
258 Cabinet Office, Procurement Policy Note 05/21: National Procurement Policy Statement (June 2021)

178. Questioned on the Government's plans to improve procurement practices in this area, Lord Callanan said that under new procurement policies, in force since October 2021 "all Government suppliers bidding for contracts above £5 million [are] required to disclose the carbon footprint of projects":

> If they do not comply with net zero provisions, it is possible they could be removed from Government procurement lists for the future.[259]

179. In the 2022 Queen's Speech the Government announced that it planned to introduce its Procurement Bill during the 2022–23 Session, to simplify public sector procurement and to provide new opportunities for small businesses.[260] Among other elements, the Government intends that the bill will:

(1) give public sector buyers more flexibility to design the buying process to meet their specific procurement needs;

(2) enshrine in law the objectives of public procurement including maximising public benefit, and

(3) require buyers to have regard to the Government's strategic priorities for public procurement as set out in the National Procurement Policy Statement.[261]

The strategic priorities set out in the policy statement include consideration of social value outcomes related to tackling climate change and waste. The Government states that the bill will also provide 'several sector-specific features where necessary'.

Our view on Government procurement to drive sustainable construction

180. **The Government has committed to using public procurement to drive demand for low-carbon industrial products and expects whole-life carbon assessments to be undertaken in respect of all public works projects. The extent to which this expectation is met, and the impact it has had on procurement practice, is unclear. Guidance that contracting authorities should consider environmental impacts when undertaking public procurement is little more than advisory.**

181. **Public procurement policy which mandates the completion of whole-life carbon assessments could kick-start the market for low-carbon construction. In time, a low-carbon standard for public works projects would help to remove the data barriers to establishing this market. The introduction of a Procurement Bill in the 2022–23 Session provides an opportunity for the Government to legislate for whole-life carbon assessments to be included in assessment of competing tenders for publicly financed building projects. This would strengthen the guidance in the Construction Playbook.**

182. ***We recommend that, in its response to this report, the Government should set out the number and proportion of public works construction projects for which whole-life carbon assessments have been undertaken pursuant to the provision in the 2020 Construction Playbook. For each project where an assessment has not been undertaken, we recommend that the justification be published.***

259 Q223

260 Prime Minister's Office, Queen's Speech 2022, 10 May 2022

261 Prime Minister's Office, The Queen's Speech 2022: background briefing notes, 10 May 2022. The Bill was introduced to the House of Lords on 11 May 2022: Procurement Bill [HL]

183. ***We recommend that the Infrastructure and Projects Authority establish clear guidance on the criteria for exemption from conducting whole-life carbon assessments for public works projects. We further recommend that, not later than the spring of 2023, the Government undertake a feasibility study on the introduction of a low-carbon standard for all public works projects, with a view to its swift implementation.***

184. ***We recommend that the Government bring forward legislative proposals, by amending the Procurement Bill if necessary, so as to require a whole-life carbon assessment to be produced as a condition of participation in any tender for publicly financed building projects.***

5 Retrofit and reuse of existing buildings

185. The construction, demolition and excavation sector is responsible for 62 per cent of the total waste generated in the UK.[262] It is estimated that 80 per cent of buildings currently standing will still be in use in 2050: if the UK is to meet its net zero goals, the majority of these will require retrofitting to become energy efficient.[263]

186. There is a clear policy imperative to reduce the consumption of resources in the building and construction sector, to reduce waste material arising from demolition and replacement of existing properties, and to prioritise work to reduce emissions attributable to the built environment.

187. The evidence we received consistently recommended that retrofit and reuse be prioritised over new build[264] in order to conserve resources, reduce waste, minimise embodied carbon emissions, and provide a cost-effective solution to delivering on housing demands. [265] For example, Portsmouth City Council decided that when undertaking major refurbishment of Wilmcote House (a high-rise housing estate), after accounting for the cost of demolition, rebuilding, disturbance allowance and rent loss, and the savings on building maintenance, a high quality refurbishment was cheaper over a 30-year-plan than demolition and replacement.[266] The Chartered Institute of Buildings (CIOB) noted that even when using lower carbon materials to construct new building, this approach was less effective at conserving energy than reusing or repurposing existing buildings. Green Alliance, citing research they had commissioned, claimed that long term vacant properties could fulfil between 14 and 46 per cent of new housing needs to 2030 across different metropolitan areas.[267]

188. Pressure on local authorities to meet social housing need whilst having limited access to grant funding, creates a complex environment in which to balance retrofit, demolition and the need for new low-carbon buildings, and can sometimes lead to demolition being prioritised over retrofit.

Government policy on reuse and retrofit

189. In its submission to this inquiry the Government stated that it understood the importance of properly accounting for carbon, "which is why we are promoting the benefits of reusing and retrofitting ahead of demolition."[268] The Departments of Business, Energy and Industrial Strategy and of Levelling Up, Housing and Communities said that both departments were allocating funding across several existing government schemes to support reuse and retrofit, including:

262 Department for Environment, Food and Rural Affairs, UK statistics on waste (March 2020)
263 UK Green Building Council. 'Climate Change', accessed 26 April 2022
264 Chartered Institute of Building (SBE0063); Green Alliance (SBE0135); Dr Niamh Murtagh et al (SBE0035); Royal Institute of British Architects (SBE0039); Royal Institution of Chartered Surveyors (SBE0083); The Institution of Structural Engineers (SBE0080)
265 Q44; Historic England (SBE0098); Rockwool (SBE0058)
266 Rockwool (SBE0058)
267 Green Alliance (SBE0135)
268 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)

a) the **Local Authority Decarbonisation (LAD) Scheme**, which aims to support the ambition set out in the Clean Growth Strategy, that as many social homes as possible are improved to Energy Performance Certificate (EPC) band C by 2035;

b) the **Home Upgrade Grant (HUG)**, which aims to provide energy efficiency upgrades and low-carbon heating to low-income households living off the gas grid in the worst performing homes in England;

c) the **Social Housing Development Fund**, which aims to improve the energy performance of social rented homes. Wave 1 involves up to £160 million being made available to registered Providers (RPs) of Social Housing, including Private and Local Authority (LA) providers in England to support the installation of energy performance measures in social homes by 31st January 2023 taking a "worst first, fabric first, lowest regrets approach"; and

d) the new **Energy Company Obligation (ECO)** scheme, which will require larger energy suppliers to install energy efficiency and heating measures to people's homes across Great Britain.[269]

190. Evidence we received nevertheless disputed the Government's assertion that it was prioritising retrofit ahead of demolition, citing reforms to permitted development rights which allow for the demolition of properties without planning permission, and inequity in the liability for value added tax (VAT) incurred by new-build and retrofitting solutions.[270] The latter complaint was addressed in part by a change to the VAT regime for energy saving materials announced by the Chancellor of the Exchequer in his Spring Statement in March 2022, an announcement made after the evidence to this inquiry had been gathered.[271]

Permitted development rights

191. Permitted development rights (PDRs) allow the improvement or extension of homes "without the need to apply for planning permission, where that would be out of proportion with the impact of the works carried out".[272] Developments benefitting from PDRs are still required to comply with Building Regulations.

192. In June 2020, PDRs were extended so that a proposal to demolish and rebuild a vacant and redundant residential or commercial building would not require planning consent if the demolished building was to be replaced by a residential property.[273]

193. RIBA told us that the extension of PDRs meant that local authorities now had less control over many changes to the built environment in the areas under their planning

269 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)

270 Chartered Institute of Building (SBE0063); Green Alliance (SBE0135); Dr Niamh Murtagh et al (SBE0035); Royal Institute of British Architects (SBE0039); Royal Institution of Chartered Surveyors (SBE0083); The Institution of Structural Engineers (SBE0080). Evidence was given before the Spring Statement where the Chancellor of the Exchequer announced a reduction in VAT for energy saving materials.

271 HM Revenue & Customs, Changes to the VAT treatment of the installation of Energy Saving Materials in in Great Britain (March 2022)

272 Department for Levelling Up, Housing and Communities. Permitted development rights for householders: technical guidance (September, 2019)

273 *Planning in England: permitted development and change of use,* CBP 00485, House of Commons Library, June 2021

jurisdiction.[274] An independent review undertaken for the Government in 2020 concluded that permitted development conversions "seem[ed] to create worse quality residential environments than planning permission conversions".[275] The properties it assessed which had been constructed under the revised PDRs were found to be significantly below the nationally described space standards, with implications for overheating, amenity space and natural light.

194. Several submissions criticised the changes to PDRs as running counter to environmental commitments, as the changes were perceived to encourage demolition and rebuild over retrofitting.[276] The written evidence we received presented a broad consensus that retrofit and reuse of existing properties was substantially more effective at conserving carbon than demolition and new build, even when the new construction used lower carbon materials.[277]

195. The UK Green Building Council (UKGBC) called the reforms a "highly retrograde step" that should be withdrawn, In UKGBC's view, PDRs should be restricted (for example, to small-scale, low-impact development that is unlikely to be contentious), and the regime should be reformed to include much stronger sustainability requirements, such as securing higher energy efficiency, air quality standards and access to green spaces.[278]

196. Rhian Williams, Principal Strategic Planner for the Greater London Authority, told us that PDRs involving conversion of buildings from commercial to residential with demolition and rebuild was not something that the Mayor of London supported:

> [C]ommercial to residential [conversion] …. often results in poor quality accommodation, affecting the health of high streets and London's economic success. It is a way of missing out on lots of our important policies. It reduces contributions for affordable housing and other important infrastructure …. [and] it means that we cannot apply those environmental and sustainability qualities […], so it is an issue.

197. The Institution of Structural Engineers and academics from the University of Sheffield said PDRs should not be allowed where properties were to be replaced with housing, as this only incentivised demolition.[279] Dr Asif Din, Sustainability Director at Perkins & Will, a global design practice proposed that buildings ought to be demonstrably unfit for purpose before demolition could be authorised.[280] The Heritage Alliance believed that demolition should remain fully within the ambit of the planning permission process, so that environmental and sustainability factors could be assessed with rigour.[281]

274 Royal Institute of British Architects (SBE0039)

275 Ministry of Housing, Communities & Local Government, Research into the quality standard of homes delivered through change of use permitted development rights. Report on the independent MHCLG funded research into quality standard of homes delivered through certain permitted development rights for the change of use. (July, 2020)

276 Green Alliance (SBE0135); Royal Institute of British Architects (SBE0039); UK Green Building Council (SBE0144)

277 Chartered Institute of Building (SBE0063); Green Alliance (SBE0135); Dr Niamh Murtagh et al (SBE0035); Royal Institute of British Architects (SBE0039); Royal Institution of Chartered Surveyors (SBE0083); The Institution of Structural Engineers (SBE0080)

278 UK Green Building Council (SBE0144)

279 Dr Danielle Densley Tingley, Senior Lecturer at University of Sheffield, et al (SBE0052); Q180

280 Dr Asif Din (Sustainability Director at Perkins & Will) (SBE0041)

281 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy and Department for Environment, Food and Rural Affairs (SBE0149)

The Government's position on permitted development rights

198. The Government told us that PDRs "make an important contribution to housing delivery while making best use of existing buildings and avoid building on greenfield land."[282] The Government said that reforms to PDR to allow for greater demolition came with requirements on the developer to provide the local planning authority with a report for the management of the construction of the development, including the proposed use of materials, and the plans for the disposal and recycling of waste generated by the development.

199. The planning system in England is under comprehensive review: a Planning White Paper was published in August 2020[283], together with a consultation paper on reforms to the current planning system[284], and the Levelling Up White Paper of February 2022[285] also has significant implications for planning policy. In written evidence to the Committee, the Government undertook to ensure that "the reformed planning system supports our efforts to combat climate change and help bring greenhouse gas emissions to net zero by 2050."[286]

200. When we asked Ministers about the potential of PDRs to incentivise demolishing buildings over retrofitting, Minister Hughes contested the point:

> Largely, [demolition rather than retrofit] is not what is happening [… .] I have seen lots and lots of examples of the conversion from commercial to residential and that seems like an appropriate use [… .I]n some circumstances there are unintended consequences with people taking the type of action that you are explaining. I am not altogether sure that it is of a significant enough nature at the moment for us to change the legislation.
>
> However, having said that, these are the types of things that we constantly should be revisiting [… .] One of the things that we saw, for example, was because there were no minimum specified space standards, people were creating flats that were too small to be habitable. We have addressed that. [… .] Government are monitoring these things to keep up when devious and inappropriate development takes place.[287]

282 Department for Levelling Up, Housing and Communities, Department for Business, Energy and Industrial Strategy, Department for Environment, Food and Rural Affairs (SBE0149)
283 Ministry of Housing, Communities and Local Government, White Paper: Planning for the Future (August, 2020)
284 Ministry of Housing, Communities and Local Government , Changes to the current planning system Consultation on changes to planning policy and regulations (August 2020)
285 HM Government, Levelling Up the United Kingdom (February 2022)
286 *Ibid.*
287 Q234

VAT liability for new build and retrofit

201. The difference between the VAT liability incurred by new build and by retrofitting was raised by several witnesses as evidence that the Government was not prioritising reuse and retrofit over demolition. Until 23 March 2022, new build was zero-rated for VAT, while most renovation and repairs were liable for VAT at 20 per cent.[288] Multiple organisations recommended the removal or reduction of VAT on repair and retrofit so that it better aligned with the regime applicable to new build.[289]

202. In our March 2021 report on *Energy Efficiency of Existing Homes* we recommended reductions in VAT for refurbishment, retrofit and Energy Saving Materials.[290] In the course of this inquiry we also pressed Ministers to address the apparent discrepancy in VAT treatment.[291]

203. We therefore greatly welcome the Chancellor of the Exchequer's announcement during the 2022 Spring Statement of a "time-limited zero-rate of VAT for the installation of certain Energy Saving Materials."[292] Removing VAT on energy efficiency measures is a significant gain for the sector that has been calling for this for a long time. We nevertheless note that unless Ministers introduce further secondary legislation to extend the period of the zero rate, the installation of Energy Saving Materials will revert back to the 5% reduced rate from 1st April 2027.[293]

204. We also note that the tax exemption is limited in scope, covering only Energy Saving Materials such as insulation and heat pumps rather than capturing the broader aspects of retrofit work including extensions, refurbishment, and re-modelling. We were told repeatedly that VAT changes should extend to all aspects of retrofit work, so there was a level playing field between retrofit and new build. Research by CBI Economics commissioned jointly by the Federation of Master Builders and Royal Institution of Chartered Surveyors (RICS) found that a temporary 5-year VAT cut to 5% on the labour element of repair, maintenance and improvement works could help create 345,000 jobs and provide an economic boost worth £51 billion.[294] Green Alliance argued that zero-rating retrofit could provide an economic stimulus of over £15 billion, while modestly impacting Treasury revenue, with net losses in the first year totalling around £920 million.[295]

288 HM Government, 'VAT for builders', accessed 26 April 2022

289 UK GBC (SBE0144); University of Sheffield (SBE0052); Royal Institute of British Architects (SBE0039); Supply Chain Sustainability School (SBE0054); National Green Specification & Green Building Encyclopaedia (SBE0004); Mr Robin Miller (Managing Director at Beco Products Ltd) (SBE0008); STBA (SBE0014); The Council for British Archaeology (SBE0018); The Alliance for Sustainable Building Products (ASBP) (SBE0027)

290 Environmental Audit Committee, Fourth Report of Session 2019–21, Energy Efficiency of Existing Homes HC346

291 Q235

292 HM Revenue & Customs, Changes to the VAT treatment of the installation of Energy Saving Materials in in Great Britain (March, 2022). The change was made in the Value Added Tax (Installation of Energy-Saving Materials) Order 2022 (SI, 2022, No. 361)

293 HM Revenue & Customs, Policy paper: The Value Added Tax (Installation of Energy-Saving Materials) Order 2022 (March, 2022)

294 Federation of Master Builders, Cut the VAT: A proposal for building back better and greener (March 2021)

295 Green Alliance (SBE0135)

Further ways for the Government to incentivise retrofit

205. Beyond changes to value added tax and permitted development rights, several other recommendations for greater incentives to retrofit were made in evidence to us, including:

- **linking Stamp Duty bands to energy efficiency**. RIBA and academics from the University of Sheffield argued that linking stamp duty to energy efficiency would incentivise thermally efficient and water efficient homes, thus incentivising retrofitting.[296]

- **requiring circular economy statements** as part of planning applications. This is already a requirement of the GLA's London Plan.[297] For existing buildings on-site this involves a decision tree type analysis with exploration of: a) adaptation and reuse of the existing building; b) partial building reuse, e.g. of the facade or structure where a) is not possible; c) deconstruction and component/material reuse where a) and b) are not appropriate.[298] The analysis must explain why retrofit is not possible. Statements must outline how waste has been reduced in the design approach and how the building components can be disassembled and reused.

- **mandatory pre-demolition audits** to highlight the potential resources available for reuse and plan for their management accordingly, for example, temporary storage of those secondary materials until their reuse in other projects.[299]

- **mandatory requirements for whole-life carbon assessments and setting operational energy and embodied carbon targets** for buildings. RIBA, Green Alliance and the CIOB recommended this approach. By assessing and limiting the whole-life carbon of buildings, developers are likely to opt for retrofitting solutions to meet housing demands.[300]

296 Federation of Master Builders (SBE0048); Dr Danielle Densley Tingley (Senior Lecturer at University of Sheffield) et al (SBE0052); Royal Institute of British Architects (SBE0039)
297 Greater London Authority, The London Plan (March 2021)
298 Dr Danielle Densley Tingley (Senior Lecturer at University of Sheffield) et al (SBE0052)
299 Dr Danielle Densley Tingley (Senior Lecturer at University of Sheffield) et al (SBE0052)
300 Royal Institute of British Architects (SBE0039); Green Alliance (SBE0135); Chartered Institute of Building (SBE0063)

Box 3: Case study on demolition and retrofit: Marks & Spencer building, 458 Oxford Street

In 2018 Pilbrow & Partners developed a proposal to demolish the Marks & Spencer building at 458 Oxford Street and replace it with new 10-storey building that would house offices, a gym, a smaller Marks & Spencer's shop and a pedestrian arcade.[301] Due to the size of the proposed development, the plans had to be cleared by the Greater London Authority, as well as by the local authority, Westminster Council. Westminster Council approved the proposal in November 2021 and the Mayor of London approved it in March 2022.[302]

The Mayor reconsidered his decision following growing campaigns to preserve the building due to its heritage and the potential carbon footprint of bulldozing the building.[303] A critical report authored by Simon Sturgis[304] and commissioned by SAVE Britain's Heritage concluded that the scheme comes with an upfront carbon cost of almost 40,000 tonnes of CO_2 — the equivalent of driving a typical car 99,000,000 miles, "further than the distance to the Sun."[305] Simon Sturgis concluded that the scheme was incompatible with both national climate policy and the Greater London Authority's climate policies and commitments in the London Plan.[306] SAVE Britain's Heritage also started a petition calling for the demolition to be stopped, the petition has received over 3500 signatures.[307]

After reconsidering the scheme, the Mayor of London decided it was compatible with the London Plan and the grounds did not exist to allow the Mayor to intervene in the scheme proceeding.[308] A week after this decision Secretary of State Michael Gove intervened to pause the project in order for the Department for Levelling Up, Housing and Communities (DLUHC) to examine the scheme further and decide whether to call-in the scheme.[309] Under Article 31 of the Town and Country Planning (Development Management Procedure) (England) Order 2015 the Secretary of State may give directions restricting the grant of permission by a local planning authority.[310]

This case study brings the debate regarding the environmental credentials of new build versus retrofit into public focus.

Consumer demand and trust in the retrofit sector

206. We heard that a significant barrier to increasing the use of retrofitting in the built environment was a lack of consumer demand and trust in the retrofit sector.

207. Academics from University College London, the University of Leeds and Imperial College London told us that the public's awareness, understanding, or demand for low embodied carbon products, including buildings, may be limited. They recommended that policies on retrofit and embodied carbon target homeowners as well as practitioners to create market demand for sustainable buildings.[311]

301 Pilbrow & Partners 'Marks & Spencer's Marble Arch Store', accessed 3 May 2022
302 Architects Journal, Exclusive: New carbon report slams Pilbrow's Oxford St demolition plans, 21 January 2022; Architects Journal, M&S Oxford St demolition scheme halted by Gove, 20 April 2022
303 BBC News, Marks & Spencer: Flagship Oxford Street store to be demolished, 12 April 2022
304 Simon Sturgis was Specialist Adviser to this Committee on its inquiry into *Sustainability of the built environment*. A record of his declared interests is available on page 7.
305 Architects Journal, Exclusive: New carbon report slams Pilbrow's Oxford St demolition plans, 21 January; Architects Journal, M&S Oxford St demolition scheme halted by Gove, 20 April 2022
306 Ibid
307 38 Degrees, Stop the demolition of Oxford Street – save and re-use M&S flagship store, accessed 3 May 2022
308 BBC News, Marks & Spencer: Flagship Oxford Street store to be demolished, 12 April 2022
309 Architects Journal, M&S Oxford St demolition scheme halted by Gove, 20 April 2022
310 The Town and Country Planning (Development Management Procedure) (England) Order 2015 No. 595
311 Dr Niamh Murtagh (Senior Research Fellow at University College London (UCL)); Prof Alice M Owen (Professor at University of Leeds); Dr Kate Simpson (Research Associate at Imperial College London) (SBE0035)

208. The Federation of Master Builders recommended that the Government work to increase consumer awareness for the environmental benefits of high-quality natural and recycled materials.[312] They added that additional financial incentives could be introduced, for instance through mortgage lenders offering better rates for those buildings with lower carbon footprints and higher energy efficiency ratings. The Chartered Institution of Building Services Engineers noted that this awareness raising was necessary in order to justify the disruption and capital investment required of homeowners when choosing retrofit.[313]

209. Professor Alice Owen, of the School of Earth and Environment, University of Leeds, had been a member of a cross-university research group which had studied the decision-making processes of Repair-Maintenance-Improvement practitioners in England. She recommended that policies needed to address not only the cost of higher energy efficiency but the perception of cost.[314] The group's research had found that that some practitioners believed that customers could not or would not pay extra for more energy efficient work and their perception of increased cost for customers led to negative attitudes to newer energy technologies. This had led practitioners to "over-protect" customers from the perceived higher costs of energy efficiency measures. To address this, the group recommended that policy and policy communications should align sustainability goals with practitioners' motivations in the retrofit and construction sector—to remain in business in the longer term, to deliver excellent customer outcomes and to maintain a good reputation. They recommended that Government should communicate the relationship between specific sustainability outcomes (such as energy efficiency) and high-quality work, customer benefits and reputation. They also warned that policies and market interventions needed to address not only the cost of higher energy efficiency but the perception of cost.

210. Lord Deben, Chair of the Climate Change Committee, spoke of the need to guarantee the quality of retrofit work to create trust and demand in retrofitting solutions:

> One of the worries I found when I was a Secretary of State was that older people did not like the Warm Homes programme because they did not trust the people who came into their house to do it. You also have to trust people's ability to do it. There are far too many examples of people putting in, for example, air-source heating who do not know how to do it. We need Government intervention to make people feel confident. Lots of people will do the right thing if it is easy and they have confidence that what they have done will in fact work.[315]

211. Lord Callanan agreed that consumer confidence in retrofit needed to be addressed:

> Unfortunately, there have been some examples of quite shoddy workmanship, through Government funded schemes and private funded schemes in the past. All new modern schemes that we are supporting have to be Trustmark approved. The companies have to be registered with their appropriate standards organisation—the MCS for heat pumps, the

312 Federation of Master Builders (SBE0048)

313 CIBSE (Chartered Institution of Building Services Engineers) (SBE0090)

314 Dr Niamh Murtagh (Senior Research Fellow at University College London (UCL)); Prof Alice M Owen (Professor at University of Leeds); Dr Kate Simpson (Research Associate at Imperial College London) (SBE0035)

315 Q25

> Insulation Association for insulation standards and so on—and all the work needs to be accompanied by a two-year insurance-backed guarantee, so there is consumer redress.
>
> On informing consumers, we have a number of different Government websites and information campaigns to give them confidence in the sector, to make sure that the work is of the appropriate quality. In my view that is the best way to encourage consumer confidence, to know that the work will be done to the required standard and that they have appropriate redress if, unfortunately, something goes wrong.[316]

212. Overall, the evidence before us, unfortunately exacerbated by botched implementation of the Green Homes Grant scheme in 2020–21, indicates that mistrust in the retrofit sector and a lack of consumer awareness and fluctuating demand in retrofit work is creating a vicious cycle of low investment in retrofit skills and deployment.

Our view on reuse and retrofitting policy

213. **Retrofit and reuse of existing buildings, where practicable, should be prioritised over new build to conserve resources, minimise embodied carbon emissions, reduce demolition waste and deliver cost-effective solutions to delivering on housing demand. Local authorities and housing developers are expected to balance multiple objectives when meeting housing needs, and therefore require a coherent policy framework to support the balancing of retrofit and new, low-carbon housing delivery. The Government states it is promoting the benefits of re-using and retrofitting ahead of demolition, but we have seen limited evidence to demonstrate that this is yet the case. In some cases, reforms to permitted development rights appear to have created a perverse incentive for demolition and new-build over retrofit. We are concerned that the amendment to permitted development rights which allowed demolition and replacement was introduced without full consideration of its potential impact on sustainability and on carbon emissions. In our view, permitted development conversions should deliver low-carbon homes: regrettably, in some areas they have established a legacy of sub-standard properties that will need to be retrofitted in the future.**

214. ***We recommend that Ministers urgently commission a comprehensive evaluation of the impact which recent amendments to permitted development rights have had on incentives to retrofit existing properties. The outcome of that evaluation should inform further amendments to the permitted development rights regime to ensure full alignment with the Government's stated commitment to promote reuse and retrofit ahead of demolition.***

215. **We welcome the steps taken by the Chancellor of the Exchequer to address the inequity in the VAT regime between new build and retrofit. We nevertheless note that this differential treatment will expire in 2027 and is limited in scope, covering only Energy Saving Materials rather than broader aspects of retrofit work**

216. ***We recommend that Ministers evaluate the impact of the time-limited zero-rate of VAT for the installation of certain Energy Saving Materials well before its expiry date of 2027, with a view to extending the provision beyond 2027 if it has made a demonstrable***

316 Q246

and positive contribution to meeting carbon budgets and the Government's Net Zero objectives. We also recommend that Government go further and consider harmonising the VAT rates of new build and retrofit work. We have already recommended that the Government consider extending the zero-rate of VAT to innovations which improve energy efficiency, such as energy storage systems

217. **A mandatory requirement to undertake whole-life carbon assessments when undertaking building projects will further incentivise retrofitting. This provides another justification for our whole-life carbon recommendation in chapter 2.**

218. ***We recommend that circular economy statements including pre-demolition audits should be a requirement of planning applications which entail demolition of properties, as is already the case for certain applications which London boroughs are required to refer to the Mayor of London for consideration. The circular economy statement must explain why retrofit to match existing or new uses is not possible if demolition is proposed and be accompanied by a whole life carbon assessments of both new build and retrofit. This requirement should be introduced as soon as is practicable and not later than any package of reforms to the planning system which the Secretary of State for Levelling up, Housing and Communities is expected to introduce before the end of the current Parliament.***

219. **A lack of consumer awareness regarding retrofitting solutions, the perception that retrofit work is costly and/or disruptive, and consumer mistrust in the retrofit sector's ability to deliver quality housing solutions, is creating further barriers to investment in retrofit. In our view there is a clear role for Government to support the industry in promoting retrofit installations, in particular at a time when energy costs are rising rapidly, and the running cost of heating homes and businesses could be reduced by improving energy efficiency of buildings.**

220. ***We recommend that the Government work with industry to increase consumer awareness of the environmental and monetary benefits of high-quality retrofit solutions with a view to increasing the uptake of retrofit work in line with the net zero trajectory and at a time of rising energy costs.***

6 Skills and training

221. The CCC has argued that the "chopping and changing of UK Government policy has inhibited skills development in housing design, construction and in the installation of new measures."[317] We heard repeatedly that skills gaps remain, inhibiting the industry from implementing low-carbon construction solutions.

222. To address the skills shortage, in our *Energy Efficiency in Existing Homes* report we recommended a national retrofit strategy be published as part of the Heat and Buildings Strategy. We recommended this retrofit strategy be developed with education providers to prepare homes for a low-carbon future and that it must address the shortage of certified heat pump installers.

223. The Government responded that Department for Business, Energy, and Industrial Strategy was continuing its work with the Green Jobs Taskforce to produce an Action Plan for Net Zero skills across a range of sectors.[318] The response acknowledged the need to increase trained heat pump installers and said it was working to ensure appropriate training was available to address this.

224. Neither the Green Jobs Taskforce report nor the Heat and Buildings Strategy included a retrofit skills strategy. The Green Jobs Taskforce report set out the scale of the challenge and the Heat and Buildings Strategy contained analysis of skills gaps and current shortfalls in training provision and capacity for retrofit and heat pumps. The Government said that to meet demand it would 'incentivise certification' to British Standards Institution retrofit standards and work with industry and the education sector to improve the availability of high-quality appropriate training and apprenticeships.

225. In our *Green Jobs* report we concluded that this fell short of the level of detail and planning needed to meet the scale of the challenge. A national retrofit strategy, which encompasses skills provision for heat pump installation, could help deliver this holistic action and address these skills and capacity shortages. Building on the retrofit strategy recommendation of the *Energy Efficiency of Existing Homes* report, the *Green Jobs* report recommended that by the end of 2021 the Government needed to set out a programme to encourage the development of relevant skills across the construction trade, to stimulate development of skilled trades to increase the capacity markedly.

226. The Government responded to this recommendation in January 2022. The response did not engage directly with the Committee's recommendation, pointing instead to its September 2020 Green Homes Grant skills training competition, and existing wider skills reforms such as Skills Bootcamps and T Levels, and noting that the recent 'Engineering for Construction' T Level covered retrofit and heat pump installation. The Government also noted that the Construction Industry Training Board, an arm's length body of the Department for Education, was beginning to review options to develop 'green skills' training modules to embed environmental understanding across 'every aspect of construction'.

317 Committee on Climate Change, UK Housing: fit for the future? (February 2019) p9

318 Environmental Audit Committee, First Special Report of Session 2021–22 on Energy efficiency of existing homes: Government Response to the Committee's Fourth Report of Session 2019–21, HC 135 (May, 2021)

227. Asked how the Government sought to address the need for upskilling in the construction trade, Lord Callanan replied:

> We have the construction skills delivery group. It is a joint BEIS and DfE group set up in November 2020 to try to identify where the skills gap is and do what we can to fix it. Under the Green Homes Grant Local Authority Delivery, we allocated £6.9 million—which was oversubscribed—towards upskilling various parts of the workforce. We are working with the DfE to expand the green skills bootcamps in different areas of the country. That provides free training courses for 16 weeks for adults, including on in-home retrofit management and so on, and finally, £95 million from the Green Skills Fund to fund adults without existing level 3 equivalent qualifications to take those level 3 qualifications.[319]

Skills in embodied carbon assessment

228. Over the course of our inquiry, we heard that skills exist in undertaking embodied carbon assessments, but, in the absence of a Government-approved methodology and standardised tools, such assessments were undertaken by specialist architects and consultants, and were not widely understood by the entire trade and supply chain.[320]

229. Peter Conboy, Development Director, igloo Regeneration Ltd, which focuses on developing low-carbon housing projects, said:

> [Whole-life carbon assessments are] generally done at quite a high level of technical expertise—master's level—… because … . there is no set regulatory process for measurement of embodied carbon and therefore it is unnecessarily complex. We are talking £200 to £400 a property, minimum. It will come down but it will only come down when we standardise.[321]

230. There was consensus across the contributors who addressed the issue that skills in WLC assessments and low-carbon building needed to be accessible across all levels of education and the entire supply chain so that tradespeople, designers and consultants all understood how to build lower carbon buildings. Louisa Bowles from LETI said that this accessibility would help contractors understand why designers were specifying particular designs and change behaviour from doing things "how I used to do it" to building differently for net zero.[322]

231. A common theme in evidence was that upskilling in WLC assessments could be a relatively simple and inexpensive process, once standardised. Dr Giesekam told us:

> At the end of the day, it could be a very simple process if it is to do a basic assessment with a tool … .it is multiplying quantities of stuff by a factor and adding it up together. It is not rocket science … I think this is a process that we can teach very easily.[323]

319 Q244
320 Q63, Q70
321 Q70
322 Q149
323 Q90

Ways to increase skills in WLC assessments

232. Several recommendations were made to us for ways to increase skills in whole-life carbon assessments, including:

- **making WLC assessments mandatory with a standardised methodology and incrementally setting carbon reduction targets** to achieve net zero by 2050. This recommendation received the strongest support from stakeholders as the most simple and effective way to encourage upskilling. France has already started this process, since 2016 WLC assessments have been conducted on a voluntary basis to build a database and upskill the sector. Mandatory requirements will start from 2022.[324]

- **a freely accessible database for anonymised Whole Life-Cycle Carbon Assessment data** of new buildings.[325]

- **an Embodied Carbon Hub** to provide guidance, training and support best practice in embodied carbon assessment so that embodied carbon lessons are widely learnt. [326] The ASPB noted that this had already been done in Finland.

- **legislation requiring proof of professional competence in embodied carbon methodology.** The National Federation of Roofing Contractors noted that the "lowest cost tender approach" was readily acknowledged as driving poor behaviour and a lack of investment in training and professional development. They believed that the industry would only change its decision-making processes through legislation.

Our view on skills and training

233. **The present shortage of workers in the energy efficiency and retrofit sector is chronic, given the overall timetable for decarbonisation of properties. This is a point we have repeatedly emphasised in our recent reports. Significant skills gaps also exist in the measurement of embodied and whole-life carbon and the use of low-carbon materials. On the evidence before us, the Government has not yet responded adequately to our recommendations to develop a retrofit strategy and programme to encourage the development of relevant green skills across the construction trade.**

234. ***We reiterate our recommendation to develop a retrofit strategy and up-skilling programme for construction to meet the needs of net zero. This should be published before the 2022 summer recess.***

235. ***Alongside a mandatory requirement to undertake whole-life carbon assessments and a national methodology for assessments, the Government should make training in undertaking whole-life carbon assessments accessible across all levels of education and the entire supply chain. The Government, in response to this report, should set out how the Department for Education plans to achieve this.***

324 Edie, EU to start measuring embodied carbon emissions from buildings (November, 2021)
325 The Alliance for Sustainable Building Products (ASBP) (SBE0027)
326 The Alliance for Sustainable Building Products (ASBP) (SBE0027)

Conclusions and recommendations

Whole-life carbon assessments

1. There is no Government policy requiring the assessment or control of embodied carbon emissions from buildings. As a result, no progress has been made in reducing these emissions within the built environment. This inaction remains despite the built environment making up 25 per cent of the UK's total greenhouse gas emissions and the UK's Nationally Determined Contribution, made at COP26, committing the UK to achieve a 68% reduction in the UK's carbon emissions by 2030. This is only eight years away. This is an extremely short time frame within which to start assessing and substantially reducing embodied carbon emissions. The first step must be a requirement to undertake whole-life carbon assessments for buildings so the industry can start measuring and then controlling for this carbon. (Paragraph 69)

2. A broad cross-section of the construction industry is willing and able to undertake whole-life carbon assessments. In the absence of an approved UK national methodology, the RICS Professional Statement on WLC is used as the accepted industry methodology for WLC assessments. Alongside this, various further guidance and software tools have been developed. As a result of the lack of an approved national methodology, the variety of assessment tools and interpretations for WLC that have developed appear to have created inconsistency, have unnecessarily increased the cost of WLC assessments and have led to an uneven playing field in conducting assessments. (Paragraph 70)

3. The Department for Business, Energy, and Industrial Strategy is currently considering the possibility of funding an update of the RICS methodology. This update is intended to make the methodology more accessible and more transparent thus addressing the concerns raised by Ministers to us about the RICS methodology. Once the national methodology and requirement to undertake whole-life carbon assessments is in place, the cost of undertaking assessments is likely to be minimal. (Paragraph 71)

4. The UK is slipping behind comparator countries in Europe in monitoring and controlling the embodied carbon in construction. If the UK continues to drag its feet on embodied carbon, it will not meet net zero or its carbon budgets. There is significant opportunity for the UK to learn from emerging international best practice on how to introduce whole-life and embodied carbon regulations. (Paragraph 72)

5. Local authorities are mandating WLC assessments of their own accord. Evidence so far shows that the policy is achievable and is working, with few barriers to its introduction. Introducing mandatory WLC assessments for buildings could be an easy way for the Government to dramatically reduce carbon in construction. The industry has repeatedly asked for an ambitious, clear timeframe for when whole-life carbon assessments will become mandatory. This timeline should align with the introduction of the Future Homes Standard, which should itself be brought forward to 2023. This will help bring together efforts to tackle operational and embodied carbon within the same timeframe. (Paragraph 73)

6. We recommend that Ministers immediately assign responsibility to the relevant member of the BEIS Departmental Board to monitor international policy developments in embodied carbon, with a remit to feed observations into the development of UK policy on embodied and whole-life carbon. (Paragraph 74)

7. We recommend that the Government introduce, not later than December 2023, regulations to mandate whole-life carbon assessments for buildings above a gross internal area of 1000m^2, or which create more than 10 dwellings. This requirement should be established in Building Regulations, and ought to be reflected in the planning system through national planning policy. Local authorities should be encouraged and supported to include this requirement within their Local Plans ahead of the introduction of national planning requirements. (Paragraph 75)

8. The timeline for the Future Homes Standard should be brought forward to December 2023 to align the timeframes for addressing operational and embodied carbon. This will help provide the industry with the confidence it requires to construct low-carbon, energy efficient buildings. (Paragraph 76)

9. We recommend that following the introduction of whole-life carbon assessments, the Government should develop progressively ratcheted carbon targets for the built environment, to match the pathway to net zero set out in periodic carbon budgets. These ratcheting targets should be reported on annually, and progress reports towards achieving these targets should be published annually as part of the Net Zero Strategy indicators. (Paragraph 77)

10. We recommend that a clear timeframe for the introduction of mandatory whole-life carbon assessments and ratcheting targets should be set by Government by the end of this year. (Paragraph 78)

11. In our view, the RICS Professional Statement on whole-life carbon assessments is fit for use and already familiar to UK industry. We recommend that, as soon as possible following promulgation of the planned update of the Statement, the Government should seek to establish the RICS methodology as the UK industry standard for whole-life carbon assessments. (Paragraph 79)

Building materials

12. The National Model Design Code represents a good start to the task of improving efficiency and reducing the environmental impact of materials used in construction. Regrettably, in its current form it does not provide the ambition or detailed guidance necessary if it is to make a meaningful contribution to addressing the climate and nature crises which the country faces. The code does not provide the supporting detail which design codes require to set standards related to whole-life carbon. The definition of 'embodied energy' it uses is confusing, and it offers no guidance on how to assess embodied carbon or how to mitigate these emissions. (Paragraph 90)

13. We recommend that the Government should change the term embodied energy to embodied carbon in the National Model Design Code and provide a clear definition of embodied carbon and whole-life carbon in the NMDC based on the WLCN,

LETI and RIBA definitions. The Government should provide guidance on how to assess embodied carbon by setting a national methodology for whole-life carbon assessments, as we have recommended in Chapter 2 above. (Paragraph 91)

14. We welcome the Government's investment in the development of low-carbon cements as set out in the Industrial Decarbonisation Strategy. Alongside research and development, more needs to be done to raise awareness of low-carbon cements within the industry and amongst the public, to generate demand and increased investment in these products. (Paragraph 106)

15. The Department for Business, Energy, and Industrial Strategy should invest in raising awareness within the industry and amongst the public on the existence and benefits of low-carbon cement and continue to encourage research and development into new low-carbon products. (Paragraph 107)

16. We recommend that the Government investigate possible ways, beyond public procurement, to incentivise the use of low-carbon cement to ensure that these cement alternatives become the product type of choice by 2030. This should include an assessment of the feasibility of restricting the disposal of a range of waste products, so as to facilitate their use as clinker substitutes, as is the case in the Netherlands. (Paragraph 108)

17. The reuse of steel components is not yet common practice in the UK. One of the main barriers to steel reuse is the collection, storage, testing and certification of used steel components. The Department for Business, Energy and Industrial Strategy and the Infrastructure and Projects Authority are already investing in how to better promote recycling and reuse of steel, alongside long-term investment in decarbonising the primary production of steel. (Paragraph 125)

18. Mandating whole-life carbon assessments for buildings, as we have already recommended, would be a simple, material neutral way of encouraging the greater reuse and recycling of steel components. (Paragraph 126)

19. The Government should work with local authorities to investigate effective and appropriate ways to store and catalogue steel components for reuse and to communicate the availability of components across local area networks of constructors prepared to reuse steel. (Paragraph 127)

20. Significant obstacles to the uptake of timber products in construction remain. These include issues regarding fire risk and insurance, price volatility, securing sustainable and local supply chains, and addressing skills gaps in the use of timber. The Government has made little progress in addressing these barriers since the Climate Change Committee's 2019 recommendation for an increase in the use of timber in construction. (Paragraph 150)

21. The post-Grenfell prohibition on the use of combustible materials in external walls has had a disproportionate impact on the use, innovation and testing of structural timber. Material safety perceptions have also affected the availability and cost of insurance, making it near impossible for developers to use timber in high rise or medium-rise buildings. There has been a substantial delay in the Government's response to its consultation on amendments to the combustible materials ban,

which closed in May 2020. This delay is unacceptable: it has left the construction industry without the guidance and confidence it needs to invest in timber structures. (Paragraph 151)

22. Whilst timber is often the most appropriate material to use to lower the embodied carbon of a building project, it cannot be assumed that this will always be the case. Timber use, from appropriate sources, should be verified as the best whole-life carbon answer to a given construction project, in comparison to other alternatives. Timber use should be seen in the context of UK, European and global forestry resources. A major increase in the use of timber in UK construction will put pressure on existing timber resources. (Paragraph 152)

23. The Government must develop a coherent policy, joined up across Departments, to address the need for increased tree planting to address biodiversity and climate change concerns and the need for sustainable commercial plantations using appropriate tree species to meet the demand for domestic timber in construction. Government has committed to developing a policy roadmap on use of timber in construction. This should be delivered by the end of 2022 at the latest: it must comprehensively address the afforestation commitments made in the England Tree Action Plan and the need for timber construction products. (Paragraph 153)

24. In response to this report, Government should set out how its strategies to develop green jobs will address the need for skills in timber use in construction. (Paragraph 154)

25. The Government must invest now in further research and safety testing on the use of structural timber. The outcome of such research must inform a review of all relevant building regulations so as to render them properly applicable to modern timber materials and to ensure that fire safety regulations can take account of how modern timber materials behave in fire. The Government's response to the consultation on proposed amendments to the combustible materials ban must now include clarification of the Government's position of structural timber in the ban on combustible materials. The Government's response to the consultation should be issued at the latest before the House rises for the 2022 summer recess. (Paragraph 155)

26. There is a lack of Environmental Product Declaration (EPD) data for a wide range of materials, limiting the ability of developers to choose low-carbon materials. The UK is falling behind European counterparts where EPD data is far more widely available, resulting in developers choosing European materials over locally sourced UK products. The lack of EPD data makes conducting whole-life carbon assessments more laborious and expensive than necessary. (Paragraph 162)

27. The Government should encourage development of a centralised national database of EPDs and, through its own procurement practices require the collection and publication of EPDs. The EPD database should be digital, freely available to end users, and user-friendly. (Paragraph 163)

28. To limit 'greenwashing', the Government should introduce measures requiring suppliers who wish to make an environmental claim about a construction product to produce an EPD to substantiate it. (Paragraph 164)

29. The Government should conduct a cost-benefit analysis of whether to provide advice or financial support to smaller manufacturers to enable them to produce EPDs for their materials. (Paragraph 165)

30. There is availability of low-carbon and recycled building products to meet current demand, however there are insufficient incentives for product manufacturers to develop new low-carbon materials and for developers and designers to use these products. The Government has invested in initiatives and programmes, set out in the Industrial Decarbonisation Strategy, to encourage the development and use of low-carbon materials. This is welcome; but as there is no requirement to conduct whole-life carbon assessments of building projects, there remain limited incentives to reduce the embodied carbon of building projects and thus develop and use low-carbon materials. (Paragraph 166)

31. In our view, the most effective way overall to encourage resource efficiency and the development and use of low-carbon materials, whether low-carbon concrete, steel, timber, or any other material, is to establish a mandatory requirement to measure whole-life carbon and introduce progressively more stringent carbon targets on buildings. (Paragraph 167)

32. The Government should also issue its response to the consultation on the draft Waste Prevention Programme for England: Towards a Resource-Efficient Economy not later than the date the House rises for the 2022 summer recess. This will be over a year since the consultation closed. Industry and stakeholders require clear direction on future plans for waste prevention and resource efficiency now. (Paragraph 168)

Government procurement

33. The Government has committed to using public procurement to drive demand for low-carbon industrial products and expects whole-life carbon assessments to be undertaken in respect of all public works projects. The extent to which this expectation is met, and the impact it has had on procurement practice, is unclear. Guidance that contracting authorities should consider environmental impacts when undertaking public procurement is little more than advisory. (Paragraph 180)

34. Public procurement policy which mandates the completion of whole-life carbon assessments could kick-start the market for low-carbon construction. In time, a low-carbon standard for public works projects would help to remove the data barriers to establishing this market. The introduction of a Procurement Bill in the 2022–23 Session provides an opportunity for the Government to legislate for whole-life carbon assessments to be included in assessment of competing tenders for publicly financed building projects. This would strengthen the guidance in the Construction Playbook. (Paragraph 181)

35. We recommend that, in its response to this report, the Government should set out the number and proportion of public works construction projects for which whole-life carbon assessments have been undertaken pursuant to the provision in the 2020 Construction Playbook. For each project where an assessment has not been undertaken, we recommend that the justification be published. (Paragraph 182)

36. We recommend that the Infrastructure and Projects Authority establish clear guidance on the criteria for exemption from conducting whole-life carbon assessments for public works projects. We further recommend that, not later than the spring of 2023, the Government undertake a feasibility study on the introduction of a low-carbon standard for all public works projects, with a view to its swift implementation. (Paragraph 183)

37. We recommend that the Government bring forward legislative proposals, by amending the Procurement Bill if necessary, so as to require a whole-life carbon assessment to be produced as a condition of participation in any tender for publicly financed building projects. (Paragraph 184)

Retrofit and reuse of existing buildings

38. Retrofit and reuse of existing buildings, where practicable, should be prioritised over new build to conserve resources, minimise embodied carbon emissions, reduce demolition waste and deliver cost-effective solutions to delivering on housing demand. Local authorities and housing developers are expected to balance multiple objectives when meeting housing needs, and therefore require a coherent policy framework to support the balancing of retrofit and new, low-carbon housing delivery. The Government states it is promoting the benefits of re-using and retrofitting ahead of demolition, but we have seen limited evidence to demonstrate that this is yet the case. In some cases, reforms to permitted development rights appear to have created a perverse incentive for demolition and new-build over retrofit. We are concerned that the amendment to permitted development rights which allowed demolition and replacement was introduced without full consideration of its potential impact on sustainability and on carbon emissions. In our view, permitted development conversions should deliver low-carbon homes: regrettably, in some areas they have established a legacy of sub-standard properties that will need to be retrofitted in the future. (Paragraph 213)

39. We recommend that Ministers urgently commission a comprehensive evaluation of the impact which recent amendments to permitted development rights have had on incentives to retrofit existing properties. The outcome of that evaluation should inform further amendments to the permitted development rights regime to ensure full alignment with the Government's stated commitment to promote reuse and retrofit ahead of demolition. (Paragraph 214)

40. We welcome the steps taken by the Chancellor of the Exchequer to address the inequity in the VAT regime between new build and retrofit. We nevertheless note that this differential treatment will expire in 2027 and is limited in scope, covering only Energy Saving Materials rather than broader aspects of retrofit work (Paragraph 215)

41. We recommend that Ministers evaluate the impact of the time-limited zero-rate of VAT for the installation of certain Energy Saving Materials well before its expiry date of 2027, with a view to extending the provision beyond 2027 if it has made a demonstrable and positive contribution to meeting carbon budgets and the Government's Net Zero objectives. We also recommend that Government go further and consider harmonising the VAT rates of new build and retrofit work.

We have already recommended that the Government consider extending the zero-rate of VAT to innovations which improve energy efficiency, such as energy storage systems (Paragraph 216)

42. A mandatory requirement to undertake whole-life carbon assessments when undertaking building projects will further incentivise retrofitting. This provides another justification for our whole-life carbon recommendation in chapter 2. (Paragraph 217)

43. We recommend that circular economy statements including pre-demolition audits should be a requirement of planning applications which entail demolition of properties, as is already the case for certain applications which London boroughs are required to refer to the Mayor of London for consideration. The circular economy statement must explain why retrofit to match existing or new uses is not possible if demolition is proposed and be accompanied by a whole life carbon assessments of both new build and retrofit. This requirement should be introduced as soon as is practicable and not later than any package of reforms to the planning system which the Secretary of State for Levelling up, Housing and Communities is expected to introduce before the end of the current Parliament. (Paragraph 218)

44. A lack of consumer awareness regarding retrofitting solutions, the perception that retrofit work is costly and/or disruptive, and consumer mistrust in the retrofit sector's ability to deliver quality housing solutions, is creating further barriers to investment in retrofit. In our view there is a clear role for Government to support the industry in promoting retrofit installations, in particular at a time when energy costs are rising rapidly, and the running cost of heating homes and businesses could be reduced by improving energy efficiency of buildings. (Paragraph 219)

45. We recommend that the Government work with industry to increase consumer awareness of the environmental and monetary benefits of high-quality retrofit solutions with a view to increasing the uptake of retrofit work in line with the net zero trajectory and at a time of rising energy costs. (Paragraph 220)

Skills and training

46. The present shortage of workers in the energy efficiency and retrofit sector is chronic, given the overall timetable for decarbonisation of properties. This is a point we have repeatedly emphasised in our recent reports. Significant skills gaps also exist in the measurement of embodied and whole-life carbon and the use of low-carbon materials. On the evidence before us, the Government has not yet responded adequately to our recommendations to develop a retrofit strategy and programme to encourage the development of relevant green skills across the construction trade. (Paragraph 233)

47. We reiterate our recommendation to develop a retrofit strategy and up-skilling programme for construction to meet the needs of net zero. This should be published before the 2022 summer recess. (Paragraph 234)

48. Alongside a mandatory requirement to undertake whole-life carbon assessments and a national methodology for assessments, the Government should make training

in undertaking whole-life carbon assessments accessible across all levels of education and the entire supply chain. The Government, in response to this report, should set out how the Department for Education plans to achieve this. (Paragraph 235)

Formal minutes

Wednesday 11 May 2022

Members present

Philip Dunne, in the Chair

Duncan Baker

Helen Hayes

Caroline Lucas

Cherilyn Mackrory

John McNally

Sustainability of the built environment

The Committee deliberated.

Draft Report (*Building to net zero: costing carbon in construction*), proposed by the Chair, brought up and read.

Paragraphs 1 to 235 read and agreed to.

Summary agreed to.

Resolved, That the Report be the First Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

Adjournment

Adjourned till Wednesday 18 May 2022 at 2.00 pm.

Witnesses

The following witnesses gave evidence. Transcripts can be viewed on the inquiry publications page of the Committee's website.

Wednesday 14 July 2021

The Rt Hon. the Lord Deben, Chair, Climate Change Committee; **Emily Huynh**, Technical Adviser for Advancing Net Zero, UK Green Building Council; **Dr Tia Kansara**, Entrepreneur and co-founder, Kansara Hackney Ltd — Q1–27

Jane Anderson, Board Member, The Alliance for Sustainable Building Products (ASBP); **Dr Danielle Densley Tingley**, Senior Lecturer in Architectural Engineering, The University of Sheffield; **Ms Phoebe MacDonald**, Senior Policy and Public Affairs Advisor, Royal Institute of British Architects — Q28–56

Wednesday 20 October 2021

Dr Jannik Giesekam, Chancellor's Fellow (Lecturer), Department of Civil and Environmental Engineering, University of Strathclyde; **Peter Conboy**, Development Director, igloo Regeneration Ltd; **Dr Alice Moncaster**, Senior Lecturer, School of Engineering and Innovation, The Open University — Q57–91

Dr Alice Owen, Professor: Business Sustainability and Stakeholder Engagement, University of Leeds; **Caterina Brandmayr**, Head of climate policy, Green Alliance; **Robert Lambe**, Fellow, Chartered Institute of Building, Managing Director, Melius Homes Limited — Q92–110

Wednesday 17 November 2021

Michael H. Ramage, Director, Centre for Natural Material Innovation, Department of Architecture, University of Cambridge; **Louisa Bowles**, Representative, LETI (London Energy Transformation Initiative), Head of Sustainability, Hawkins Brown Architects LLP; **Dr Joe Jack Williams**, Associate, Researcher, Feilden Clegg Bradley Studios; **Elaine Toogood**, Head Of Architecture, MPA The Concrete Centre, Representative, Mineral Products Association — Q111–151

Will Arnold, Head of Climate Action, The Institution of Structural Engineers; **Sam Liptrott**, Director, OFR Consultants, Fire and Risk Consultants; **Rhian Williams**, Principal Strategic Planner (London Plan), Greater London Authority — Q152–180

Wednesday 19 January 2022

Adam Mactavish, Director, Currie & Brown; **Alexia Laird**, Sustainability Manager, Landsec — Q181–206

Eddie Hughes MP, Parliamentary Under-Secretary of State (Minister for Rough Sleeping and Housing), Department for Levelling Up, Housing and Communities; **Catherine Adams**, Director of Net Zero and Greener Building, Department for Levelling Up, Housing and Communities; **The Lord Callanan**, Parliamentary Under-Secretary of State (Minister for Business, Energy and Corporate Responsibility), Department for Business, Energy & Industrial Strategy; **Damitha Adikaari**, Director for Climate Science and Energy Innovation, Department for Business, Energy & Industrial Strategy — Q207–249

Published written evidence

The following written evidence was received and can be viewed on the inquiry publications page of the Committee's website.

SBE numbers are generated by the evidence processing system and so may not be complete.

1 A Proctor Group (SBE0078)

2 Ajayebi, Atta (Research Associate, The Exeter Centre for Circular Economy); and Professor Peter Hopkinson (Director, The Exeter Centre for Circular Economy) (SBE0124)

3 Allen, Dr Stephen, Dr Antony Darby, Dr Veronica Ferrandiz-Mas, Dr Will Hawkins, Dr Juliana Calabria-Holley, Dr Daniel Maskell, Matt Roberts, Dr Andrew Shea, Dr Victoria Stephenson, Prof. Pete Walker (Centre Director); BRE Centre for Innovative Construction Materials, University of Bath (SBE0036)

4 Anderson, Jane (Director, ConstructionLCA Ltd) (SBE0155)

5 Anglian Water Services (SBE0025)

6 Architects' Climate Action Network (SBE0123)

7 Arnold, Will (Head of Climate Action, The Institution of Structural Engineers) (SBE0153)

8 BRE Group (SBE0140)

9 BSW Group (SBE0065)

10 Bowles, Louisa (Head of Sustainability, Partner, Hawkins Brown Architects LLP) (SBE0152)

11 British Ceramic Confederation (SBE0064)

12 British Glass (SBE0032)

13 Built Environment group, The Open University School of Engineering and Innovation (SBE0131)

14 CIBSE (Chartered Institution of Building Services Engineers) (SBE0151)

15 CIBSE (Chartered Institution of Building Services Engineers) (SBE0090)

16 CLA (Country Land and Business Association) (SBE0099)

17 Cabinet Office; Department for Business, Energy and Industrial Strategy; Department for Levelling Up, Housing and Communities; and Department for Environment, Food and Rural Affairs (SBE0156)

18 Canary Wharf Group (SBE0046)

19 Centre for Alternative Technology (SBE0068)

20 Centre for Natural Material Innovation, Department of Architecture, University of Cambridge (SBE0106)

21 Chartered Institute of Building (SBE0063)

22 Clean Air in London (SBE0100)

23 Concrete Block Association (SBE0017)

24 Construction Liveries Group (SBE0053)

25 Construction Products Association (SBE0134)

26 Council for Aluminium in Building; British Constructional Steel Association; Galvanizers Association; Steel Construction Institute; and UK Steel (SBE0070)

27 Cramer, Marlene (Research Assistant, Edinburgh Napier University) (SBE0097)

28 Danish Energy Agency (SBE0015)

29 Densley Tingley, Dr Danielle (Senior Lecturer, University of Sheffield); Prof Buick Davison (Professor, University of Sheffield); Professor Matthew Gilbert (Professor, University of Sheffield); Dr Iman Hajirasouliha (Senior Lecturer, University of Sheffield); Dr Maud Lanau (Research Associate, University of Sheffield); Dr Xinyi Li (Research Associate, University of Sheffield); Prof Virginia Stovin (Professor, University of Sheffield); Dr Ling Min Tan (Research Associate, University of Sheffield); and Dr Wil Ward (Research Associate, University of Sheffield) (SBE0052)

30 Department for Levelling Up, Housing and Communities; Department for Business, Energy and Industrial Strategy; and Department for Environment, Food and Rural Affairs (SBE0149)

31 Din, Dr Asif (Sustainability Director, perkins&will) (SBE0041)

32 Earth Building Association of Australia, EBAA (SBE0096)

33 Earth Building UK and Ireland (SBE0117)

34 Edwards, Mark (Technical Director - Climate Change & Sustainability, Arcadis) (SBE0127)

35 Eley, Dominic (Architect, Buckley Gray Yeoman) (SBE0109)

36 Elliott Wood Partnership Ltd (SBE0092)

37 Energy Systems Catapult (SBE0081)

38 FSC UK (SBE0050)

39 Federation of Master Builders (SBE0048)

40 Giddings, Joe (Campaigns Coordinator & Project Director, Architects Climate Action Network & ASBP); and Sophia Ceneda (Sustainability Lead at Glenn Howells Architects & Director at Carbogno Ceneda Architects) (SBE0119)

41 Giesekam, Dr Jannik (Research Fellow in Industrial Climate Policy, University of Leeds) (SBE0075)

42 Glasshouse Group Limited (SBE0086)

43 Goodhew, Professor Steve (Associate Head of School (Research), Art, Design & Architecture, University of Plymouth); Dr Matthew Fox (Research Fellow in CobBauge, University of Plymouth); and Dr Jim Carfrae (Research Fellow in CobBauge, University of Plymouth) (SBE0031)

44 Grantham Institute - Climate Change and Environment at Imperial College London (SBE0059)

45 Green Alliance (SBE0135)

46 HTA Design LLP (SBE0044)

47 Haghi, Mostafa Aref (Architect, Independent) (SBE0030)

48 Harris, Rachel; Benjamin Brace; Gloria Lo; Mina Samangooei; and Kat Scott (SBE0115)

49 Hart, Jim (Sustainability Consultant, JH Sustainability Ltd) (SBE0089)

50 Hill, Director Callum (Environmental Consultant, JCH Industrial Ecology Ltd) (SBE0021)

51 Historic England (SBE0098)

52 Institute of Environmental Management and Assessment (SBE0024)

53 Institute of Materials, Minerals and Mining (IOM3) (SBE0056)

54 Insulation Manufacturers Association (SBE0028)

55 Intergenerational Foundation (SBE0023)

56 James Wilson (SBE0085)

57 Jigsaw Infrared (SBE0147)

58 Kansara, Dr Tia (Entrepreneur and co-founder, Kansara Hackney Ltd) (SBE0145)

59 Kiss House (SBE0061)

60 Knauf Insulation (SBE0138)

61 Laan Lomas, Janna (Director, Grain Architecture); Elin Keyser (Architectural Assistant, Outpost Studios); Emma Twine (Associate and architect, DK-CM); Clare Whitney (Marketing & Sustainability Manager, Clayworks); Will Kirkman (Managing director, Ecomerchant); Martin Brown (Sustainability Provocateur, Fairsnape); Cypren Edmunds (Communications Specialist, StrawBaleUK); Debbie Mauger (Communications Officer, ASBP); and Joe Duirwyn (Founding director, Hartwyn) (SBE0129) LETI (London Energy Transformation Initiative) (SBE0137)

62 Landscape Institute (SBE0111)

63 Landsec (SBE0154)

64 Lendlease Europe (SBE0038)

65 London Borough of Hackney (SBE0142)

66 MCS (SBE0076)

67 MPA UK Concrete (SBE0069)

68 Maids Moreton & Foscote Action Group (SBE0146)

69 Make UK: Modular (SBE0051)

70 Material Research Ltd (SBE0047)

71 Mesh Energy (SBE0040)

72 Mike Wye & Associates (SBE0026)

73 Miller, Mr Robin (Managing Director, Beco Products Ltd) (SBE0008)

74 Mineral Wool Insulation Manufacturers Association (MIMA) (SBE0074)

75 Mitie Group plc (SBE0093)

76 Murtagh, Dr Niamh (Senior Research Fellow, University College London (UCL)) (SBE0043)

77 Murtagh, Dr Niamh (Senior Research Fellow, University College London (UCL)); Prof Alice M Owen (Professor, University of Leeds); and Dr Kate Simpson (Research Associate, Imperial College London) (SBE0035)

78 NHBC (SBE0033)

79 National Federation of Roofing Contractors (NFRC) (SBE0045)

80 National Green Specification & Green Building Encyclopaedia (SBE0004)

81 Natural Building Systems Limited (SBE0010)

82 OFR Consultants (SBE0150)

83 Oliveira, Dr Sonja; Professor Elena Marco; Professor Ana Betancour; Dr Torsten Schroeder; and Dr Jonathan Mosley (SBE0060)

84 Ombudsman Services (SBE0066)

85 Orbit Group (SBE0022)

86 Outpost (SBE0104)

87 Owens, Mr Nicholas (Director; Parish Councillor, Owens Insight Limited; Hassocks Parish Council) (SBE0091)

88 Owens, Rachael (Architect, Buckley Gray Yeoman); and Seb Laan Lomas (Head of Sustainability, Hopkins Architects) (SBE0095)

89 Penn, Joe (Architect, Rock Townsend); and Matteo Sarno (Architect, Boito Sarno) (SBE0126)

90 Price & Myers LLP (SBE0067)

91 Rammed Earth Consulting CIC (SBE0120)

92 Ridley-Ellis, Dr Daniel (Associate Professor, Edinburgh Napier University) (SBE0125)

93 Rockwool (SBE0058)

94 Roderick James Architects (SBE0020)

95 Royal Institute of British Architects (SBE0039)

96 Royal Institution of Chartered Surveyors (SBE0083)

97 STBA (SBE0014)

98 Scharf, Mr Daniel (Consultant, PfT Planning) (SBE0009)

99 Signify Commercial UK Limited (SBE0143)

100 Sir Robert McAlpine (SBE0055)

101 Spear, Dr Morwenna (Research Scientist, The BioComposites Centre, Bangor University) (SBE0118)

102 St. Modwen (SBE0079)

103 Stonewater (SBE0141)

104 Straker, Mr Thomas (Proprietor, Tom Straker Design) (SBE0133)

105 Straw-Bale Building UK (SBE0094)

106 Structural Timber Association (SBE0003)

107 Studio Bark (SBE0130)

108 Supply Chain Sustainability School (SBE0054)

109 The Alliance for Sustainable Building Products (ASBP) (SBE0148)

110 The Alliance for Sustainable Building Products (ASBP) (SBE0027)

111 The Architects' Journal (SBE0116)

112 The Construction Carbon Footprint Scheme; Elmhurst Energy; Targeting Zero; and Bionova Ltd (OneClick LCA) (SBE0122)

113 The Council for British Archaeology (SBE0018)

114 The Embodied Carbon Group (SBE0062)

115 The Heritage Alliance (SBE0049)

116 The Institution of Structural Engineers (SBE0080)

117 Timber Accelerator Hub (SBE0029)

118 Timber Development UK; Timber Trade Federation; and Timber Research and Development Association (SBE0042)

119 UK Architects Declare (SBE0132)

120 UK Green Building Council (SBE0144)

121 UKRI Interdisciplinary Circular Economy Centre for Mineral-based Construction Materials (SBE0084)

122 University of Wolverhampton (SBE0071)

123 WSP UK (SBE0087)

124 Weyforward CIC (SBE0121)

125 Wiberg, Professor Aoife Houlihan (Professor of Architecture, Director of the Architectural Research Group, Research Lead Net Zero GHG Emission buildings and neighbourhoods, The Belfast School of Architecture and the Built Environment, Faculty of Computing, Engineering and the Built Environment, Ulster University, UK) (SBE0128)

126 Wildlife and Countryside Link (SBE0073)

127 Winn, Mr Shawn (Draughtsman, Shawn Winn, Draughtsman) (SBE0002)

128 Wood for Good (SBE0072)

129 Worshipful Company of Constructors (SBE0057)

130 Zurich Insurance (SBE0139)

131 igloo Regeneration Ltd (SBE0136)

132 think tank engineering (SBE0012)

List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the publications page of the Committee's website.

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Number	Title	Reference
1st	Biodiversity in the UK: bloom or bust?	HC 136
2nd	The UK's footprint on global biodiversity	HC 674
3rd	Green Jobs	HC 75
4th	Water quality in rivers	HC 74
5th	Greening imports: a UK carbon border approach	HC 737

Number	Title	Reference
1st Special Report	Energy efficiency of existing homes: Government Response to the Committee's Fourth Report of Session 2019–21	HC 135
2nd Special Report	Growing back better: putting nature and net zero at the heart of the economic recovery: Government and Bank of England Responses to the Committee's Third Report of Session 2019-21	HC 327
3rd Special Report	Biodiversity in the UK: bloom or bust?: Government Response to the Committee's First Report	HC 727
4th Special Report	Green Jobs: Government Response to the Committee's Third Report	HC 1010
5th Special Report	The UK's footprint on global biodiversity: Government Response to the Committee's Second Report	HC 1060

Session 2019-21

Number	Title	Reference
1st	Electronic Waste and the Circular Economy	HC 220
2nd	Pre-appointment hearing for the Chair-Designate of the Office for Environmental Protection (OEP)	HC 1042
3rd	Growing back better: putting nature and net zero at the heart of the economic recovery	HC 347
4th	Energy Efficiency of Existing Homes	HC 346

Number	Title	Reference
1st Special Report	Invasive species: Government response to the Committee's First report of Session 2019	HC 332
2nd Special Report	Our Planet, Our Health: Government Response to the Twenty-First Report of Session 2017–19	HC 467
3rd Special Report	Electronic Waste and the Circular Economy: Government Response to the Committee's First Report	HC 1268