Written evidence from Straw-Bale Building UK

Introduction

Straw-Bale Building UK (SBUK) is a membership association of practitioners, designers, academics and enthusiasts who work together to provide a voice to increase the uptake of straw-bale building across the UK.

There are many reasons that we promote and are passionate about the use of straw bales in construction, including their ability to be sustainable, energy efficient and highly insulating, and to contribute a viable construction and retrofit system.

They also have a founded reputation for being healthy, are able to manage moisture, and are less liable to mould providing a cleaner healthier internal air quality.

Testing shows that straw-bale construction offers compliant fire resistance, is structurally sound, and offers acoustic benefits within and between buildings, and as barriers in locations of high external noise.

They can be constructed affordably and have been used for social housing, they use local co-product materials from the agricultural sector, and can deliver durable and robust buildings that have been tried and tested over two centuries.

Executive Summary

This response has been provided on behalf of members of SBUK, Straw-Bale Building UK, and has the following key responses:

- The inclusion of natural, locally grown and bio-based materials can and should play a significant part in the reduction of UK construction emissions;
- Many natural materials including straw, hemp, lime, timber, etc can sequester carbon, both whilst growing and in use, contributing further to the carbon reduction targets;
- Straw is a co-product of the agricultural sector and a proportion each year goes into waste streams. Including it as a construction material provides additional income to farmers and increases linkages between local growers and users;
- Natural materials offer better building performance in use lowering operation carbon requirements;
- Straw-bale buildings are flexible in use, adaptable, demountable and can be built affordably. The insulation value can provide a very energy demand across the year such as Passivhaus performance, and straw-bale buildings can readily last for at 40% longer than current building methods;

Answers to the call for evidence.

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

1.1. There is no currently no national policy that incentivises the use of low carbon structural fabric materials. Instead the policy focus is on operational carbon, even though embodied carbon emissions are significant and can represent 50-70% of the lifetime emissions of a new building.

1.2. The Climate Change Committee''s repeated recommendation to grow the use of wood in construction has been covered in a number of reports over many years, and still holds true. Countries like Japan and France have policies incorporating timber frame as a primary construction method and not just for low level development but for multi-storey construction.

1.3. Better data is required for both housing and non-domestic construction to monitor the materials that are used in the structural fabric of homes and other types of development.

1.4. In terms of materials:

- Straw is an excellent product generated across the UK that is highly effective at reducing the embodied carbon in new buildings. In fact it has the capability of sequestering carbon throughout its lifetime which is expected to be 100 years rather than the 60 given the brick and block housing method. Straw is also a by-product of the agricultural industry and offers further economic benefits to the farming community. Research by Pittau et al (2019) shows that straw used in construction could remove 3% of the CO2 emitted by the entire construction sector in Europe.
- Lime[1], limecrete and hempcrete[2] similarly offer sequestration capabilities and are available UK wide as materials that can offset the use of e.g. cement/concrete.
- Companies such as MCi in Australia are developing processes to store carbon in concrete materials.[3] However they still use mined resources and are heavily processed. We believe there is an addiction to 'innovation' like this, to cover up a sort of 'business as usual' approach which plays out as a minimal change approach.

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

2.1. As mentioned above materials that have lower embodied carbon, or which can be used efficiently together to provide low embodied carbon solutions should form the primary layer of carbon reduction for new build and the larger challenge of retrofit. Following on in priority are materials that sequester and store carbon over the building's service life and beyond, such as straw, lime, hemp, timber, etc.

2.2. A focus on materials that reduce operational energy in terms of both heating and cooling. The inclusion of materials that have thermal mass, allows buildings to heat up and cool

[1] https://www.sciencedirect.com/science/article/pii/S0959652619332007?via%3Dihub
[2] https://www.sciencedirect.com/science/article/abs/pii/S095965262031893X?via%3Dihub
[3] https://www.engineering.com/story/mineral-carbonation-a-concrete-use-for-captured-co2

down slowly, serving user comfort by both retaining internal heat over winter and reducing the impact of the peaks of external temperatures during warmer months.

2.3. The consideration of a circular economy framework to minimise the use of virgin materials, use waste and or co-products such as straw and maximising the durability of both materials and products. This includes improving recycled content of materials and the amount of products that are available for reuse, as well as supporting the physical recycling processes within the UK.

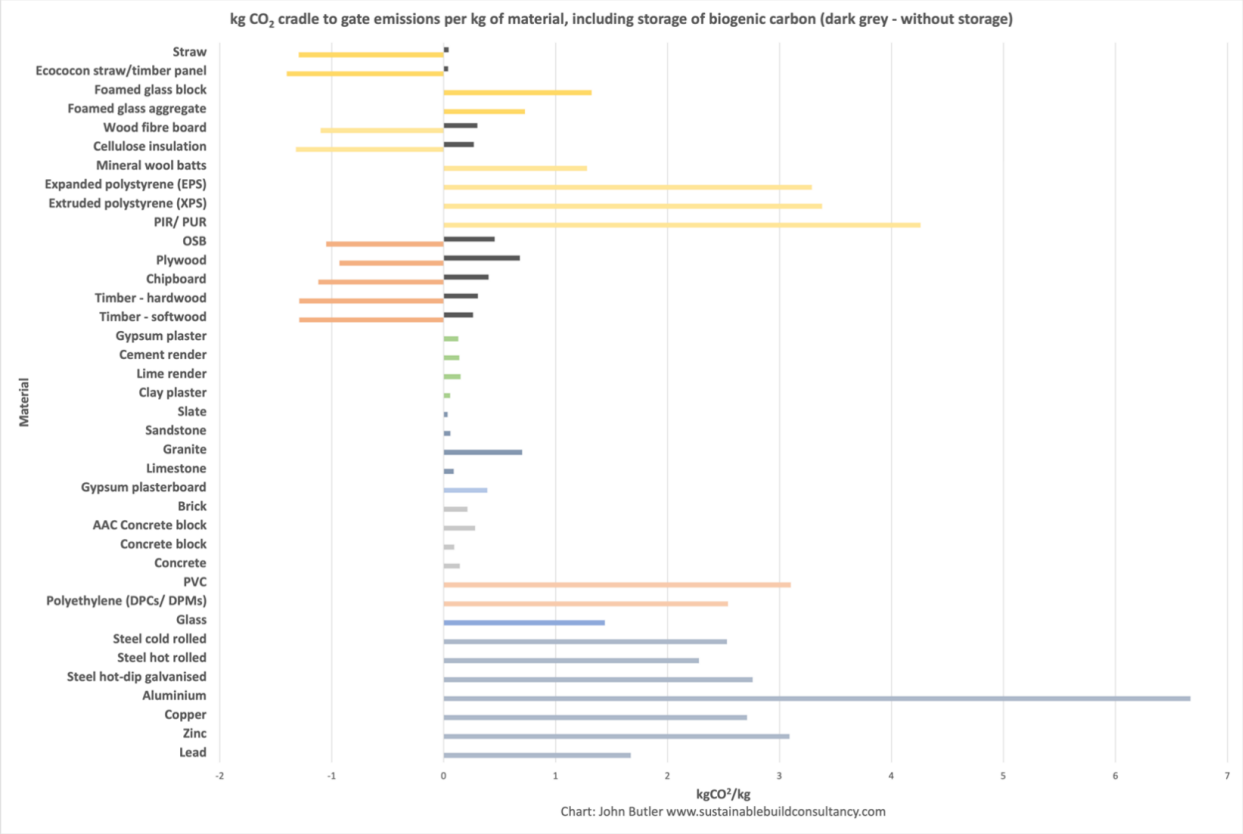
2.4. Increasing construction standards as well as the understanding of natural materials in the construction sector on the ground across the trades, and also through the professions should increase early adoption. It should also focus on the reduction of a need for 'value engineering' which frequently strips out any marginally more expensive low carbon materials and design inclusions in order to save on capital costs. The result of these capital savings increases the lifetime burden of higher running costs and more regular replacement requirements to keep up with increasing standards. It is therefore a negative opportunity and should be highlighted for increased awareness.

2.5. Carbon comprises roughly 50% of the mass of most bio-based material so each kg of structural timber, for example, sequesters the equivalent of 1.63 kg of CO_2 out of the atmosphere. Ensuring bio-based materials including straw are used in a circular and durable way means that this carbon can be locked up within the building fabric for many decades and beyond.

2.6. John Butler of Sustainable Building Consultancy created the table below showing comparable kgCO_2 cradle to gate emissions per kg of a range of construction materials. It shows how low is the carbon impact of natural materials in comparison with the current major construction materials such as aluminium, concrete, masonry glass, oil-based insulations and plastics. Note that straw has one of the lowest carbon impacts.

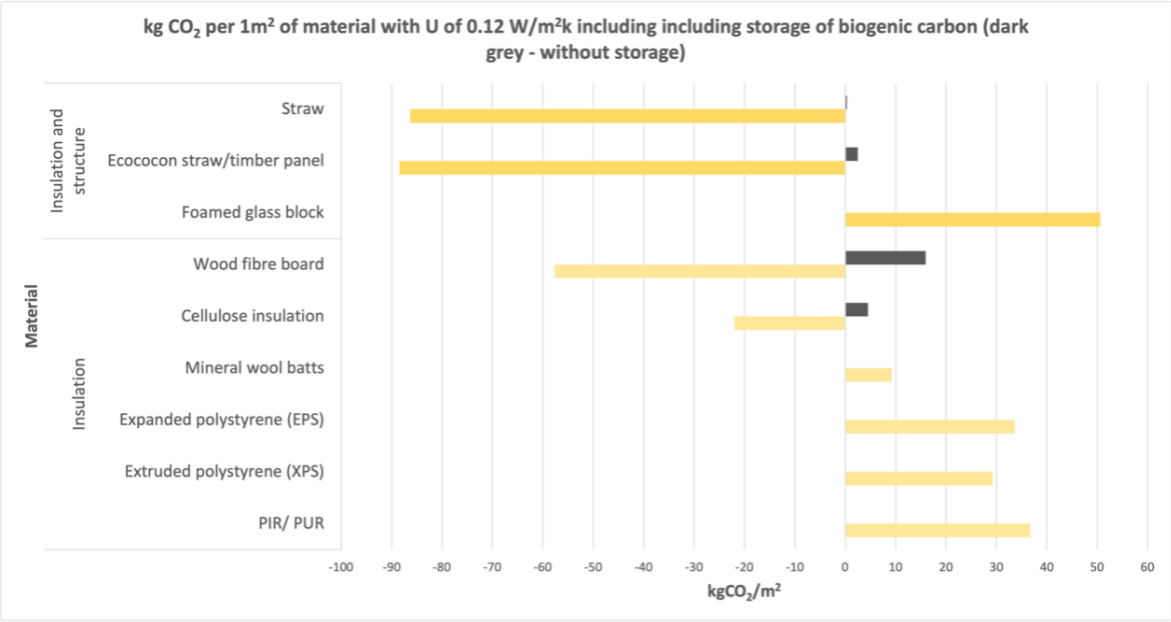
2.7. The whole sector must become increasingly fluent in the carbon impacts of the materials and components and processes we are producing, importing, transporting, specifying and utilising in

construction.

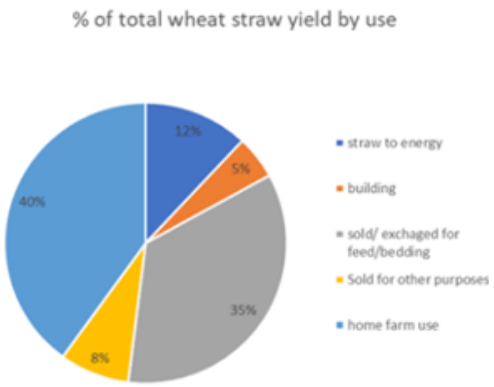


Embodied Carbon of Construction Materials; John Butler, 2020

John Butler also created a more detailed and informative table of comparative carbon impacts of a few specific materials and products including the storage of biogenic carbon:



2019 Data on UK yield of wheat straw



Using data from: UK Gov. DEFRA, 2019, cereal and oilseed area, yield, and production, https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june

In France, straw-bale building is officially recognised, including by insurers, as a mainstream form of construction, and the sector is growing quickly. Many public buildings are now completed using straw construction, and the government has now set up protected allocations of straw from each year's yield specifically for construction.

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

3.1. The planning system and building regulations can make priority use of bio-based, UK grown natural materials a simple requirement. This is what France has done - bio-based and natural materials must be considered as a first priority in all stages of design and construction.

3.2. The planning and building control systems could support educated preferences by producing educational hierarchies for developers and contractors to utilise. By providing guidance on the 'best' low carbon and carbon sequestering materials to use and how to use them, uptake will increase and prices should be required to correspondingly fall, negating the option for 'value engineering' to occur.

3.3. This approach could be done through changes to the SAP/SBEM building regulations certificate that could incorporate an embodied carbon figure for compliance. In the same way that the building certificate has an associated EPC (energy performance certificate) the inclusion of biobased materials would affect the environmental impact of the building providing both a carrot and stick for developers and building owners.

3.4. Net zero is unlikely to be achieved without changing the way land is managed across the UK, and a CCC report [4] suggests a programme of afforestation and agroforestry with the planting of 30,000 hectare of mixed woodland including broadleaf and conifers is necessary.

[4] "Reducing UK emissions: 2020 Progress Report to Parliament ...." 25 Jun. 2020, https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/. Accessed 14 May. 2021.

3.5. In specific regard to permitted development rights, an amendment to the Town and Country Planning Act in August 2020 allows the demolition of single detached buildings, including purpose-built blocks of flats, offices & light industrial buildings. It has been dubbed the 'Right to Demolish'. The demolition of a building, replacing it with a new one entails high energy-consumption that would be captured if whole life embodied carbon were part of the picture being assessed by the government.

3.6. Demolition is almost always the worst option in terms of carbon emissions, and it is predicted that 98% of existing buildings will still be in use by 2050 and the retrofit of these should be a primary consideration in the discussion of net zero carbon.

3.7. In order to create barriers to the practice of demolition and rebuilding, changes to permitted development rights could be retracted, and a review of pre-existing permitted development rights for demolition of other building types undertaken.

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

4.1. YES, Net zero performance should include the consideration of embodied and whole life carbon but in order to do this we need to combat a lack of consistent measurement leading to mis-aligned benchmarks, project targets and claims.

4.2. Access to and use of whole life carbon databases should be part of the assessment and building design process allowing responsibility and awareness to be spread across the delivery chain.

4.3. Embodied carbon assessments should also take into account the following that are all relevant to compare the impact of construction materials. Whether the carbon impact of delivery to site has a bearing on decisions to import or not depends on the proximity of the factory to the site:

- the transport to site;
- wastage on site;
- construction impacts;
- maintenance;
- repair and replacement, and
- the impacts at the end of life.

4.4. The Government should build on the requirements in the Construction Playbook to create a preference for sustainable construction with low whole life carbon in UK Government procurement.

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

5.1. Some of these proposed technologies are bolt-on solutions and these should be taken into account and considered only when truly appropriate in the whole circular design of new build and retrofit projects. They have been shown through schemes like BREEAM to be used as points-generators even when they are not relevant for the site and the project. Some of these proposed

technologies are bolt on solutions and solving the problem of increased detailing, better air quality, and lower energy demands reduces the need to incorporate them. Particularly if the national grid for electricity is to continue increasing the reliance on renewables rather than fossil fuels. This combined with the use of finite resources to produce e.g. PV panels may mean that these are no longer part of the local solution. Water harvesting and grey water are not always appropriate responses to individual situations and can cause more harm than good, a blanket policy should be avoided for inclusion.

5.2. The water cycle within design is often forgotten at concept stage and it has to be brought to greater prominence in government guidance for low and net zero carbon projects. For example, SUDS taken in isolation within the location water cycle can have unintended consequences. The Energy/ Water nexus is well documented and has great impact on overall construction sector carbon footprints. Designers and contractors need greater education in these impacts and how to minimise them

5.3. Where government policy is driving to decarbonise the national grid for electricity this will continue to increase the reliance on renewables rather than fossil fuels. The use of finite resources to produce renewable energy infrastructure such as PV panels may mean that these are no longer part of the local solution. These technologies also have a limited functional life-span. PV panels usually have about 25 year life (the performance decays over time) so we will soon come to the end of life point for the first waves of PV panels in the 90s. We need to dismantle them and retrieve the metals (copper, cadmium, gallium, germanium, indium, selenium, and tellurium….) for new panels as well as mobile phones and electric car batteries so that the need for mining (and the human rights abuses involved in some places) is reduced. Mechanisms such as scrappage trade-in schemes have worked for other products and should be considered here.

5.4. The European Standard, BS EN 15804:2012 covers the assessment of embodied impact at product level, which includes a number of impacts, as well as embodied carbon. This results in Environmental Product Declarations (EPDs) which have been widely adopted globally, including in the US, Australia and New Zealand. There are now over 10,000 EPD available for construction products using EN 15804. As EPDs are becoming so significant in whole life carbon accounting, the government should incentivise companies to add their products.

5.5. As previously noted there are various tools available to undertake embodied carbon assessments and life cycle assessments at both product and building level but there is not one standard industry tool for the UK. In countries where there is regulation at building level (e.g. the Netherlands, France, Finland, Sweden), the common approach is to provide a national methodology (in line with EN 15978) which provides default assumptions etc.

6. How should reuse and refurbishment of buildings be balanced with new developments?

6.1. The large proportion of existing buildings in comparison with the relatively small number of those being built, and targeted to be built, as new shows that the scale of reuse and refurbishment should be urgently supported with financial mechanisms, and, critically, training and education to do it to high quality and correctly. Natural materials play a significant role in retrofit to ensure that the management of moisture is not mis-handled causing serious problems for health and structural damage.

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

7.1. The most fundamental and simple tool available to the government in this regard is to zero rate low carbon retrofit.

7.2. The repeated failure of schemes such as the most recent Green Homes Grants and the previous Green Deal show a need to change the way these operate. Many stakeholders have shown how these schemes could work better to achieve the intended aims - our government must work with stakeholders to continue and increase the investment in successful ways.

7.3. Education across the trades and professions is key to this as is scaling up production of materials to replace the worst offenders on the carbon list. For example replacing extruded polystyrene insulation with sheep wool is practically straightforward as they hold the same technical requirements and are made to be interchangeable.

7.4. There is scope for the government to increase the supply chain for materials in the supply chain. At the moment the uptake of natural materials such as wood-fibre board for internal insulation has out-stripped the supply available from Germany. Now is the time to work to upscale small UK manufacturers of these and other retrofit products to create a home-based supply chain, and to achieve the carbon reductions within the UK accounting.

7.5. In addition, the running of schemes from a trusted source e.g. a local authority would allow for more local people to become involved keeping local jobs, increasing local training opportunities (from schools, to colleges, universities and tool box talks for the trades), opening up local conversations between producers, manufacturers, installers and users and providing a reliable sign off process. Handing off the programme to a small number of major companies fails because there is no connection between installers and profits, and no incentive to change.

ENDS

May 2021