Why Interior Designer Should Understand the Carbon Footprint of an Interior Design

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Literature Review

This Literature review provides a research study of legislation, certification standards and professional opinions which pertain to the question, whether it is possible to calculate the carbon footprint of interior design.

The goal of the literature review is to obtain an understanding of current practice associated with the identification and calculation of carbon emissions concerning interior design products. As current new build interiors and refurbished interiors are not required by law to meet carbon emission targets the aim of the investigation it to comprehend how an interior design carbon calculation could link to manufacturing and construction existing carbon calculations. This review will investigate how to calculate the elements of interior furniture, fixtures and fitting's carbon footprint and if this is achievable.

Research by American behavioural scientist, professor Riley E. Dunlop of Oklahoma State University concerning the denial of climate change revealed over 100 publications written during 2010 denying climate change were funded by industries such as fossil fuel and written by non-academics who were largely members of Conservative Think Tanks (CTTs). (Riley E. Dunlap, 2013)

Yair Schwartz et al published a research paper presenting an embedded framework to integrate Building information modeling (BIM) with Life Cycle Assessment (LCA) components (Schwartz, 2016). The research concluded applying different data inventories to support the decision justification for environmental responsible designs was viable. A pilot of Building Information Modelling (BIM) on the Dutch Bluewater Energy Services building used BIM to analyse materials and carbon emission values over time and when the building requires repair and disassembly. The build was certified to the Building Research

Establishment Environmental Assessment Method (BREEAM). Upon completion, the project handover includes a log of materials that enables materials to be repurposed.

Remanufacturing is central to a circular economy; manufactured products emit greenhouse gas (GHG) emissions. Each year over 92 billion tonnes of minerals, fossil fuels, metals and biomass are used and less than 10% of these are reused in any form. Upcycling and remanufacturing can easily be incorporated into interior design reducing the carbon footprint. Professor Simon Sturgis AADip RIBA (Royal Institute of British Architects) an environmental specialist and advisor to the EU Commission for the past 10 years is a prolific published academic. Professor Sturgis is the accredited author of the paper published by the RIBA 'Embodied and whole life carbon assessment for architect' (Sturgis, 2017) which has set out a code of practice and methodology for carbon-neutral design. Sir Norman Foster, Chairman and Founder of Foster + Partners, based in London, has an international reputation as well as having pioneered a sustainable approach to commercial and residential building's architecture and product design. According to the World Green Building Council, Foster + Partners has committed that company operations will be net-zero carbon by 2030 (World Green Building Council, 2019) and is also leading others to transition through their design projects. (Foster + Partners, 2020)

According to the UK Green Building Council (UK Green Building Council, 2020) the sector currently generates some 35-40% of the total carbon emissions in the UK. Carbon Neutral manufacturing for construction is extensively researched and the UK Construction Industry has set government targets for a carbon-neutral industry by 2050. (Legislation.gov.uk, 2020)

Carbon footprint calculation tools and sustainable construction specification directories are available for building materials and some of these are also relevant to interiors. Construction Industry legislation and regulation standards such as LEED, BREEAM, ISO20400, PAS2060

are recognised for sustainable building practice and methodology, aspects of these should align with interior design fixtures and fitting specifications.

Locally sourced and sustainable products are considered to be environmentally kind, however when one looks at where the components are sourced the true story is revealed. A good illustration of this is furniture manufacturing and how timber is sourced and the product marketed. The Timber Trade Federation is one of many such organisations which will provide relevant secondary research aligned to interior design. Carbon emissions are already measured within the construction industry and there is a rich source of research, academic papers, data and legislation available from this market sector.

The Furniture Industry Research Association (FIRA) undertook their research to calculate furniture's carbon footprint, although published in 2011 it is still relevant as carbon emissions in furniture manufacturing have not been reduced significantly. (FIRA, n.d.)

Manufacturers became inclined to exaggerate green and sustainable properties of their products (this is also known as Greenwashing), which brings additional problems for designers trying to select carbon neutral products and is why legislation and standards will be necessary. Luxury bed manufacturer Harrison Spinks, Leeds is a carbon neutral+ company that has worked to the PAS2060 certifications and will be used as a case study for the purpose of this research. (Harrison Spinks, 2020)

Existing certifications and standards relevant to the research question are:

- ISO14064-1/2/3 specification with guidance for the verification and validation of greenhouse gas statements. (British Standards Institution, 2019)
- ISO20400 a guidance standard for sustainable procurement can be applied to any type of organisation. (British Standards Institution, 2019)
    - Public Health Wales has an interesting case study for refurbishing offices with sustainable products that met ISO20400.
- PAS2060 internationally recognised certification standards for the demonstration of carbon neutrality. Produced by the British Standards Institution (BSI) in effect since April 2010. Willmott Dixon Group has already reduced carbon emissions by 59% since 2010 (Willmot Dixon, 2020).
- LEED - The organisation of Leadership in Energy and Environmental Design (LEED) an American agency with worldwide recognition for a green building rating system. LEED for Interior Design and Construction (LEED ID + C) a green rating system for building projects which have to be registered with them and the current membership is over 12,000 organisation and people.
- BREEAM. Launched in 1990 BREEAM certification is an internationally recognised standard accreditation that validates the sustainability value of materials cost-effectively. BREEAM helps clients during planning, design, construction, operation or refurbishment. The commercial of lowering running costs, increase market value and desirability.

Summary

Sustainable design has become mainstream, today eco-friendly is a recognised design model with trends and styles which will continue to evolve to suite different tastes and needs. Upcycling furniture, buying local and actively seeking energy-efficient materials will become standard practice in the movement to reduce carbon emissions. Manufacturers of high-quality product brands will invest in new practices and procedures to maintain market share and profitability, inevitably prices will increase and interior design influences will change to reflect higher quality, sustainable, cradle to cradle goods which will become more locally sourced.

Until clear international standards exist for manufacturing, carbon-neutral labeling and calculations will continue to be inconsistent or misleading. As an interim measure, a clear internationally recognised product labeling system giving a rating and country of origin would enable consumers and professionals to make better-informed choices.

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Introduction

Increasingly interior design and the decisions designers and their clients are making, are decisions being shaped by environmental considerations, in terms of their sustainability. Influencing factors should now include how the design can improve energy efficiency (heating and lighting), CO_2 levels involved in producing materials should be considered (renewable materials), the longevity and future flexibility of the scheme (moveable walls, modular furniture which can be easily changed to accommodate shifting needs) and looking to reduce waste by factoring in 'product life costs'.

The research aims to identify if an Interior Designer can calculate the carbon footprint of a design scheme and if there is a valid case for this requirement now or in the future. The research will identify those standards which are best applied to the interior design market sector and consider whether these are subject to a validated process and certification and how they can be identified.

On 1 May 2019, the UK Parliament declared an Environment and Climate Change Emergency and by June 2019 the Climate Change Act was amended to commit the UK government to a net-zero emissions target by 2050. In response to the Act the Construction Industry Council and the built environment professional bodies including the British Institute of Interior Design (BIID) became signatories to a combined statement of intent, the statement committed the signatories to publish and implement climate change and biodiversity action plans, working together, bilaterally and also through the Construction Industry Council (Appendix 1)

History

Carbon dioxide (CO_2) emissions started to increase dramatically in the Eighteenth Century when the Industrial Revolution began as a consequence of the growth in fossil fuels, manufacturing, transportation and railroads. Swedish Nobel Prize laureate for physical chemistry, Arrhenius, had published a calculation of global warming from human emissions of CO_2 by the end of the Eighteenth Century despite further research it was not until 2019 that a Climate Change Crisis was recognised by the UK government and the rest of the world.

The awareness of the dangers brought to the world by climate change acted as a catalyst for influencing interior design trends and movements. In the past design was influenced by new technology such as LED lighting, fashion trends for linens and seasonal colours, improved communication improving design and production, trade restrictions reducing the availability of materials, advances in manufacturing (eg. Glass production improved to enable large glazed window units) immigration and migration as well as the climate of a particular region. Increasingly Government policies and legislations will continue to impact interior design, with a major factor for future product specification being based on the carbon emissions, sustainability and environmental impact generated throughout the manufacturing and supply chain process.

Sustainability is now the movement which has stemmed from the recognition of a worldwide climate change crisis. Trends will continue to develop within the sustainability movement and these will be influenced by the availability of environmental resources, geography, economics, local and worldwide politics and culture. These are already emerging and being given descriptive titles such as ‘Japandi’ a mixture of Japanese and Scandinavian cultural beliefs and aesthetic style.

Introduction to Research

In responding to the needs to reduce carbon omissions a series of different standards and legislation have subsequently developed over time. These variations have resulted in a confusing picture in terms of carbon-neutral certifications and standards published by global and national organisations. For the purpose of this research we will be considering which international and UK standards and certifications can be relied upon and the application methods used within the construction industry and if these are transferable to the Interior Design Profession to enable accurate carbon emission calculation.

Methodology

The method of research for this proposal has been the critical review, evaluation and interpretation of policy documents, legislation, research, initiatives and case studies. All the data used will be secondary research due to the quantity, validity and breadth of publications available. Online research from reputable online sources or references and offline references from written publications, documentaries and interviews from industry professionals, government and international commissions.

Why Interior Designers Should Understand the Carbon Footprint of an Interior Design

Sir David Attenborough warned in January 2020 ‘The moment of crisis has come…. we can no longer prevaricate.’ He urged governments to act urgently and not accept the risks created by a further decade of denial and inaction. In 2019 growing concerns led to a global recognition that emissions needed to dramatically reduce and on 1 May 2019 the UK government legislated for a net-zero target in 2050. This action significantly increased the urgency for businesses to move from just being aware, to a position of acting now with greater drastic measures. In February 2020 the climate crisis led to a combined statement of intent being released by the Construction Industry Council and multiple professional bodies including the British Institute of Interior Design (BIID). In the released statement the listed members committed to publish and implement climate change and biodiversity action plans working with other professional bodies and the Construction Industry Council.

In recent years Interior Design and Architecture Degrees added modules on sustainability and Eco-friendly design due to the recognition that the construction industry, which includes Architects and Civil Engineering, is a major culprit of the climate change crisis. However, many professionals already in practice are not as aware of the significant changes both commercial and private clients need to implement for a carbon-neutral future. According to Susan Slotkis author of the Foundation of Interior Design, *‘there is now no doubt that sustainability is an industrywide movement and not a trend’* **(Slotkis, 2017)**.

Within the Architecture and Construction industries, carbon emission calculations are possible at the design stage, throughout the construction process and at completion. These calculations are only possible due to the significant investment which has been made into

developing technology and the collation of the carbon calculation of the product specification data. The product data has been collected for a directory specifically for use with the internationally recognised BREEAM system of construction management.

Statement of Intent

The recent and important statement of intent from the British Institute of Interior Design (BIID)supports the response to the research question that interior designers should be aware of carbon emission reduction within their role. Although the construction industry had already implemented a change in working practice the interior design profession did not commit until 25 February 2020 with the release of the combined statement of intent.

The statement of intent adds weight to the value of the research question and confirms that interior design professionals need to understand the significance of carbon emissions. BIID will be working with climate change organisations who are experts in the field. The statement of intent signed by BIID commits to implement best practice by education accreditation, membership qualification and Continuing Professional Development (CPD) as well as encouraging a change in thought process and leadership to its organisation and members which will support a net-zero carbon emission pathway. This commitment by BIID if adhered to will influence and educate members of the Interior design profession who have not benefited from the changes made to education and training for graduates. The statement refers to changes of requirements to membership qualification, a logical step will be for a change in the membership agreement which commits the signatory to agree to follow the BIID best practice in relation to the net-zero carbon pathway.

The Construction Industry and Carbon Emissions

In May 2018, it became mandatory for the Royal Institute of Chartered Surveys (RICS) members to conduct a minimum of two Whole Life Carbon (WLC) assessments, one at the design stage and another at completion. Whole Life Carbon includes the carbon emissions of the building construction and the carbon emissions of the operational needs of the building, such as heating and water.

The World Green Building Council stated on the 23 September 2019 that buildings and construction were accountable for 39% of the global energy consumption and one-third of global greenhouse emissions. As a result, the construction industry's role in achieving legislative targets in the UK is one of the most critical for achieving the World Green Building Councils Net Zero Carbon Buildings Commitment. Although the construction industry has been specifically targeted with a date to become carbon neutral this currently pertains to the construction and operational carbon emissions, so the interior furniture, fixtures, fittings and decoration do not currently contribute to the WLC assessment of a building.

Professor Simon Sturgis AADip RIBA (Royal Institute of British Architects) for the past 10 years has practised as an environmental specialist and is an advisor to the EU Commission, UKGBC, Green Construction Board, RICS, BRE and has written numerous articles, essays and books relating to carbon emissions and sustainability. Sturgis is the accredited author of the paper published by the RIBA 'Embodied and whole life carbon assessment for architects' which has set out a code of practice and methodology for carbon-neutral design. A press release on the 15 February 2018 quotes RIBA Sustainable Futures Group chair Simon Sturgis '*The guide encourages architects to think about the sourcing of materials from all aspects and to understand the implications of design choices and what happens after practical*

completion……'. The report references relevant standards and further research confirmed that PAS 200, PAS 2080 and the ISO 14000 series are also transferable to interior design product specification.

The majority of Architects, Engineers and Construction companies operate with Building Information Modelling (BIM) which is an intelligent 3D model process for designs, plans, construction and the total management of a building's infrastructure from concept through to completion and during its lifecycle. Mott McDonald global engineering company with a presence in over 150 countries developed a carbon portal that works with BIM software and can calculate the carbon footprint of a building within 30 seconds, allowing product specifications to be replaced with alternatives to reduce the final carbon emissions the project.

In a press release in March 2013, Mott McDonald global sustainability leader Davide Stonati was quoted as saying (Mott McDonald, 2020)

> *'As the importance of carbon management increases across the industry, we expect carbon to become fully embedded alongside scheduling and cost details as the sixth dimension of BIM…….'*

In 2018 the government published a policy paper for a carbon emissions tax which will be introduced gradually, the tax will be calculated with the existing method of monitor, report and verification (MRV) scheme on an annual basis. If this tax becomes applicable to all products manufactured in the UK which are not carbon neutral the cost to the consumer will increase conversely carbon neutral product costs tend to be raised due to higher material, quality and manufacturing expenditure to meet accreditation.

Sustainability and business

Carbon neutrality has been recognised as one of the main metrics for a global response to climate change. Carbon is one of the main components which contributes to greenhouse gases and climate change which now needs a dramatic and significant impact to achieve the net-zero carbon emissions target by 2050. A sustainable business generates more customers who wish to source product which does not have a detrimental impact on the environment. New York university's (Kronthal & Whelan, 2019) Center for Sustainable Business research into consumers' purchasing packaged goods found that 50% of the growth from 2013 to 2018 came from products marketed as sustainable (Kronthal-Sacco et al, 2019).

Carbon Neutral is a term that identifies a product, company or event which has balanced out the carbon emissions generated. There is an increasing number of businesses claiming to be carbon neutral. These companies recognise that being carbon neutral can play a key part in their Corporate and Social Responsibility (CSR) strategy and keen to be recognised as working for the common goal of halting climate change. They are also aware that individuals and corporate customers prefer to buy products and services from environmentally conscious suppliers, therefore there is a significant risk of greenwashing by manufacturers.

Many companies use Carbon Offsetting to achieve a carbon-neutral rating, by offsetting excess emissions with certified schemes such as renewable energy generation, improving energy efficiency, reducing deforestation and planting more trees excess carbon emissions are traded against certified schemes to meet the carbon-neutral target. Mattress manufacturer Harrison Spinks, Leeds published in February 2020 their current total CO_2 emissions are 3566.84 tonnes, which they are reducing each year and offset the excess by supporting registered environmental initiatives.

Harrison Spinks started to implement changes in working practice in 2009 and became a carbon neutral+ certified business in 2017. The certification was audited by an independent and the standard the certification was given against was PAS 2060 a carbon neutral+ standard developed by Department for Environment Food & Rural Affairs (Defra), the Carbon Trust and British Standards Institute. Harrison Spinks changed how they sourced materials and now have their own farm close to the manufacturing site to grow 800 tonnes of natural fibre including hemp, flax and wool. As a result of reducing the wool and cotton content of their mattresses with hemp and flax fibres the CO_2 production has been reduced by 83% per mattress. Producing 90% of their materials saves 1,300 tonnes of CO_2 each year and by weaving their chemical-free fabric they remove 500Kg of chemicals a year from the environment. The innovative spring system developed by the company replaced the need for foam making the mattress fully recyclable and no longer a landfill problem.

Commercial businesses and products claiming to be carbon neutral are increasing as consumer's awareness grows for the global climate change crisis. Growing preference by consumers for goods and services marketed as sustainability and environmentally friendly highlights the need for an instantly recognisable global standard rating label. Specialist and mainstream online shopping websites are improving search filters to reflect a demand for ethical shopping but the number of products available with a certification of a carbon footprint is minimal. The UK currently has twenty or more different certifications for products claiming to be Eco Friendly with carbon-neutral products being the least represented.

Recycling and repurposing materials reduce the need for high carbon emission manufacturing. The UK Government's Resources and Waste Strategy for England was published on 18 December 2018, with the key goal *'…to move to a more circular economy*

which keeps resources in use for longer'. The aim is to encourage a shift away from the *'take, make, use and throw'* approach with a push towards wasting less and reusing, recycling and repairing more, this practice has become known as the cradle to cradle life cycle. Instead of automatically specifying new products, Interior Designers can specify re-upholstery, upcycling and repurposing, furniture from specialist suppliers of vintage, antiques and secondhand furniture and reclamation companies.

The Furniture Industry Research Association (FIRA) undertook research to calculate furniture's carbon footprint, although published in 2011 it is still relevant as carbon emissions for UK furniture manufacturing have not reduced significantly since 2005 (Energy and Enviromental Services, Feb 6, 2020).

To be a responsible Interior Designer sustainability should be at the center of each project, this will generate a positive impact on the environment, the community, business and individuals which it serves. Interior design can influence occupants behaviour to further reduce energy consumption.

Selecting a supplier

Selecting a supplier with an effective Environmental Management System, such as ISO 14001, or is a full member of the Furniture Industry Sustainability Programme (FISP) strongly suggests they are addressing carbon reduction and environmental management. FIRA's report concluded that quantitative benchmarking for carbon emissions in the furniture industry was unreliable when selecting alternative products.

According to FIRA statistics, the UK produces 1.6 million tonnes of bulky waste, 42% of this being furniture and mattresses. The waste also represents a substantial loss of raw material

and the cost of this is estimated to be £150m. Leading carbon-neutral manufacturing within the home furnishing sector is Leeds based Harrison Spinks, it took them 8 years to achieve carbon neutral+ accreditation. They changed and improved the manufacturing process and material supply sourcing to local inhouse supply and component manufacture; the product is also now fully recyclable. The carbon neutral+ accreditation awarded follows the PAS2060 Carbon Neutrality programme and meets the British Standard Institute (BSI)'s specification on carbon neutrality. PAS 2060 came into effect in April 2010 and was developed by BSI, Defra and the Carbon Trust, although not yet recognised as a British or European Standard major construction and manufacturing companies consider it the most probable certification to be developed further. (Carbon Trust, 2020)

Climate change, sustainability, carbon-neutral and global warming have become everyday phrases we repeatedly see and hear, yet do we fully acknowledge how we have individually contributed to the harm caused to our planet. Interior Design professionals have an additional responsibility in reversing the harm to our planet made in the name of progress, as commercial and residential clients invest in product s specified within a design scheme. Architectural designs and construction methods have already changed to meet carbon neutral targets set by governments. Interior Design projects will have the same responsibility and designers must understand why and how to calculate the carbon footprint of each commercial and domestic scheme.

Construction is one of the largest industry sectors of the UK economy in revenue generation and employment, but it also produces more than half of the UK's waste (Construction statistics, Great Britain: 2018, 2019). The purpose of this research is to understand how a carbon footprint in construction is calculated and if this can be applied to interior furnishings and fittings. As the major factor of a carbon emission calculation is dependant on the product

manufacturing process this calculation must be validated and certified to ensure confidence and trust in the calculated figure. Many of the factors calculated for construction materials can also be applied to furniture, fixtures and fittings using industry standards.

Interior Designers should consider how to improve the energy efficiency of a scheme as energy consumption has one of the most significant impacts on climate change. Materials origin and environmental impact need to be identified such as wood. Furniture with an FSC label ensures that the timber was sustainably harvested from responsibly managed forests and the Carbon Neutral+ certification shows the product has been manufactured by a responsible company that is compliant to PAS2060 standards.

Products made from waste materials and remanufactured into usable materials reduce the environmental impact on a manufacturing process from new resources. Carpets and fabrics can be made from discarded plastics instead of nylon produced from crude oil. German flooring manufacturer Nora announced in early 2019 that all floorings produced by them are carbon neutral, the method used to support this statement is due to the carbon emissions being offset and the client then receives a certificate issued by the company with the quantities purchased. This could be considered carbon guilt as there is no incentive to tackle the problem. The life cycle of the product is verified to the ISO 14064-3 standard, which validates this claim and allays fears that it could be an instance greenwashing, a term used when misleading and unsubstantiated claims about environmental benefits are made. Nora has also developed a range of floorings and accessories which have been certified Cradle to Cradle (Silver) a quality standard with the aim to promote an infinite product recycling economy, the rating level ranges from Bronze, Silver, Gold and Platinum. A selection of Nora products has Environmental Product Declarations (EPDs) that contribute to LEED, however they are not endorsed by BRE so are not acceptable in a BREEAM assessment. The

declaration contains information concerning the recycled content, rapid renewable content, take-back programs, regional materials, and low-emitting flooring and adhesives. (Appendix 2).

Carbon Neutral Sustainable design has become desirable to both the consumer, corporates and manufacturers. Today Eco-friendly is not a fleeting fashion but a mainstream classic style that will continue to evolve to suit different tastes and needs. Upcycling furniture, buying local and actively seeking energy-efficient materials will become key elements of future design briefs for residential and commercial environments.

This study has highlighted that currently there are multiple policies, standards and legislations being applied. In the future it is probable that products that are not aligned to the carbon-neutral world policy will become more expensive as it is logical that these products will be subject to higher tax rates with the introduction of a Carbon Tax. The revenue generated from these taxes will be used as additional funding to offset carbon emissions with registered schemes, a system already working within the construction industry for new builds that are not carbon neutral.

Product Labeling

This research aimed to define how interior designers will be able to fulfill a specification for carbon-neutral interiors and whether it will be possible to calculate the carbon footprint of an interior. As the government and world climate change organisations to date have focused on the largest consumers of combustible fossil fuels of which residential and commercial buildings are included, the legislation and standards have not been clearly defined for product labeling. The report published by FIRA concluded that it was not possible to have a ‘one

size fits all' approach to carbon emissions data for the furniture industry. The results of the FIRA study identified that it was not possible to achieve reliable carbon calculations despite standard methodology being applied. This supports the conclusion of this research that until legislation is made for all products to have a carbon footprint label which is internationally recognised it will not be possible for interior designers to calculate the carbon footprint of a design scheme.

Greta Thornberg the Swedish Environmentalist stated in her speech to the World Economic Forum in February 2020 that '*…we should not wait to rely on technologies that don't even exist today as perhaps they never will.*' The decisions we make today without the ability to calculate the carbon emissions will still affect the future of our planet and so until the tools are developed for interior design carbon calculation, consideration should be given with the information available on the probable carbon footprint level of a product.

Product labeling has been researched and hypothesised for decades and the consumer still has no visible guide to select a product that does not contribute to harmful greenhouse gas emissions. Although there are many organisation publishing information for sustainable and Eco-friendly materials e.g. the Forestry Stewardship Council (FSC), there is no singular group focusing on developing a comprehensive labeling system for carbon-neutral products.

In January 2007, Sir Terry Leahy, Chief Executive of Tesco announced Tesco's intent to have carbon labels printed on all of their products, the company stocks over 70,000 products and was a gigantic commitment and resulted in only 20 of the Tesco own-brand products having a carbon footprint label on the packaging. The University of Manchester has undertaken extensive research since 2007 as have other global academic institutes and no singular method of labeling has been identified to date.

The debate and research into carbon labeling have been ongoing for many years due to the complex multiple calculations which can alter the footprint of a single product when a component source is changed or even the power requirements of a manufacturing process. Large manufacturers have to review the supply chain for carbon emissions data and this new focus has encouraged reductions in energy use, transportation and packaging methods and developed new marketing opportunities and employment roles, however, we are no closer to having an instantly recognisable global labeling or data specification system.

Dr. Brenda Boardman, MBE, FEI argued in her report Carbon labeling: Too complex or will it transform our buying? that unless an agreement on how the calculation boundaries would be defined it would not be possible to have a standardisation for labeling. The calculation could end at the point the product reaches the shelf or beyond this point when it is at the point of use. She concluded that carbon labeling should be and A-G colour rating system similar to the system used for electrical appliances. However, this approach could only be developed if an agreement was met on the categorisation of products, for example, should all meat products go into band G. She also argued that carbon labels will only prove truly effective when consumers can compare carbon footprints using an A-G colour rating system similar to that shown on electrical devices. However, Boardman warned that the development of such an approach would only be possible if an agreement is reached on how to categorise products. She gave an example in relation to the food industry *'We have to ask if all meat products will go into the G band, or if beef goes in the G band and chicken goes in a lower band'* she then highlights that a lower carbon emission beef might also apply to a lower band. Transferring this system to other manufacturing groups would result in similar confusion, a sustainable oak timber grown in North America, shipped to China for furniture manufacturing and then shipped to Europe for sales and distribution would be a completely different classification to a sustainable timber grown in Sweden and then manufactured in

Sweden and shipped to Europe for sales and distribution. The research undertaken by FIRA agrees with Boardman's conclusions that a standardisation of a uniform carbon footprint labeling system is not yet possible.

Design Considerations

Commercial interior design projects are responsible for large amounts of waste due to the lifespan of commercial interiors often being refreshed every 5 - 7 years, as disposal is an easy option. The act of refurbishing an interior with such short lifespans is often not considered as an operational energy cost for a building's CO_2 emission over its lifespan. Many designers or suppliers have little knowledge regarding the properties of the materials they specify and as clients become more aware of the climate change crisis they will expect guidance and information from the professional services they have contracted.

Targeting Zero (Sturgis, 2020 p.28) highlights that interior design installations for buildings have a short life cycle in comparison to the structure and shell. As a result, the carbon cost of refits over the life of a commercial building can be far greater than initially calculated when only accounting for the initial interior design scheme. Sturgis confirms that the interior specifications need to consider the initial carbon cost and the future possibility for recycling to reduce carbon cost as illustrated in the carbon footprint for curtain walling, Figure 1, Illustrative supply chain for aluminum curtain wall frame. (Sturgis, 2017, Chapter 2, p36) Flexible layouts, partitioning systems that are not fixed and can be reused, combined with reducing the number of products. Sturgis identifies Marks and Spencer's food halls designs which no longer have ceiling systems and Apple stores which are thoughtfully designed to be simplistic and sparse and keep carbon costs to a minimum, although Apple has recently been

critised for resisting a move towards right to repair which would follow the action plan for a circular economy proposed by the European Commission. (European Commission, 2020)

In addition to limiting the supply chain to certified carbon neutral companies, recycling, upcycling and using local suppliers whenever possible the actual design of an interior can also reduce carbon emissions. Natural light reduces the need for electric lighting and by embracing as much natural sunlight as possible energy savings can be made, window treatments need to consider the building aspect and how space will be used and when. When external environmental temperatures are raised window treatments can be used to create shade and thereby reduce the need for air-conditioning and lowers energy costs. Incorporating technology for lighting and heating controls via apps, Led lighting and motion-sensitive lighting, Living walls and houseplants can be used inside the home to absorb dust and air pollution. When choosing colour palettes, it is possible to give a feeling of warmth with red and yellow tones giving a feeling of warmth and light beige and cream tones promote a feeling of coolness. It is also possible to purchase a mattress that can be cool on one side for the summer and warmer on the reverse for winter, due to the airflow, thickness of interior fillings and air vents. A professional Interior Designer needs to educate themselves about every product specified with the thought process of reducing carbon emissions.

Certifications

As a result of this research, from the perspective of the professional Interior Designer, the cerifications which demonstrate a commitment to a carbon-negative organisation and product are PAS2060, PAS2080 and ISO14064-1:2019 when these are validated by an accreditated assessment organisation.

The research identified existing carbon neutral standards already implemented by the construction industry and manufacturing are transferable to furniture fixtures and fitting manufacturing working practice. Mattress manufacturer Harrison Spinks of Leeds has been validated by an independent assessor as a carbon-neutral + company to PAS2060 and ISO14064.

The standards identified can be used separately or in conjunction with each other, the standards listed below are the most relevant.

- ISO14064-2019 is an international set of standards used to monitor, report, quantify and then verify the greenhouse gas emissions which affect climate change.

- ISO20400:2017 an international guidance set of standards for all organisations which implement a sustainable procurement process. A company that meets the IS020400 standard will consider the environmental impact of any purchase as part of the buying process.

- PAS2060:2010 is an internationally recognised carbon-neutral standard and builds on the existing PAS2050 enviromnetal standard. Produced and published by the British Standards Institute (BSI) PAS2060 companies are validated by a third party or can self-certify they are carbon neutral. Carbon neutral certifications and carbon neutral product certifications are award if the strict criteria for neutrality is achieved

- PAS 2080:2016 is an industry-standard on carbon management that guides those who want to cut carbon in infrastructure delivery.

In addition to the ISO and PAS standards, Architects and Construction companies work to green building rating systems Leadership in Energy and Environmental Design (LEED) and BREEAM Sustainable building certification are both globally recognised systems.

- LEED - Leadership in Energy and Environmental Design recognised worldwide for green building certification developed by the United States Green Building Council (USGBC). LEED for Interior Design and Construction (LEED ID + C) has a certification method for building and interiors. It includes rating systems for the design, construction, operation, and maintenance of green buildings, homes and districts with the aim of environmentally responsible resources and efficiency. LEED certification is only issued if an Accredited Professional (AP) is used and the report is submitted to the United States Green Building Council for assessment to issue a certificate.

- BREEAM an internationally recognised accreditation standard that validates the sustainability value of construction materials. BREEAM can be used with BIM software at the design and planning stage and can calculate the carbon footprint of a building in seconds. Trained assessors report against a credited criterion and this assessment is then validated to the BRE to issue a certification.

Sustainability is a movement driven by climate change and carbon-neutral specifications for interiors will inevitably become the standard and not the exception. PAS2060 will probably become the UK standard for carbon neutral+ manufacturing and if a company combines this with ISO14064-2019 which certifies the companies standards to a recognisable international certification the product and organisation meets the highest level of certified and verified carbon neutral products.

Conclusion

Evidence shows that an understanding of how to calculate the carbon footprint of a product is desirable, however, calculations are complex, and the reliability of the data would be open to question if not validated by a professional. The research identifies a connection between government targeting of the construction industry for carbon emissions and the subsequent investment into developing tools and changes in working practice to achieve carbon emission targets and reduce costs. An example of this investment was the development of the carbon calculator portal by Mott McDonald which integrates with the BIM software and calculates carbon emission of building design in seconds. It is feasible to conclude that tools required to accurately calculate the carbon footprint of a design scheme will not, therefore, receive investment required for development until the industry is forced to react by government legislation and the further cost implications of a carbon tax.

Research suggests that all products will eventually have a material passport, which will be used for the end of its useful life to ascertain the potential for reuse, recycling or recovery of component materials. Commercial and larger residential schemes with building management systems hold and update data for all products and materials contained within the building, it is probable that the same material passport will be issued with furniture, fixtures and fittings in the future.

As software modeling for interior design advances product directories, similar to those currently available to the construction and engineering industry with BREEAM and BIM technology will inevitably include specifications of products carbon data. Until findings show that valid and certified data and technology are available the interior designer will not be able to speedily and accurately calculate the carbon footprint of a design scheme at the initial design stage. The implementation of changing any manufacturing process and

company ethos into a carbon-neutral organisation takes time, strong leadership and a strong profit margin capable of financing the cost of change. The luxury mattress manufacturer, Harrison Spinks is a major supplier of high quality and highly-priced products, the changes were implemented and it took 7 years to achieve their certification, the company is continuing to reduce the need for carbon offsetting by working to continue to reduce any surplus emissions.

Carbon emission calculations will eventually become part of the manufacturing process for all companies. However, until such time the decision-making process of an Interior Design Professional should include the following principals: -

- Does the client brief reference sustainability and is the client working to reduce their carbon footprint by following the guidelines to a recognised standard. If the client has not considered reducing carbon emissions, it will become the professional responsibility of the Interior Designer to educate the client. As a consequence of the commitment statement released by BIID to the Climate Change Emergency, it is highly probable that members of the professional body will have agreed to be responsible for reducing the carbon footprint of future projects. As a result, it will be best practice to research products and manufacturers, request copies of their certifications and learn to recognise current standards that are relevant to the interior design industry (e.g., PAS2050, PAS2060 and ISO14064-2019). Manufacturing companies with a carbon neutral or carbon neutral+ certification will become preferred suppliers as will manufacturers which are local to the project site. Regional directories for sourcing products from local suppliers will begin to emerge and when a suitable supplier is not available it will be important to consider how the product is moved from the point of manufacture in addition to the credentials of the product.

- Evaluate each design choice in terms of the upfront carbon reductions and as part of a whole lifecycle approach. Consider the lifespan of an item from cradle to cradle, can it be repurposed, reupholstered or recycled as part of the design. Source antique, vintage and repurposed furniture fixtures and fittings from specialist furniture suppliers and reduce the carbon emissions generated by manufacturing.

- Plan for the future by understanding the components life cycle of a product to avoid future embodied carbon at end of life. Examples of this are the Harrison Spinks mattresses which are completely recyclable due to the elimination of any foam filling.

- It is a recognised fact that commercial projects are refreshed more frequently than residential interiors and therefore it is vital to consider how to reduce carbon emissions as part of any refurbishment. The designer needs to consider repurposing furniture, reupholster when possible and renovation instead of discard. When specifying new furniture fixtures and fittings the life cycle of the product needs to be considered and the client made aware of the future potential of the furniture fixtures and fittings for their subsequent refurbishment programmes. These are changes in working practice and the interior designer will need to source skilled tradespeople to undertake this type of refurbishment programme.

- Offsetting carbon emissions should be seen as a last resort; it is better to reduce than offset residual embodied carbon emissions. However, consciences advocates of a carbon-neutral manufacturing process will continue to work towards a real net-zero rating without offset. There has been growing concern about the climate crisis and how the "Greta Thunberg effect" has created huge increases in the offset trade. Off-setting is detrimental to achieving progress as it maintains a business as usual philosophy and passes the off-set cost to the consumer without the producer taking responsibility or

ownership of the issue. Individuals, as well as businesses, are choosing to offset emissions by purchasing carbon credits and investing in developing countries' projects.

There are many different factors to be considered when trying to achieve a carbon-neutral economy of which interior design contributes a small percentage, however, every decision made can be made to reduce the carbon footprint of a specification. Ultimately, we will always have emissions, net-zero is an aspirational goal.This research document began with a statement from Sir David Attenborough and it seems correct that it should be concluded with a quote from Greta Thunberg's speech at the World Economic Forum in Davos on 25 January 2020.

> *'.... until we have the technologies that at scale can put our emissions to minus, then we must forget about net-zero. We need real zero, because distant net-zero emission targets will mean absolutely nothing if we just continue to ignore the carbon dioxide budget that applies for today, not distant future dates.'*

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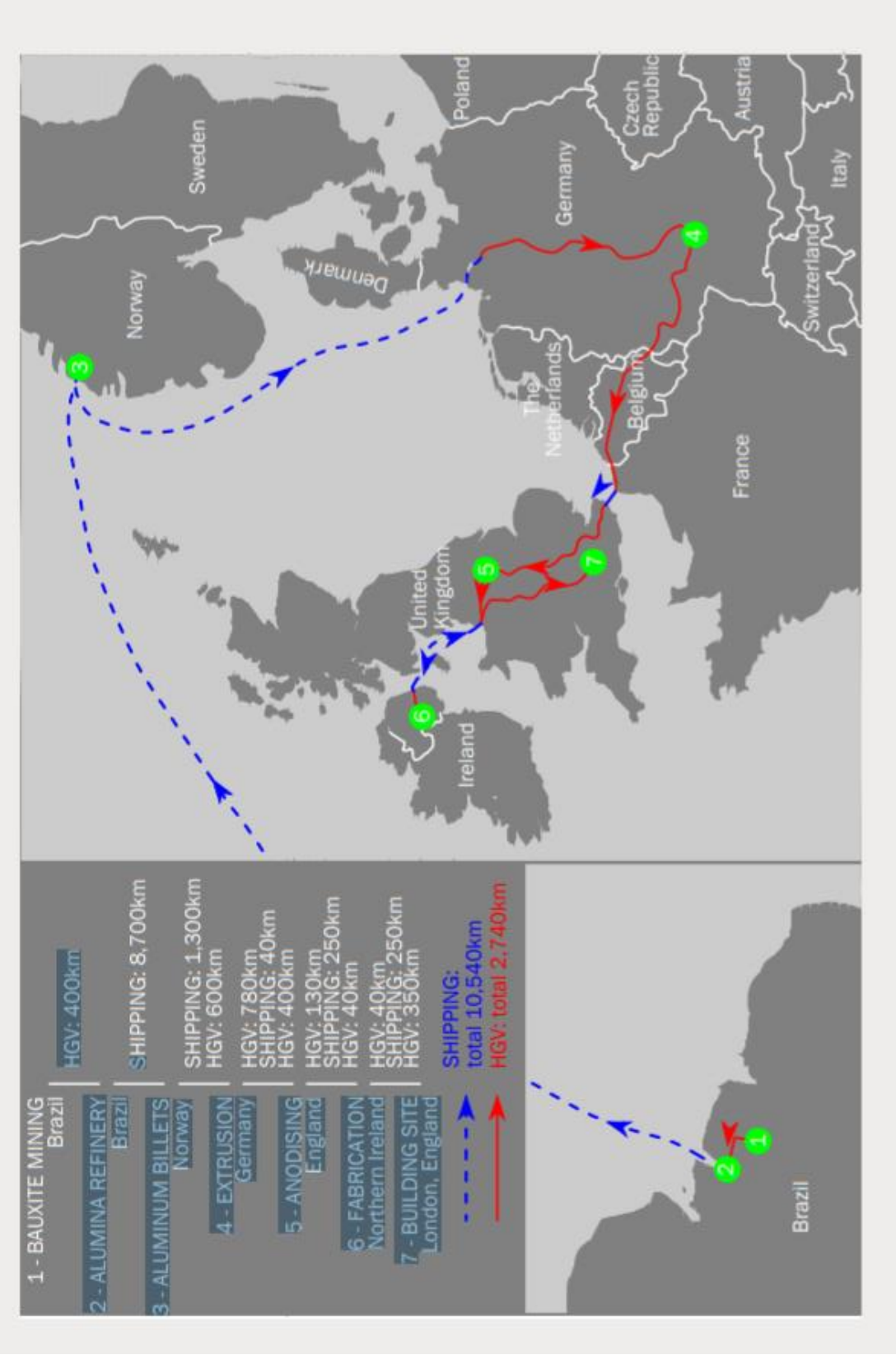
Images

Figure 1



Appendices

Appendix 1.

The BIID and members of the Construction Industry Council respond to the Climate Change Emergency

On 1st May 2019, the UK Parliament declared an Environment and Climate Change Emergency. In the following month, the Climate Change Act was amended to commit the UK government to a net zero emissions target by 2050.

In response, the Construction Industry Council and the built environment professional bodies including the BIID that are signatories to this statement:

- recognise that the breakdown in global climate and biodiversity is the most serious issue of our time and that the built environment is a major contributor, accounting for almost 40%[1] of energy-related carbon dioxide emissions whilst also having a significant impact on our natural habitats;
- agree that there is an urgent need for coordinated action to address and mitigate the impact of the built environment on both the climate change and biodiversity 'emergencies';
- agree the need to ensure that our built and natural environments have increased resilience and are capable of adapting to the future climate;
- commit to a fundamental change in thinking, behaviour and policy by working individually and together, to drive programmes of change within and across our professions; and
- support the establishment of an Expert Panel, formed from leaders within each profession and convened by CIC, to aid collaboration and shared endeavour between the professional bodies

The signatory professional bodies will publish and implement a climate change and biodiversity action plans relevant to their own discipline, membership and organisation; and working together, bilaterally and through the CIC, they will:

1. raise awareness and knowledge of the climate and biodiversity 'emergencies' and the urgent need for action, particularly through members' sharing knowledge and research;
2. form a panel of experts that will develop and regularly review actions and a CIC Action Plan that recommends how best the built environment professions working together can:

- drive a net zero carbon emissions pathway;
- identify and promote examples of best practice carbon reduction, climate resilience, biodiversity protection and improvement;
- encourage thought leadership and innovation to bring about change;
- share best practice in terms of education accreditation, membership qualification and CPD development;
- provide advice and guidance on all matters relating to the mitigation of the climate change and biodiversity 'emergencies' and the appropriate adaptation of the built and natural environment, including:
  - new regulatory and policy approaches;
  - embedding the mitigation and adaptation of climate change and the protection and improvement of biodiversity into:
    - industry standards;
    - the accreditation of education;
    - requirements of professional membership; and
    - Continuing Professional Development (CPD);
  - what constitutes best practice;
  - advocacy; and
- report regularly to all members of CIC on these recommendations and actions.
- Oversee actions (and an action plan) that is recommended by the expert panel.

3.On behalf of members and with the advice of the Expert Panel, CIC will:

- support and provide co-ordination and information exchange for the climate change and biodiversity action plans and activities of individual CIC member organisations;
- work with the professional bodies to develop partnerships with governments, the Committee on Climate Change, the Construction Leadership Council and other

governmental and non-governmental organisations in pursuit of these objectives; and

- communicate activities both internally and externally, including through the publication of a regular Climate Change and Biodiversity Digest.

AGREED AND SIGNED ON BEHALF OF THE FOLLOWING ORGANISATIONS:

Association for Project Management

Association for Project Safety

British Institute of Interior Design

Building Services Research & Information Association

Chartered Association of Building Engineers

Chartered Institute of Architectural Technologists

Chartered Institute of Building

Chartered Institute of Purchasing and Supply

Chartered Institution of Civil Engineering Surveyors

Chartered Institution of Building Services Engineers

Chartered Institution of Highways and Transportation

Chartered Institute of Plumbing and Heating Engineers

Construction Industry Research and Innovation Association

Institute of Clerks of Works and Construction Inspectors

Institute of Engineering Technology

Institute of Works and Facilities Management

Institution of Structural Engineers

International Institute of Risk and Safety Management

Landscape Institute

Local Authority Building Control

National House Building Council

Royal Institute of British Architects

Royal Institution of Chartered Surveyors

Royal Town Planning Institute

The Edge

UK Green Building Council

University College of Estate Management

[1] The Global Alliance for Buildings and Construction, in partnership with UN Environment and the International Energy Agency released the 2018 Global Status Report – Towards a Zero-Emission, Efficient and Resilient Buildings and Construction Sector

Appendix 2.

Contribution of nora® products to LEED v4

		Materials & Resources						Indoor Environment Quality			
		Building product disclosure and optimization						General Emissions Evaluation		VOC Content Requirements	
		environmental product declarations	sourcing of raw materials	material ingredient reporting							
N. America	International	Option 1 EPD (1)	Option 2 Leadership extraction practices recycled content (2)	Option 1 HPD (3)	Option 2 C2C (4)	Option 2 REACH (5)	Construction and demolition waste management (6)	Greenguard Gold (7)	Blue Angel (8)	SCAQMD (9)	European Decopaint Directive (10)
norament®											
	926	●		●	●	●	●		●		
	825					●	●				
grano	926 grano	●		●	●	●	●	●	●		
satura	926 satura	●		●	●	●	●	●	●		
arago	926 arago	●		●	●	●	●	●	●		
round/ hammered/ jubilee						●	●	●			
noraplan®											
eco	eco	●		●		●	●	●	●		
lona	lona	●		●		●	●	●	●		
sentica	sentica	●		●		●	●	●	●		
environcare	signa	●		●		●	●	●	●		
stone	stone	●		●		●	●	●	●		
	uni					●	●	●	●		
unita	unita	●		●		●	●	●	●		
	ultra grip					●	●				
valua	valua	●		●		●	●	●	●		
stairtreads / skirtings / wall base											
noraments round/ hammered	noraments 926	●		●		●	●	●	●		
noraments satura	noraments 926 satura	●		●		●	●	●	●		
noraments grano	noraments 926 grano	●		●		●	●	●	●		
	nora skirtings					●	●				
nora wall base							●	●			
special qualities											
norament											
920						●	●	●			
992	992		50%			●	●	●			
992 grano	992 grano		50%			●	●	●			
grano ed	ed (926, 928 grano)					●	●	●			
	ec (927 grano)					●	●				
sp/ sp trac						●	●	●			
noraplan											
acoustic (environcare, sentica)	acoustic (sentica, signa, stone)		22%			●	●	●			
	ec (astra)					●	●				
ed (environcare, sentica)	ed (sentica, signa, stone)					●	●	●			
adhesives/ primer/ filler											
nora® 385/483/685						●		●		●	
nora® 585						●				●	
	nora® hybrid 310					●			●	●	
	nora® fiber 410/ ESD 414					●			●	●	
nora® profix/ stepfix/ dryfix	nora® profix/ stepfix					●		●		●	●
nora® nTx	nora® nTx					●		●		●	●
	nora® primer					●			●		●
	nora® 2K primer					●			●		●
	nora® primer plus					●			●		●
	nora® level compound					●			●		●
	nora® level compound FA					●			●		●
	nora® level compound SF					●			●		●

(1) nora® product specific, type III, 3rd party certified environmental product declaration (EPD) that conforms to ISO 14025 and EN 15804

(2) pre-consumer recycled content

(3) Health Product Declaration v2.1 available in HPD Public Repository – https://www.hpd-collaborative.org/hpd-public-repository/

(4) Cradle to Cradle (C2C) v3.1 Silver Certified

(5) nora® flooring is in compliance with REACH requirements as they do not contain substances on the authorization or candidate lists

(6) nora® Take-Back Program

(7) Greenguard Gold certified and compliant with California Department of Public Health (CDPH) Standard Method v1.1-2010 and General Emissions Evaluation

(8) Blue Angel certified and in compliance with the German AgBB Testing and Evaluation Scheme (2010) and General Emissions Evaluation

(9) adhesives in compliance with the South Coast Air Quality Management District (SCAQMD) Rule 1168 and wet-applied VOC content requirements

(10) adhesives in compliance with European Decopaint Directive (2004/42/EC) and wet-applied VOC content requirements