UK GREEN BUILDING COUNCIL

24 APRIL 2014

Summary report

Embodied Carbon Week – Seeing the whole picture

Key findings from Embodied Carbon Week 2014

CAMPAIGN FOR A SUSTAINABLE BUILT ENVIRONMENT

ARUP

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INTRODUCTION

Embodied carbon is rising up the agenda and rapidly becoming a key area of focus for those working across the built environment. That is why UK-GBC jointly ran Embodied Carbon Week from 7 – 11 April in partnership with British Land, Derwent London, Land Securities, Tishman Speyer and WRAP to explore the topic in greater detail and start a wider discussion about what more can be done to advance best practice.

Organisations from across the industry hosted 22 thought provoking events including master classes, debates, workshops and webinars related to embodied carbon, which highlighted key issues from across different sectors and looked at ways in which the industry can move the agenda of embodied carbon forward. The week's events were widely attended with over 900 individual registrations from approximately 300 organisations.

The purpose of Embodied Carbon Week was to bring together built environment practitioners to:

- Raise awareness of the importance of embodied carbon in the built environment;
- Hear from experts about what is currently happening around embodied carbon within each sector, and what the challenges are;
- Encourage collaboration on the different measurement approaches and identify ways forward to achieve consistency in approach; and
- Identify actions for the various actors in this working context as to next steps to ensure best practice prevails across the industry.

This report summarises the feedback gained from the industry events that took place over the course of the week. It has been prepared by Arup based on summary feedback provided on sixteen Embodied Carbon week events.

EVENT OVERVIEW

Embodied Carbon week consisted of 22 events hosted by industry. They ranged in format and approach covering managed debate, knowledge sharing, webinar, PechaKucha, workshop, launch event, masterclass, round table discussion, amongst others. A summary listing of events is provided in Table 1.

Table 1: Summary listing of 22 Embodied Carbon week events, their hosting organisation, and event title

Event Host	Event title
UK-GBC	UK-GBC Masterclass: How to measure embodied carbon
UK-GBC	Embodied Carbon: Seeing the whole picture
Arup	Pechakucha: Embodied carbon what is your priority?
AECOM	What are the practical ways to reduce embodied carbon?
ASBP	Debate: Embodied carbon – 2019
Atelier Ten	Architecture without shadow mass
Sturgis Carbon Profiling LLP	Consistency in CO2 Assessment
Tishman Speyer	Come Share With Me: who has all the materials data, and how can I get to it?
Planet Positive	Embodied Carbon Week: Planet First Presentation with partners

Event Host	Event title
WRAP (Waste Resources and Action Programme)	Launch of the Embodied Carbon Database
Useful Simple Trust	Life cycle embodied carbon modelling - bring your own building workshop
Wood for Good	Wood First Plus: life cycle database for timber products
Best Foot Forward	Cradle to cradle: reducing the whole life carbon impacts of buildings
University of Reading & Sainsbury's	Embodied Carbon - Linking academic research with industry innovation
Mineral Products Association	Concrete Elegance: Buildings for Concerts and Council Tax Event
eTool	EN15978 compliant LCA's - a how to session
CPD Foundation	RICS Guidance on Embodied Carbon
Circular Ecology	1. A single tonne of CO2e - Provenance, perspective, progression 2. Online training - Introduction to life cycle assessment 3. Online training - Embodied energy and carbon of construction
Institute of Civil Engineers	Infrastructure Carbon Review Lecture
BSI	The Standard for Embodied Carbon and LCA

A full listing of Embodied Carbon week events including their agenda and content can be found on the UK-GBC website:

www.ukgbc.org/content/calendar-events-embodied-carbon-week

A general characterisation of event focus was developed by UK-GBC in coordinating the Embodied Carbon week schedule. This established events as falling within one of seven working themes as summarised in Table 2. There was clear weighting of events towards the topic of how to measure embodied carbon and what it means for design.

Table 2: Working themes of Embodied Carbon week events

Event theme	Number of events
Measurement	8
Design	6
Products	4
Legislation	1
Research	1
Client	1
Value chain	1

ATTENDANCE, HOSTING & PARTICIPATION

Engagement at Embodied Carbon week was strong with broad industry participation.

The Embodied Carbon Week's events were widely attended with over 900 individual registrations from across 300 organisations. An organisational attendee list based on received responses from event hosts can be found in Appendix B. Multi-stakeholder attendance from across the construction value chain can be seen.

There were 19 hosting organisations across the 22 events, a categorisation and spread of hosts is summarised in Table 3.

Table 3: Constitution of Embodied Carbon week hosting organisations

Organisation type	Number of events
Consultant	7
NGO	3
Designer/engineer	3
Certification body	3
Trade body	2
Professional institution	2
Academic	1
Property client	1

Although strong participation was evident in the events over the week, a number of stakeholder groups were underrepresented when it came to hosting/organising events. This included manufacturers, property clients, academics, government & policy makers (including local authorities), contractors, planners and quantity surveyors.

ANALYSING EVENT FEEDBACK

This review has been put together using data collected from event feedback forms submitted by sixteen event organisers. This text was analysed to identify trends in four working themes. These are noted below and were chosen by UK-GBC based on the feedback form used:

- Key messages: What were the key messages from the event?
- Challenges: What challenges were identified?
- Next steps: What are the next steps for improving the way we work?
- Leadership: Who should lead on this piece of work?

The data and text narratives in feedback were used to create summary supporting graphs and word analysis visualizations where appropriate.

The reader should be aware that providers of the feedback were offering comment from a basis of their own event discussions, differing professional experience, organisational context, and technical background.

KEY FINDINGS

Key Messages

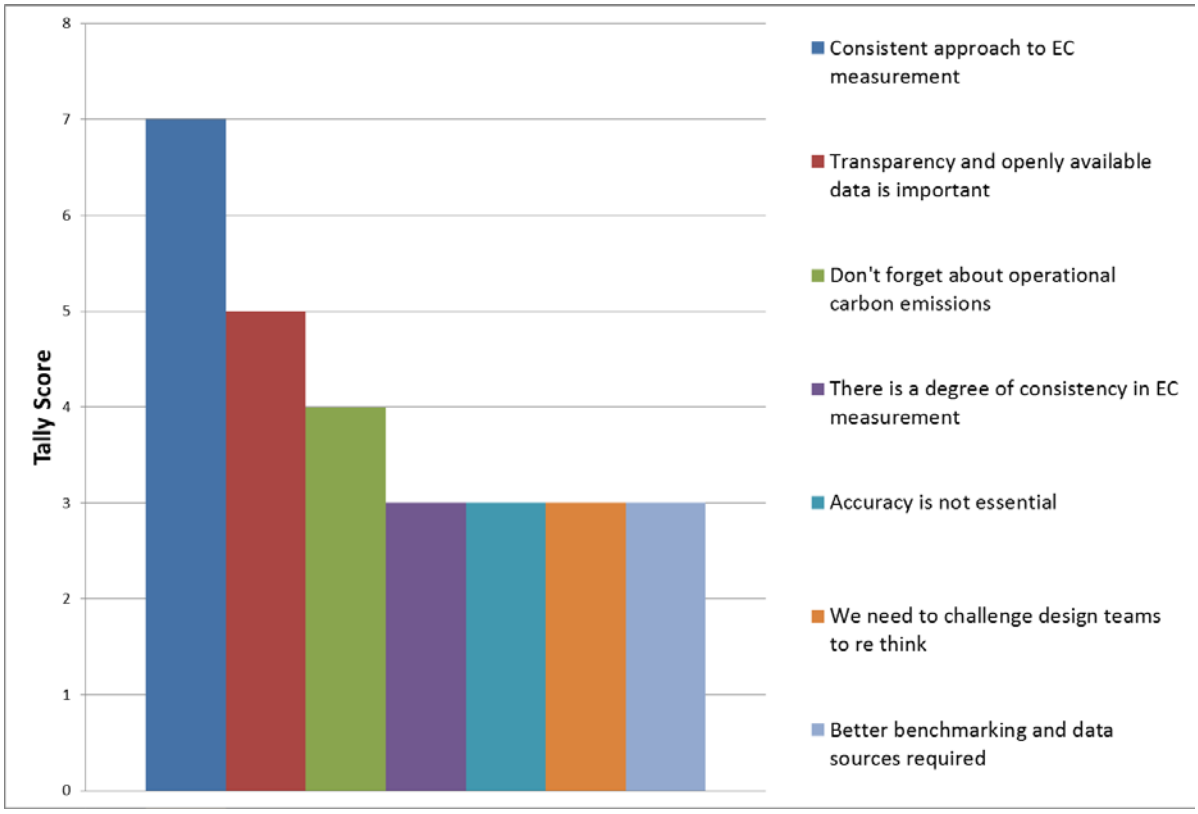
The key messages section of each feedback form was reviewed. Responses varied in the detail provided and in their length of narrative. Some responses only identified one key message; others offered comment on two or more. Through the process of review fifteen key message themes were identified. These are paraphrased in the listing below:

1. The consistency of measuring embodied carbon must improve.
2. Calculation should focus on major structural elements with the notion that granularity can be addressed at a later date.
3. Design teams must be challenged to come up with innovative solutions that address Embodied Carbon.
4. Closed loop systems should be promoted so to maximise resource efficiency and lower Embodied Carbon (i.e. new build should be designed for re-use).

5. It is unlikely that legislation will address embodied carbon in a sufficient manner in the near future. In light of this industry should lead.
6. The focus for reducing embodied carbon should be on every day builds rather than iconic ones.
7. Operational Carbon emissions should not be forgotten and should be the priority.
8. Accuracy [of measuring embodied carbon] is not essential [at this time].
9. Data should be transparent and openly available across the industry.
10. Better benchmarking and data sources are required.
11. A business case for reducing embodied carbon is needed.
12. Embodied carbon modelling does not have to be overly complicated to be useful.
13. Stronger links between researchers and practitioners should be forged.
14. Embodied carbon savings made now are important and will help to offset climate change.
15. Architectural approaches exist that can reduce both embodied and operational carbon. They are not necessarily conflicting issues.

The fifteen key message themes were tabulated and a tally score was developed for each. This was based on how regularly the theme was mentioned in the key message field of the feedback forms. Many themes scored only one or two mentions; by contrast a number of others scored three or more mentions. The outcome of this tally can be seen in Figure 1 representing the most prominent key messages identified from the feedback.

Figure 1: Key messaging from Embodied Carbon week



It is clear that a consistent approach to measurement throughout the industry is desired; seven out of sixteen responses identified this as a key message. The UK-GBC Masterclass noted "*there is a need for consistency in data sets, the tying together of different methodologies, to come up with a methodology robust enough to become regulation*".

Two further prominent messages included the need for transparency and openly available data, and that operational carbon emissions should not be forgotten. The Useful Simple Trust event noted *"more 'open' data and 'open' modelling - transparency is critical"*.

Figure 1 also identifies three further priority areas (each identified as important by three events). These include creating greater accuracy of measurement, the need for benchmarking, and the need to challenge design teams. The Concrete Centre event concluded *"It's not all about* [embodied] *carbon, but it is about whole life measurement both embodied and in use. On-going embodied carbon reduction by the concrete industry can be further enhanced by architects and engineers by the use of cement replacements".*

Interestingly and in contradiction to the most frequently identified key message is the point that a number of events felt that there was already a degree of consistency in EC measurement. This view point which was identified with in a number of feedback responses would indicate towards a community of construction professionals who are well informed on embodied carbon both in calculation methodology and in what their peers are doing on the issue. This might indicate toward the quickly maturing landscape within the industry and its undertakings on EC.

Challenges

The analysis of 'challenges' facing embodied carbon was undertaken in the same manner as that applied to the key messages review. From received feedback fifteen challenge themes were identified, these included:

1. Cultural resistance regarding the change from AC to higher thermal mass buildings.
2. Changing industry attitudes when legislation is not forth coming.
3. Improving consistency in EC calculation methods.
4. Availability of comparable data.
5. Opinion on whether there should be a single source of industry data for embodied carbon.
6. Finding a way to involve and engage the entire supply chain.
7. Understanding the significance of carbon measures and what to do.
8. Creating a methodology robust enough for legislation.
9. The risk of results being skewered according to a preferred calculation methods.
10. Concern over extra cost and complexity it can bring to a project.
11. Finding sources for funding and promotion to help develop and promote existing databases/tools.
12. Insufficient demands or active drivers for change to engage clients.
13. Poor client awareness of issues.
14. The complexity involved with creating a single platform to compare data.
15. Finding a place for the measurement of embodied carbon to sit (planning system / Building Regulations, etc.).

It is immediately apparent that a number of 'key messages' are also identified in this listing of challenges. Using a tally count against these challenge themes, it was possible to identify the frequency with which they were raised as important within the received feedback forms. The results are presented in Figure 2.

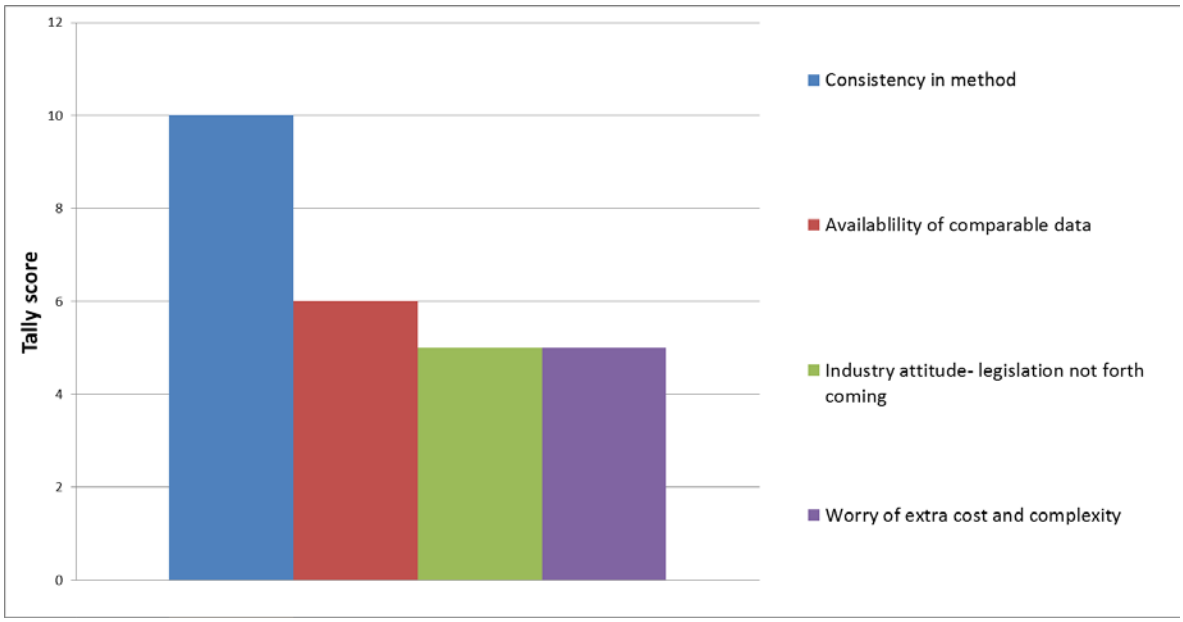
Ten out of the sixteen events that responded flagged consistency of measurement method as a key challenge to be addressed. If a slightly looser interpretation of feedback narratives is made, it can be observed that a total thirteen of the sixteen responses raise some reference of their concerns about consistency of measurement in their response to 'challenges'. This feedback closely mirrors the tally of seven events identifying consistent approach to measurement as the priority in their key message. It is therefore clear that tackling this issue is seen by many as a fundamental need for progressing embodied carbon.

Changing the industry's attitude [to embodied carbon] when legislation is not forth coming was also voiced to be a difficulty by a number of events. The event conducted by the University of Reading and Sainsbury's saw the "*conservative nature of the industry*" and "*current competitive procurement methods*" as barriers to change and the "*increased use of innovative* [low carbon] *materials*".

The worry of extra cost and complexity was also seen as a challenge from a number of the responses. The Useful Simple Trust carried out a survey before their event which suggested that the prevailing perception of building life cycle analysis was that it was too "*complicated*" and "*technical*". However, they also reported that by the end of the session participants who were unfamiliar with life cycle analysis before the event were able to apply the concept by the end of the session (which is an encouraging observation). Tishman Speyer also saw challenge in complexity, but with the focus to accessing and comparing data (the second most commonly voiced challenge) whereby "*there are lots of existing data sources of varying accessibility but no way to search through it all*".

Other important and linked themes coming through in challenges were with insufficient demand, lack of drivers for change, and poor client awareness fitting very much alongside the difficulties of changing industry's attitudes to embodied carbon. The Wood for Good event summarised this well noting "*there are skills in the market to deliver embodied carbon reductions*"; but "*that there is still insufficient demand and no apparent financial value associated with emissions reduction"*. The Arup PechaKucha event underlined lack of demand and poor client awareness when BAM Construct noted that in 350 projects only 22 made reference to embodied carbon and only 4 followed through with focused requirements.

Figure 2: Challenges to Embodied Carbon



For further perspective a 'Wordle' was created using all the responses identifying challenges from the sixteen events. This 'Wordle' has been included in Appendix A.

Next Steps

The analysis of 'next steps' for embodied carbon was undertaken in the same way as that of the previous working themes. Review of feedback identified fourteen common issues across the staged events:

1. Carbon reduction (both operational and embodied) must be better related to cost savings.
2. Embodied carbon needs to be incorporated into the planning system.
3. Better link design and procurement decisions to carbon emission reductions.
4. Better guidance is needed from specifiers on low carbon solutions.
5. Learning's must be shared across the industry to maximize progress; i.e. master classes.
6. A base calculation methodology must be agreed upon.
7. The government must be lobbied to get formal legislation and policy on embodied carbon.
8. Clients must be informed on the benefits of low carbon outcomes.
9. Industry must take the lead and not wait for legislation.
10. A freely available buildings benchmarking tool must be created.
11. Potential funding sources for improving databases and tools must be identified.
12. There needs to be a shift from retrospective to proactive building LCAs as part of building design.
13. Better acknowledgement should be made of material supply chains that are reducing their impacts.
14. More materials carbon intensity data should be developed and verified.

Using a tally count for these next steps across the feedback received it was possible to identify the frequency with which they were raised. The results are presented in Figure 3.

By some margin the sharing of lessons learnt across industry was seen as the most important next step with eight of the fourteen events recognising the need. The UKGBC masterclass identified with this need and talked of an on-going programme of events similar to Embodied Carbon week noting that *"events of this nature will aid in the sharing of lessons learnt, and with data and information availability across the industry"*. The view that this UKGBC event stated, fits well with the UKGBC mission of campaigning for a sustainable built environment; and also with the feedback steer that UKGBC is seen by many as having an important 'leadership' role in driving the embodied carbon agenda; (see Leadership).

The fact that so many events identified knowledge sharing as important perhaps reflects the level of expertise on embodied carbon across industry. There is clearly an interest to understand more and learn from others.

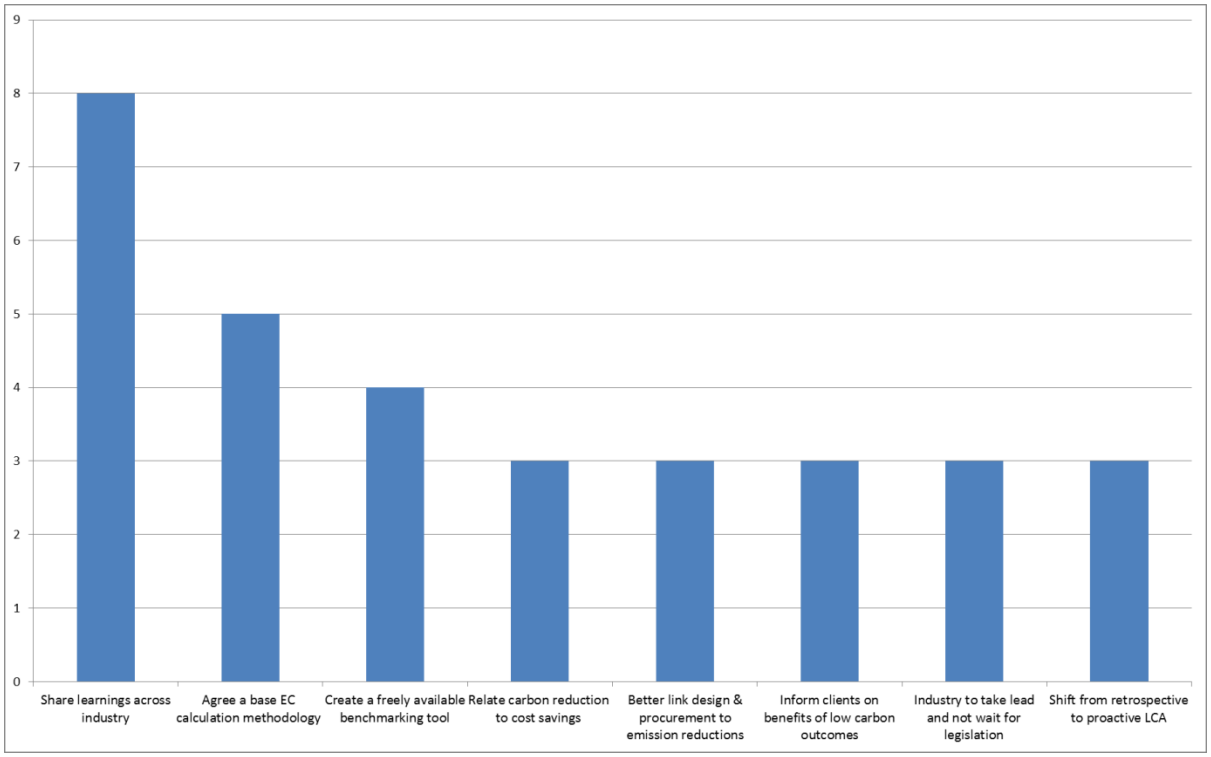
Agreeing upon a base methodology for embodied carbon assessments was also identified by five out of the fourteen events as being an important next step. This clearly follows on the strong feedback to key message and challenges. In fact through all feedback the most consistent theme coming through is for agreeing a commonly applied method for calculating embodied carbon. With so many and varied working contexts, scales of assessment, 'standardised' methodologies, and differing project goals and scopes, it is perhaps not surprising that inconsistencies exist between practitioners and the studies they undertake. In this regard it may also be impractical to find consensus on approach, but clearly guidance on how to undertake embodied carbon assessments, and selecting the best methods and data for studies is something the industry is looking for.

The third most identified next step was the issue of embodied carbon benchmarking. This was largely noted to be a buildings related need. On this point WRAP and UKGBC took the opportunity of Embodied Carbon week to launch the new buildings embodied carbon database. This is available online (http://ecdb.wrap.org.uk/) with over 200 buildings already for people to use to benchmark their projects against and with the capacity for people to add their own. This asset therefore represents a great first response to the benchmarking need.

The Tishman Speyer event addressed a similar theme but with a different perspective this time linking benchmarking to materials and products; *"There are lots of existing data sources holding embodied carbon information about specific materials/products. Some of these are expensive,*

which has led practitioners to develop their own data sets. At present none of these are searchable from a single point. Numerous EU countries, and others, have created national EC databases already. Some of these are free to use, others not".

Figure 3: Suggested next steps for Embodied Carbon



Leadership

Responses to the question of leadership were highly varied with many responders repeating back the short list of suggested organisations in the feedback form, and or providing little or no narrative towards what they were looking for from identified leadership organisations. Nonetheless a number of observations can be made from the feedback forms.

The industry should take the lead: this view was explicit on a number of feedback forms, and implicit on many others with little or no reference to Government and the role it should play.

Industry and sector bodies are important: reflecting the diversity of events and participants in Embodied Carbon week, a wide range of organisations (RIBA, RICS, CPA, UKGC, IStructE, ICE, etc.) were identified as having forward roles. This may indicate toward different sector groups all viewing that embodied carbon is relevant to them and the role they play within the construction value chain, and that they are looking for their sector associations and industry bodies to lead this engagement.

What about Government? BIS, DCLG, and local authority planning departments were all mentioned in passing on forms. The steer is that most are looking for Government to play a more prominent role, but at the same time are acknowledging this is unlikely. WRAP and the work it has delivered on the embodied carbon benchmarking database was welcomed by many. The Green Construction Board was identified on a couple of feedback forms as an important programme within which Government and Industry can come together and address embodied carbon.

UK-GBC: of all organisations identified within feedback, the UK-GBC is mentioned the most consistently and regularly when it comes to taking forward embodied carbon. This may be a reflection of its role in coordinating Embodied Carbon week, but also perhaps because it is one of the few, indeed perhaps the only, that has the diverse industry membership that will be necessary to address the challenges of embodied carbon, and which at the same time is championing the cause for a sustainable built environment.

SUMMARY

The priority key messages can be summarised as 'methodological' and 'calculation' based issues about how to measure and quantify embodied carbon and take account of what it means in decision making.

Key challenges were similar, with consistency in measurement and the availability of comparable data being identified as most important.

As the industry looks ahead to the next steps, the priorities of sharing knowledge and experience were considered as essential, as is the need to develop consistency in calculation methods.

The overriding message on leadership is that all in the construction value chain have a role to play in addressing embodied carbon. Practitioners appear to be looking for their respective membership organisations to lead this engagement. In the absence of any direct Government participation/action on embodied carbon, the view is that industry must lead and use programmes like the Green Construction Board and WRAP to bolster and support efforts.

As the main convenor of Embodied Carbon week events many identified the UK-GBC as having an important role to play in taking forward next steps. Potential actions suggested included:

- Across the 'range' of different embodied carbon calculation methods, and working contexts in which they may be applied, help foster greater consistency in the measurement of embodied carbon.
- Help improve the transparency and availability of data and information that can be used for embodied carbon calculations.
- Foster wider knowledge sharing and lessons learnt across industry so to better equip practitioners with the expertise to address the challenge of embodied carbon.
- Facilitate the development of tools and aids that will enable practitioners to address embodied carbon in decision making including benchmarking of materials, supply chains, products, and constructed assets[1].
- Look into ways in which embodied carbon and operational carbon can be dealt with in tandem and how this might be more formally addressed within UK construction.

[1] With the establishment of the WRAP/UK-GBC embodied carbon buildings database this process is already underway.

APPENDIX A

Challenges Wordle

Wordle created using all the responses identifying challenges from the sixteen embodied carbon week events.

APPENDIX B

Events attendance list:

Organisation
5th Energy
A Philippides Architects
Adapt & Sustain
AEA Architects
AECOM
Aggregate Industries
Ahmarra
Akzo Nobel Decorative Coatings
Allford Hall Monaghan Morris
Altechnica
Amey
Andrew Pratt
Architype
Argent
Artillery
Arup
Arup Associates
ASBP
Atelier Ten
Atkins
B & K Structures Ltd
BAM
Barratt Developments PLC
BBC
BCIS
Bennetts Associates
Better Building Partnership
BioRegional
BK Structures
Black
Bloom Sustainability
Bouygues UK
BRE
Brick Development Association Ltd
British Retail Consortium
British Woodworking Federation
Brookfield Multiplex
BSI Group
BSRIA
Burns Guthrie and Partners
Buro Happold
Burt Boulton & Haywood Ltd

Organisation
BWF
C4Ci Ltd
Cambridge Sustainability Consultants
Capita
Carbon Credentials
Carbon Estates
Carillion plc
CBRE
CCS
CH2M HILL
Circular Ecology
Ciria
Coillte Panel Products
Compact Lighting
Confor
Construction Products Association
Costain Group Plc
Crossrail
CSIRO
Dalen Group
David Hickey
David Morley Architects
Deloitte
Department for Business, Innovation and Skills
Derwent London
Durkan Ltd
East Brothers Timber Ltd
ebb
ECiBE Ltd
Ecofys
ecointelligentgrowth
Ecostruct
EED
Elementa Consulting
Elliott Wood Partnership
Energy Building
Energy Live News
EP&T Global
EQ Consultancy
Equitis
etool
Etude
Eurban Limited
Faithful+Gould
Feilden Clegg Bradley Studios
Fielden Fowles Architects

Organisation
Finnish Fibreboard (UK) Ltd
Fit Out (UK) Ltd
Forestry Commission England
Foster + Partners
Fundamental Architectural Inclusion
Geoff Rhodes Associates
Global Forest and Trade Network
Great Portland Estates plc
Greengage
Groundwork London
Grown in Britain
GS PRODUCTIONS & PROMOTIONS
GVA
Happold Physics
Haverstock Associates
Hawkins Brown
Highways Agency
Hilson Moran
Hoare Lea & Partners
Hodkinson Consultancy
HOK
Hunter & Partners Ltd
HWL SP
IMS Consulting
Integral Engineering Design
INternational Facilities and Property Information Ltd
International Timber
Interserve Plc.
IOM3
ISG
J Browne Construction
J Murphy & Sons Limited
Jaimie Grace
James Latham plc
John Byde
John Lewis
John Rowan & Partners
Jones Lang LaSalle
Juice Architects
Julie's Bicycle
K&M McLoughlin Decorating ltd
Keepmoat
Kier Infrastructure
KLC Timber
KLH UK Ltd
KTICIC Architects

Organisation
Laing O'Rouke
Land Securities
Lend Lease
Liverpool John Moores University
LLDC
London Legacy Development Corporation
Longcross Group Ltd
Low Carbon Technologies
Lucideon
LUSAS
Lythgoe Consulting Ltd
Mace
MAKAR Ltd
Make
Malcolm Hollis LLP
Marks and Spencer
Materials Council
Max Fordham
McNicholas Construction
Medway Council
Meter Timber Ltd
METSÄ WOOD UK Ltd
Metsims
MIT
mma
Morgan Timber
Mott MacDonald
MPA
Napier University
National Grid
Natural Resources – Europe
Network Rail
Nicholas Hare Architects LLP
Norbord Europe Ltd.
Northumbria University
Osborne Energy
Oxford Brookes University
Paget St.Claire Associates
Parsons Brinckerhoff
PE INTERNATIONAL
PEFC UK Limited
Peter Brett Associates
Plaut International Limited
Price & Myers
Prologis
PRP Architects

Organisation
Qingtech
Quoinstone Property Limited
RAAS
Reading Climate Change Partnership
Reading Borough Council
Recipro
Retane
RG Group
RIBA
Riccardo Giusti
RICS
Rider Levett Bucknall UK Ltd
Robert Loader Architect
Robin Partington & Partners
Royal Academy of Engineering
Royal Bank of Scotland
Sainsburys
SBP Consulting
SCI
Second Nature Partnership
Sefaira
Sergo
Sheppard Robson
Shinz Design Consultancy
Sir Robert McAlpine Ltd
Skanska UK
Storm Building Limited
Stugis Profiling LLP
Sustain Ltd
Sustainable Commercial Solutions
Sweett Group
Telereal Trillium
Tesco Stores Ltd
TfL
The Berkeley Group
The British Constructional Steelwork Association Ltd
The British Land Company Ltd
The Clancy Group Plc
The Concrete Centre
The Monomoy Company
The Sustainable Business Partnership
Thornton Tomasetti
Timber Expo
Timber Trade Federation UK
Tishman Speyer

Organisation
Trada
Tuffin Ferraby Taylor LLP
Turner & Townsend
UCL
Hawkins Brown
Institute for Sustainable Resources
UEL
UK Green Building Council
University of Portsmouth
University of Brighton
University of Cambridge
University of East Anglia
University of East London
University of Nottingham
University of Reading
University of Westminster
URS
Useful Simple Project
Valuation Office Agency
Verco
W.L. West & Sons Ltd
Waterman
Watts Group
Westminster City Council
Whitbread
Willmott Dixon
Wood Window Alliance
Woodland Trust
Workspace Group
WRAP
WSP
XCO2 Energy

ABOUT THIS REPORT

Embodied Carbon Week 2014 was run in partnership with British Land, Derwent London, Land Securities, Tishman Speyer and WRAP.

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