SMART PRACTICE
CONFERENCE 2020

CONFRONTING THE CLIMATE EMERGENCY

30 SEPTEMBER | 1 OCTOBER

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How to use

Welcome to your interactive Delegate Resource Pack. We would like to take this opportunity to thank you for attending the Smart Practice Conference 2020.

This document offers a summary of the insights shared throughout the two day event and links to recordings of presentations should you wish to watch them again.

Speaker presentations for Projects and Practice can be viewed on Box.

Clicking the arrow icon on each session summary will take you to the recording.

Day 1: Projects

Goldsmith Street by Mikhail Riches © Tim Crocker

Welcome

Jo Bacon, Managing Partner, Allies and Morrison

Welcome

- Practices are adapting to the challenges of the coronavirus pandemic, becoming increasingly agile while meeting our design commitments. But we must not lose focus on the bigger crisis of climate change and biodiversity.
- Good architecture embodies the principles of designing for a sustainable future. It is essential that architects enter the profession knowing this. As a community we need to share knowledge.
- The RIBA launched its 2030 Climate Challenge in October 2019. This provides specific targets for operational energy, embodied energy, and potable water use. More recently, the London Energy Transformation Initiative (LETI) has provided valuable guidance via its Climate Emergency Design Guide.
- Post Occupancy Evaluation (POE) is essential to ensure our buildings perform as well as we require them to. The RIBA provides resources that can help including the updated Plan of Work 2020; the POE Primer; the Sustainable Outcomes document; and the forthcoming Plan for Use guide.

Keynote: Everyday Activism

Evelyn Choy, Coordinator, Architects Climate Action Network (ACAN)

Anyone can get involved; everyone should

- Everyone needs to take action on climate change. We need to foster an environment in which architects' actions can have an impact.
- Do not be intimidated by a lack of experience in activism or a lack of knowledge of sustainable design: anyone can make a meaningful contribution to groups such as ACAN.

Why activism?

- Architecture is inherently political. But architects cannot fight climate change on their own; it is essential that regulations change to meet the climate challenge. Meaningful action therefore requires activism.
- Not enough MPs are committed to addressing climate change. Fossil fuel industries receive subsidies of around £10bn per year; permitted development rights encourage demolition rather than retrofit; and pursuit of fossil fuels via fracking is encouraged.

The architect's position

- Architects may feel constrained by our obligations to clients and contractors. But we always have some agency in the clients, suppliers, subcontractors and engineers we elect to work with.
- Closer collaboration with engineers and subcontractors earlier in the process can have a profoundly positive impact on a project's sustainable outcomes. Seek to specify low carbon materials and products where possible.

Supporting activism as a practice leader

- Senior staff can act as role models by making their sustainability commitments visible and supporting bottom-up activism.
- Practice leaders can support activism by allowing staff time off to attend conferences and access to sustainable design training.
- Turning down a project is a challenge, but an uncompromising ethical position adds credibility when lobbying for systemic change.
- Regenerative design should be the goal: architecture that is environmentally and socially sustainable and leaves the community and the planet better off.

Five steps everyone can take

1. Be a possibilist

   This is someone who believes that what might seem impossible is possible. Having a possibilist mindset maximises our agency and can be contagious.

2. Be visible in your activism

   Being vocal and visible in what you are passionate about can encourage others to do the same. Climate activism needs more vocal role models, including senior-level figures in workplaces.

3. Seek out and share knowledge

   There are huge gaps in our understanding of sustainable design across the industry. Nobody knows everything; it is important to ask for help.

4. Hold leaders accountable

   Our political leaders are not the only figures we should hold to account. Architects should also hold their practice leaders to account. Similarly, architecture students have written to their heads of department to demand for climate literacy in their courses.

5. Empower those around you

   This is particularly important for younger team members. They can then enact change on their own projects.

Introducing the RIBA 2030 Climate Challenge

Gary Clark, Principal, HOK London Studio

The scale of the challenge

- The World Health Organisation estimate that there are currently 250,000 deaths per year due to climate change. The actual figure may well be significantly more, given that the NHS estimates there are 40,000 deaths alone in the UK due to air pollution.

- The planet is under the extreme threat of a global temperature increase above industrial levels of between 4 and 8 degrees if we procrastinate. We need to bring the same global scale of effort to climate change as the coronavirus response. The next decade is critical.

The UN Sustainable Development Goals (SDGs)

- Both the RIBA 2030 Climate Challenge and Sustainable Outcomes Guide are guided by the UN's Sustainable Development goals, distilling them down to the essential metrics that can be measured at a project level.

- Metrics beyond carbon include sustainable land use, social value and the enabling of sustainable communities.

- The UN SDGs are also embedded in the RIBA Plan of Work 2020. They allow architects to define the desired sustainable outcomes of a project and track them throughout the work stages.

- The architect then moves to a monitoring role during construction, while a light-touch approach to Post Occupancy Evaluation (POE) has been integrated into RIBA stages 5 to 7.

The RIBA 2030 Climate Challenge

- The RIBA's 2030 Challenge asks practices to achieve defined net-zero carbon metrics by 2030. A net zero building , in its simplest definition, is one that either eliminates or balances all the carbon emissions occasioned by it.

- The Challenge focuses on 4 outcomes, with stepped targets for 2025 and 2030:

1 Operational Energy

- The 2030 Challenge measures operational carbon in kilowatt hours per square metre. This is not a perfect proxy – it could be measured per person or per bedroom
- For domestic projects the 2025 target is a reduction to 70 kWh/m2, while the 2030 target is to 35 kWh/m2 or below.
- The targets can be achieved through airtight envelopes and generation of renewable energy onsite. Some carbon offsetting may be necessary in tight urban areas.
- For non-domestic projects there are slightly different metrics: they use DEC D as their benchmark for percentage improvement by 2025 (achieving a DEC B rating) and 2030 (DEC A).

2. Embodied carbon

- The UKGBC defines embodied carbon as the total greenhouse gas (GHG) emissions (often simplified to "carbon") generated to produce a built asset. This includes emissions caused by extraction, manufacture/processing, transportation and assembly of every product and element in an asset.
- The more operational carbon is reduced (via the greening of the grid) the more significant embodied carbon becomes.
- 'Retrofit first' should therefore be the priority, rather than demolition and new construction.
- The substructure and superstructure account for the majority of the building envelope, so are prime considerations in embodied carbon reduction targets. Locally available materials with low embodied carbon should be prioritised.
- A range of digital modelling tools are available to calculate embodied carbon, including Rapiere (which links embodied carbon, operational energy and cost), Eccolab and OneClick. The Inventory of Carbon and Energy (ICE) is a useful database, hosted by Bath University, of the embodied energy and carbon of building materials.

3. Sustainable water cycle

- These metrics may be achieved through use of: low flow appliances; leak detection; rainwater recycling; and other measures.

4. Health and wellbeing

- This should include considerations such as: integration with green space; appropriate density of occupancy; indoor air quality; access to natural light; and thermal comfort across the year.

Regulated energy versus unregulated energy use

- Total operational energy is made up of regulated components – including heating, cooling, hot water, fans, pumps and lighting – and unregulated ones, such as IT equipment, lab equipment, catering facilities, and so on.
- Unregulated energy, and discrepancies of measurements of energy use, are a challenge to assessment of operational energy.
- Energy Performance Certificates (EPCs) are too inaccurate to be fit for purpose. PassivHaus standards provide much better outcomes and a better template for regulations.

Understanding Net Zero

Karl Desai, Senior Advisor, UK Green Building Council (UKGBC)

The carbon cost of the built environment

- The built environment is responsible for around 40% of the world's energy consumption; over 30% of worldwide carbon emissions; and over 30% of worldwide resource consumption
- A net-zero UK can therefore only be achieved through co-ordinated action to achieve a 50% reduction of emissions in the construction sector by 2030.

The UKBC roadmap to Net Zerot

- The UKGBC is an industry-led network with a mission to radically improve the sustainability of the built environment.
- Its recent work has been informed by the World Green Building Council's roadmap for 'Advancing Net Zero'. This advocates for all new buildings to be net zero carbon by 2030 and all existing buildings to be net zero by 2050. It defines a net-zero building as: 'highly efficient, with all remaining energy from on-site and/or off-site renewable sources."
- The UKGBC produced 'Net zero carbon buildings: a framework definition' (2019), a document which sought to provide an industry-standard net zero definition.
- It calls for the reduction of construction impacts and operational energy use; an increase in renewable energy supply; the offsetting of remaining carbon emissions; and the public disclosure of building performance.

An introduction to whole-life carbon

It accounts for the carbon emissions associated with the entire building life-cycle, to include:

1. Embodied carbon

The total greenhouse gas emissions generated to produce a built asset. This includes emissions caused by extraction, manufacture/processing, transportation and assembly of every product and element. Sometimes, it may also include the maintenance and replacement of materials and systems that make up the asset. It excludes operational emissions.

Upfront carbon
Emissions caused in the materials production and construction phases before the building is used.

Use-stage embodied carbon
Emissions associated with the upkeep of the building throughout its life.

2. End of life carbon

Emissions during demolition or deconstruction and processing of materials for re-use, recycling or disposal.

Implementing whole-life carbon targets

- It is vital to work with engineers and engage clients on whole-life goals as early as possible on a project.
- Use metrics to set whole life carbon ambitions: there are many whole-life carbon software tools available. The UKGBC uses OneClick LCA, for example.

A hierarchy of carbon reduction potential

1. Build nothing (100% carbon reduction potential)

   Challenge the root cause of the need.

2. Build less (80%)

   Maximise the use of existing assets; reduce extent of new construction.

3. Build clever (50%)

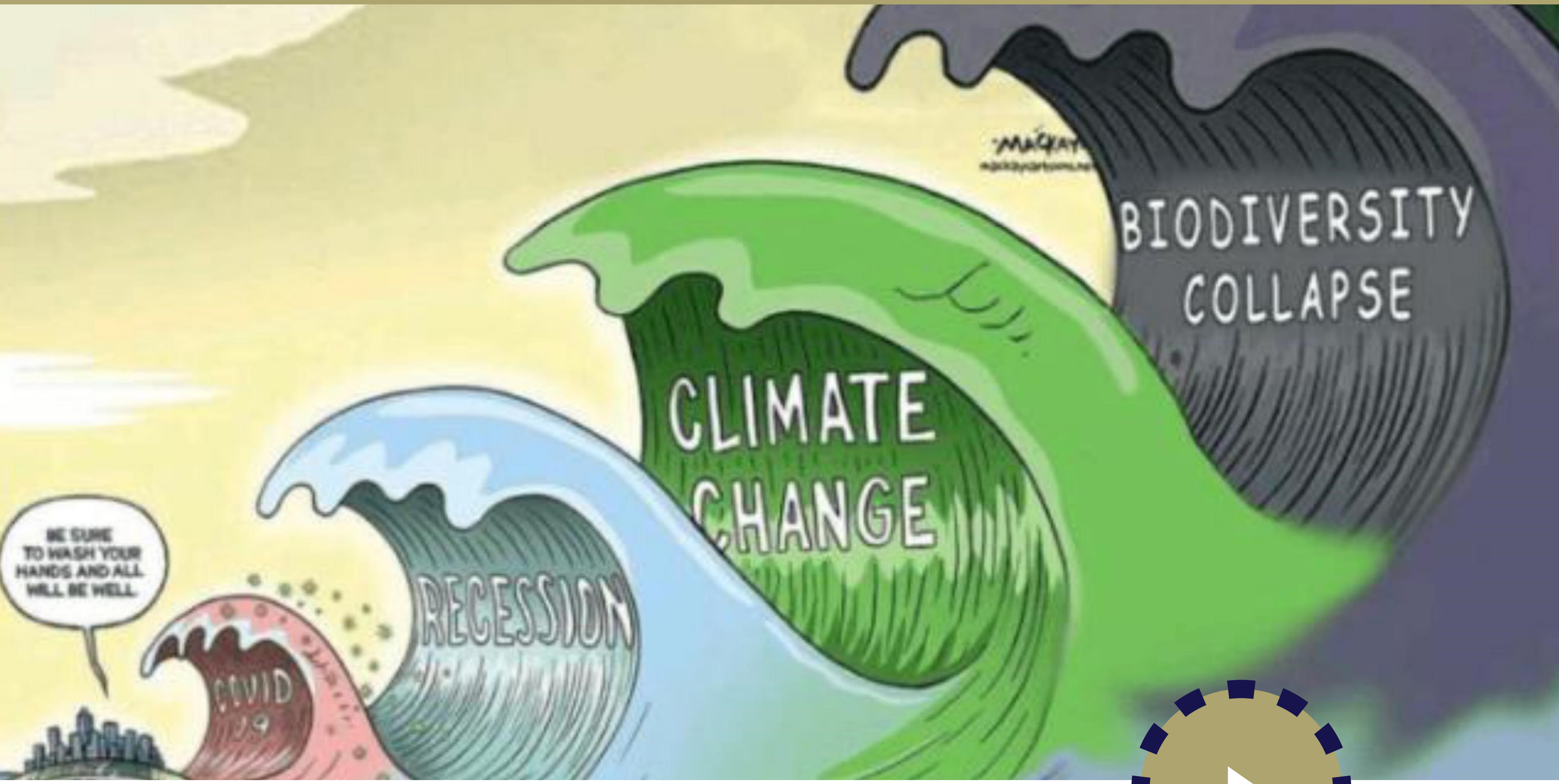
   Design with low-carbon materials; streamline delivery processes.

4. Build efficiently (20%)

   Embrace new construction technologies; eliminate waste.

Beyond Carbon

Maria Smith, Director of Sustainability and Physics, Buro Happold



While reducing our carbon emissions is critical, there are other significant greenhouse gas emissions alongside a raft of other non-carbon-related negative environmental pollutants.

Ecosystems and biodiversity

- Ecosystems are complex and species loss, especially of insects which are the basis of food chain, could lead to a biodiversity crisis unfolding with unknowable effects.
- Development is encroaching on wild habitats across the globe, and not just on greenfield sites. Often brownfield sites have greater biodiversity.
- Water cycles that ecosystems depend on are disrupted by the sealing of surfaces . 'Heat island' effects caused by development affect microclimates; which in turn harms biodiversity.
- Thinking of the built environment as the opposite of the natural environment is a simplistic view: it is possible for humans to create regenerative environments.

Pollutants and GHGs

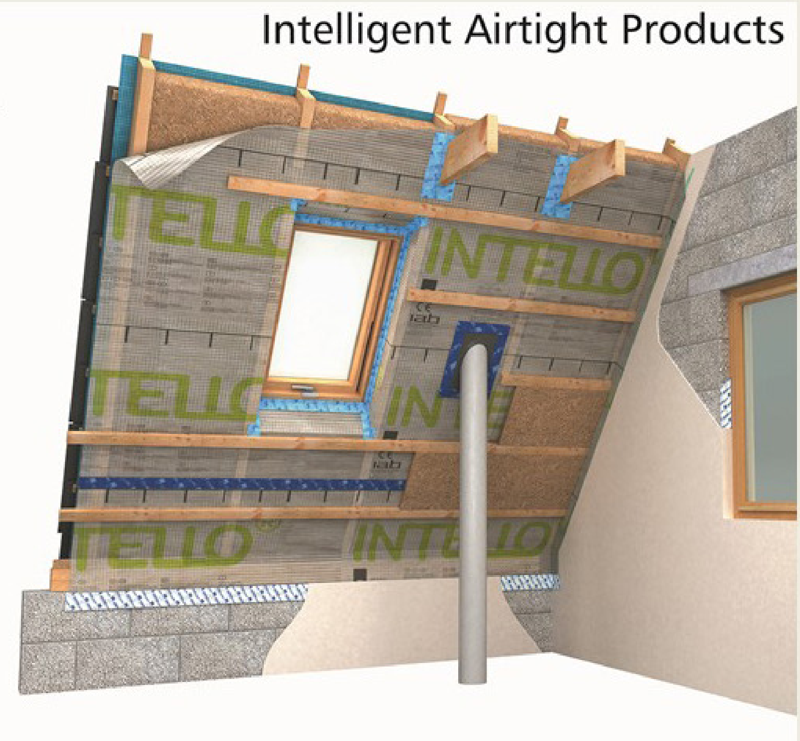
- Nitrous oxide, a by-product of cement manufacture, is the third most significant GHG.
- The acidification of air, water and soil is still a problem. Acidic pollutants released during the production of steel lead to forest dieback.
- Pollutants released in concrete production contribute to the increased production of algae and aquatic plants and associated major loss of marine life.
- Many by-products of construction materials are near impossible to dispose of. 'Red mud', or bauxite residue, is a waste produce of aluminium production that requires large amounts of space for its disposal.

Minimising the footprint of construction

- Minimise material consumption.
- Putting all hope in carbon-removal technologies is a head-in-the-sand approach. Pursuing systemic change is a better way forward.
- Minimising energy consumption is essential. At current use levels, renewable energy generation will never satisfy all demand.
- Architects are ‘environment professionals’ who should work more closely with ecologists, landscape architects, and horticulturalists to create thriving habitats.
- Environmental Product Declarations (EPDs) allow built environment professionals to find out how damaging a building product is, such as the amount of acidic content in concrete.

Principles of Residential Retrofit

Marion Baeli, Partner, PDP London



The UK's current building stock

- The UK has Europe's oldest building stocks, with 55% dating from before the 1960s.
- 85% of buildings existing today will still be here in 2050; only around 1% of the building stock is replaced each year.
- Older building stock is particularly energy inefficient and accounts for a significant proportion of total UK carbon emissions
- Around 60% of the embodied carbon of a house is attributable to the substructure and superstructure, so retrofitting rather than demolishing old homes offers huge embodied carbon savings.
- There are roughly 27 million dwellings in the UK. We therefore need to retrofit several million of them per year in order to meet the overall 2050 net zero target for the UK.

The cost-benefit calculation of retrofit

- The cost of retrofitting the UK's housing stock is estimated at around £500bn: the cost of the rescue package offered to UK banks after the 2008 financial crash.
- There is a health case to be made for retrofitting UK homes. The 4 million UK residents experiencing fuel poverty cost the NHS an estimated £1.4bn per year.
- Campaigners want the government to remove VAT (20%) on retrofits to remove the tax incentives for new builds.
- Reduction of energy demand should be the priority, using a fabric-first rationale that is sensitive to the comfort and health of occupants.

The need to upskill

- Architects should seek help from low-energy retrofit consultants, or upskill via an accredited Retrofit Coordinator course.
- To access several current government energy improvement grants, PAS 2035 accreditation is required of the installer.

5 retrofit steps

1. Analyse the building: its construction, its energy performance, and response to moisture and temperature changes.
2. Set your performance targets post retrofit
3. Develop a strategy and assess phasing. Can the retrofit be completed in one go, or in several stages.
4. Monitor construction to ensure the retrofit is implemented to a high standard.
5. Measure the actual energy performance in use and benchmark against the targets.

5 key factors

1. Insulation

This can be applied internally by removing and relining the interior building fabric. More breathable, organic materials may also be chosen. Insulation can also be applied externally, though gutters and complex facades may present a challenge.

2. Windows

Higher-performance windows offer significant energy savings; available options include Fineo and Velfac products. This can be problematic in conservation areas; fortunately, relatively little UK housing stock lies in conservation areas.

3. Ventilation

Mechanical Ventilation and Heat Recovery (MHVR) systems are key equipment for ensuring low energy demand. They keep heat inside the building while bringing fresh air in. They can be quite bulky but can be hidden in cupboards or attic space. Heat pumps should only be installed if airtightness is achieved to avoid high running costs.

4. Airtightness

Hot air must not escape through different buildings elements. A more client-friendly word than 'airtight' is perhaps 'draughtproof', as ventilation is important.

5. Thermal bridging

It is very important to understand cold bridges and moisture movements. Internal condensation needs to be avoided to prevent the growth of mould.

After a retrofit

- Make sure the building occupants understand the basic principles of how the building maintains heat, and how to maintain any installed equipment.
- Monitor the building's in-use performance. Immediate evidence can be gathered by a thermal imaging camera: if the exterior walls appear as a shade of blue (cold) the retrofit was successful.

Making Retrofit Work for Residents: Energiesprong Nottingham

Richard Partington, Founding Director, Studio Partington

The Energiesprong approach

- Energiesprong was conceived in the Netherlands, meaning 'energy leap'. It is an approach that incorporates:

  A financial model: the cost of the retrofit is being recouped via energy savings over time.

  A wellbeing and comfort prerogative that improves homes for residents.

  An outcomes-based philosophy: a project should consider the benefits to residents accrued over a sustained period of time.

- Energiesprong is most economical if the client can consider future capital investments, such as impending renovation work, and bring it forward. Consolidating long-term requirements into one project maximises the energy performance improvements that can be made.
- Architects should not narrowly focus on improved insulation only . They should always look holistically at the need for wider improvements to the building and streetscape to improve resident wellbeing.

Challenges of a social housing Energiesprong project

- Every retrofit is different. It is important to return to 'first principles' on every project.
- In most UK social housing developments, there is some element of private ownership due to Right to Buy. As the public sector is not allowed to financially support the retrofitting of privately owned units, this often results in a patchwork retrofit if private owners are not willing or able to pay.
- Balancing the residents' aesthetic preferences and desires for spatial improvements with high energy standards is challenging but also inspiring in terms of a brief.
- Insulation panels had to be customised to account for the impact of ageing and buildings settling over time
- Adding cladding increases the wall thickness and in turn requires increasing the size of the roof. This provides both challenges and opportunities in terms of drainage and shading.

Energy provision and use

- The goal to reduce all households total annual energy bill to less than £320was achieved
- Photovoltaic panels were used in some places, doubling as structural roof panels to reduce costs.
- Communal energy centres with ground source heat pumps fed by electricity generated from solar roof panels supply clusters of around 25 homes. This helps manage shifts in demand which require management beyond the scale of a single home.
- To be successful, a low-energy retrofit requires buy-in and cooperation from residents, and understanding of how the ventilation and heating systems work: a good user manual is necessary but not enough.

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Is Passivhaus Limiting your Creativity? Debunking Common Misconceptions

Justin Bere, Director, bere:architects

Creative responsibility

- Architects have a duty of care as professionals. They also have ethical obligations and a responsibility to deliver truly sustainable buildings.
- Creativity means adaptation to the environment and optimising the chance of survival, rather than superficial design flourishes.
- Simplicity of form should therefore not be considered any less creative. The natural world offers a model: the diversity of the species is a result of adaptation to their environment.
- A 'mildly sustainable' building might satisfy UK building regulations; a 'seriously sustainable' building would probably adopt PassivHaus or Enerphit targets.

Fundamentals of Passivhaus

Certified Passivhaus buildings meet performance requirements on:

1. Space heating energy demand
   Buildings should meet a space heating demand of less than 15 kWh/m2 (the total annual energy required to heat the building) or a 'heating load' (the peak load at any one time) of less than 10 W/ m2.
2. Airtightness
   Measured in 'air changed per hour', this is tested after construction is complete.
3. Thermal comfort/summer overheating
   This is measured as the percentage of time any space in the building is over 25°C.
4. Primary energy demand
   Primary energy is that of the raw resources mined, extracted or harvested; not the energy delivered or used in the building, or measured on the meter.
5. Renewable energy generation
   Metrics for the on-site renewable energy generation per year per m2 of a building's footprint apply to Passive House 'Plus' and 'Premium' certification, but not for 'Classic' (standard).

Key elements of a fabric-first design

1. Super-insulation of walls, floors and roof is vital, as is avoidance of cold bridges. It is under-estimated how much heat is lost to the ground via poorly insulated floors.
2. Draught-free design detailing and construction.
3. High performance triple-glazed windows, doors and insulated frames.
4. Heat recovery ventilation system
5. Electric heat pump for heating of water and any marginal heating or cooling requirements. Usually, a Passivhaus has negligible demand for heating.

A 'Zero-Zero' house

- The 'Zero-Zero House' achieves net zero annual operational energy; but also net zero whole-life carbon over 60 years through generating energy via photovoltaic roof panels.
- It can be achieved on 'any orientation': it does not require certain rooms to be south facing.

Passive House Plus

- The Lark Rise project was a successful attempt to meet Passive House Plus standards: it reduces dependence on grid energy by 94% compared to similar new builds.
- It generates 2.5 times more energy than it uses annually, while also exporting 10 times more energy to the grid than it imports.
- Homes should be treated as a part of the energy infrastructure: this requires ingenuity and creativity.
- By using high energy-absorbing glass it maximises the harvesting of winter heat. This is necessary as the building faces north-west, proving that a Passivhaus need not be south facing.

Material Explorations

Fergus Feilden, Director, Feilden Fowles

Taking inspiration from the landscape and vernacular architecture

- When adopting a passive, fabric-first approach, the chosen materials inform the design. The embodied carbon of materials plays a huge part in shaping Feilden Fowles' work.
- A low-tech approach is at the core of Feilden Fowles' philosophy: simple, legible buildings that are embedded in the landscape.
- Vernacular architecture can be instructive: in the past, buildings had to function successfully using limited resources.

Using local materials

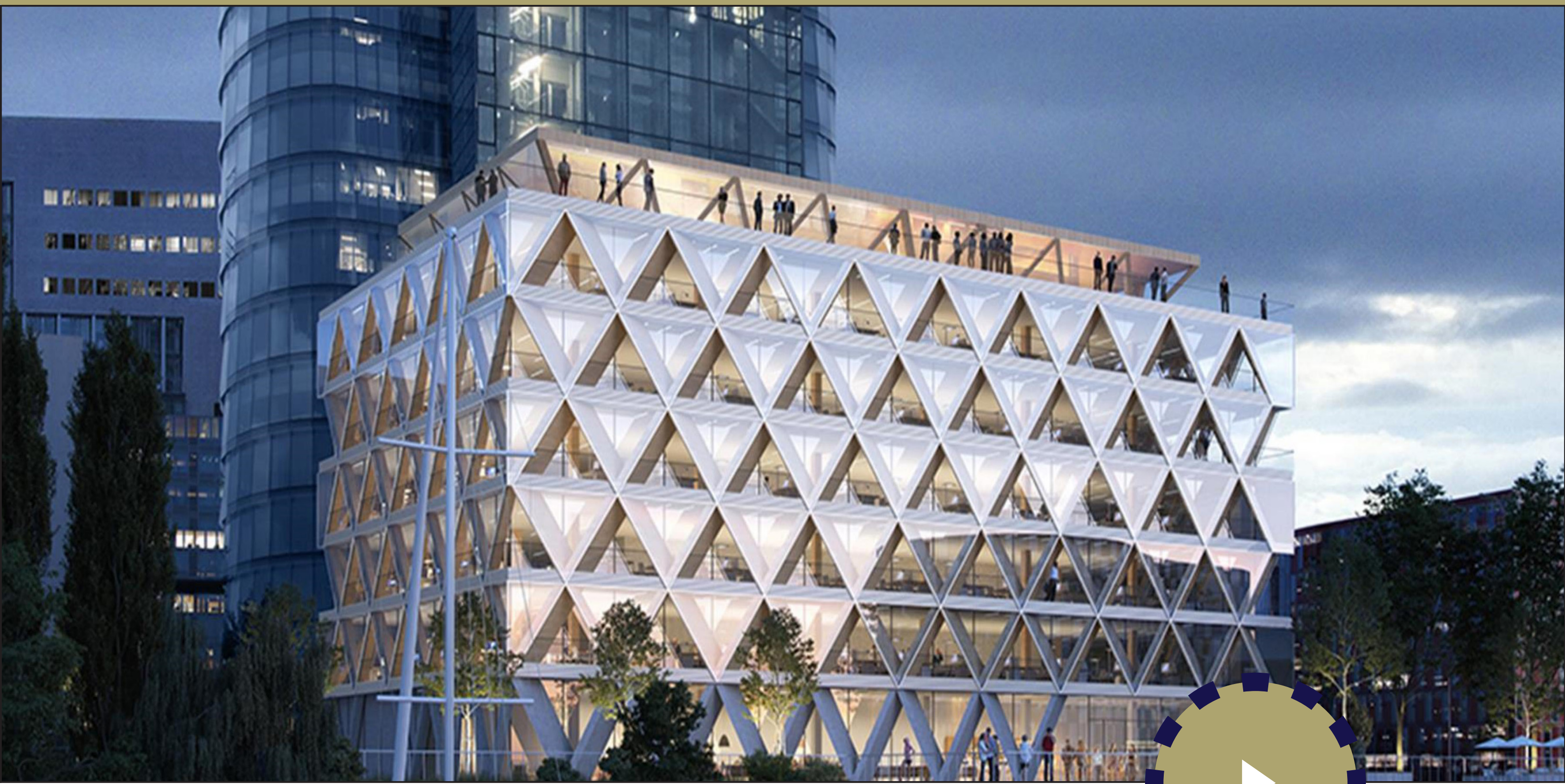
- For 'Ty Pren', a house in the Brecon Beacons, the longhouse typology provided inspiration. The local environment provided materials such as recycled slate and wood from larch trees that was milled on site.
- The building's thermal mass was maximised as much as possible. Sheep's wool was used as insulation. All heating was supplied by a combination of solar panels on the roof and a wood burning stove.
- Trees were planted that would be mature enough to be used for new cladding once the old cladding neared the end of its life.

Challenges of scale

- Maintaining this design approach for larger buildings such as schools is more challenging. Addressing carbon culprits such as concrete becomes more important. Look for opportunities to minimise their use, for example by reducing the density of foundations.
- Use cross-laminated timber (CLT) where possible. Maximise natural light and ventilation to minimise energy use.
- Sustainability is also linked to good design more broadly: only if a building meets the needs of its users will it be maintained in the long run.

Introducing a Cradle to Cradle Approach

Marco Abdallah, Head of Engineering UK, Drees & Sommer



What does ‘cradle to cradle’ mean?

- Cradle to cradle (C2C) describes an approach that considers the entire life-cycle of a building.
- C2C provides a future-proof business case for a sustainable asset. The Environmental Protection Encouragement Agency (EPEA) has developed C2C products and compiled a large materials database.
- Buildings are responsible for around 33 percent of global carbon emissions and around 60% of the total waste production in the UK. A C2C approach is therefore essential.
- Focusing primarily on improving energy efficiency is not sufficient. Instead, we need to achieve a holistic approach in which buildings become part of the material and ecological cycle rather than an extractive economy.
- A C2C approach should be fully holistic, addressing energy, water, health and biodiversity.

A circular economy

- Recycling is typically ‘down cycling’. The glass recycled from a window becomes a green bottle; then a brown bottle; then eventually landfill. In a circular economy, the window should be recycled into a new window. Buildings and their components should have multiple lives and be designed for disassembly. Circular economy principles are ‘chain thinking’: a new mentality and approach.
- We therefore need to rethink the urban environment, viewing cities as sites of material storage. This would address finite resources as well as carbon emissions from primary material extraction and processing.
- The UKGBC has published the ‘Circular economy guidance for construction clients’ on how to apply C2C principles throughout the project stages. The new London Plan promotes circular economy principles.

Circular engineering

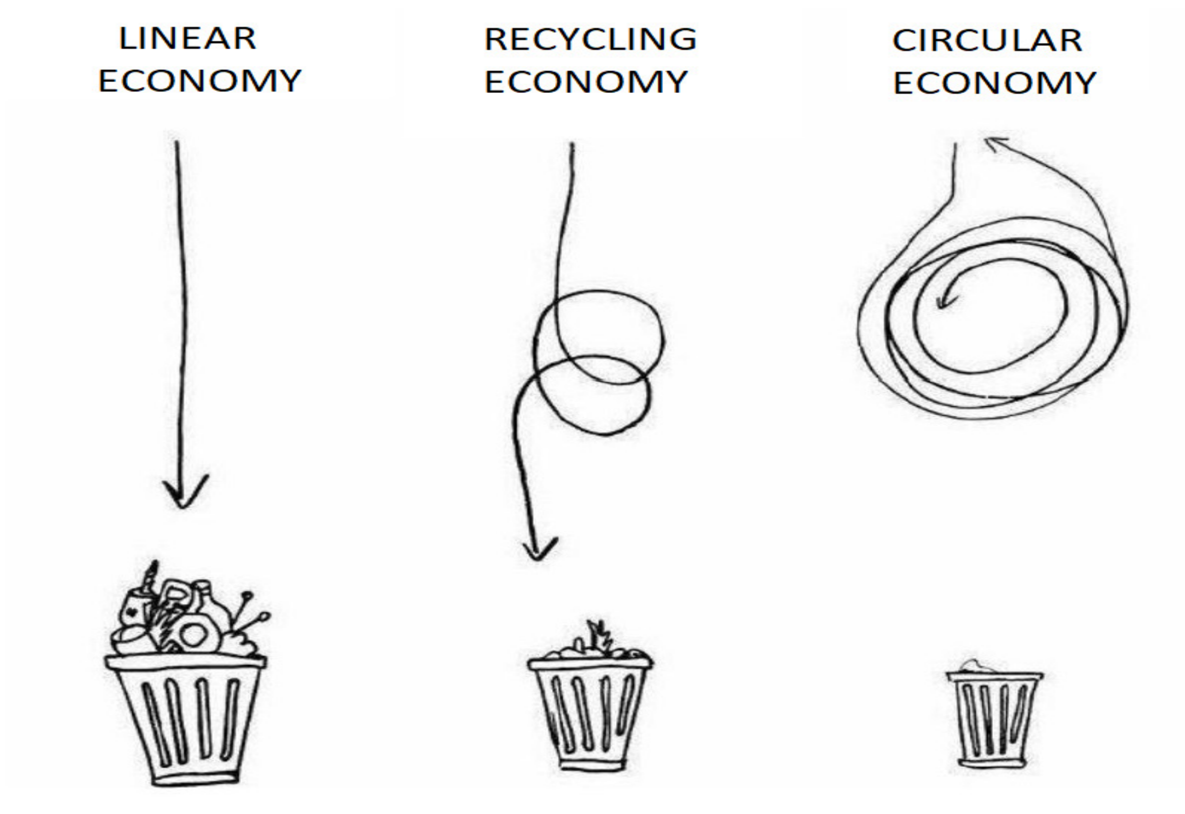
- A new discipline, circular engineering, is needed, which would address:

1. Recyclability and separability of materials
2. Flexibility and design for disassembly
3. Use of healthy materials, free of pollutants

- A 'circular engineer' would advise on material reuse without loss of quality or waste generation, demonstrating to clients the value in dismantling rather than demolition.
- An important part of circular engineering is analysis of products on the market and their certificates; establishing their credentials for health, recyclability and whether they already include recycled content.

Buildings as material banks

- The Cradle, a timber hybrid building in Dusseldorf, Germany, can be disassembled at the end of its lifetime. Its components can be reused and are biodegradable. It is fully 'circular'.
- Parameters have been integrated into its BIM model to monitor its material performance. This helps visualise its recyclability to clients who may lack technical expertise.
- A Building Material Passport can be produced to provide information about a building's 'health', its carbon footprint, ease of disassembly, recyclability of materials and components, and other factors. This information could be published and shared to provide a database of existing materials for buildings.
- Components could be sold on at the end of a building's life. A recent EU study concluded that this could recoup a significant share of the original construction costs.
- C2C principles are also applicable to renovation and fit-out projects.



Applying Circular Economy Thinking at the Brussels World Trade Centre

Johan Anrys, Partner, 51N4E and Michael Moradiellos del Molino, Head of Real Estate Belux & France, EPEA/Drees & Sommer

The ZIN building

- The Brussels World Trade Centre is made of two office towers built in the 1970s comprising 100,000m2 of office space. It is owned by an investment fund
- The client commissioned 51N4E to transform it from a 'monofunctional' building into a multi-use, diverse space hosting office, housing, commercial and leisure facilities and hotel rooms.

Retaining existing qualities

- The best circular economy building is one that does not have to be built. Therefore, only the façade and the floors were demolished: the underground infrastructure and foundation system were retained and a new envelope built around it. The new design comprised the core of the two towers, connected by a new 'slab' building.
- 1,646 tonnes of materials from the previous building are being reused onsite and elsewhere, including insulation, carpet tiles, partition wood panels, mineral tiles, stone tiles, roof tiles, raised floors, wood panels, flatglass and furniture.

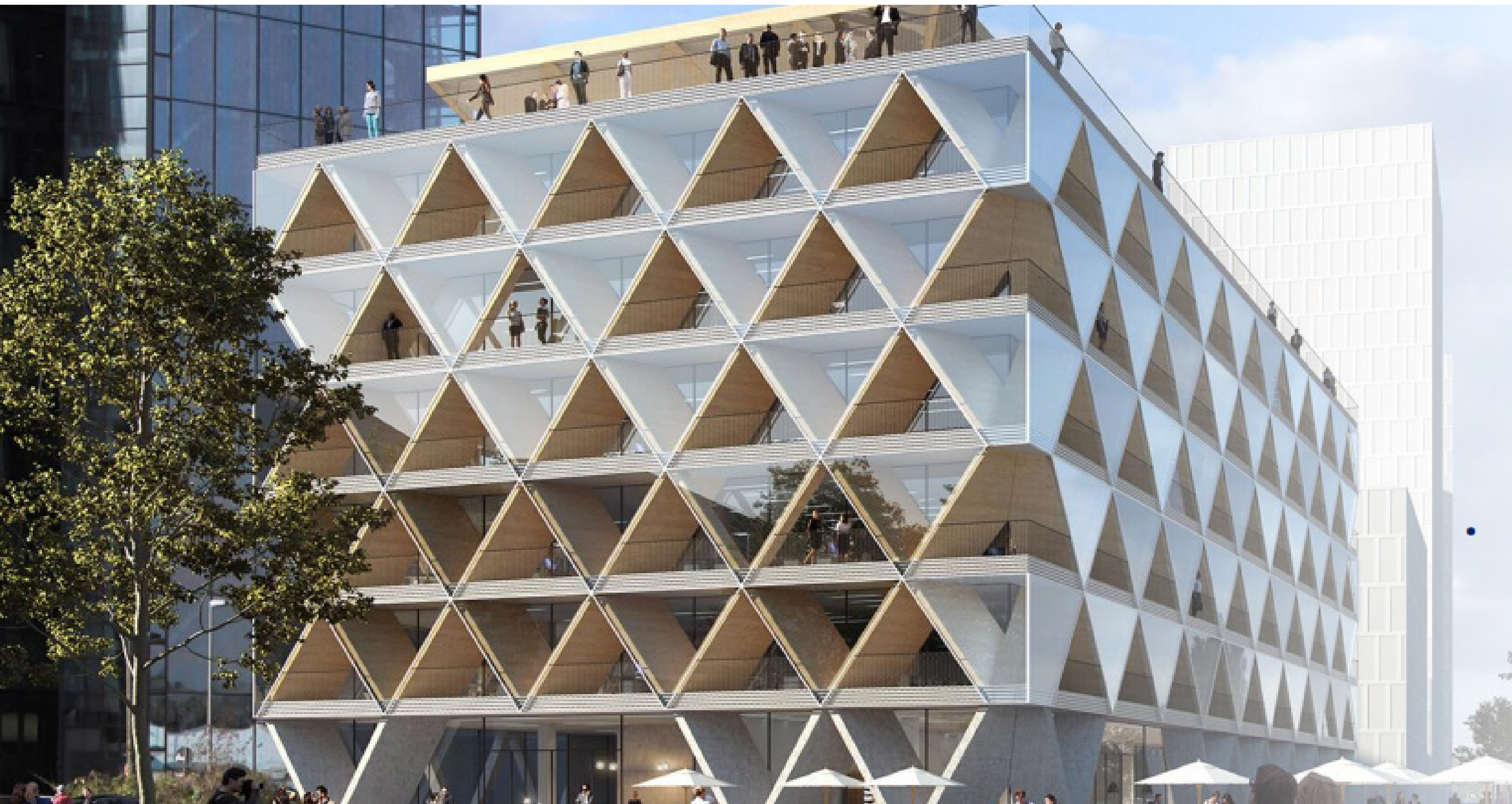
Future adaptability

- The clients wanted the useful building life to exceed one lease cycle. Any part of the building should be adaptable to different uses without requiring major interventions or disrupting the everyday lives of current occupants.
- New floors were added so that the building could be readily adaptable.
- The new building element connecting the towers contains 14 floors of offices, each one at double-height. This over-sizing means it could be transformed from offices into any other use.
- The over-sizing is both spatial and technical: each floor is acoustically and thermally designed to enable potential different uses, including residential, to co-exist on top of each other. This strategy requires a higher up-front investment, but adaptations will be significantly less expensive.

- The internal ground floor spaces are designed to be accessible by the public, containing for example sports facilities or co-working spaces. This ensures the building becomes an integral part of the city.

Materials information management

- The Horizon 2020 project, led by the Minister of Environment in Brussels, provides guidance in managing circular economy projects at a building level, demonstrating how to collect circular economy building data for a Building Materials Passport and BIM models.
- The resulting software tool, the Building Material Scout, allows architects, contractors and developers to provide a life-cycle assessment of a project.



Day 2: Practice

Goldsmith Street by Mikhail Riches © Tim Crocker

Keynote: No Such Things As Waste

Anders Lendager, CEO, Lendager Group

Lendager Group's core philosophies

- Clients' risk aversion and conventional business models have meant the built environment has been slow to address sustainability. Lendager Group therefore attempts to provide cost-neutral sustainability strategies, creating high-end architecture that focuses on aesthetics as much as sustainability.
- All of Lendager Group's designs aim to address five problems: CO2 emissions; waste elimination; resource efficiency; climate change; and biodiversity.

Tackling the Circular Economy

- The Upcycle House was the start of the Lendager Group's circular economy journey. The challenge was to build a family house using only recycled materials such as aluminium from beer cans, upcycled textiles and newspapers.
- Using an industrial freight container as its core and wood insulation, the house was inexpensive and saved 86% of the CO2 of a benchmark conventional house.

Scalability

- Having proven that upcycled materials could be used on domestic project; the next step was to apply the same principles to larger projects and different typologies; and to develop a wider reuse supply chain.
- Lendager established a consultancy and upcycled products business. The latter sources reuse materials, upcycling them and selling them to other contractors and architects.
- Denmark produces 12m tonnes of construction waste annually while using 10 million tonnes of raw material: this points to huge untapped potential for reusing materials and cutting down waste.

Upcycle studios

- Upcycle Studios, a live-work housing development, was one of the first commercial circular economy building projects in the world. It re-used around 1000 tonnes of waste while also generating a profit.
- 850 tonnes of concrete waste from a Copenhagen Metro construction site were crushed and re-cast onsite.
- The timber façade and flooring were constructed from offcuts sourced from timber manufacturers which are usually burned.
- 900 windows were re-used, the majority sourced from derelict public houses: they were cleaned, tested for U and G values, and placed one in front of the other to increase their thermal efficiency.
- No fillers, glues or chemical-based paint were used. This supports health and wellbeing, and the scope for deconstruction and reuse at the end of building life.
- High ceilings enhance the building's adaptability for future uses.
- The project cost was comparable to standard new builds while achieving a 45% CO_2 reduction and the creation of 20 new jobs. The flats were highly sought after and sold immediately.

Resource Rows

- Denmark's first larger residential development to be built from reuse materials, Resource Rows converted 500 tons of waste; the project cost no more than a conventional build..
- Re-using bricks on the project would provide carbon savings of 32kg of CO_2 per m2. However, when held together with mortar, bricks are hard to separate and reuse individually.
- At Resource Rows, Lendager used composite 'panels' of bricks and mortar cut from walls of condemned buildings. These saved 42 kg CO_2 per m2 and shaped the building's unique aesthetic.

Sustainability By Stealth

Ruth Butler, Director, Ruth Butler Architects

The case for sustainability

- Sustainable design is inseparable from good design. Design cannot be considered successful if it is profligate with natural resources.
- Across her own projects, Ruth Butler has found that a fabric-first approach adds around 7% to the overall construction cost. However, architects make a plethora of design or material choices that can impact costs in a similar way.

Embedding sustainability into the brief

- Clients deserve to occupy comfortable, healthy buildings that are cheap to run and do not harm the environment. When discussing the brief with clients, sustainability should not be presented as an optional extra but the default position.
- Sustainability should be mentioned as early as possible in client conversations. The Climate Change Act of 2008 provides a legislative context for this discussion: a net-zero target for the UK by 2050. The RIBA's 2030 Climate Challenge provides target performance metrics for architects.

Working with contractors and monitoring delivery

- Achieving sustainable outcomes requires engaging the whole project team: low-energy buildings are often a rewarding process for all involved.
- Appoint an 'airtightness champion' onsite to monitor this crucial performance factor.
- Instigate hands-on 'toolbox talks', in which a building performance specialist can brief the builders.

Plugging the Performance Gap

- Passivhaus is an excellent model. It consistently delivers low energy in use, while other methods may have a performance gap between predicted and in-use results.
- The Passive House Planning Package (PHPP) is a user-friendly, software-based tool. It can be used from the early design stages to model different design options.
- The PHribbon plug-in is an invaluable embodied carbon calculation tool

Easy wins for reducing embodied energy

- The best embodied carbon strategy is the re-use of existing buildings rather than building new ones. Any new builds should be designed for disassembly and reuse.
- Use recycled materials wherever possible. Timber sequesters carbon, therefore use of CLT (cross laminated timber) can be a significant embodied carbon win. The London Energy Transformation Initiative (LETI) has published a helpful Embodied Carbon Primer.

The Power of Storytelling

Julia Skeete, Associated Director, Skidmore Owings & Merrill (SOM)

The ‘vision approach’

- Understand the client’s culture, values and vision.
- At the early stages of the project, facilitate workshops with relevant stakeholders to envision the project’s possibilities. These workshops should discuss the client organisation’s current environment and typical actions of stakeholders throughout the day.

Create a ‘decision-making ecosystem’

- Identify the stakeholders responsible for key decisions and map out when they need to take them.
- Assess what further expertise needs be brought in.
- Add key questions for high goals.

Set specific performance indicators and continuously test them

SOM set sustainability performance indicators and monitor their attainment across RIBA stages 0-8. These indicators are:

- Data gathering for learning patterns
- Application of intelligent BMS (Building Management Systems) with continuous monitoring
- Mitigating glare and overheating
- Adoption of a whole-life carbon approach
- Use of renewable energy and carbon offsets
- Harvesting rainwater and recycling grey and black water
- Generating energy and water

Taking sustainability further than the client’s ambitions

- Create a strong identity for the project
- Increase the wellbeing of occupants
- Understand and engage with the client values
- Do not be afraid to take an ambitious lead: challenge the brief and target

Learning From Clients

Jane Wakiwaka, Head of Sustainability, Real Estate, The Crown Estate and John Davies, Head of Sustainability, Derwent London

The Design for Performance initiative (DfP)

- Current practice focuses on compliance, not outcomes. Part L or Energy Performance Certificate standards do not take into account a building's energy consumption once occupied and under operation.
- DfP is a client-led initiative to tackle the performance gap and ensure new office developments perform as designed.
- DfP provides certification, not just a statement of intent. A client can clearly articulate to occupiers or other stakeholders how an asset is going to perform in practice.

Do not leave the field to engineers

- Too much responsibility is placed on building services. Energy performance is not just the MEP engineer's job. There are significant opportunities for an architect to influence the DfP rating.
- Energy performance should be embedded in the design stage. But also a building's performance in use can be improved through good facility management.

Challenge the Brief

- Sustainability has become an important value driver for real estate businesses: it is how they differentiate themselves in the marketplace.
- Clients such as Derwent and the Crown Estate welcome the brief being challenged by knowledgeable design teams. Some of the most interesting project outcomes derive from architects challenging the client over retaining the existing building structure, for example. They expect to work closely with architects and design teams to find the best solution rather than setting prescriptive briefs.
- Architects should be confident in challenging the client and exploring opportunities for ambitious sustainability targets. Do not prioritise form over sustainability. An unsustainable building is never good design.

Futureproofing buildings

- Adaptability is much easier to embed into new builds. Adapting and retrofitting the existing portfolio is a much greater challenge.
- Buildings that have been retrofitted at different times throughout their life are especially problematic. There are no one-size-fits-all solutions: the approach to net-zero will be necessarily on an asset-by-asset basis.

Communicating Sustainability as a Small Practice

Tara Gbolade, Co-founder, Gbolade Design Studio; Clare Nash, Clare Nash Architects

Use your website and social media to demonstrate your expertise

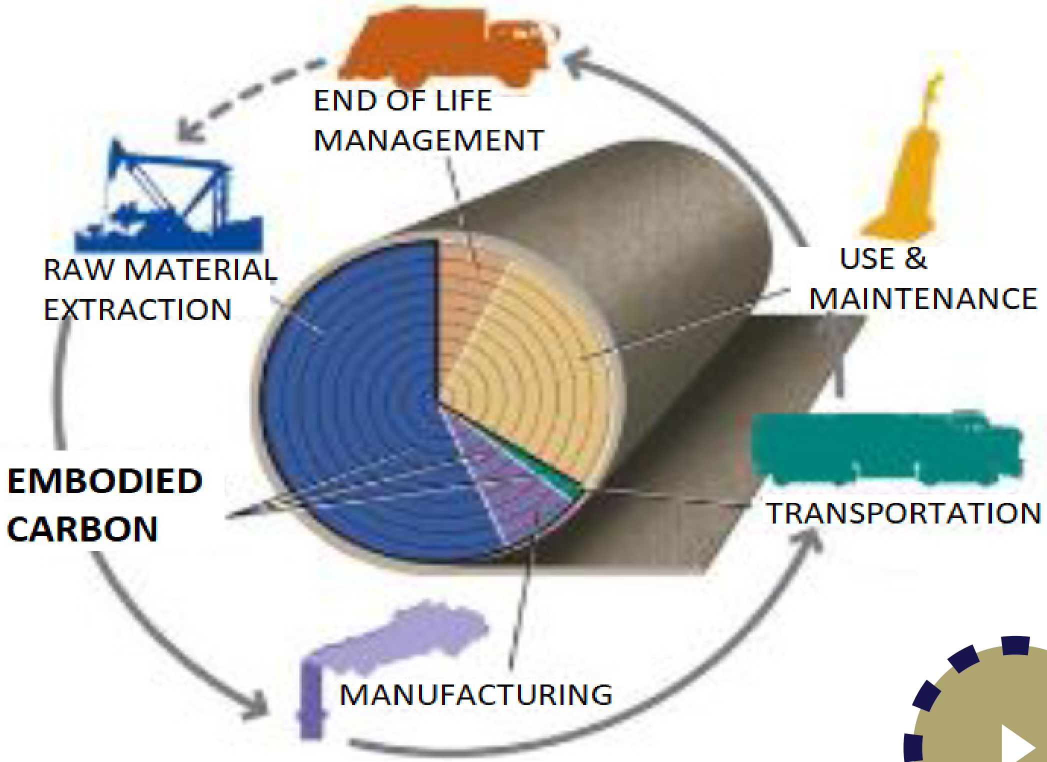
- Gbolade Design Studios created a 'Clients' Guide to Sustainable Development' to both demonstrate their expertise and increase opportunities to work on larger projects. It has led to new work with local authorities, consultancy opportunities and collaboration with larger practices.
- Clare Nash Architects regularly publish blog posts for a client audience, avoiding jargon and illustrating a range of sustainable decisions clients can consider: from small home improvements and heating and insulation ideas, right up to Passivhaus builds.
- In marketing messaging, aim to de-bunk and de-mystify sustainable design for clients. Speak to the client's concerns and aspirations, which might include: a future-proof home that will not reduce in value; cost concerns; and misapprehensions about airtightness and ventilation.
- Emphasize the added value of an eco-building: clients ultimately may be prepared to pay more once they appreciate the wellbeing benefits.
- Use case studies to showcase energy efficient buildings that are beautiful and well designed to appeal to clients.

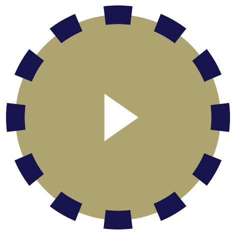
Embedding sustainability in a project

- Inform clients of your practice's sustainability ambitions right at the start. Point out any gaps between building regulations and your ambitions for the project.
- Explain key design considerations to clients at an early stage, such as the importance of building orientation and fabric-first principles.
- Identify clear targets on energy efficiency, renewable energy use, water consumption, and circular economy criteria. Discuss the need for post occupancy evaluation to measure performance.

Optimising Structures in the Design Process

Andrew Wylie, Partner, Buro Happold





Minimise material use

- It is imperative we reduce our footprint by using as few materials as possible. CO_2 is not the only greenhouse gas (GHG) and carbon emissions are not the only critical environmental issue: the consumption of natural resources for building materials is a huge global challenge.
- Reducing embodied carbon means challenging every element of the building fabric and scrutinising how materials are brought to site.
- #Circular economy and cradle to cradle (C2C) principles entail taking strategic decisions about the long-term purpose and lifespan of buildings before specifying materials and their quantities.

Adopt a rigorous approach to assessing embodied carbon

- Too often, design conversations are not backed up by data. Embodied carbon analysis should be a rigorous, item-by-item analysis of a building's base and frame and expressed in kilogrammes of carbon per m2.
- Such analysis is important for high-carbon materials like concrete and steel. But even the use of renewable materials such as timber should be optimised to minimise material use. Less timber used in the structure may also help reduce the needed foundation thickness.

Reducing embodied carbon

- The building floors are consistently shown to constitute the largest proportion of embodied carbon. Finding alternatives to concrete and using the most efficient column grids are two possible strategies for minimising embodied carbon .
- Measures such as cement replacement; alternative grades of concrete; higher quantities of reinforcement; and cross-laminated timber decks.
- Typically, engineers over-specify the structural load capacity of buildings. This is often done with good intent: for instance to maximise future adaptability. But identifying possibilities to reduce the loading imposed on a frame and persuading clients to accept this has great potential for embodied carbon reduction.
- Some regulatory change may be necessary. The load capacity of buildings is often unnecessarily high in response to safety regulations that could be met in other ways.

Foster early and meaningful collaboration

- Achieving a structurally efficient building requires challenging the design approach as early as possible.
- The structural engineer's expertise is crucial for minimising material use. However, it requires holistic thinking by all members of the design team and creative collaboration from concept stage on.

Future possibilities for reducing embodied carbon

- Thermal mass is currently seen as a necessity in buildings. But buildings are often essentially sealed boxes, so the benefits of purge cooling are not there.
- Re-use and recycling of materials is currently challenging, due to codes, standards and insurance issues, and for good reason. Being able to recycle the foundations of buildings would be an embodied carbon win.
- There are significant potential carbon savings to be made if greater levels of deflection could be specified. Engineers currently overspecify to minimise deflection and build exclusively very stiff structures.

Interrogating the Whole-life Carbon Impact of your Project

Louisa Bowles, Partner, Hawkins\Brown and Joe Jack Williams, Associate, FCBS

What is whole-life carbon?

A zero-carbon assessment should address the whole life-cycle of a building, taking into account both embodied and operational energy, from the beginnings of its existence as a 'product' to its next life after it is decommissioned. Three documents currently best encapsulate whole-life carbon principles:.

1. BS EN 15978 is a BSI Standards publication addressing the sustainability of construction works and the assessment of environmental performance of buildings, providing a calculation method.
2. The RICs publication 'Whole life carbon assessment for the built environment'
3. The RIBA publication 'Embodied and whole life carbon assessment for architects'

The 5 Stages of whole-life carbon

BS EN 15978 categorises whole-life assessment into 5 stages:

1. Product (a building's material constituents)
2. Construction
3. Operational (its use and maintenance)
4. End of life
5. Next life.

The London Energy Transformation Initiative (LETI) provides an assessment of the relative embodied carbon impact of each stage in its Embodied Carbon Primer document.

Calculating the carbon footprint of materials

- The University of Bath's Inventory of Carbon and Energy (ICE) is a free to use database specifying the embodied carbon of building materials, which aggregates data from EPDs (environmental product declarations) and manufacturers.
- The EPDs themselves can be looked up directly on websites such as environdec.com or greebooklive.com. Each EPD will typically provide hard numbers on the product's environmental impact, such as its GWP (global warming potential) measured in kg of CO2.
- Use the quantities calculated by the QS or in the BIM model to calculate the total embodied carbon for your project
- There are numerous embodied carbon software tools available to facilitate this process such as H\B:ERT, OneClick, EC3 and Eccolab . Some are free to use, some are commercial products. The free tools generally require you to enter the data yourself; paid-for ones usually have databases attached.

Opportunities for reducing embodied carbon

- In the early, cradle to gate stages, architects should weigh up material and product options. Optimise designs to reduce overall quantities. Specify natural materials and aim to re-use elements from existing buildings. Choose materials that come with EPDs: manufactures need to know there is a demand for them.
- Data from BEIS (the Department for Business, Energy and International Strategy) is available to determine the carbon cost of transportation. Plane freight is very bad, so use of local suppliers is important. MMC (modern methods of construction) may potentially reduce the amount of construction waste. The more bespoke the design, the more likely it is to create more waste.
- There may be a trade-off between the initial carbon cost of construction and the building's longevity: Designing for ease of repair and maintenance is important to extend the useful building life.
- Considering the end of life stage is vital. Materials and components that can be disassembled, reused or recycled reduce the whole-life carbon impact. Reduce the palette of materials as far as possible and specify recyclable materials. Buildings should be material banks: making them easy and transparent to take apart is the design team's responsibility

BS EN 15804 Life Cycle Assessment Stages

Learning from Projects

James Turner, Associate, Mikhail Riches

Keep it simple

- The sustainability philosophy at Mikhail Riches is to keep it simple; to adopt a 'from the ground up' approach. This has been a common thread from early projects through to Goldsmith Street.

Achieving Passivhaus certification at Goldsmith Street

- Passivhaus has become a shorthand for highly sustainable low-energy homes. Goldsmith Street reduced the energy cost of its two-bedroom houses down to £150 per year, operating at around 16KwH per m2.
- Mikhail Riches had not delivered to Passivhaus standard prior to Goldsmith Street. Working very closely with a consultant was crucial and proved inspiring, providing opportunities to improve design ideas creatively.
- Using staggered terraces from East to West with sloping rooflines maximised solar gain. Thinking very carefully about solar gain and building orientation is key to a passive design.
- As a Local Authority development, Goldsmith Street set a benchmark, and managed to do so using a traditional JCT contract. It is a Passivhaus development in step with the local vernacular, using a timber frame hidden behind a brick skin.
- Incorporating renewable energy generation in this model is the next step for Mikhail Riches. The practice is now also using PHribbon software to calculate the embodied carbon of current projects.

Project considerations for Passivhaus

- From the client's perspective there are two additional fees: for a Passivhaus consultant and a certifier.
- For architects, more complexity is introduced, with several more iterations to go through with the consultant.
- While designing a building to this higher standard costs more, this premium can be recouped over the building's lifespan due to lower energy costs

Feedback and Post Occupancy Evaluation (POE)

- Mikhail Riches' earlier Clay Field project benefited from post-occupancy analysis conducted by Buro Happold.
- While official POE has not been carried out at Goldsmith Street, occupants have reported they have not needed to put their heating on.
- The 'ginnel spaces' at Goldsmith Street provide safe children's play areas. While Goldsmith Street is dense housing, every resident has their own front door and each house faces onto the street. This imparts a sense of ownership and control. All of these factors have helped create a sustainable long-term community.

Understanding your Impact and Identifying Quick Wins

Diana Dina, Head of Sustainability and Regenerative Design, Haworth Tompkins

Embedding accountability across the practice

- A sustainability strategy within a practice can be both bottom-up and top-down. Haworth Tompkins has an in-house sustainability team comprised of project architects who meet monthly to monitor the practice's progress.
- The practice has created a succession plan to ensure its sustainability ambitions are permanently embedded and driven forward by future directors.
- An away day for the entire office, featuring talks by sustainability and regenerative design experts, fed into a design toolkit later developed.

Raising awareness and demonstrating commitment

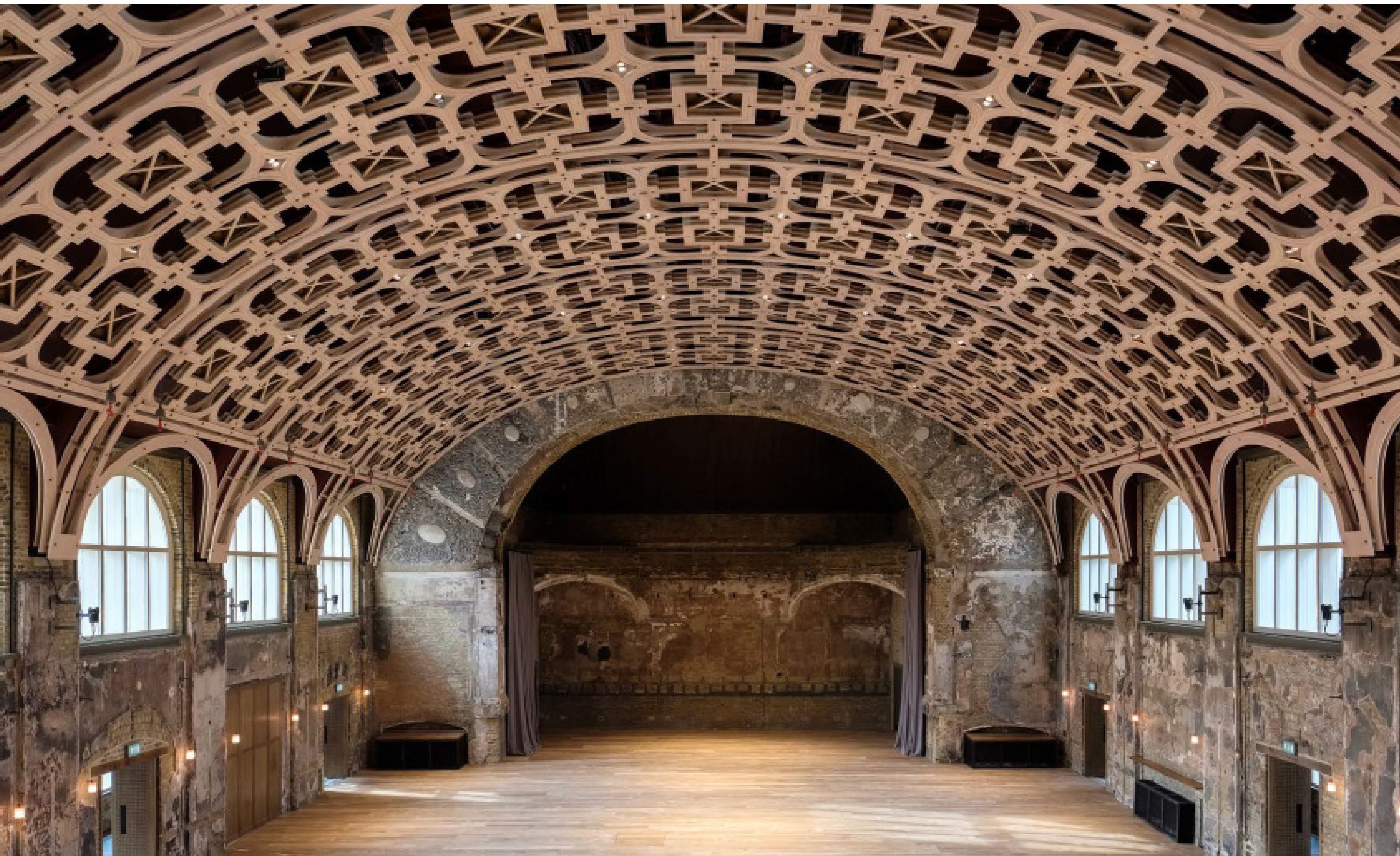
- A practice operational carbon footprint is dwarfed by the impact of projects designed by architects. But measuring the office and staff members' carbon footprint is an excellent tool for awareness raising, galvanising the team and demonstrating commitment to clients
- Haworth Tompkins set out to measure its operational carbon footprint including staff travel.
- The indoor temperature it was monitored to assess how user preferences impacted energy consumption and how temperature related to productivity.

Commit to measurable targets and empower the team

- Haworth Tompkins signed up to the RIBA's 2030 Climate Challenge, metrics in the London Energy Transformation Initiative (LETI) Climate Emergency Design Guide as well as the Living Building Challenge, which also addresses biodiversity.
- All project architects receive training on the relevant metrics to enable them to discuss them with clients and consultants.
- All staff members received basic training on Passivhaus principles, and staff have started using the H\B:ERT embodied carbon tool.
- A reporting template has been set up to help staff carry out POE on their projects.

5 key quick wins

1. Engage the entire team
2. Support and train staff
3. Collaborate and ask for help
4. Engage in workshops with clients
5. Reach out to others, such as LETI or Architects Climate Action Network, and share resources



Your Studio, your Laboratory

Paul Bulkeley, Director, Snug Architects

The office as training ground

- Having signed up to the RIBA 2030 Challenge, Snug Architects decided to start by getting their own house in order and refurbish their offices to achieve Net Zero Carbon by 2022
- The refurbishment was intended as equal parts learning vehicle for the team and demonstrator project for clients.
- Budget constraints allowed for only £18 per square foot spending, the benchmark local rate for similar premises, with a total budget of £400,000.

Reducing operational energy

- The office is located in a former church, built from bricks with an uninsulated metal roof.
- Before refurbishment, the annual energy consumption stood at 250kWh (just above the 2020 target of the 2030 CC). Snug set themselves the target to reduce it to under 55kWh per m2 per year.
- To achieve the 2030 targets, a fabric-first approach was necessary.

Key steps

- Triple glazing was installed on all windows and rooflights
- The uninsulated metal roof was replaced
- New dormer walls were installed and existing walls were filled with cavity insulation.
- More efficient services and low-carbon heating were installed, using an air source heat pump
- Mechanical ventilation and heat recovery (MVHR) were employed in bathrooms
- 48 solar panels were installed

The Importance of marginal gains

- Meeting the RIBA targets for 2020 or 2025 is relatively straightforward. Achieving the RIBA 2030 targets for an existing building is much more challenging.
- To do so requires scrutinising the minutiae of performance and embodied carbon of all components, and to achieve marginal gains wherever possible.

Regulated versus unregulated energy

- Operational energy covers the energy required during the service life of a structure: lighting, heating, cooling and ventilation systems and operating building appliances, according to CIBSE's document TM54, 'Evaluating Operational Energy Performance of Buildings at the Design Stage'
- Unregulated energy refers to the energy consumption of electrical devices and appliances used for work or leisure; as well as lifts or escalators.
- Factoring in the practice's Mac computers became a problem, as they accounted for as much as 700% more power output than the CIBSE assumption of 10W/ m2. Strictly speaking, the building only met the 2030 criteria if the Macs' power demands were overlooked.
- Ideally, aspirations for managing unregulated energy should be defined at RIBA Stage 0 and post occupancy evaluation (POE) is necessary at Stage 7 to determine true operational energy.

The art of embodied carbon assessment

- It is important to assess the relative impact of each material, analysing not only its embodied carbon but also how much of it is used. While aluminium, for example, has a significantly higher embodied energy than concrete, it is typically used in much lower quantities than concrete.
- It is critical to work closely with an engineer right from the beginning to minimise embodied carbon. The frame and foundations account for most of this.

Introducing a Roadmap for Change

Alasdair Ben Dixon, Collective Works; Mina Hasman, SOM; Ian Taylor, FCBS

Members of the Smart Practice Conference Steering Group developed a 'Roadmap for Change' to guide architectural firms seeking to forge a path to sustainable practice. They mapped out six steps:

Commit to change

- Start by making sure staff members' values are aligned.
- Host a climate emergency roundtable in which staff can share hopes, fears, anxieties and doubts.
- Review and discuss the practice's existing commitments.
- Larger practices should engage in a leadership workshop to define targets and goals.

Commit to action

- Commit to concrete targets, such as the RIBA 2030 Challenge, the World Green Building Council's Net Zero Carbon Commitment, and sign up to Architects Declare.
- Take account of the practice's office structure, the typologies, sectors and locations it works across.
- Define current expertise and knowledge gaps to prioritise.
- Assign the resources needed to achieve your goals.
- Ensure there is alignment between different offices, if applicable.

Understand your impact

- Carry out a carbon footprint assessment for all staff, the office and operations. Encourage discussion around the results and suggestions for reducing the footprint,
- Carry out a full life cycle assessment for a typical project and estimate the annual impact of the practice's work. Set targets to review and reduce project impacts within 6 months.
- Larger practices should compare different typical project typologies and client aspirations across sectors

Put your house in order

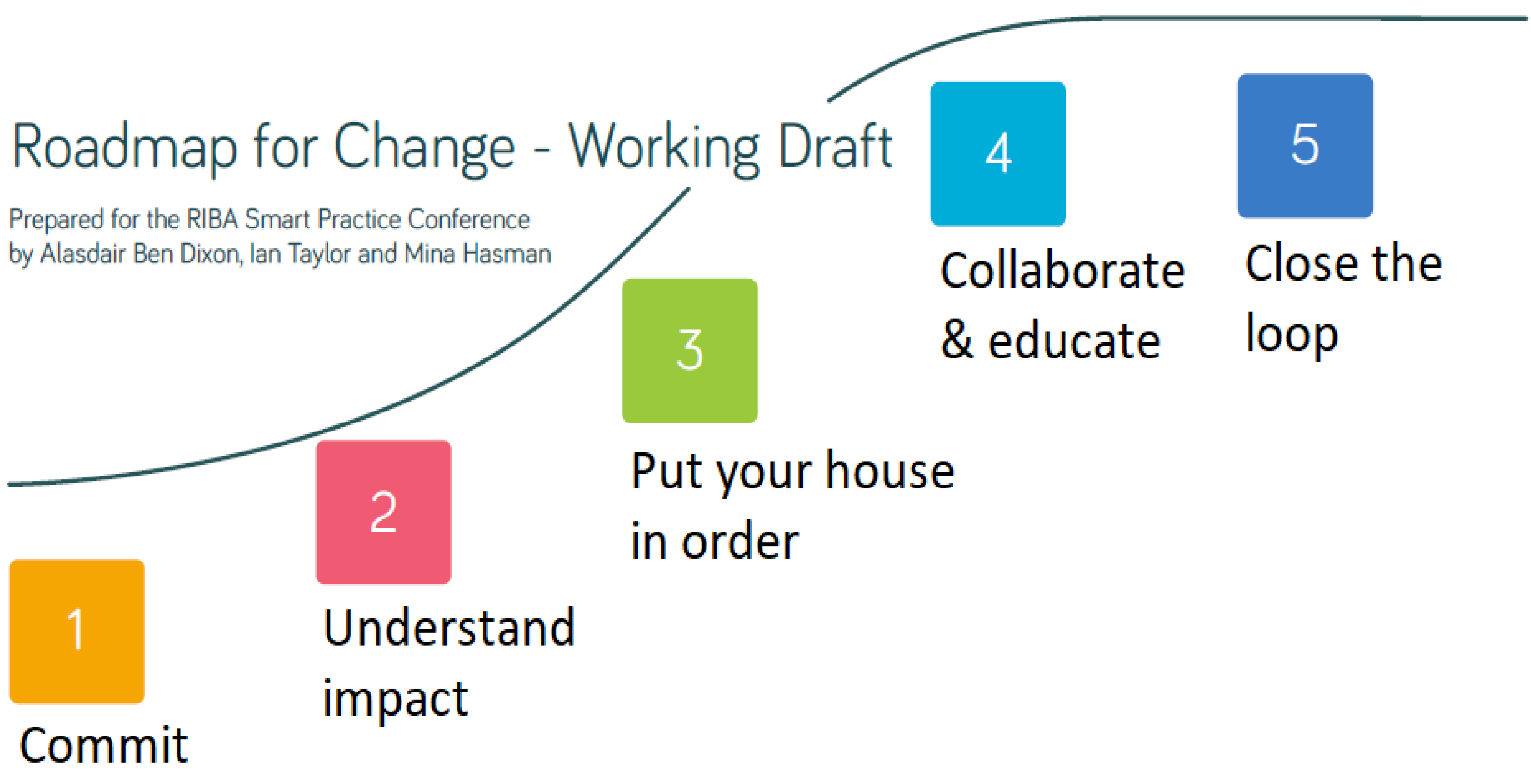
- Communicate progress to staff via regular weekly meetings between teams.
- Identify sustainability champions and upskill staff at all levels. Identify specialists and address knowledge gaps. Senior staff should lead by example.
- Update the practice's systems and host a library of success stories: the strategies, design solutions and processes that work. Identify any shortfalls between intentions and outcomes.

Collaborate and educate

- Engage and inform clients: early discussions with clients about sustainability objectives can be transformative.
- Build a clear business case for each project, recognising there will be competing priorities. Ensure that appointment letters align values and mention sustainability targets.
- Engage in stakeholder meetings and identify allies; align agreed goals with the project team. Define responsibilities and targets against all project stages, and advocate for post occupancy evaluation (POE).
- Lobby for change in a broader context by engaging with professional institutions and MPs. Support relevant lobbying and action groups to ensure a strong industry voice is heard. Share knowledge and learning experiences across the built environment industry.

Close the loop

- Celebrate successful projects. Share learning about sustainable practice and enter projects for any relevant awards
- Monitor how the practice is performing: review and improve. Revisit previous or current targets and set more ambitious future goals. This may well require addressing the practice's available resources, in terms of staff, software or expertise, and making changes.



Further resources

- Net zero: a framework definition; Richard Twinn, Karl Desi and Philip Box; UK Green Building Council
- Building the case for net zero; Karl Desai, Richard Twinn and Alexandra Jonca; UK Green Building Council
- RIBA 2030 Climate Challenge, frequently asked questions and guidance on how to talk to clients
- Climate Emergency Design Guide and Embodied Carbon Primer; Clara Bagenal George (Lead Editor); London Energy Transformation Initiative (LETI)
- The impact of sustainability on value; Jon Neale; Jones Long Lasalle (JLL).