

UK Architects
Declare Climate
and Biodiversity
Emergency

Practice Guide
2021



UK Architects Declare Climate and Biodiversity Emergency

Practice Guide 2021

UK Architects Declare

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Architects Declare is a not-for-profit organisation, launched in the UK on 30 May 2019. At the time of publication, it has over 1,100 signatories in the UK. It is part of Built Environment Declares, which is now represented in 27 countries around the world.

www.builtenvironmentdeclares.com

Design by Lands
lands.ie

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This document has been created by an Architects Declare working group to help signatories convert their declaration into meaningful action and build momentum within their practice.

The guide is intended to be a live, working document that helps fulfil the fourth point in our 12-point declaration by encouraging the sharing of knowledge and research on an open source basis. We expect this guide to evolve and be refined in future iterations as our understanding of the climate and biodiversity crises develops, and as our industry innovates to find new solutions to these challenges. We encourage our signatories—and other architectural practices or built environment practitioners—to contact us with feedback on this version and examples for the next version.

Throughout the guide we have named suppliers, methods and frameworks which

our authors have experience of. We included these specifics to help clarify our intention but encourage practices to do their own due diligence on specific services.

We have contacted the practices and initiatives featured in the guide to request permission to reproduce their work. If we have missed any, please do get in touch so that we can resolve this in future versions of this Guide.

The Architects Declare Practice guide would not have come to light without the contribution, kind help, and guidance of an enthusiastic group of volunteers, and excellent feedback from expert reviewers. We would like to acknowledge and thank all:

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Climate Context

We are all aware of the current climate and biodiversity global crises, the challenges we face and the risks of catastrophic damage to the natural world.

We know that our oceans have become 30 percent more acidic since the Industrial Revolution. Extreme and devastating climate events are multiplying rapidly across the globe and the population of mammals, birds, fish, reptiles, and amphibians is estimated to have fallen by 70 percent in the last 50 years. The pace of ice loss in the Arctic and Antarctic has tripled over the last decade.

As the earth's life support systems come under increasing threat, we also know that construction is responsible for over 40% of global CO₂ emissions, (see Fig. 1) yet the scale and intensity of urban development, infrastructure and building construction globally continues to expand, resulting in greater greenhouse gas generation and loss of habitat each year. Current ways of regulating building performance and construction have not achieved significant reductions in carbon emissions from buildings.

For everyone working in construction and the built environment sector, meeting the needs of our societies within the earth's ecological boundaries will demand a paradigm shift in practice. If we are to reduce and eventually reverse the environmental damage we are causing, we will need to re-imagine our buildings, cities and infrastructures as indivisible components of a larger, constantly regenerating and self-sustaining system.

Such a transformation cannot happen without a wide-ranging declaration of intent, followed by committed action, international cooperation and open-source knowledge sharing. Our united declaration supports more effective lobbying of policy makers and governments to show leadership and commit resources.

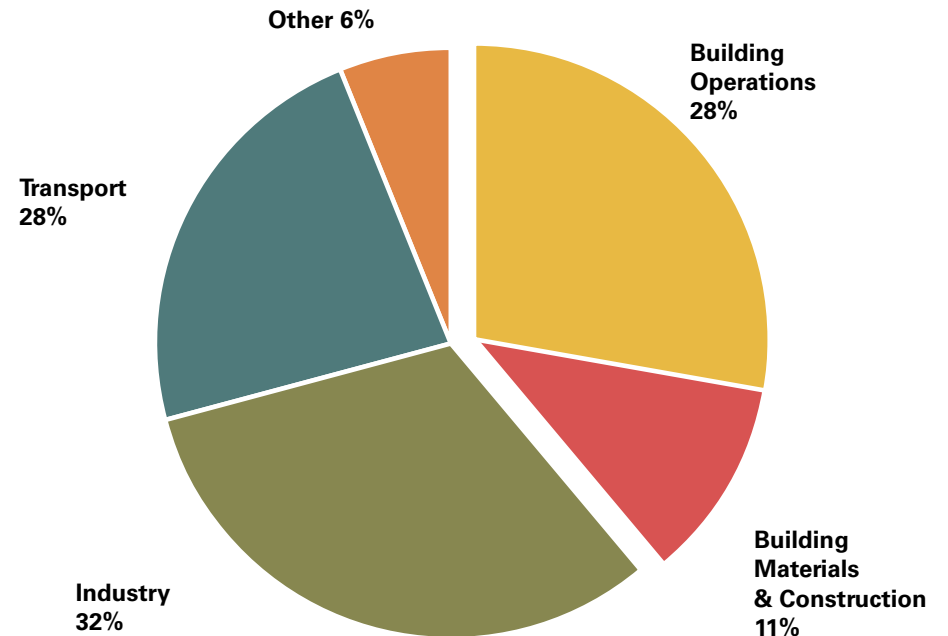


Fig. 1 Global CO₂ Emissions by Sector
Source Global Alliance for Buildings and Construction, 2018 Global Status Report

The Carbon Budget

The Carbon Budget is the additional quantity of greenhouse gas emissions that can enter the atmosphere if the world is to limit global warming to 1.5°C.

“According to the new IPCC report, the carbon budget that gives us the best odds of staying below 1,5°C runs out in less than 5 and a half years at our current emissions rate. Maybe someone should ask the people in power how they plan to ‘solve’ that?”

Greta Thunberg
Climate Activist
August, 2021

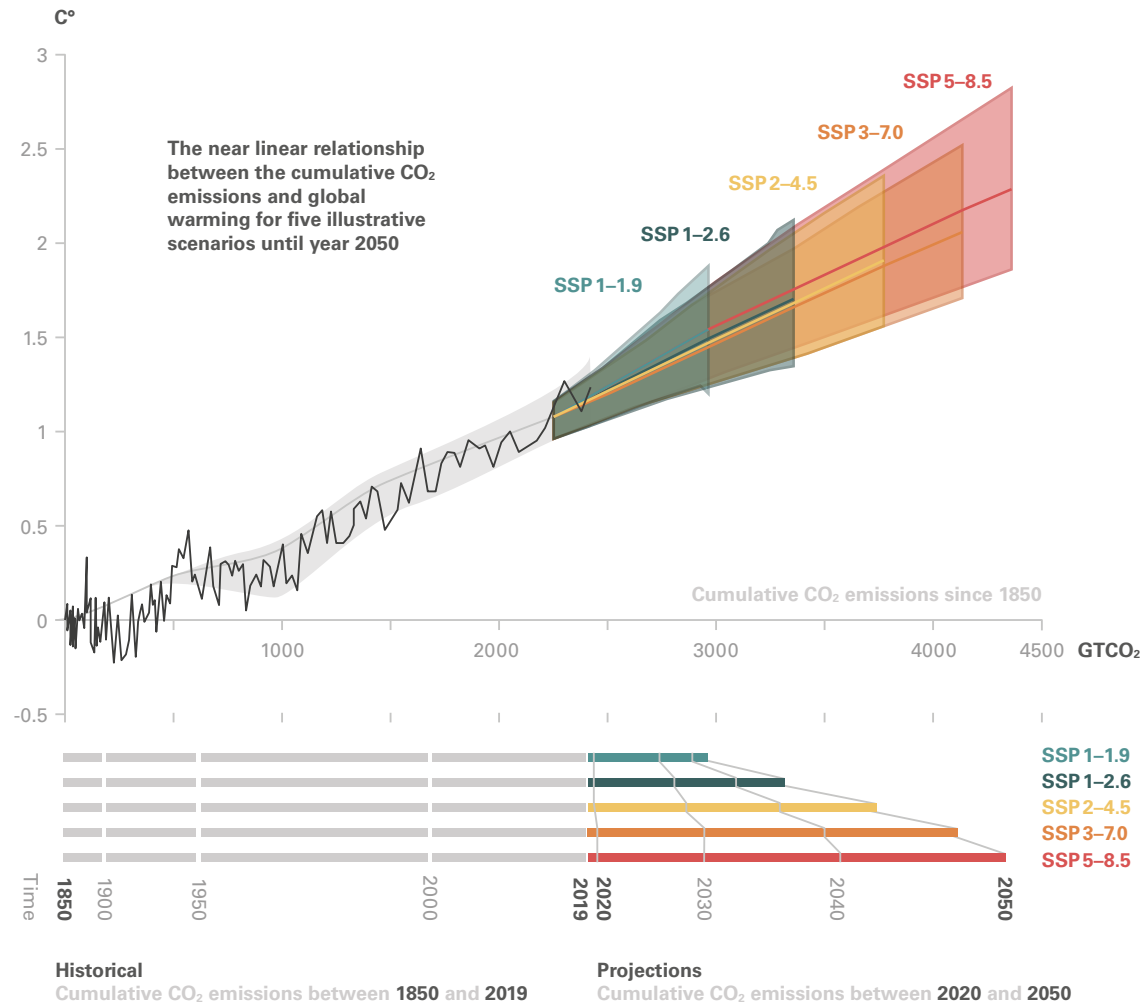


Fig. 2 Global surface temperature increase since 1850–1900 (°C) as a function of cumulative CO₂ emissions (GtCO₂)

Source IPCC report AR6 2021, Summary for Policymakers, Figure SPM.10

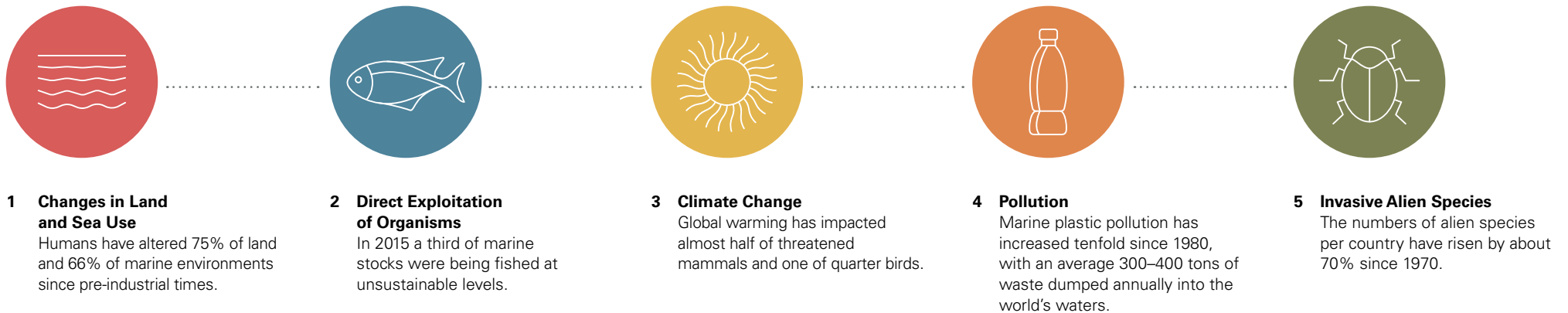


Fig. 3 Five main drivers of biodiversity loss

Source IPBES Report

Graphic UK Architects Declare

Biodiversity Loss

In December 2020 the WWF published their Living Planet Report which identified the five major threat categories that are driving biodiversity's rapid decline. Analysis was carried out for 5 regions: Europe and Central Asia, Asia Pacific, Latin America & Caribbean, Africa and North America. Taking species population as a measure, a significant loss in biodiversity was found in all regions, with encroachment on natural land identified as the most prominent threat to wildlife. Latin America & the Caribbean have sustained a loss of 94% since 1975 and Africa 65% loss in the same time period.

In the UK 13% of species are threatened with extinction, 41% of species have seen their population decrease since 1970, and 72% of land is managed for agriculture, according to the RSPB UK State of Nature 2019 report (www.rspb.org.uk/our-work/state-of-nature-report). They note that 'changing agricultural management has had the biggest single impact upon nature in the UK over recent decades'.

"The multiple problems confronting us right now are symptoms of an even more profound problem: The underlying structure of a global economic and political system that is driving civilisation toward a precipice. We need to move from a civilisation based on wealth accumulation to one that is life-affirming; an ecological civilisation."

Jeremy Lent

Author, *The Patterning Instinct*

Killer Facts

THE PROBLEM

Fossil Fuels

Fossil fuels were laid down at the rate of 1 gram / second and are now being burnt at the rate of 500 tonnes / second.

Source Max Fordham

80%

Embodied carbon emissions account for up to 80% of a building's total emissions over its life span in UK yet are unregulated.

Source Carbon Brief

45%

Latest National Climate Pledges of emissions cuts fall far short of what is required to achieve Paris targets – only 3% when 45% is needed.

Source UN Climate Report 2021

40%

Construction generates 40% of Global CO₂ emissions.

Source IPCC Report Oct 2018

10.3 Million

10.3 million people displaced by climate changed induced events in last six months.

Source Reuters March 27th

1.6 Planets

1.6 planets are needed to meet current consumption levels.

Source Earth Overshoot Day

Concrete

Concrete = 8% of global CO₂ emissions and second most consumed substance globally after water.

Source Karen Scrivener–TEDTalk

34%

Food systems responsible for 34% of all human caused CO₂ emissions.

Source Carbon Brief

92%

Global North is responsible for 92% of total excess CO₂ emissions.

Source Jason Hickel

CO₂

44% of all the CO₂ we emit now will still be around in 400 years.

Source Max Fordham

“We have an economy that needs to grow, whether or not it makes us thrive. We need an economy that makes us thrive, whether or not it grows.”

Kate Raworth
Economist

ENVIRONMENTAL DEVASTATION



96%

People, and the livestock we rear for food = 96% of all mammals on the planet. 4% is everything else.

Source The Dasgupta Review



2050

If we carry on as we are by 2050 there will be more plastic than fish in the oceans.

Source Ellen MacArthur Foundation



20%

20% of the world's population will be at risk of flooding by 2050.

Source World Resources Institute



Poultry

Farmed poultry makes up 70% of all birds on the planet.

Source Biomass distribution on Earth, PNAS



40%

40% of all deforestation is commodity driven.

Source Global Forest Watch



1%

Today, in north west Europe, only 1% of building elements are reused following their first application.

Source EU FCRBE Project



HOPE



Two Thirds

Two thirds of people in UK want action now to save planet.

Source Greener UK / Climate Coalition



Denmark

Denmark to regulate embodied carbon for all buildings over 1000m² from 2023.

Source Jane Anderson, Construction LCA



LETI

In just one year LETI Operational energy targets have been met by: 30,000 homes at masterplan level 2,500 homes pre-construction.

Source LETI, April 2020—April 2021



Architects Declare

Architects Declare (AD) formed in the UK in May 2019, as a declaration of Climate and Biodiversity Emergency, after the IPCC's 2018 report. AD is both a public declaration of our planet's environmental crises and a commitment to take positive urgent action in response to climate breakdown and biodiversity collapse.

AD's aim is to transform the built environment so that it is planned, constructed and operated within planetary boundaries delivering positive social benefits for all.

The AD movement is about encouragement, with every signatory organisation expected to self-govern its progress toward achieving the declaration commitments it has made. On the basis that no single architect is currently meeting every part of the radical commitment to change, a firm 'no public blame and shame' policy is in place.

AD is part of the wider Built Environment Declares movement which brings together a large number of professionals involved in the sector: architects, designers, landscape architects, engineers, project managers, surveyors, developers and estate managers, contractors, material suppliers, students, academics etc.

As of October 2021, 1,155 UK practices are signed up to UK Architects Declare, and over 7,000 companies in 27 countries worldwide have declared a Climate and Biodiversity emergency under the wider umbrella of 'Built Environment Declares' (previously Construction Declares). This worldwide initiative continues to grow, with more countries and professions soon to initiate their own declarations. We hope that this growing awareness and recognition of the gravity of the crises humanity and nature face will help to provoke necessary change. We are starting to work together with our international sister organisations, sharing knowledge

The AD movement is about encouragement, with every signatory organisation expected to self-govern its progress toward achieving the declaration commitments it has made.

and galvanising energy across borders, and feeding knowledge back into the work we are doing in the UK. It feels only right that we address these global issues on an international platform.

In 2020, the UK Architects Declare Steering Group conducted a survey of AD signatory Practices, to better understand how Practices are changing the way they operate and conduct business, and to uncover barriers that are beyond the ability of individual Practices to alter on their own. The survey found that while most Practices had already made some change as a result of joining the AD movement, there is still a lot more work to be done, and meeting the declaration commitments in full will be an aspiration for some time.

The survey also revealed that signatory practices wanted Architects Declare to be more than a moment of declaration, and desired a continual, supportive network that brought their voices together to galvanise action and to become greater than the sum of its parts. One of the key areas identified via the survey was a lack of knowledge and requests for more support to Practices in meeting the declaration commitments. The result is this document, produced by a newly created Working Group. The hope is that this document will help signatories to convert their declaration and good intentions into meaningful action. (www.architectsdeclare.com/uploads/2020_ADSignatorySurveyReport-1.pdf)

Most of all there needs to be a total shift in mindset and culture – a shift from an extractive, degenerative, linear mindset to a regenerative, circular, low carbon mind set. To effect system and mindset change we knew we needed a strategy for change. The next few years will be decisive in shaping our collective future—now is the moment to act.

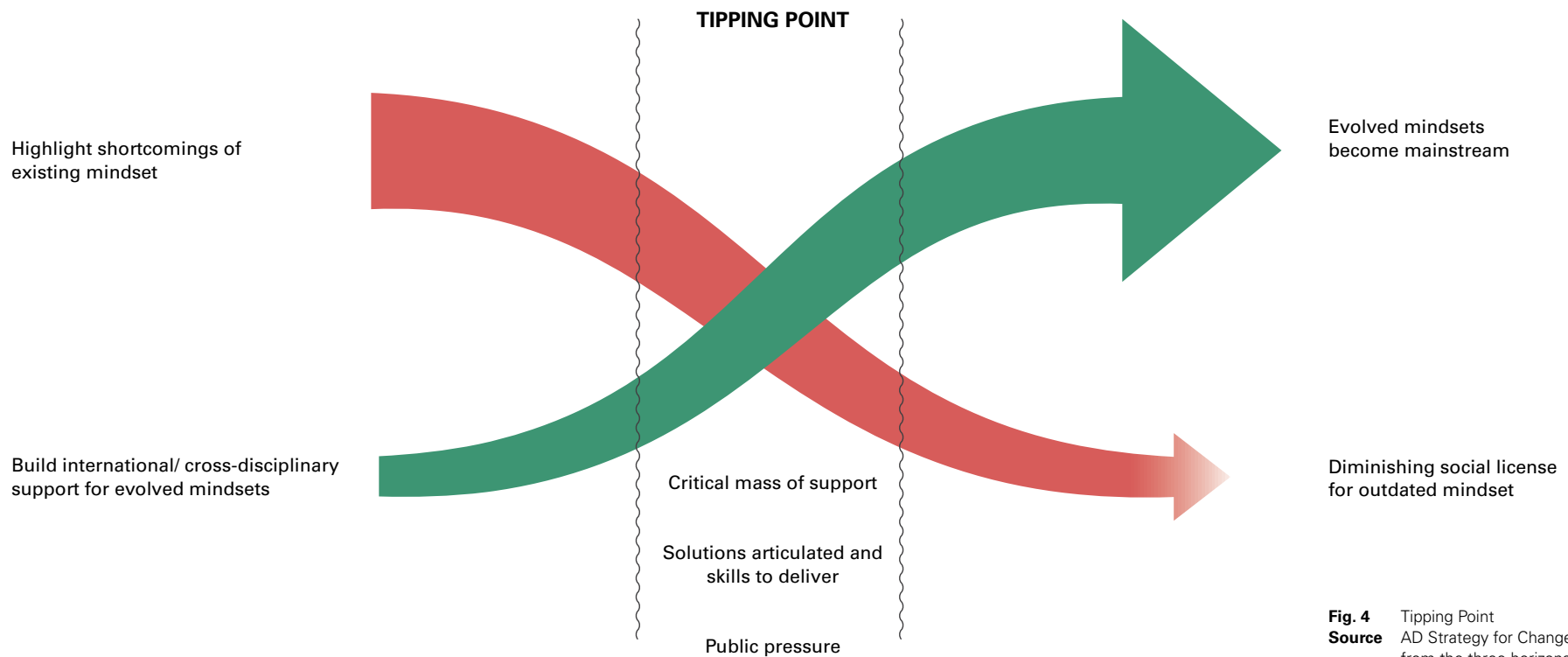


Fig. 4 Tipping Point
Source AD Strategy for Change, adapted from the three horizons framework

Our Strategy

30 years of conventional design accompanied by limited levels of ‘sustainable’ design have not got us even remotely near where we need to be. Indeed, the very term ‘sustainable’ has been hijacked and overused resulting in the continuation of business as usual. Soon after forming, the AD steering group instigated a workshop, led by consultants from the New Economics Foundation, which was to define our Strategy for Change based on understanding how change happens and the industry’s capacity to effect that change.

The AD steering group’s Strategy for Change is underpinned by the systems thinking of Donella Meadows and an understanding that the most effective way to effect change is by changing the paradigm or mindset out of which the system behaviour emerges. Current goals/economics are based on infinite growth, linear resource use and a view of nature as something to be plundered, it is this kind of thinking that has led to the emergency we find ourselves in. We need to move on from the current paradigm of merely targeting Sustainable

design, which often simply mitigates negatives, into the realm of Regenerative design which strives for a net positive impact of our projects. In preparing the proposed AD Strategy for Change the Steering group have also harnessed the Three Horizons thinking (www.youtube.com/watch?v=_5KfRQJqpPU) which looks at three possible futures:

- 1. Business as Usual
- 2. Disruptive innovations (H positive - good; and H negative - bad)
- 3. A positive Vision of a Future within planetary boundaries.

This was featured more extensively as a tool for enabling regenerative design thinking in our second AD event ‘Ideas into Action’ (www.architectsdeclare.com/resources#architects-declare-resources)

The Declaration Points

1 Raise Awareness

Raise awareness of the climate and biodiversity emergencies and the urgent need for action amongst our clients and supply chains.

2 Change Fast

Advocate for faster change in our industry towards regenerative design practices and a higher Governmental funding priority to support this.

3 New Goals

Establish climate and biodiversity mitigation principles as the key measure of our industry's success: demonstrated through awards, prizes and listings.

4 Share Knowledge

Share knowledge and research to that end on an open source basis.

5 Evaluate Projects

Evaluate all new projects against the aspiration to contribute positively to mitigating climate breakdown and encourage our clients to adopt this approach.

6 Upgrade Existing

Upgrade existing buildings for extended use as a more carbon efficient alternative to demolition and new build whenever there is a viable choice.

7 Whole Life

Include life cycle costing, whole life carbon modelling and post occupancy evaluation as part of our basic scope of work, to reduce both embodied and operational resource use.

8 Regenerative Design

Adopt more regenerative design principles in our studios, with the aim of designing architecture and urbanism that goes beyond the standard of net zero carbon in use.

9 Collaborate & Reduce

Collaborate with engineers, contractors and clients to further reduce construction waste.

10 Low Carbon

Accelerate the shift to low embodied carbon materials in all our work.

11 Minimise Waste

Minimise wasteful use of resources in architecture and urban planning, both in quantum and in detail.

12 Climate Justice

Support those who are working for climate justice and strive to ensure equity and an improved quality of life for all.

Purpose of this Guide and How to Use it

This Guide is designed to assist practices of all sizes—and at any stage in their journey on the Climate and Biodiversity Emergency—as they seek to fulfil their commitments to our shared declaration.

One of the declaration points is to share knowledge and research on an open source basis, and this guide helps us to fulfil this. As such, we expect it to be a live working document which will evolve and be refined through the sharing of research and experience, as our understanding of the climate and biodiversity crises develops, and as our industry innovates to find new solutions to the problems we face.

Throughout the guide we have named suppliers, methods and frameworks which our authors have experience of. We included these specifics to help clarify our intention but encourage practices to do their own due diligence on specific services.

There are two key areas of influence that each AD Signatory has, through which they can emulate and contribute to the climate and biodiversity goals set out by the AD Declaration points. These areas are: Practice operations and Project work, both are important and may overlap or be in dialogue with each other.

For the purposes of clarity the AD Practice Guide is structured in two parts:

Part 1 Practice Roadmap, looking at the overall business strategy and operations

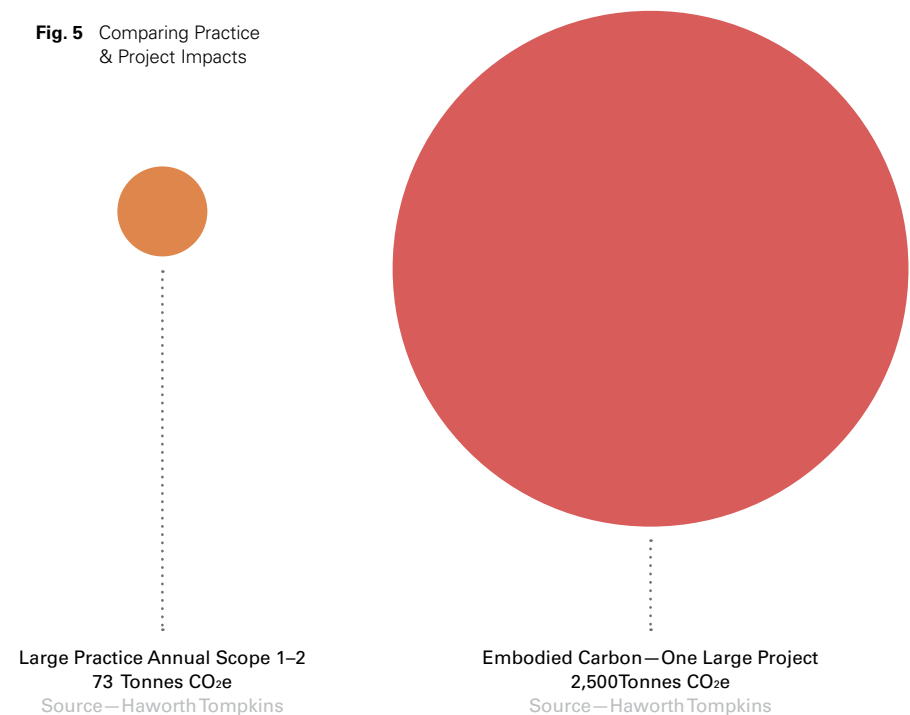
Part 2 Project Design Guide, which focuses on day-to day guidance for project work

Given the evolving nature of the subject matters the content of the guide will evolve over time and we hope it will generate further debate. In accordance with Point 4 of the AD Declaration, we would welcome feedback and we intend to review and update the document as our knowledge base increases collaboratively, so please send any feedback to the AD Practice Guide working group here info@architectsdeclare.com.

“Typically an architectural practice will build or refurb at least 100 times the area of their own office each year and major building work presents much bigger opportunities than just inhabiting or using a building so a practice’s design work is around 1000 times as significant in terms of pure carbon accounting. The practice’s premises are important in terms of setting the right culture and showing your staff and visitors that you are committed.”

Michael Pawlyn
Exploration Architecture

Fig. 5 Comparing Practice & Project Impacts



PART 1

PRACTICE ROADMAP



We recognise that for our signatories to meet all of the Architects Declare declaration points will involve collectively building a new culture of practice committed to decarbonisation, regenerative design and advocacy.

AD have developed this Roadmap to help signatories transition from standard practice towards a more regenerative culture.

The five steps along this path are not intended to be overly prescriptive and can be applied to practices of all sizes. We have provided a template at the end of this guide that you can tailor according to your practice's specific characteristics.

Many signatories will already have progressed through some of the steps we suggest. We hope this guide gives confidence on the route you are travelling, and provides extra ideas for you to develop and areas to advocate for change beyond the practice.

1 ALIGN AND COMMIT



1	Raise Awareness	7	Whole Life
2	Change Fast	8	Regenerative Design
3	New Goals	9	Collaborate & Reduce
4	Share Knowledge	10	Low Carbon
5	Evaluate Projects	11	Minimise Waste
6	Upgrade Existing	12	Climate Justice

This guide is about a journey. A useful first step is to help your practice develop a shared understanding of the climate and biodiversity emergency we face and what our declaration points mean. You might find an open, roundtable discussion will help people to share their uncertainties, anxieties, and ideas about the challenges our sector faces, what the practice has done already and the opportunities ahead. Starting this conversation together might help to develop your framework for reducing the practice's impacts and agreeing the resources you will need.

ALIGN VALUES

- Host a 'no-blame' democratic climate emergency roundtable discussion in your office, open to all practice members.
- An external facilitator may help provide neutral safe space for all voices to be equally heard.
- The workshop can be relatively short but should cover both project work and practice operation impacts.
- Define current expertise & area of focus—The SDGs, RIBA Climate Framework, or this guide could form a basis for these discussions.

ADDITIONAL STEP FOR LARGER PRACTICES

- + Instigate discussions between Partners/Directors/Principals and all employees.

COMMIT TO ACTION

- Review and discuss the various frameworks and commitments available then map them against the practices previous work, to find alignment or measure gaps.
- Set in motion an exercise to re-define practice values, goals and appropriate project targets which are reported, ideally publicly, against a timeframe.
- Assign time, resources and budget to tackling next steps—For example: 1 person for 1 day / month for small practices (1-10 people) and up to 3 dedicated people within large practices (50+ people).
- Commit to practice operations targets such as the UN Race to Zero.
- Commit to project targets such as the RIBA 2030 Climate Challenge or the WorldGBC's Net Zero Carbon Buildings Commitment.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Define responsibilities for actions, taking account of office structure and locations, and work typologies and sectors.
- + Ensure alignment between management groups and across different office locations.

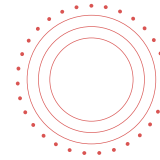
Commitment	Covers Practice	Covers Projects	Metrics
Architects Declare www.architectsdeclare.com	✓	✓	
RIBA 2030 Climate Challenge www.architecture.com/about/policy/climate-action/2030-climate-challenge		✓	✓
LETI www.leti.london/carbonalignment		✓	✓
UN Race to Zero www.unfccc.int/climate-action/race-to-zero-campaign	✓		✓
UKGBC Net Zero Carbon Buildings Commitment www.ukgbc.org/ukgbc-work/thecommitment		✓	✓

Fig. 6 Comparisons of Declarations

“Architects Declare has given fresh impetus to our internal programme of exchange and debate through a series of open forums, reviews and workshops focused on sustainability. These discussions have been invaluable in engaging staff, critically assessing our work and have allowed exciting design opportunities to emerge.”

Cecilia Sundstrom
David Chipperfield Architects

2 UNDERSTANDING IMPACT



- | | | | |
|---|------------------------|----|----------------------------|
| 1 | Raise Awareness | 7 | Whole Life |
| 2 | Change Fast | 8 | Regenerative Design |
| 3 | New Goals | 9 | Collaborate & Reduce |
| 4 | Share Knowledge | 10 | Low Carbon |
| 5 | Evaluate Projects | 11 | Minimise Waste |
| 6 | Upgrade Existing | 12 | Climate Justice |

Once you have committed to action it's important to take time to carefully understand the environmental impact of the practice, recognising that as architects our business operations are likely to be dwarfed by our project impacts. Despite that imbalance it's important to understand that our business impacts are within our direct control and having them well understood will make it easier to advocate for change with our clients and contractors, who are directly responsible for the project impacts.

MEASURE BUSINESS RELATED CARBON EMISSION IMPACTS

- Carry out carbon footprint assessment of office and operations, covering as many scopes as possible.
- Host an open discussion around the results, with clear graphs showing relative impact of various personal and office choices.
- Assess biodiversity & biophilic design around the office.
- Measure air quality within the office (CO₂ level, VOCs, Temp & humidity) then discuss factors which affect these results.
- Transparent publication of annual carbon footprint results.
- Increase carbon literacy by sharing an example of a personal carbon footprint and encourage staff to carry out their own footprint assessment to help them understand typical impacts.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Upgrade building fabric, windows & ventilation.
- + Install renewable energy sources on your premises (potentially through partnership with local NGOs such as Power Up North London).

“At Grimshaw we have set science-based targets aligned to restrict global temperature rise to 1.5 °C. These targets look across all aspects of our operations including our scope 3 emissions, for example water use. We implement an environmental management system to further reduce impacts.”

Paul Toyne
Grimshaw Architects

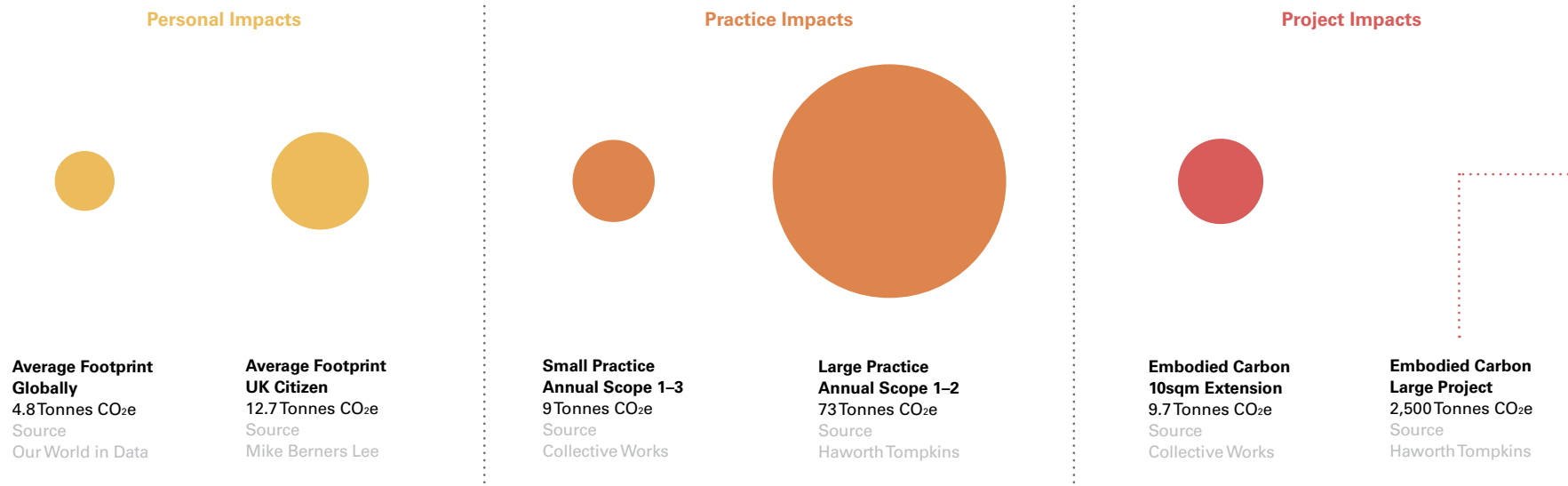


Fig. 7 Comparing Personal, Practice and Project Impacts

MEASURE PROJECT IMPACTS

- Start by carrying out a full Life Cycle Assessment or Whole Life Carbon analysis for at least one project in each sector which the practice works in, or on typical elements and build-ups on projects.
- Start to create a library of components that have been carbon assessed to learn from e.g. facade panels, floor build ups, ceiling build-ups.
- Estimate Whole Life Carbon impact of practice's project work, annually.
- Set targets to review impacts and reduce every 6 months.

For more detail on measuring and reducing project impact see Part 2 of this guide, which starts on p.33.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Estimate Whole Life Carbon impact of practice's project work, annually.
- + Report against external commitments and explain assessment methods.
- + Compare client aspiration for highly sustainable/regenerative design across each sector with a view to advocating for change.

Personal Impact Tools

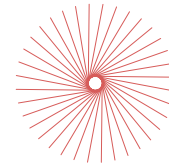
- [WWF Carbon Footprint Tool footprint.wwf.org.uk/#/](https://www.footprintcalculator.org/)
- www.footprintcalculator.org/

Office Carbon Footprint Examples

- www.bennettsassociates.com/media/gri-report-our-office-footprint/
- www.bennettsassociates.com/media/low-carbon-travel-with-possible/
- www.haworthtompkins.com/studio/regenerative-design/our-carbon-footprint-report-2019

See Examples above or Resources at end of Section 1 for solutions to reduce the office carbon footprint.

3 PUT YOUR HOUSE IN ORDER



- | | | | |
|---|------------------------|----|------------------------|
| 1 | Raise Awareness | 7 | Whole Life |
| 2 | Change Fast | 8 | Regenerative Design |
| 3 | New Goals | 9 | Collaborate & Reduce |
| 4 | Share Knowledge | 10 | Low Carbon |
| 5 | Evaluate Projects | 11 | Minimise Waste |
| 6 | Upgrade Existing | 12 | Climate Justice |

Once you have understood your impact you'll be in a much better position to make meaningful changes. We suggest tackling the business side first, starting with the overall structure and then focussing on energy, transport, products, services and waste. Once these changes are underway you should focus on upskilling to ensure that the practice design work, which has a larger overall footprint, is as sustainable as it can be. As you progress, keeping staff engaged and sharing ideas will help to maintain momentum and ownership as your new strategies emerge.

REDUCE BUSINESS IMPACTS:

GOVERNANCE & FINANCE

- Consider alternative ownership structure or external accreditation such as an Employee Owned Trust or B Corp.
- Investigate R&D tax credits for the research work.
- Consider impacts from financial services. Review pension funds (e.g. make my money matter) for divestment opportunities and check the ethical credentials of your bank then consider switching.
- Transparent publication of annual carbon footprint results.
- Share an example of a personal carbon footprint and encourage staff to carry out a personal carbon and ecological footprint assessment to help them understand typical impacts and increase carbon literacy.

ENERGY

- Agree annual energy targets for the office.
- Implement tangible improvement strategies against key milestones and ensure IT infrastructure is energy efficient—e.g. nighttime shutdown.
- Publicise environmental credentials around the office and create a very simple building user guide with insights from team.
- Negotiate with your landlord if changes to energy supplier, lighting or HVAC are desirable.
- Consider opportunities for agile and shared use of office space.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Upgrade building fabric, windows and ventilation.
- + Install renewable energy sources on your premises (potentially through partnership with local NGOs such as Power Up North London).



Update Systems and Libraries

“We are developing a toolkit specific to our office, to use as a guide to low carbon design and to measure how well our designs are doing in terms of form efficiency and embodied carbon.”

Jennie Hunter
CZWG Architects

TRANSPORT

- Undertake commuting and business travel survey then support staff in swapping to lower carbon commuting.
- Allow people to work en-route to holiday by offering additional flexibility for slow travel: www.climateperks.com.
- Enable staff to access meetings remotely to avoid commuting—learn from the positives of the pandemic.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Identify a sustainable travel champion and develop a sustainable travel plan.
- + Provide showers, lockers, changing spaces and secure indoor storage for bikes.

PRODUCTS AND SERVICES

- Review major office spending and switch to local and low impact suppliers where possible.
- Organise fewer deliveries by sharing with nearby practices and neighbouring businesses.
- Investigate Green data providers and low carbon hosting services.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + If you provide food in the office, implement a switch to low-carbon, plant-based, local and fair trade alternatives; promote plant based catering, no GMOs, no RSPO palm oil, plastic-free packaging.
- + See Well standard for more ideas.

WASTE

- Engage in understanding quantities of material used and waste.
- Consider Terracycle (or other) for non-standard waste streams: www.terracycle.com
- Eliminate SUP (single use plastic).

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Ensure e-waste recycling system in place.
- + Target zero waste to landfill.

REDUCE PROJECT IMPACTS:**TRAINING AND SKILLING UP**

- Identify training opportunities and use CPDs and in-house presentations to share knowledge amongst your peer network, invite experts to share their experience.
- Ask those who are already trained to train others in order to develop a learning culture and consider bi-weekly workshops on specific topics for upskilling.
- Identify roles and responsibilities for introducing change in your practice for two main areas: practice operations and design work, consider appointing a champion for each.
- Discuss resourcing options to support those staff who maybe able to spend a half day or a full day per week/fortnight focusing on specific tasks.
- Consider recruitment to fill knowledge gaps within your office.

UPDATE SYSTEMS & LIBRARIES

- Build a Library of success stories: strategies, systems, processes and team structures which have worked well in the past.
- Ensure all staff are familiar with the RIBA 'Plan for Use' guidance and that the office implements this.
- Within project programmes set regular project reviews and sustainability kick-off meetings and use Project Quality Plan to monitor performance against agreed sustainability objectives.
- Ensure that all learning from project reviews and monitoring is fed back into the next design project—set up internal systems to enable this.
- Identify gaps between intent and outcomes, review all output, and identify blocks to action and performance gaps.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Set tangible targets for each major typology within the practice.

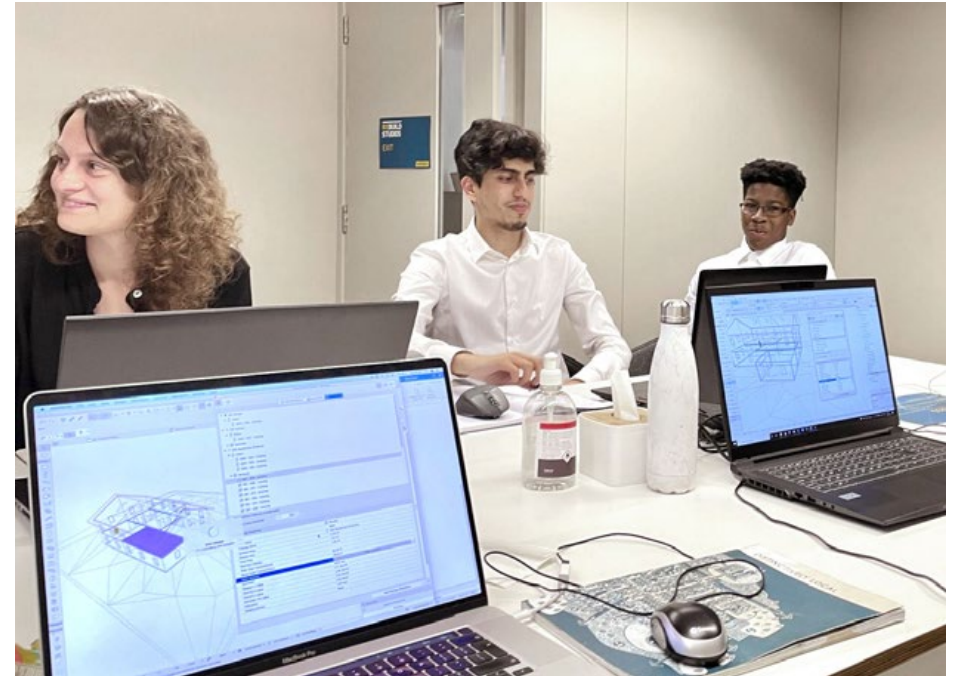
COMMUNICATE ACROSS PRACTICE

- Make sure everyone in the practice knows they are an AD signatory and discuss the AD declaration points regularly to instill a sense of ownership.

- Define practice-wide, regular communication platform and include climate action on agenda for office away days.
- Maintain transparency and openness in regularly communicating progress, successes and shortfalls, on company website, newsletter and social media.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Share action plan or roadmap with internal and external commitments on company website, newsletter and social media.



Training and Skilling Up



Fig. 8 The five impact areas measured during the B-Corporation assessment process
Source bcorporation.net
Graphic UK Architects Declare

PRACTICE STRUCTURE

Engagement from the CEO, partners and directors is crucial for the practice to be most effective as an AD signatory. Re-appraise the business plan priorities if necessary, identify the type of work you now want to target as a result of being part of AD and set clear red lines for work that you will no longer take on.

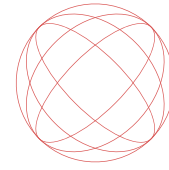
The way your organisation is structured and /or owned can influence how effective it is in meeting AD commitments. Kate Raworth's talk at the Architects Declare gathering in Nov 2019 makes the point well as part of the wider picture (www.vimeo.com/387734201).

Collective responsibility for the studio's output, along with transparency of income and profit distribution, usually helps to foster a sense of common purpose and shared endeavour. Wider ownership such as an Employee-Owned Trust, B Corp or similar might be considered as an alternative practice model.

Some of the available structures, certifications and standards for responsible and ethical business:

- **B Corp – Certified B Corporation (e.g. Stride Treglown, Kennedy Woods, Expedition Engineering)**
- **SEUK – Registered Social Enterprise**
- **Employee Ownership Association (EBT/EOT)**
- **ISO 26000 – Social Responsibility**
- **ISO 14001 – Environmental Management**
- **Science Based Targets Initiative**
- **EMAS – EU Eco-Management and Audit Scheme**
- **Planet Mark Certified**
- **UNFCCC Climate Neutral Now Initiative**
- **IBE – Business Ethics Network**
- **Local sustainable business groups such as Heart of the City, Islington Sustainable Energy Partnership, Camden Climate Change Alliance + other Non-London examples.**

4 COLLABORATE & EDUCATE



- 1 **Raise Awareness**
- 2 **Change Fast**
- 3 New Goals
- 4 **Share Knowledge**
- 5 Evaluate Projects
- 6 **Upgrade Existing**
- 7 **Whole Life**
- 8 Regenerative Design
- 9 **Collaborate & Reduce**
- 10 **Low Carbon**
- 11 Minimise Waste
- 12 Climate Justice

Architecture is a team effort so once you have worked through your impact and made appropriate changes you are encouraged to engage with your clients and design teams to set ambitious targets for project performance. While having these discussions you will likely discover areas where policy and regulation don't align with best practice so you can join forces with others and lobby for change on such issues. Although there are clear spheres of influence within the industry you shouldn't underestimate the collective power we can have as advocates for a better built environment.

COMMUNICATE WITH CLIENTS

- Engage in discussions about the climate and biodiversity emergencies at the earliest stage on your projects—discussions of overall budget, life cycle costing and resilience can be introduced to find common ground with clients and establish shared values.
- Once the design team is appointed revisit the discussion and identify allies on the team with knowledge of relevant performance.
- Encourage clients to take a long term view and to cost projects in this way. See Working with Clients section on page 28.
- Communicate your Architects Declare commitments to new and existing clients, consultants, suppliers, and stakeholders.
- Engage your wider professional network in conversations around Architects Declare.
- Communicate the value of Climate Change Mitigation, not only to the planet but also to your brand, ability to access green finance and potential insurance liabilities.

ADDITIONAL STEP FOR LARGER PRACTICES

- + Advocate for life cycle costing, whole life carbon modelling and post occupancy evaluation to be part of the wider design team's basic scope of work, to reduce both embodied and operational resource use.



Advocate for Change

COLLABORATE WITH PROJECT TEAM

- Engage in a stakeholder roundtable, identify common aims and areas of opportunity, highlight challenges and start to develop strategies to overcome them.
- Define project targets at each stage and monitor performance against them in design team meetings.
- Ensure 2020 Plan of Work Sustainability overlay sections and the RIBA Sustainable Outcomes Guide are followed in relation to the 2021 RIBA Plan for Use guidance.

ADDITIONAL STEP FOR LARGER PRACTICES

- + Discuss and agree the performance targets in your scope and contract with continuous monitoring and reporting at the outset of the team engagement process and review regularly at each RIBA PoW stage.

ADVOCATE FOR CHANGE

- Share innovation with generosity and co-operation.
- Engage with national and local citizens groups and other NGOs , professional institutions, local MPs and local government officers and councillors on issues that matter to you.
- Consider supporting relevant networks, action groups and campaigns which promote sustainable design, circular economies and climate literacy e.g. AECB, LETI, ACAN, Passivhaus Trust, Association for Sustainable Building Products.
- Consider joining Architects Declare Regional meetings and contribute to the Architects Declare Working Groups.
- Join your regional Architects Declare group—email hello@architectsdeclares.com.
- See all UK signatories practices here: www.architectsdeclare.com.

ADDITIONAL STEPS FOR LARGER PRACTICES

- + Use your influence responsibly and advocate for positive change.

“As an architect, I am on my construction site everyday and on hand to make decisions and communicate (and justify) my reasoning for using non-standard materials or building styles. I communicate openly with neighbours, colleagues and associates and breathe this ethos as the new normal.”

Brigitte Clements

OKI Architecture & Development Ltd

ADVOCACY AND KNOWLEDGE NETWORKS



Architects Climate Action Network
www.architectscan.org



Association for Environment Conscious Building
www.aecb.net



London Energy Transformation Initiative
www.leti.london



UK Green Building Council
www.ukgbc.org

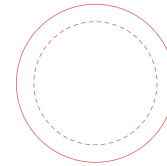


Passivhaus Trust
www.passivhaustrust.org.uk



The Alliance for Sustainable Building Products
www.asbp.org.uk

5 CLOSE THE LOOP



- | | | | |
|---|------------------------|----|----------------------|
| 1 | Raise Awareness | 7 | Whole Life |
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| 3 | New Goals | 9 | Collaborate & Reduce |
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We must celebrate successes by sharing stories of our most sustainable projects and submit them for relevant awards. And finally, carry out regular reviews such as Post-Occupancy Evaluations and use these assessments to improve our practice. This is important, not just for our practice, but the wider industry, who need to be better at sharing knowledge and celebrating buildings designed within planetary limits.

REVIEW AND IMPROVE

- Review and update the internal and external commitments which the practice has set and share the results with the entire office.
- Encourage feedback and reflection on successful initiatives as well as those that struggled to gain traction.
- Monitor and Report on Project Performance—While many clients and organisations believe that they are already fully engaged with reviewing the performance of their projects, there is still very little actual reviewing and evaluation of building performance at the in-use stage.
- Revisit targets and set stretch goals.
- Adjust resourcing to allow time and budget for review and feedback.
- Provide client post completion services through engagement in RIBA stage 7.
- See Part 2, Chapter 5: Designing for Performance, Feedback and Closing the Performance Gap.

ADDITIONAL STEP FOR LARGER PRACTICES

- + Feedback to teams to improve Design Process and Decisions
- + Help with the definition of benchmark targets across industry

CELEBRATE SUCCESS

- Share stories of most sustainable projects (see Part 2, Chapter 5 Designing for Performance, Feedback & Closing the Performance Gap) and consider entering them for relevant awards.
- Consider entering projects 1–2 years after occupation, when it has been possible to conduct BPE/POE—note recent changes to RIBA competition data requirements.
- Offer up data within press releases as increasingly even to publish a project online or in a publication one needs to provide info on the project's operational energy and embodied carbon.
- Publish annual progress report against Roadmap steps.

We must celebrate successes by sharing stories of our most sustainable projects and submit them for relevant awards.



Review and Improve

AVAILABLE AWARDS WITH A FOCUS ON SUSTAINABILITY

RIBA MacEwen Award—Recognising architecture for the common good
RIBA Regional Sustainability Awards
RIBA Stirling Prize

AJ Retrofit Awards
AJ100 Sustainability Champion
AJ100 Sustainability Initiative

NLA Don't Move Improve—Environmental Leadership Prize
ASBP Awards - Ideas For A Better Built Environment

Dezeen Sustainable building
Dezeen Sustainable interior
Dezeen Sustainable design

Lafarge Holcim Awards for Sustainable Construction
CIBSE Building Performance Awards

“We enjoyed contributing to energy|buildings|people, a publication that openly shares detailed research and lessons from the full cycle from project inception to a building in use with close support from the client, design, construction and operational teams.”

Robert Hopkins
AHR Architects

WORKING WITH CLIENTS

HOW TO ENGAGE WITH THE CLIENT

- Set up a Sustainability and Regenerative design workshop with the client and design team at the start of the project (RIBA Stages 0-1 or 2).
- Advocate and agree best practice targets for operational energy, embodied carbon, potable water use, biodiversity and habitat increase, post occupancy evaluation and reporting on meter data after building completion. Refer to RIBA Sustainable outcomes guide, RIBA plan of work Sustainability Overlay, LETI publications, Living Building Challenge.
- Advise on any specialist appointments required to meet targets e.g. to provide analysis of operational energy through PHPP modelling, to provide whole life carbon and circular economy assessments. Ideally appoint specialists early to influence the design from concept.
- Track progress at each work stage and identify deliverables and the person responsible for each action.
- Ensure that your client understands the benefits of building to higher environmental standards e.g. targeting Passivhaus certification can improve construction quality resulting in robust buildings that are easier to maintain.
- Ensure that your client understands the risk associated with not targeting low energy design from the outset and the high cost penalties for retrofitting buildings within the first 10-20 years of their life.
- Advocate that your clients consider future-proof design solutions that increase resilience to climate change and extreme weather patterns i.e. designing to reduce overheating risk, provision of a heatwave strategy, increase biodiversity and natural habitat, consideration of drainage (SUDs) and flood mitigation.
- Explain the importance of retaining architect from inception to completion in order to achieve project sustainability targets.
- If you inherit a project, take this opportunity to improve its sustainability credentials. Set up a workshop with the client to review the opportunities to improve its sustainability targets, advocate for capital and lifecycle costs to be taken into consideration. Focus on improving energy efficiency, reducing construction waste through materials and specification and by working with contractors to develop good onsite practices.

KEY CONSIDERATIONS FOR ADVISING CLIENTS

Smaller /Private Clients

Smaller and private clients with less experience may require more hand-holding to guide them towards the most sustainable outcome. This will rely on interpreting the client's brief to integrate clear sustainability targets at the outset. It is important to stress the long-term benefits of a sustainable approach to gain client buy-in and avoid only satisfying short-term objectives. It may also be necessary to explain the urgency of the climate emergency and point towards industry guidance and evidence to support these targets.

- Consider stressing the benefits of targeting higher building performance specifications including:
 - Improvements to building energy efficiency could lower energy bills.
 - Investing in high performing building fabric could improve indoor comfort, as well as the health and wellbeing of occupants
 - Good environmental design could reduce the overheating risk
 - Avoids the need for retrofitting in future
- Highlight the importance of specialist involvement when required, and be upfront about the cost and programme requirements.
- Be sensitive to any client pressures but ensure there is adequate time and budget for the effective coordination and delivery of a quality output.
- Where there are constraints due to low client aspirations, limited budget or challenging site conditions target the big wins which provide the largest energy and carbon savings

It is important to stress the long-term benefits of a sustainable approach to gain client buy-in.

Housing Associations (HA)

Housing Associations have a particular ethos, as they remain solely responsible for the whole life of their assets. As such Housing Associations are often interested in how to make their stock more sustainable and easier to maintain in the long run. They often have their own sustainability policies but it is still important to debunk myths and overcome concerns about the installation and maintenance of renewable technology, heating and ventilation systems.

- Identify a Sustainability Champion in the HA and work with them to develop or respond to the project brief, alongside other stakeholders
- Review the HA Sustainable Design Guide and Employers requirements. Raise any concerns related to climate literacy and sustainable design. Identify any areas that are missing and suggest they update their documents e.g. to include embodied carbon emissions, POE requirement etc.
- Ideally ensure tenants are engaged with the design and POE development process - this will increase their sense of environmental stewardship for the homes they live in and the project as a whole. Include tenants in monitoring biodiversity. Engage with facilities managers to provide lessons learnt from existing buildings and improve the design to reduce maintenance.
- Explain how excellent building fabric and energy efficient design should be the starting point for reducing energy demand before considering other climate change mitigation measures: extra insulation is not hugely expensive, but providing more services and systems can be costly.

Local Authorities (LA)

Most local authorities have declared a climate emergency already, so suggest ways in which the project will help achieve their targets. If no climate action plan exists already, consider writing to LA with solutions as the ones outlined in Friends of the Earth local authorities climate action plan checklist and ACAN Embodied Carbon group's briefing note to local authorities.

- Identify a Sustainability Champion within the LA to work alongside other stakeholders when developing the brief or responding to a brief.
- Review local plans and policies that already exist. Look for best practice in the local authority's portfolio, or to exemplars by other local authorities if none to date.
- Review local authorities data and map resources to ensure the project is appropriate at the strategic level.
- Focus on their sustainability policies and review these as necessary to ensure they include all relevant areas that might be missing e.g. embodied carbon, POE.

- Explain how excellent building fabric and energy efficient design should be the starting point for reducing energy demand before considering other climate change mitigation measures : extra insulation is not hugely expensive, but providing more services and systems can be costly.
- Discuss availability of funding streams that support low-energy building, especially those supporting a retrofit-first approach. Consider procurement methods that could be available to LA and schemes that exist already e.g. Energiesprong.



Working with Clients

Larger/Developer Clients

Larger commercial clients and developers may be more concerned with the initial investment or the capital value of their asset rather than the long-term benefits of sustainable targets. However, it is still possible to advocate the business case to invest in more sustainable objectives as there is a growing demand for low energy building solutions. Additionally building regulations, policy, and financing are likely to shift towards these objectives in future which could render the current business-as-usual model obsolete. Many clients will have their own sustainability policies in place, however it is important to identify how these can be implemented efficiently and how to avoid greenwashing solutions.

- Review the client's sustainability policy and identify what their priorities are. Use these to inform the approach and qualify design decisions on the project. Recommend that your client follows best practice targets and any appropriate environmental certifications schemes that will lead to more sustainable outcomes e.g. LETI design guidance, RIBA Sustainable Outcomes report, UKGBC Net zero carbon buildings framework, etc). Avoid 'green' certifications just for the sake of marketing.
- Stress that building regulations are shifting towards improving energy efficiency and incentivising heat pumps over gas boilers. Investing in delivering these targets sooner rather than later will pay diffidence and de-risk the transition when regulations catch up.
- Learn what climate literacy capabilities exist within the client organisation and project team, as well as within the design team. Seek additional specialist input where needed.
- Work on an interdisciplinary basis to develop the sustainable design strategy for the project.
- Research similar size developers who are leading on sustainability in that sector and hold them up as exemplars and show that this has enabled their success. Appeal to their ambition and suggest that they can do better than their competitors by getting ahead in this market.
- Work with clients to develop their climate crisis policies to promote their brand.

- When reviewing your client's portfolio, advise against the creation of stranded assets that become too expensive to run or refurbish in the near future. Recommend that existing assets are refurbished over demolition where this is safe and practical to do so (use Whole life carbon assessments to assess whether refurbishment, deconstruction for re-assembly, or new build is the best option). Advise that new build assets target excellent fabric performance to ensure the energy demand is low and will fit within a decarbonised grid.
- Work with the client to ensure their portfolio is future proofed i.e. resilient to future climate change scenarios, avoids fossil fuel based heating, energy efficient to avoid future carbon taxes.
- For design and build procurement ensure that good environmental performance specifications are included within Employer's Requirements.

Many clients will have their own sustainability policies in place, however it is important to identify how these can be implemented efficiently and how to avoid greenwashing solutions.

RESOURCES PART 1

MEASURING OFFICE IMPACT

- www.carbontrust.com/resources/briefing-what-are-scope-3-emissions
- www.recyclenation.com/2015/08/15-ways-your-office-can-reduce-its-carbon-footprint
- www.bennettsassociates.com/sustainability
- www.haworthtompkins.com/studio/regenerative-design/our-carbon-footprint-report-2019
- climax.community/climate-essentials

MEASURING PROJECT IMPACT

- LETI publications www.leti.london/publications
- RIBA Sustainable Outcomes www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide which includes the RIBA Challenge 2030 www.architecture.com/about/policy/climate-action/2030-climate-challenge
- Net Zero Carbon Buildings—A Framework Definition, UKGBC
- Embodied and Whole Life Carbon Assessment for Architects—RIBA
- RICS Whole Life Carbon Assessment for the Built Environment www.rics.org/uk/upholding-professional-standards/sector-standards/building-surveying/whole-life-carbon-assessment-for-the-built-environment
- www.architecture.com/awards-and-competitions-landing-page/awards/riba-presidents-awards-for-research/2020/the-hawkins-brown-emission-reduction-tool

SKILLING UP

Online courses and webinars:

- UKGBC (UK Green Building Council) Virtual Learning Portfolio
- RIBA Academy
- Access to the RIBA academy is free to RIBA members. The academy is currently offering CPD courses on passivhaus principles and design, fire safety for designers, community engagement strategies and off-site construction.
- AECB (Association of Environment Conscious building)

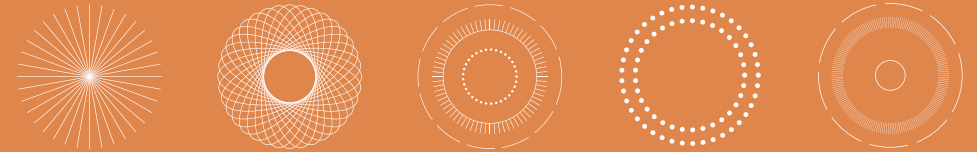
- ASBP (The Alliance for Sustainable Building Products)
- Green Building Store www.greenregister.org.uk
- BRE (Building Research Establishment)
- Open University
- Carbon Leadership Forum
- Supply Chain Sustainability School
www.haworthtompkins.com/studio/regenerative-design/reading-research-and-tools-suggestions
- www.retrofitacademy.org

WORKING WITH THE CLIENT

- LETI Client Guide for Net Zero Carbon Buildings www.leti.london/clientguide
- LETI Embodied carbon primer www.leti.london/ecp
- UKGBC Embodied Carbon: developing a client brief
www.ukgbc.org/wp-content/uploads/2017/09/UK-GBC-EC-Developing-Client-Brief.pdf
- Councils who have declared climate emergency
www.climateemergency.uk/blog/list-of-councils
- Universities who have declared climate emergency
www.climateemergency.uk/universities
- www.ukgbc.org/ukgbc-work/circular-economy-guidance-for-construction-clients-how-to-practically-apply-circular-economy-principles-at-the-project-brief-stage
- www.ukgbc.org/wp-content/uploads/2020/09/Building-the-Case-for-Net-Zero-UKGBC.pdf
- www.ukgbc.org/wp-content/uploads/2020/11/Delivery-Guidance-Report.pdf
- www.ukgbc.org/wp-content/uploads/2020/08/Nature-based-solutions-to-the-climate-emergency.pdf
- www.ukgbc.org/ukgbc-work/embodied-carbon-practical-guidance
- www.ukgbc.org/wp-content/uploads/2018/03/Social-Value.pdf
- Absolute Zero by UK FIRES
- www.architecture.com/-/media/gathercontent/post-occupancy-evaluation/additional-documents/buildingknowledgpathwaystopoepdf.pdf

PART 2

PROJECT DESIGN GUIDE



Practices have signed up to Architects Declare in recognition of the climate and biodiversity emergency and the recognition that, as a profession, architects are very much part of the problem. In signing the declaration, we all have acknowledged that we should be leaders in developing solutions. This requires answers to some very practical questions: do we know how much energy our designs are using? How do we practically engage with the clients, consultants, and everyone working in our practices, to reach the goals we signed up to?

The most recent IPCC report (2021) shows that architects still need to go far beyond the conventional understanding of what sustainability means and of established benchmarks or assessment tools, to better respond to the urgency of the crisis. Our designs have not only to minimise energy and material consumption but also to contribute to a regenerative approach in the built environment, to increase biodiversity and redefine our relationship with nature, and also recognise the ability of architecture to influence the societal move towards a low carbon lifestyle.

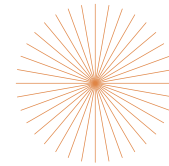
Part II of the AD Guide signposts and compiles best practice guidance from a wide range of sources into one consolidated location, to make it easier for practitioners to meet each of the

Architects Declare commitments and go beyond them. It is structured along key design areas that match the UN SDG topics, the RIBA Sustainable Outcomes areas of interest, LETI design guides, and the Climate Framework approach. While we are aware this will not be a fully comprehensive guide, we hope it can be a starting point on the journey towards delivering on the AD declaration points.

This part of the guide is intended as a live resource to help practitioners across the profession, in practices of all sizes, working on a variety of projects, with a wide range of skills. Each chapter consists of an Introduction (overview of the topic, why it's important and the aim of focusing on it), a range of Key Issues that address the topic, Resources offering further information (documents, websites that provide deeper understanding) and Examples of best practice (projects that embody some aspect of the key issues in an overt way).

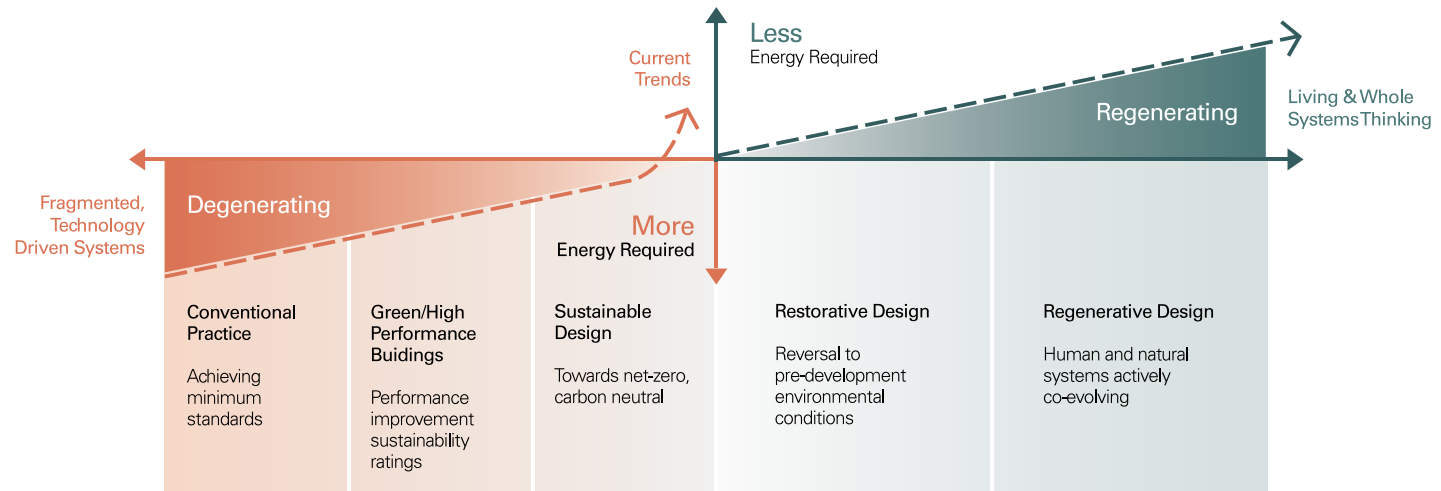
We are aware there will be some duplication with existing documents as we are re-stating the key points in existing, ambitious industry guidance and presenting sources of information, offering a condensed, evidence-based practical guidance for project architects.

1 REGENERATIVE DESIGN



- 1 Raise Awareness
- 2 **Change Fast**
- 3 New Goals
- 4 Share Knowledge
- 5 **Evaluate Projects**
- 6 Upgrade Existing
- 7 Whole Life
- 8 **Regenerative Design**
- 9 Collaborate & Reduce
- 10 Low Carbon
- 11 Minimise Waste
- 12 Climate Justice

Fig. 9 Regenerative Design
Source Bill Reed



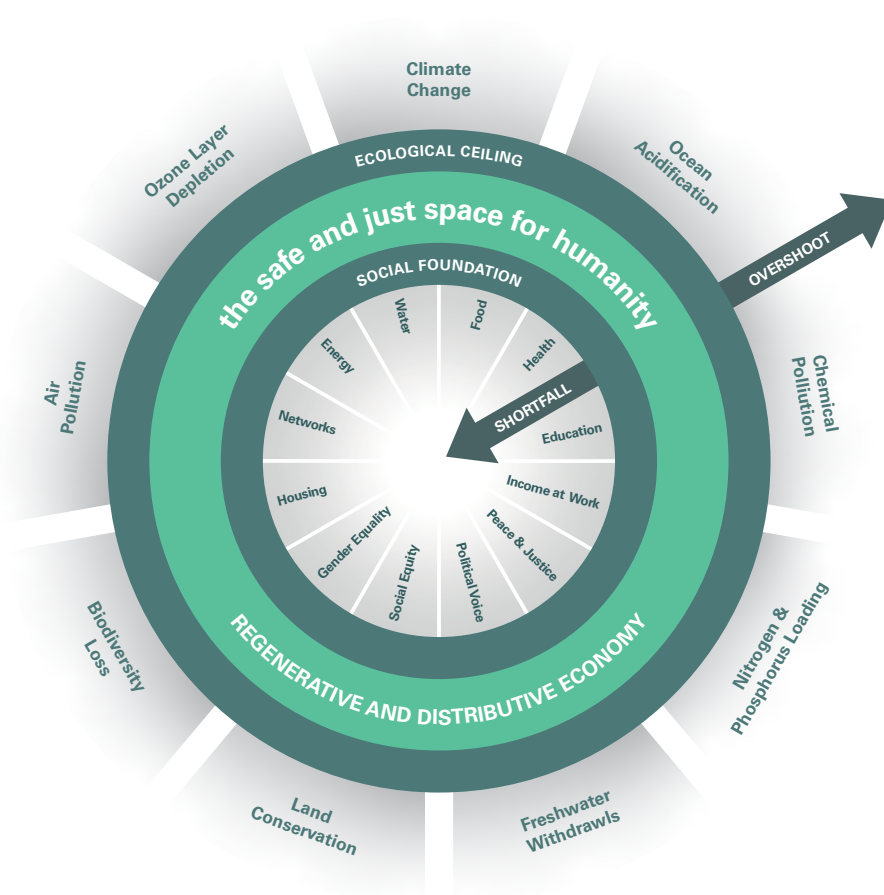
INTRODUCTION

The diagram above by Regenerative Design pioneer Bill Reed provides a good summary of the difference between sustainable design and regenerative design. At the lowest level is compliance-based design which can be characterised as ‘One step better than breaking the law’. Above that is the realm of relative improvement or ‘green design’. The highest level of sustainable design has been described by the Cradle To Cradle author Bill McDonough as “100% less bad”. Bill Reed argues that as it is currently framed, sustainability can at best achieve a form of neutrality in which all negative impacts have been mitigated. The key problem with the sustainability paradigm is that the vast majority of building projects are below the neutrality line and are therefore part of a degenerative cycle. For those who have devoted many years of their careers to sustainable design, it may be hard to accept that most of this work was just making things less bad.

We urgently need to move to a new paradigm and, just as many of us debated what is the ultimate aim of sustainability, it is now time to ask ourselves how

to excel in regenerative design. It is important to realise that this new paradigm involves much more than ‘sustainability with all the bolts tightened up’—it requires some fundamentally different starting points.

There is a growing consensus amongst advocates of regenerative design that the best sources of new design thinking are all life-centred approaches such as bioregionalism, biomimicry and radical indigenism. All of these involve more holistic ways of thinking in contrast to the mechanistic thinking that has arguably been the hallmark of most sustainability rating systems in use. Mechanistic thinking suggests that something can be understood if you break it down into its distinct parts. While this may have been literally true for early mechanisms such as clocks, it is not the case for systems in which there are countless elements that interact in complex ways. The challenge of regenerative design is to embed all human activities into the complex web of planet earth life support systems while avoiding negative impact and consequences.



As noted by Kate Raworth in her seminal work ‘Doughnut Economics’, it is crucial to meet the needs of our society by creating a safe and just space for humanity without breaching the earth’s ecological boundaries.

Fig. 10 Doughnut Economics
Source Kate Raworth

As noted by Kate Raworth in her seminal work ‘Doughnut Economics’ and described in the diagram above, it is crucial to meet the needs of our society by creating a safe and just space for humanity without breaching the earth’s ecological boundaries. This approach demands a critical change in our attitude to our work and life, to avoid overshooting the ecological ceiling of what the planet can provide. Buildings, cities and infrastructures must become indivisible components of a constantly regenerating and self-sustaining ecological system.

Most construction is based on a ‘consuming’ model, and on minimising the negative impact of designs and construction work, rather than an entirely new holistic approach that considers ways to produce a net positive impact through a regenerative design approach. Regenerative design would help to address wider crises beyond carbon, towards issues of widespread biodiversity loss, mass extinction, of land injustice and climate justice—all of which are ‘externalities’ we have a very limited grasp on in our current system.

Regenerative Design essentially underpins that ‘sustaining’ a current status quo of what we know to be a flawed system is not enough—and that our approach to design needs to better factor in externalities and wider impacts that arise through supply chains, building processes and our occupation of built environments over time in order to address the biodiversity crisis and ecosystem impacts of our industry.

Architects Declare adopted a language referring to Regenerative Design, rather than Sustainable Design from the outset, in recognition of this important distinction. This terminology is relatively recent in architectural discourse, and as such its meanings may not be widely understood or agreed as yet. We see this definition to be emerging, and therefore this is one of the areas that is likely to change in the guide in the future. There may still be references to ‘sustainability’ used throughout, as a term that everyone employs and is easily recognised at the moment. We hope this will change in the future as the concept of regenerative design becomes widely used.

The problems inherent in an economic system based on endless growth also apply to companies – if you are fixated on growth it will be much more difficult to be selective about which projects to take on and which ones to reject.

KEY POINTS

• Guidelines for Regenerative Design – Initial Design Stages

Seek project opportunities in which there is likely to be client commitment to regenerative principles. Assemble persuasive arguments so that you can advocate for regenerative approaches.

The problems inherent in an economic system based on endless growth also apply to companies – if you are fixated on growth it will be much more difficult to be selective about which projects to take on and which ones to reject. Being agnostic about growth as Kate Raworth suggests allows a company to be more discerning about new commissions and choose to more effectively build a reputation for regenerative design. The argument “If we don’t do it, someone else will and they may not do it as well as us” increasingly sounds like the outdated paradigm of mitigating negatives. Many clients use high profile practices to add credibility to projects with questionable environmental standards and turning down these approaches is a powerful way to bring about change.

• Appointments

Make the case for appointments that will assist in developing a deeper understanding of place (likely to include at least some input from an ecologist and potentially a cultural historian, a sociologist, etc.). Consider the benefits of having a whole team of companies that are signatories to Built Environment Declares – most local authorities have now declared a climate emergency and you will be able to use this as positive leverage when you get into negotiations about planning consent.

• Site Information

Gather information on the place and its ecological systems as follows:

1. What would a thriving ecosystem look like in this location?
2. How much exists on site in terms of carbon sinks i.e. trees and soil?
3. How does water move through the site?
4. What biodiversity exists on site and what can reasonably be concluded is missing?
5. What potential building materials exist on site?
6. What human and social networks exist?
7. What exists adjacent to the site and what opportunities might arise outside the site boundaries?

- For each of the items above, explore how these could be enhanced.
- Regenerative design pioneers Pamela Mang and Bill Reed of Regenesis Group and Story of Place Institute recommend that you “Anchor thinking to the future. Rather than dwell in what exists today, bring into mind the larger purpose of your project. What particular future is it intended to create for its place? Envision this future in concrete images, as if it was present today and the project was up and running, carrying out its role as an integral part of its place. It is most productive to do this as a conversation, starting within but not limited to the design team.”
- Develop a map of resource flows for the location and consider that cities will increasingly need to resemble ecosystems – running on solar energy, zero waste (everything is nutrient), interconnected and interdependent.

- **Briefing**

The early stages of a project are the best time to raise the level of ambition and discuss the long-term goals for the area, site, and local community.

As a useful tool, explore **The Long Time** (www.thelongtimeproject.org) project strategies which encourage a longer view and approach. Consider using their 'Human Layers' method in an early stage workshop. This helps to focus all participants on what it means to be a good ancestor for future generations and what might be achieved by a project in terms of long-term legacy.

1. **Analyse the ecosystems and energy flows on site and the wider neighbourhood or area.** Assess how human settlements/buildings on that specific site can create platforms for diverse ecosystems, restoring local natural systems, creating a bond of the social-ecological system.
2. **Use the Living Building Challenge principles.**
3. **Use a regenerative development and design framework based on:**
 - Living systems thinking: Define the site, discover its core patterns, the relationships and dynamics of the place, its character and nature through site visits, interviews, maps etc. These core patterns will help describe and shape the structure of a Story of Place for the project (e.g. www.regenesisgroup.com/services/story-of-place).
 - Using an Integrative design process that brings together all the streams of work engaged simultaneously and synergistically to create a truly regenerative impact, in a transformative process (e.g. www.regenesisgroup.com/how-we-work).
 - Growing democratic stakeholder partnerships (provide platform for inclusivity, representation, social and climate justice)
 - Understanding the place.
 - Design for ongoing/future co-evolution and a harmonious integration within local ecosystems.

- **Next Design Stages**

Ensure the aims and ambitions of the project are implemented in the next design stages - use the RIBA Plan for Use, RIBA Sustainable Outcomes guidance and the Living Building Challenge principles.

RESOURCES

Shifting from 'sustainability' to regeneration, Bill Reed, Integrative Design Collaborative and Regenesiis, Arlington, MA, US
www.informaworld.com/smpp/title~content=t713694730

Doughnut Economics—Kate Raworth

Michael Pawlyn Regenerative Design RIBA journal article—'Sustainability is dead, long live regenerative design'
www.ribaj.com/intelligence/climate-change-emergency-regenerative-design-michael-pawlyn

Designing for Hope

<https://www.amazon.co.uk/Designing-Hope-Pathways-Regenerative-Sustainability/dp/1138800627>

Regenesiis group work

www.regenesisgroup.com/team

Living Building Challenge 4.0—A Visionary Path to a Regenerative Future www.living-future.org/wp-content/uploads/2019/04/Living-Building-Challenge-4.0.pdf

Letters to Earth published by Culture Declares

www.letterstotheearth.com

Video by Carol Sanford on Principles of Regenerative Design Paradigm

www.youtube.com/watch?v=zLXX6VqWYTg

Fab City Movement & Resources
www.blog.fab.city/co-creating-the-fab-city-poblenuou-roadmap-at-ouishare-fest-barcelona-2016-afb418c5a151

Roman Krznaric 'The Good Ancestor' esp. Chapter 10 'Ecological Civilisation'

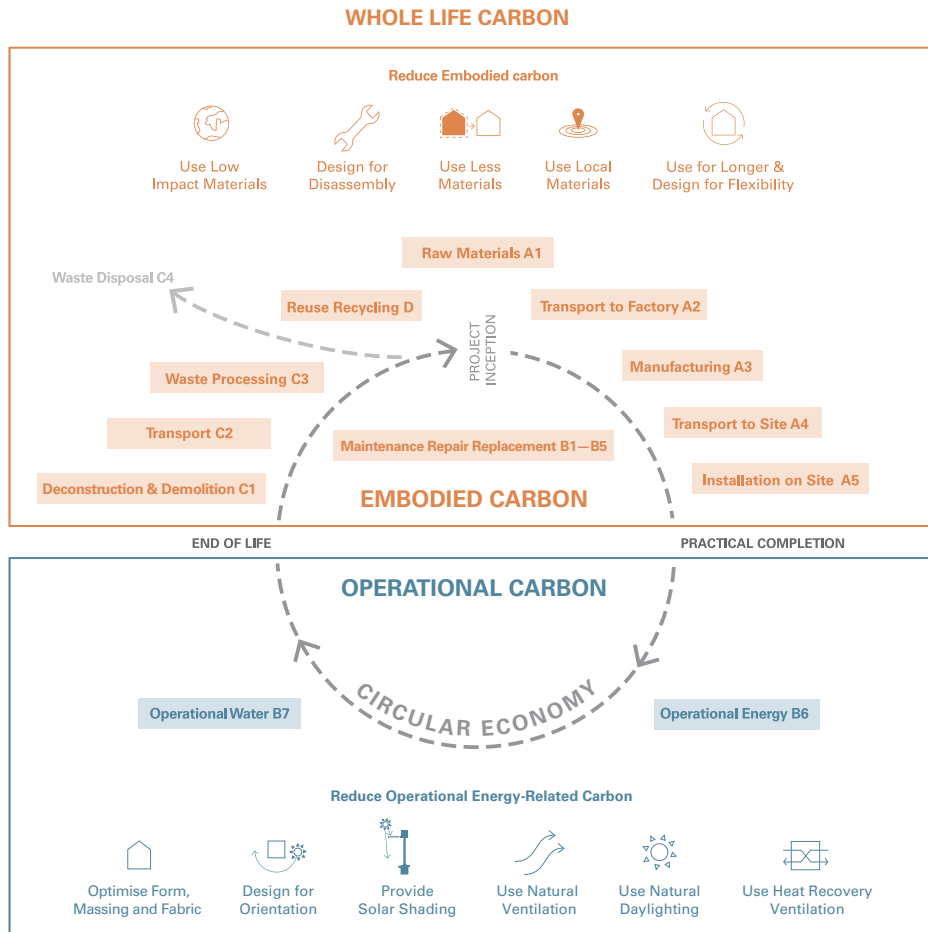
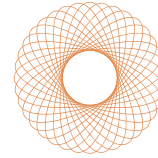
Herman Daly 'Steady State' economics
www.ec.europa.eu/environment/ecoap/achieving-steady-state-interview-ecological-economics-pioneer-herman-daly_en

David Korten, Earth Charter & Ecological Civilisation ideas
www.davidkorten.org/home/ecological-civilization/ & <https://earthcharter.org/read-the-earth-charter/>

The Regenerative Business – Carol Sanford

Donella Meadows – Systems Thinking principles and how to intervene/ change existing systems for the better—Leverage Points: Places to Intervene in a System—The Donella Meadows Project

2 ENERGY, WHOLE LIFE CARBON & CIRCULARITY



EN 15978 Introduces a modular approach to whole life cycle analysis of a building:
 A1–A5 Products and Construction Processes / B1–B7 Use / C1–C4 End of Life
 D Benefits and Loads Beyond The System Boundary

INTRODUCTION

Global carbon emissions continue to rise at exponential rates and we are way off target to meet the IPCC targets of halving emissions by 2030. Buildings are responsible for more than 40% of global CO2 emissions and construction accounts for more than 10%. Both figures are higher in the UK (see graph on p.5).

Minimising the embodied carbon and operational energy-related carbon emissions in buildings by targeting re-use of existing buildings and structures, and through careful design for new build projects, is key to achieving the carbon reductions needed. This approach can help keep the global temperature increase within the levels recommended by the IPCC reports to prevent extreme climate events.

Whole Life Carbon

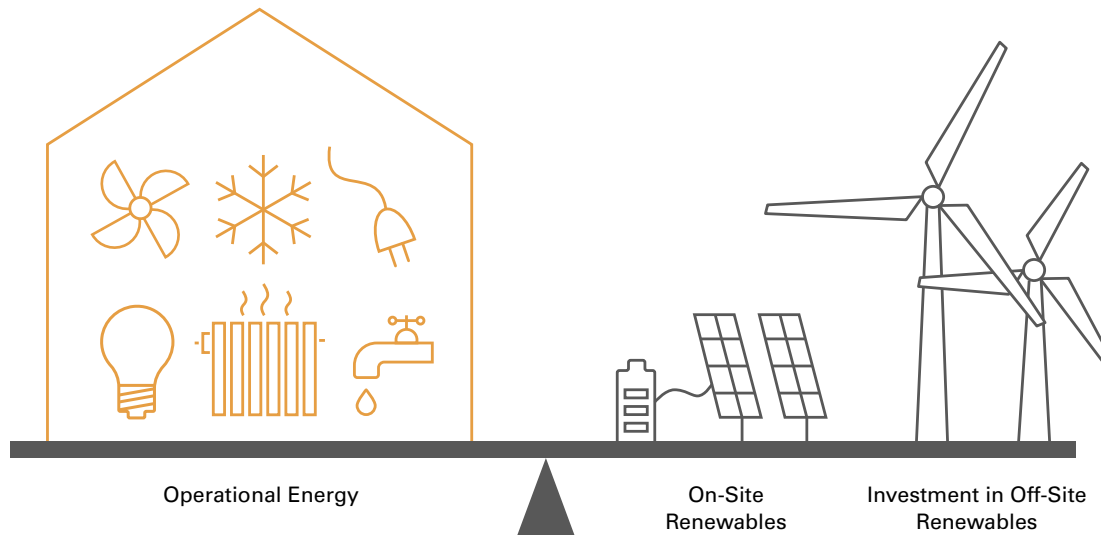
Whole Life Carbon emissions are the sum total of all building related greenhouse gas (GHG) emissions and removals, both operational and embodied over the lifecycle of a building including its disposal (Modules: A1-A5 Upfront; B1-B7 In Use, B8, B9 for infrastructure only, C1-C4 End of Life).

A Whole Life Carbon (WLC) approach is needed to assess all emissions produced over the entire life of the building, from sourcing of raw materials through to construction and operation of the building, to disposal (cradle to grave), covering both embodied and operational energy. **See the Embodied Carbon, Operational Energy and Retrofit chapters.**

It is also intrinsic to future resource efficiency and carbon reduction to consider potential reusability or recyclability of all the building elements (cradle to cradle). **See the Circularity & Waste and Materials chapters.**

Fig. 11 Whole Life Carbon and Circularity
Source Marks Barfield Architects

The aim is to maximise renewable generation on and off-site and minimise the amount of offset required, by minimising the embodied and operational related emissions.



Net Zero Carbon

There are several net zero carbon definitions available from the Whole Life Carbon Network, UKGBC Net Zero Framework, or the International Future Institute/Living Building Challenge (see Resources).

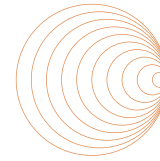
LETI and RIBA 2030 Challenge provide guidance and specific targets which can be used as part of the client brief to achieve net zero (operational, embodied, and whole life carbon).

The Whole Life Carbon Network (WLCN) defines a 'Net Zero (Whole Life) Carbon' asset as one where the sum total of all asset related greenhouse gas (GHG) emissions, both operational and embodied, over an asset's life cycle (Modules A1-A5, B1-B7 (plus B8 and B9 for Infrastructure only), C1-C4) are minimized, meet local carbon, energy and water targets, and with residual 'offsets', equals zero.

The aim is to maximise renewable generation on and off-site and minimise the amount of offset required, by minimising the embodied and operational related emissions. See the Embodied carbon, Operational energy, and Power Purchase Agreements & Carbon offsetting chapters.

Fig. 12 Net Zero Operational Balance
Source LETI

2.1 Embodied Carbon



- | | | | |
|---|--------------------------|----|------------------------|
| 1 | Raise Awareness | 7 | Whole Life |
| 2 | Change Fast | 8 | Regenerative Design |
| 3 | New Goals | 9 | Collaborate & Reduce |
| 4 | Share Knowledge | 10 | Low Carbon |
| 5 | Evaluate Projects | 11 | Minimise Waste |
| 6 | Upgrade Existing | 12 | Climate Justice |

INTRODUCTION

Embodied Carbon emissions are the total greenhouse gas (GHG) emissions and removals associated with **materials and construction processes** throughout the whole life cycle of a building (Modules A1-A5, B1-B5, C1-C4 of the Life Cycle stages defined by BS EN 15978:2011—Whole Life Carbon Network definition. **See Life Cycle module chart on page 38**).

This includes emissions caused by extraction of raw materials, transport to factory, manufacture/processing, transportation to site, and the assembly of every product and element within the building. It also includes emissions generated through the maintenance, replacement of materials and building systems during the building's lifetime; as well as the deconstruction and recycling or disposal of the materials and systems at the end of the building's life. **See also the Circularity & Waste, Materials and Operational Energy chapters.**

The carbon emitted in producing the building materials of a building or development can represent upwards of two-thirds of the total carbon emissions of that project over its lifetime, and this proportion might increase further given the decarbonisation of the grid. Over time a cleaner grid will lead to improved operational efficiency of buildings. A good design solution will consider both embodied carbon and the carbon emissions related to operational energy **to optimise whole life carbon reductions.**

Given the current climate crisis and the need to make dramatic reductions in carbon emissions immediately, the embodied carbon released during the construction process needs to be a key focus of attention.

1. Dalston Works
Image taken during construction.
Completed 2017
Waugh Thistleton

The metrics used to assess embodied carbon emissions are kgCO_e/m².

CO₂e is the abbreviation for carbon dioxide equivalent, 'a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.' (ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Carbon_dioxide_equivalent)



KEY POINTS

- **Establish a project programme that allows time within the design work for embodied carbon analysis and iterations to be made before key project gateway decisions.**
- **Establish a project strategy with upfront and total embodied carbon targets** in collaboration with the client and all consultants: Assess or request an assessment of any existing buildings to determine whether they can be retained - in particular the substructure and superstructure which are high in embodied carbon. Any demolition decisions need to be accompanied by a pre-demolition audit to assess which materials can be reused/reclaimed.
- **Measure embodied carbon** in new and existing buildings using software listed in the resources below. Focus initially on structure and façade. Structure should be assessed against the IStructE SCORS rating system, which is simple for most projects. To estimate volumes of key materials, use their standard density to find their overall weight and use the ICE Bath database of embodied carbon to do a quick manual calculation. Check results against RIBA 2030 Challenge/LETI Embodied Carbon Primer targets.
- **Avoid high carbon materials** such as concrete, aluminium and steel wherever possible as we transition to low carbon versions or alternatives. Avoid high cement content mixes and include cement replacement in concrete.
- **Investigate low carbon and bio based materials** wherever possible (e.g. timber and stone but also hempcrete, straw, mycelium, rammed earth). See Materials section. It is advisable to safeguard low-impact choices such as timber through early pro-active engagement with insurers, specialist consultants, and using the latest guidance.
- **Engage with the structural engineer** to investigate and optimise structural options and appraise their embodied carbon, following a hierarchy of project decisions. Reduce the amount of materials used, rationalise and optimise structures: significant savings can be made by optimising the grid spans, floor to ceiling heights, not overdesigning floor loadings and deflections, and designing lightweight structures to minimise the concrete in foundation systems. Investigate alternative foundation options e.g. screw piles.
- **Engage with the services engineer** to quantify the embodied energy of MEP service systems using CIBSE TM65 guidance (see resources p.43).

- **Undertake a full Life Cycle Assessment** (eg GLA London Plan Policy S12) and test real design options you are considering. Engage with the consultants and suggest structural options or façade alternatives to be tested, rather than use the automatic suggestions proposed by the LCA software. Use MESH, H/BERT or the FCBS Carbon tool for quick analysis at concept design stage.
- **Be aware of embodied carbon emissions related to the operational use of a building**—emissions generated through the maintenance, replacement of materials and building systems during the building’s lifetime. **See the Circularity & Waste, Operational Energy and Low Energy Services & Renewables chapters.**

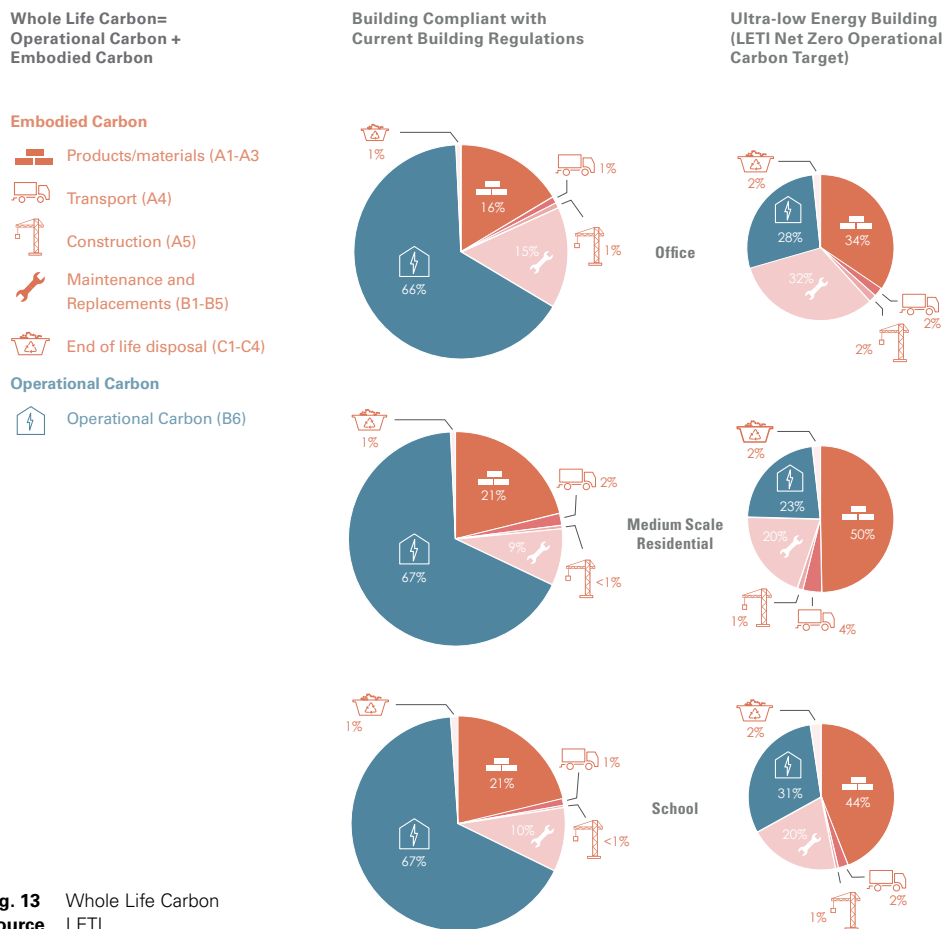


Fig. 13 Whole Life Carbon
Source LETI



2. Flat House
Practice
Architecture



3.



4.



5.



6.

EXEMPLARS

1. Dalston Works

Large Residential | London, UK

Waugh Thistleton

www.waughthistleton.com/dalston-works

2. Flat House

Small Residential | Cambridgeshire, UK

Practice Architecture

practicearchitecture.co.uk/project/flat-house

3. Cork House

Small Residential | Berkshire, UK

Matthew Barnett Howland Matthew Barnett Howland with Dido Milne (CSK Architects) and Oliver Wilton (UCL)

www.matthewbarnetthowland.com/cork-house

4. The Den

Performance Space | Manchester, UK

Haworth Tompkins

www.haworthtompkins.com/work/the-den

5. King's Cross Sports Hall

Office | London, UK

Bennetts Associates

www.bennettsassociates.com/projects/sports-hall-kings-cross-site-q2/

6. The Enterprise Centre

Educational | Norwich, UK

Architype

architype.co.uk/project/the-enterprise-centre-uea

RESOURCES

LETI Embodied carbon primer

www.leti.london/ecp

RIBA Sustainable Outcomes which includes the RIBA Challenge 2030

www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide

www.architecture.com/about/policy/climate-action/2030-climate-challenge

www.materialepyramiden.dk

Buro Happold—Structural sensitivity analysis www.istructe.org/IStructE/media/Public/Resources/case-study-embodied-carbon-routes-to-reduction-20200406.pdf

Buro Happold—embodied energy in structural systems

www.vimeo.com/402881887

IStructE Guides—low carbon structural design

www.istructe.org/resources/climate-emergency

Embodied and Whole Life Carbon Assessment for Architects —RIBA

www.architecture.com/knowledge-and-resources/resources-landing-page/whole-life-carbon-assessment-for-architects

RICS Whole Life Carbon Assessment for the Built Environment

www.rics.org/uk/upholding-professional-standards/sector-standards/building-surveying/whole-life-carbon-assessment-for-the-built-environment/

Embodied Energy and Embodied Carbon in Materials—ICE Database

www.circularecology.com/embodied-carbon-footprint-database.html

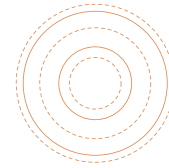
CIBSE Guidance TM 65

www.cibse.org/knowledge/knowledge-items/detail?id=a0q3Y00000IPZOhQAP

Targeting Zero: Embodied and Whole Life Carbon explained—Simon Sturgis

www.ribabooks.com/Targeting-Zero-Embodied-and-Whole-Life-Carbon-Explained_9781859466438

2.2 Circularity & Waste



- | | |
|---------------------|------------------------|
| 1 Raise Awareness | 7 Whole Life |
| 2 Change Fast | 8 Regenerative Design |
| 3 New Goals | 9 Collaborate & Reduce |
| 4 Share Knowledge | 10 Low Carbon |
| 5 Evaluate Projects | 11 Minimise Waste |
| 6 Upgrade Existing | 12 Climate Justice |

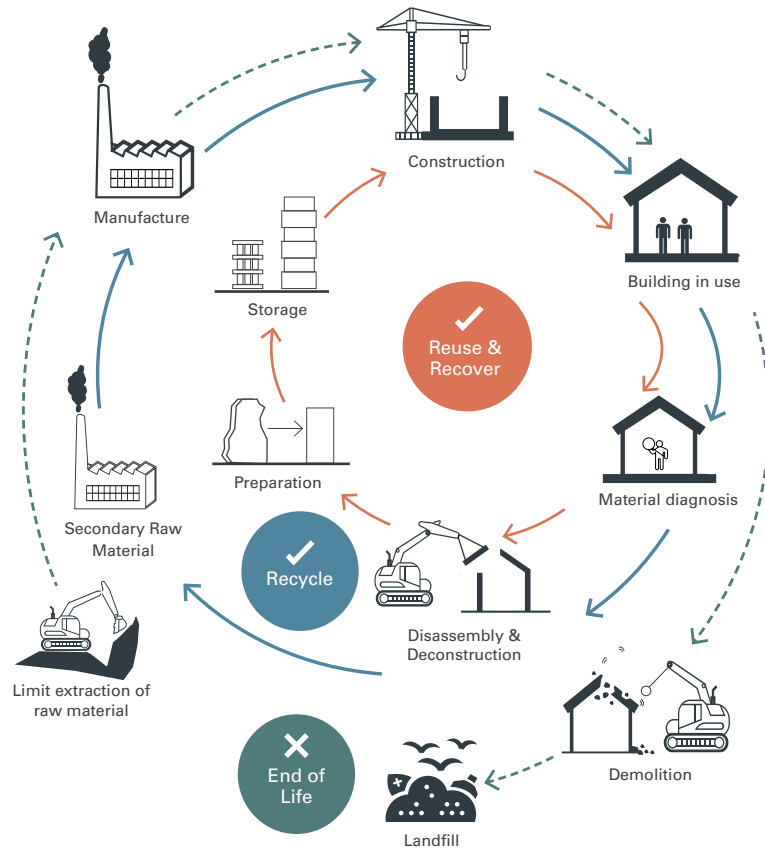


Fig. 14 Circular Economy
Source Elementa Consulting

INTRODUCTION

A Circular Economy can be defined by two distinct, closed, materials loops: the ‘Biological’ and the ‘Technological’. Biological materials are part of a cycle of absorbing CO₂ which is then sequestered until it is released by decomposition back into the biological cycle. The ‘Technological’ materials are derived from raw materials, through mining and refining and other human activities – these materials will never decompose, and therefore need to be recycled and reused.

A circular economy is attained when no waste is produced, and all forms of production, including production of buildings, are designed to be restorative and regenerative within a system of reuse, repair, repurposing, and recycling.

Three principles are key to moving towards a circular economy in the construction industry:

1. Conserve resources, e.g. by avoiding demolition, and reusing assets and materials that can be recycled or adapted, so as to avoid new construction where possible. Upgrade and intensify building use where possible. Where it is necessary to use virgin material sources, do so efficiently and design out construction waste.
2. Design to eliminate future waste, e.g. by designing for longevity, ease of repair and maintenance, flexibility and adaptability or deconstruction and reusability. Use material passports to assist future reuse.
3. Manage existing material resources so they retain their quality and value, and don’t become waste, e.g. by designing recycled products to increase the demand for them and making surplus materials available to others, reducing wastage.

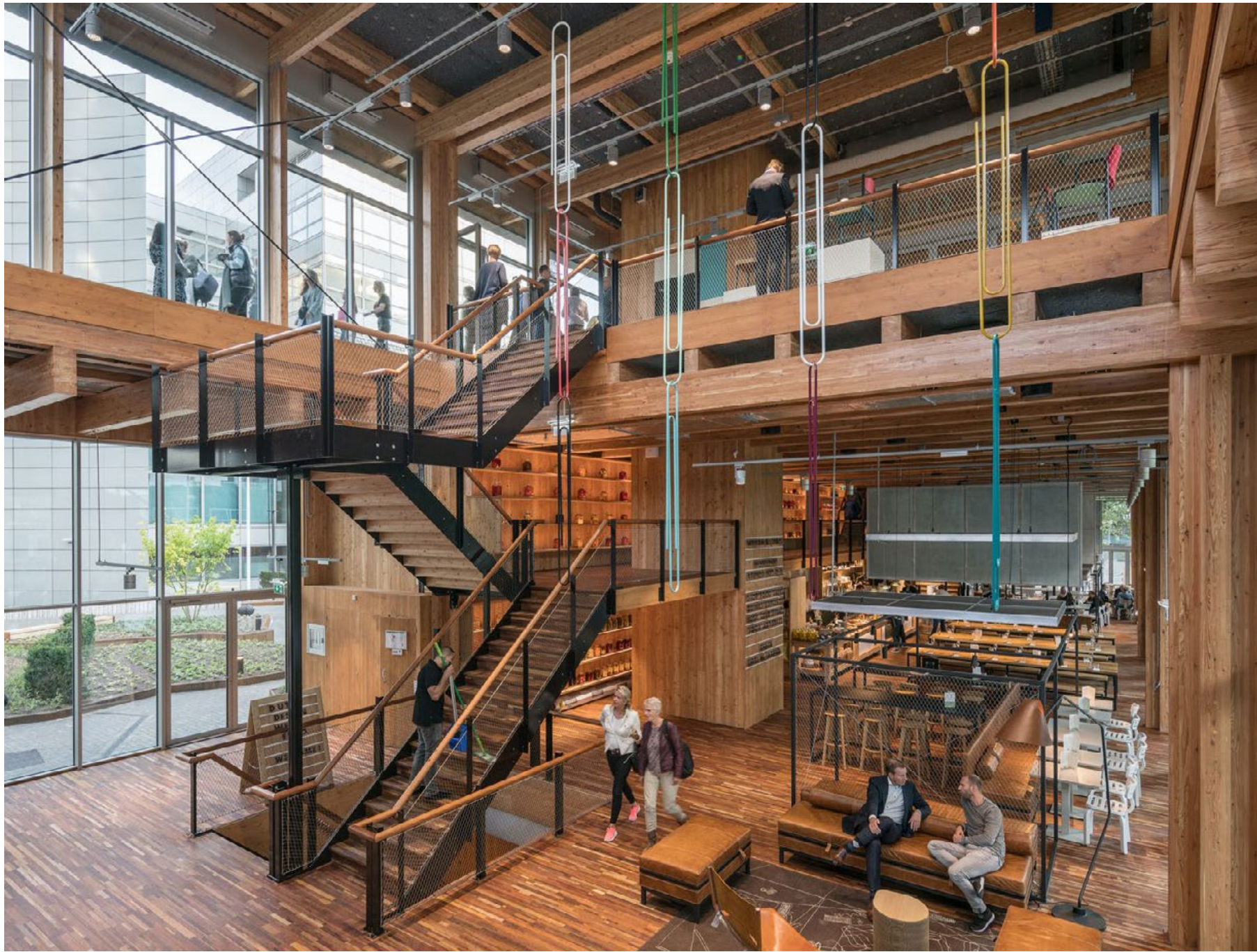
KEY POINTS

- **Organise workshops** as early as possible with the client, their maintenance/asset management team, and the design team to discuss a circular economy strategy at the outset of the project.
- **Recommend that a pre-demolition audit/material inventory is carried out as early as possible** to identify opportunities for on-site material reuse or repurposing. Discuss storage space for reclaimed materials at an early stage and clarify intended reclamation, storage and reuse of materials. Consider including reclamation of materials in tender documents when procuring demolition/deconstruction.
- **Recommend that testing and sampling of reclaimed materials** is carried out at an early stage to build confidence in technical/aesthetic properties and process; reclaimed materials often need additional testing and validation.
- **Discuss the end-of-life expectations of different layers of the building** (from structure and cladding to internal finishes and fitout) with the client and the project team: the brief should establish the approach to longevity, future changes of use, and deconstruction/disassembly.
- **Specify materials and components that can be reused at the end of a building's life:** opt for reversible connections and design for disassembly. Be mindful of, or avoid if possible, specifying composite products with inseparable materials that will cause difficulty in upgrading of components, reclaiming and recycling.
- **Consider elements and products that could be procured through leasing agreements** with suppliers that will take back end-of-life components for reuse and recycling.
- **Evaluate opportunities to source secondary materials** from local reclamation yards, materials exchange platforms (maps.supplychainschool.co.uk) and local building sites.
- **Handover information**—think of the construction/As-built information as the building owner's record of their 'material bank'; make sure they are equipped with the information needed to be able to effectively adapt and eventually deconstruct it; share BIM; create material passports (see Resources) and establish legacy ownership and management strategy for material information including future upgrades and maintenance changes.

- **Work with contractors to adhere to WRAP recommendations** (<https://wrap.org.uk/resources/guide/recycling-guidelines>) and achieve >90% landfill diversion where materials cannot be reused on- or off-site.
- **Think of the current buildings you are working on as Material Banks for future buildings** (see the BAMB research under Resources)
- **Operational waste:** enable minimum waste in operation through recycling provision, food/bio compost provision (in-line with Government target of 0% biodegradable waste to landfill by 2025). Explore opportunities for surplus goods 'banks' on site and in the local community; establish a waste manager with the client and any share & repair opportunities on site; use a 'library of things' (e.g. <https://www.libraryofthings.co.uk/>).
- **Be aware of issues linked with waste disposal:** e.g. toxins leaching from landfills, financial loss of wasting resources, carbon cost.

“It is estimated that 32% of landfill waste comes from the construction and demolition of buildings, and 13% of products delivered to construction sites are sent directly to landfill without being used.”

UK Designing Buildings Wiki



1. CIRC Pavilion
de Architekten Cie



2.



3.



4.



5.

EXEMPLARS

1. CIRCL Pavilion

Large Residential | Amsterdam, Netherlands
de Architekten Cie
www.architizer.com/projects/circl

2. Waterloo City Farm

Office/Education/Agriculture | London, UK
Feilden Fowles
www.feildenfowles.co.uk/waterloo-city-farm

3. Oasis Children's Venture

Education/Children Centre | London, UK
Benjamin Barfield Marks and Matt Atkins
www.ribaj.com/buildings/segal-segue

4. The Waste House

Residential/Prototype | Brighton, UK
BakerBrown Studio
www.architectsjournal.co.uk/buildings/brighton-waste-house

5. PLACE/Ladywell

Small Residential | London, UK
Rogers Stirk Harbour + Partners
www.asbp.org.uk/case-studies/placeladywell

RESOURCES

UKGBC Circular Economy Guidance for Construction Clients
www.ukgbc.org/ukgbc-work/circular-economy-guidance-for-construction-clients-how-to-practically-apply-circular-economy-principles-at-the-project-brief-stage

The Re-use Atlas—A Designer's Guide Towards a Circular Economy—Duncan Baker Brown
www.ribabooks.com/The-Re-Use-Atlas-A-Designers-Guide-Towards-a-Circular-Economy_9781859466445

UKGBC Circular Economy Implementation Packs for Products as a Service and Reuse
www.ukgbc.org/ukgbc-work/circular-economy-implementation-packs

GLA, 2019. Circular Economy Primer: Designing for a Circular Economy
www.london.gov.uk/sites/default/files/design_for_a_circular_economy_web.pdf

Re-fabricate www.re-fabricate.co.uk

BAMB Buildings as materials banks
www.bamb2020.eu/library/overview-reports-and-publications

Material passports: example
www.orms.co.uk/insights/materialpassports

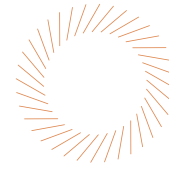
Sheffield University's Regenerate. An Excel-based tool to assess circular design potential of a project
regenerate.urbanflows.ac.uk

CIRCUIT Circular Economy Built Environment — Horizon 2020—Circular Construction in Regenerative Cities
www.circuit-project.eu

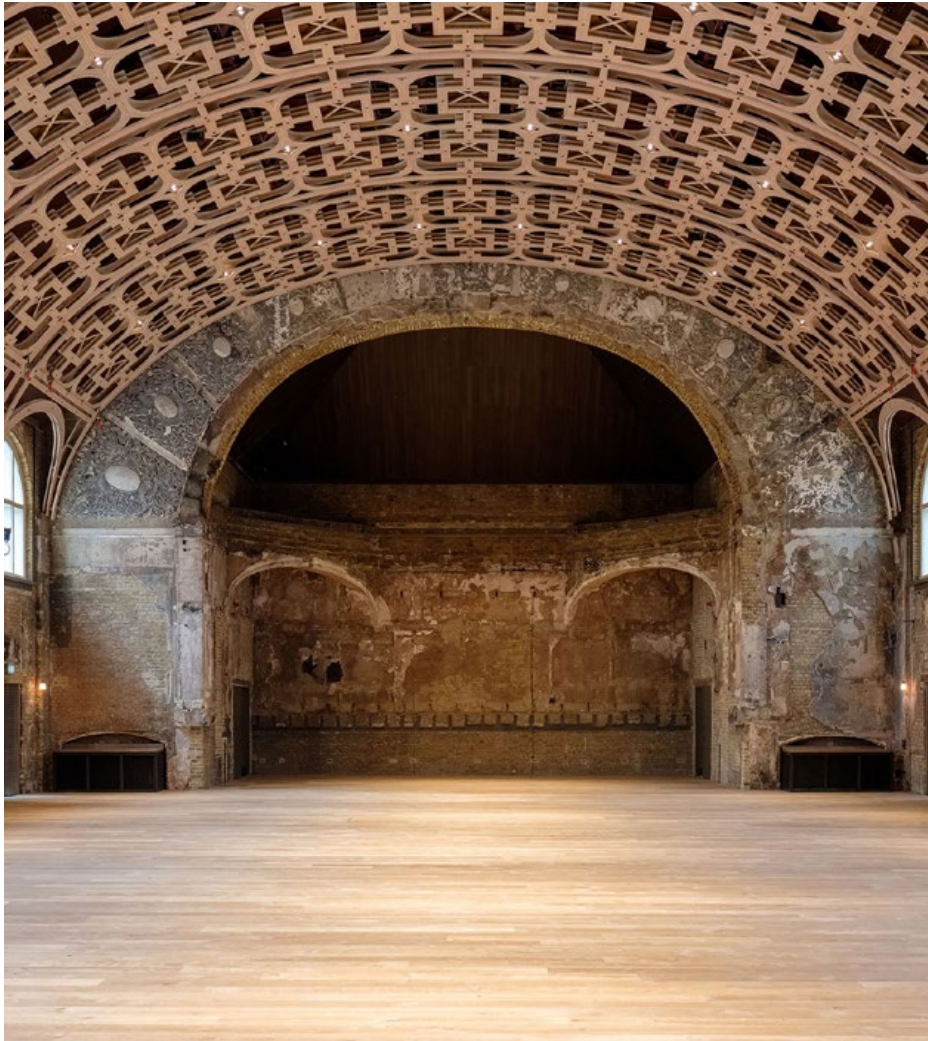
Supply Chain Sustainability School
www.supplychainschool.co.uk/topics/sustainability/waste-and-resource-efficiency

RotorDC Material Salvage www.rotordc.com

2.3 Retrofit



- | | | | |
|---|-------------------|----|----------------------|
| 1 | Raise Awareness | 7 | Whole Life |
| 2 | Change Fast | 8 | Regenerative Design |
| 3 | New Goals | 9 | Collaborate & Reduce |
| 4 | Share Knowledge | 10 | Low Carbon |
| 5 | Evaluate Projects | 11 | Minimise Waste |
| 6 | Upgrade Existing | 12 | Climate Justice |



INTRODUCTION

Retrofitting existing buildings and preserving the communities around them can lead to important social benefits, and also to major savings in:

- Embodied carbon emissions (that would otherwise arise from using new materials, and from demolition), and
- Operational carbon emissions (linked to improved fabric performance and lower energy use).

As a rule of thumb, retrofit opportunities should be considered and assessed before considering demolition and new construction.

Whilst retrofit projects share some commonalities, they also require unique and specific strategies for each building, aiming to achieve:

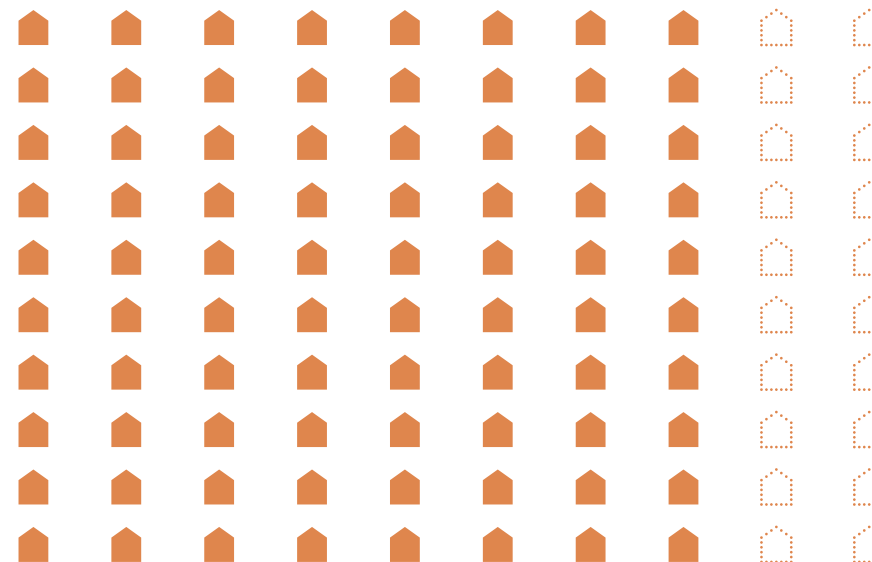
- Improved ability of building to meet functional needs
- Improved quality of the building fabric
- Improved environmental performance (reduced energy use intensity—see Operational Energy chapter—and resource consumption, lower emission of pollutants, waste generation, and noise)
- Improved comfort and health of occupants

1. Battersea Art Centre
Haworth Tompkins

KEY POINTS

- **Suggest effective stakeholder engagement at early design stage to fully evaluate the optimal long-term possibilities for retention of buildings/ structures and any challenges:**
 - The building construction and condition, plot ratio and site occupancy, and ability to meet current and future needs
 - The cultural, social and architectural value of the building (including the embedded value and quality of the existing spaces and materials; note the social benefits of improving existing buildings rather than decanting and relocating residents)
 - Climate resilience, and ability to upgrade
 - Investment and maintenance budgets
 - User behaviour and energy use patterns
 - Length of design programme (retrofits can require more time upfront in understanding how existing buildings work and in tailoring approaches to improve the existing fabric) and of construction programme (requirements for fabric upgrades and services installation within existing constraints)
- **Formulate a ‘Retrofit plan’ following the LETI Retrofit Guide (see Resources), prioritising:**
 - Assessment of the existing building construction and condition, constraints, risks, and opportunities, including recognising any risks associated with: fire safety, structural safety, health (asbestos, etc).
 - Set out the proposed strategies as appropriate for the building type, size, use, context and heritage value:
 - Strategy for ‘Fabric First’ energy conservation measures including mitigation of cold bridges
 - Strategy for ventilation, moisture management and indoor air quality
 - Strategy for energy and water efficiency based on supply, demand and storage, low carbon heat source, airtightness
 - Consider and detail the phasing work if needed and have a holistically considered step-by-step refurbishment plan to ensure that upgraded components are properly sequenced and that future works can be integrated into the ‘retrofit masterplan’
 - Include a plan to monitor the building performance after the retrofit and stay with the building as the works/phasing progresses, etc.
- **Consider the appropriate use of new materials and ventilation strategies** within the existing buildings, particularly in traditional buildings. Unintended consequences of retrofit works can include: increased moisture risk (with

We have 28 million energy inefficient existing homes in the UK. 80% of the buildings we’ll have in 2050 have already been built.



negative effect on the comfort and health of occupants; deterioration of the condition of the building fabric; and a fall in conservation value of the building).

See also the Embodied carbon, Materials, Operational Energy & Carbon, and Low Energy Services chapters.

- **Refurbishment strategies should allow for layering, modularity and to enable future retrofit or deconstruction (see the Circularity chapter).**
- **Domestic Retrofit:** explore the Retrofit Coordinator Certification Scheme which allows qualified Retrofit Coordinators to manage domestic retrofit projects, in-line with the requirements of the new PAS 2035:2018 – Specification for the Energy Retrofit of Domestic Buildings published in June 2019 (see Resources).
- **As far as possible, ascertain whether building contractors have the necessary skills and experience** to implement the works. Building performance should be built in to the contract in order to minimise the performance gap.
- **Advocate to change policies and legislation** to incentivise refurbishment over demolition and new build (advocacy should include appropriate retrofit strategies for conservation areas).



2. Transformation
of 530 dwellings—
Before and After
*Lacaton & Vassal,
Druot, Hutin*



3.



4.



5.

EXEMPLARS

1. Battersea Art Centre

Community Centre/Theatre | London, UK

Haworth Tompkins

www.haworthtompkins.com/work/battersea-arts-centre

2. Transformation of 530 dwellings— Block G, H, I

Large Residential | Bordeaux, France

Lacaton & Vassal, Druot, Hutin

www.lacatonvassal.com/index.php?idp=80

3. Princedale Road

Small Residential | London, UK

PDP London

pdplondon.com/princedale-road

4. Ortlieb's Bottling House

Office | Philadelphia, USA

Kieran Timberlake

kierantimberlake.com/page/ortliebs-bottling-house

5. Mayville Community Centre

Community Centre | London, UK

Bere Architects

www.bere.co.uk/architecture/mayville-community-centre

RESOURCES

LETI Climate Emergency Retrofit Guide

www.leti.london/retrofit

RIBA Climate Change Toolkit, Principles for Low Carbon Design and Refurbishment

Possible funding mechanisms:

www.energiesprong.uk &
www.cibsejournal.com/case-studies/a-forward-leap-how-dutch-housing-process-energiesprong-guarantees-performance

AECB Retrofit Standard

www.aecb.net/aecb-retrofit-standard

AJ Retrofit First Campaign

www.architectsjournal.co.uk/news/retrofitfirst

National Standards Authority Ireland - Standard Recommendation S.R. 54:2014 - Code of Practice for the energy efficient retrofit of dwellings

Residential Retrofit: Twenty Case Studies— Marion Baeli

Scottish Ecological Design Association Design Guides (Sustainable Renovation, Design and Detailing for Airtightness/ Deconstruction/Toxic Chemical Reduction)
www.seda.uk.net/design-guides

STBA Responsible Retro-fit in conjunction with Department of Energy and Climate 'The Responsible Retro-fit of Traditional Buildings' Change online tool
www.responsible-retrofit.org/greenwheel

PAS 2035:2019 Retrofitting Dwellings for Improved Energy Efficiency

Greenspec Website

www.greenspec.co.uk/building-design/old-buildings

Innovate UK—Retrofit the Future
www.ukgbc.org/ukgbc-work/retrofit-for-the-future-innovate-uk

2.4 Materials



- | | |
|----------------------------|-----------------------------------|
| 1 Raise Awareness | 7 Whole Life |
| 2 Change Fast | 8 Regenerative Design |
| 3 New Goals | 9 Collaborate & Reduce |
| 4 Share Knowledge | 10 Low Carbon |
| 5 Evaluate Projects | 11 Minimise Waste |
| 6 Upgrade Existing | 12 Climate Justice |



INTRODUCTION

Consideration of the environmental, social and economic life-cycle impact of materials is an essential part of the design work.

Appropriate material use in construction - for refurbishment, new build, structure, façade, mechanical & electrical services, finishes, furniture, etc - is key to minimising carbon emissions, resource depletion, deforestation, waste and pollution. It is also important to the promotion of human health and wellbeing as we demand more transparency of our materials' provenance and content to avoid toxins and off-gassing in manufacture and in use.

Our choices could lead to new developments in a thriving low carbon bio-based material manufacturing sector both in the UK and slightly further afield.

These considerations overlap with the climate justice topic - we need to consider supply chain impacts on communities worldwide so that material sourcing becomes regenerative at every level, something that currently is not the case.

1. Cambridge Mosque
Marks Barfield

KEY POINTS

- **Host a materials workshop** – with the client and project team, agree an approach to materials and circularity, together with a Sustainable Procurement Plan. Set performance targets and methodology for how to reduce the amount of materials and how to choose them. Review opportunity for material passports (see an example here www.orms.co.uk/insights/materialpassports) to enable future tracking of materials (see BAMB report www.bamb2020.eu) and to use for spec guidelines. Discuss fit-out options (if applicable) with clients in the early stages to avoid waste. See Circularity and Retrofit chapters.
- **Reduce** – apply design strategies to reduce the amount of materials needed including compact design, optimisation of structure and of materials use for finishes.
- **Reuse** – identify opportunities to reuse materials in the design of building structure, skin, services and fit-out. Consider future re-use of the materials as well (see chapter on Circularity).
- **Recycle** – Choose either recycled materials or those incorporating a high recycled content, and materials which can be recycled at the end of their life. Be aware of finishes requirements and paints, adhesives that impact future recyclability (e.g. anodised vs powder coated metals, and coatings on or in glass). Use Life Cycle Assessment to determine if a recycled product is better or not.
- **Choose natural and renewable** – materials that are grown or extracted but not processed often come with both environmental benefits and health impact such as breathability and improved air quality (e.g. timber, bamboo, hemp, straw, wool, mycelium, unfired clay, lime, stone).
- **Aim for materials that need minimal finishes or no finishes** (e.g. no wallpaper, no varnish).
- **Choose locally sourced and manufactured materials** - this provides opportunity to minimise environmental impact from transportation whilst supporting local economies, practices and services. They can also contribute to a sense of place.
- **Use Environmental Product Declarations (EPD); Health Product Declarations (HPD); and products with the International Living Futures Institute's Declare Label** – Ask your supplier if they have an independently certified EPD and HPD, or use the Precautionary Principle (<https://www.iisd.org/articles/precautionary-principle>). Be aware that a product with an EPD is not necessarily sustainable. For guidance on product choice see EU Green Building Product Scout,

GreenSpec UK and The Alliance for Sustainable Building Products (ASPB) - see Resources. Use Life Cycle Analysis (LCA) tools for full analysis of alternative materials options. Aim to avoid materials and products that contain toxic substances included in the Building Red List www.living-future.org/declare/declare-about/red-list and the EU Reach list www.echa.europa.eu/candidate-list-table . Refer to Living Building Challenge's materials approach to ensure healthy choices.

- **Consider maintenance & durability** – Choose durable materials appropriate to the life span of the project, e.g. a pop-up vs a public building. Careful detailing is key for longevity and for materials to perform as intended, faulty use can result in poor environmental performance and health risk. Can it be maintained and cleaned with minimal use of chemicals?
- **Focus on the big wins** – pay particular attention to materials that are being used in big quantities (such as the structure, facade elements, etc) and that users are predominantly exposed to through close contact or prolonged time spent in a space.
- **Construction waste** in the UK amounts to around one third of the total waste output. It is important to work with contractors early on in the process to help develop a site waste management plan—**see the Circularity and Waste chapter**.
- **Consider social implications of materials choices** (labour standards in the supply chain, living wage, modern slavery issues)—**see also the Human Factors chapters**—use certification schemes for internal fit out projects (e.g. GoodWeave label—anti child labour and anti bonded labour certificate for carpets).
- **Consider the biodiversity implications** of materials choices related to the extraction of raw materials, manufacture processes and in use (e.g. chemicals and cleaning products), **and the sustainable supply of materials** (e.g. use FSC/ PEFC timber certifications as standard specification requirements).



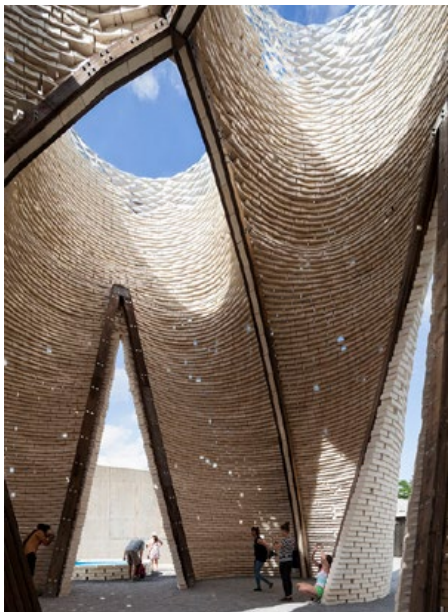
2. Children Village
*Aleph Zero and
Rosenbaum*



3.



4.



5.



6.

EXEMPLARS

1. Cambridge Mosque

Religious | Cambridge, UK
Marks Barfield

marksbarfield.com/projects/cambridge-mosque

2. Children Village

Education | Formoso Do Araguaia, Brazil
Aleph Zero and Rosenbaum

www.archdaily.com/879960/children-village-rosenbaum-plus-aleph-zero

3. Bushey Cemetery

Religious | Hertfordshire, UK
Waugh Thistleton

waughthistleton.com/bushey-cemetery

4. Sands End Arts and Community Centre

Community and Arts | London, UK
MAE

www.mae.co.uk/projects/sands-end

5. Hy-Fi

Installation | New York, US
The Living

www.thelivingnewyork.com/index.html

6. Clay Field

Large Residential | Suffolk, UK
Mikhail Riches

www.mikhailriches.com/project/clay-fields

RESOURCES

LETI Embodied carbon primer
www.leti.london/ecp
 Appendix on materials

AIA Carbon Smart Materials Palette
www.materialpalette.org

Green Spec
www.greenspec.co.uk/green-products

EU Green Building Products Scout
www.building-material-scout.com/en

The ASBP Alliance of Sustainable Building Products
www.asbp.org.uk

Materials for a Healthy, Ecological and Sustainable Built Environment—Principles for Evaluation, 2017, Emina Kristina Petrovic, Brenda Vale and Maibritt Pedersen Zari

Living Building Challenge Materials Petal
living-future.org/lbc-3_1/materials-petal

Red List living-future.org/declare/declare-about/red-list Reach List www.echa.europa.eu/substances-restricted-under-reach

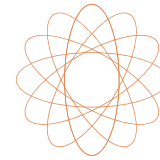
BAMB: Buildings as materials banks
www.bamb2020.eu/library/overview-reports-and-publications

Architecture salvage sites
www.retrouvius.com
www.powerday.co.uk/material-recycling-facilities/metal-recycling
www.salvoweb.com

Reuse materials sites
www.opalis.eu/en

Material passports
www.orms.co.uk/insights/materialpassports

2.5 Operational Energy & Carbon



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|----------------------------|------------------------------|
| 1 Raise Awareness | 7 Whole Life |
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| 3 New Goals | 9 Collaborate & Reduce |
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| 6 Upgrade Existing | 12 Climate Justice |

INTRODUCTION

The operational energy used by buildings over their lifetime is a key contributor to carbon emissions in the atmosphere, so minimising this through good design can achieve significant carbon savings. It also helps reduce fuel poverty (**see the Community, Amenity and Social sustainability Chapter**), and reduce the load on the electricity grid, making it easier for the UK to transition to a grid powered mostly by renewable energy. A good design will consider both operational energy related carbon emissions and embodied carbon to **minimise whole life carbon emissions**.

The operational energy use includes **regulated use** (for lights, heating, hot water, cooling, ventilation, and pumps), and **unregulated use** (any plug-in small power equipment e.g. kettles, TV, computers, and catering, lift operation, or specialist end-uses).

Energy use intensity (EUI) is used to quantify the operational energy use, in kWh/m², that is kWh of total energy (electricity, gas, etc) used per m² (GIA) of building area. The energy use can be estimated (modelled) at design stage by building service engineers or architects, and recent benchmarks can be used at very early stages to guide design choices. The energy use can be translated into greenhouse gas emissions using the conversion factors published by the UK Government (www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021).

Operational energy is influenced by:

- **Passive design measures** (e.g. massing, orientation, glazing, shading, etc),
- **Fabric performance** (e.g. insulation, airtightness, glazing specification, minimal thermal bridges)
- **Low energy services** with adequate controls, commissioning and performance (see separate chapter)

Operational Carbon refers to the greenhouse gas (GHG) emissions arising from all energy consumed by an asset in-use, and water supply and wastewater treatment for an asset in-use, over its life cycle. (Modules B6 operational energy and B7 operational water of the Life cycle stages defined by BS EN 15978:2011 – Whole Life Carbon Network definition. **See the Energy & Whole Life carbon title page for reference to life cycle modules**).

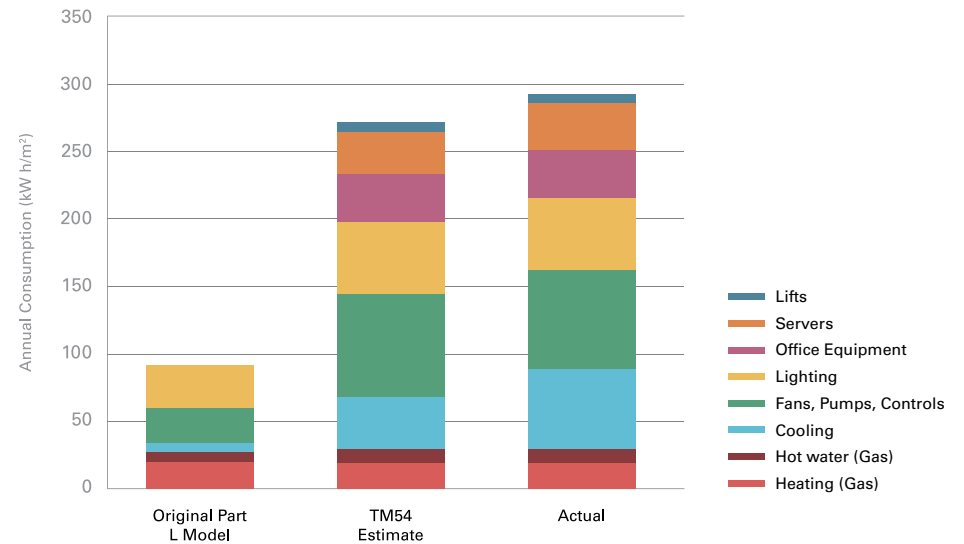


Fig. 15 Part L Model versus TM54 Estimate versus Actual Source CIBSE

KEY POINTS

- **Set ambitious targets** with the client and the design team to aim for as little energy use as possible (minimise the need for heating or electric light during daylight hours), use natural ventilation, heat pumps and heat recovery ventilation.
- **Create an energy strategy with the design team** early in the design process and have an open discussion with the client also at the outset about setting clear energy targets (RIBA Challenge 2030 and LETI Pioneer project targets – see Resources) and how these can be incorporated in the Employer Requirements and followed through on site.
- **Consider design for performance certification**, eg. NABERS
www.nabers.gov.au/about/news/nabers-launches-uk
www.bregroup.com/nabers-uk/nabers-uk-products/nabers-design-for-performance
- **Start with passive measures:** orientation, form factor, massing, controlled glazing ratios, optimised floor to ceiling heights, shading to prevent overheating **and a fabric first approach:** thermal performance of walls, floor, roof, windows, good airtightness and minimal thermal bridges. Consider the appropriate use of thermal mass by using dense materials with high thermal resistance and heat capacity to maximise time lag.
- **Build tight, ventilate right!** Airtight buildings require adequate ventilation (see resources below). Use passive ventilation where appropriate, but mechanical ventilation with heat recovery is likely to be required to save energy and meet energy efficiency targets, alongside openable windows.
- **Develop an appropriate, dynamic energy model to estimate both the regulated energy use** (heating, hot water, ventilation, cooling, lighting) **and unregulated** (small power)- for the latter agree assumptions with the clients based on expected use, occupancy and operation times. The BRUKL SBEM and SAP models for Part L are used for compliance only and are not accurate energy estimation tools. They do not include estimates of the unregulated (small power) energy use, which is significant. Discuss with the client that the MEP consultant includes developing a detailed energy model in their scope of work. Discuss the importance of being able to estimate the energy use at design stage to minimise the performance gap between design assumptions and performance in-use with the client.
- RIBA Sustainable Outcomes guide recommends TM54 or PHPP as suitable energy modelling options, see also Design for Performance below under **Resources**.

- **Avoid fossil fuel-based sources** for heating and hot water—avoid gas and boilers for heating, or stoves which cannot be made zero carbon. Aim for zero combustion on site.
- **Use heat pumps for heating and hot water and heat recovery mechanical ventilation.** Ground source heat pumps (GSHP) can be much more efficient than air source heat pumps (ASHP), but currently more expensive, and require extensive ground work. **See the Low Energy Services chapter.**
- **Consider the embodied carbon** associated with the choice of services and equipment used, their maintenance and replacement requirements.
- **Consider seasonal optimisation and easy to use and to configure operational controls** (building management system settings, operability).
- **Design to minimise and eliminate the performance gap.** Predictions can help guide the design, but high build quality, diligent commissioning and educating the end-users will help achieve the targeted building performance, so monitor the key building aspects all the way to occupation and in-use. **See Post Occupancy Evaluation chapter.**
- **Incorporate energy performance targets (energy budgets) in the building contract** if possible and how the targets are intended to be achieved (clearly defining responsibilities and project brief requirements, e.g. expected operational hours, occupancy levels, etc).
- **Assign responsibilities** for updating the performance targets at key project stages and reconciling with achieved performance in use.
- If working with an existing building, **start by using existing DEC data or existing bills** as a benchmarking tool to indicate areas to make improvements.
www.epcregister.com/reportSearchAddressByPostcode.html

The UKGBC Net zero carbon buildings framework defines net zero carbon operational as the instance “when the amount of carbon emissions associated with the building’s operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/ or off-site renewable energy sources, with any remaining carbon balance offset.”



1. Agar Grove
Hawkins|Brown



2.



3.



4.



5.

EXEMPLARS

1. Agar Grove

Large Residential | London, UK

Hawkins\Brown

www.hawkinsbrown.com/projects/agar-grove

2. Hackbridge Primary School

Education | London, UK

Architype

architype.co.uk/project/hackbridge-primary-school

3. Cranmer Road, King's College

Education | Cambridge, UK

Allies and Morrison

www.alliesandmorrison.com/projects/kings-college-cambridge

4. Goldsmith Street

Large Residential | Norwich, UK

Mikhail Riches

www.mikhailriches.com/project/goldsmith-street

5. Lark Rise

Small Residential | Buckinghamshire, UK

Bere Architects

www.bere.co.uk/architecture/lark-rise

RESOURCES

The LETI Climate Emergency Design Guide

www.leti.london/cedg

LETI net zero one pager

www.leti.london/one-pager

RIBA Sustainable Outcomes—the guide recommends energy targets and addresses a wide range of subjects that can be discussed with the clients and consultants.

www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide

NABERS

www.nabers.gov.au/about/news/nabers-launches-uk and www.bregroup.com/nabers-uk/nabers-uk-products/nabers-design-for-performance

Easi guide to passivhaus design

www.levittbernstein.co.uk/research-writing/easi-guide-to-passivhaus-design

UKGBC net zero carbon framework

www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition

Design for Performance

www.betterbuildingspartnership.co.uk/node/360

RIBA Plan of work—Sustainability Overlay—from page 74 onwards www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work

Energy | People | Buildings - making sustainable architecture work, RIBA Publishing 2021, Kimpian, J., Hartman, H., Pelsmakers, S.

Overheating

www.cibse.org/News-and-Policy/Policy/Key-Technical-Themes-for-2019/Overheating

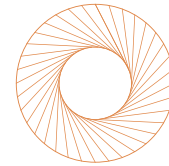
Excellent airtightness resources

www.aecb.net/airtightness

CIBSE TM54: Evaluating Operational Energy Performance of Buildings at the Design Stage

www.cibse.org/Knowledge/knowledge-items/detail?id=a0q200000817f7AAC

2.6 Low Energy Services & Renewables



- | | |
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| 1 Raise Awareness | 7 Whole Life |
| 2 Change Fast | 8 Regenerative Design |
| 3 New Goals | 9 Collaborate & Reduce |
| 4 Share Knowledge | 10 Low Carbon |
| 5 Evaluate Projects | 11 Minimise Waste |
| 6 Upgrade Existing | 12 Climate Justice |



INTRODUCTION

With the electricity grid on a path to decarbonise in the near future, projects can use highly efficient electric energy supply (e.g. heat pumps) for heating, domestic hot water, and cooking. This will ensure the carbon footprint of a building reduces as the grid improves.

The electricity grid has a limited capacity and buildings will still be required to use energy very efficiently to ensure that a decarbonised grid can cope with the demand, avoiding the need for more gas-fired power stations or relying on nuclear power. **As more industries electrify, there will be an increased demand on the grid, so reducing the energy demand of buildings, both thermal and electrical, can help the overall decarbonisation and efficient functioning of the grid.**

Low energy services (such as heat pumps) are an obvious answer to providing energy efficient heating and cooling, once passive measures (orientation, massing, form factor, percentage glazing, shading) have been used, and the performance of the fabric is improved (thermal performance, airtightness, minimising thermal bridges, etc). Low energy services such as heat pumps and heat recovery ventilation will not work well with leaky, energy intensive buildings.

Renewable energy can be generated on-site, feeding into the grid when not needed, thus assisting with grid decarbonisation. Battery storage at domestic and commercial scale is becoming more readily available, and microgrids serving groups of housing units are likely to be more cost effective.

1. Powerhouse Kjørbo
Energy Plus Building
Snøhetta

KEY POINTS

- **Consider passive measures and an improved fabric performance first**, to prevent high energy costs and help a decarbonised grid cope with the demand. (see **Operational Energy** chapter).
- **The building services controls should be simple**, easy to adjust, and should be included in a visual user guide for the building users/facilities managers.
- **Consider how seasonal operational optimisation can be addressed**, and coordinate with the services engineers to ensure that adequate commissioning is taking place at completion and in the first year of operation (see **Post Occupancy Evaluation** chapter).
- **Heat pumps** significantly reduce the amount of energy needed for heating, by a factor of 2.5-3.0 (called Coefficient Of Performance—COP) for air source heat pumps (ASHPs), and up to 7.0 for a ground source heat pump (GSHP). **Attention must be paid to the selection of refrigerants**, which can have a global warming potential (GWP) much worse than CO₂. They can also have shorter lifespans than other equipment, requiring replacement every 20–25 years.
- **Low Global Warming Potential (GWP) refrigerants**—R-290 (propane) and R-744 (CO₂) are currently the best available in the UK, and should be prioritised. Leakage should be expected, even in well maintained systems.
- **Fifth Generation heat networks**—share heat across a site with good load diversity (such as a mix of residential, office, and retail) improving the performance of local heat pumps.
- **Mechanical ventilation** with heat recovery (MVHR) will provide fresh, filtered air, and can deliver high energy savings by recovering heat which otherwise would be lost (i.e. by using simple extract ventilation MEV).
- **PV panels**—simplest way to produce electricity on site, and are reasonably cost efficient, even without feed-in tariffs. Consider how their location and orientation and angle can be optimised to increase their energy output.
- **Solar thermal**—can work well in buildings with a high summertime hot water load, but can be more difficult to commission than a PV system. PVs feeding into a thermal store can work out to be more cost effective.
- **Wind turbines**—suitable in a rural setting, often require strict planning approval, with site specific wind and noise surveys carried out.

- **Water wheels**—energy from running water requires a significant flow, either speed or quantity, and potentially approval from the Environment Agency.
- **Feed-in-tariffs** (www.gov.uk/feed-in-tariffs)—help improve the cost for a renewable energy generation system, but are subject to change.
- **Battery storage**—to provide generated energy on site outside daylight hours. These can be linked together to make site-wide storage and local energy networks.
- **Discreet PV systems**—most panels can be retrofitted and fixed over existing roof systems, or can be integrated systems (in roof or facade).



2. Aktiv-Stadthaus Speicherstraße
HHS Planer + Architekten AG



3. Métropole
Rouen Normandie
HQ—*Integrated
Photovoltaic panels
on the roof and
facade.*
*Ferrier Marchetti
Studio*



4.



5.

EXEMPLARS

1. Powerhouse Kjørbo

Office | Baerum, Norway

Snøhetta

nordregio.org/sustainable_cities/powerhouse-kjorbo

2. Aktiv-Stadthaus Speicherstraße

Large Residential | Frankfurt, Germany

HHS Planer + Architekten AG

hhs.ag/projekte.html?projekt=aktiv-stadthaus-frankfurt&typologie=

3. Métropole Rouen Normandie HQ

Office | Rouen, France

Ferrier Marchetti Studio

ferriermarchetti.studio/project/metropole-rouen-normandie

4. Trent Basin

Large Residential | Nottingham, UK

Marsh Grochowski Architects

www.cibsejournal.com/case-studies/battery-packs-a-punch-europes-largest-community-energy-battery

5. White Collar Factory

Office | London, UK

AHMM

www.ahmm.co.uk/projects/office/white-collar-factory

RESOURCES

Estimate PV generation for free by PVWatts
pvwatts.nrel.gov

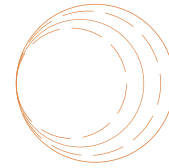
Feed-in-tariff rates from Ofgem
www.ofgem.gov.uk/environmental-programmes/fit/fit-tariff-rates

Global Warming Potential (GWP) of different refrigerants
ww2.arb.ca.gov/resources/documents/high-gwp-refrigerants

A good starter on batteries and solar
www.bre.co.uk/filelibrary/nsc/Documents%20Library/NSC%20Publications/88166-BRE_Solar-Consumer-Guide-A4-12pp-JAN16.pdf

Simple guide to renewable energy technology from the Centre for Alternative Technology
www.cat.org.uk/info-resources/free-information-service/energy

2.7 Power Purchase Agreements & Carbon Offsetting



- 1 **Raise Awareness**
- 2 Change Fast
- 3 New Goals
- 4 Share Knowledge
- 5 **Evaluate Projects**
- 6 Upgrade Existing
- 7 **Whole Life**
- 8 **Regenerative Design**
- 9 Collaborate & Reduce
- 10 Low Carbon
- 11 **Minimise Waste**
- 12 **Climate Justice**

INTRODUCTION

Whole Life Carbon emissions are the sum total of all building related greenhouse gas (GHG) emissions and removals, **both operational and embodied over the life cycle** of a building including its disposal (Modules: A1-A5 Upfront; B1-B7 In Use, B8, B9 for infrastructure only, C1-C4 End of Life). (Whole Life Carbon Network definition). **See Embodied Carbon and Operational Energy & Carbon chapters.**

The UKGBC Net zero carbon buildings framework mentions that, **‘A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset.’**



Energy use not met by on-site renewables should be met by an investment into additional renewable energy capacity off-site OR a minimum 15 year renewable energy power purchase agreement.

Power Purchase Agreements (PPA)

A PPA is a long term contract between a business and a renewable energy provider, where the business agrees to purchasing renewable energy, which means the renewable energy provider has the financial security to add additional renewable energy capacity to the grid. PPAs currently require substantial projects, or a collective of building occupiers, so it is more challenging to use for smaller scale projects.

The remaining carbon emissions can be balanced off through investment in offsetting.

Carbon offsetting means that emission reductions or removals achieved by one entity (carbon offsetting scheme) can be used to compensate (offset) the emissions of another entity (building/project/asset).

The simplest form of offsetting is through tree planting, with the trees absorbing the atmospheric CO₂ and storing it within the biomass of the plant. Other forms of carbon offsetting include carbon capture and storage, restoring habitats, etc. See the UKGBC Renewable Energy Procurement & Carbon Offsetting document and LETI’s Embodied Carbon primer Offsetting appendix 10 for guidance, under **Resources** below.

CO₂ is a long lasting molecule, so removing CO₂ prior to emissions has a benefit in reducing overall cumulative global warming. **Carbon offsetting should be the last option when trying to reduce carbon footprints.**

KEY POINTS

- **First step to avoid offsetting** is to minimise the energy use and the sources of carbon emissions, through passive measures (orientation, massing, form factor, percentage glazing, shading, etc), improving the fabric performance (insulation, airtightness, minimised thermal bridges), and reducing embodied carbon emissions.
- **Use Power Purchase Agreement** in first instance and investigate options to invest in off-site renewables
- **Key requirements of offsetting** are: accurate measure of emissions to offset (see Embodied Carbon and Operational Energy & Carbon chapters), accurate measure of the carbon saved elsewhere, and additonicity (i.e. is the funding supporting carbon saving measures or would they have happened without the offset funding).
- **Use the Gold Standard for offsetting schemes**, which provides an independent audit to ensure viability of schemes.
- **Prioritise schemes that can be audited**, to ensure that they are viable (e.g. ensure trees are still alive).
- **Projects aiming for net zero** should not assume future availability of low cost offsetting options, as currently costs vary, from £5 per tCO₂e to over £500 per tCO₂e, but will rise as the cheaper options are taken up (we only have so much space for forests in the UK).

RESOURCES

UKGBC Renewable Energy
Procurement & Carbon Offsetting
[www.ukgbc.org/ukgbc-work/
renewable-energy-procurement-
carbon-offsetting-guidance-for-net-
zero-carbon-buildings](http://www.ukgbc.org/ukgbc-work/renewable-energy-procurement-carbon-offsetting-guidance-for-net-zero-carbon-buildings)

LETI Embodied carbon primer
www.leti.london/ecp
Appendix 10, p.109— Offsetting

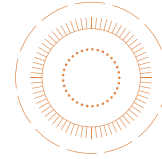
RIBA Sustainable Outcomes
[www.architecture.com/knowledge-
and-resources/resources-landing-page/
sustainable-outcomes-guide](http://www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide)

www.climatecare.org

[www.woodlandcarboncode.org.uk/
about/context](http://www.woodlandcarboncode.org.uk/about/context)

IstructE Guide to offsetting
[www.istructe.org/journal/
volumes/volume-99-\(2021\)/
issue-7/a-short-guide-to-carbon-
offsetting](http://www.istructe.org/journal/volumes/volume-99-(2021)/issue-7/a-short-guide-to-carbon-offsetting)

3 ECOLOGY



INTRODUCTION

The Architects' Declaration recognizes two interlinked crises, climate change and biodiversity loss: both impact on the design of the built environment, including all of its natural components.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) suggests that one million species are currently at risk of extinction (www.ipbes.net/global-assessment). Most ecologists agree that we are currently experiencing the sixth mass extinction of species in the history of life on Earth (see **Resources**).

The mass extinction currently underway refers to the loss of many plant and animal species, from mosses to insects, to birds and bats which were once part of the diversity of life in the UK, and worldwide.

In the UK the link between social, economic and ecological policies was recently re-emphasised by the Dasgupta Review www.gov.uk/government/collections/the-economics-of-biodiversity-the-dasgupta-review which states:

'We are part of Nature, not separate from it. We rely on Nature to provide us with food, water and shelter; regulate our climate and disease; maintain nutrient cycles and oxygen production; and provide us with spiritual fulfilment and opportunities for recreation and recuperation, which can enhance our health and well-being'.

The Covid pandemic has highlighted the adverse effects that a lack of personal and communal greenspace in our cities can have on our wellbeing. We need to redefine our relationship with nature.

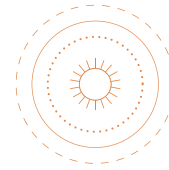
"We are part of Nature, not separate from it. We rely on Nature to provide us with food, water and shelter; regulate our climate and disease; maintain nutrient cycles and oxygen production; and provide us with spiritual fulfilment and opportunities for recreation and recuperation, which can enhance our health and well-being."

The Economics of Biodiversity: The Dasgupta Review



1. Bryggervangen
and Sankt Kjeld's
Square
SLA

3.1 Biodiversity



- 1 **Raise Awareness**
- 2 Change Fast
- 3 **New Goals**
- 4 Share Knowledge
- 5 **Evaluate Projects**
- 6 Upgrade Existing
- 7 Whole Life
- 8 **Regenerative Design**
- 9 Collaborate & Reduce
- 10 Low Carbon
- 11 Minimise Waste
- 12 **Climate Justice**



INTRODUCTION

Every built project is part of a highly modified ecosystem. Most urban areas are now devoid of many of the characteristics of ecosystems as they are dependent on fossil fuels, do not recycle waste and have little space for organisms other than people. How can we give back more than we are taking away?

We need to consider the ecosystem impacts and the potential for biodiversity and habitat losses (e.g., in the course of manufacture of materials) as well as within the site red line and within the ecological zone of influence of the project.

Areas of urban development globally have doubled since 1992, destroying habitats and displacing or destroying species. This means that whether we are involved in large scale planning development, or smaller sites and buildings, everything we do should be informed by the science of ecology.

The need for this has been recognised by the UK Government, and with the passage of the Environment Act it will become mandatory to secure biodiversity net gain in development projects.*

Use of biotic systems as part of the urban design palette has been referred to as the use of ‘nature-based solutions’ on which there is extensive guidance, much of it produced in Europe.

2. Mountbatten House
Arup/Grant Associates

*For guidelines on how to approach biodiversity net gain in any development [cieem.net/wp-content/uploads/2019/02/C776a-Biodiversity-net-gain.-Good-practice-principles-for-development.-A-practical-guide-web.pdf](https://www.cieem.net/wp-content/uploads/2019/02/C776a-Biodiversity-net-gain.-Good-practice-principles-for-development.-A-practical-guide-web.pdf)

KEY POINTS

- **Work with experts**—Consider engaging ecological consultants as standard practice, and assess existing conditions on both rural and urban projects.
- **Assess existing conditions**—Advise that baseline surveys are undertaken for the site and surrounding area at the earliest design stages of a project.
- **Design for resilience**—Consider the resilience of existing and created ecosystems on the site and wider area, and their ability to provide long term ecosystem services. This needs to start with the soils and include all trophic levels in the relevant systems.
- **Introduce green roofs & walls**—Explore opportunities for biodiversity on roofs (subject to safe access), walls, window boxes and internal planting. Consider water-absorbing planted roof coverings for increasing attenuation and improved biodiversity.
- **Explore opportunities for tree planting**— and assess the biodiversity value of any existing trees. The value of trees for biodiversity is greatly increased when they are provided with a shrub, ground flora and deadwood understorey. See resources on Street tree cost/benefit analysis.
- **Create homes for wildlife**—Consider the use of artificial refuges for desired species of native animals, such as solitary bees or birds or bats, as part of an approach to the overall design that aims to meet their lifecycle habitat requirements.
- **Introduce water sensitive urban design**—This directly affects ecosystems, eg. via acidification and eutrophication of water systems. **See the Water Use chapter.**
- **Understand the local ecological context**—Use local features as a framework for all proposals and incorporate them into the scheme to reference, reflect and enhance surrounding biodiversity.

- **Design for wellbeing**— allow provision of key ecosystem services to promote health and wellbeing by advising on site selection where possible, to choose sites located close to communities, making designs accessible for all and helping break down cultural and social barriers, to facilitate community cohesion. **See the Human Factors & Climate Justice chapters.**
- **Engage with local groups promoting action on this topic**—e.g. Architects Climate Action Network (ACAN) has a thematic group aimed at tackling biodiversity challenges—Where The Wild Things Aren't.
- **Consider material choices to reduce pollution**, which has a significant impact on biodiversity (e.g. choose low VOC products, check products for toxic substances in the product manufacturing process by asking the supplier to share their Environmental Product Declarations- (EPD) and Health Product Declarations (HPD). **See the Materials and Health & Wellbeing chapters.**

Consider the resilience of existing and created ecosystems on the site and wider area, and their ability to provide long term ecosystem services. This needs to start with the soils and include all trophic levels in the relevant systems.



3. Dalston
Eastern Curve
J&L Gibbons



4.



5.

EXEMPLARS

1. Bryggervangen and Sankt Kjeld's Square Landscape | Copenhagen, Denmark SLA

www.sla.dk/en/projects/bryggervangen-sankt-kjelds-plads

2. & 5. Mountbatten House Office | Basingstoke, UK Arup/Grant Associates

research.hgt.org.uk/item/mountbatten-house-the-hanging-gardens-of-basingstoke

3. Dalston Eastern Curve Community Garden | London, UK Landscape: J&L Gibbons

jlg-london.com/Dalston-Eastern-Curve-Garden

4. Stratford East Village Large Residential | Stratford, UK Hawkins Brown, Eric Parry, HT

www.eastvillagelondon.co.uk

RESOURCES

RIBA Sustainable Outcomes

www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide

Designing for Biodiversity: A technical guide for new and existing buildings, Williams, Carol; Gunnell, Kelly; Carol Williams, Murphy, Brian

Living Roofs

www.livingroofs.org

Building with Nature User Guide; including Core, Wellbeing, Wildlife and Water Standards

www.buildingwithnature.org.uk

Natural England Biodiversity Metric publications.naturalengland.org.uk/publication/5850908674228224

DEFRA Department for the Environment, Food and Rural Affairs - Biodiversity Metric 2.0. publications.naturalengland.org.uk/publication/5850908674228224

The Sixth Extinction by Elizabeth Kolbert (Bloomsbury 2015)

www.bloomsbury.com/uk/sixth-extinction-9781408851241

London Plan Urban Greening Factors www.london.gov.uk/what-we-do/planning/london-plan/london-plan-guidance/urban-greening-factor-ugf-guidance

UKGBC Biodiversity Net Gain Actor and Resource Map

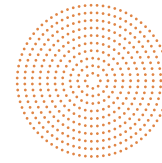
embed.kumu.io/0933341b0531fdc3cc72e3e-90077a5eb#biodiversitynetgain

StreetTree Cost Benefit Analysis www.treconomics.co.uk/wp-content/uploads/2018/08/GBU_Street-Tree-Cost-Benefit-Analysis-2018.pdf

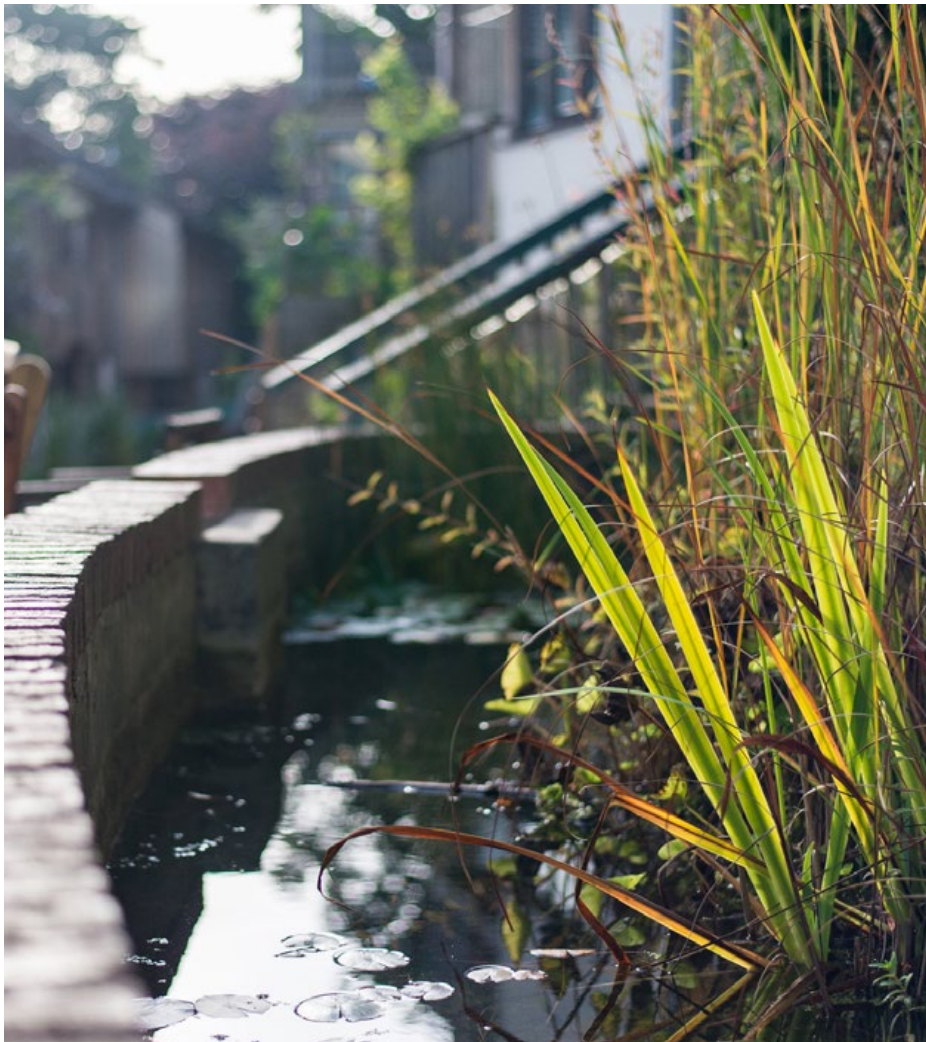
UNECE Air Pollution, Ecosystems, Biodiversity

www.unece.org/air-pollution-ecosystems-and-biodiversity

3.2 Water Use



- | | |
|----------------------------|------------------------------|
| 1 Raise Awareness | 7 Whole Life |
| 2 Change Fast | 8 Regenerative Design |
| 3 New Goals | 9 Collaborate & Reduce |
| 4 Share Knowledge | 10 Low Carbon |
| 5 Evaluate Projects | 11 Minimise Waste |
| 6 Upgrade Existing | 12 Climate Justice |



INTRODUCTION

Water resources are already stretched in the UK and around the world and, as the climate changes, drought conditions are predicted to become increasingly common. The UK has no centralised water network, so water stress can be very location specific.

Avoiding unnecessary use of potable water is key to reducing the likelihood of future droughts while the industry becomes increasingly aware of this issue. This is not just about using water efficiently, but also using alternative sources of water where we can, such as rainwater or greywater. Work with the water outflows from the site to understand the opportunities for retention and reuse.

Reducing unnecessary water consumption can also significantly impact a building's carbon footprint, often reducing the domestic hot water heating demand and its associated carbon emissions.

1. Springhill Co-Housing
Architype/Robert Bray



2. Springhill Co-Housing

Architype/Robert Bray

KEY POINTS

- **Recommend the use of water meters**—which can reduce the billed cost of water, as well as enable reporting against RIBA 2030 metrics. Smart water meters can also help water suppliers identify leaks.
- **Recommend installation of leak detection**—for medium and large developments, detecting slow leaks that may not otherwise be noticeable.
- **Use low-flow fittings**—physically reducing the amount of water used, often with little noticeable difference in flow.
- **Specify self-closing taps**—in communal toilets to prevent taps being left running.
- **Specify showers instead of baths** wherever possible and suitable for the client—typically use less water, and save space. Mist showers can use even less water and can be an option for domestic buildings.
- **Specify efficient WCs**—dual-flush toilets are the best practice solution, but zero water toilets are also possible. Waterless urinals are an effective solution in male WCs.
- **Recommend using rainwater for irrigation**—where possible, by connecting the water butts to the rainwater system; this is often better for the plants than using potable water.
- **Propose low flow irrigation**—automated drip systems which avoid overwatering and water wastage.
- **Recommend the use of integrated SUDS**—work with the engineers and consultants to define water collection, treatment, and reuse strategies wherever possible. Link to design of attenuation and sustainable urban drainage systems (SUDS) on a site wide basis.
- **Recommend rainwater harvesting**—for toilets can be a simple solution, but requires space for a tank and separate pipework that is clearly labelled as non-potable water. For large developments this tank can be located underground.
- **Recommend greywater and blackwater harvesting**—where possible, use shower/bath/basin runoff to flush toilets, etc.



3. Klingelbeek Estate
Vic Landscapes



4.



5.

EXEMPLARS

1. & 2. Springhill Co-Housing

Large Residential | Stroud, UK

Architype/Robert Bray Associates

www.susdrain.org/case-studies/case_studies/springhill_cohousing_development_springfield_road_stroud_gloucestershire.html

3. Klingelbeek Estate

Small Residential | Arnhem, Netherlands

Vic Landscapes

www.viclandscapes.nl/klingelbeek/

4. DATA 1

Office | Seattle, USA

Weber Thompson

www.weberthompson.com/project/data-1/#anchor-landscape-architecture

5. Frick Environmental Centre

Education | Pennsylvania, USA

Bohlin Cywinski Jackson

www.bcj.com/projects/civic-cultural/frick-environmental-center

RESOURCES

Table 8.3 of BREEAM 2018 provides indicative flow rates /capacities to be targeted

www.breeam.com/NC2018/#08_water/wat01_nc_a.htm#Water_efficient_consumption_levels_by_component_type

RIBA Sustainable Outcomes

www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide

Waterwise www.waterwise.org.uk

Living Building Challenge water use approach

living-future.org/lpc/water-petal

RIBA Plan of Work – Sustainability Overlay – from page 74 onwards

www.architecture.com/-/media/GatherContent/Test-resources-page/Additional-Documents/2020RIBAPlanofWor_koverviewpdf.pdf

4 HUMAN FACTORS & CLIMATE JUSTICE



INTRODUCTION

People are spending over 90% of their time inside their homes, so designing internal spaces that foster healthy lifestyles, and outdoor spaces that encourage people to be active and to facilitate a connectedness with nature and others, are important aspects of designing built environments.

The twin crises of climate and biodiversity emergency have potential for untold impact on humankind, as well as nature and environmental systems. We are already seeing that the consequences of our changing climate are more likely to impact the least advantaged in our communities, and that globally those who are most responsible for climate change are least likely to face difficulties arising from this.

Here in the UK, issues such as fuel poverty, lack of access to green space, air pollution and poor internal air quality disproportionately affect Black, Asian and Minority Ethnic communities as well as those who are less well-off in our society. In addressing the climate and biodiversity crises, there is huge potential for future investments and structural change in how we design our built environment to address the structural inequalities that exist and to ensure socially equitable outcomes in relation to climate change. It is important for us to consider human factors and climate justice not only in new construction, but in retrofit of existing buildings to anticipate likely climate changes and risks arising - e.g. flooding, overheating etc. We should avoid designing poorly performing new buildings that would require near-future retrofits, in order to provide human comfort in a more challenging, changed climate, as this is inherently wasteful in resources and time.

Climate justice - It is important to be aware that the effects of climate change disproportionately impact the people who already face social injustices and racism, and have done the least to cause it. 'The global North is responsible for 92% of

total excess CO₂ emissions' (Jason Hickel). These impacts will be felt greatest by communities elsewhere in the world, where temperatures are likely to rise beyond habitable levels and sea levels rise to encroach existing settlements. These are the people who have the least resources to remedy these effects.

Social justice needs to be an underpinning principle of everything we do, and it is only recently getting the attention it deserves.

Climate justice has only recently been added as an additional AD declaration point:

12 Climate Justice

We will seek to support those who are working for climate justice and strive to ensure equity and an improved quality of life for all.

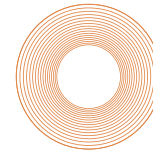
At this stage no specific principles have been given within this guide, avoiding over-simplifying an incredibly complex and important topic.

We hope to develop this further with feedback from signatory practices, so that future iterations of this guide will incorporate increased guidance on social justice, as we all learn more.



1. R-Urban
*Atelier d'Architecture
Autogeree*

4.1 Community, Amenity & Social Sustainability



- | | | | |
|---|--------------------------|----|----------------------------|
| 1 | Raise Awareness | 7 | Whole Life |
| 2 | Change Fast | 8 | Regenerative Design |
| 3 | New Goals | 9 | Collaborate & Reduce |
| 4 | Share Knowledge | 10 | Low Carbon |
| 5 | Evaluate Projects | 11 | Minimise Waste |
| 6 | Upgrade Existing | 12 | Climate Justice |



INTRODUCTION

Kate Raworth's Doughnut diagram (Fig. 10, p.35) describes the social foundation upon which a safe and just space for humanity can be created, without going beyond Earth's ecological boundaries.

A key aspect of sustainable and regenerative design is providing the basis for social sustainability and the backdrop against which communities can develop and thrive, in existing and new developments.

A good design will aim to:

- Assess the impact the project has on the existing community and how it can provide local amenity, how it improves the health and wellbeing of the users of the building, and how it can withstand future climate change.
- Consider the wider communities that are affected or connected with the project through the construction process, through supply chains and broader impacts of the construction.
- Explore existing local social networks and how the project will impact these, and what positive contribution it can bring about in the area, to established communities.

2. Rise Temporary Theatre
Collective Works

3. Musholm AART Architects



KEY POINTS

- **Involve communities** in the making and monitoring of their buildings and places. Ensure that participation is built into the process so that people feel committed to their places.
- **Consider using local materials and services** to encourage a sense of connection to the place.
- Encourage the local procurement of maintenance for buildings maintenance. Can the building use materials/components that have a local support network? See the Circularity & Waste chapter.
- New buildings can be daunting and unintelligible. **Providing simple guides** and drop-in sessions can help the occupants understand their building and settle into a low carbon routine, understand the management and controls, and optimise it for seasonal operation. **See the Operational Energy & Carbon chapter.**
- Supporting a transition to a low carbon economy means working with suppliers to develop their products to be more sustainable. **Aim to work with local businesses that will share the benefits with their local community.**
- **Fuel poverty** can cause significant health issues, this can be mitigated through low carbon design which results in low fuel bills. **See Operational Energy & Carbon, Low Energy Services & Renewables and Health & Wellbeing chapters.**
- Communities can become disconnected and miss out on sharing informal knowledge that can help support a healthy, sustainable lifestyle. **Fostering community groups through provision of flexible, shared spaces and focused community engagement** can provide an opportunity for a network for them to help each other.
- **Build-in resilience** in projects to withstand climate change and to ensure that they can continue to be the thriving, low carbon spaces they were designed to be, resilient in extreme weather. **See the Adaptability and Resilience chapter.**
- **Aim to work with schools and teachers** to embed sustainability and regenerative design in their curriculum.



4. Marmalade Lane
Co-Housing
Mole Architects



5.

EXEMPLARS

1. R-Urban

Large Residential | Paris, France
Atelier d'Architecture Autogeree
r-urban.net/en

2. Rise

Temporary Theatre | London, UK
Collective Works
collectiveworks.net/projects/temporary-theatre

3. Musholm

Recreation | Korsor, Denmark
AART Architects
aart.dk/en/projects/musholm

4. Marmalade Lane Co-Housing

Large Residential | Cambridge, UK
Mole Architects
www.marmaladelane.co.uk
www.molearchitects.co.uk/projects/housing/k1-cambridge-co-housing

5. St Clement's

Large Residential | London, UK
JTP
www.jtp.co.uk/projects/st-clements-hospital

6. Freiburg Vauban District

Large Residential/Urban Planning | Freiburg, Germany
Masterplan Architect: Kohlhoff & Kohlhoff
www.smartcitiesdive.com/ex/sustainablecitiescollective/words-most-successful-model-sustainable-urban-development/229316



6.

RESOURCES

RIBA Sustainable Outcomes
www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide

Living Building Challenge Health & Happiness Petal—healthy neighbourhood design
living-future.org/lcc/health-happiness-petal/#08-healthy-neighborhood-design

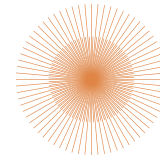
UKGBC Social Value measurement
www.ukgbc.org/ukgbc-work/delivering-social-value-measurement and
www.ukgbc.org/ukgbc-work/social-value

www.architecture.com/-/media/GatherContent/Social-Value-Toolkit-for-Architecture/Additional-Documents/RIBAUoR-Social-Value-Toolkit-2020pdf.pdf

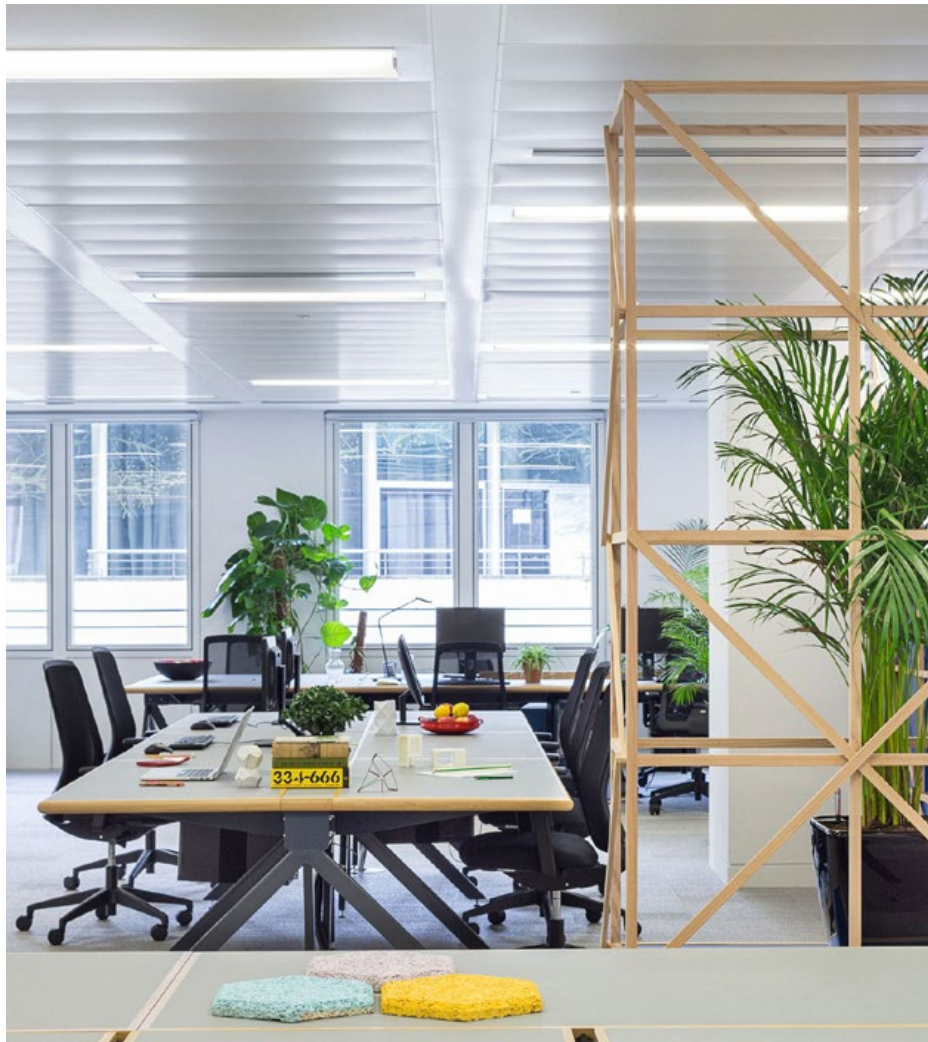
Connective Social Infrastructure
www.london.gov.uk/sites/default/files/connective_social_infrastructure_0_0.pdf

RIBA Social Value Toolkit
www.architecture.com/-/media/GatherContent/Social-Value-Toolkit-for-Architecture/Additional-Documents/RIBAUoR-Social-Value-Toolkit-2020pdf.pdf

4.2 Health & Wellbeing



- 1 **Raise Awareness**
- 2 Change Fast
- 3 New Goals
- 4 Share Knowledge
- 5 **Evaluate Projects**
- 6 **Upgrade Existing**
- 7 Whole Life
- 8 **Regenerative Design**
- 9 Collaborate & Reduce
- 10 Low Carbon
- 11 Minimise Waste
- 12 **Climate Justice**



INTRODUCTION

In 2013, World Green Building Council reported on ‘The Business Case for Green Building’ and highlighted research demonstrating that green buildings could enhance health and wellbeing for their occupants.

At the same time, in the current biodiversity crisis, closeness with the natural environment will foster a culture more likely to take care of local biodiversity and ecology (with impact on the wider planetary systems). Providing good internal and external air quality and adequate thermal, acoustic and visual comfort are beneficial to the health and wellbeing of a building’s occupants but can also be a way of reducing pollutants into the wider atmosphere.

How can we create healthy buildings that foster the wellbeing of their users?

The Healthy Buildings Program of the Harvard T.H. Chan School of Public Health (see Resources) suggests nine foundations to a healthy building: ventilation, air quality, thermal health, moisture, lighting and views, noise, water quality, dust and pests, safety and security.

1. One Carter Lane
Cundall/Studio Ben Allen

KEY POINTS

- **Consider using guidance that provides a holistic view to health & wellbeing design areas** (eg. The International Living Future Institute ILFI & the Living Building Challenge, the Healthy Buildings Program of the Harvard T.H. Chan School of Public Health, etc) or consider adopting an established framework, to enable a focus on health and wellbeing in design (e.g. WELL, Fitwel, etc).
- **Discuss air quality** and sources of pollution and any need for testing or mitigating measures. Consider the ingress of pollutants from the outside, pollutants from the fabric of the building and pollutants that arise from occupants' lifestyle and activities.
- **High-filtration mechanical ventilation**, with high-efficiency particulate absorbing filter and high-efficiency particulate arrestance (HEPA) filters to remove incoming particulates where supply air cannot be located away from sources of external pollution. **See also the Low Energy Services chapter.**
- **Specify healthy materials** that don't use toxic substances in the manufacturing process (ask the suppliers to provide information - **see also the Materials chapter**). **Specify materials that are low in VOCs** during the construction process and post occupation where feasible. Educating the contractor and the client from the outset to have their buy-in is crucial as everything impacts on the internal air quality from the cleaning products used to the plant pots selected.
- **Set up a project materials tracker** to help discuss healthy and sustainable materials for each category from the early design stages: infrastructure, superstructure, facade/cladding, internal finishes, furniture.
- **Explore biophilic design** including: ventilated green walls, allowance for plants throughout the building, open views to nature, and exposing natural materials in the design.
- **Monitor the incoming mains water** quality to assess if filters are needed to achieve WHO recommended limits.
- **Consider adequate lighting design** that helps reduce disruption to the circadian system. Synchronizing lighting to work with the natural day-night cycle has been shown to improve sleep quality, mood and productivity.
- **Design for climate change** to build-in resilience for the unknown future impacts of climate change, especially overheating risks, by using passive design measures and adequate services. **See Adaptability & Resilience, Operational Energy & Carbon, and Low Energy Services chapters.**
- **Embrace adaptive thermal comfort** (see resources) to reduce the energy associated with providing a comfortable environment.
- **Consider ways to promote exercise** through easy access to opportunities for physical activity, including: safe and secure cycle storage, designated activity space.
- **Include opportunities to connect people** at every scale, as this increases the sense of inclusion, social cohesion, and wellbeing. **See also the Community, Amenity & Social Sustainability chapter.**
- **Make buildings easily adaptable** to various uses and spatial configurations, as this can help foster a sense of empowerment, ownership of the space, and connection with others.
- **Work to reduce the in-use costs of buildings**, to alleviate fuel poverty and its high impact on health and wellbeing. **See also the Operational Energy & Carbon chapter.**



2. Maggie's Centre
dRMM Architects



3.

EXEMPLARS

1. One Carter Lane
Office | London, UK
Cundall/Studio Ben Allen
cundall.com/Projects/One-Carter-Lane.aspx

2. Maggie's Centre
Health | Oldham, UK
dRMM Architects
drmm.co.uk/project/maggies-oldham

3. Pennington Street Warehouse
Office | London, UK
JTP
www.jtp.co.uk/projects/pennington-street-warehouse-wapping

4. Garden School Hackney
Education | London, UK
Oliver Heath Design
www.oliverheath.com/portfolio-item/garden-school-hackney



4.

RESOURCES

The Healthy Buildings Program of the Harvard T.H. Chan School of Public Health
9foundations.forhealth.org

RIBA Sustainable Outcomes
www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide

Living Building Challenge Health & Happiness Petal—healthy neighbourhood design
www.living-future.org/lcc/health-happiness-petal/#08-healthy-neighborhood-design

Living Building Challenge Declare Label
www.declare.living-future.org

www.worldgbc.org/health-framework

Fitwel Guidance www.fitwel.org

World GBC Better Places for People Well V2 Guidance
www.worldgbc.org/better-places-people

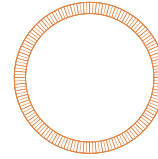
www.v2.wellcertified.com/wellv2/en/overview

CIBSE TM52 The Limits of Thermal Comfort: Avoiding Overheating in European Buildings

RIBA Social Value Toolkit
www.architecture.com/-/media/GatherContent/Social-Value-Toolkit-for-Architecture/Additional-Documents/RIBAUoR-Social-Value-Toolkit-2020pdf.pdf

Adaptive Thermal Comfort Model
en.wikipedia.org/wiki/Thermal_comfort#Adaptive_comfort_model

4.3 Adaptability & Resilience



- | | | | |
|---|-------------------|----|----------------------|
| 1 | Raise Awareness | 7 | Whole Life |
| 2 | Change Fast | 8 | Regenerative Design |
| 3 | New Goals | 9 | Collaborate & Reduce |
| 4 | Share Knowledge | 10 | Low Carbon |
| 5 | Evaluate Projects | 11 | Minimise Waste |
| 6 | Upgrade Existing | 12 | Climate Justice |

INTRODUCTION

As architects, our aim is to create buildings and spaces with longevity that respond to environmental challenges and inevitable ongoing and future climate change.

We understand climate change is already happening and that mitigation and adaptation principles are required to limit the effects of further climate change. We are in a period of trying to reduce our impacts on the planet, however even if we stopped emitting greenhouse gases (GHGs) into the atmosphere today, the existing GHGs will continue to warm the planet. This means that temperatures will continue to rise (with estimates ranging from 2-5°C average temperature increase by the end of this century), with increasing instances of extreme weather events (heatwaves, excessive winds, rain) and water events such as droughts and flooding.

Ecological and climatic feedback loops may cause the extreme weather events to accelerate at a rate we had not anticipated. We will need to adapt the majority of the existing built environment, including schools, homes and workplaces, to maintain healthy internal temperatures and habitable buildings in this changing climate. New buildings constructed today should be designed to be adaptable for future changing uses, to avoid demolition and waste, and wherever possible, designed to anticipate future climate risks. Therefore, what we design today needs to take into account the likely future, to protect the quality of life of occupants and to limit the necessity, and extent, of future retrofits.

The biodiversity crisis is another great threat to a stable future for humankind on Earth. It is characterised by a rapid loss of species and degradation of ecosystems, destroying nature - our life support system.

Exploitation of resources for use in construction are part of the cause - e.g. using sand for concrete, exotic timber, rare metals for renewable technologies. It is therefore vital, going forward, to treat all resources as extremely precious.

Resilience

Resilience is the ability of the built environment and society to withstand and recover from extreme events, either natural or manmade, e.g. flood, pandemic, food insecurity, migration, conflicts and consequent societal challenges. Climate change can have a number of impacts that require assessment, mitigation and adaptation measures for the built environment. Negative impacts can include higher wind speeds, extreme cold, overheating, flood and more frequent extreme weather events. Resilience will be enhanced by the careful use of passive measures (working with massing, orientation, glazing area, shading, etc), fabric performance and adequate operational controls and management (**see Operational Energy & Carbon chapter**), and also strong community cohesion. **See Community, Amenity & Social Sustainability chapter.**

Adaptability & Flexibility

To enable longevity of the built environment there is a need to allow for change, to meet the needs of the present, but with consideration of how those needs might change in the future, and to enable periodic remodelling. A 'loose fit' approach will more easily enable modifications and replacement of parts, with space for alternative technologies. Flexibility is required in order to balance the needs of the present with how those needs will develop over time and to enable change through easy reconfiguring, with minimum carbon emissions. **See the Circularity & Waste chapter.**

KEY POINTS

- **Assess the life-span of different building elements** and ensure that:
 - Building elements with different life-spans can be serviced and replaced without disturbance to the longer life-span elements, e.g. the life-span of membranes and insulation products should match the life-span of the overall wall build-up;
 - Systems (e.g. MVHR) are easy to access;
 - Shorter life-span elements should be easy to dis-assemble (mechanically fixed) and can be easily reused/recycled;
 - Longer life-span products and materials are prioritised over shorter ones.
- **Address the risk of overheating** - we should not rely on old rules of thumb for internal/external temperature differences, and instead be designing to take into account increasingly high summer peak temperatures at day and night. If your building will likely have 2-3 days of overheating in 2021, how many days could this be in 20-50 years time? See Resources for guidance.
- **Work with your services engineers** and environmental consultants and address the issues above in your designs, suggest they use future weather files and climate risk tools, such as the Good Homes Alliance tool for Overheating:
 - Recommend that it is in their scope to carry out overheating analysis using future climate data. Suggest that overheating calculations (using the TM59 methodology) take into account any heat gains from likely occupant density and appliances as well as the mitigating factor of thermal mass and stratification
 - Consider the benefits of thermal mass and the thermal lag it provides, as well as the thermal performance of the fabric, as this will prevent heat build-up over the day in the summer and store heat in the winter.
- **Consider the risk of rising sea levels**, associated erosion and future climate impact in schemes designed in coastal and riverside areas.
- **Use Post Occupancy Evaluation studies** to explore the impact of climate change on design decisions and to learn from previous experience (especially regarding overheating risks).
- **Include external and internal shading in the design**, either through permanent planting or external shading devices adequate for the facade orientation e.g. overhangs, vertical shading, external blinds or shutters. Internal shading devices are not effective at keeping heat out, once it has entered the building envelope). Be aware that occupants tend to open windows above 26°C regardless of the overheating risks, and design for this.
- **Address urban heat island effects** (en.wikipedia.org/wiki/Urban_heat_island) in a number of ways, e.g. facade and roof materials and colours, incorporation of landscape and trees within schemes to reduce temperatures and increase solar shading in summer, use of hard-surfacing in landscape and public realm areas and their performance on sunny days.
- **Discuss using adaptable systems** with the services engineers, as MEP systems have high embodied carbon and can be difficult to retrofit, so it is important to minimise the impact of potential future retrofits - e.g. allowing for increased size of risers, locations for increased size of equipment in future. **See also the Low Energy Services & Renewables chapter.**
- **Consider potential future flood and drought** scenarios, working closely with landscape architects and ecologists. Incorporate rainwater harvesting and storage, including SUDs, and designing landscapes that don't require intensive maintenance in dry seasons - planting the right plant, in the right place.
- **Learn from building typologies and vernaculars** in places that have climate similar to what can be expected on the particular site you are designing. Consider permeability of hard surfaces and how material choices can affect groundwater run off. Learn from vernaculars in places like the Netherlands, Bangladesh, Venice for addressing water in the built environment. **See the Water Use chapter.**
- **Consider nature-based, regenerative solutions** to all these issues as a first priority, over technological or built solutions, so as to address both climate issues and biodiversity and ecological issues. These can save money in the long term, and are best incorporated in schemes from the outset in a holistic way, e.g. green roofs will have structural and MEP impacts and should be incorporated as early in the design process as possible.



1. Project Tagpuro
Eriksson Furunes,
Leandro V. Locsin
Partners



2.



3.



4.



5.

EXEMPLARS

1. Project Tagpuro

Community Facility | Tacloban, Philippines
Eriksson Furunes, Leandro V. Locsin Partners
www.archdaily.com/883163/streetlight-tagpuro-eriksson-furunes-plus-leandro-v-locsin-partners

2. Bridget Joyce Square Community Rainpark

Community Rainpark | London, UK
Robert Bray Associates
robertbrayassociates.co.uk/index.php/portfolio/bridget-joyce-square-community-rainpark

3. Amphibious House

Small Residential | Buckinghamshire, UK
Baca Architects
www.baca.uk.com/amphibioushouse.html

4. Svalbard Global Seed Vault

Storage | Svalbard, Norway
Peter W. Søderman
www.croptrust.org/our-work/svalbard-global-seed-vault

5. Amphibious Homes

Small Residential | Maasbommel, Netherlands
Factor Architecten & Dura Vermeer
www.factorarchitecten.nl/project/drijvende-woningen-maasbommel

RESOURCES

Bill Gething CC Report

www.arcc-network.org.uk/wp-content/D4FC/01-introduction-Bill-Gething-CCreport-0510.pdf

Independent Assessment of UK Climate Risk - Climate Change Committee, June 2021

www.theccc.org.uk/wp-content/uploads/2021/07/Independent-Assessment-of-UK-Climate-Risk-Advice-to-Govt-for-CCRA3-CCC.pdf

Ellen MacArthur Foundation: Designing Buildings for Adaptable Use, Durability and Positive Impact

www.ellenmacarthurfoundation.org/assets/downloads/2_Buildings_Designing_Mar19.pdf

UK Climate Projections (UKCP)

www.metoffice.gov.uk/research/approach/collaboration/ukcp/index

UKGBC Nature-based solutions to the climate emergency: The benefits to business and society

www.ukgbc.org/ukgbc-work/nature-based-solutions-to-the-climate-emergency-the-benefits-to-business-and-society

BREEAM UK New Construction— for functional adaptability

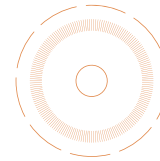
www.breeam.com/NC2018/content/resources/output/10_pdf/a4_pdf/print/nc_uk_a4_print_mono/nc_uk_a4_print_mono.pdf

CIBSE TM55

www.cibse.org/Knowledge/knowledge-items/detail?id=a0q20000008176aAAC

Good Homes Alliance for Overheating
goodhomes.org.uk/wp-content/uploads/2019/07/GHA-Overheating-in-New-Homes-Tool-and-Guidance.pdf

5 DESIGNING FOR PERFORMANCE, FEEDBACK & CLOSING THE PERFORMANCE GAP



- | | | | |
|---|-------------------|----|----------------------|
| 1 | Raise Awareness | 7 | Whole Life |
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| 6 | Upgrade Existing | 12 | Climate Justice |

INTRODUCTION

Architecture as a profession is notoriously poor at critically analysing built works. This is linked with architectural education traditionally teaching students to defend their creative work, perhaps more than accepting critical appraisal.

How our designs perform, the way the occupants use the buildings and adjust them to meet their needs over time, is an essential source of design inspiration and the basis of continuous improvement. Like any other design industry, feedback on achieved performance in use improves accountability and gives designers greater control over design quality. Very few architects routinely employ building performance in-use or post-occupancy evaluation studies on their projects. The studies help clients to improve their briefing process, contractors to improve their build process, and generally improve building performance and quality.

Feedback via building performance in-use studies can reflect on the use of spaces and changes to layout, adequacy of service and maintenance regimes, thermal comfort, ventilation strategies, indoor air quality, lighting levels, durability of materials, construction detailing, finishes and equipment, accessibility, etc.

The projects that come closest to meeting net zero carbon performance incorporate qualitative and quantitative targets and a mechanism to provide feedback on performance-in-use to all stakeholders.

This approach supports a design culture where design goes hand-in-hand with research at a time when the sector must innovate at an unprecedented pace. While net zero carbon targets do not necessarily deliver architectural quality, good architectural design is essential to achieve mainstream net zero. Feedback is key for both.

Professional bodies are rising to the challenge, the RIBA requires the reporting of in-use performance data for its National Awards and Stirling Prize award while CIBSE Building Performance Awards have included this for years. In London all major projects are required to report to the GLA's new BE Seen database. Many NGOs, such as LETI, Good Homes Alliance and Wood Knowledge Wales, are already incorporating building performance evaluation and in-use studies into their guidance.

How our designs perform, the way the occupants use the buildings and adjust them to meet their needs over time, is an essential source of design inspiration and the basis of continuous improvement.

KEY POINTS

- **Discuss and agree** with the client at the start of the project (RIBA Stage 0) an initial contingency sum for a Building Performance Evaluation (BPE) process that includes building performance in-use/POE. Ensure that the initial client brief defines the qualitative and quantitative aims to report on throughout key project design-and-build milestones, and reconcile achieved performance with targets. Set out the scope (in a separate appointment) for this to minimise the cost of collating all the relevant information post-completion, which accounts for the majority of the cost involved, and to avoid any misunderstanding of what is required from all stakeholders involved in the process.
- **Choose the right methodology** for gathering feedback, based on the client, the scale and type of project and available expertise. Identify this during the design stage so that any monitoring equipment or metering can be included as necessary. If in doubt, partner with experienced academic institutions or external consultants to make the most of the research for your organisation and the client. At the very minimum it is recommended to carry out a light-touch building performance in-use/POE approach to provide you with basic feedback on how the design goals have been delivered and lessons learned.

The new British Standard 40101 on BPE is using definitions from RIBA:

Building Performance Evaluation (BPE)—the setting of targets and monitoring of performance at any point in the life of a building project. (Ref Building Knowledge: Pathways to Post Occupancy Evaluation, p50 footnote 25, RIBA ISBN 9780704915718)

Post Occupancy Evaluation (POE)—the evaluation of a building in use. (Ref Building Knowledge: Pathways to Post Occupancy Evaluation, p50 footnote 25, RIBA ISBN 9780704915718). **Please note that RIBA as well as the new BS 40101 is adopting the term ‘Building Performance in-use’ rather than ‘POE’.**

In-Use BPE—BPE study as specified in BS40101, carried out over a twelve month period, at any time during the life of the building, provided the building is occupied.

- **The initial performance-in-use analysis: follow the recommendations of the RIBA 2020 Plan for Use**, which covers BPE and POE activities in relation to the RIBA Plan of Work: www.architecture.com/knowledge-and-resources/resources-landing-page/plan-for-use-guide to align and inform a minimal light-touch approach. This could include:
 - Document review of intended design drawings against actual as built drawings to understand and learn from the reasons for any changes during the design and build process
 - Annual energy use
 - Annual water use
 - Occupant satisfaction survey (e.g. the Arup BUS methodology)
 - Walkaround visit to the project with design team, contractor, client and an occupant representative to discuss the outcome of the project.

Use also the Resources listed in this chapter.

- **Combining these initial ‘light touch’ methods** together and comparing them can generate a profound understanding of how a project has performed from all points of view. If any particular issues arise from this initial study, the client can then instruct the BPE team to ‘drill down’ to more investigative levels of POE such as energy, temperature, humidity and carbon dioxide monitoring, re-commissioning of services, fabric performance measurements etc. Therefore it is useful to follow a graduated approach in gathering data - start at high level and dig deeper as and when needed. Document that the architectural and social brief was met as well as quantitative performance parameters. Will the building stand the test of time?
- **Performance gap:** many recent well designed low energy buildings, amongst others, have failed to meet their design performance targets through failures in contract design, construction, commissioning, user operation, etc. Housing typically uses twice as much energy as predicted in the UK. The introduction of a ‘soft landings’ methodology into the design and construction process will help reduce this ‘performance gap’ between design expectations and performance in-use, especially if accompanied by tangible targets, whether qualitative or quantitative. See the Resources further below.
- **It is recommended to assign responsibilities to a Building Performance Champion** from the outset of the project for the tracking of data (design and construction), collection (post completion) of energy data, indoor environmental quality, embodied carbon (as built) and occupant satisfaction survey data.

KEY POINTS CONTINUED

- **Include the requirement for reporting on energy and water use targets** and embodied carbon if the client and contractors are open to setting up a 'performance contract'. Complete as-built bill of materials, supported by Environmental Product Declarations in the contractors' prelims. Ideally link this to financial incentives to deliver these. Ensure that adequate 'Employers Requirements' are developed for the contract stage, which cover all BPE/POE activities.
- **For retrofit projects**, it is recommended to carry out some form of occupant survey and basic survey of the indoor conditions and end user needs prior to starting design work, to understand the existing constraint and provide a benchmark for the post occupation evaluation.
- **It is recommended to carry out a baseline calculation** of likely energy and water consumption at design stage, including all likely energy end uses (appliance and equipment loads, special functions, vertical transportation, catering, etc), under realistic occupancy scenarios, to make this design baseline comparable with measured performance in use as per CIBSE TM54 guidance, **as noted in the Operational Energy & Carbon chapter. See also the Resources.**
- **Consider carrying out a basic energy and water use audit**, with permission, of the end users one year post occupation. Break down the annual figures (KWh and litres) in relation to the relevant net floor area to compare with chosen Energy Use Intensity (EUI) benchmarks (KWh/m²/year) (litres/home/year) and compare with initial design assumptions. Use TM22 methodology where suitable (see Resources). Understanding energy use first, before carbon emissions, is important as this is closer to the actual building performance, due to the various carbon factors that need to be applied. See the Energy & Whole Life Carbon chapters.
- **Consider carrying out an occupant survey** of all stakeholders one year post occupation to allow for seasonal variations. Follow existing standards to get statistically significant feedback for larger buildings. Ask questions around the following areas: Is the building physically performing as expected? Are the users' needs met? Are there any physical and/or social problems that need solving? How could the design be improved for the future? See the Arup Building User Survey methodology and relevant similar studies carried out— **see Resources.**
- **Investigate the use of easy to install environmental sensors** to find out indoor conditions (temperature, CO₂, relative humidity). Get acquainted with the metrics and scales— **see Resources.**

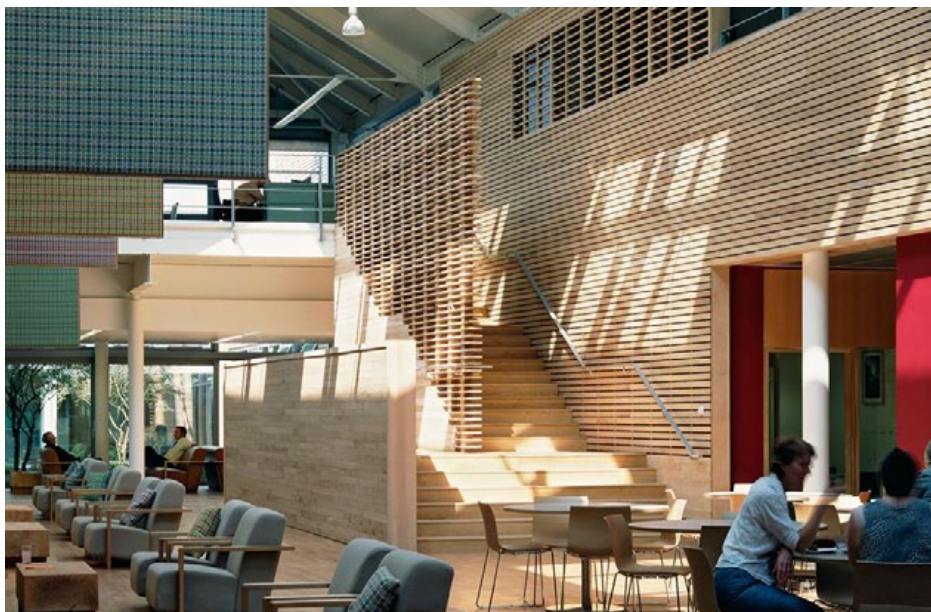
- **Share the post occupancy assessment data** and overall evaluation with the client, contractor, occupants, engineers and design team to help them understand the successes and challenges and for each stakeholder to be able to respond to the findings.
- **Consider sharing knowledge** and lessons learned in articles, events, and webinars.

1. Camden Passive House
Bere Architects



2. The Liverpool
Everyman
Haworth Tompkins





3.



4.

EXEMPLARS

1. Camden Passive House

Small Residential | London, UK

Bere Architects

www.bere.co.uk/architecture/camden-passivhaus-ranulf-road

2. The Liverpool Everyman

Theatre | Liverpool, UK

Haworth Tompkins

www.haworthtompkins.com/studio/regenerative-design/post-occupancy-evaluation-liverpool-everyman-theatre

3. National Trust Headquarters

Office | Swindon, UK

Feilden Clegg Bradley Studios

fcbstudios.com/work/view/national-trust-headquarters

4. Wilkinson Primary School

Education | Wolverhampton, UK

Architype

www.architype.co.uk/project/wilkinson-primary-school

RESOURCES

Wood Knowledge Wales BPE Primer

www.woodknowledge.wales/wkw-resource/building-performance-evaluation-guide

Post Occupancy Evaluation and Building Performance Evaluation—RIBA Primer

www.architecture.com/-/media/gathercontent/post-occupancy-evaluation/additional-documents/ribapoebprimerpdf.pdf

RIBA Plan for Use Guide

www.architecture.com/knowledge-and-resources/resources-landing-page/plan-for-use-guide

Building Performance Network UK—an NGO dedicated to BPE in-use—contains many case studies and extensive guidance
building-performance.network

Usable Buildings Trust contains many case studies and excellent articles on BPE and POE: Innovate UK BPE studies are now hosted here

www.usablebuildings.co.uk/UsableBuildings/CaseStudiesListAll.html

Housing Fit for Purpose: Performance, Feedback and Learning (2019), RIBA Publishing—Fionn Stevenson

www.ribabooks.com/housing-fit-for-purpose-performance-feedback-and-learning_9781859468241

Energy, People, Buildings: Making Sustainable Architecture Work (2021)—Judith Kimpian, Hattie Hartman, Sofie Pelsmaker

www.energypeoplebuildings.com

Mayor of London 'Be seen' energy monitoring guidance, pre-consultation draft
www.london.gov.uk/publications/be-seen-energy-monitoring-guidance

Building Knowledge: Pathways to Post Occupancy Evaluation

www.architecture.com/-/media/gathercontent/post-occupancy-evaluation/additional-documents/buildingknowledgepathwaystopoe.pdf

Soft Landings Framework—Bill Bordass

www.bsria.com/uk/consultancy/project-improvement/soft-landings

CONCLUSION

WHAT NEXT?

The next decade will be critical for safeguarding life on our planet and establishing resilient communities where humanity can thrive. As architects, we can be at the forefront of that work, as we shape people's lives through the places they live, work and play. To deliver these places whilst respecting planetary limits however, our sector must radically limit carbon expenditure and resource consumption.

This guide provides a broad set of tools to help practices decarbonise and work towards a more regenerative practice – both in business operations (where guidance has been limited so far in our sector), and on project work, where the majority of our environmental impacts arise.

We have provided a range of actions and strategies for practices to adopt, whether big or small and whichever typology they usually deliver. It is now up to each practice, and each architect to evaluate and improve upon the approach outlined in this guide; to develop your practice roadmap; set clear objectives and targets to measure progress against; to develop and nurture the skills and procedures to deliver this; and finally, to monitor, reflect and learn from successes and failures.

We hope that you will share those lessons learnt with the Architects Declare network and help participate in future initiatives. We are all on this journey together and will only succeed by sharing our knowledge and being honest about areas where there's still room for improvement. We must work collaboratively with other built environment professionals, recognising the limits of our own knowledge and seek to address shortcomings wherever we can.

IN SUMMARY

We recognise that meeting all the Architects Declare commitments and making the necessary change in how we practice and measure what good architecture looks like will take dedication. We are acutely aware that each practice will have its own challenges to overcome in affecting this change. Therefore, we urge AD signatories, wherever they may be on their journey, to establish an action plan based on their own procedures and priorities and to work towards these in earnest.

Our understanding of sustainable, regenerative architecture and the way we operate our businesses is constantly evolving. This guide is intended as a live document that will be revised to keep pace with emerging knowledge and we will require your help to make this possible. We therefore welcome feedback on the guide and contributions in terms of content and relevant case studies and will endeavour to incorporate these in future iterations.

With signatory support and collaboration with the wider Built Environment Declares network¹, we hope that Architects Declare can continue to inspire the radical change required from our industry to address the most pressing issue of our time.

1. www.builtenvironmentdeclares.com

Practice Template AD Five Year Plan

Link to overall template docs.google.com/spreadsheets/d/1XsifZLcscKjVdFj-pXZgOqflolfLesGcoAfJ1YcC7mo/edit#gid=0

Architects Declare Declaration Points Headlines— See p.12 for full text	Business Incentive How will this benefit the practice? Ways it can benefit income streams - this can help get directors etc on board.	Current Status What's normal now in the practice? What knowledge is already there?	Next 6 Months What can realistically be achieved in the coming 6 months?	One Year From Now What can be achieved in the subsequent 6 months?	Five Years From Now Where do we want to be in 5 years?
1 Raise Awareness					
2 Change Fast					
3 New Goals					
4 Share Knowledge					
5 Evaluate Projects					
6 Upgrade Existing					
7 Whole Life Carbon					
8 Regenerative Design					
9 Collaborate & Reduce					
10 Low Carbon					
11 Minimise Waste					
12 Climate Justice					

Practice Template AD Five Year Plan—Low Carbon Example

Link to filled Low Carbon example docs.google.com/spreadsheets/d/1oleU9_AHrVZZGiv5yQL3xs-LerQvPdc2EuuaSQUVVDw/edit#gid=1727580733

Architects Declare Declaration Points	Business Incentive How will this benefit the practice? Ways it can benefit income streams— this can help get directors etc on board.	Current Status What's normal now in the practice? What knowledge is already there?	Next 6 Months What can realistically be achieved in the coming 6 months?	One Year From Now What can be achieved in the subsequent 6 months?	Five Years From Now Where do we want to be in 5 years?
10 Low Carbon	Embodied carbon statements required for referable schemes in London under New London Plan	Projects			
	Potential work in helping clients include targets & strategy in Employer's Requirements	No quantifying of embodied carbon other than on large retrofit projects to justify proposals	Target kgCO ₂ /m ² and strategy to achieve this for all projects. Create checklist for early client meeting - ensure understand building's long term ownership, priorities, maintenance etc	Report target / predicted kgCO ₂ /m ² in stage reports	Domestic projects achieve <300 kgCO ₂ /m ²
	More clients are now interested – offer this as an additional service	Some evidence of decision making based around embodied carbon			Non-domestic projects achieve <350 kgCO ₂ /m ²
		Knowledge			
		Highest level - awareness of metrics, EPDs, assessment methodology, which materials are higher / lower embodied carbon	Include in internal office sustainability awards	Train staff on implications of other disciplines' input to encourage good collaboration	All staff understand implications of embodied carbon and methods to minimise this
		Lowest level - limited awareness - may have attended 1 internal CPD	More detailed internal training on embodied carbon - stages, EPDs, how retrofit is measured, successful case studies	Internal CPD on embodied carbon assessments carried out on live project	All staff able to carry out basic embodied carbon assessment
		Software		New samples in materials library to include E.C. data	
		Trial of H\B:ERT underway (Free Revit-linked quick feedback tool)	Create library of materials with embodied carbon embedded for use in Revit	Staff to request EPDs when speaking to manufacturers / suppliers	
		More complex software available, but has cost & training requirements	Test H\B:ERT on live project.	Expand Revit embodied carbon library	Embodied carbon routinely assessed through Revit models
		Fees / Appointments / Bids		Train all staff on H\B:ERT & use on all projects	
		No reference to embodied carbon unless specifically requested	Ensure fees allow for calculation & statement for referable schemes in London	Offer external CPD to clients on embodied carbon	All fees include for appropriate level of embodied carbon assessment and reduction
	Include embodied carbon commentary in all bids / competitions				

Resources Part 2

GENERAL READING

- Leverage points, Thinking in Systems, Dancing with Systems *Donella Meadows*
- Doughnut Economics *Kate Raworth*
- Biomimicry: Design Inspired by Nature *Janine Benyus*
- Biomimicry in Architecture (2nd ed.) *Michael Pawlyn*
- Cradle to Cradle *McDonough & Braungart*
- Designing Regenerative Cultures *Daniel Wahl*
- The Patterning Instinct *Jeremy Lent*
- Out of the Wreckage *George Monbiot*
- A Paradise Built in Hell, and Hope in the Dark *Rebecca Solnit*
- Drawdown edited *Paul Hawken*
- Utopia for Realists, and Humankind *Rutger Bregman*
- Eco-Minimalism: the Antidote to Eco-bling *Howard Liddell*
- From What Is to What If: Unleashing the Power of Imagination to Create the Future we Want *Rob Hopkins*
- Housing Fit for Purpose: Performance, Feedback and Learning *Fionn Stevenson*
- Letters to the Earth *Culture Declares*
- Sustainable Construction *Sandy Halliday*
- The LETI Guides www.leti.london/publications
- RIBA Sustainable Outcomes Guide
www.architecture.com/knowledge-and-resources/resources-landing-page/sustainable-outcomes-guide
- UKGBC – Net Zero Carbon Buildings—A Framework Definition- April '19
www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition
Building case for Net Zero – Sept '20
www.ukgbc.org/ukgbc-work/building-the-case-for-net-zero
- Unlocking Barriers low carbon heat – Sept '20
www.ukgbc.org/ukgbc-work/unlocking-the-barriers-to-low-carbon-heat-an-industry-view
- Green recovery Paper – June '20 landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2020/09/12332-greener-recovery-v6.pdf
- Nature Based Solutions – Aug '20
wild.org/wp-content/uploads/2020/09/NatureBasedSolutions-WILD-WSG-WFG-final-19-Aug-20.pdf
- RIBA Plan of work – Sustainability Overlay – from page 74 onwards
www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work
- Embodied and Whole Life Carbon Assessment for Architects—RIBA
www.architecture.com/-/media/GatherContent/Whole-life-carbon-assessment-for-architects/Additional-Documents/11241WholeLifeCarbonGuidancev7pdf.pdf
- DESIGN FOR A CIRCULAR ECONOMY Primer—GLA/Mayor of London
www.london.gov.uk/sites/default/files/design_for_a_circular_economy_web_2.pdf
- Living Building Challenge Guidance/ International Living Futures Institute
www.living-future.org
- Passivhaus Trust: Online Resources
www.passivhaustrust.org.uk/guidance_detail.php?gld=20
- RIBA Post Occupancy Evaluation Primer
www.architecture.com/-/media/gathercontent/post-occupancy-evaluation/additional-documents/ribapoebpeprimerpdf.pdf
- Scottish Ecological Design Association Design Guides (Sustainable Renovation, Design and Detailing for Airtightness/Deconstruction/Toxic Chemical Reduction) www.seda.uk.net/design-guides
- Building with Nature User Guide
- Building With Nature case studies www.buildingwithnature.org.uk
- Natural England Biodiversity Metric Resources
www.publications.naturalengland.org.uk/publication/5850908674228224
- DEFRA Department for the Environment, Food and Rural Affairs—Biodiversity Metric 3.0 (this replaced Biodiversity Metric 2.0 in July 2021)
nepubprod.appspot.com/publication/6049804846366720
- Biodiversity Net Gain Standards
naturalengland.blog.gov.uk/2021/09/21/biodiversity-net-gain-more-than-just-a-number
- How to measure embodied carbon
www.istructe.org/resources/guidance/how-to-calculate-embodied-carbon
- Urban Forestry www.landscapelearn.com/library
- Landscape Institute's Action Plan
www.andscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2020/05/12284-climate-biodiversity-action-plan.pdf
- Deep Energy Renovation by the Heritage Council
www.heritagecouncil.ie/content/files/Deep_Energy_Renovation_of_Traditional_Buildings.pdf
- Report: Measuring the Impact of your Design—Creating +Positive spaces by Measuring the Impact of your Design via Pre and Post-Occupancy Evaluation (POE) Publication date: September 2019
blog.interface.com/en-uk/creating-positive-spaces-measuring-impact-of-design

GENERAL EXEMPLARS

- Living Building Challenge case study: Vandusen Botanical garden visitor centre www.living-future.org/lbc/case-studies/vandusen-botanical-garden-visitor-centre
- Living Building Challenge case study: Frick Environmental Center www.living-future.org/lbc/case-studies/frick-environmental-center
- Sahara Forest Project - Pilot Project www.exploration-architecture.com/projects/sahara-forest-project
- Drawing matter archive www.hughstrange.com/architecture-archive.html
- Rock Farm Residency sawa-architecture.org/projects/rock-farm
- The Growing Pavilion www.dezeen.com/2019/10/29/growing-pavilion-mycelium-dutch-design-week/
- Zero Waste Barn www.dezeen.com/2018/09/05/overtreders-w-zero-waste-barn-lowlands-festival-brasserie-2050-architecture/
- Silo Restaurant www.dezeen.com/2020/04/23/silo-restaurant-interiors-sustainable
- The Cork Oak House www.corkoakhouse.co.uk/
- Oasis Children's Centre www.ribaj.com/buildings/segal-segue
- LILAC Leeds www.lilac.coop/
- The Willow School regenesisgroup.com/project/the-willow-school/
- The Vertical Forest www.stefanoeriarchitetti.net/en/project/vertical-forest
- The Eden Project grimshaw.global/projects/the-eden-project-the-biomes
- The Cheonggyecheon Stream www.theguardian.com/cities/2016/may/25/story-cities-reclaimed-stream-heart-seoul-cheonggyecheon

REGENERATIVE DESIGN – ADDITIONAL RESOURCES

- Open City Podcast 'Green Cities Start Here' (07.09.2020) – Clear and accessible introduction to the issues uk-podcasts.co.uk/podcast/the-open-city-podcast/green-cities-start-here
- Upcoming: Flourish: Design Paradigms for Our Planetary Emergency, Sarah Ichioka and Michael Pawlyn www.flourish-book.com

BIODIVERSITY – ADDITIONAL RESOURCES

- www.bats.org.uk/resources/guidance-for-professionals/designing-for-biodiversity-a-technical-guide-for-new-and-existing-buildings
- www.plantlife.org.uk/uk/our-work/publications/good-verge-guide-different-approach-managing-our-waysides-and-verges
- UKGBC Insights into Nature & Biodiversity – Feb 2019 www.ukgbc.org/wp-content/uploads/2019/01/Insights-into-Nature-and-Biodiversity-Industry-trends-commitments-and-best-practice-examples.pdf

BIODIVERSITY – ADDITIONAL EXEMPLARS

- Centre for Alternative Technology, Machynlleth cat.org.uk
- Jardin de Resistance, The Third Landscape, Jardin d'horties - biodiversity Gilles Clément landscapetheory1.wordpress.com/tag/gilles-clement/
- Living Building Challenge: Indian Creek Nature Centre living-future.org/lbc/case-studies/indian-creek-nature-center/#place
- Camley Street Natural Park, London, UK www.wildlondon.org.uk/nature-reserves/camley-street-natural-park
- Gloucester Services www.glennhowells.co.uk/project/gloucester-services/

WATER – ADDITIONAL EXEMPLARS

- Lilac cohousing www.communityledhomes.org.uk/success-stories/lilac
- Rainwater harvesting www.annethornearchitects.com/#/boatmahwalk

OPERATIONAL ENERGY – ADDITIONAL RESOURCES

- Association for Environment Conscious Building www.aecb.net/webinar-recordings
- www.bere.co.uk/research/airtightness-report-a-practical-guide-to-achieving-airtightness-in-passive-house-buildings/
- Moisture control www.aecb.net/download/measure-moisture-buildings

OPERATIONAL ENERGY – ADDITIONAL EXEMPLARS

- Keynsham Civic Centre, performance contracting DEC A www.maxfordham.com/assets/media/publications/Keynsham%20Civic%20Centre/Case%20Study.pdf
- www.bathnes.gov.uk/sites/default/files/building_standards_study_section_7.pdf
- Oriam Sports Centre www.cibsejournal.com/case-studies/oriam-scotlands-sporting-great

HEALTH & WELLBEING – ADDITIONAL RESOURCES

- velocityplacemaking.co.uk/our-team
- Happy by Design: A 'Guide to Architecture and Mental Wellbeing' – Ben Channon www.ribabooks.com/Happy-by-Design-A-Guide-to-Architecture-and-Mental-Wellbeing_9781859468784

MATERIALS – ADDITIONAL RESOURCES

- Institute for Building Biology baubiologie.de

- Sentinel Haus Institut www.sentinel-haus.de/de
- HPD database www.hpd-collaborative.org/hpd-public-repository
- Green Spec www.greenspec.co.uk/building-design
- Construction Products UK www.constructionproducts.org.uk

RETROFIT—ADDITIONAL RESOURCES

- Deep Energy Renovation of Traditional Buildings - Addressing Knowledge Gaps and Skills Training in Ireland www.heritagecouncil.ie/content/files/Deep_Energy_Renovation_of_Traditional_Buildings.pdf
- www.leti.london/retrofit

RETROFIT—ADDITIONAL EXEMPLARS

- Bristol Old Vic www.haworthtompkins.com/work/bristol-old-vic
- Karakusevic Carson Architects, The Record Hall, Clerkenwell, London karakusevic-carson.com/work/the-record-hall
- Grosvenor passive house for a conservation area passivhaustrust.org.uk/projects/detail/?cld=68
- Yorkton Workshops Hackney pearsonlloyd.com/project/pearson-lloyd-yorkton-workshops

CIRCULARITY & WASTE—ADDITIONAL RESOURCES

- Resource Efficient Scotland, 2017, Maximising re-use of materials on-site. energy.zerowastescotland.org.uk/sites/default/files/Maximising%20Re-use%20of%20materials%20on-site.pdf
- INTERREG FRCRBE - Facilitating the circulation of reclaimed building elements www.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/#tab-2
- Circular Economy in Construction usefulprojects.co.uk/circular-economy-in-construction
- Library of Things www.libraryofthings.co.uk
- NTS Warehouse building (steel frame reuse) www.steelconstruct.com/wp-content/uploads/CS01-NTS-building-Thirsk.pdf

CIRCULARITY & WASTE—ADDITIONAL EXEMPLARS

- Circle House gxn.3xn.com/project/circle-house
- Cambridge Avenue, SEGRO (steel frame relocation) asbp.org.uk/case-studies/9-cambridge-avenue
- UKGBC office (circular refurb)

- www.ukgbc.org/ukgbc-work/ukgbc-office-refurb-project-2016/
- LWARB Office Refurbishment www.awspaces.co.uk/work/lwarb
- Resource Rows (brick panel reuse), Lendager lendager.com/en/architecture/resource-rows/
- Liander Headquarters, RAU/Turntoo www.circulareconomyclub.com/solutions/from-buildings-to-head-office
- Park 20|20 in Amsterdam, Delta Developments consciously designed their buildings to be both adaptable and deconstructable mcdonoughpartners.com/park-2020-amsterdam-born-recycled
- Hub 67 in Hackney Wick, community centre constructed with recycled material from the London 2012 Olympic and Paralympic Games. www.lynatelier.com/hub67-1
- www.accoya.com/uk/project/bosch-siemens-house/
- Venlo City Hall (DfD, leasing, material passports), Kraaijvanger archello.com/project/municipal-office-venlo
- Brummen Town Hall, RAU/Turntoo www.circulareconomyclub.com/solutions/modular-building-brummen-town-hall

EMBODIED CARBON—ADDITIONAL RESOURCES

- The Carbon Leadership Forum at the university of Washington www.carbonleadershipforum.org
- Mesh Energy Carbon Calculator www.mesh-energy.com/resources/embodied-carbon-calculator-v2
- Embodied Carbon: the Blindspot of the Building Industry—Anthony Pak, Canadian Architect www.canadianarchitect.com/embodied-carbon-the-blindspot-of-the-buildings-industry

EMBODIED CARBON—ADDITIONAL EXEMPLAR

- www.architype.co.uk/project/burry-port-community-primary-school/

COMMUNITY, AMENITY & SOCIAL SUSTAINABILITY—ADDITIONAL RESOURCES

- Ty Pawb Wrexham, Featherstone Young www.designcurial.com/news/t-pawb-arts-centre-wrexham-by-featherstone-young-6978578
- HT Coin street www.haworthtompkins.com/work/coin-street-neighbourhood-centre
- Community Gateway Cardiff, Dan Benham www.cardiff.ac.uk/community-gateway/our-projects/community-meeting-places/grange-gardens-bowls-pavilion/grange-pavilion-redevelopment

- Incredible Edible Todmorden www.incredible-edible-todmorden.co.uk
- Onion Collective Watchet with Invisible Studio
www.invisiblestudio.org/tag/onion-collective-cic/
- Two upTwo Down Urbed urbed.coop/projects/2up-2down-homebaked

POST OCCUPANCY AND EVALUATION—ADDITIONAL EXEMPLARS

- Maggie's Centre, Nottingham - CZWG
- www.ribaj.com/buildings/centre-czwg-support-nottingham-england-sroi
- Loudoun Road, Camden - Levitt Bernstein
www.levittbernstein.co.uk/research-writing/loudoun-road-post-occupancy-evaluation/
- Haymarket Media Group - Spacelab
spacelab.co.uk/projects/haymarket-media-group
- Gordon Street - Buro Happold www.burohappold.com/projects/ucl-22-gordon-street-the-bartlett-school-of-architecture/
- Keynsham Civic Centre AHR / UCL www.ahr.co.uk
- Morelands, London Practice: Allford Hall Monaghan Morris www.ahmm.co.uk/
- New Art Exchange, Nottingham Practice: Hawkins\Brown
www.hawkinsbrown.com
- Lordship Eco-Hub, London Practice: Anne Thorne Architects
annethornearchitects.co.uk/
- Foundry Studios, London Practice: Cullinan Studio cullinanstudio.com/

Architects Declare is a not-for-profit organisation, launched in the UK on 30 May 2019. At the time of publication, it has over 1,100 signatories in the UK. It is part of Built Environment Declares, which is now represented in 27 countries around the world.

This guide has been compiled by a group of practitioners and coordinated by members of the Architects Declare steering group. It is intended as a live document, introducing the issues we all acknowledged by signing this declaration. As such we welcome feedback on this work at any time and will endeavour to include comments and contributions in the next iteration.

www.architectsdeclare.com