LETI and Beyond

SPACES Study Day: 22nd June 2023

Joe Jack Williams
LETI / FCBStudios

Agenda

01 Introduction to LETI

02 What LETI has done

03 What LETI currently working on

04 What next?


OUR LONDON


LETI


LETI
CELEBRATES


LETI Climate Emergency
Retrofit Guide
How existing homes can be adapted to meet UK climate targets
LETI
LETI Embodied Carbon Primer
Supplementary guidance to the Climate Emergency Design Guide
LETI Client Guide
for Net Zero Carbon Buildings
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LETI Climate Emergency
Design Guide
How new buildings can meet UK climate change targets
2020
2030
Path to zero carbon

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Net Zero FAQs
What does Net Zero mean?
Supported by:
Circular Economy for the built environment: a summary
Embodied Carbon Target Alignment
Whole Life Carbon
Embodied Carbon
Improving Consistency in Whole Life Carbon Assessment and Reporting
Carbon Definitions for the Built Environment
Life Cycle stages

TUESDAY LUNCHTIMES 1-2PM -- EVERY 2-3 WEEKS

★ LETI ★

2023 LECTURE SERIES

WHOLE LIFE CARBON

24TH JAN - INTRODUCTION TO WHOLE LIFE CARBON AND THE LETI WEBINAR SERIES | 7TH FEB - EMBODIED CARBON CASE STUDIES | 21ST FEB - OPERATIONAL CARBON IN WHOLE LIFE CARBON ASSESSMENTS

COMING SOON

★ CIRCULAR ECONOMY ★ DEMOLITION/RETROFIT GUIDANCE ★ ENERGY FROM WASTE ★
★ EMBODIED CARBON SPECIFICATION AND PROCUREMENT GUIDANCE ★
★ OPERATIONAL ENERGY MODELLING GUIDANCE ★

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WWW.LETI.UK

www.leti.uk

02 LETI publication

What we have published

Our LETI publications

- **Climate Emergency Design Guide**
- **Embodied Carbon Primer (and carbon alignment)**
- Climate Emergency Retrofit guide
- Retrofit Unpicker
- Net Zero Client guide
- Circular Economy work
- Operational Modelling Guide

- Carbon definitions for the Built Environment
- Net Zero FAQs (& NZCBS)
- Embodied carbon case studies
- Low Embodied Carbon Spec and procurement
- Operational carbon in WLC- opinion piece

Operational Energy & the Climate Emergency Design Guide

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Climate Emergency Design Guide

Downloaded over
100,000 times

In **100+** countries

Developed in collaboration with:

LETI · UK GBC · BBP BETTER BUILDINGS PARTNERSHIP

Developed with the support of:

Good Homes Alliance · RIBA Architecture.com · CIBSE

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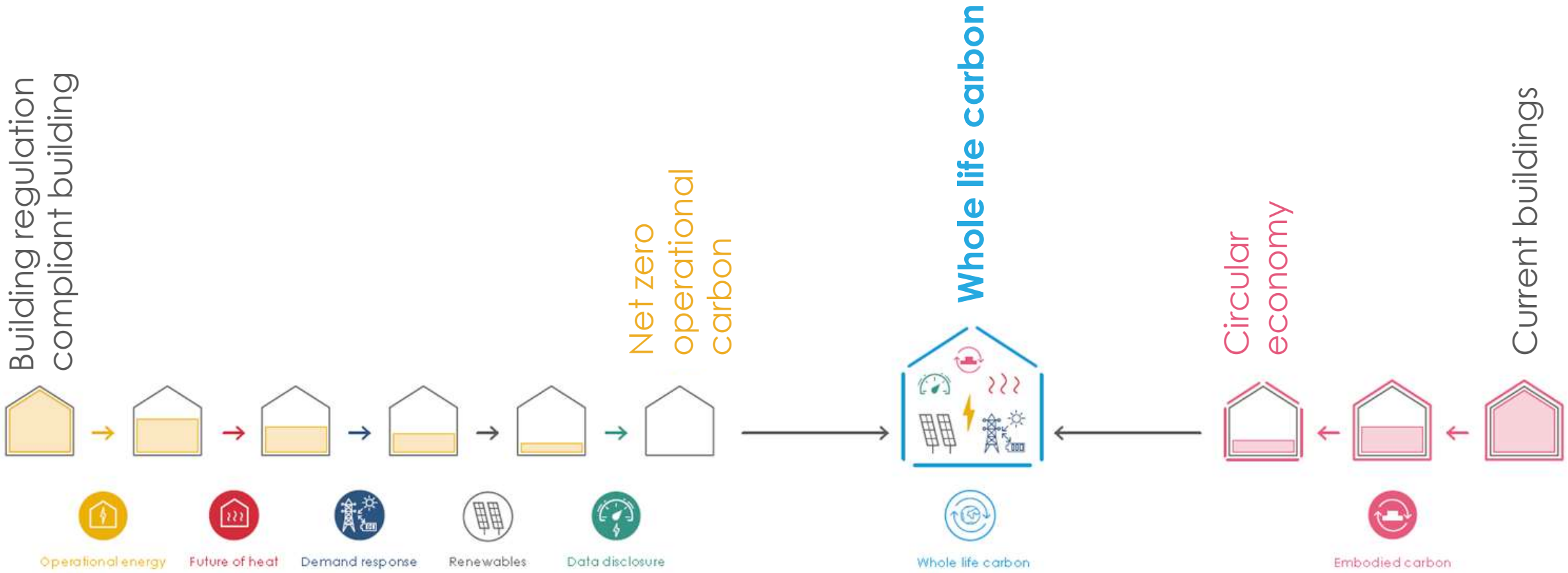
Climate Emergency Design Guide

Chapter guide:

Elements of net zero carbon



Whole life carbon

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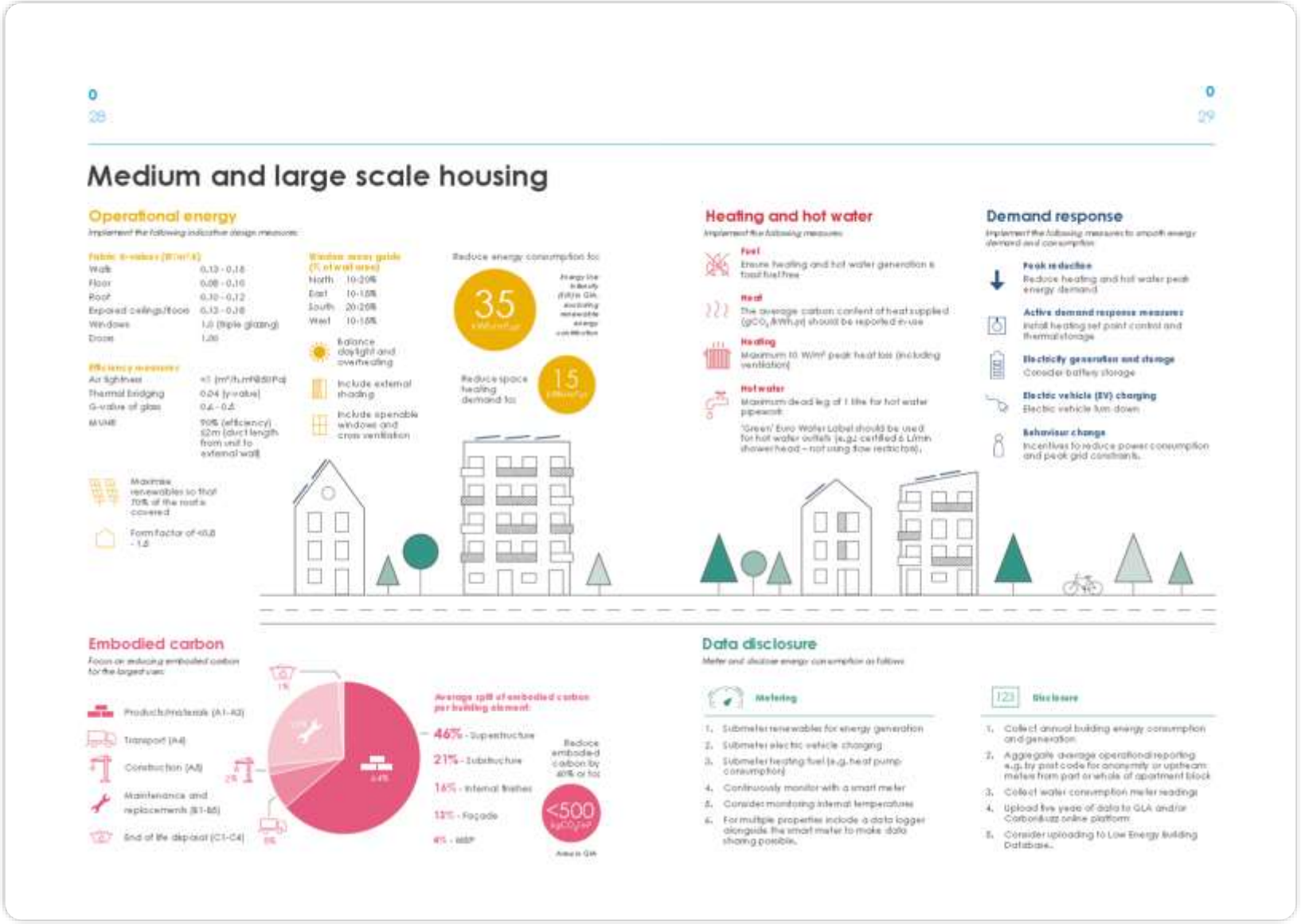
Archetypes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28
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29
Medium and large scale housing
Operational energy
Implement the following indicative design measures:
Fabric U-values (W/m²·K)
Wall 0.13 - 0.18
Floor 0.08 - 0.16
Roof 0.10 - 0.12
Exposed ceilings/floors 0.13 - 0.18
Windows 1.0 (triple glazing)
Doors 1.00
Efficiency measures
Air tightness ≤1 (m³/h.m²@50Pa)
Thermal bridging 0.04 (y-value)
G-value of glass 0.4 - 0.5
MVHR 90% (efficiency) 52m (duct length from unit to external wall)
Window areas guide (% of wall area)
North 10-20%
East 10-15%
South 20-25%
West 10-15%
Balance daylight and overheating
Include external shading
Include openable windows and cross ventilation
Reduce energy consumption by:
35
Reduce space heating demand by:
15
Maximise renewables so that 70% of the roof is covered
Form factor of <0.8 - 1.0
Heating and hot water
Implement the following measures:
Fuel
Ensure heating and hot water generation is fossil fuel free
Heat
The average carbon content of heat supplied (gCO2/kWh.yr) should be reported in-use
Heating
Maximum 10 W/m² peak heat loss (including ventilation)
Hot water
Maximum dead leg of 1 litre for hot water pipework
'Green' Euro Water Label should be used for hot water outlets (e.g. certified 6 L/min shower head – not using flow restrictors).
Demand response
Implement the following measures to smooth energy demand and consumption:
Peak reduction
Reduce heating and hot water peak energy demand
Active demand response measures
Install heating set point control and thermal storage
Electricity generation and storage
Consider battery storage
Electric vehicle (EV) charging
Electric vehicle turn down
Behaviour change
Incentives to reduce power consumption and peak grid constraints.
Embodied carbon
Focus on reducing embodied carbon for the largest uses:
Products/materials (A1-A3)
Transport (A4)
Construction (A5)
Maintenance and replacements (B1-B5)
End of life disposal (C1-C4)
Average split of embodied carbon per building element:
46% - Superstructure
21% - Substructure
16% - Internal finishes
13% - Façade
4% - MEP
Reduce embodied carbon by 40% or to:
<500
Data disclosure
Meter and disclose energy consumption as follows:
Metering
1. Submeter renewables for energy generation
2. Submeter electric vehicle charging
3. Submeter heating fuel (e.g. heat pump consumption)
4. Continuously monitor with a smart meter
5. Consider monitoring internal temperatures
6. For multiple properties include a data logger alongside the smart meter to make data sharing possible.
Disclosure
1. Collect annual building energy consumption and generation
2. Aggregate average operational reporting e.g. by post code for anonymity or upstream meters from part or whole of apartment block
3. Collect water consumption meter readings
4. Upload five years of data to GLA and/or Carbon.Live online platform
5. Consider uploading to Low Energy Building Database.

Regulation

Relative

%

Reduction in CO_2 emissions over notional building

Comparison with fixed building specification

Permits inefficiency in building form

Adversely influenced by fuel supply

Best practice

Absolute

kWh/m²/yr

Energy use intensity
(EUI)

Measures energy 'at the meter'

Influenced by efficient design

Energy supply agnostic

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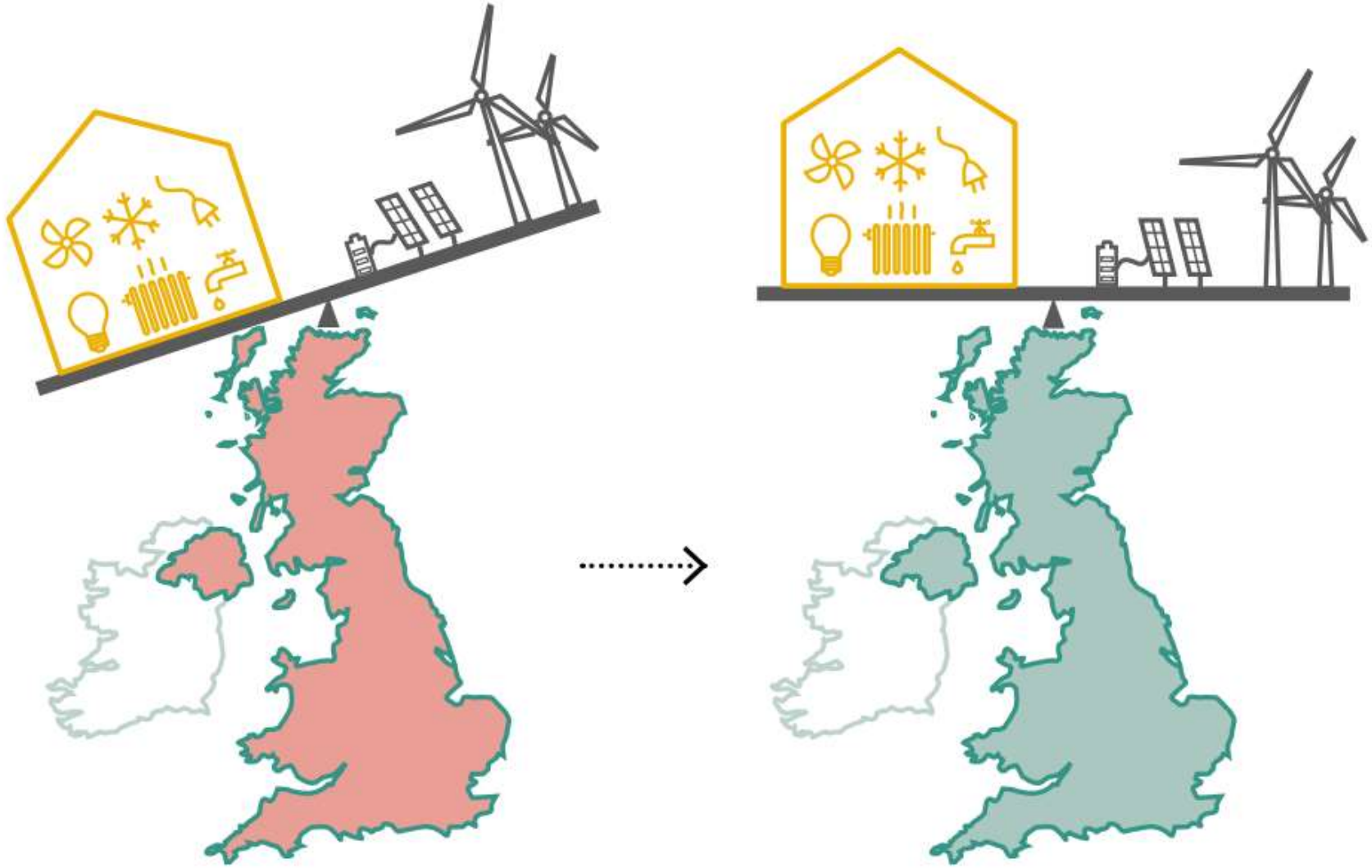

No EUI targets:

energy consumption > renewable energy production

EUI targets:

energy consumption = renewable energy production

Key performance indicators

1 Energy use intensity

- 35 kWh/m².yr — Residential
- 55 kWh/m².yr — Offices
- 65 kWh/m².yr — Schools

2 Space heating demand

- 15 kWh/m².yr — All building types

3 Renewable energy generation

- Small scale resi: Generate 100% of annual energy requirement on-site
- Medium and large scale resi: Cover 70% of roof area
- Offices: Generate the annual energy requirement for at least two floors of the development on-site
- Schools: Cover 70% of the roof area

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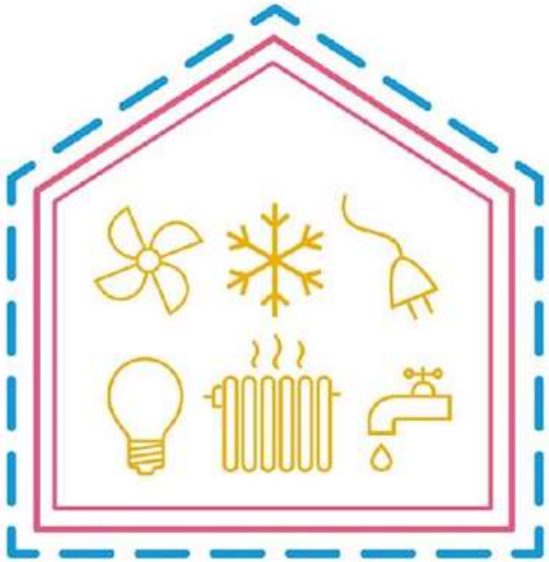

Whole life net zero carbon

=

Operational carbon

- Fossil fuel free
- Energy use target
- Water target
- Space heating and/or space cooling demand target
- Renewable energy

+

Embodied carbon

- Upfront embodied carbon target
- Lifecycle embodied carbon target

+

Offsets

For unavoidable emissions

- Upstream emissions
- Embodied carbon emissions
- Water supply and wastewater treatment emissions

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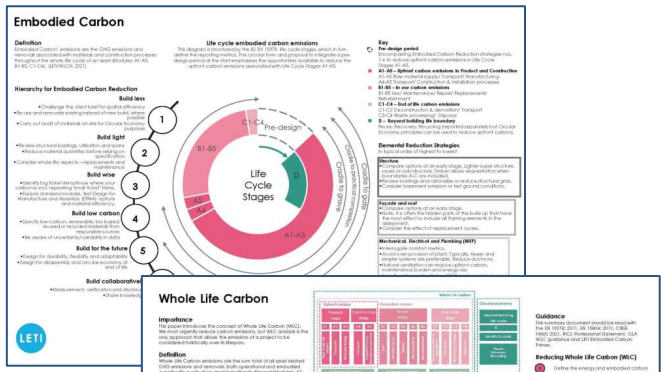
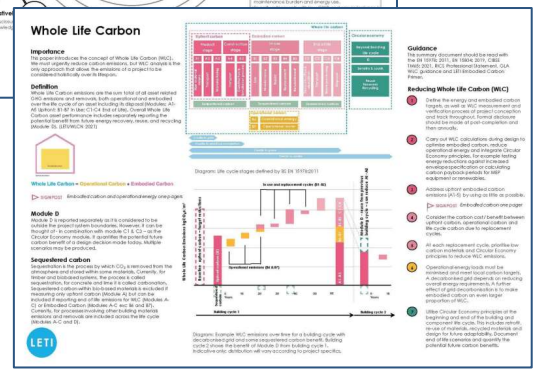
Embodied Carbon

A suite of interlinked documents on embodied carbon

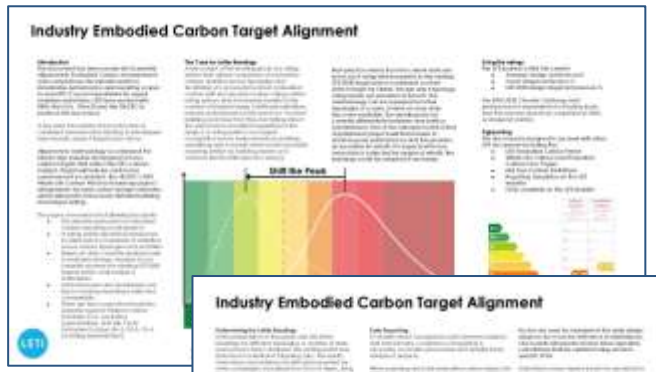
Guidance - Jan 2020

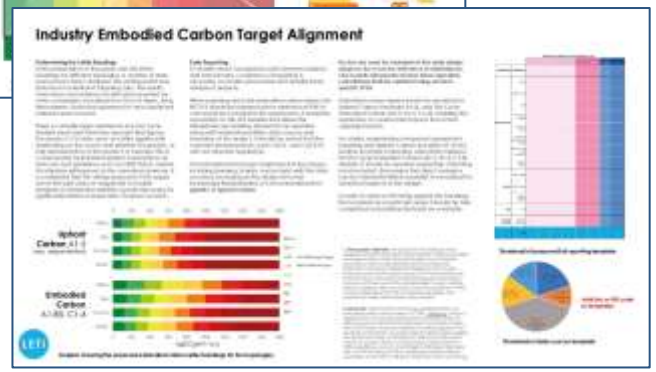
Information - May 2021





Targets - May 2021





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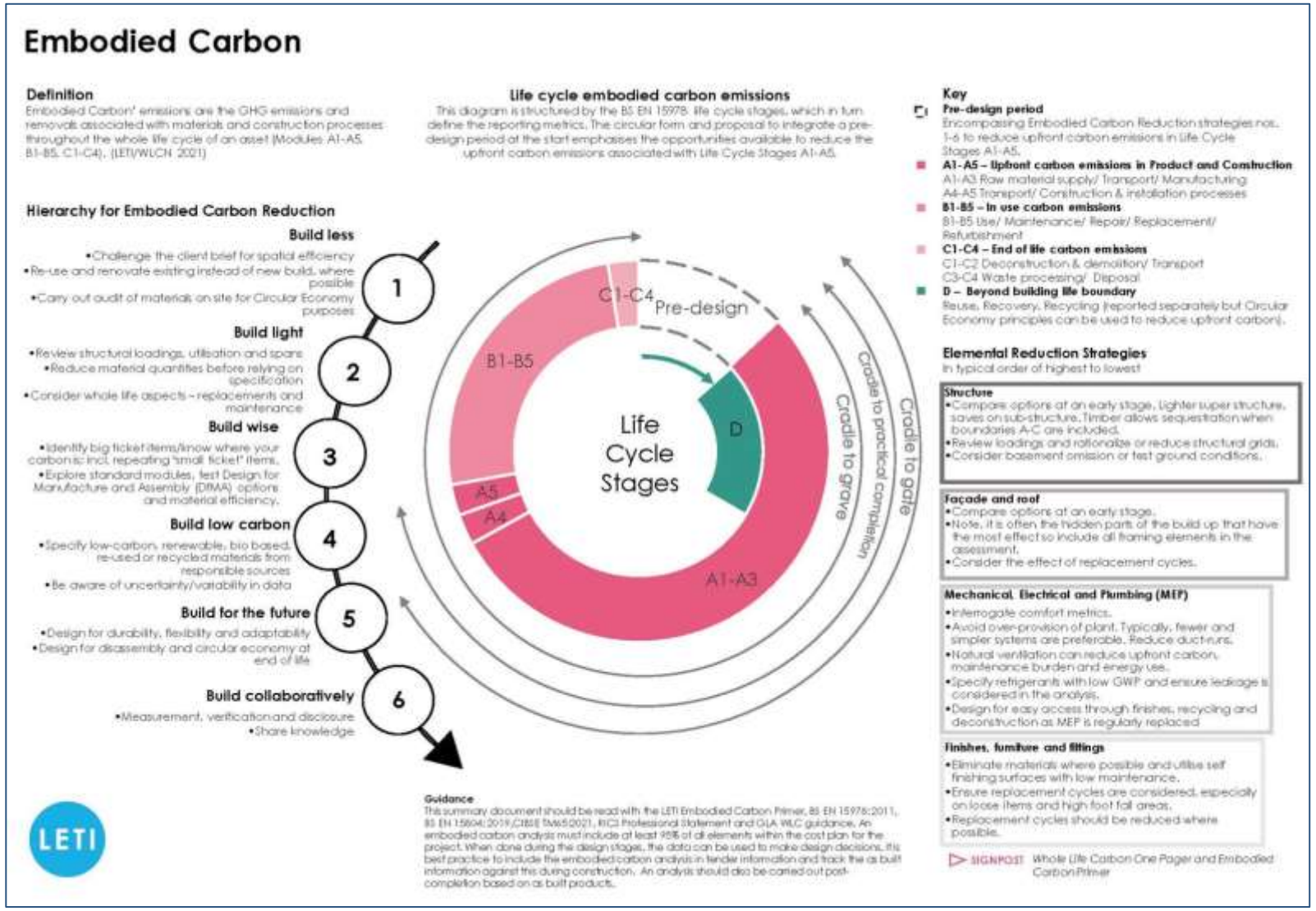
Embodied carbon

'Upfront Carbon' emissions are the GHG emissions associated with materials and construction processes up to practical completion (Modules A0-A5). Upfront carbon excludes the biogenic carbon sequestered in the installed products at practical completion.

'**Life Cycle Embodied Carbon**' emissions of an asset are the total GHG emissions and removals associated with materials and construction processes throughout the whole life cycle of an asset (Modules A1-A5, B1-B5, C1-C4)



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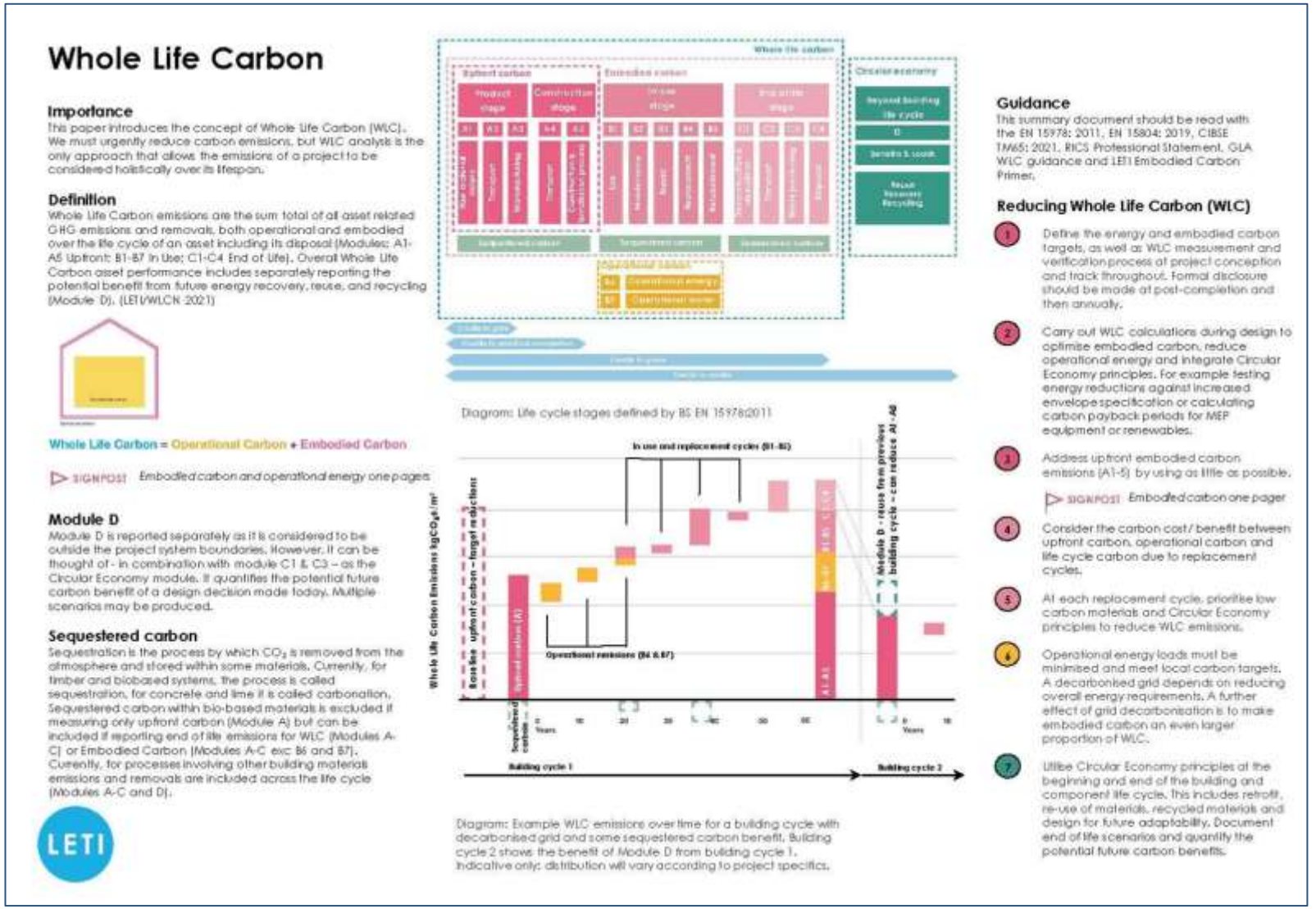
Whole life carbon

Whole Life Carbon' emissions are the sum total of all asset related GHG emissions and removals, both operational and embodied over the life cycle of an asset including its disposal (Modules: A1-A5; B1-B7; B8 optional; C1-C4, all including biogenic carbon.

Overall Whole Life Carbon asset performance includes separately reporting the potential benefits or loads from future
energy or material recovery, reuse, and recycling and from exported utilities (Modules D1, D2).



Whole Life Carbon

Importance

This paper introduces the concept of Whole Life Carbon (WLC). We must urgently reduce carbon emissions, but WLC analysis is the only approach that allows the emissions of a project to be considered holistically over its lifespan.

Definition

Whole Life Carbon emissions are the sum total of all asset related GHG emissions and removals, both operational and embodied over the life cycle of an asset including its disposal (Modules: A1-A5 Upfront; B1-B7 In Use; C1-C4 End of Life). Overall Whole Life Carbon asset performance includes separately reporting the potential benefit from future energy recovery, reuse, and recycling (Module D). (LETI/WLCN 2021)

Whole Life Carbon = Operational Carbon + Embodied Carbon

SIGNPOST Embodied carbon and operational energy one pagers

Module D

Module D is reported separately as it is considered to be outside the project system boundaries. However, it can be thought of - in combination with module C1 & C3 – as the Circular Economy module. It quantifies the potential future carbon benefit of a design decision made today. Multiple scenarios may be produced.

Sequestered carbon

Sequestration is the process by which CO_2 is removed from the atmosphere and stored within some materials. Currently, for timber and biobased systems, the process is called sequestration, for concrete and lime it is called carbonation. Sequestered carbon within bio-based materials is excluded if measuring only upfront carbon (Module A) but can be included if reporting end of life emissions for WLC (Modules A-C) or Embodied Carbon (Modules A-C exc B6 and B7). Currently, for processes involving other building materials emissions and removals are included across the life cycle (Modules A-C and D).

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Diagram: Life cycle stages defined by BS EN 15978:2011

Diagram: Example WLC emissions over time for a building cycle with decarbonised grid and some sequestered carbon benefit. Building cycle 2 shows the benefit of Module D from building cycle 1. Indicative only; distribution will vary according to project specifics.

Guidance

This summary document should be read with the EN 15978: 2011, EN 15804: 2019, CIBSE TM65: 2021, RICS Professional Statement, GLA WLC guidance and LETI Embodied Carbon Primer.

Reducing Whole Life Carbon (WLC)

1. Define the energy and embodied carbon targets, as well as WLC measurement and verification process at project conception and track throughout. Formal disclosure should be made at post-completion and then annually.
2. Carry out WLC calculations during design to optimise embodied carbon, reduce operational energy and integrate Circular Economy principles. For example testing energy reductions against increased envelope specification or calculating carbon payback periods for MEP equipment or renewables.
3. Address upfront embodied carbon emissions (A1-5) by using as little as possible.
   SIGNPOST Embodied carbon one pager
4. Consider the carbon cost / benefit between upfront carbon, operational carbon and life cycle carbon due to replacement cycles.
5. At each replacement cycle, prioritise low carbon materials and Circular Economy principles to reduce WLC emissions.
6. Operational energy loads must be minimised and meet local carbon targets. A decarbonised grid depends on reducing overall energy requirements. A further effect of grid decarbonisation is to make embodied carbon an even larger proportion of WLC.
7. Utilise Circular Economy principles at the beginning and end of the building and component life cycle. This includes retrofit, re-use of materials, recycled materials and design for future adaptability. Document end of life scenarios and quantify the potential future carbon benefits.

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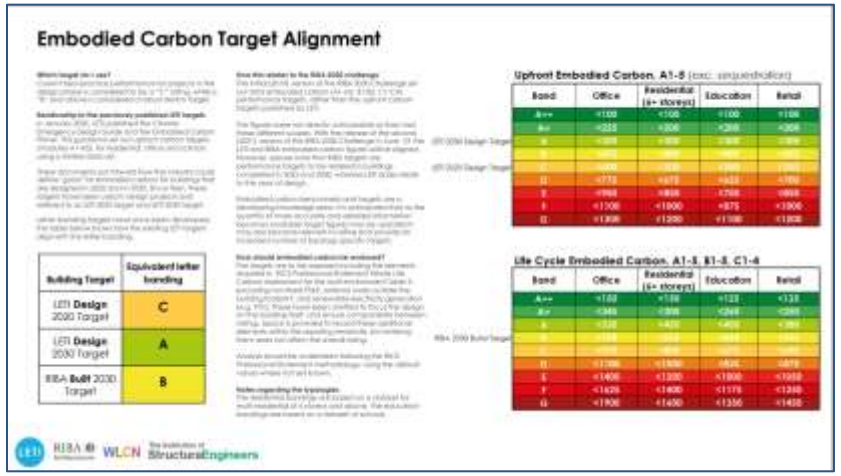
Targets or limits



Upfront Embodied Carbon, A1-5 (exc. sequestration)

Band	Office	Residential (6+ storeys)	Education	Retail
A++	<100	<100	<100	<100
A+	<225	<200	<200	<200
A	<350	<300	<300	<300
B	<475	<400	<400	<425
C	<600	<500	<500	<550
D	<775	<675	<625	<700
E	<950	<850	<750	<850
F	<1100	<1000	<875	<1000
G	<1300	<1200	<1100	<1200

LETI 2030 Design Target

LETI 2020 Design Target

Life Cycle Embodied Carbon, A1-5, B1-5, C1-4

Band	Office	Residential (6+ storeys)	Education	Retail
A++	<150	<150	<125	<125
A+	<345	<300	<260	<250
A	<530	<450	<400	<380
B	<750	<625	<540	<535
C	<970	<800	<675	<690
D	<1180	<1000	<835	<870
E	<1400	<1200	<1000	<1050
F	<1625	<1400	<1175	<1250
G	<1900	<1600	<1350	<1450

RIBA 2030 Build Target

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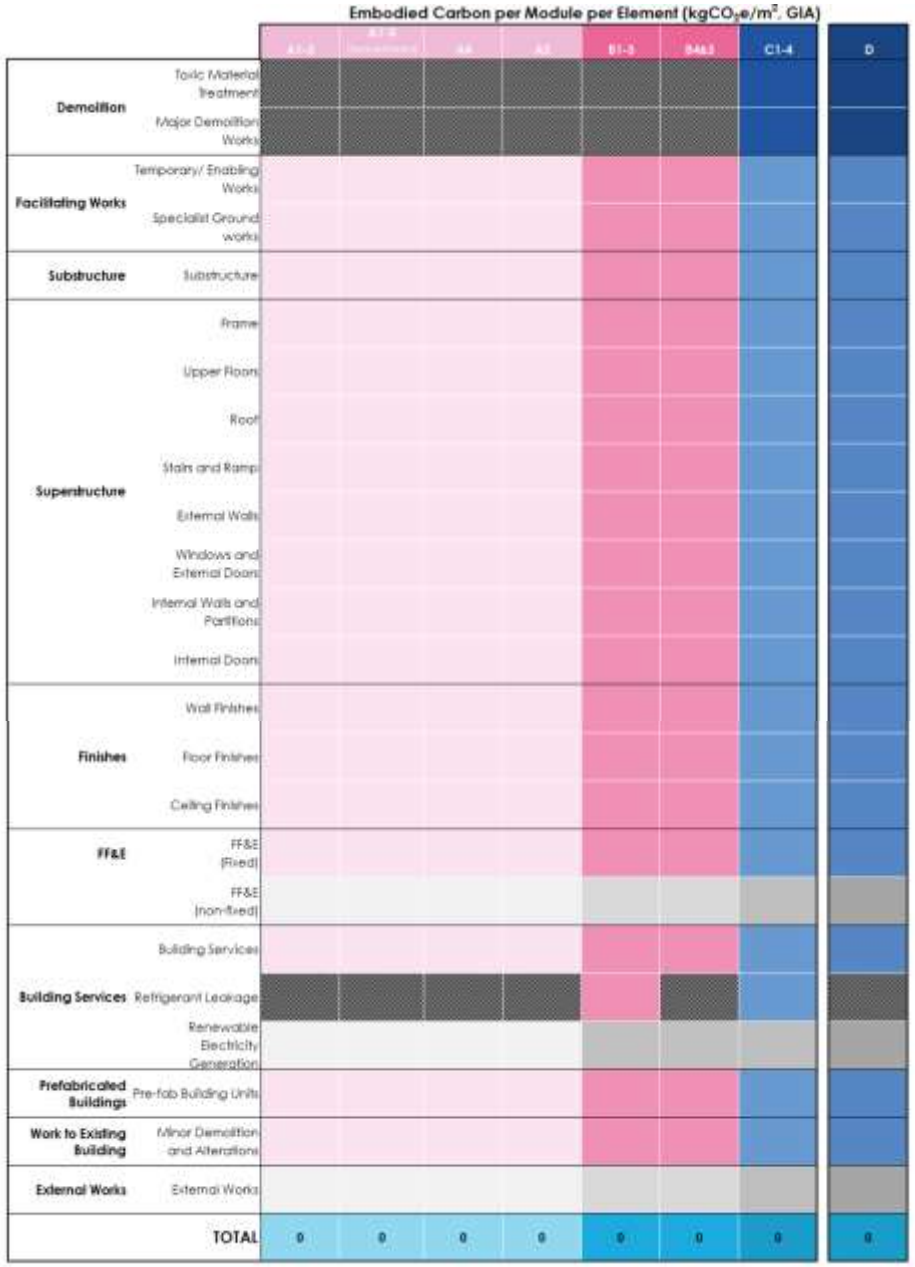
Reporting template and output

	Upfront Carbon A1-5 exc. sequestration ($kgCO_2e/m^2$)	Embodied Carbon A1-5, B1-5, C1-4 ($kgCO_2e/m^2$)
Project Name Project ABC **Project Sector** Office **Assessment Date** 23/05/2021 **Assessment By (name)** JJW **Assessment By (company)** FCBStudios		
A++	100	150
A+	225	345
A	350	530
B	475	750 **B 740**
C	600 **C 580**	970
D	775	1180
E 2020 Benchmark	950	1400
F	1100	1625
G		
Non-Listed Typology:		
Sequestered Carbon:	**-50 $kgCO_2e/m^2$**	
Module D:		**25 $kgCO_2e/m^2$**



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Retrofit:

Climate Emergency Retrofit Guide

&

Rebuild vs retrofit unpicker

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LETI Climate Emergency
Retrofit Guide
How existing homes can be adapted to meet UK climate targets
Retrofit Process
LETI

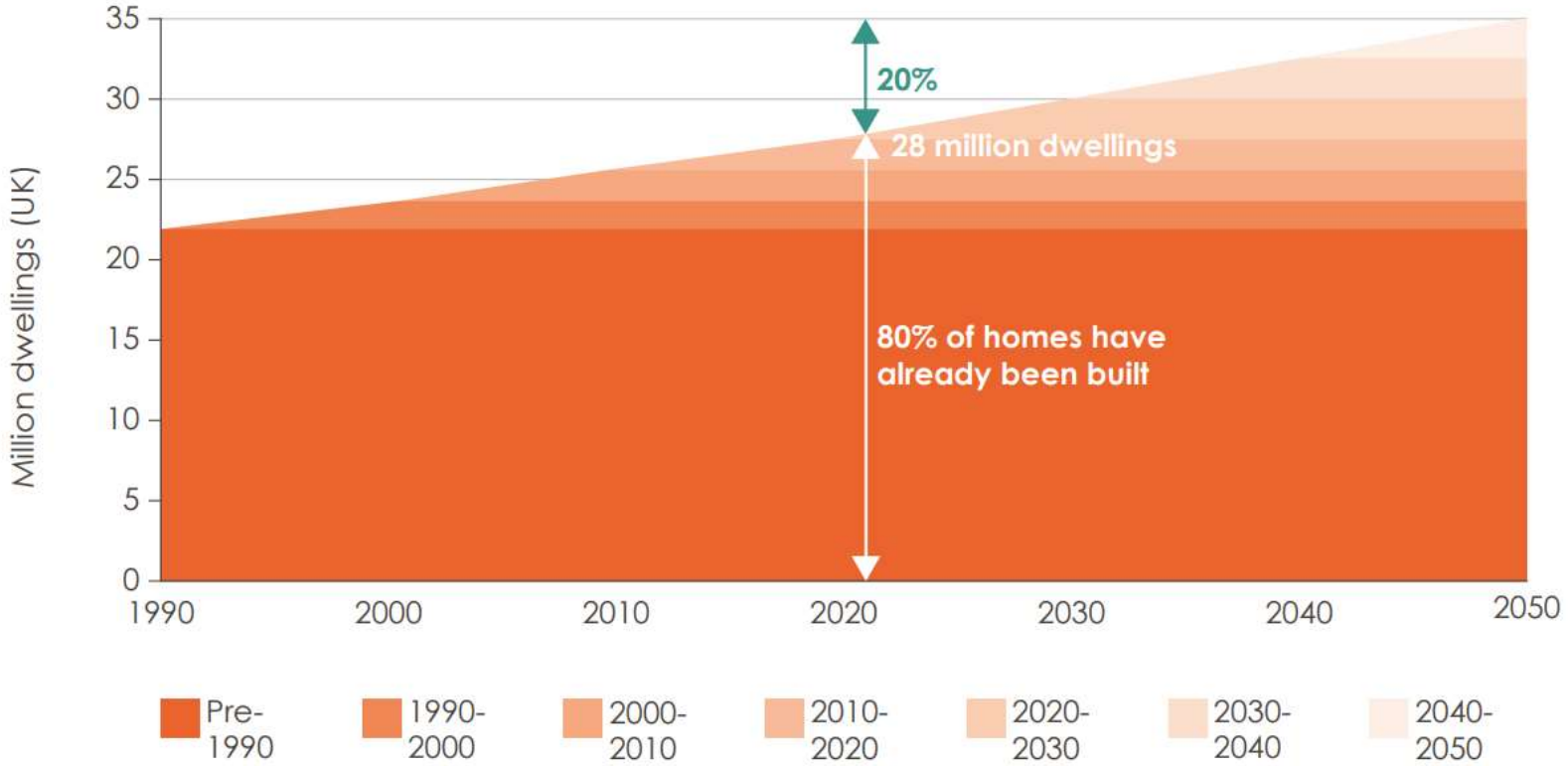


Figure 1.4 - Millions of dwellings built in the UK from pre-1990 to 2050. Note: demolition has been ignored in this table as the relatively small amount of domestic demolition is usually followed with replacement.

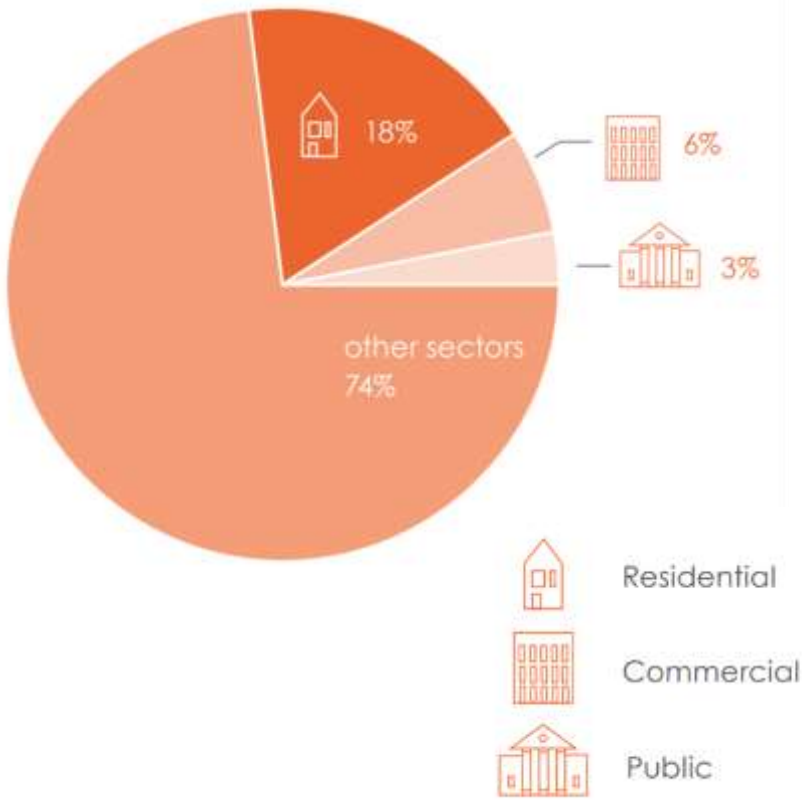
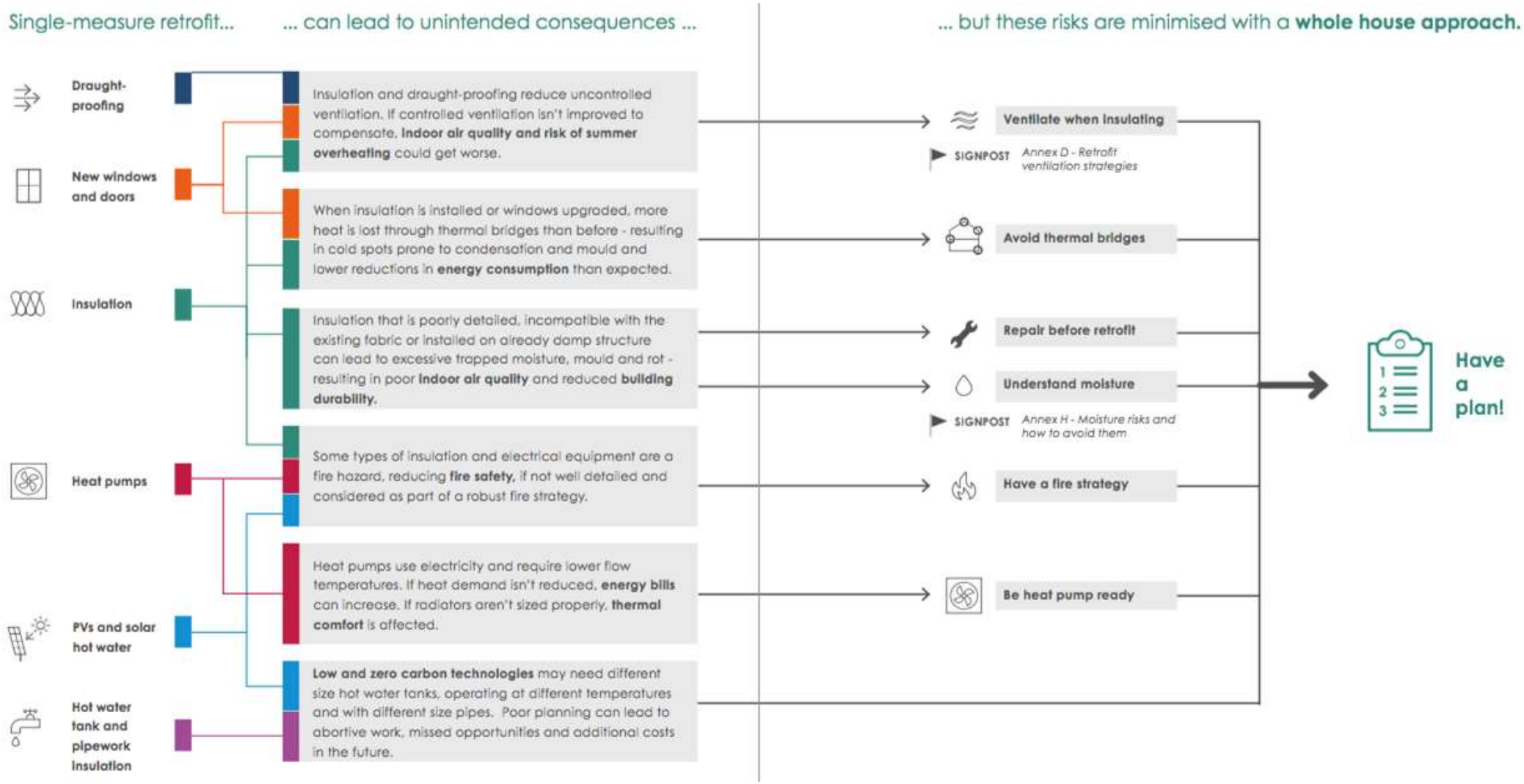
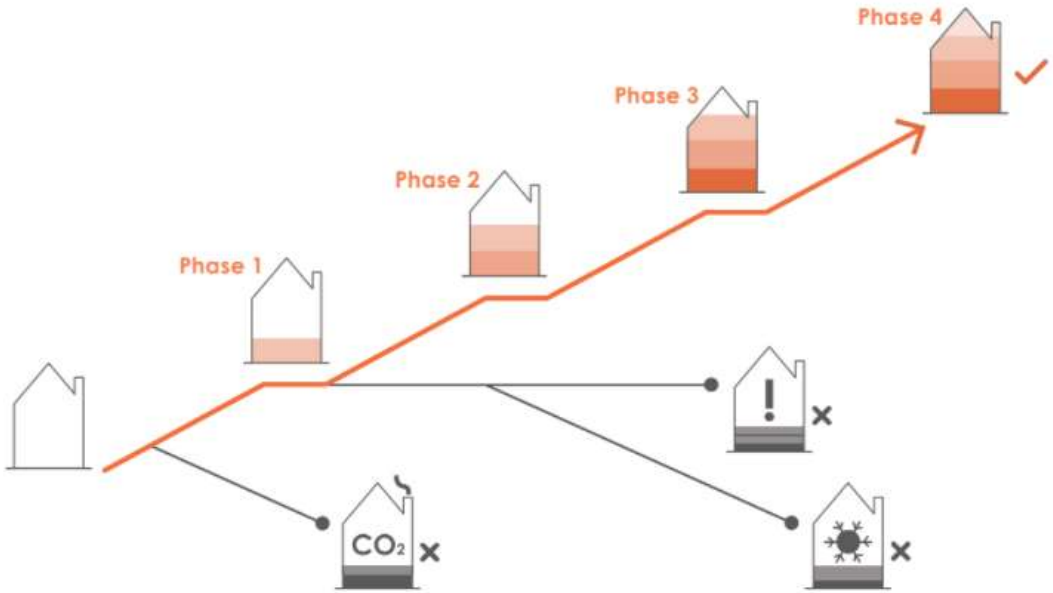


Figure 1.2 - United Kingdom buildings CO_2e emissions, 2017, includes direct and indirect emissions. Source: UKCCC, Net Zero-Technical Report, May 2019. Note: 'other sectors' include power, industry and transport[1].

Risks of retrofit





Whole building approach

A whole house approach delivers the maximum benefit with the least risk.

Piecemeal approach

A piecemeal approach can fail to deliver the energy and carbon savings predicted.

A piecemeal approach can lead to works obstructing future improvements preventing the full benefits from being realised.

A piecemeal approach can cause damage to health and the building structure.

Theory

SIGNPOST *Chapter 1 - Why retrofit?*

SIGNPOST *Chapter 2 - What is retrofit?*

SIGNPOST *Chapter 3 - Where are we now and what can we achieve?*

Practice

SIGNPOST *Chapter 4 - LETI home retrofit targets*

SIGNPOST *Chapter 5 - How do we do it?*

SIGNPOST *Chapter 6 - Case studies*

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Limits

Two depths of retrofit + Constraints

LETI Exemplar

LETI Best Practice

Unconstrained

LETI Best Practice

Constrained

Methods

Two methods

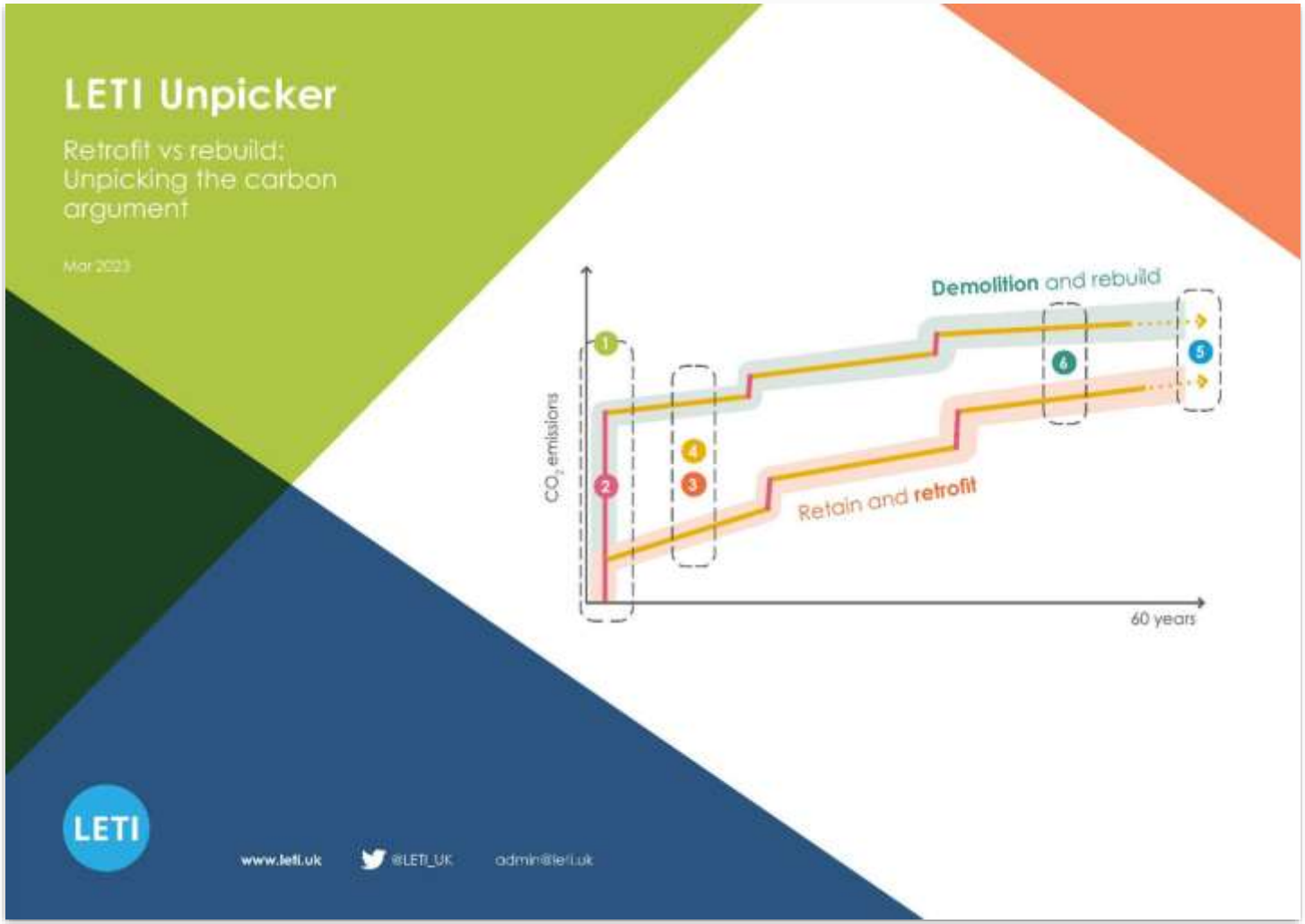
Energy Limits (Modelling method)

SIGNPOST Chapter 4 - *LETI home retrofit targets - 4.3 Constituent element method*

Building element		Retrofit actions	LETI best practice: Constrained retrofit	LETI best practice: Unconstrained retrofit (cool temperate climate)	LETI exemplar: All retrofit types
Walls	Cavity	External, cavity or internal insulation	0.24 W/m².K	0.18 W/m².K	0.15 W/m².K
	Solid uninsulated	External or internal insulation	0.32 W/m².K	0.18 W/m².K	0.15 W/m².K
	Timber frame	External or internal insulation	0.21 W/m².K	0.18 W/m².K	0.15 W/m².K
Roofs	Cold	Insulate	0.12 W/m².K	0.12 W/m².K	0.12 W/m².K
	Warm/flat	Insulate	0.22 W/m².K	0.12 W/m².K	0.12 W/m².K

Fabric and systems limits
(Constituent element method)

LETI Retrofit vs Rebuild Unpicker



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LETI Retrofit vs Rebuild Unpicker

Retrofit vs rebuild: Unpicker checklist

1 Whole life carbon (WLC) assessment methodology

- ☐ Is the WLC assessment best practice? RICS Professional Statement and latest industry guidance
- ☐ Is the WLC assessment consistent? E.g. replacement cycles
- ☐ Are the assumptions clearly stated?

The carbon impacts from demolition and strip out should be included and identified within the total WLC figure.

2 Embodied carbon options

- ☐ Are the embodied carbon options best practice?
- ☐ Has similar ambition been assumed in the retrofit and rebuild scenarios?

3 Potential of the existing building

- ☐ Has the full potential, including "deep" low carbon retrofit been considered?

4 Assessment of operational energy use

- ☐ Is the assessment of energy use realistic? Based on performance assessment (rather than Building Regulations Part L compliance)?
- ☐ Is the assessment of energy use consistent? E.g. Not new build modelled energy use vs existing metered energy use.

Beware of benchmarks and targets as they are much less informative.

Retrofit vs rebuild: Unpicker

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1 What is the whole life carbon assessment methodology?

Is it consistent between scenarios, and does it follow best practice?

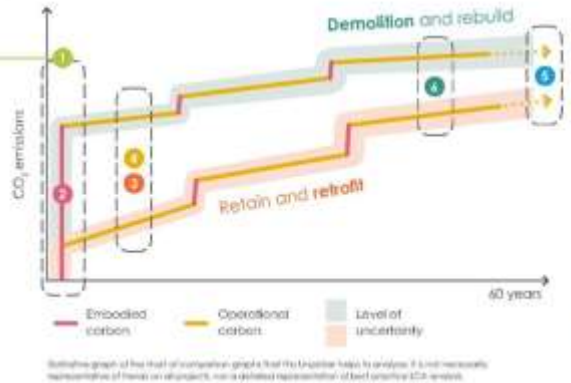
The whole life carbon (WLC) assessment should follow the RICS Professional Statement (PS) and list all assumptions and data sources. Life cycle stages should be explicitly mentioned so they can be compared across scenarios. All elements recommended in the PS should be included. If the assessment differs from the PS recommendations, this should be highlighted and justified, and the results shown alongside those obtained when following the PS recommendations.

The carbon impacts from demolition and strip-out should be included and identified within the total WLC figure.

2 Do all scenarios follow best practice?

And do they show similar ambition to reduce carbon?

All scenarios should seek to reduce carbon as much as possible, and meet targets such as those from LETI, e.g. re-using foundations, using materials efficiently, not over-sizing building services equipment. This should be consistent e.g. if the re-build scenario assumes innovative products to reduce carbon, innovation should also be explored in the retrofit scenario.



3 Is the potential performance of the existing building fully explored through a low carbon retrofit?

The WLC comparison should not be between a best performing new build, and an existing building with little or no improvement: it should consider, as alternative to demolition & new build, a low energy use, low carbon retrofit with similar level of ambition to that applied to the new build (i.e. using best practice measures and targets in both cases).

4 Are operational emissions based on a robust and realistic energy performance assessment?

Energy performance modelling methods include CIBSE TM54, PHPP, and NABERS. Part L assessments are standardised asset comparisons, they are NOT energy performance assessments and should not be used for WLC assessments.

For best practice, energy use and associated operational carbon emissions should be shown as a range, to represent possible scenarios for occupancy and operation.

Benchmarks or industry targets could possibly be used instead of energy performance modelling, but only at a very early stage, as they are much less informative about the specific project.

Metered energy use from the existing building should only be used to help calibrate the energy model before applying the retrofit measures to reduce operational energy.

5 Is the difference in carbon emissions between scenarios significant?

Or is it within the margin of error and uncertainty?

Assessment of early design stages will include many assumptions on specifications, supply chains etc. In addition, the standard period for a WLC assessment is 60 years, which inherently implies much uncertainty, and means that carbon benefits far into the future should be viewed much more cautiously than early ones. Altogether, if there is only a small difference (say, below 20%) in WLC emissions between the retrofit and rebuild scenarios, this is likely to be within the margin of error and uncertainty, and not a robust basis for decision on carbon grounds.

6 Are grid decarbonisation assumptions realistic?

Or do they risk under or over-estimating emissions from energy use?

There is reasonable agreement on future decarbonisation of the UK electricity grid. The "central" scenario in the WLC assessment should follow the RICS PS recommendation, but other scenarios could be explored e.g. using the LETI Opinion Piece. Assuming more rapid grid decarbonisation reduces operational carbon relatively. It attributes less benefit to a highly efficient new build, and more to embodied carbon. Assuming slower grid decarbonisation increases operational carbon and, relatively, gives more benefit to energy efficiency.

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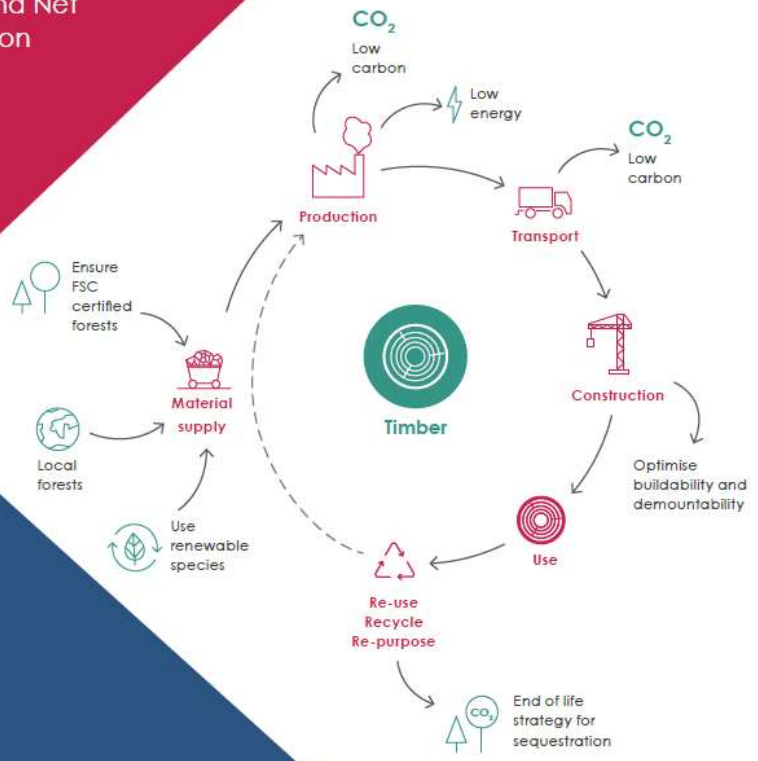
Low Embodied Carbon spec and procurement

LETI Low Embodied Carbon Specification & Procurement Guide

LETI Low Embodied Carbon Specification and Procurement Guide

For Low and Net Zero Carbon Buildings



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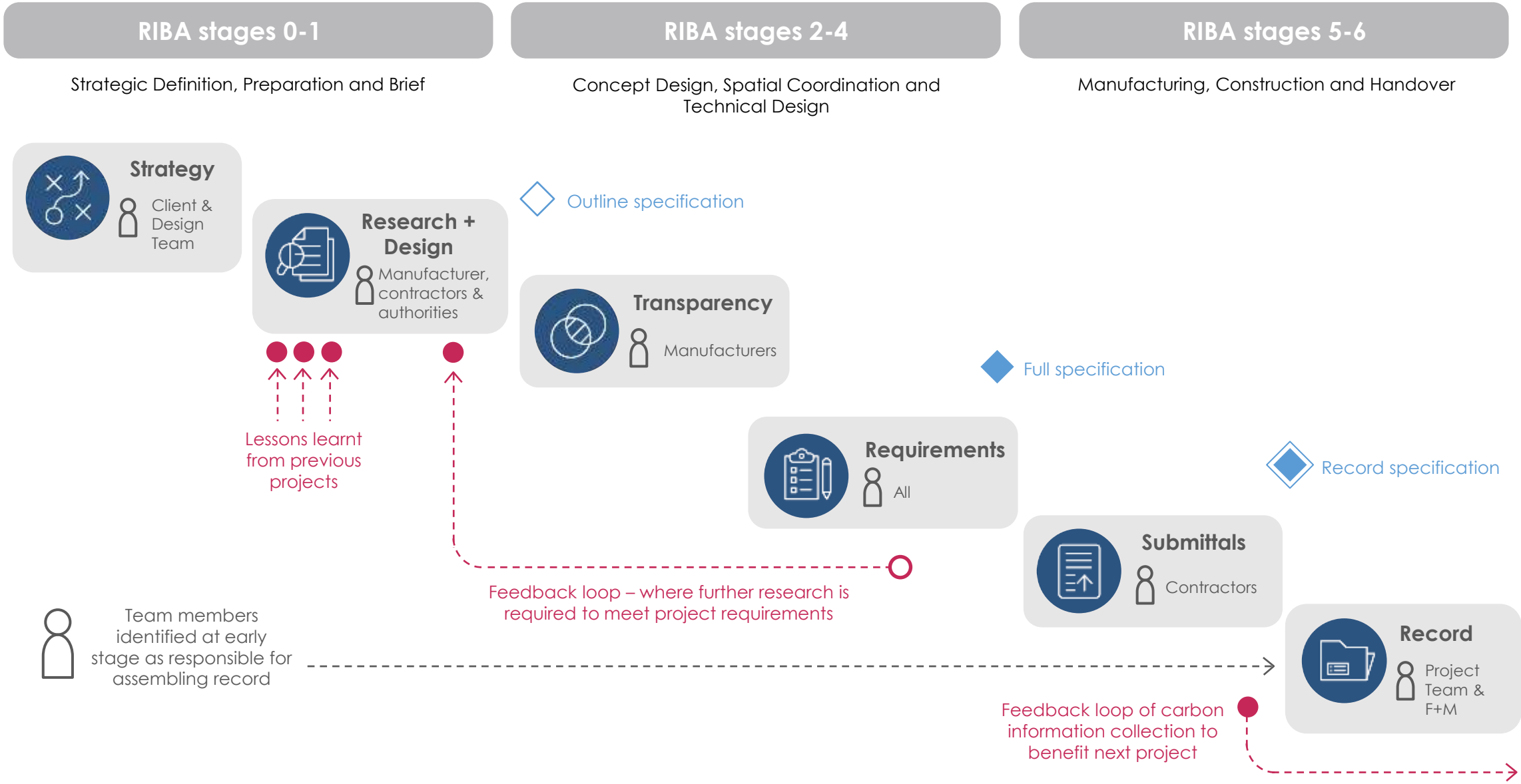
LETI Low Embodied Carbon Specification & Procurement Guide



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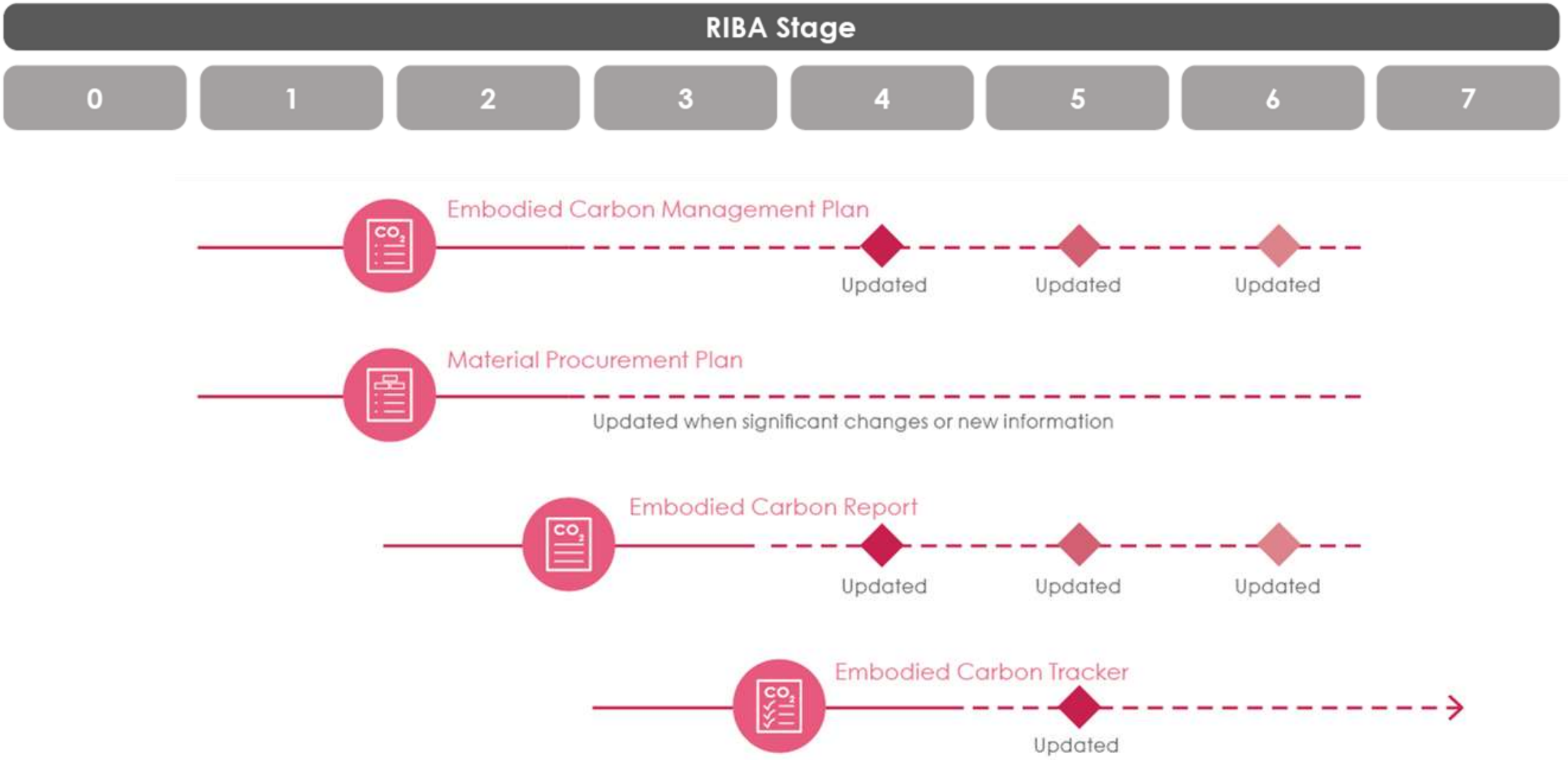
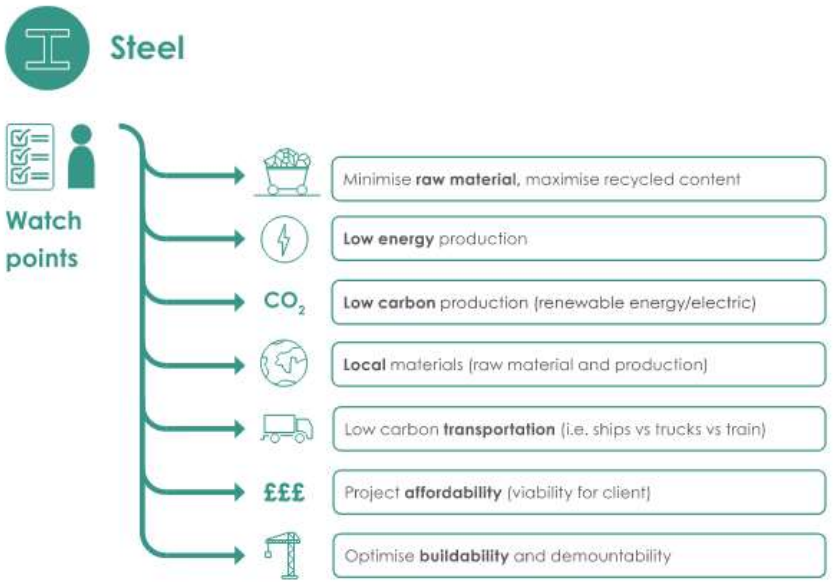
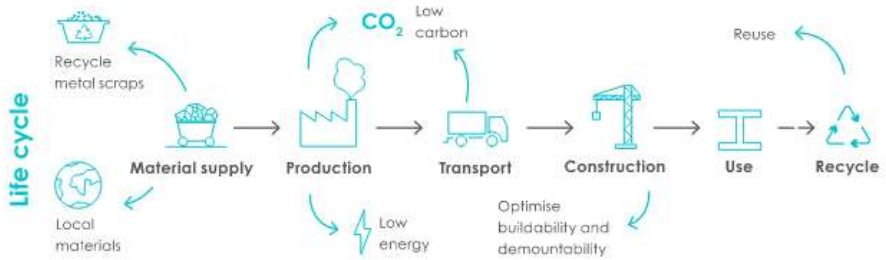


LETI Low Embodied Carbon Specification & Procurement Guide

- Material Guides Provide a best practice specification and procurement
- Encourages the setting of upfront carbon limits within specifications
- Details a whole life cycle approach to specification and procurement
- Encourages effective communication between clients, design team members, contractors and manufacturers





Client Guide

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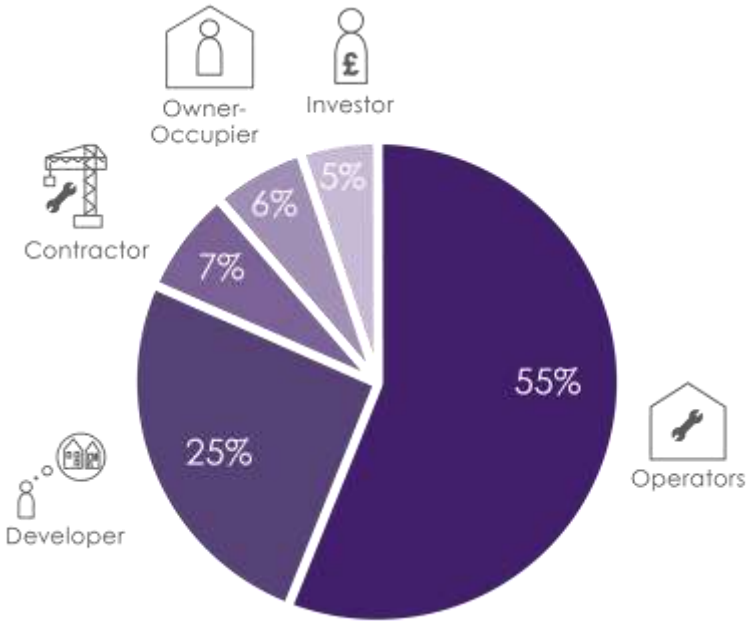

The Breakdown of the Client Profile of Respondents

60% of respondents know how to include net zero carbon in project briefs.

lack of knowledge and awareness is a key reason for net zero carbon criteria not being included in project briefs.

0 Strategic Definition

- Client leadership team leads the vision for net zero carbon and avoids delegating net zero carbon responsibilities to others.

1 Preparation and Brief

- Designers are appointed at an appropriate time where their influence on matching the brief to their skillset is minimised.
- Innovation incentives for design team are set.
- Clear criteria for client sign-off and implicators are set.

2 Concept Design

- Ensure designers are given the fee and scope to develop alternative strategies to compare and contrast approaches (as opposed to defaulting to tried -and-tested).
- Transparency and appropriate recording of the decision-making process are incorporated.

3 Spatial Coordination

- Design intent clearly communicated as design team widens.
- Effective integration/ coordination between principles are implemented.
- Clear communication with procurement team (to instil low risk zero carbon) is set.
- Single sourcing of equipment suppliers is established.

4 Technical Design

- Contractor has a collaborative ethos.
- Clear communication between design team, contractor team and suppliers during detailed design, is set.
- Sufficient oversight is in place when detail design responsibility is given to a specialist contractor.

5 Manufacturing and Construction

- Site queries are addressed by the design team in a timely and complete manner.
- Clear Zero Carbon leadership is established.
- Site labour is skilled and motivated for the effort required for Zero Carbon.
- True verification/ inspection is undertaken.

6 Handover

- Design team's focus is retained within the project with adequate fee / budget for Post Occupancy Evaluation (POE).

7 Use

- A good relationship between facilities' management team and the equipment suppliers is established.

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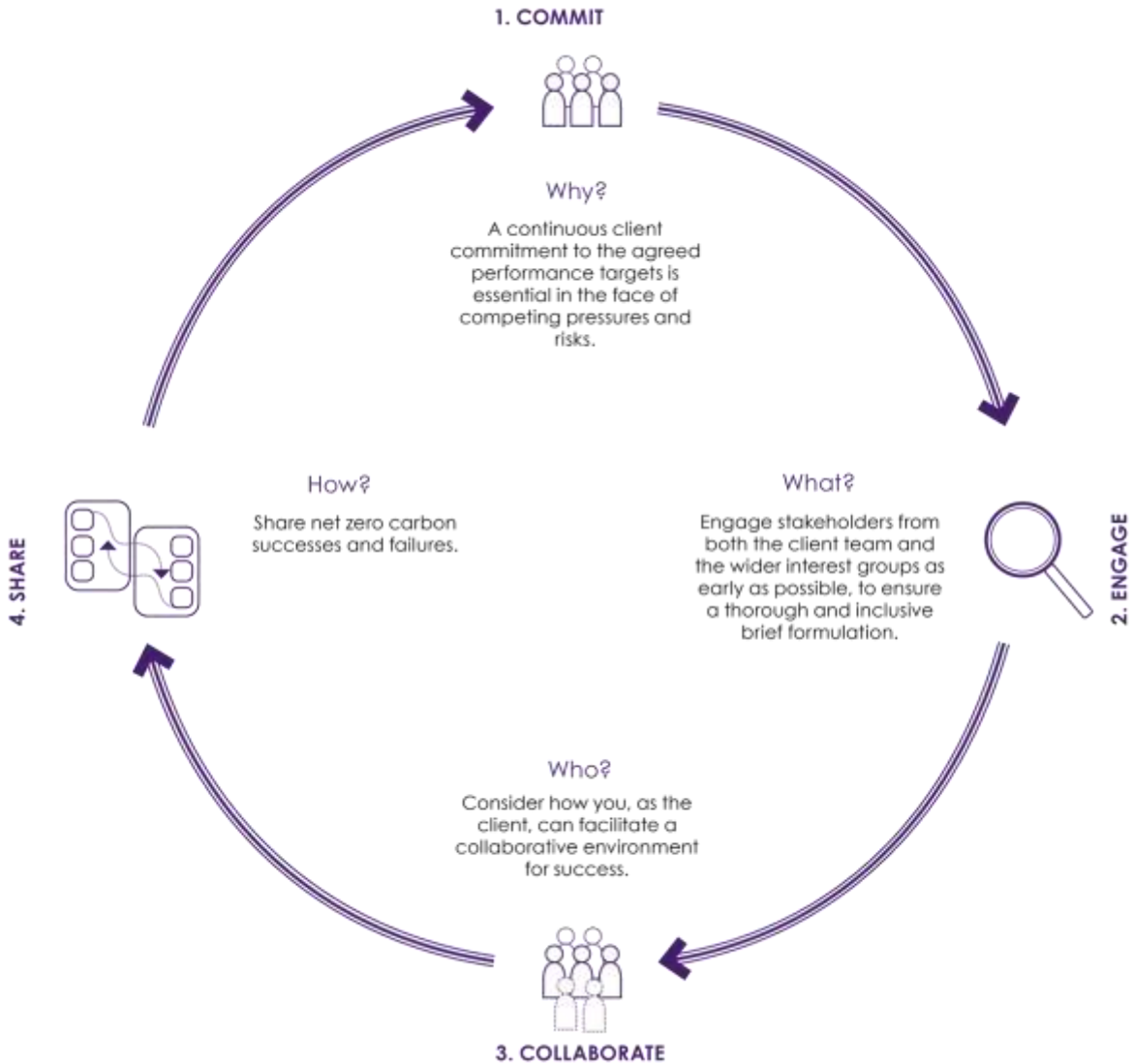
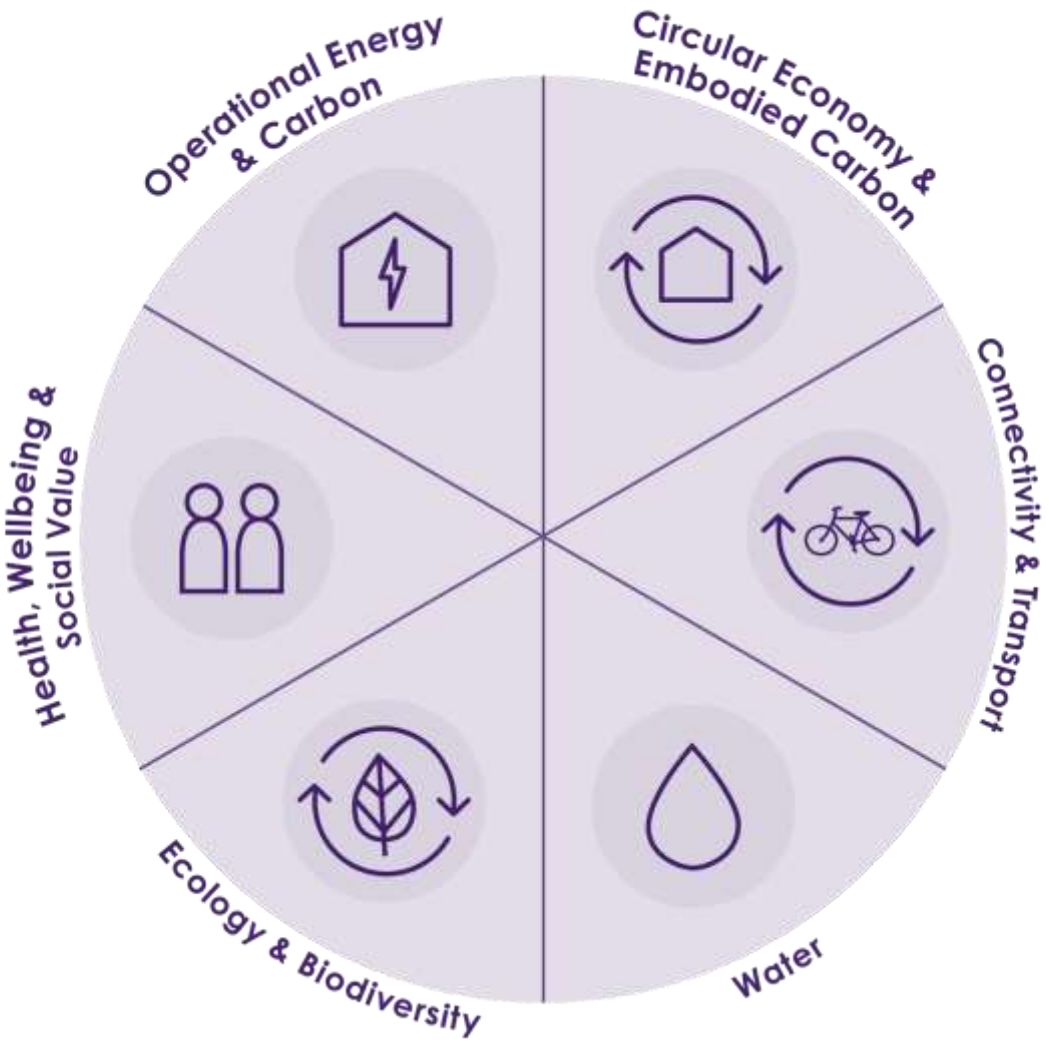

1. COMMIT
Why?
A continuous client commitment to the agreed performance targets is essential in the face of competing pressures and risks.
What?
Engage stakeholders from both the client team and the wider interest groups as early as possible, to ensure a thorough and inclusive brief formulation.
2. ENGAGE
Who?
Consider how you, as the client, can facilitate a collaborative environment for success.
3. COLLABORATE
How?
Share net zero carbon successes and failures.
4. SHARE



Reference: Climate Framework

Net Zero Carbon

Net Zero FAQs & Carbon definitions & the UK Net Zero Carbon Buildings Standard

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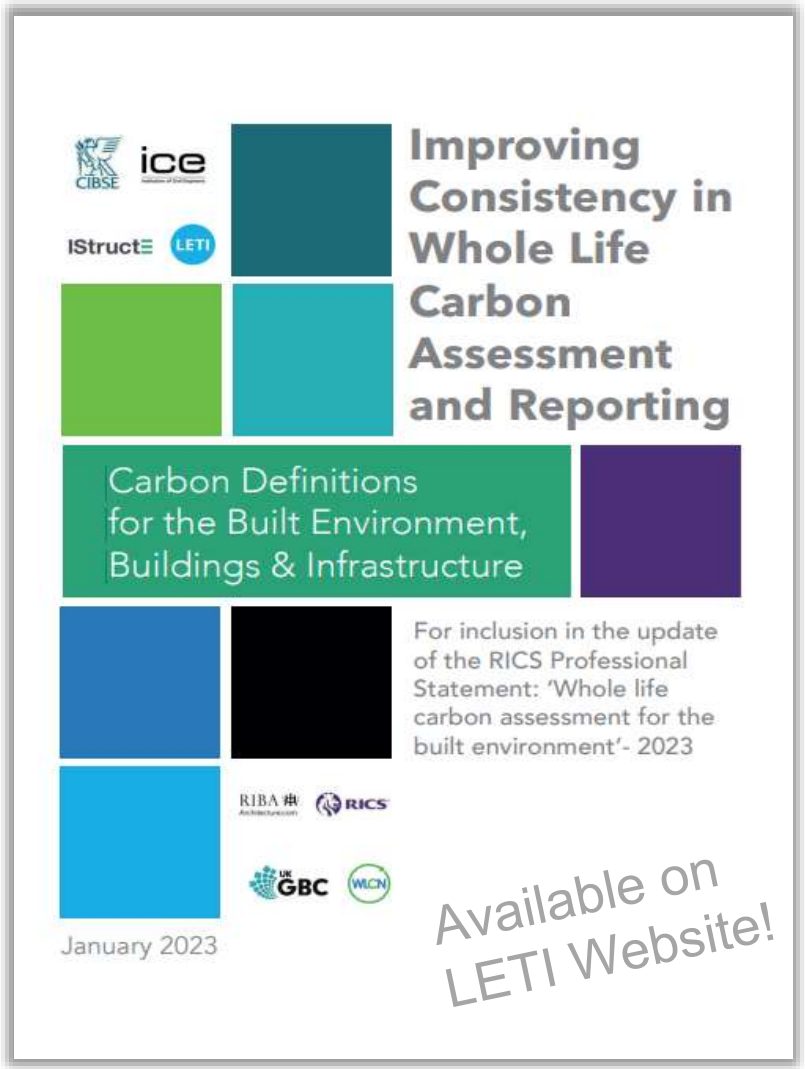
Carbon definitions for the built environment

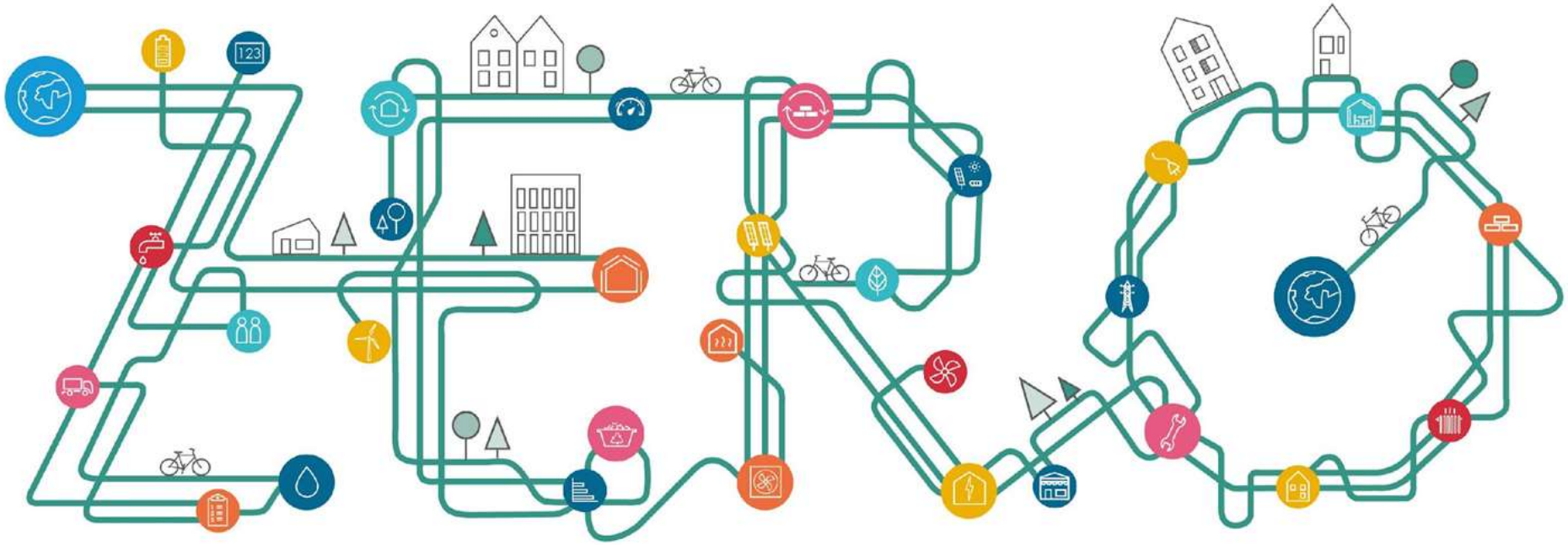
Whole life carbon

'Whole Life Carbon' emissions are the sum total of all asset related GHG emissions and removals, both operational and embodied over the life cycle of an asset including its disposal (Modules: A0-A5; B1-B7; B8 optional; C1-C4, all including biogenic carbon, with A0 assumed to be zero for buildings). Overall Whole Life Carbon asset performance includes separately reporting the potential benefits or loads from future energy or material recovery, reuse, and recycling, and from exported utilities (Modules D1, D2).



Net Zero FAQs

What does Net Zero mean?



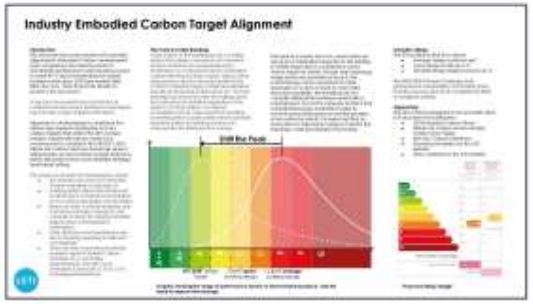
Supported by:

The Institution of Structural Engineers
RIBA Architecture.com
RICS
bre
Good Homes Alliance
WLCN

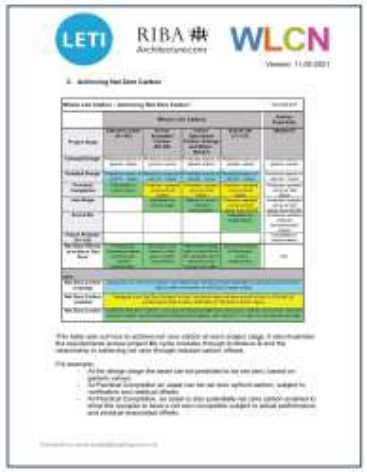
Builds on existing guidance on Net Zero

Information

Targets



Definitions



CIBSE Net Zero guidance page & links

https://www.cibse.org/News-and-Policy/Policy/Technical-Themes/Net-Zero/CIBSE-guidance-to-deliver-net-zero-carbon-new-buil

CIBSE LETI

Answers many common questions …

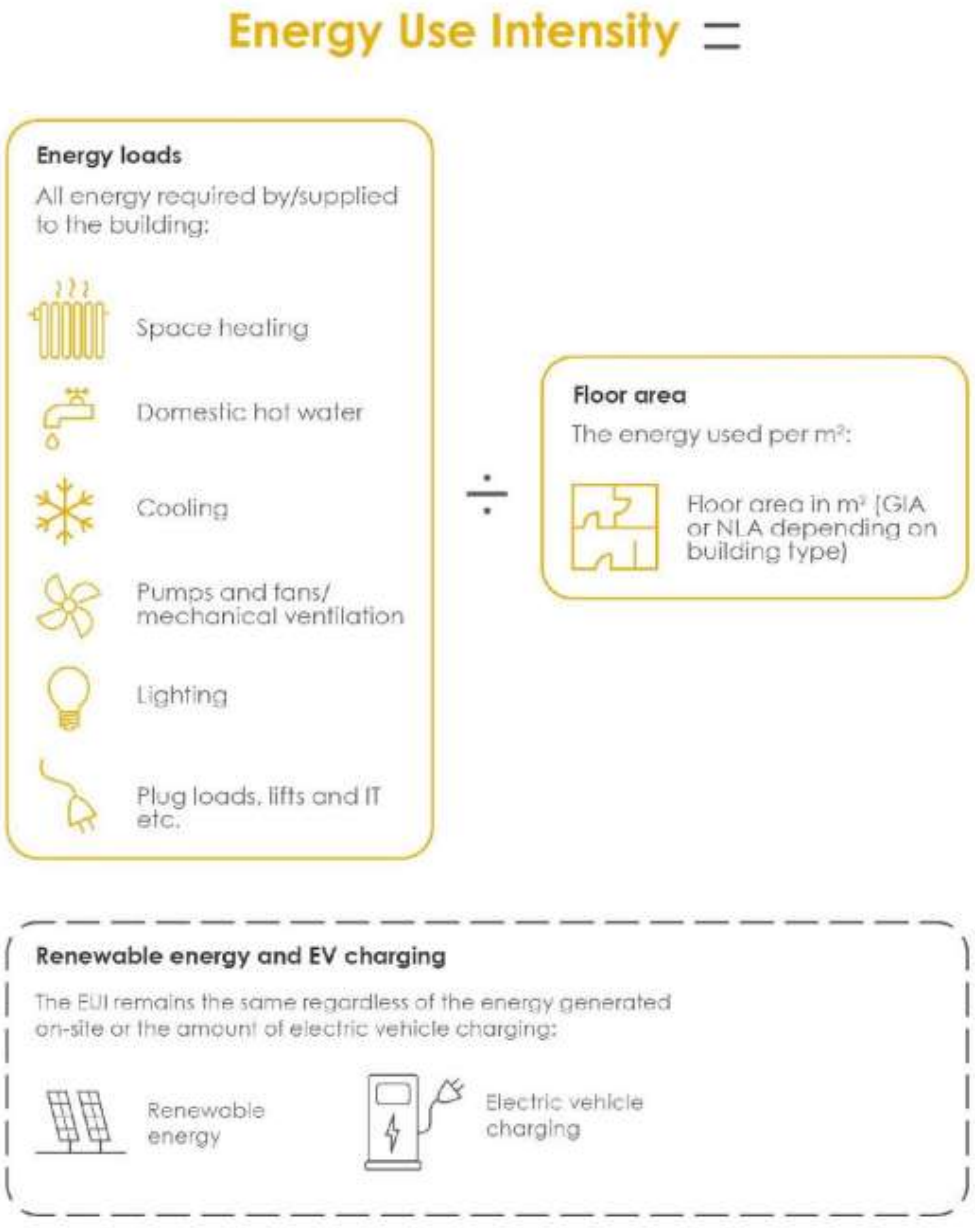
FAQ 5 - How is an EUI calculated in buildings with an on-site renewable system?

Energy Use Intensity (EUI, kWh/m^2.yr)

Energy use per m^2 required by a building over a year, including regulated & unregulated loads

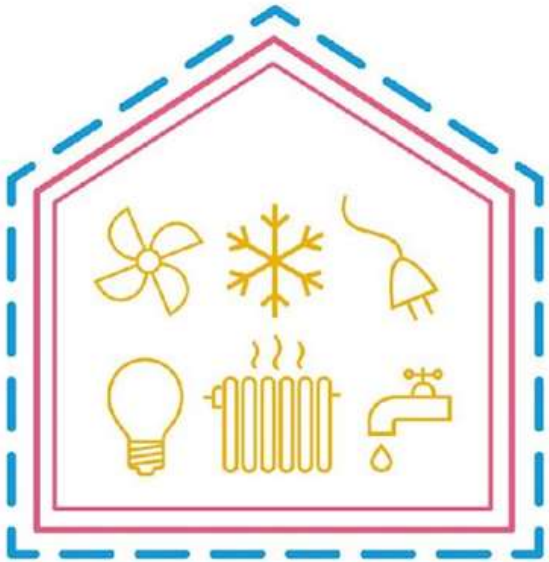
A measure of the **building's performance**

Includes **all energy supplied to the building, whether from the grid or on-site systems**.



CIBSE LETI

FAQ 19 - "Net zero whole life carbon"



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Whole life net zero carbon

Operational carbon

- Fossil fuel free
- Energy use target
- Water target
- Space heating and/or space cooling demand target
- Renewable energy

\+

Embodied carbon

- Upfront embodied carbon target
- Lifecycle embodied carbon target

\+

Offsets

For unavoidable emissions

- Upstream emissions
- Embodied carbon emissions
- Water supply and wastewater treatment emissions

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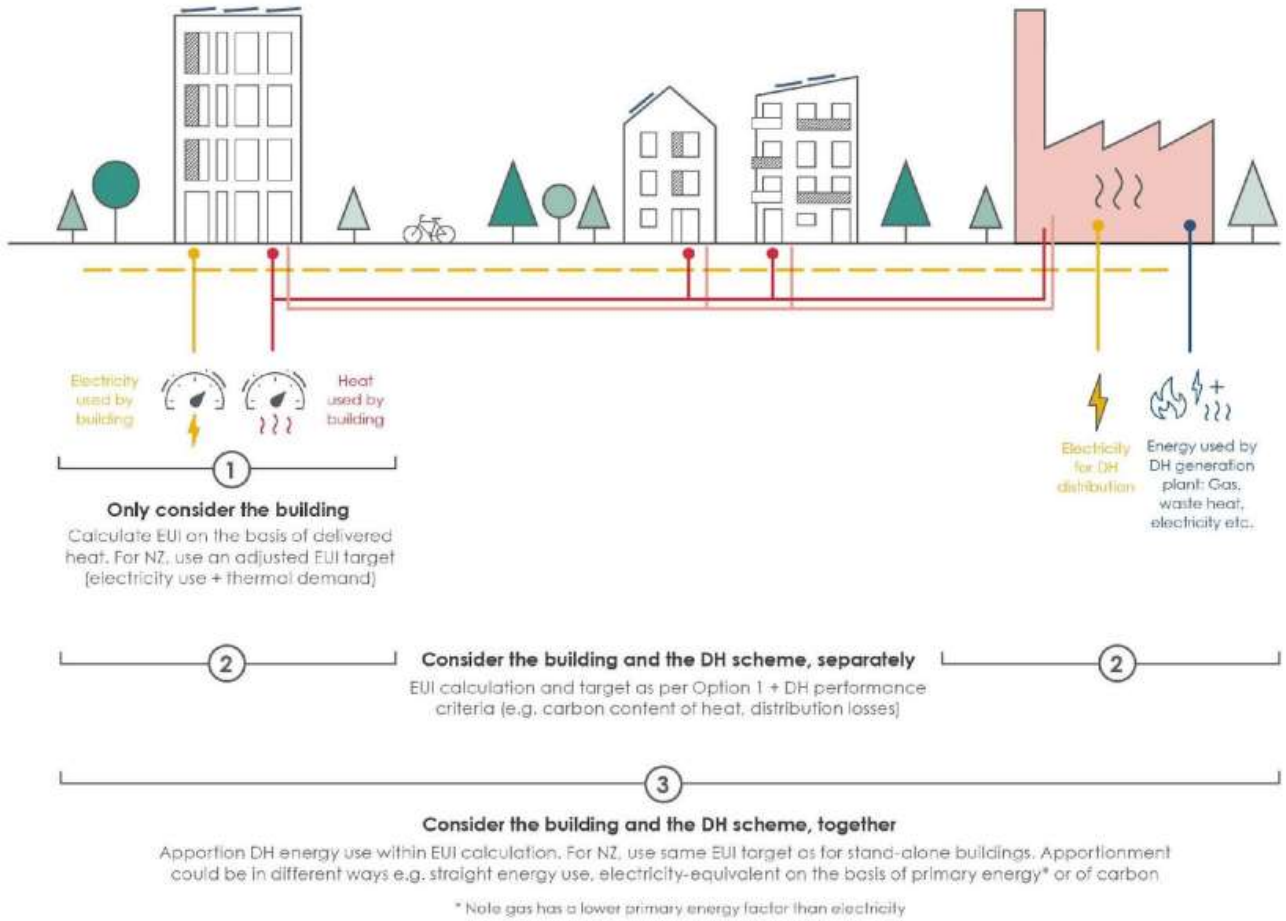
Leaves some difficult questions not fully resolved …

FAQ 7 - How are EUIs and associated targets calculated in buildings served by communal or district energy schemes?



CIBSE LETI

Claims for buildings that are not yet operating at Net Zero : Net Zero in Progress (NZiP)

Net Zero Operational Energy

Building is in use

Energy use meeting the target

+

No fossil fuels

+

Renewable energy and offset of upstream emissions

Net Zero in Progress: options

For buildings in design or built but **not yet operating**

For **existing buildings** where energy use does not meet the energy target, but with a Retrofit Plan in place to meet it.

For buildings which have to connect to non-compliant **energy networks**, where the network has a Decarbonisation Plan in place which will allow the building to meet all NZ requirements

Net Zero Embodied

Building is built

Upfront embodied carbon meeting the target

+

Offset covering upfront embodied emissions

Building is in use

+

Life cycle embodied carbon meeting the target

+

Offset covering Stage B embodied emissions

Net Zero in Progress: options

(For NZ Embodied) For buildings **in design** or built but **not yet operating**

(For NZ Upfront) For buildings **in design**

CIBSE LETI

UK Net Zero Carbon Buildings Standard

BBP BETTER BUILDINGS PARTNERSHIP
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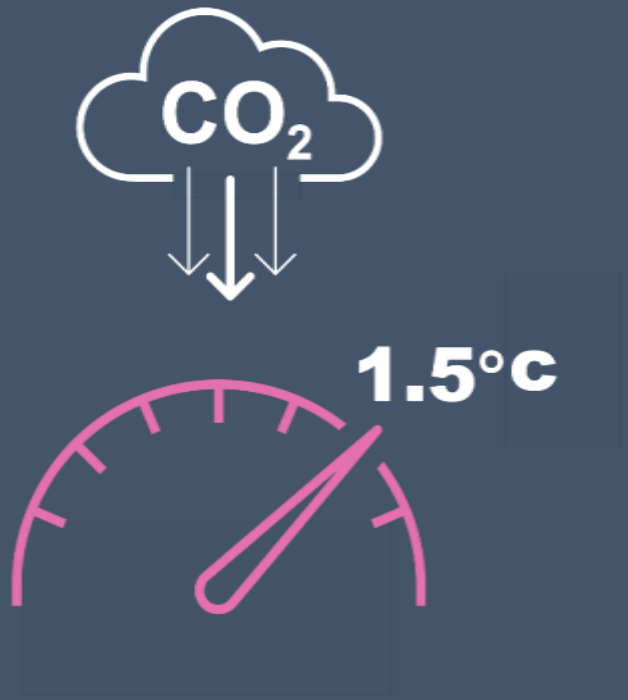
CARBON TRUST
CIBSE
The Institution of StructuralEngineers
LETI
RIBA Architecture.com
RICS
UK GBC

It will be a rule book for assessing new and existing buildings in the UK as Net Zero Carbon

In its self, it will not be a certification scheme

However it is intended that this is developed from the NZCBS at a later date

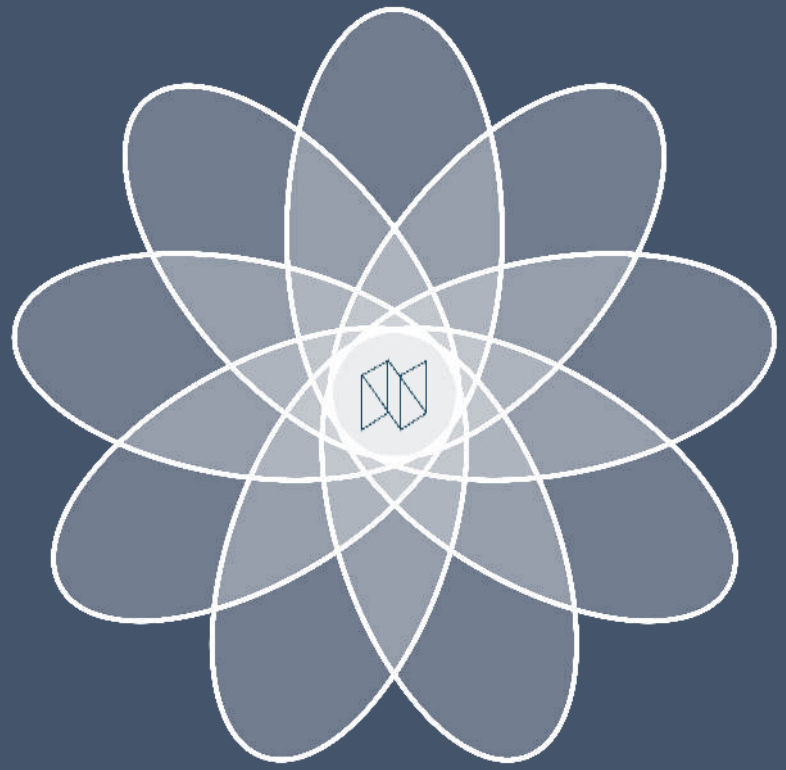
It will be science-based



Aligned with the UK's remaining carbon budget and other actions needed by the UK built environment to deliver decarbonisation in line with a 1.5°C pathway

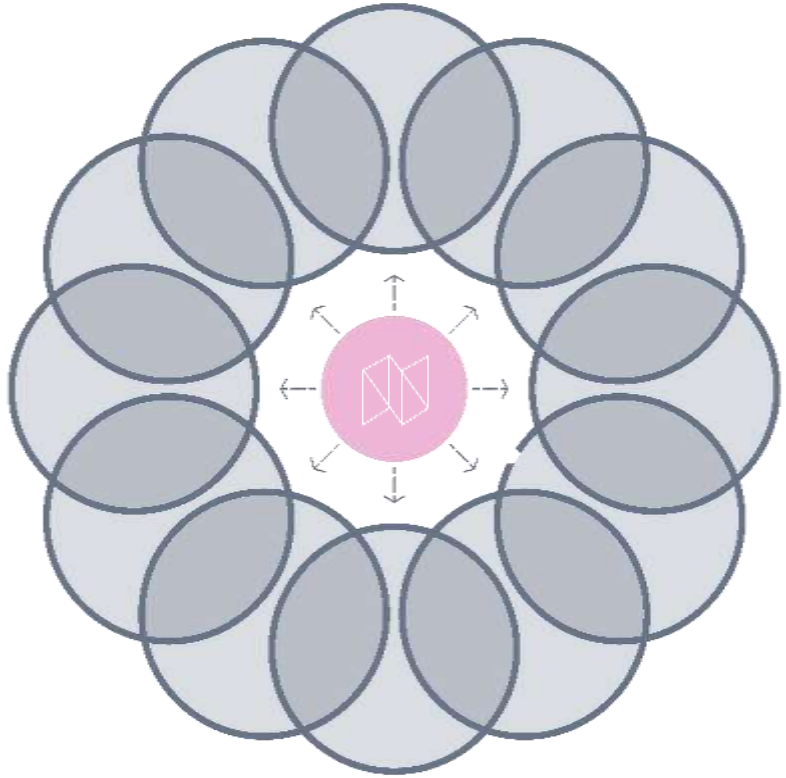
Not constrained or tied to Government policy

It will be developed collaboratively



Developed by built environment organisations in the UK that have been working in the Net Zero space

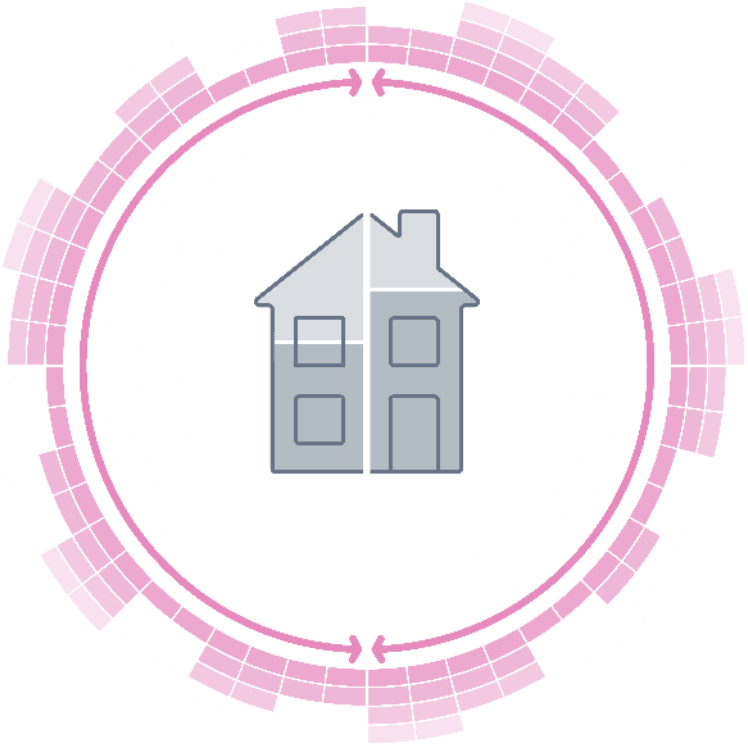
It will not be owned or developed by one organisation



It will address whole life carbon

Setting targets or limits for operational energy and embodied carbon, and other metrics

It will not address other social or environmental impacts



Such as : air quality, health and wellbeing, resource scarcity, circular economy, biodiversity, ecology and flood risk

It will cover the typologies where there is enough data available to develop Net Zero targets and limits

It will seek to cover – Homes, Offices, Schools, Logistics/Warehouses, Sport & Leisure, Retail, Higher Education, Healthcare, Science & Technology, Hotels, Commercial, Culture & Entertainment, Heritage and Data centres

It will not cover civil infrastructure projects.

03 LETI workstream update

Operational Energy Case Studies

St Johns Library, Oxford

New Build

Energy Use Intensity (EUI)

Exemplar

65

Best practice

Very good

Project Overview
A new library and Archive for St Johns College, Oxford.

Project Sector
University

Energy Data Period
2021/22

GIA (m²)
1710m²

Year of Project Completion
2019 (Complete)

Type of building
New build

Location
UK

Form Factor of 1.1

Air Permeance of 4.0m³/h.m² (Headroom)

Fabric U-values (W/m²K)

Walls	0.26
Floor	0.22
Roof	0.20
Windows	1.05

Window Areas (% of wall area)

North	23%
East	30%
South	16%
West	12%
Horizontal	16%

Heat Pump Seasonal Coefficient of Performance (SCoP) of 3.2 (Heating)

Space heating demand (+ equipment)

51

Project Brief

The brief for the project was to explore the options for a new carbon-neutral study centre and archive to be located within a historic part of St Johns college, Oxford. The term "carbon neutral" was used within the brief and this ambition was reviewed through the design stages where the definition was critiqued and the feasibility and extent for on-building and off-building renewables was explored. Other client ambitions were to provide access to more appealing and comfortable workspaces with a greater variety of spaces for different working styles including private study areas, public study areas, areas for group working, and to provide more modern facilities whilst respecting the historic location.

Servicing strategy

The all-electric MEP design includes a ground source heat pump (GSHP) for heating served by closed loop boreholes located beneath the President's garden, also provide some cooling to the archive and server rooms. Natural ventilation for background ventilation and summertime overheating control with high levels of thermal mass. Roof space is maximised with a photovoltaic array on both the flat and pitched roofs. Hot water is by local point of use water heaters.

Fabric, form and airtightness

The building is a relatively compact form. The fabric and airtightness targets were significantly better than the current Part L standards. The air tightness target of 3m³/h.m².wasn't quite met, with the building achieving just under 4 m³/h.m².

Operational energy case studies 1

Post occupancy evaluation and Soft Landings

The building underwent a 2 year period of building optimisation and aftercare where a Soft Landings team made up of the Contractor team, Design team, FM and library users reviewed building performance at quarterly intervals. The Building Management System was regularly reviewed with set points and schedules and other setting tweaked and monitored. Seasonal commissioning of the GSHP helped to ensure the system was operating as intended.

Key Lessons Learnt

The heating demand is higher than the LETI targets (15kWh/m²/yr.). Background ventilation is provided by natural ventilation, which the monitoring of internal conditions found to control air quality (CO₂ concentrations) very effectively, but will have meant the heating load was higher than if the building had heat recovery ventilation and higher levels of air tightness.

Design stage energy reviews

A detailed operational energy assessment was carried out at RIBA Stage 4, which presented the energy consumption as a range depending on a number of factors including opening hours. This presented the most likely estimate of EUI as 56 kWh/m²/yr. The building did not quite achieve this and a comparison found that the "small power" load was higher than anticipated. This included the pond plant which was not included during the design stage review.

Energy sub metering

The chart below shows the result of the energy sub metering. Not all sub meters were connected to the BMS, which meant some readings were manually taken by the FM team. The data was used to compare to the TM54 targets and allowed the GSHP SCoP to be calculated. The sum total of the orange bars represents the EUI, not accounting for the PV generation.

Energy Consumption Breakdown

Other*

Comms / Server

Small Power

Lighting & Hot water*

Auxiliary

Space Heating**

PV Generation

Data Notes

* In this case the other loads consisted of lifts.

** Because of the way the distribution boards were wired up meant the point of use electric water heaters could not easily be separated from the lighting circuits.

***Heating is the total electric consumption of the heat pumps and includes cooling. The cooling demand was very low but was used to work out the heat pump SCoP.

Client
St John's College, Oxford

Project Team
Architect: Wright & Wright
Structural Engineer: Price and Myers
Service Engineer: Max Fordham

Case Study Author
Max Fordham

Operational energy case studies 2

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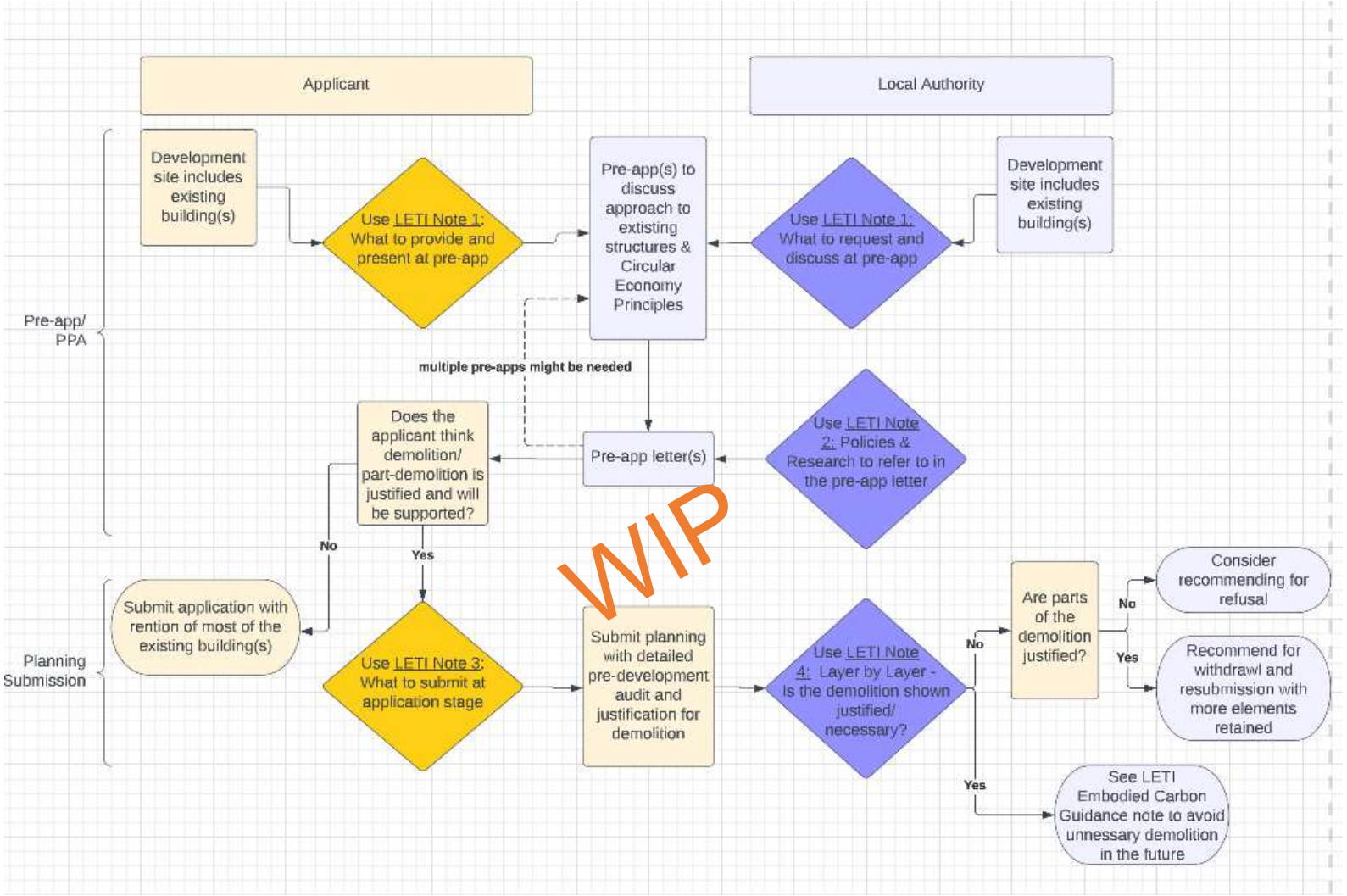
LETI Climate Emergency Planning Policy Guidance

- Policy 1: Net Zero Carbon New Buildings
- Policy 2: Energy Efficiency
- Policy 3: Low Carbon Heat
- Policy 4: Total Energy Use
- Policy 5: Renewable Energy Generation on-site
- Policy 6: Embodied Carbon
- Policy 7: Whole Life Carbon Assessment
- Policy 8: Circular Economy
- Policy 9: Overheating
- Policy 10: Delivering Performance
- Policy 11: Retrofit
- Policy 12: Offsetting

Local Authority retrofit vs demo



LETI Climate Emergency Retrofit Guide - Part 2

Homes: how many, how deep and at what cost?

Climate Emergency retrofit guide - Part 3 non-domestic

Document structure

Part A 'Spine'

Executive Summary
Overview
Technical

Modelling Pool

Part B
Sector 1:
Commercial Offices

Part C
Sector 2:
Education /Schools

Part D
Sector 3:
Higher Education

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LETI pioneers – purpose

- To be a friendly, welcoming and supportive community for projects striving for high levels of environmental performance
- To act as a sounding board of ideas, to challenge current practice and promote best practice
- To share lessons learned and resources
- To identify where additional resources could support further growth and development industry-wide

UK Net Zero Carbon Buildings Standard

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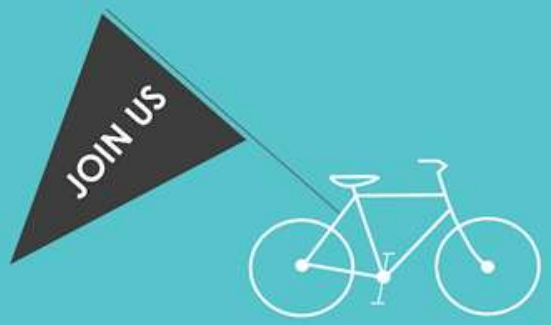
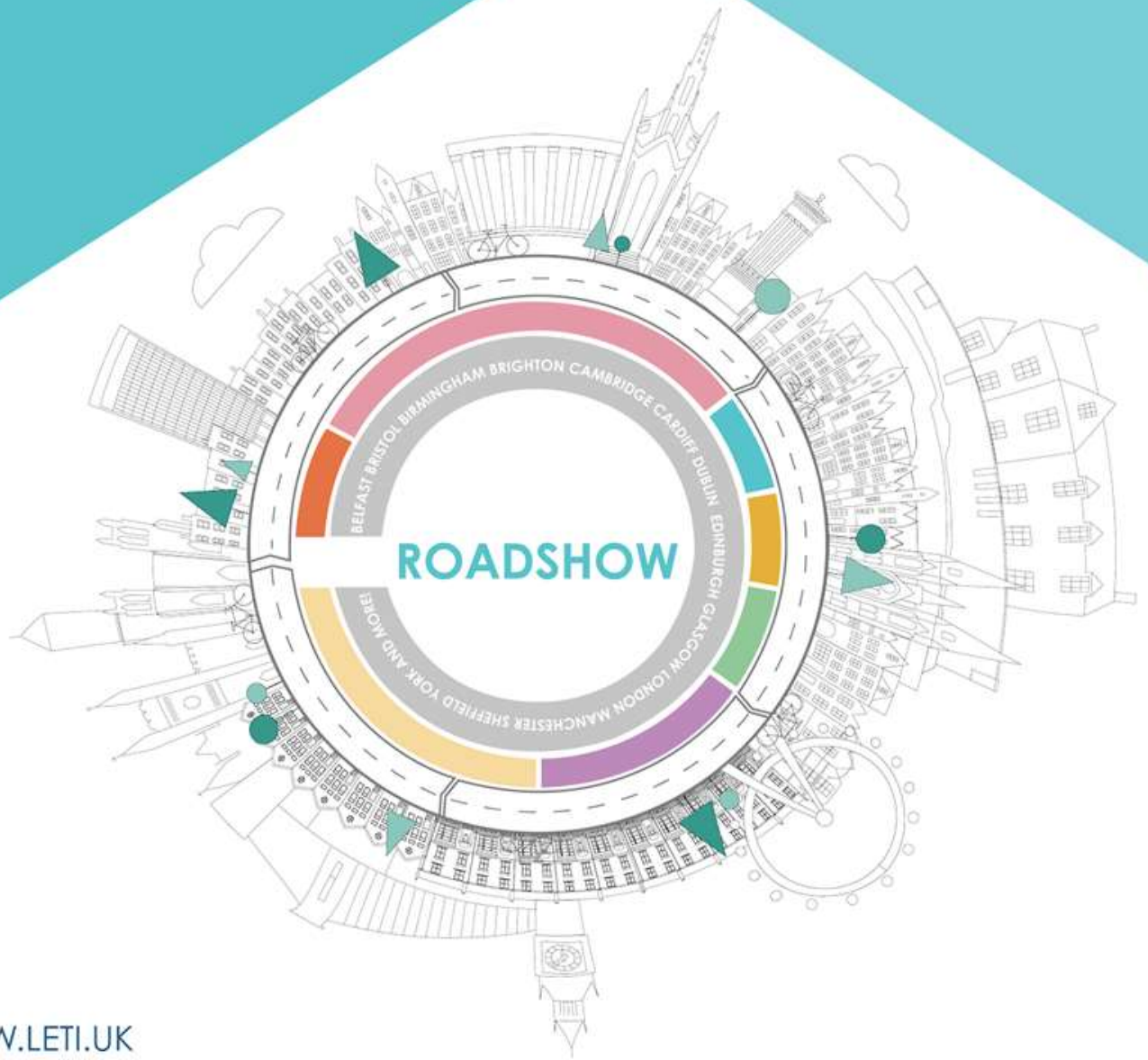
04 What Next?

LETI NATIONAL ROADSHOW





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WWW.LETI.UK

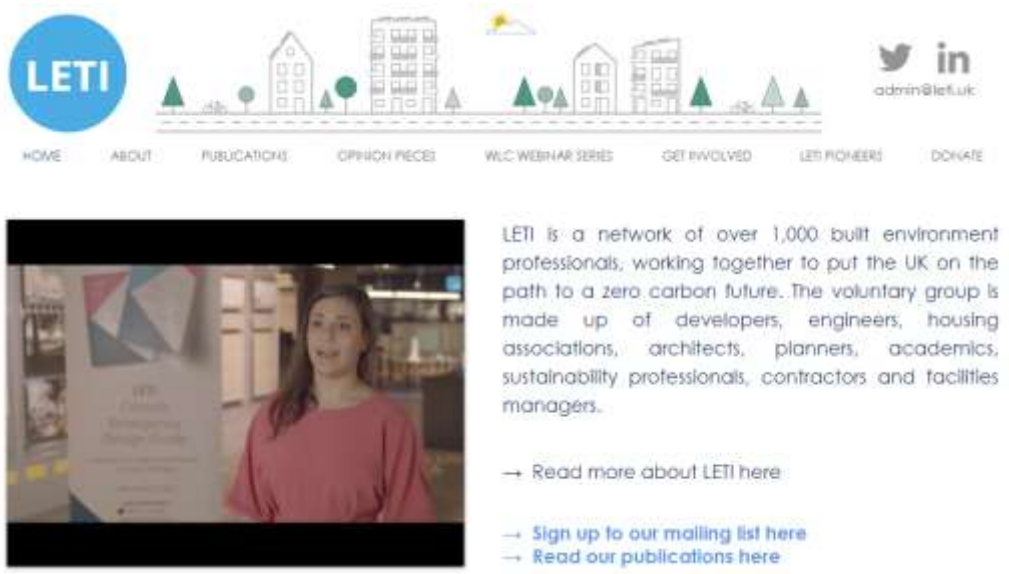
What should LETI do next?

- Drivers/barriers for zero carbon buildings
- What should LETI do next / focus on next?
- How does LETI guidance work for you?
- Where has LETI guidance been used?
- What local groups/networks should LETI work with?

How can you get involved in LETI

- Join our mailing list
- Register your interest on our website
- Fill out our form today
- Talk to us!

https://www.leti.uk/



Key takeaways

Collaborate: To meet our climate change targets we are going to have to collaborate more (even with our competitors!) - **We all need to #BuildNetZero**

Act: The time is now - show all everyone what NetZero means

Share: Don't keep your cards hidden

Be humble: Ask questions if you are not sure what you need to do

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