

An aerial photograph of a coastline, showing a wide expanse of blue water meeting a sandy beach. The water is a deep, vibrant blue, and the beach is a lighter, golden-brown color. The horizon line is visible in the upper right corner, curving away into the distance. The overall scene is bright and clear, suggesting a sunny day.

Carbon

and

PassivHaus

Sturgis Carbon Profiling LLP

Real Estate Carbon Emissions Reduction

All Energy Flows

Where from?



CO₂e



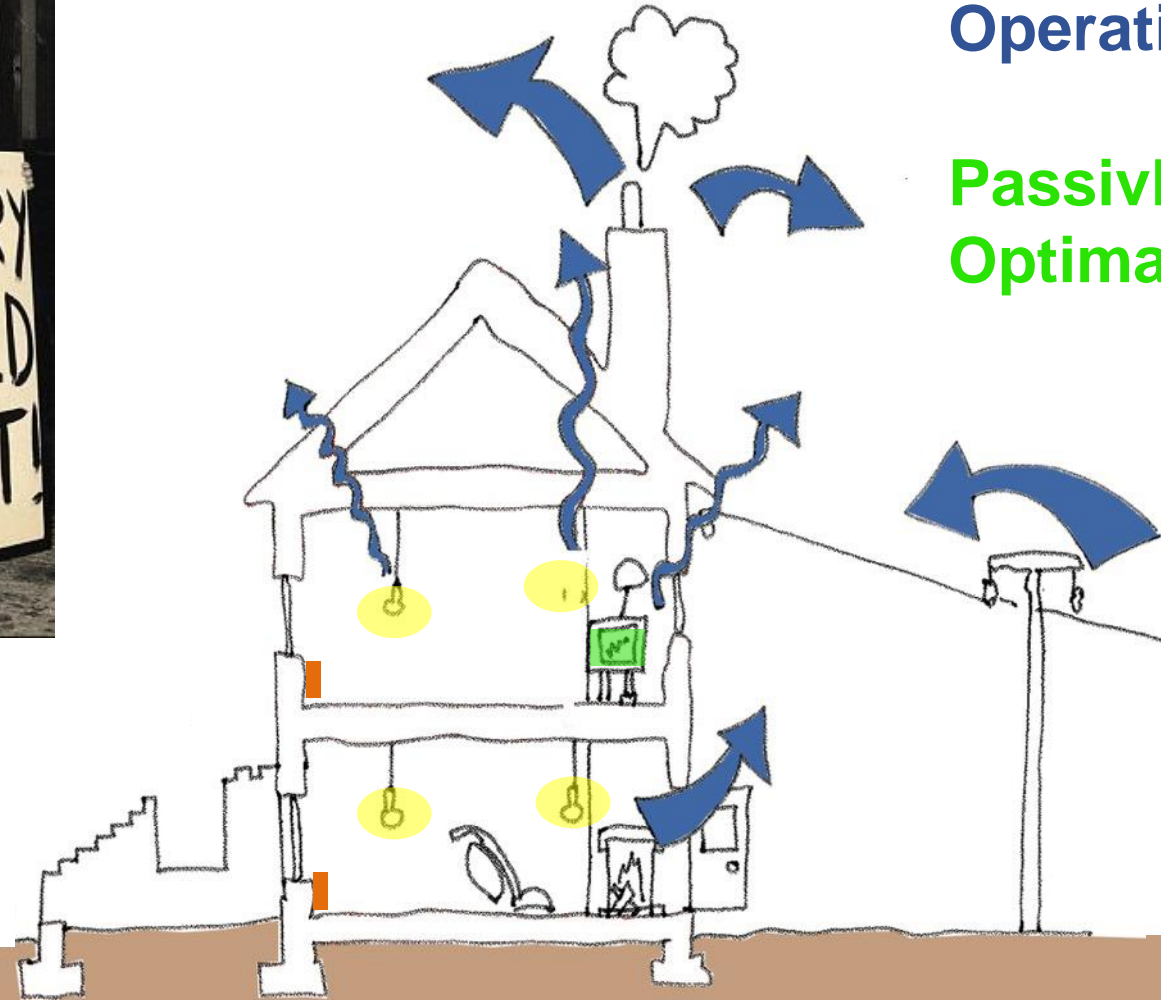
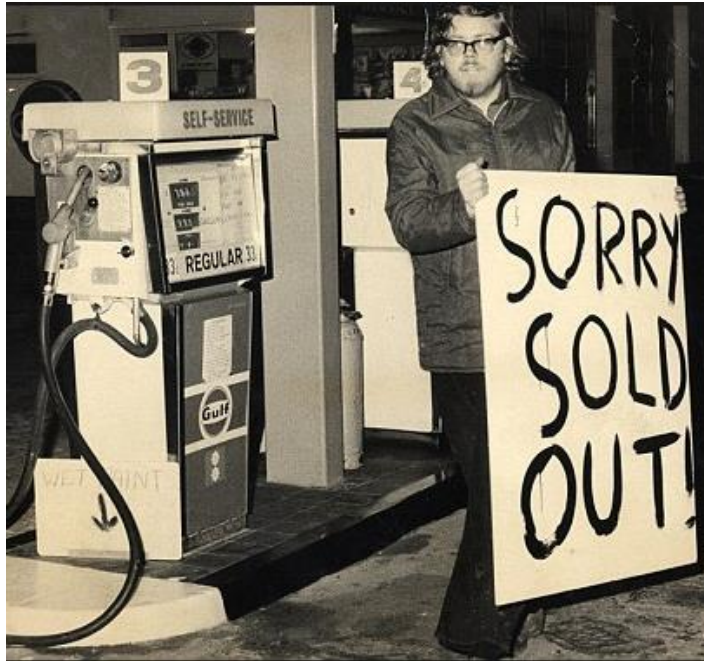
Where to?

CO₂e



Whole Life Carbon

1973

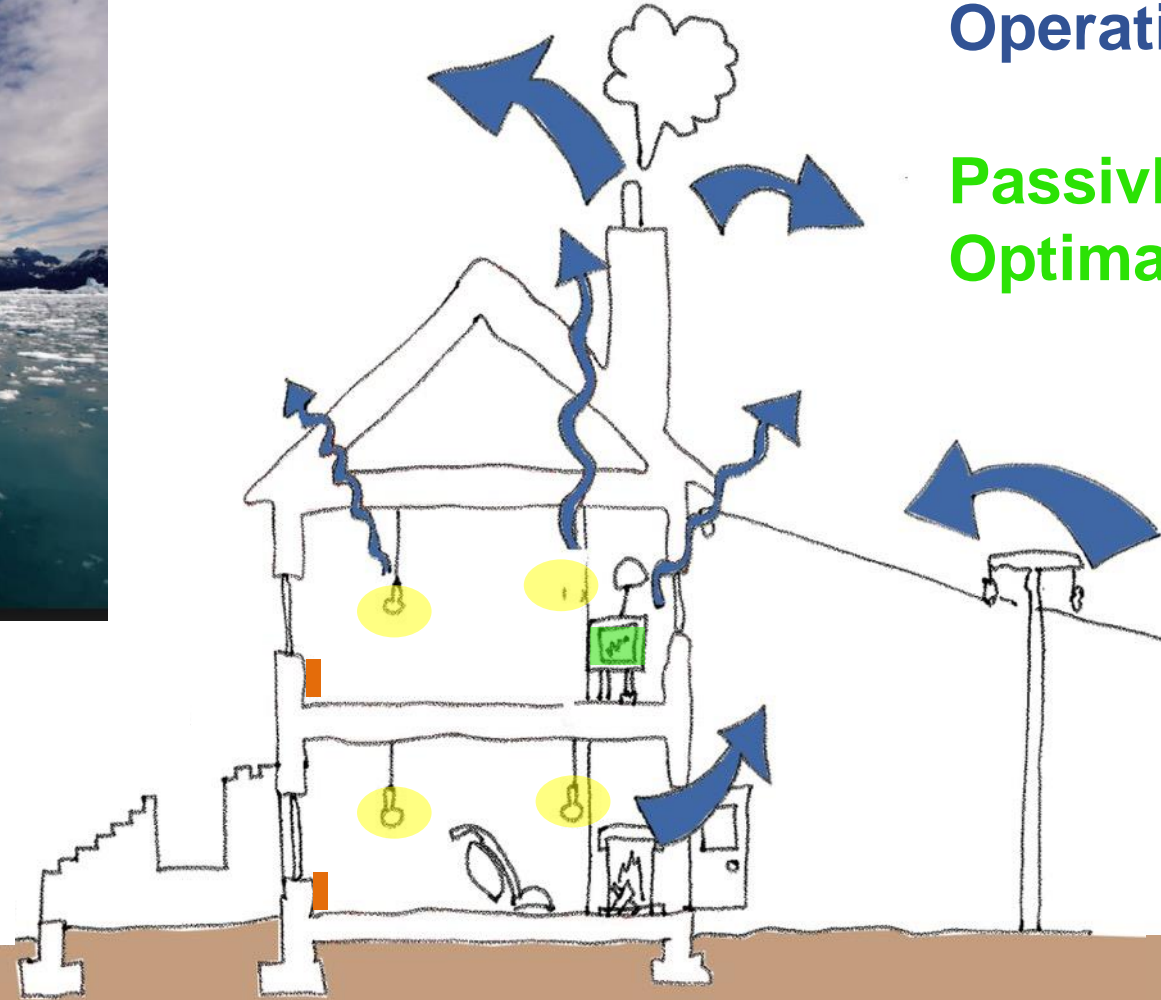


Operational Energy

PassivHaus
Optimal Solution

Whole Life Carbon

Global Warming



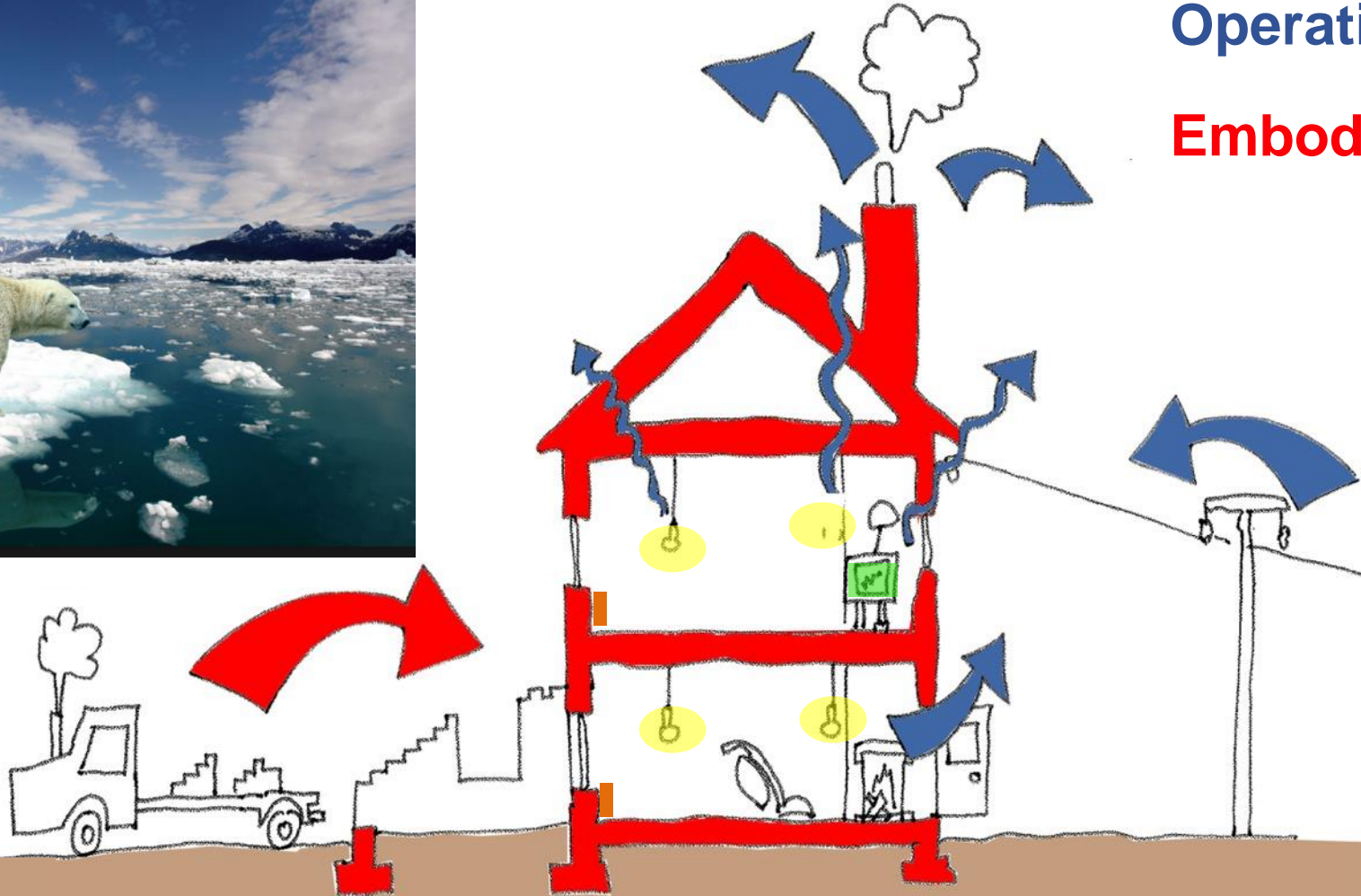
Operational Energy

PassivHaus

Optimal Solution ??

Whole Life Carbon

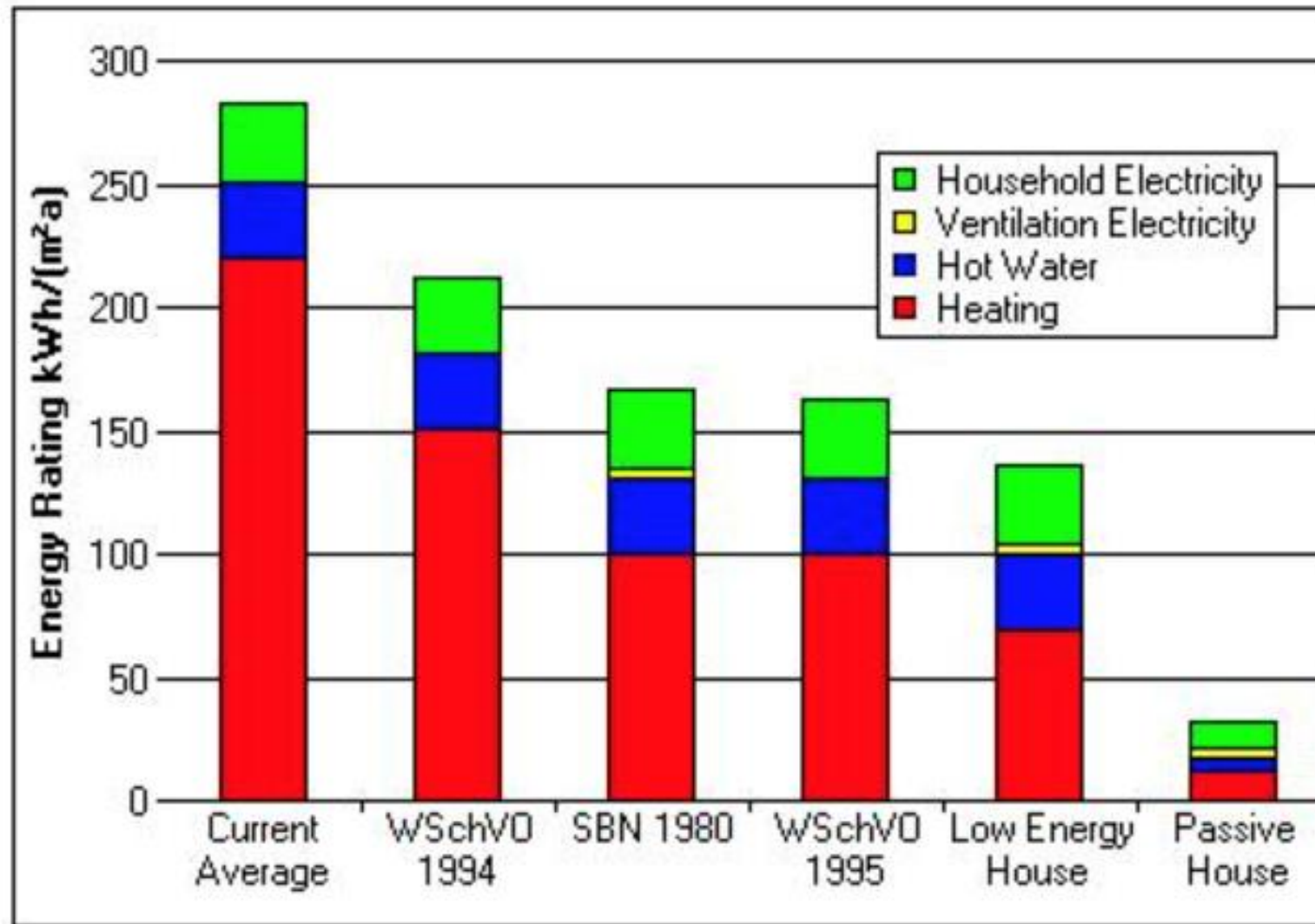
Global Warming



Operational Energy

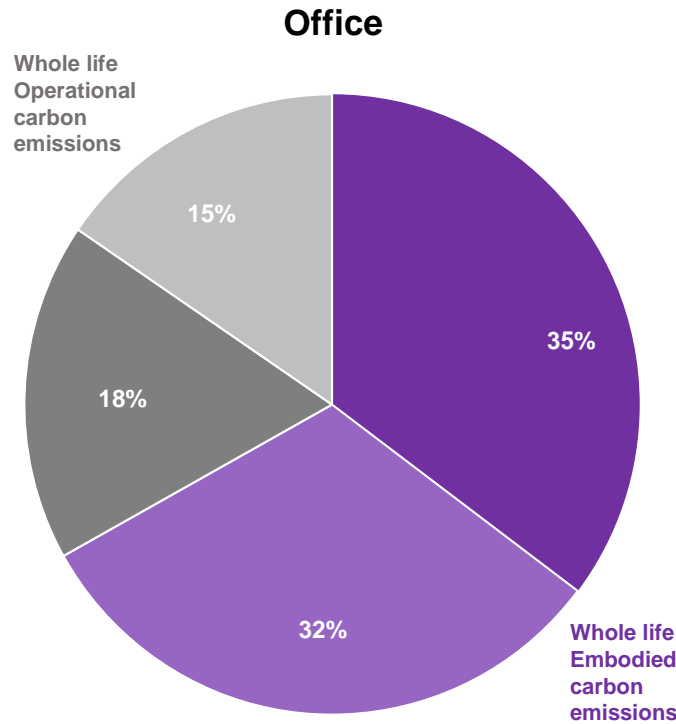
Embodied Energy

Household Energy Use

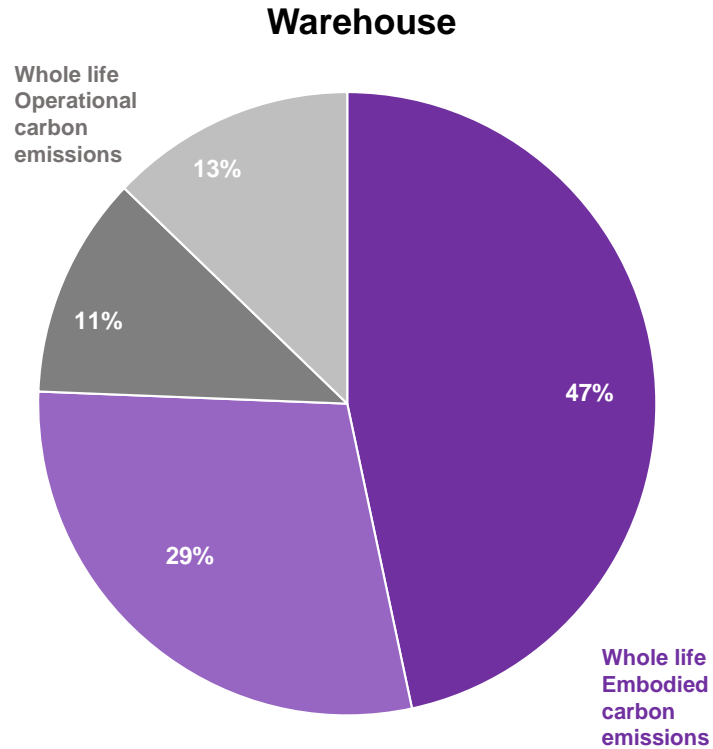


Whole Life Carbon

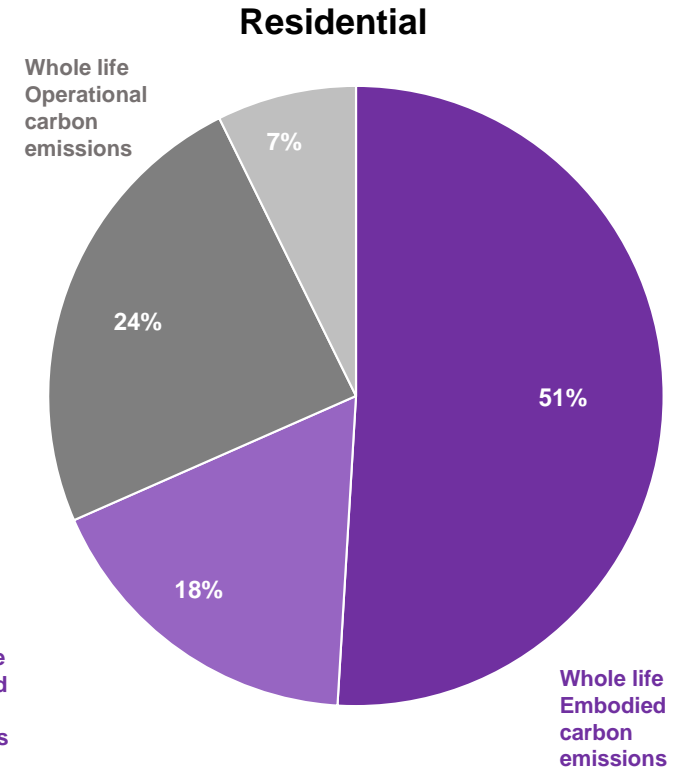
Part L compliant



Speculative office building with Cat A fit out; central London



Typical warehouse shed with office space (15% by area); London perimeter, UK



Residential block, with basic internal fit out; Oxford, UK

Carbon emissions to Practical Completion

Carbon Emissions In use

Operational emissions Regulated

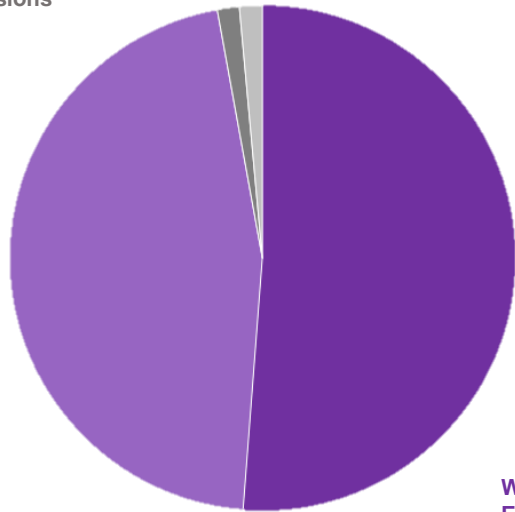
Operational emissions Unregulated

Whole Life Carbon

Indicative PassivHaus

Office

Whole life
Operational
carbon
emissions

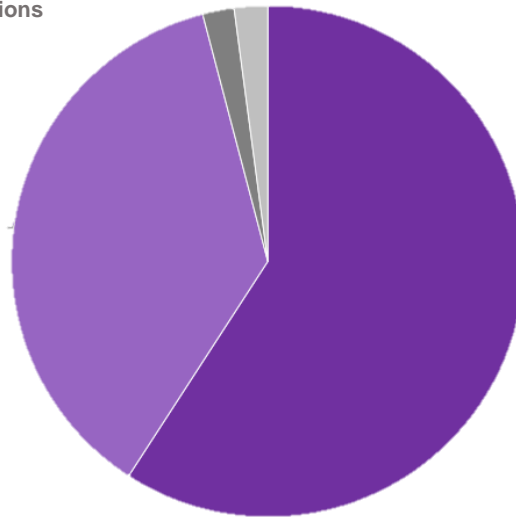


Whole life
Embodied
carbon
emissions

Speculative office building with Cat A fit out;
central London

Warehouse

Whole life
Operational
carbon
emissions

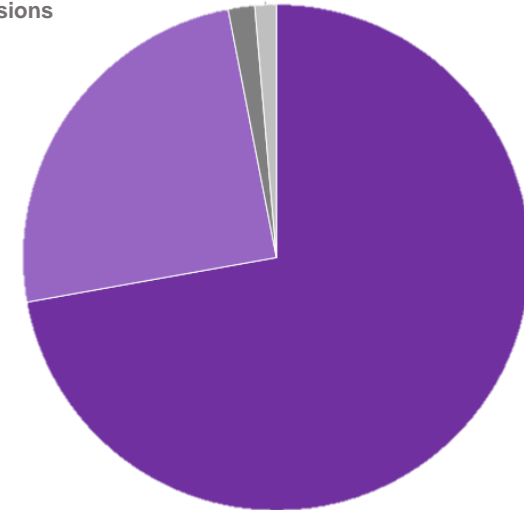


Whole life
Embodied
carbon
emissions

Typical warehouse shed with office space (15% by area);
London perimeter, UK

Residential

Whole life
Operational
carbon
emissions



Whole life
Embodied
carbon
emissions

Residential block, with basic internal fit out;
Oxford, UK

Carbon emissions
to Practical Completion

Carbon Emissions
In use

Operational emissions
Regulated

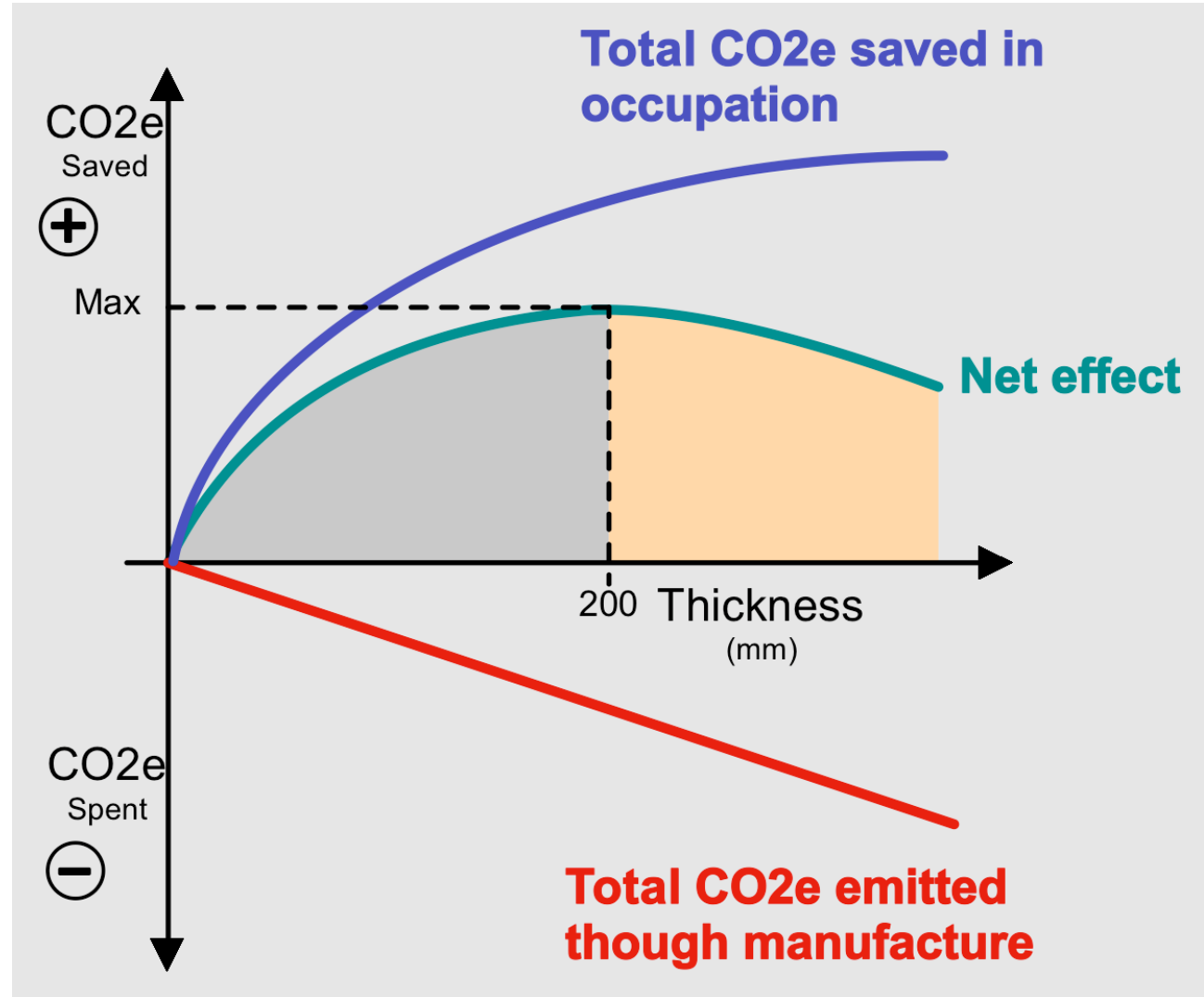
Operational emissions
Unregulated

Whole Life Carbon - CO₂ Benefit and CO₂ Cost



Great, but....

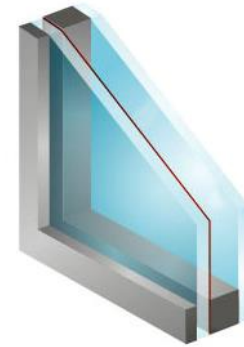
**What about the
CO₂ Cost?**



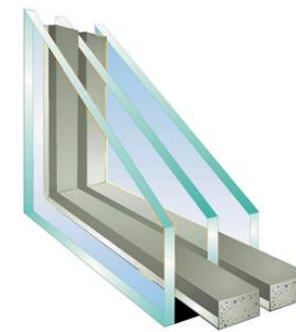
Whole Life Carbon - CO₂ Benefit and CO₂ Cost



Double vs Triple glazing over 60 years.....



Or



Benefit of 3rd sheet of glass

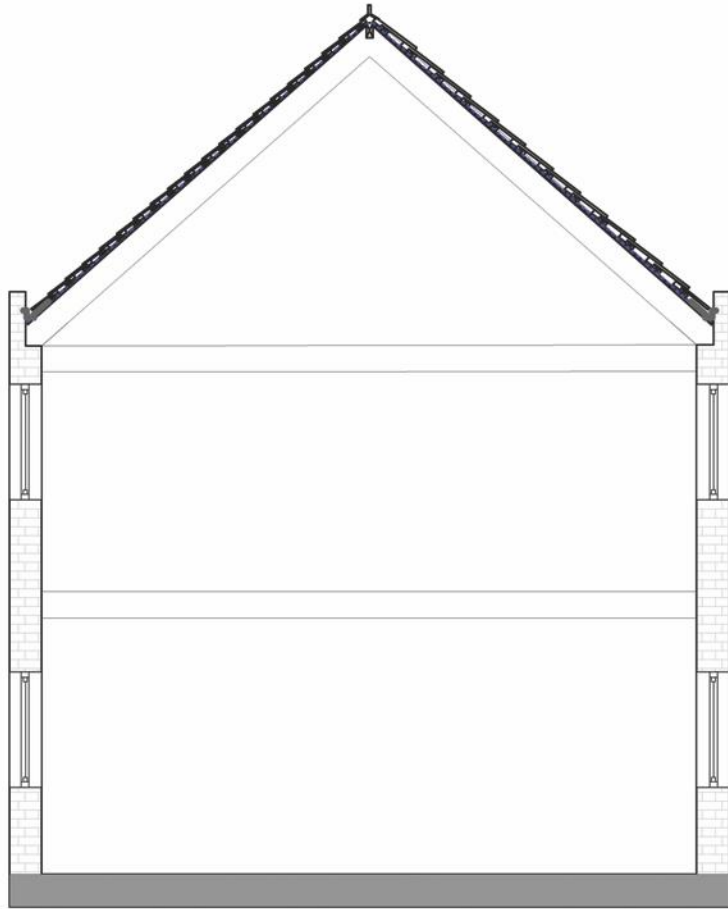
= 11,661 kgCO₂e

Cost of 3rd sheet of glass

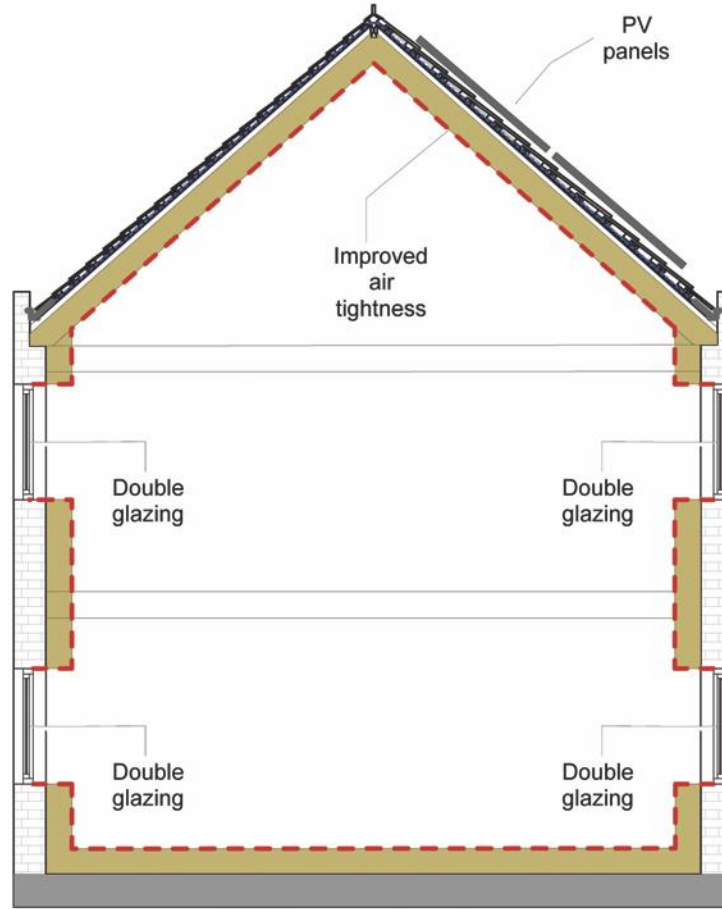
= 13,193 kgCO₂e

.....whole life analysis shows Double is more carbon efficient

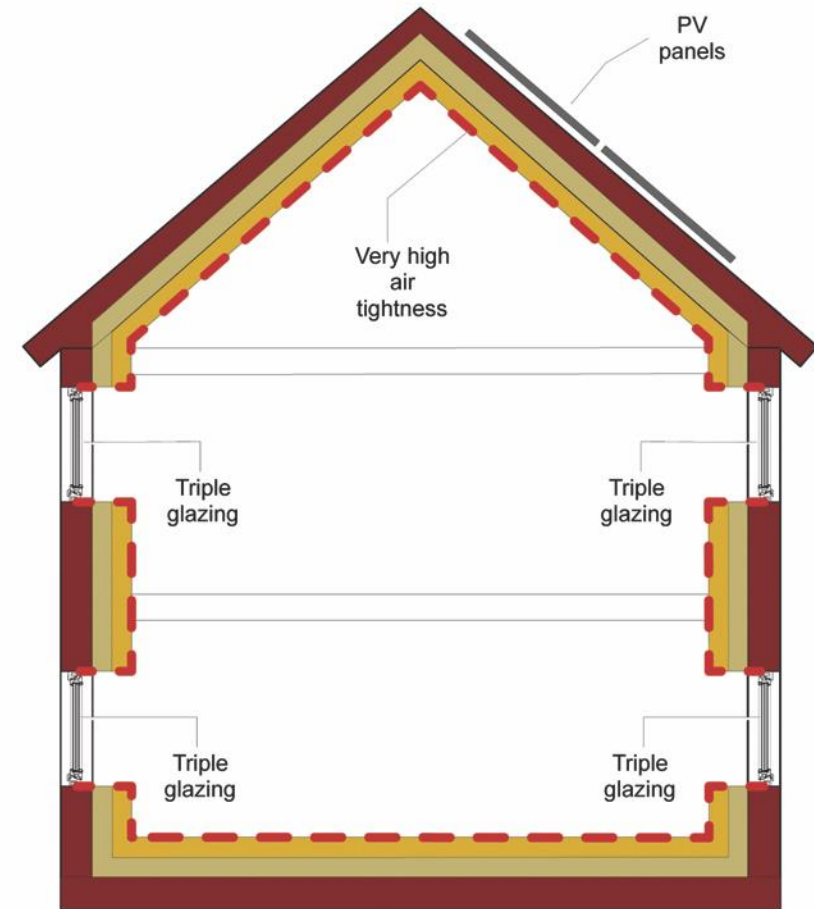
Whole Life Carbon - Terrace House



Scenario A
Victorian Terrace – ‘As is’

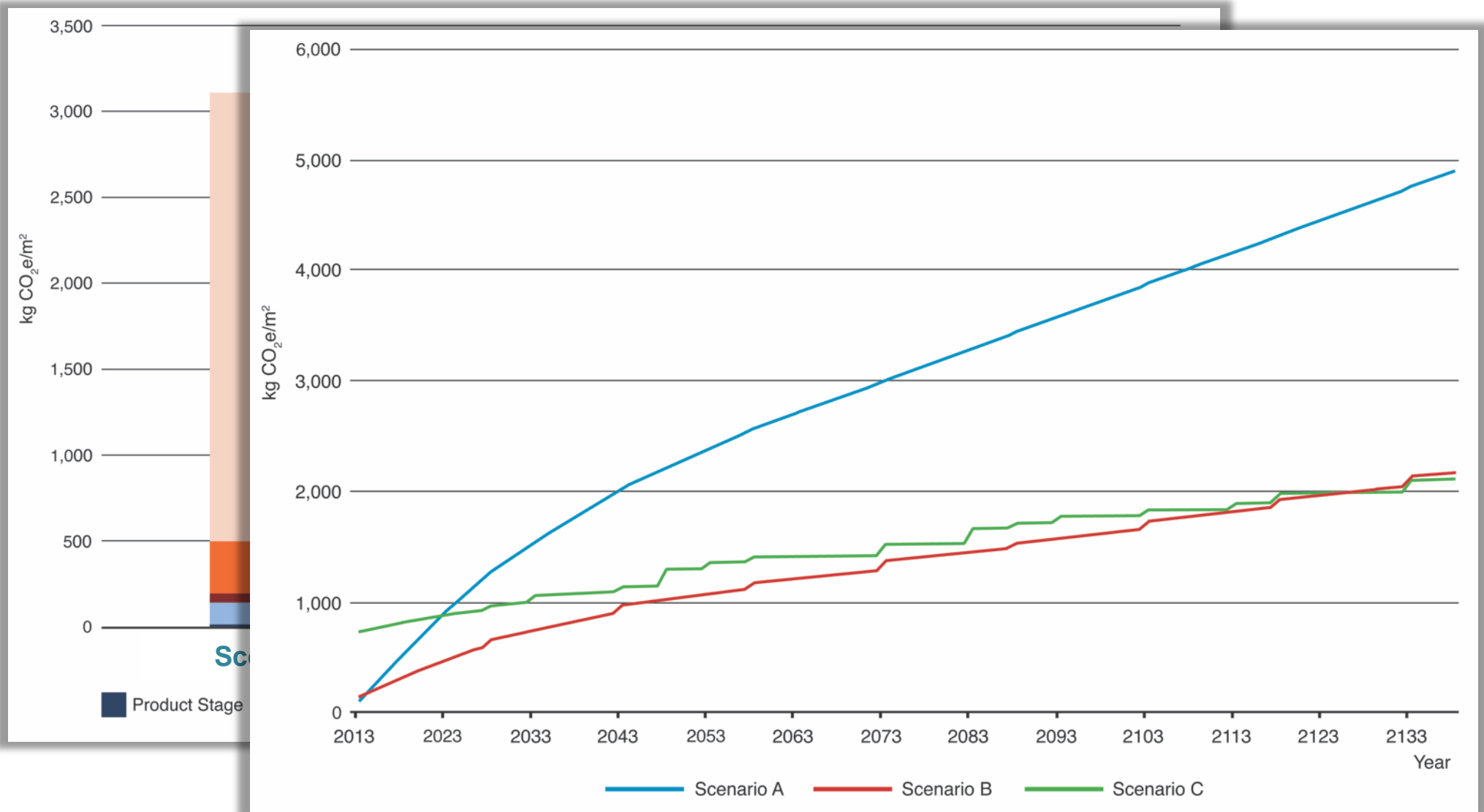


Scenario B
‘Fabric First’ Retrofit



Scenario C
New ‘Passivhaus’

Whole Life Carbon - Terrace House



Context and Standards

Drivers for Embodied Carbon Reduction



Drivers: SBTi and COP21

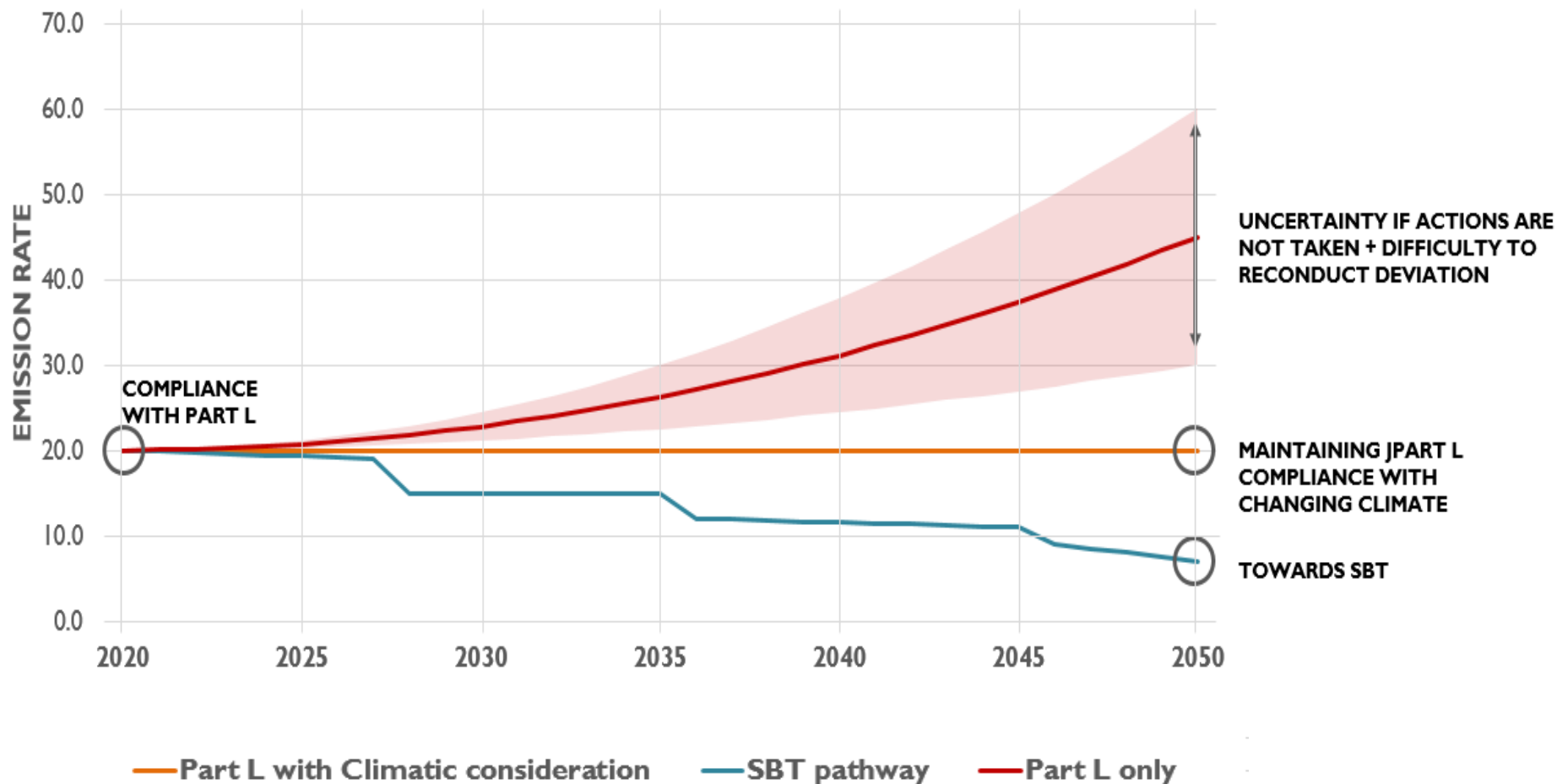


SCIENCE
BASED
TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION



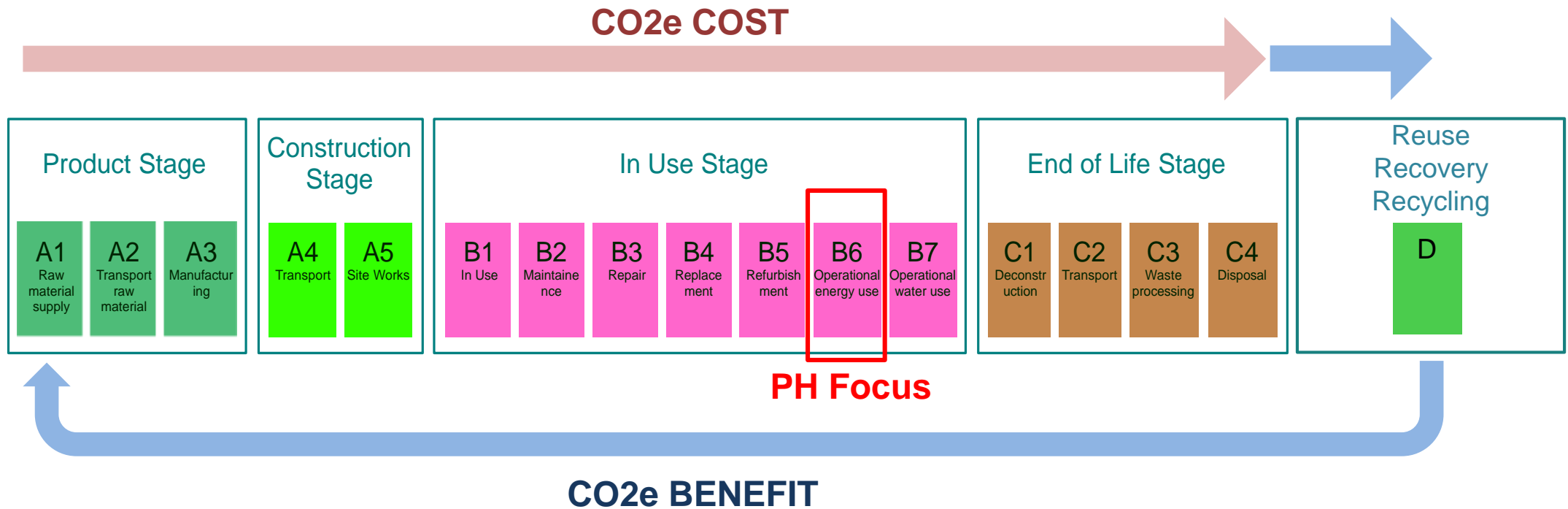
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11



Drivers: RICS Professional Statement

Whole Life Carbon

BRITISH STANDARD -- BS EN 15978



RICS Professional Statement: Whole life carbon measurement in the built environment

Whole life carbon measurement for the built environment
Final draft RICS professional statement
1st edition

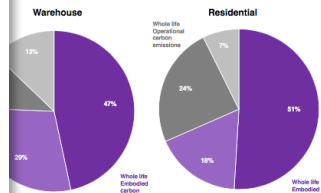


Launch - November 2017



Carbon Profiling

Status
Mandatory.
Mandatory.
Mandatory or recommended good practice (will be confirmed in the document itself). Usual principles apply in cases of negligence if best practice is not followed.
Recommended best practice. Usual principles apply in cases of negligence if best practice is not followed.
Information and/or recommended best practice. Usual principles apply in cases of negligence if technical information is known in the market.
Information only.
Information only.
Information only.



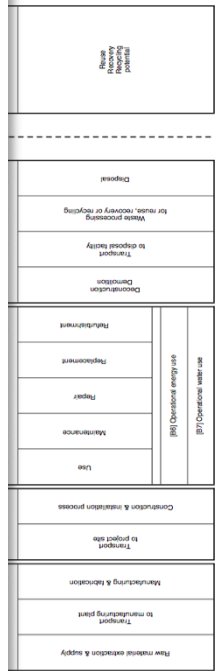
emissions breakdown for different building types, of the electricity grid according to a conservative

is the overall best combined opportunities for reducing to avoid any unintended consequences of focusing on an embodied carbon burden of installing double glazing the operational benefit resulting from the additional pane to be effectively integrated in the sustainability agenda to

43 family of standards for the sustainability assessment of or whole life assessment of the environmental impacts of cle assessment (LCA).

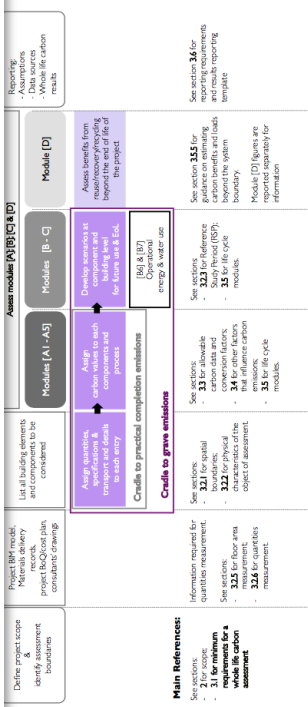
EN 15978 methodology have been subject to varying elements: different scopes commissioned according to different options made and poor quality data selectively and/or harmonised approach to the practical application of the

entation of EN 15978 and subsequently to significant ements. It has also led to substantial disparities in carbon h variations have undermined the reliability of carbon

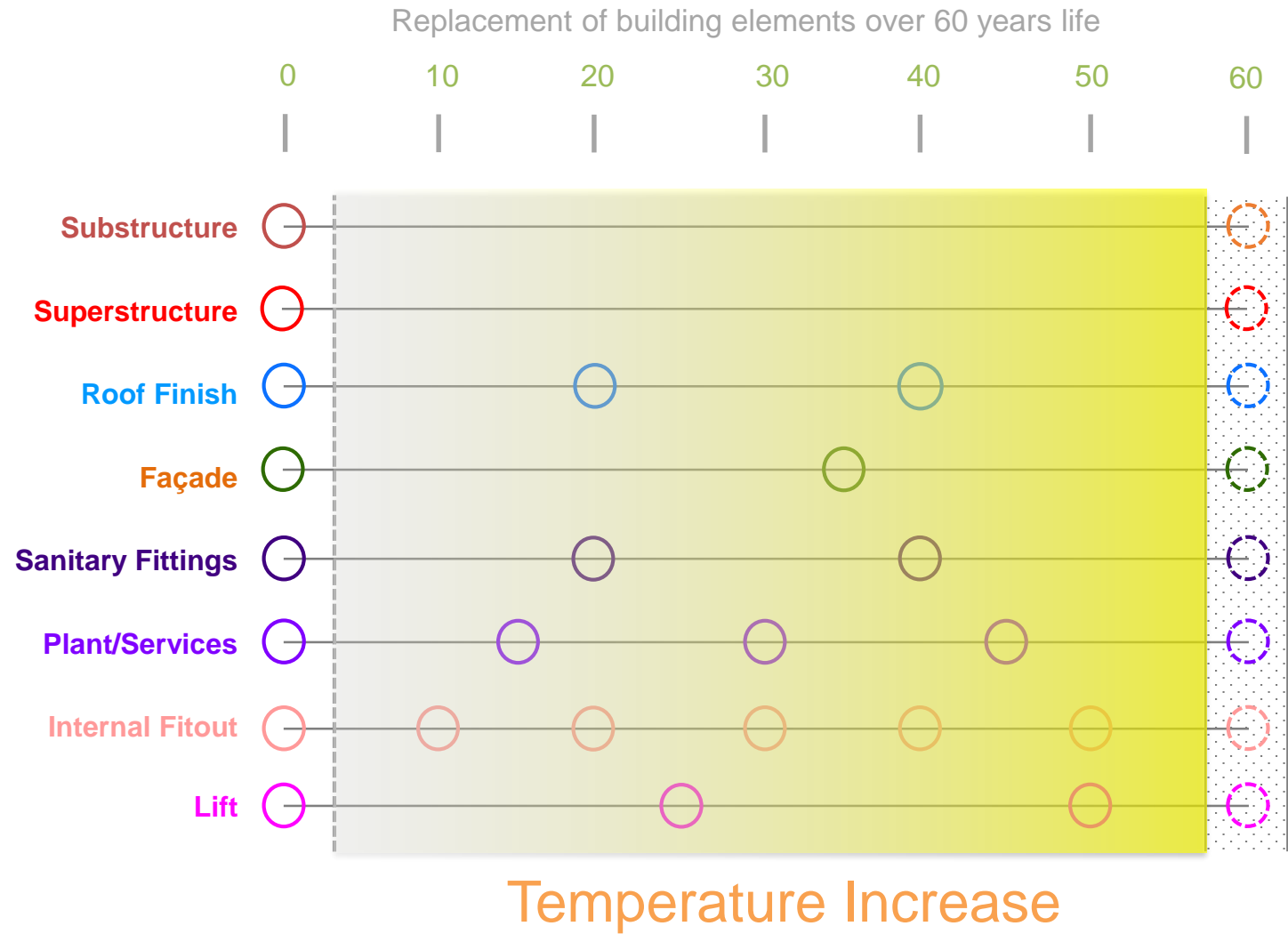
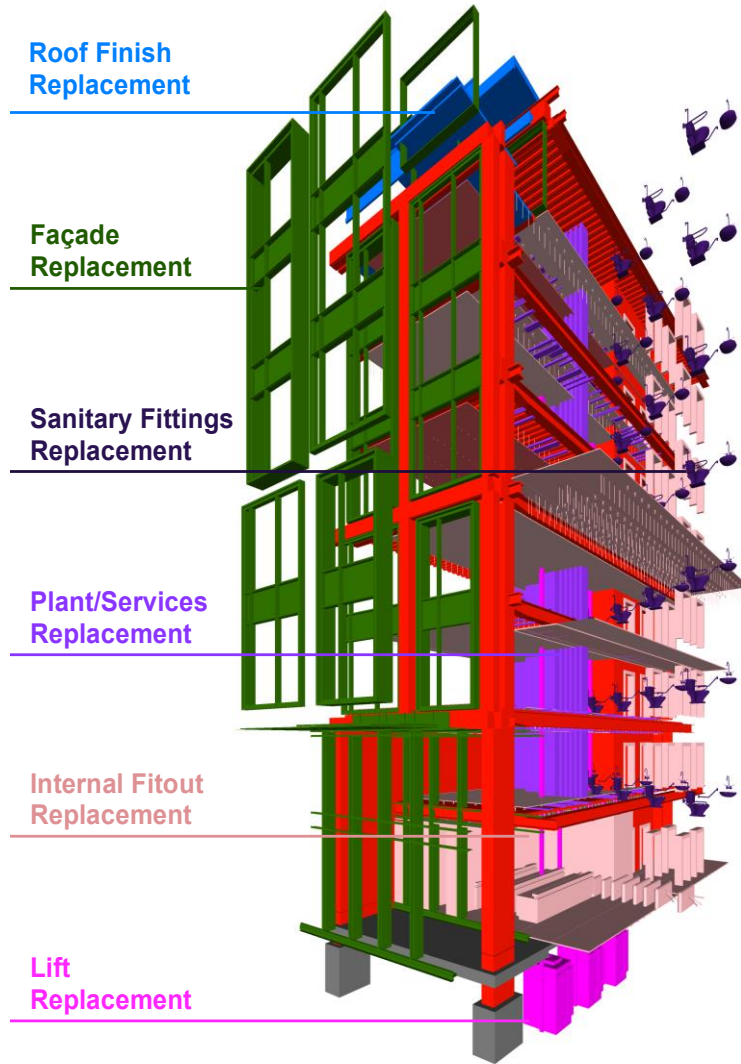


Project life cycle	Embodied carbon	Operational carbon	Whole life carbon
Raw material extraction & supply	High	Low	High
Manufacturing & distribution	High	Low	High
Transport to manufacturing plant	High	Low	High
Transport to project site	High	Low	High
Construction & installation process	High	Low	High
Use	Low	High	High
Maintenance	Low	High	High
Repair	Low	High	High
Replacement	High	Low	High
Refurbishment	High	Low	High
Demolition	High	Low	High
Transport to disposal facility	High	Low	High
Waste processing for reuse, recovery or recycling	Low	High	Low
Disposal	High	Low	High
Final building use	Low	High	High

Assessment flowchart



Life Cycle Analysis



Drivers: BREEAM 2018



MAT1 ENVIRONMENTAL IMPACTS FROM CONSTRUCTION PRODUCTS - LCA

Assessment criteria

Credits summary

The following table provides a summary of the criteria that follow and associated credits in this issue.

Description	RIBA stage	Applicable criteria	Credits available [Prerequisite criteria shown in brackets]	
			Where BREEAM benchmark available (Mandatory for: <i>[insert building use types where benchmarks are available]</i> . Except where CN 1 to CN 4 apply)	Where no BREEAM benchmark available (all others)
Building LCA comparison with the BREEAM benchmark – Superstructure	2 and 4	1 to 2	Up to 2 [None]	n/a
Building LCA option appraisal	2 and 4	2	Up to 4 [1 to 2]	Up to 4 [None]
		3 to 4	Up to 6 [1 to 4]	Up to 6 [3 to 4]
	5 to 6	1 [3 to 4]		
	7 to 9	1 exemplar [3 to 4]		
Specifying products with a recognised environmental product declaration (EPD)	2	13 to 15	1 [None]	
Building LCA option appraisal – LCA and LCC alignment	5	10 to 12	1 exemplar [3 to 6]	
Building LCA – 3 rd party verification	2 and 4	16 to 19	1 exemplar [1 to 9]	1 exemplar [3 to 9]

Whole Life Carbon Case Study



scp

Project

University of Warwick Sports Hub
Embodied and Whole Life Carbon Consultancy

Stage 3

Carbon Budget Stage 3
Current Agreed Carbon Reduction Options

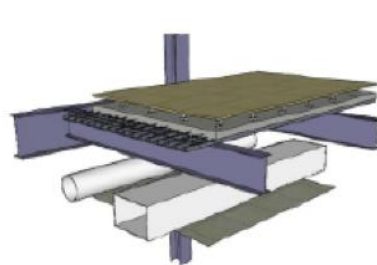
David Morley Architects



04.07
2016

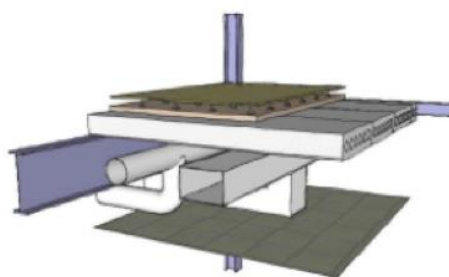
Carbon Reduction Options – Floors

Environmental Credential Comparisons & Embodied Carbon Stage A1-A5 – Floor area 6,105 m²



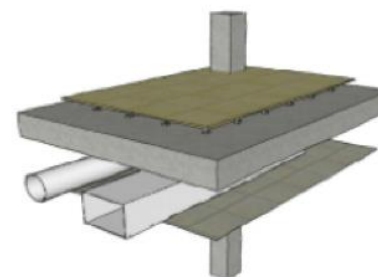
Option 1
Steel beams with composite slab on metal decking

Carbon Footprint ☆ ☆
Lifespan **60+ years**
Adaptability ☆ ☆
Recyclability ☆ ☆



Option 2
Steel beams with pre-cast concrete planks

Carbon Footprint ☆ ☆
Lifespan **60+ years**
Adaptability ☆ ☆ ☆
Recyclability ☆ ☆



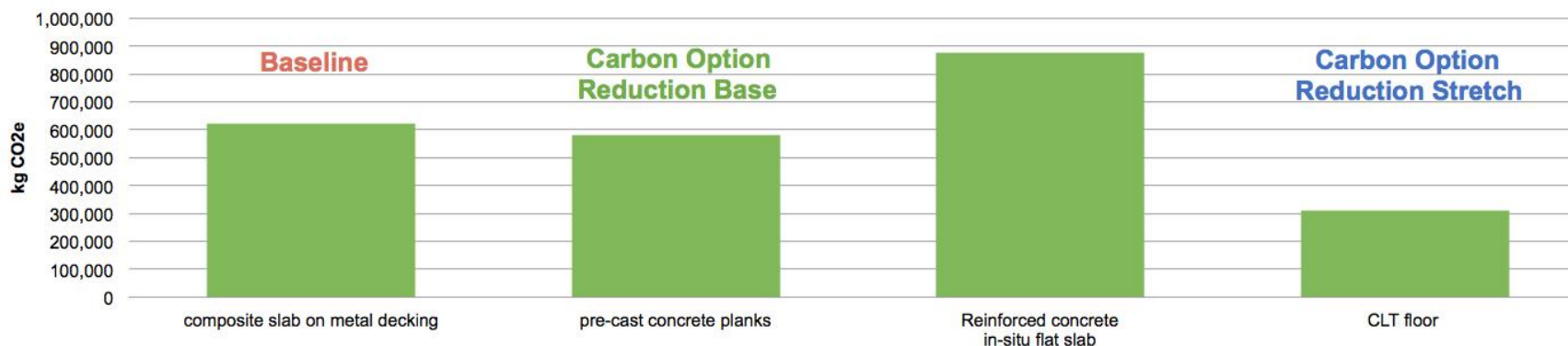
Option 3
Reinforced concrete in-situ flat slab

Carbon Footprint ☆
Lifespan **60+ years**
Adaptability ☆ ☆
Recyclability ☆



Option 4
CLT floor on steel beam

Carbon Footprint ☆ ☆ ☆
Lifespan **60+ years**
Adaptability ☆ ☆ ☆ ☆
Recyclability ☆ ☆ ☆



Carbon Reduction Options: Curtain Walling Glazed System Analysis

Quantities (Faithful +Gould)

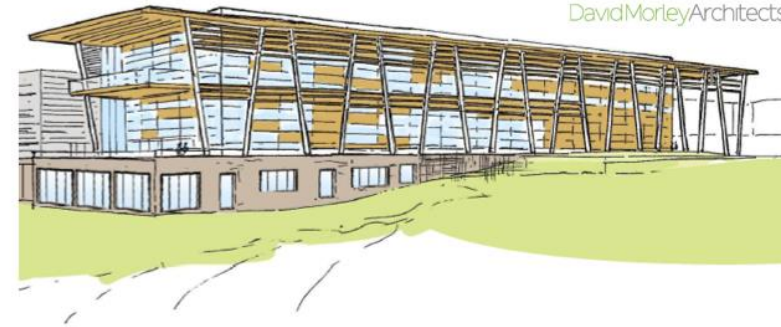
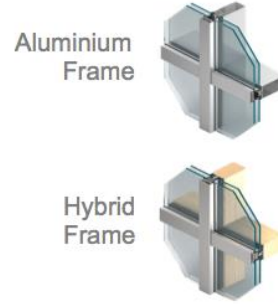
374 m²
Glass curtain walling
1,311 m²
Translucent polycarbonate panels
105 m²
Extra over for medicine ball impact to S+C room

Design Life (David Morley Architects)

25 years – Membrane

Transport Distance to Site (SCP)

500 km



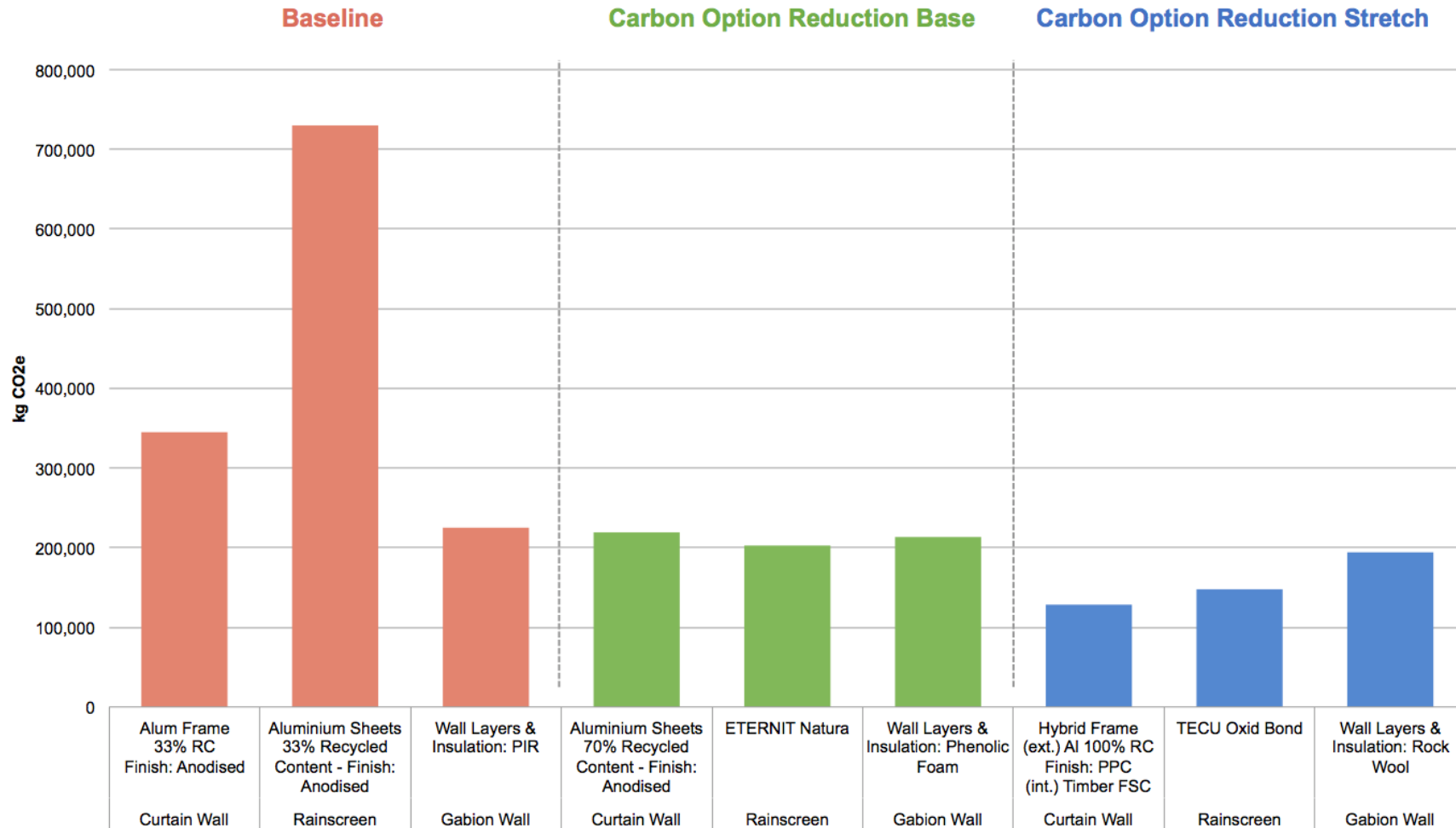
Embodied Carbon - kg CO₂e

		Stage A1-A5	Stage B (excl. B6)	Stage A-B-C
Aluminium Frame Aluminium 33% Recycled Content Finish: Anodized	Baseline	344,893	607,573	965,108
Aluminium Frame Aluminium 33% Recycled Content Finish: PPC	Alternative Option	270,775	459,227	742,644
	Carbon saving over baseline	-74,118	-148,346	-222,464
Aluminium Frame Aluminium 70% Recycled Content Finish: PPC	Reduction Base	219,074	386,532	618,248
	Carbon saving over baseline	-125,819	-221,041	-346,860
Aluminium Frame Aluminium 100% Recycled Content Finish: PPC	Alternative Option	219,074	386,532	618,248
	Carbon saving over baseline	-125,819	-221,041	-346,860
Hybrid Frame Alum. 100% Recycled Content PPC (external) Timber FSC (internal)	Reduction Stretch	113,697	209,468	372,942
	Carbon saving over baseline	-231,196	-398,105	-592,166

Sports Hub - Cladding

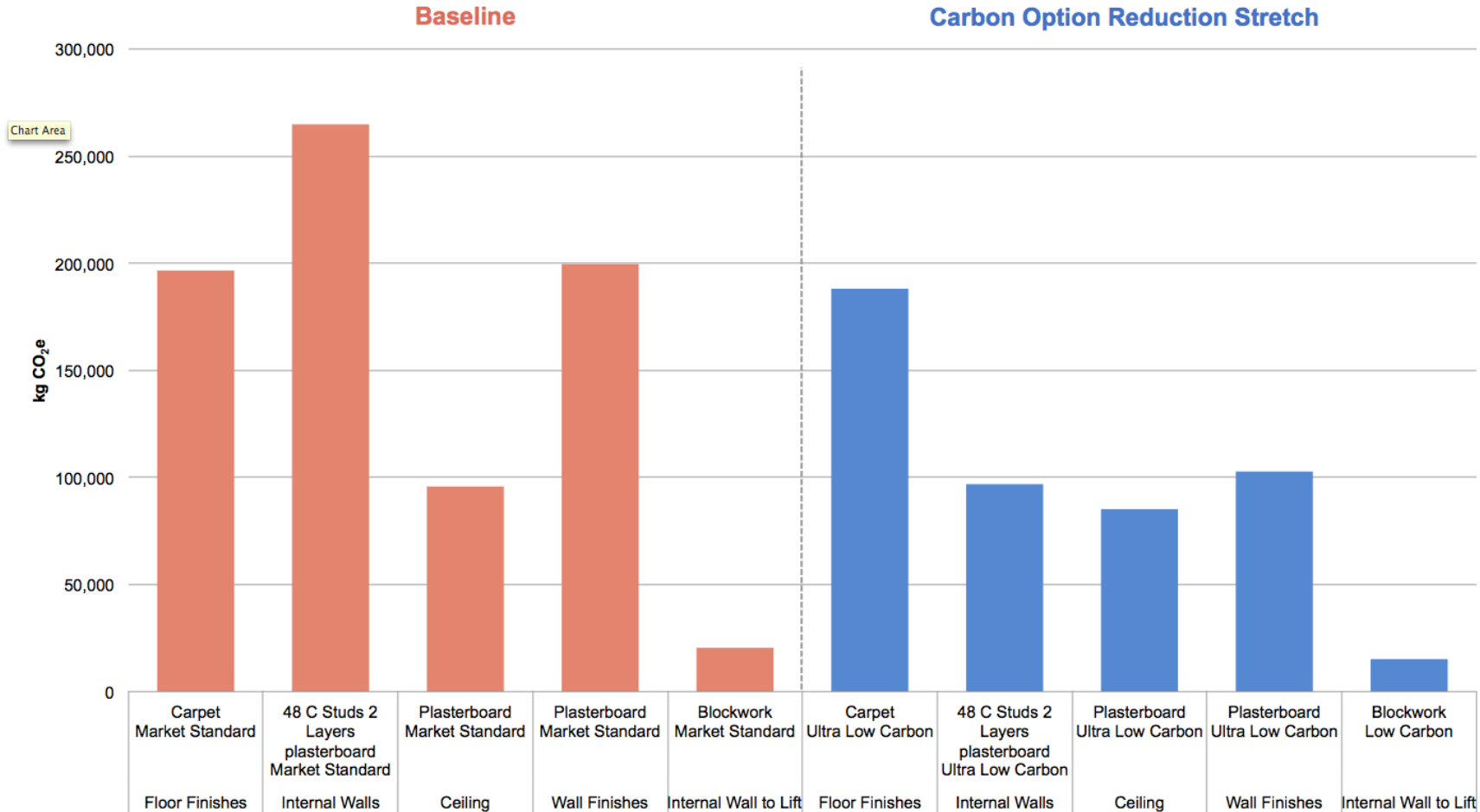
Envelope - Façades

Embodied Carbon Stage A1-A5 Analysis



Internal Finishes

Embodied Carbon Stage A1-A5 Analysis



Sports Hub – Reduction Options

Carbon Saving Options

BASELINE against REDUCTION base & REDUCTION stretch at Practical Completion (PC)

Category	Baseline
Substructure	Concrete
Substructure	Concrete
Superstructure	Composite slab
Superstructure	Structural 20% Reduction
Superstructure	Structural Transport
Superstructure	Sp Roof S
Roof	Insulation PIR sports hall, including central plant area
Roof	Glazed Roof Aluminium 33% Reduction Finish
Roof	P Insul
Façade	Glass Cl Aluminium 33% Reduction Finish
Façade	Rail Aluminium 33% Reduction Finish Insul

[*] Savings in top of baseline target

Carbon Saving Options

BASELINE against REDUCTION base & REDUCTION stretch at Practical Completion (PC)

Category	Baseline Elements	Reduction Base Target		Reduction Stretch Target	
		Base target	tonne CO ₂ e* Carbon reduction @PC	Stretch target	tonne CO ₂ e* Carbon reduction @PC
Façade	Gabion Plinth Wall Insulation: PIR	Gabion Plinth Wall Insulation: Phenolic Foam	-11	Gabion Plinth Wall Insulation: Rock Wool	-30
Internal Finishes	Carpet – Market Standard	N/A	N/A	Ultra Low Carbon Carpet	-8
Internal Finishes	Internal Wall 48 C Stud 2 Layers Plasterboard Market Standard	N/A	N/A	48 C Stud 2 Layers Plasterboard Ultra Low Carbon	-168
Internal Finishes	Ceilings Plasterboard Market Standard	N/A	N/A	Plasterboard Ultra Low Carbon	-10
Internal Finishes	Wall Finishes Plasterboard Market Standard	N/A	N/A	Plasterboard Ultra Low Carbon	-96
Internal Wall	Internal Wall Lift Blockwork Market Standard	N/A	N/A	Blockwork Low Carbon	-5

> 12%

Carbon reduction over baseline

> 38%

Carbon reduction over baseline

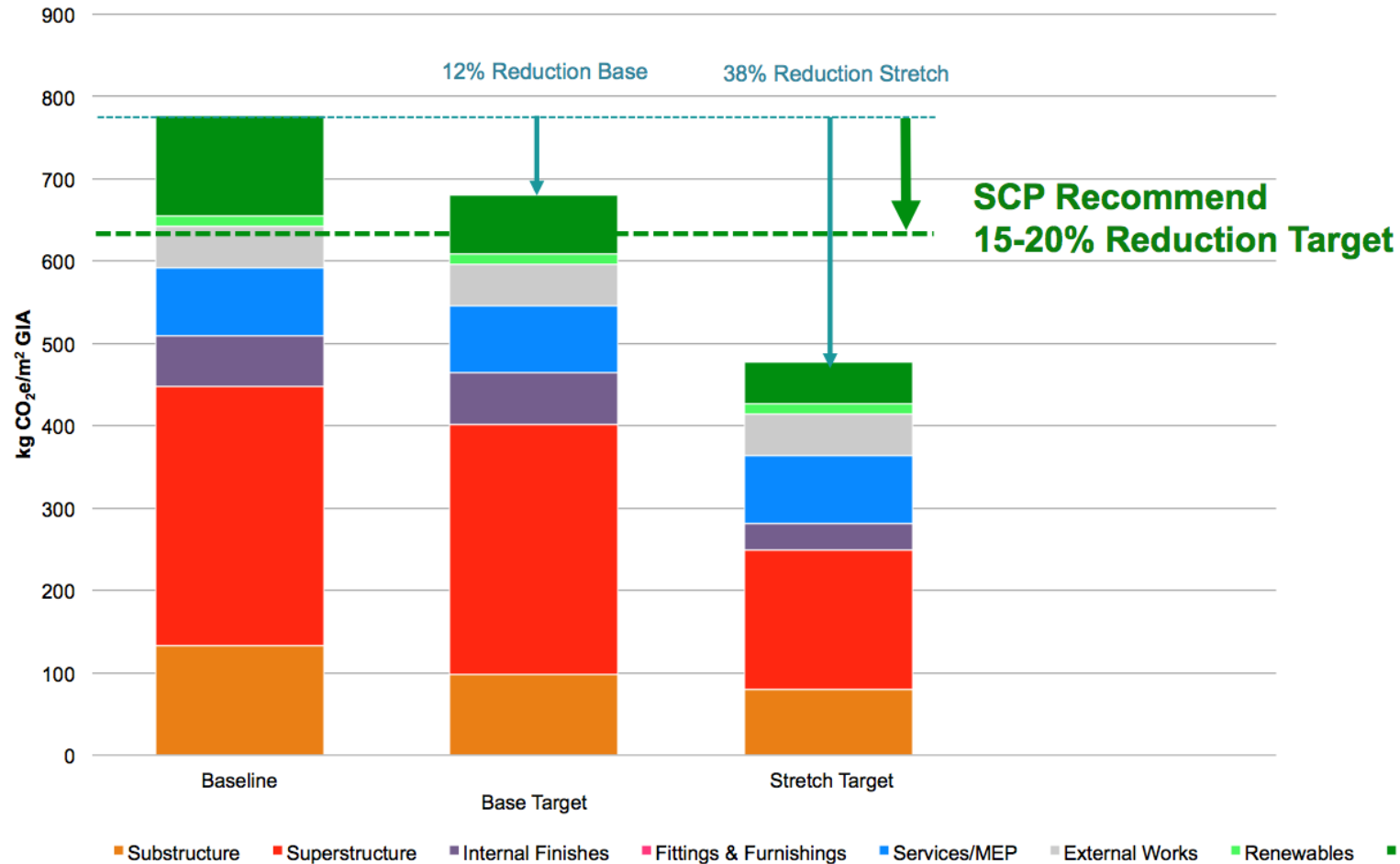


N.B. Additional embodied carbon reduction could be achieved considering further opportunities and alternative products.

[*] Savings in top of baseline target

Carbon at Practical Completion

Embodied Carbon Stage A1-A5 - Baseline and Reduction Base + Reduction Stretch (GIA 13,286 m²)



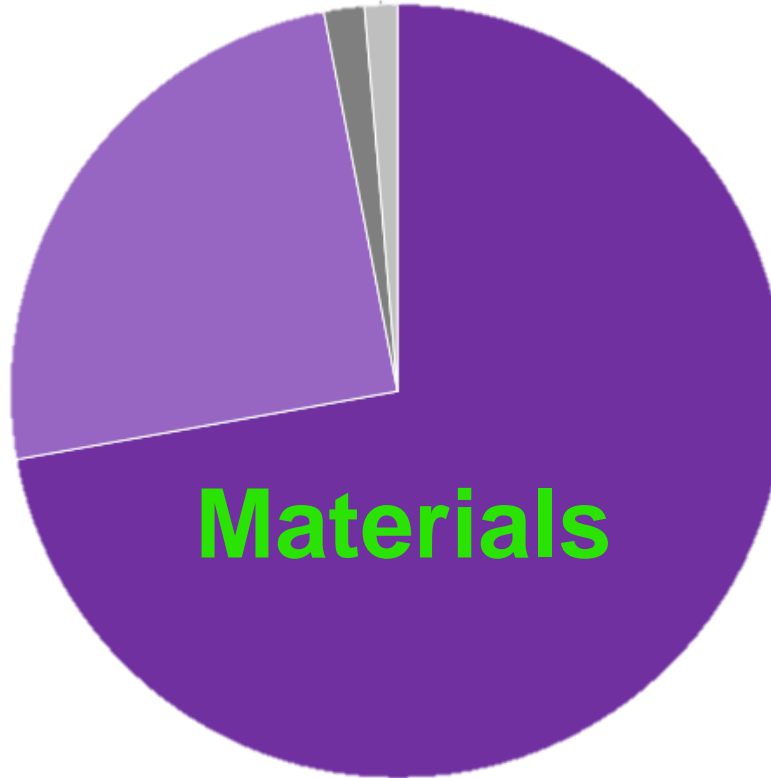
Conclusion

Indicative PassivHaus Energy Use

Where from?



CO₂e

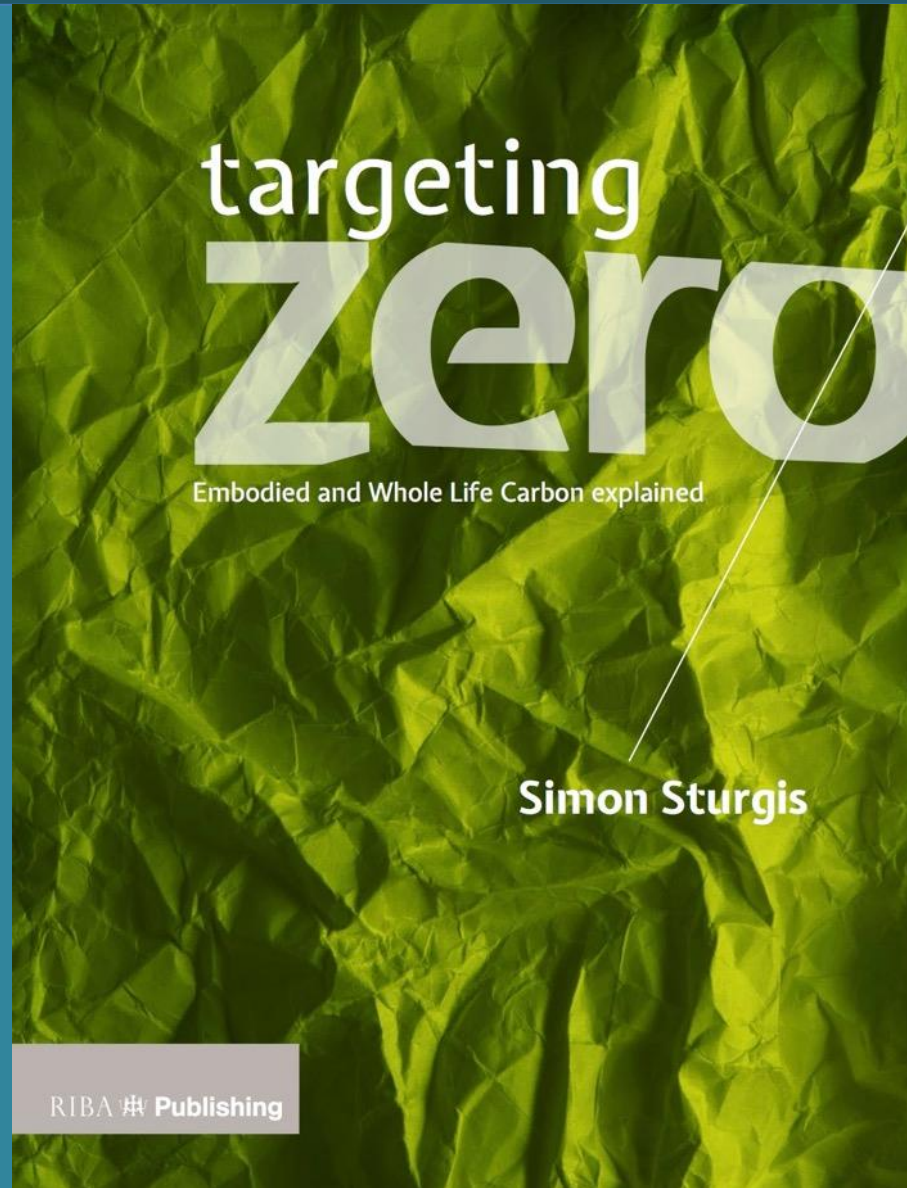


Where to?



CO₂e

Thank You!



Embodied
and
Whole Life Carbon
explained