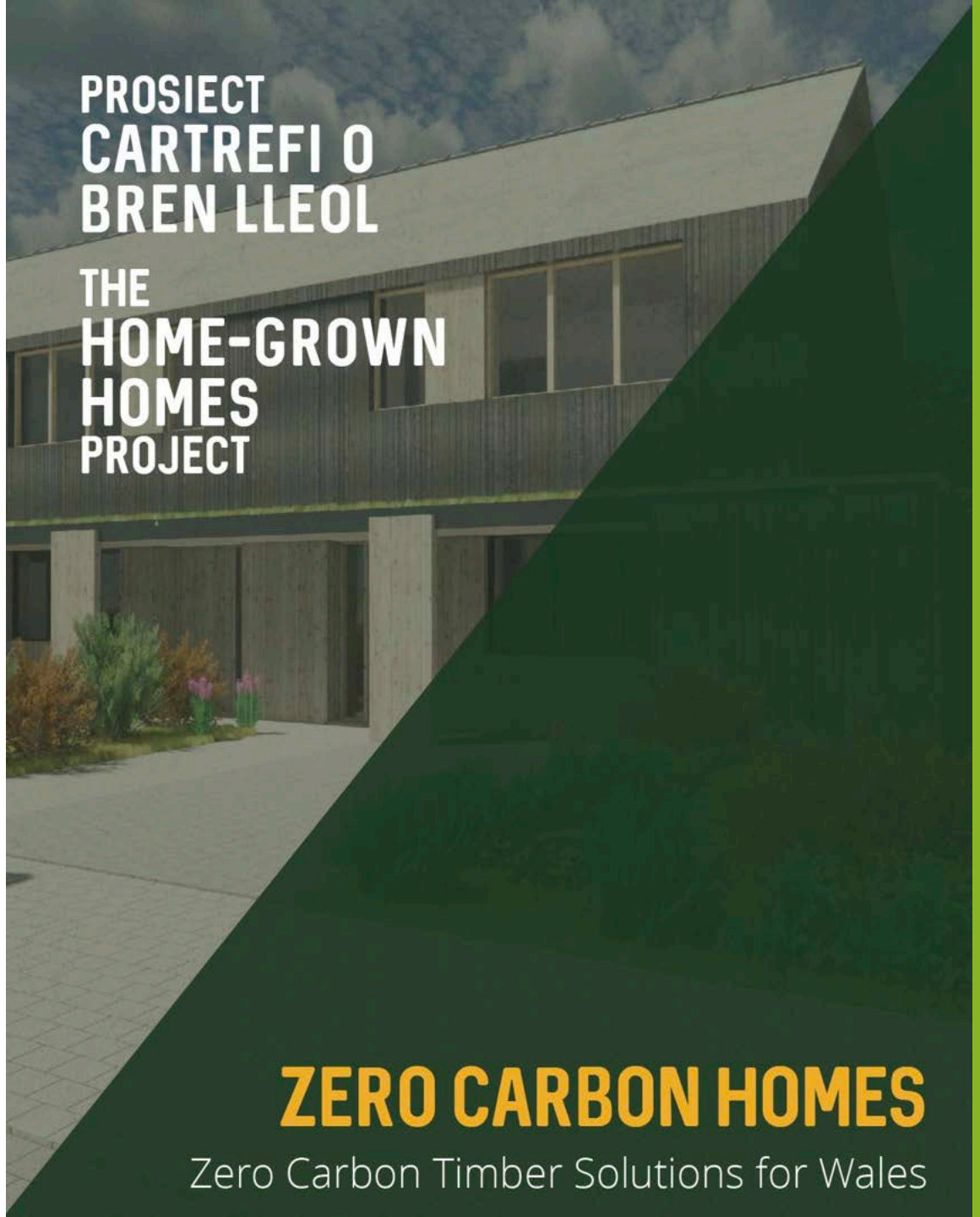


Zero Carbon Homes

Zero Carbon Timber Solutions for Wales

9 March 2021
Presentation to CEW

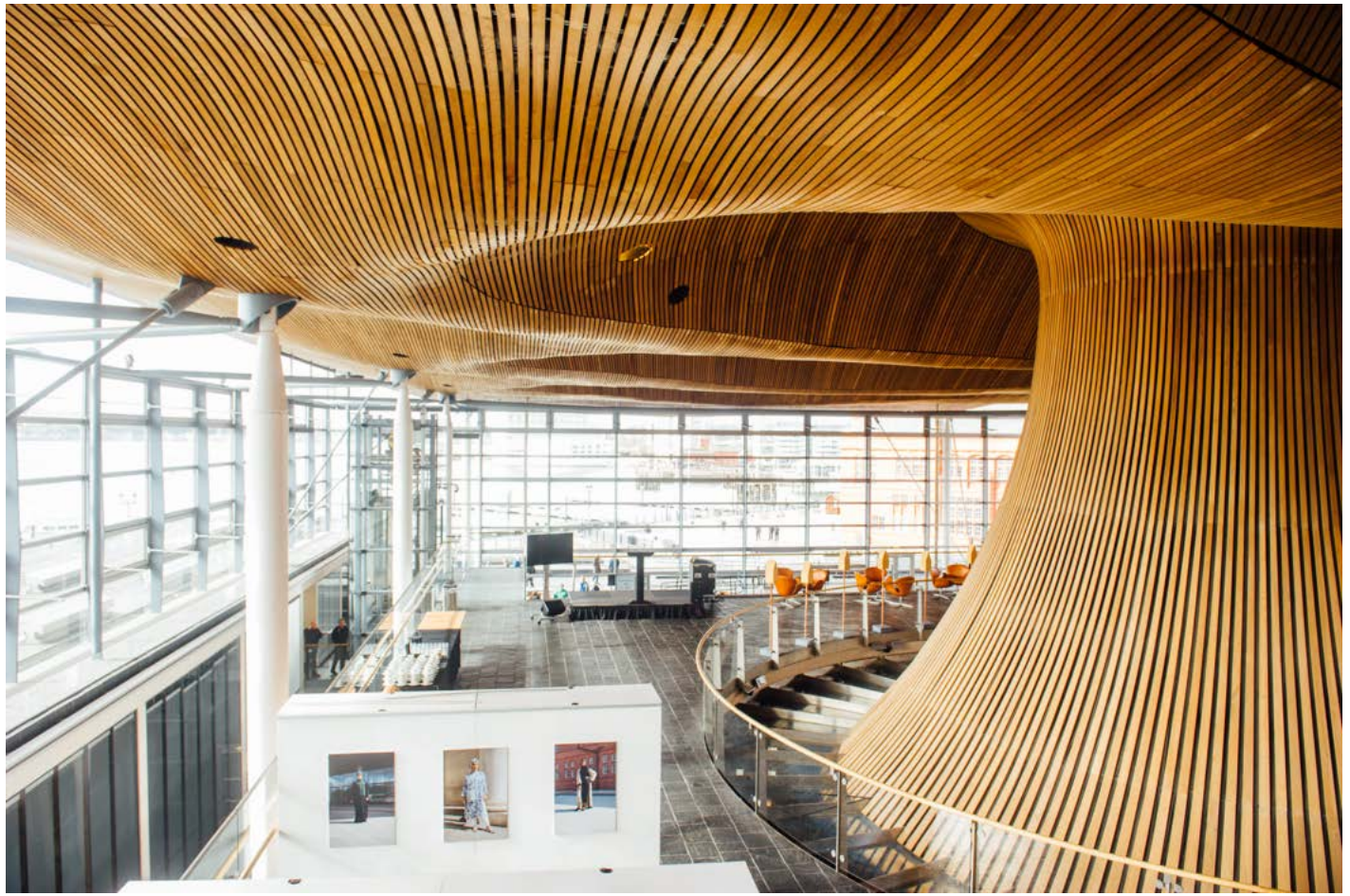
Presented by James Moxey
James.moxey@woodknowledgewales.co.uk

Prepared by:

James Moxey
Woodknowledge Wales
&
Dr Rob Thomas
Hiraeth Architecture

woodknowledge WALES

Context



Declaration of **Climate Emergencies** from Welsh Government and all 22 Local Authorities in Wales.

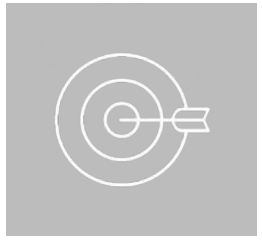
Context: Energy Legacy

Type of House	Age	No Rooms	No Storeys	Size	Area (m^2)	Electricity (kWh)	Gas (kWh)	Total Price (£)
Semi-Detached	1930-1949	3	2	Small	80	3911.6	25944.3	1397
		4	2	Medium	100	4412.8	29268.6	1576
		6	2	Large	120	4916.8	32611.4	1756

373kwh/m^2 Energy Demand of 1930's semi-detached (according to Green Age)

The Brief

VISION:
Develop a Net Zero whole life carbon build ***solution*** (not a ***system***). Evolution *not* revolution.



PRIORITIES
Reduce energy need, reduce embodied carbon, remove the use of fossil fuels and reduce the performance gap before offsetting.

WHAT WE DID:
Innovated through collaboration, research, consultation, design, modelling, knowledge creation & exchange.

The R&D Team

The Project Team

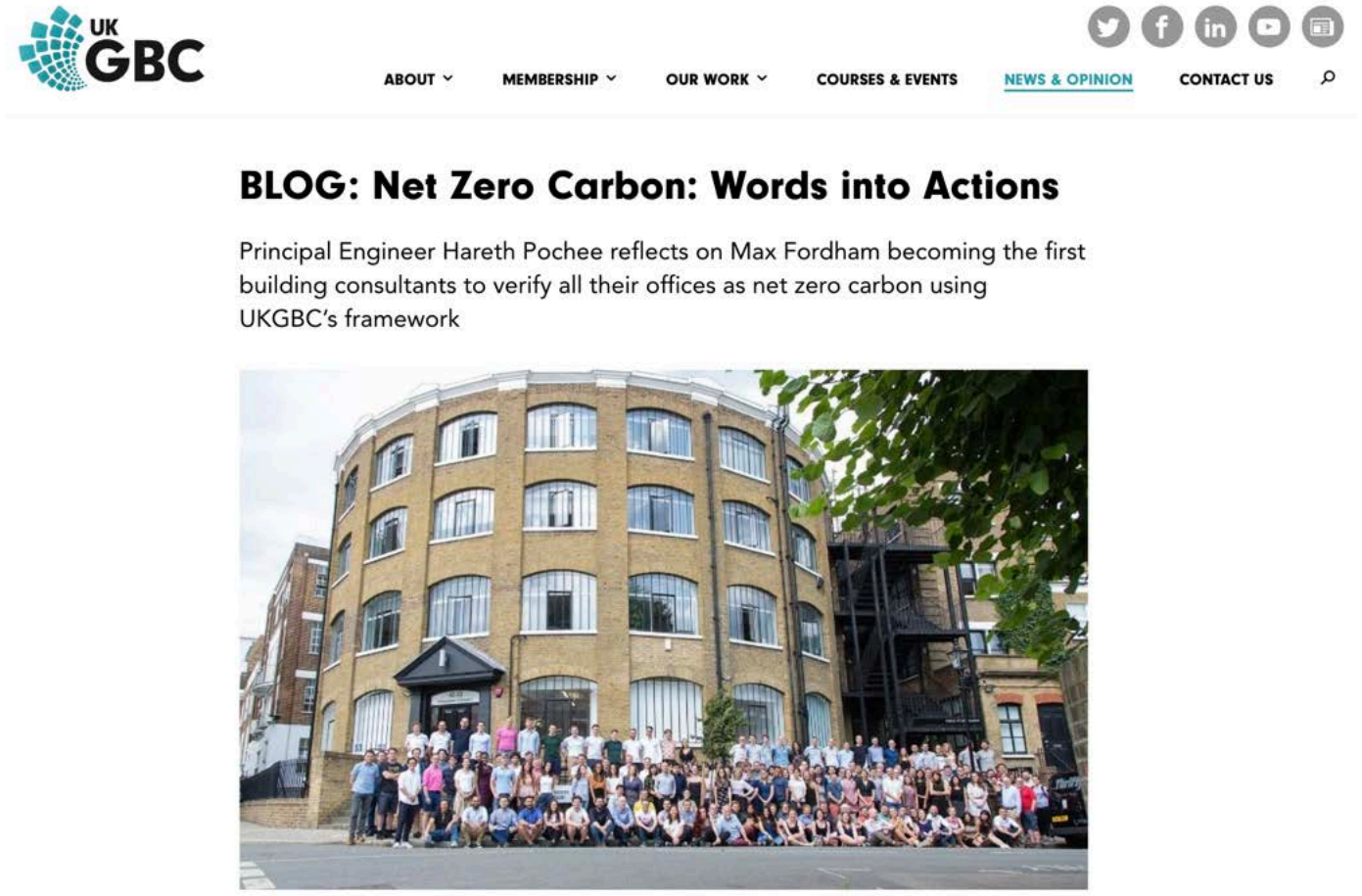
Alan Clarke	Energy and Building Services	Elemental Solutions
Beth Williams	Structural Engineer | Passive House Designer	Build Collective
Diana Waldron	Passive House Designer	Cardiff Metropolitan University
David Hedges	Housing Advisor	Woodknowledge Wales
Eilidh Forster	Embodied Carbon Assessor	Woodknowledge Wales
Gary Newman	Forestry and Timber Housing	Woodknowledge Wales
James Moxey	Project Lead	Woodknowledge Wales
Jane Anderson	Life Cycle Analysis	Construction LCA
Kasper Maciej	Building Physics | Passive House Designer	Greenguage
Nick Grant	Passive House Consultant	Elemental Solutions
Rob Thomas	Architect | Passive House Designer	Hiraeth Architecture
Rob Wheaton	Architect | Passive House Designer	Stride Treglown

Multi-disciplinary team of construction experts

The R&D Team

Pioneer.

Research Framework



Pioneers.

Research Framework

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m²/y	146 kWh/m² /y (Ofgem benchmark)	< 105 kWh/m²/y	< 70 kWh/m²/y	< 0 to 35 kWh/m²/y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon $kgCO_2e/m^2$	1000 $kgCO_2e/m^2$ (M4i benchmark)	< 600 $kgCO_2e/m^2$	< 450 $kgCO_2e/m^2$	< 300 $kgCO_2e/m^2$	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

Fig 2.3 RIBA 2030 Climate Challenge target metrics for domestic buildings

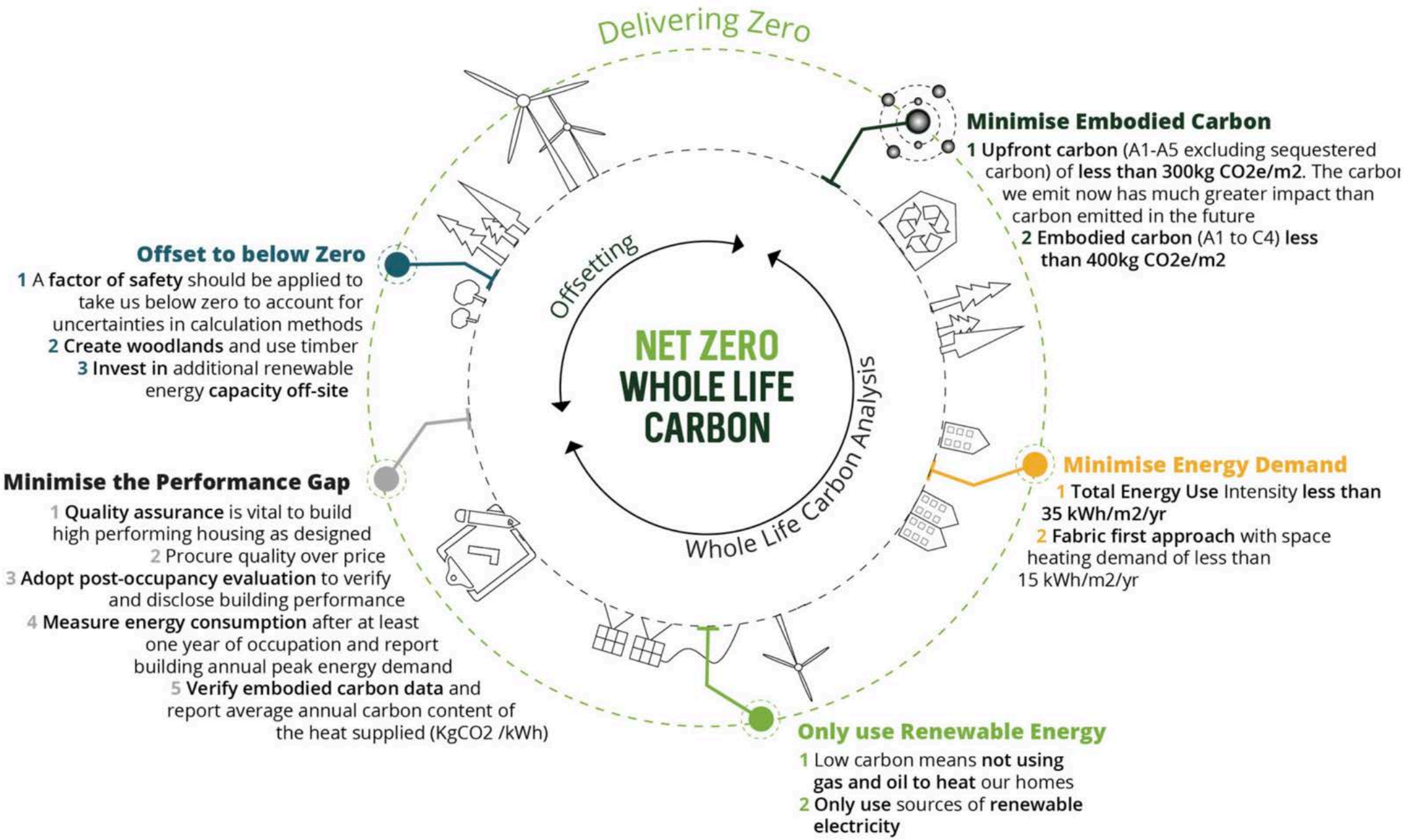
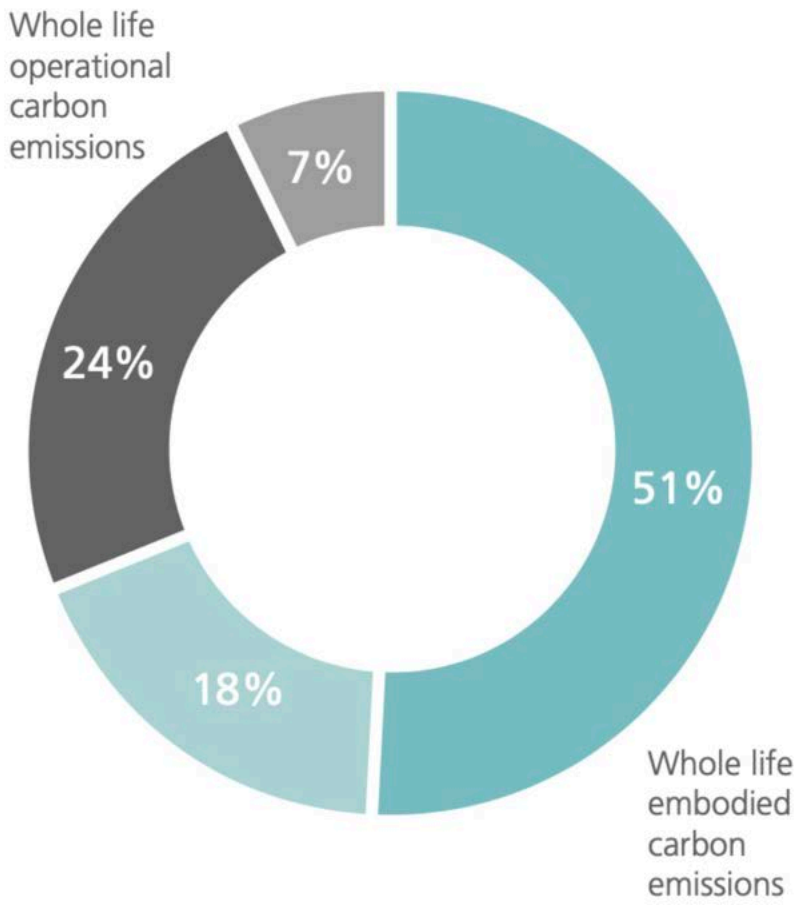


Fig 2.1 Net Zero Housing: Whole Life Carbon Guide

Total Carbon Footprint

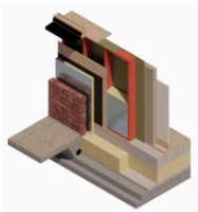
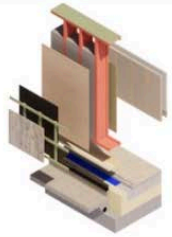


We need to consider total CO_2 emissions – not just those associated with operational energy.

What We Did: Embodied Carbon

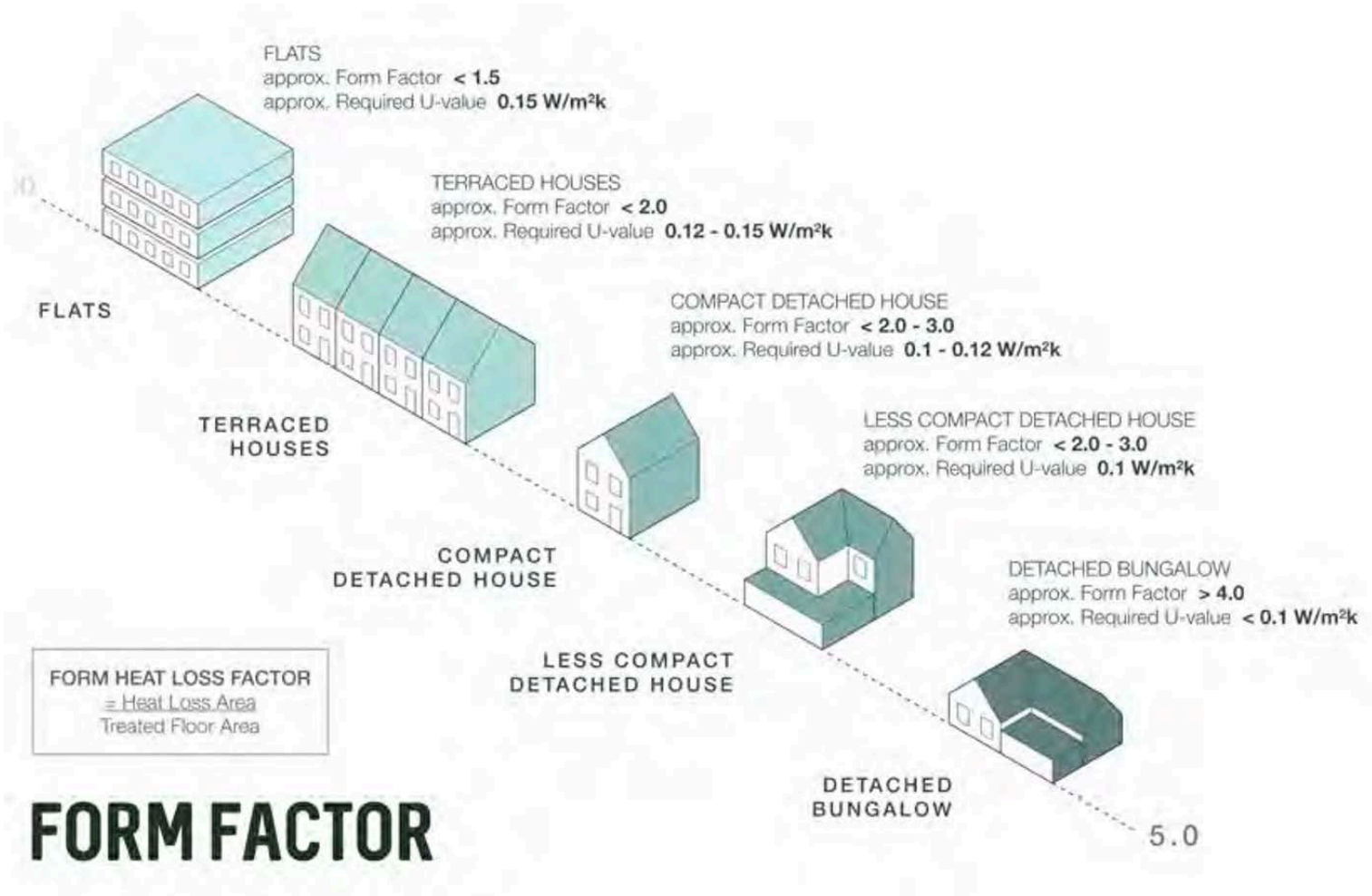
We can measure embodied carbon.

What We Did: Embodied Carbon

		UP-FRONT CO2 Walls (kgCO2eqv/ m2)	UP-FRONT CO2 Building (kgCO2eqv/ m2)	WHOLE LIFE EC CO2 Building (kgCO2eqv/ m2)
Benchmark : Solid Stud With Polyurethane Foam		198.0	471.3	820.6
Fabric Type 01 : Larsen Truss		51.9	325.2	674.5
Fabric Type 02 : I Beam		48.3	321.5	670.8

We need to consider total CO_2 emissions – not just those associated with operational energy.

What We Did: Energy Demand



Form factor as well as other variables considered.

What We Did: Energy Demand

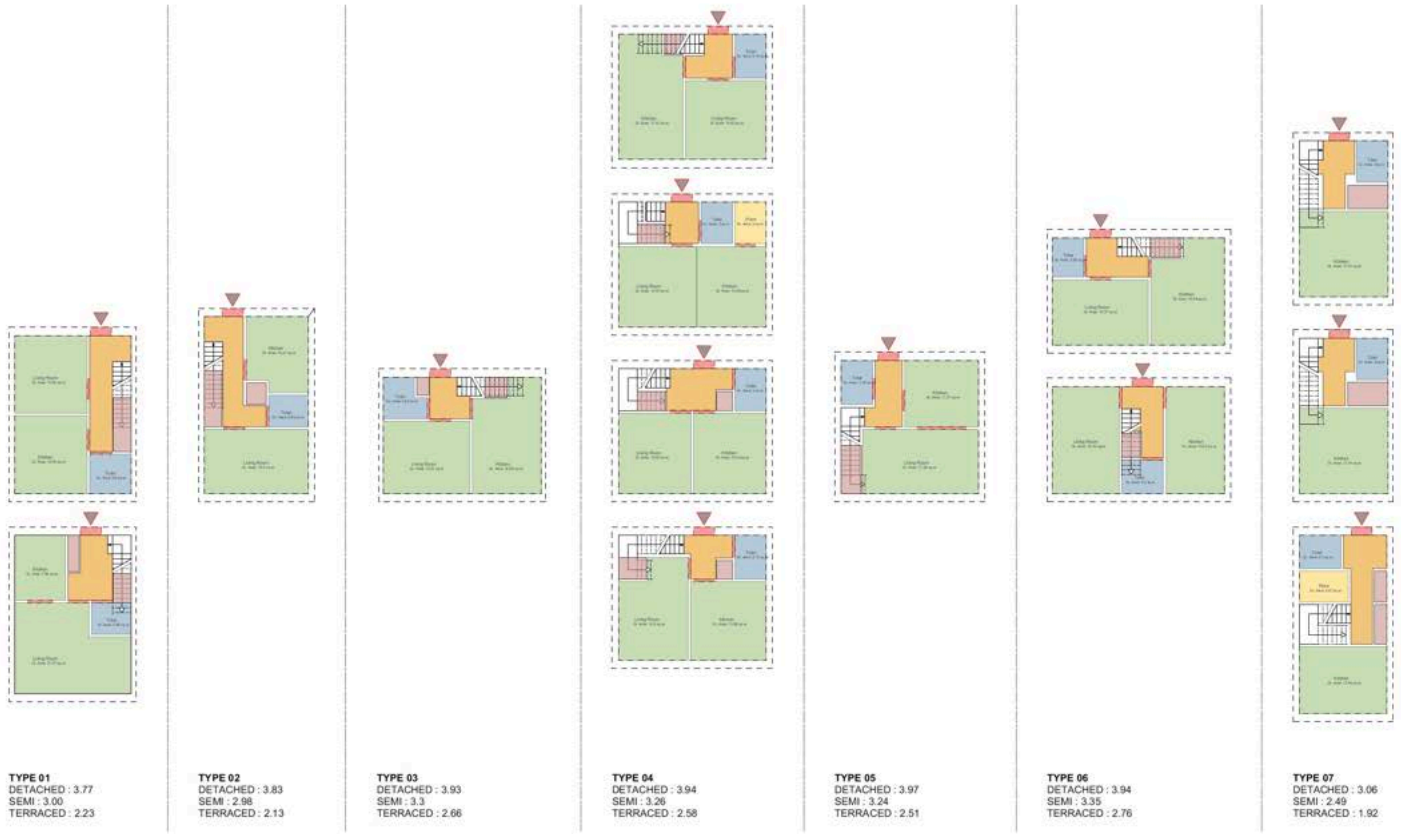
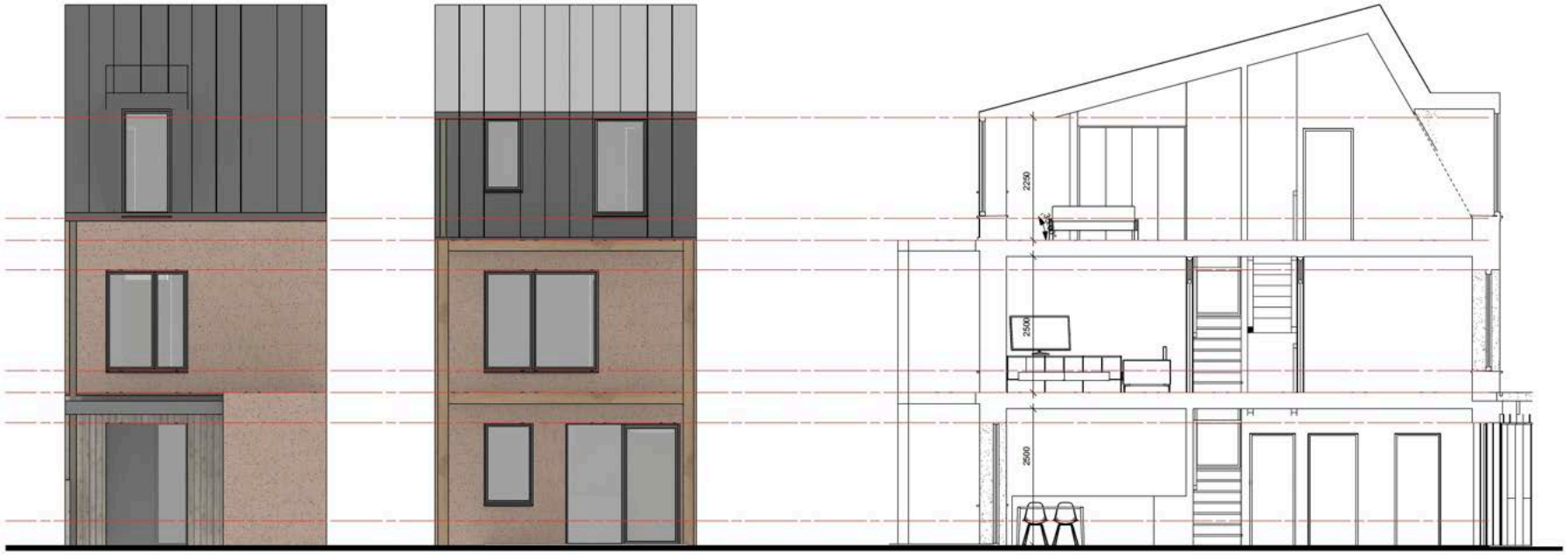


Fig 3.3.1. Pattern book of 2 bed 4 person house types

Typical 2B4P housing association house type reconsidered.

What We Did: Energy Demand

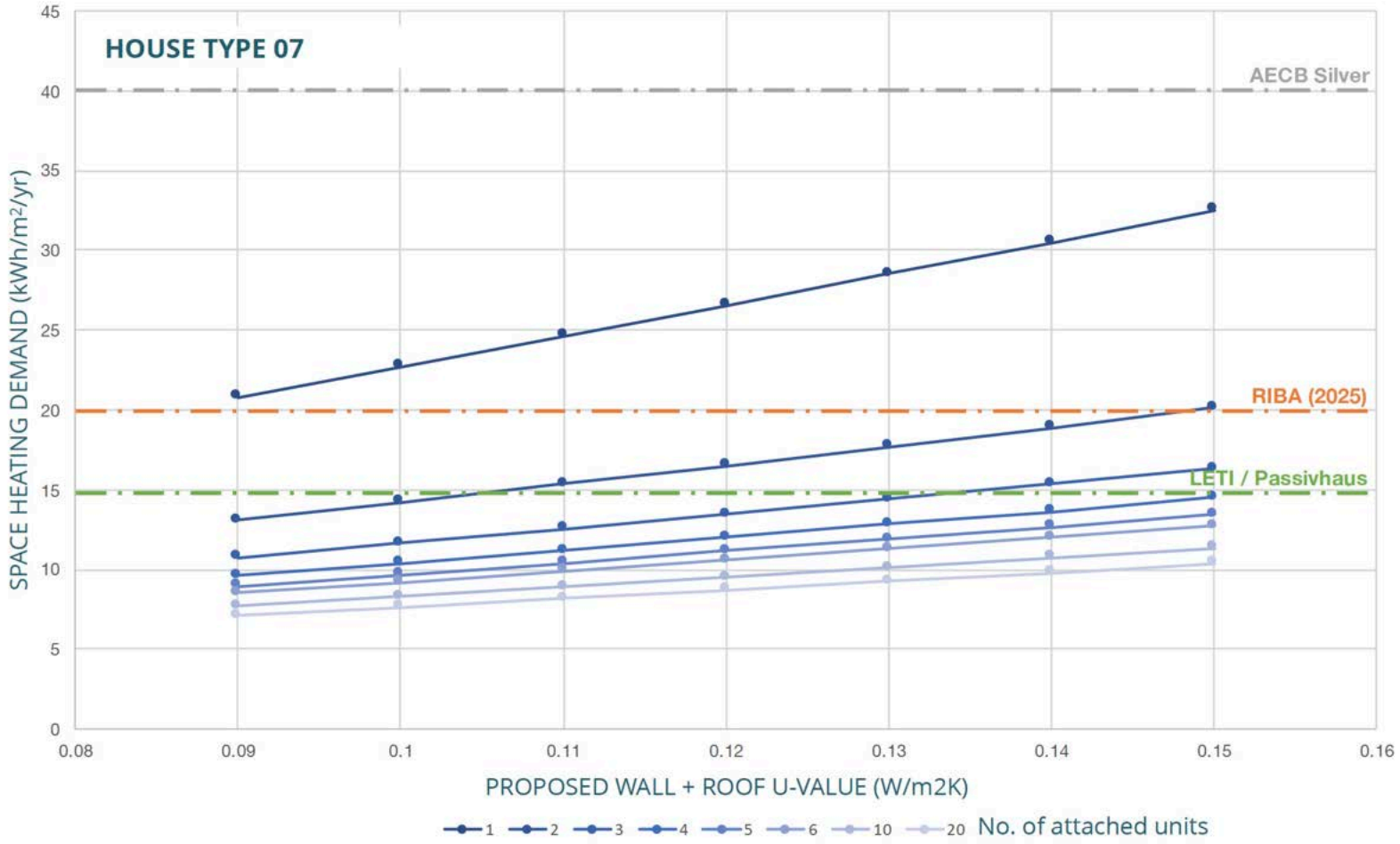


Through building physics analysis and **optimised design** we can achieve a very low space heating demand (if build as designed).

What We Did: Energy Demand

IHP4 project with 11 Local Authorities to develop town house terrace option.

What We Did: Energy Demand



Through building physics analysis and **optimised design** we can achieve a very low space heating demand (if build as designed).

What We Did: Reaching Zero

Low embodied carbon.

low energy demand.

no fossil fuels.

low performance gap.

Then compensate for CO_2 emissions.

Thank you
Please stay in touch

Woodknowledge Wales Limited
Ffarm Moelyci, Felin Hen Road, Tregarth, Gwynedd, LL57 4BB