Work Packages & Organisation Chart

WP0 Built Environment Programme Management
Chair Prof Phil Jones, Cardiff University

WP1 Sustainable Building Envelopes
Chair Kevin Bygate CORUS

WP2 Lighting
Chair Prof Paul Rees, Swansea University

WP3 Use of timber in building construction
Chair Nick Tune, BRE

WP4 Low carbon design solutions
Chair Dr Wayne Forster Cardiff University

WP5 Urban scale demand and supply
Chair Simon Lannon Cardiff University

WP6 Monitoring the performance of low carbon technologies
Chair Prof Chris Tweed, Cardiff University

WP7 Innovation, technology deployment and market development:
Chair Prof Malcolm Eames, Cardiff University

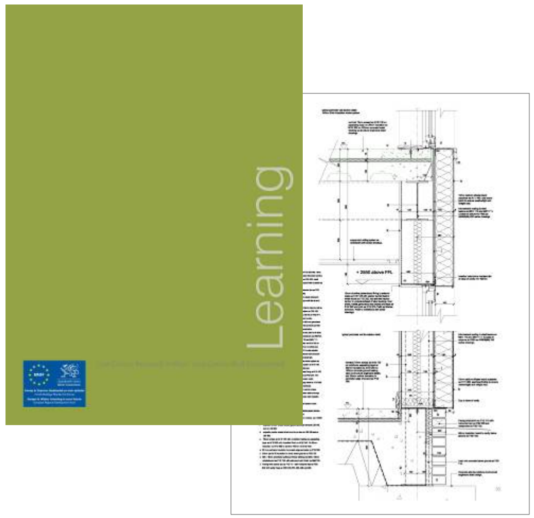
LCBE Work Package 4: Low Carbon Design Solutions

Design of Low & Zero Carbon Buildings

- To produce in collaboration with the whole supply chain, design guidance and standard proof tested zero-carbon solutions for a range of building types.
- Building types selected in response to the planned investment in the next generation of public buildings.

HOUSING

EDUCATION



Available online at
http://orca.cf.ac.uk/27168/

LCBE Work Package 4: Low Carbon Design Solutions

Design of Low & Zero Carbon Buildings - OUTPUTS

HOUSING

- Dwelling Case Study Book

Available online at
http://orca.cf.ac.uk/27168/

- Dwelling Typical Details paper
- Fabric & Systems report
- Design concept proposals
- ‘Dwelling’ conference 14th October 2011

EDUCATION

- Learning Case Study Book

Available online soon

- Cost Report
- ‘Low Carbon Learning: Lessons from Practice’ conference 5th September 2013

- Achievements: 9 companies assisted, 2 Research and Development Collaborations, 2 Processes Improved, over 100 delegates involved, Low Carbon design advice given to local Authorities across Wales (ongoing involvement), lectures & tutorials given to students of BSc & MSc at Welsh School of Architecture

Case Studies: **Housing**

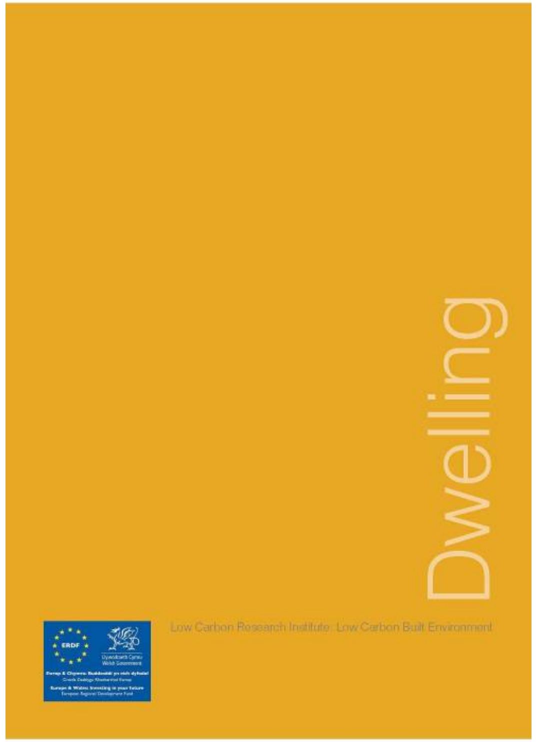
From Wales and UK over the last 5 years. Examplar housing schemes discussed:

Mariner's Quay, Old Town Dock, Newport

Chapel Close, St Athan, Vale of Glamorgan

Future Homes Visitor Centre, Ebbw Vale Passive house

Retrofit for the Future, The Turnstiles, Newport



Ty Unnos Longhouse,
The Works Ebbw Vale

Design Research Unit Wales

Blaenau Gwent County Borough Council

Brief

Comply with Works design code

Code for Sustainable Homes Level 5

Use local sustainable materials/ supply chain

Passivhaus performance <15KWh/m2/yr space heating

Innovative systems and energy conservation

Meet DQR requirements

Site plan

3b5p house type

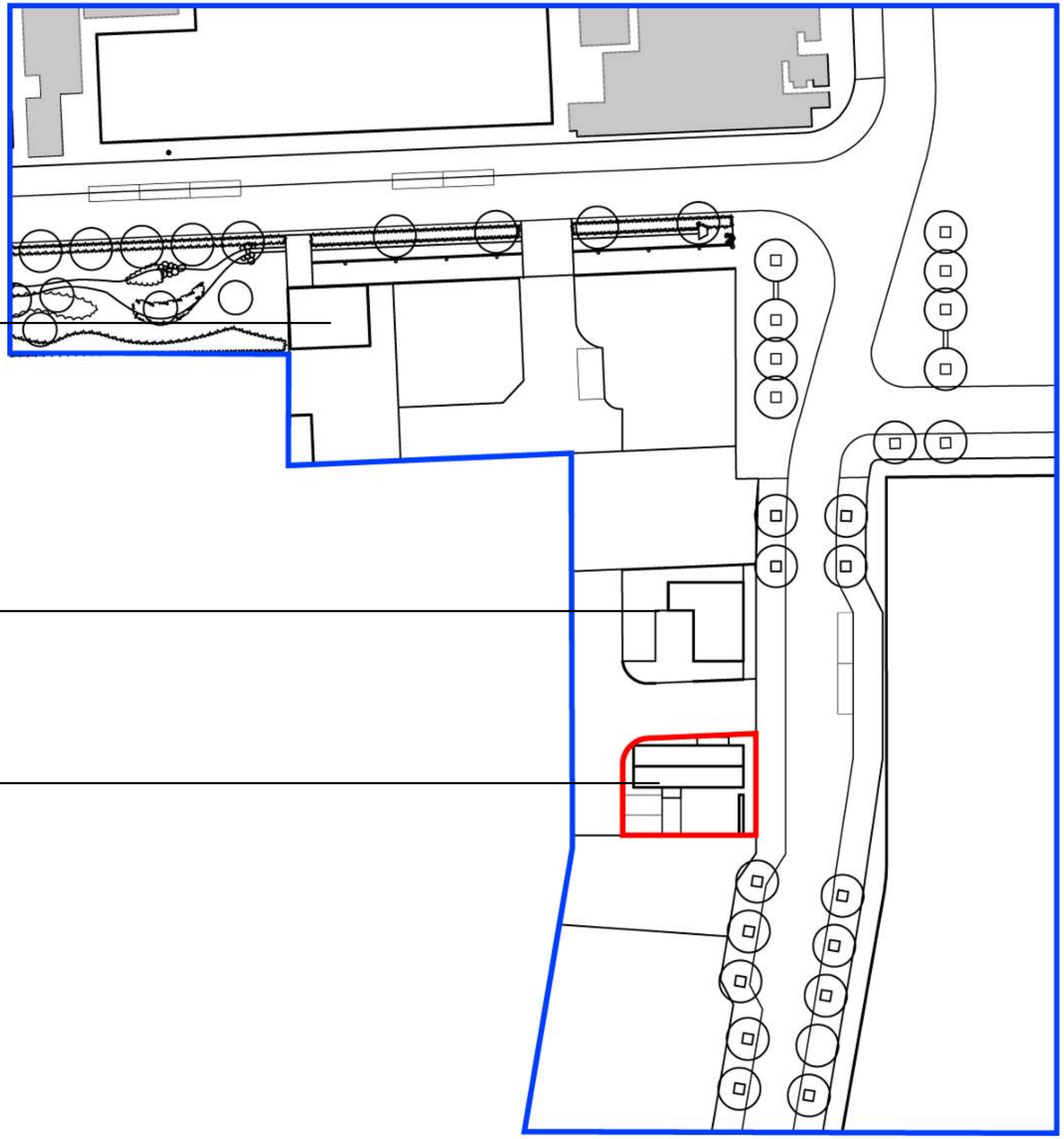
Bere Architects

2b4p house type

Dragonboard

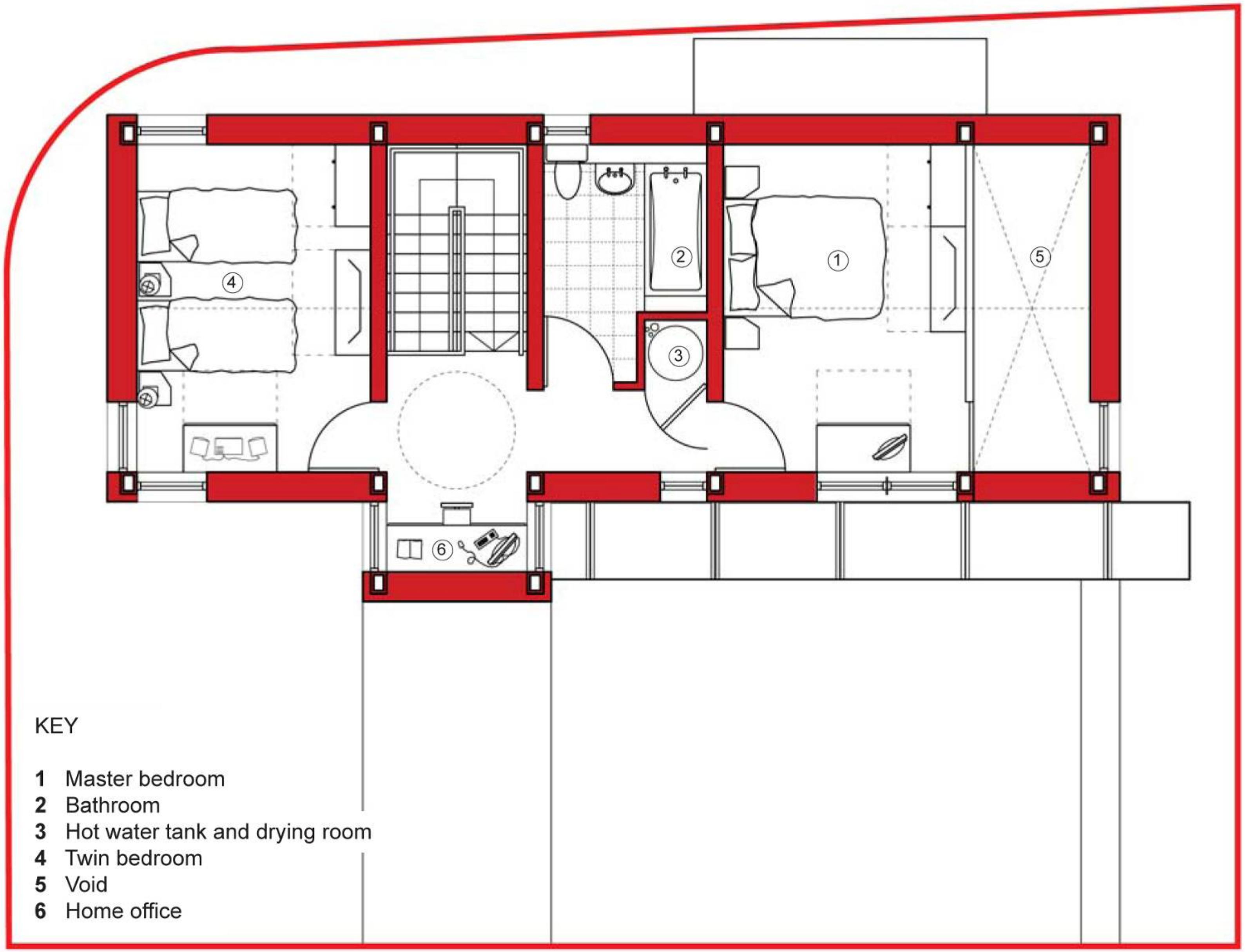
2b4p house type

Design Research Unit Wales



Ground floor plan

First floor plan



KEY

1 Master bedroom
2 Bathroom
3 Hot water tank and drying room
4 Twin bedroom
5 Void
6 Home office

KEY

1 Dark grey steel standing seam roof
2 Vertical Welsh chestnut cladding
3 Triple glazed Welsh timber framed windows
4 Render (colour as illustrated)
5 Walkway canopy/ solar shading
6 Zone for photovoltaics and solar water panels

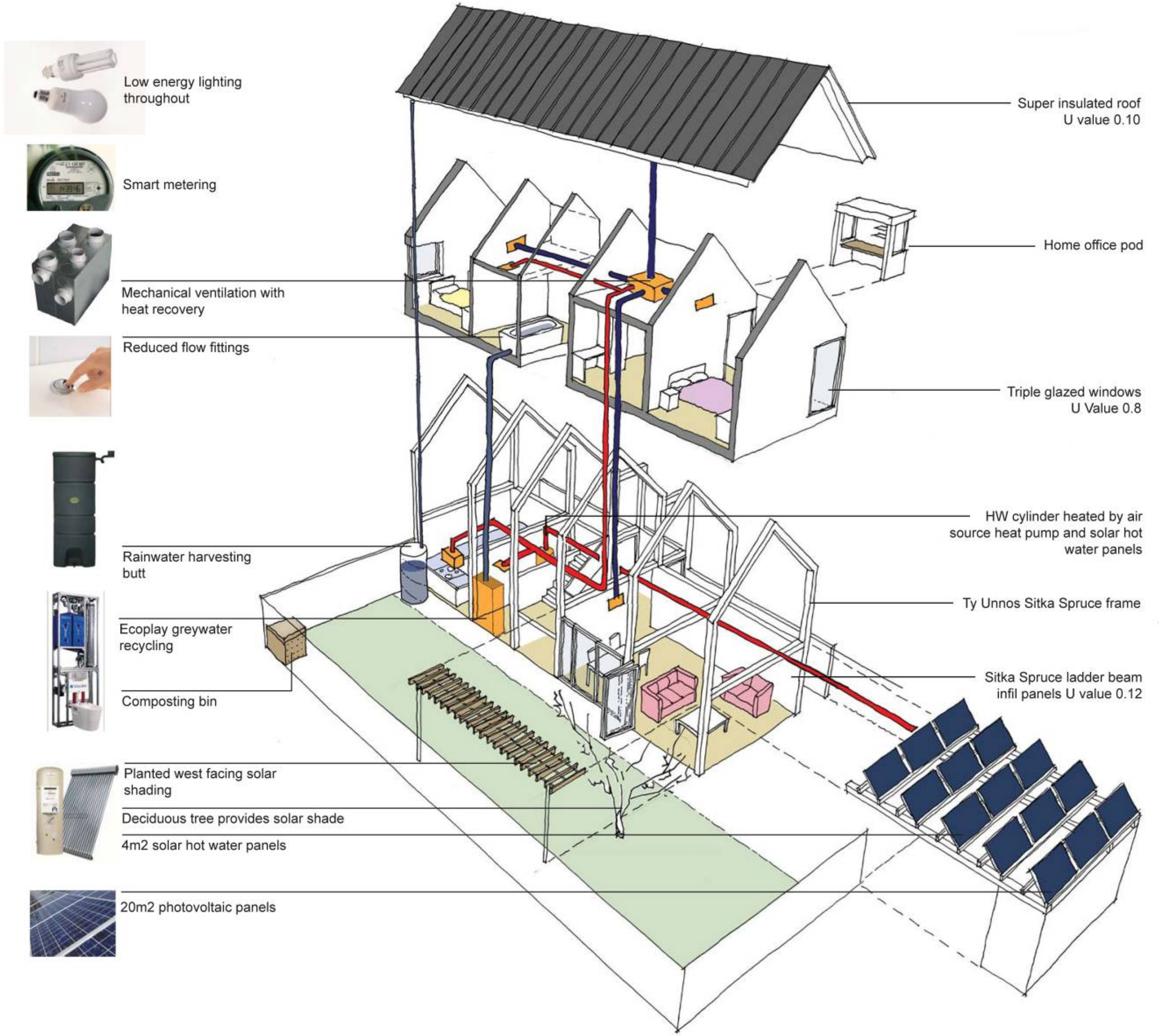
South elevation

KEY

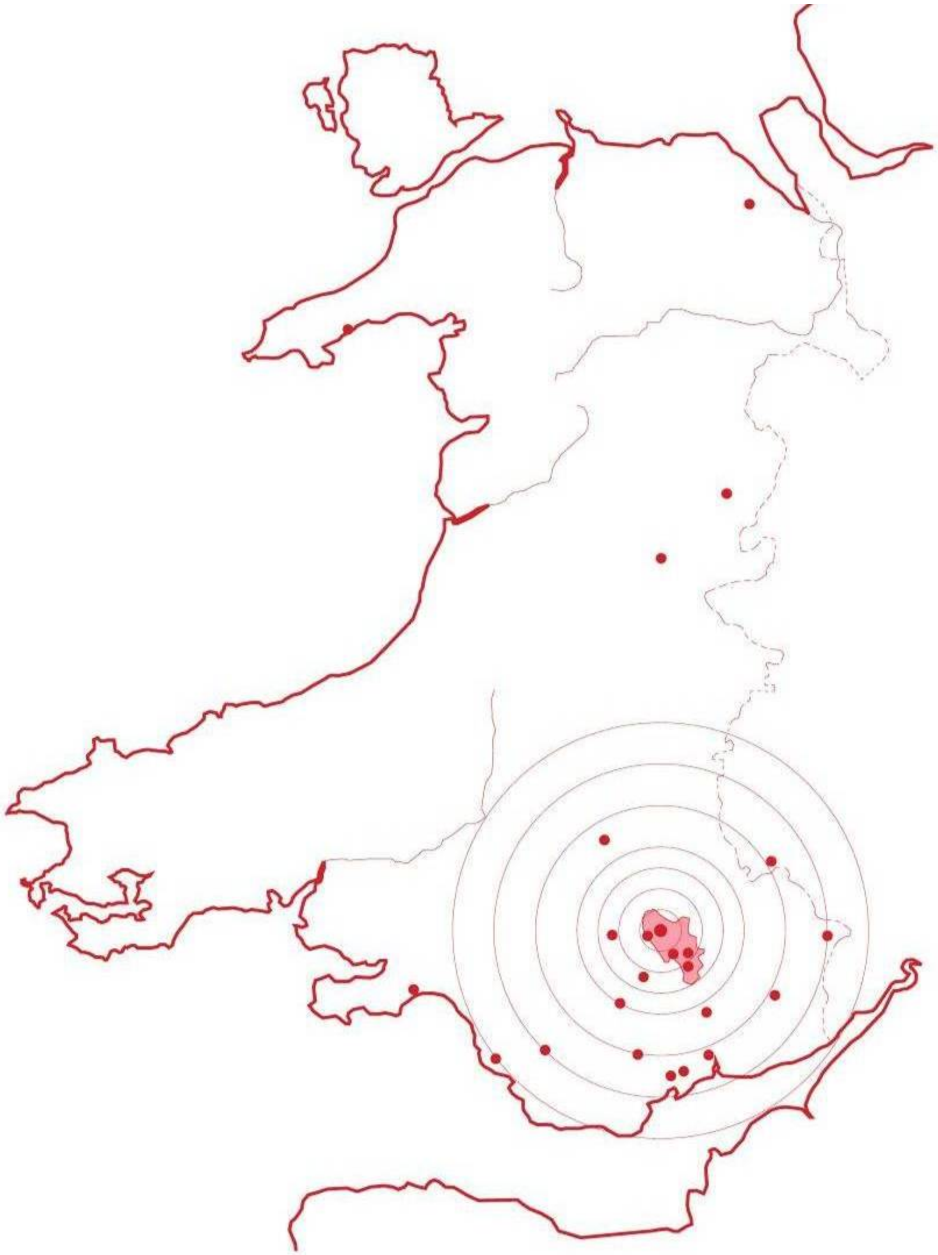
1 Dark grey steel standing seam roof
2 Vertical Welsh chestnut cladding
3 Triple glazed Welsh timber framed windows
4 Render (colour as illustrated)

North elevation

Energy and environment



Vision: local materials



Main contractor:	G Adams Construction Ltd
Mechanical sub-contractor:	Micaul Solar (Cwmbran)
Electrical sub-contractor:	M Moon Electrical (Tredegar)
Domestic Water:	N.Perret (Cwm)
Foundation concrete:	Tarmac (Ebww Vale)
Ground floor screed:	Phil Harris (Abertillery)
Ty Unnos manufacturer:	Kenton Jones (Welshpool)
Steel fabricators:	Rokel Engineering (Merthyr)
Windows, doors & stairs:	Vintage Joinery (Cwmtillery)
Ironmongery:	Locktech (Swansea)
Aluminium Flashings:	Euroclad (Cardiff)
Insulation, membranes, pressure test:	Pen-y-Coed Warmcel (Welshpool)
Ground floor external insulation:	Rockwool (Pencoed)
Ground floor internal Slate:	Welsh slate from Mandarin Stone
First floor external woodfibre insulation:	TyMawr (Brecon)
External Render:	Specialist External Renders Ltd
External chestnut cladding:	Wentwood Timber (Wentwood)
First floor sycamore supplier:	Wentwood Timber (Wentwood)
Roofing sub-contractor:	Corus Colourcoat Urban (Shotton)
Solar Panels:	Filsol Solar Panels (Newport)
Wall tiling:	W.Palfrey Tiling Ltd (Tredegar)
Radiators:	Quinn radiators (Newport)
External floor slate:	Cerrig (Pwllheli)
Scaffolding:	Shadow (Bargoed)
Building Supplies:	Robert Price (Ebbw Vale), Gwent Building Supplies (Tredegar), Travis Perkins (Ebbw Vale), Sheffield Insulation (Cardiff)
Fencing:	Price Landscapes (Merthyr)
Plant Hire:	CBL (Pyle), U Hire (Ebbw Vale)
Temp fencing:	Heras (Cwmbran)
Welfare and stores:	Kabin Hire (Caerphilly)

Vision: local materials

-**Ty Unnos:**

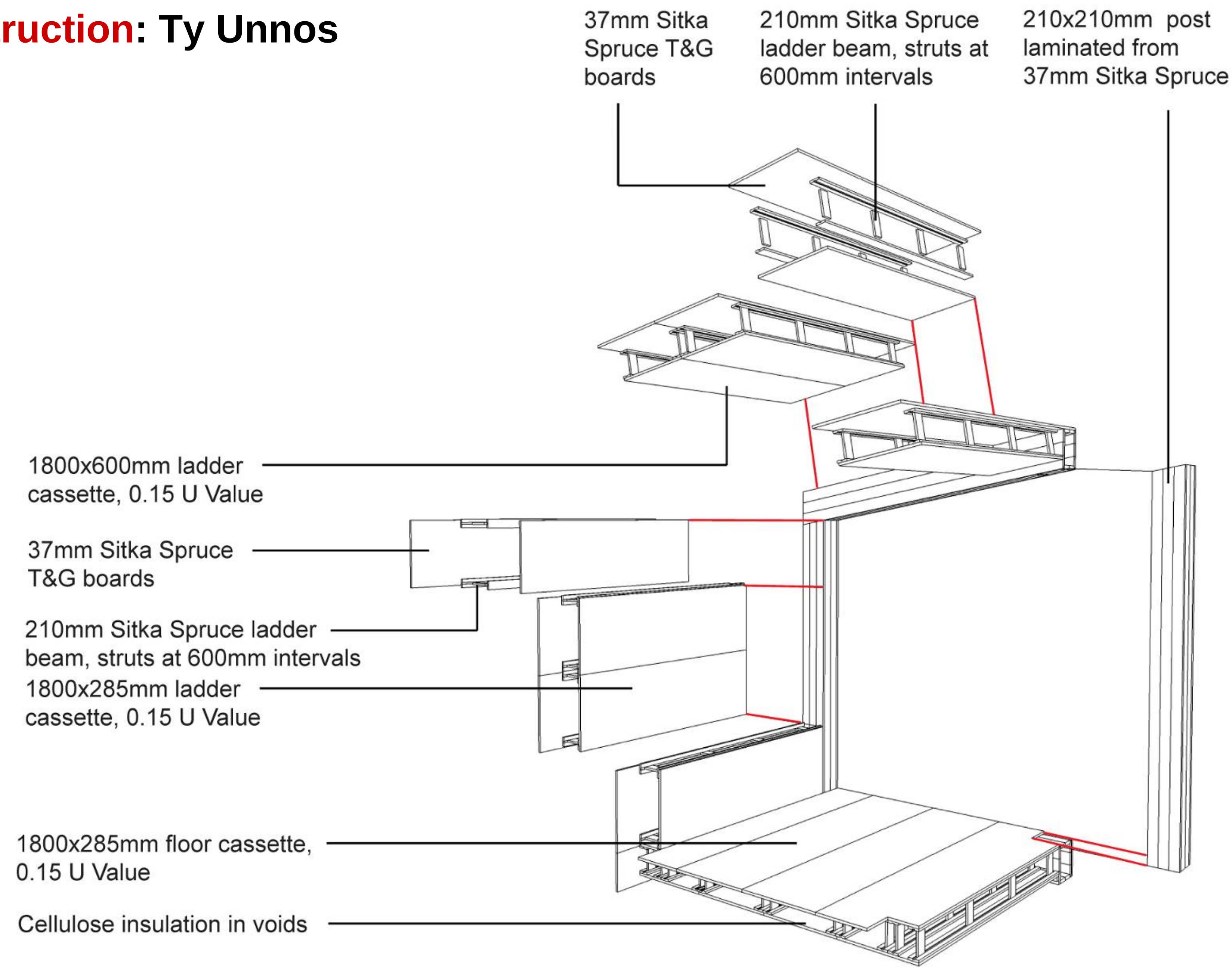
- Uses local materials in a locally developed construction system

- Adds value to a Welsh raw material

- Develops local supply chain and skills

- Regional house types derived from traditional Welsh precedent

Construction: Ty Unnos



Ty Unnos: box beam

Mariners Quay, Old Town Dock, Newport

Code 5 Affordable Housing



Speaker:
Bernadette Kinsella   Powell Dobson Architects

fairlake   CHARTER HOUSING

Leadbitter   RVW CONSULTING   Davis Langdon   HOARE LEA   ANTHONY JELLARD ASSOCIATES   powelldobson ARCHITECTS

Key Design Principles: Site

- Fabric first
- Southerly orientation – passive solar gains
- District energy centre
- Urban design principles equally as valuable
- Narrow, double fronted site – mews
- Visual and physical permeability

KEY
- 2 BED HOUSE
- 3 BED HOUSE
- 4 BED HOUSE
- APARTMENTS
- SERVICES ZONE
- ENERGY CENTRE

Site Layout

Code for Sustainable Homes: Overview

Percentage better than Part L1A 2006	
1 (★)	10 %
2 (★ ★)	18 %
3 (★ ★ ★)	25 %
4 (★ ★ ★ ★)	44 %
5 (★ ★ ★ ★ ★)	100 %
6 (★ ★ ★ ★ ★ ★)	zero carbon home

- 6 mandatory requirements
- Credits cover the following assessment themes:
  - Energy
  - Water
  - Waste
  - Materials
  - Surface drainage
  - Ecology
  - Pollution

Code Level 5 Requirements

Minimum Requirements:

Besides all the mandatory requirements related to the CSH, there are extra minimum requirements

Energy → **100%** Improvement over Part L requirements

Water → **80 litres/person/day** - Maximum potable water consumption

Overall → **84 points** of a possible 100 must be achieved

Category 1 – Energy & CO_2 Emissions

Energy efficiency measures

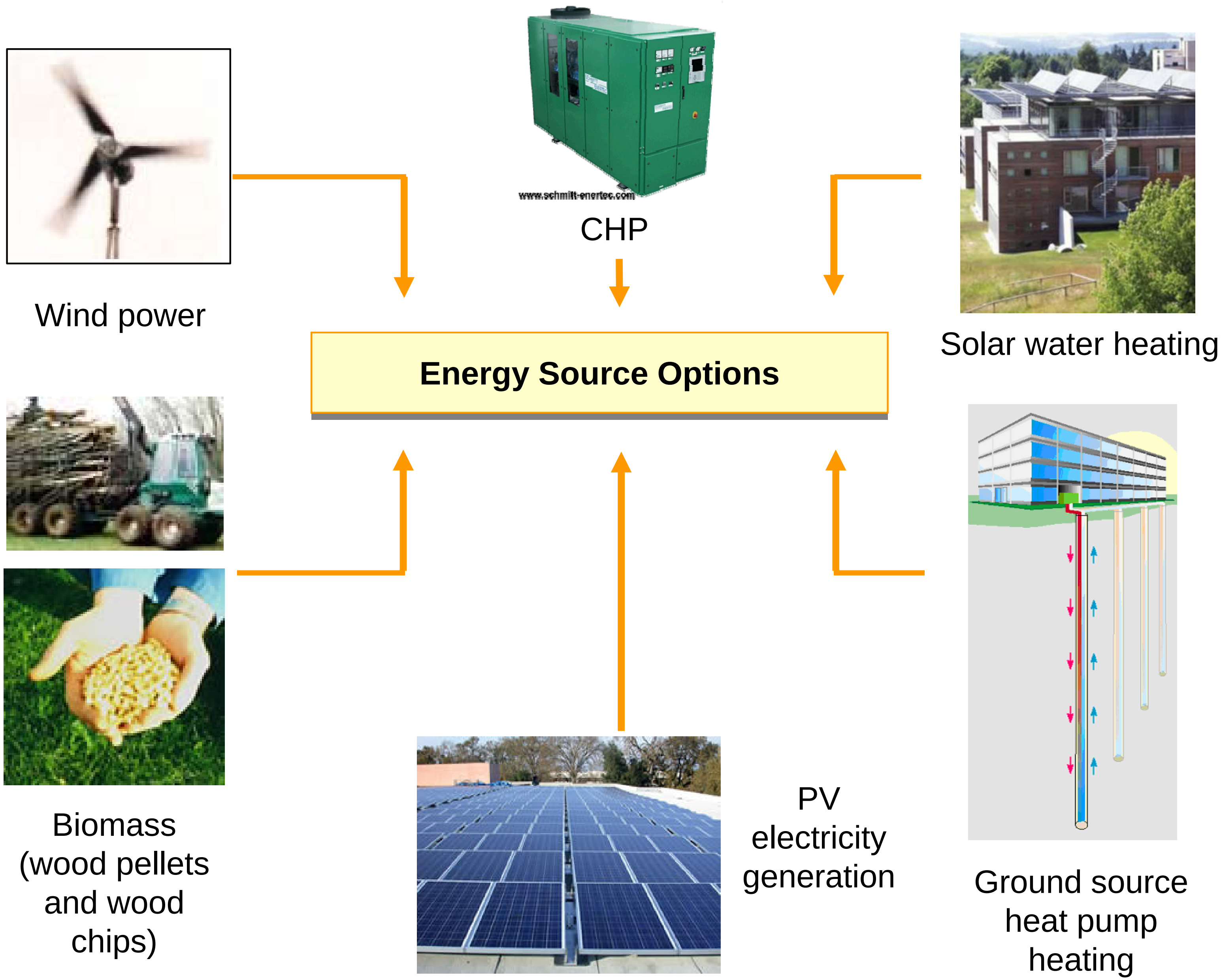
BUILDING ENVELOPE

- External Wall **U-value = 0.15 W/m^2.K**
- Better Party Wall Construction
- Window **U-value = 0.80 W/m^{2}K**
- Solar transmittance **g = 0.5**
- Timber-frame Windows
- Glazed door **U-value: 1.50 W/m^2.K**
- Solid door **U-value: 1.00 W/m^2.K**
- Low Global thermal bridges: External insulation?
- Air Permeability **= 2.6 m^3/(h.m^2)** at 50 Pa (tested)

BUILDING SERVICES

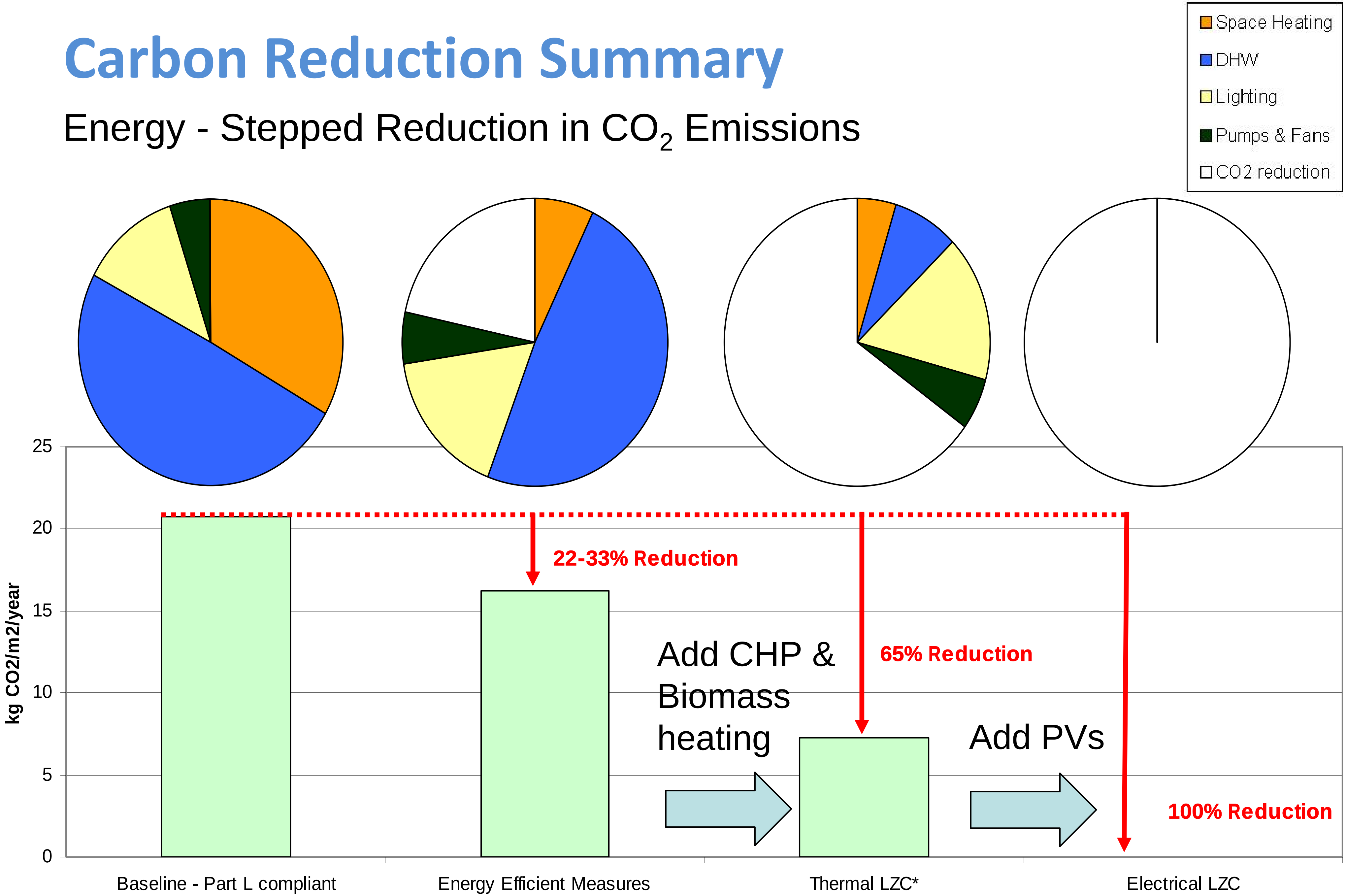
- Mechanical ventilation with heat recovery (HR efficiency > 80%)
- Low fan electricity consumption (Specific Fan Power < 1.0 W/l/s)
- Residences linked to **Community Heating System**
- **100%** Fixed **Energy Efficient Lighting Fittings**

Low or Zero Carbon Technologies



Carbon Reduction Summary

Energy - Stepped Reduction in CO_2 Emissions



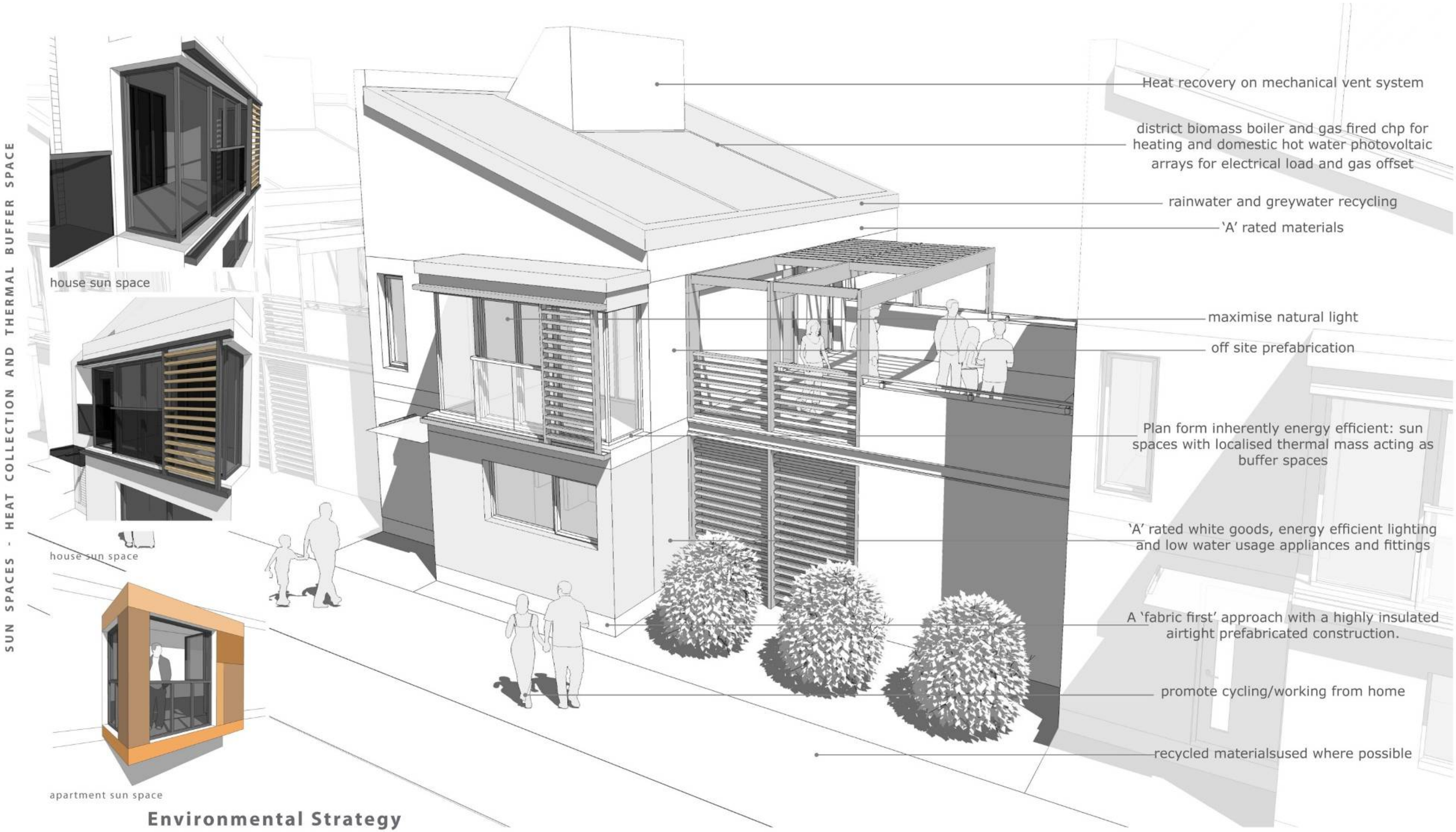
Optimum CHP providing DHW load

Biomass provides 50% space heating

~11m² PV modules (for flats)

~25m² PV modules (for houses)

How did we design to achieve Code 5?



Designing Low Carbon Homes:

Lessons from Practice

Ewrop & Chymru: Buddsoddi yn eich dyfodol
Cronfa Datblygu Rhanbarthol Ewrop
Europe & Wales: Investing in your future
European Regional Development Fund

Llywodraeth Cymru
Welsh Government



A conference at the Welsh School of Architecture
Friday 14th October 2011

'Designing Low Carbon Homes: Lessons from Practice' will focus on the definitions, standards and challenges of delivering zero carbon homes in Wales. Since the announcement of the zero carbon ambition in 2008, the construction industry has seen a severe downturn that has impacted on all sectors. This conference will attempt to address the delivery of zero carbon housing in this challenging economic climate. As part of an ongoing project to provide guidance to the industry, three key questions will be posed:

- How should we be building?
- To what standard?
- At what cost?

The conference will disseminate the early findings of the Low Carbon Research Institute's Low Carbon Built Environment programme work package, 'Design of Low/Zero Carbon Buildings'.

LCRI LOW CARBON RESEARCH INSTITUTE

General Lessons: Dwelling

- Building form, orientation, passive design and fabric first will do the hard work
- Strong partnerships between contractor, sub-contractor, design team and client, including code assessor are critical to a good output
- Aim for a high level of airtightness – use of prefabrication or MMC may assist in achieving effective results
- Drive demand for low carbon homes – market as a benefit, i.e. reduced bills, guaranteed capped energy payments.
- Incorporate Soft landings process to handover to household user, ensuring they are fully aware of how to live with low carbon technologies
- Don’t rely on just meeting minimum Building Regulations
- RIBA Plan of Work 2013 – lack of emphasis on sustainability checkpoints
- Cost & energy use not the only marker for a successful sustainable housing scheme

Case Studies: **Education**

From Wales and UK over the last 5 years. Examplar schools discussed:

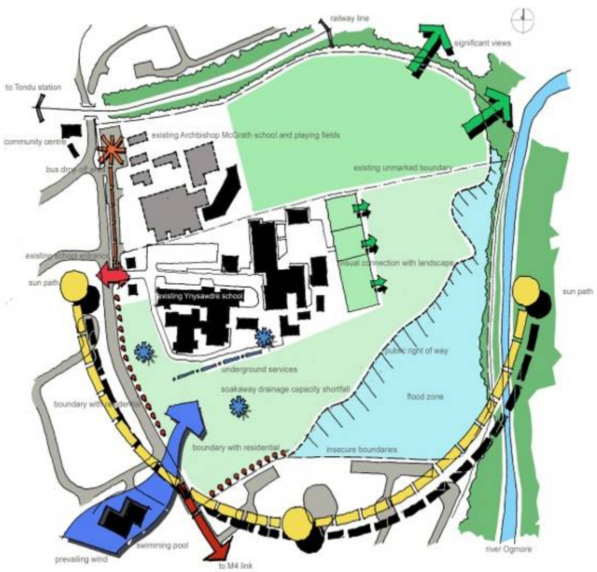
Coleg Cymunedol Y Dderwen, Bridgend; new build secondary
Blaenavon Community Campus; new build primary
Taf Ely Learning Campus; new build tertiary college
All Saints Academy Plymouth; retrofit and extend secondary

Passivhaus schools
Oakmeadow School, Wolverhampton; new build primary
Hauptschule, Klaus, Austria; new build secondary

Standardised school
'The Paxton' by Scape; model for primary
with precendent new build primary's:
Kingsmead, Cheshire
Yynysowen School, Merthyr Tydfil

Gateway to the Valleys: Coleg Cymunedol y Dderwen

Scott Brownrigg



Achieved BREEAM ‘Outstanding’ (score 89.82%)

School Brief:

1570 students (including SEN) with room to expand further if necessary

6 colleges within the school

14,450sqm

ICT rich learning

strong focus on teaching, learning and high achievement

a broad and **innovative curriculum**

an aspirational environment

school provision part of an **integrated service to students and families**

Procurement:

selected via **PQQ**

£39m project cost

appointed by LA for **full services**

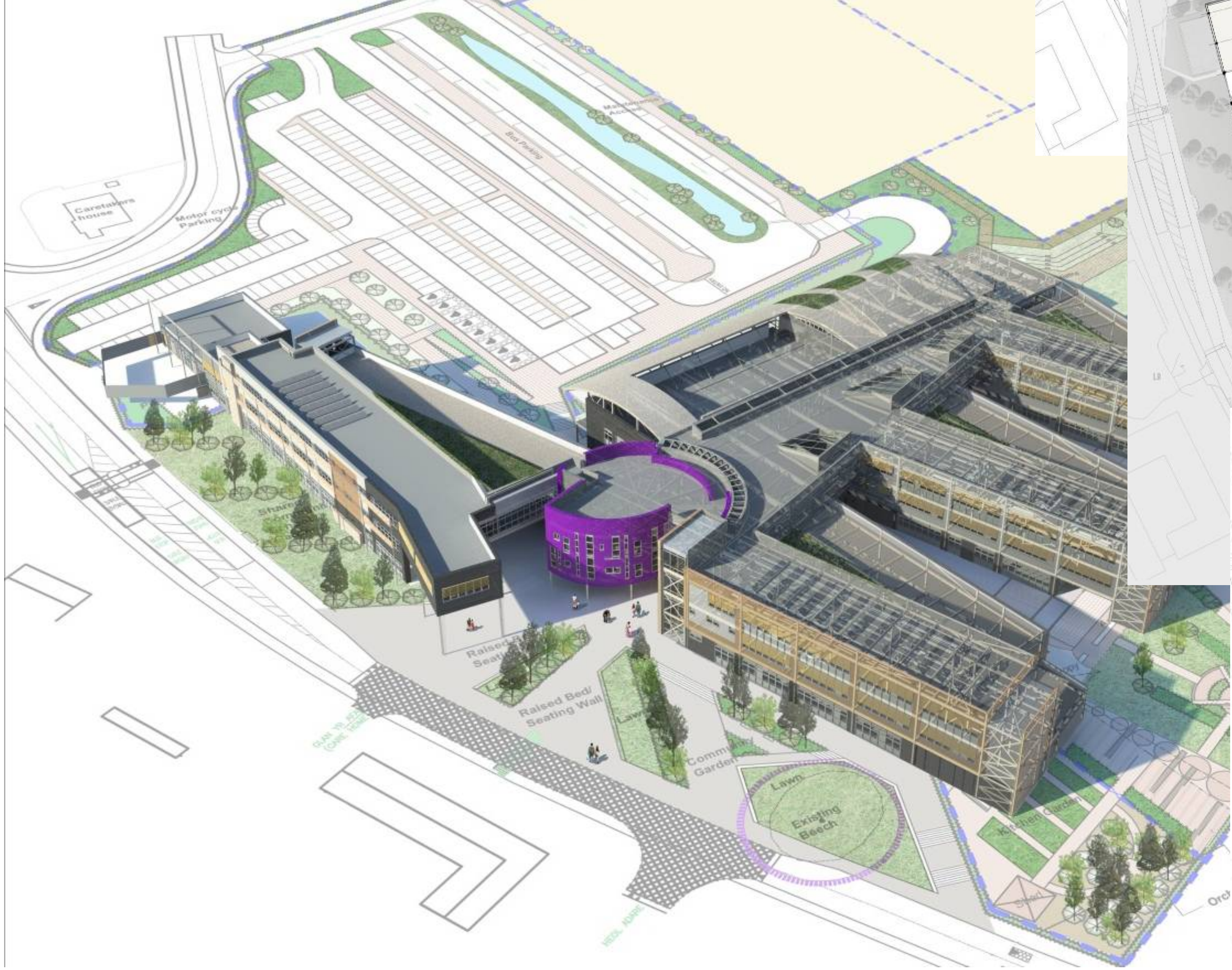
NEC3 contract – option c

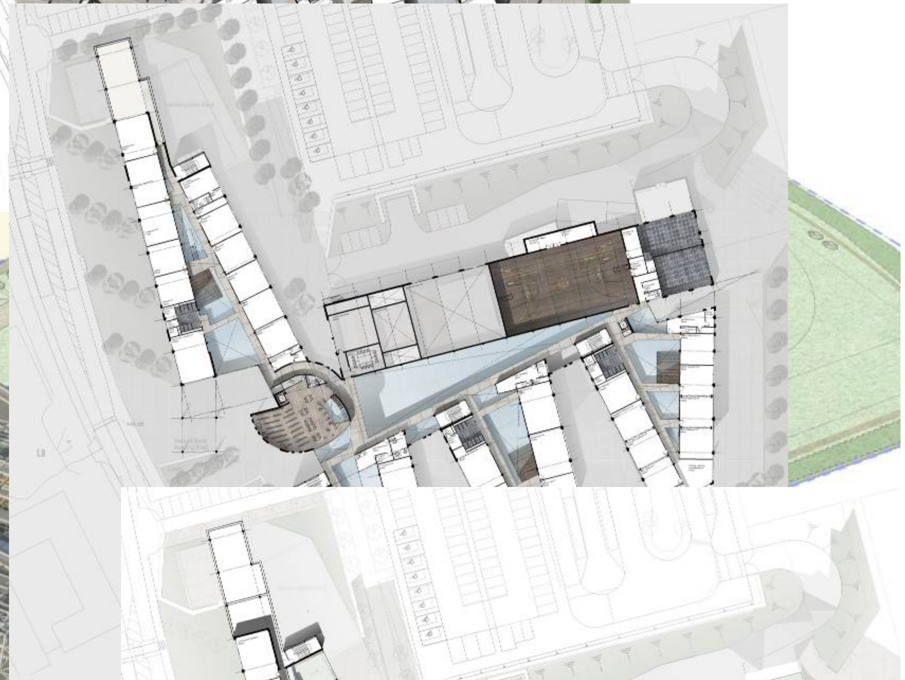
support funding **submission**

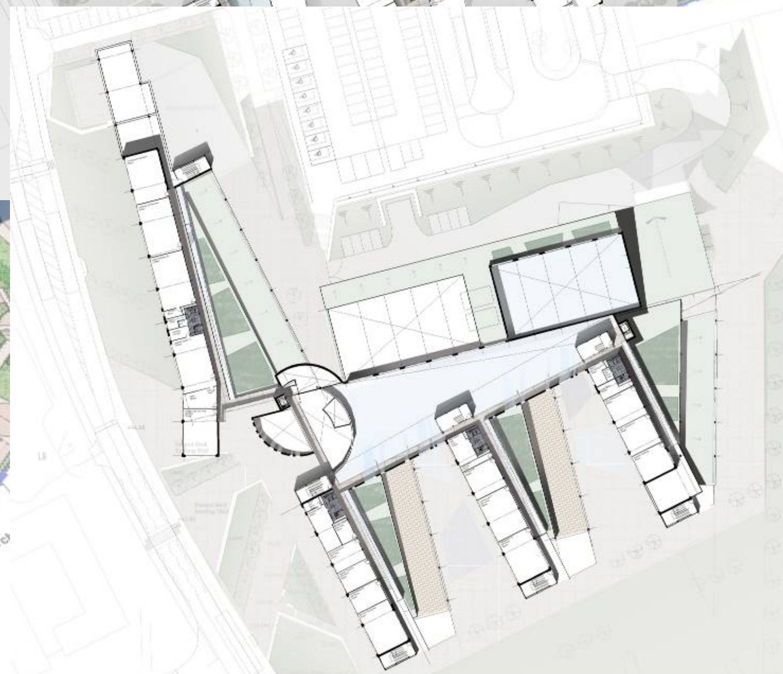
interviewed contractors - **SEWSCAP**

novated to contractor

- Colleges arranged along an internal street
- Classrooms facing East and West
- Upper street open to ground floor
- Localised M&E per college







holistic approach to designing for low carbon

reduce **in use** carbon – **passive design**

reduce water use age

use **sustainable construction materials**

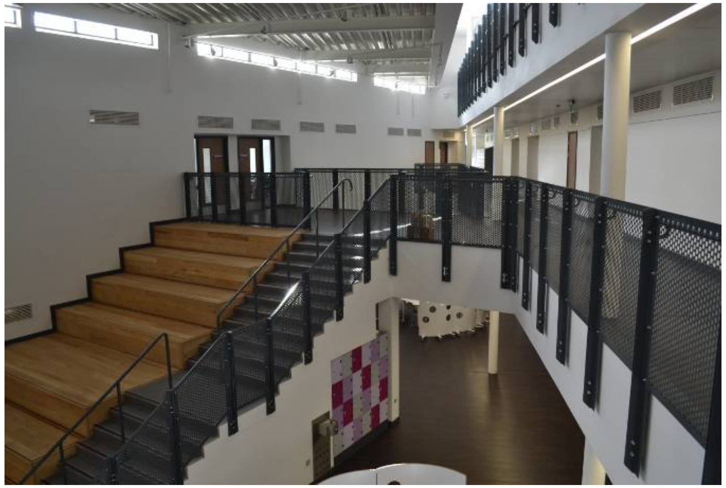
adaptable for the future

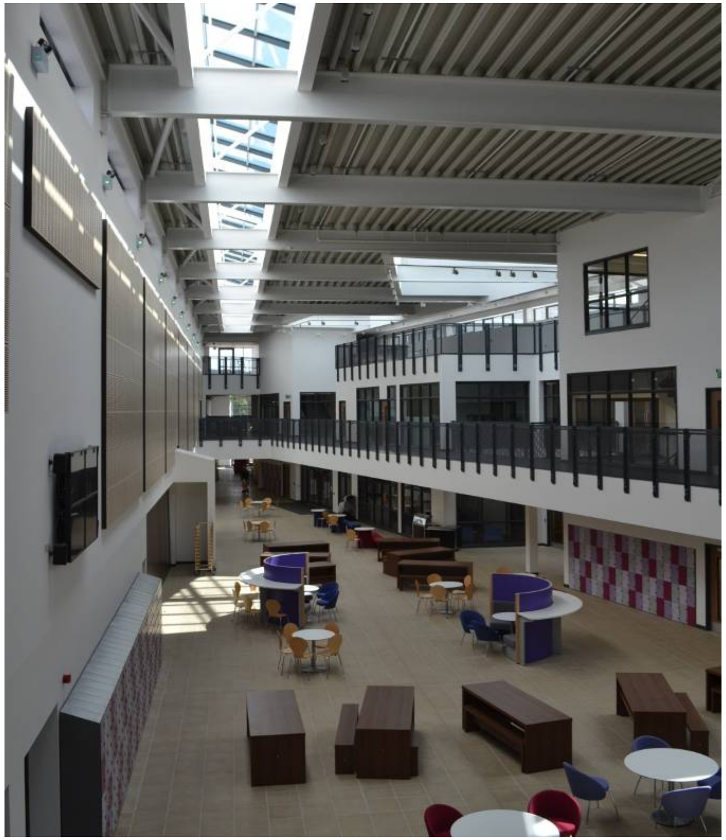
provide **positive contribution** to the community

target **local** spend both pre and during construction

provide a template that can be built on for the **future**

achieve **BREEAM excellent** target **outstanding** through *considered* sustainable design





passive design

natural Vent

maximising natural daylight

orientation

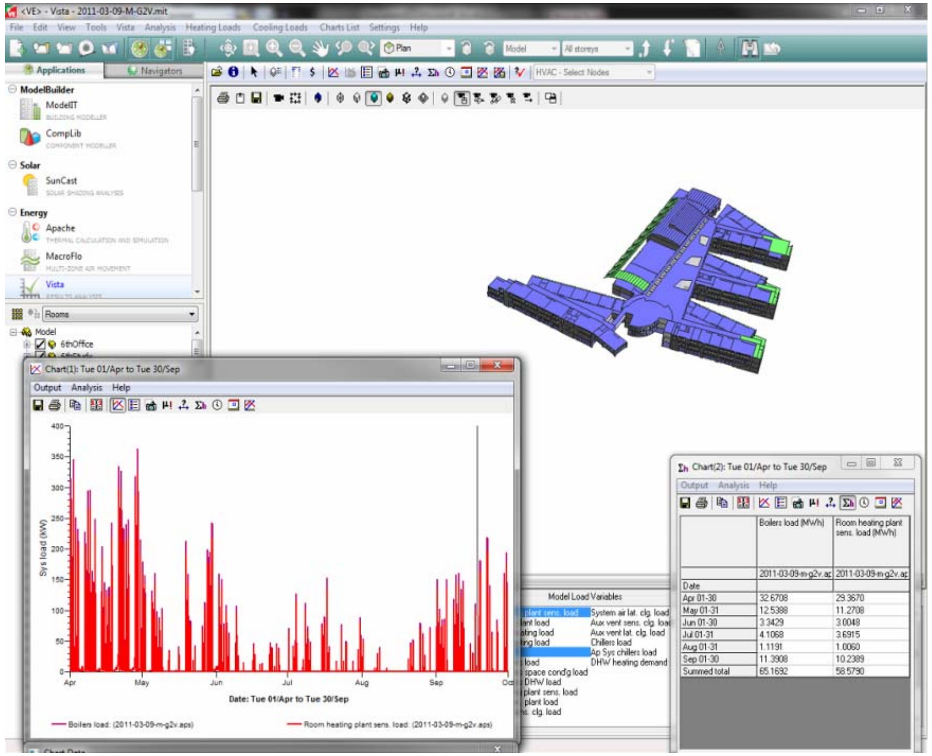
overhangs/ recessed reveals

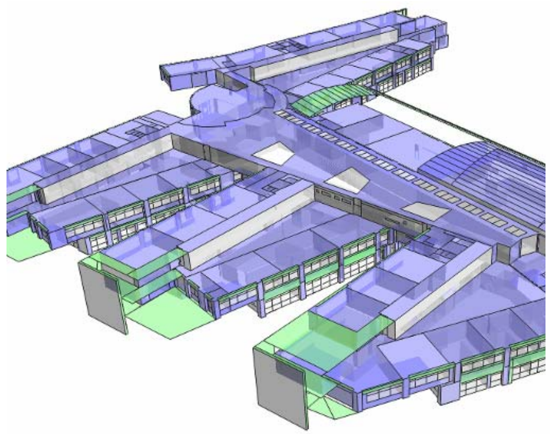
solar Control

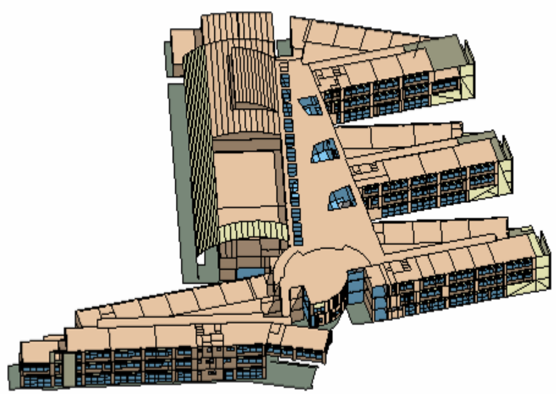
20% Improvement on U-Values

air Permeability 5 m3/m2/hr @50Pa

exposed thermal Mass







active solutions

biomass boiler

photovoltaic’s

solar hot water

rainwater Harvesting

underfloor heating

CHP connection

cashless systems

<u>education and culture</u>

solar hot water system

rainwater harvesting system

<u>meter and monitor</u>

electricity

gas

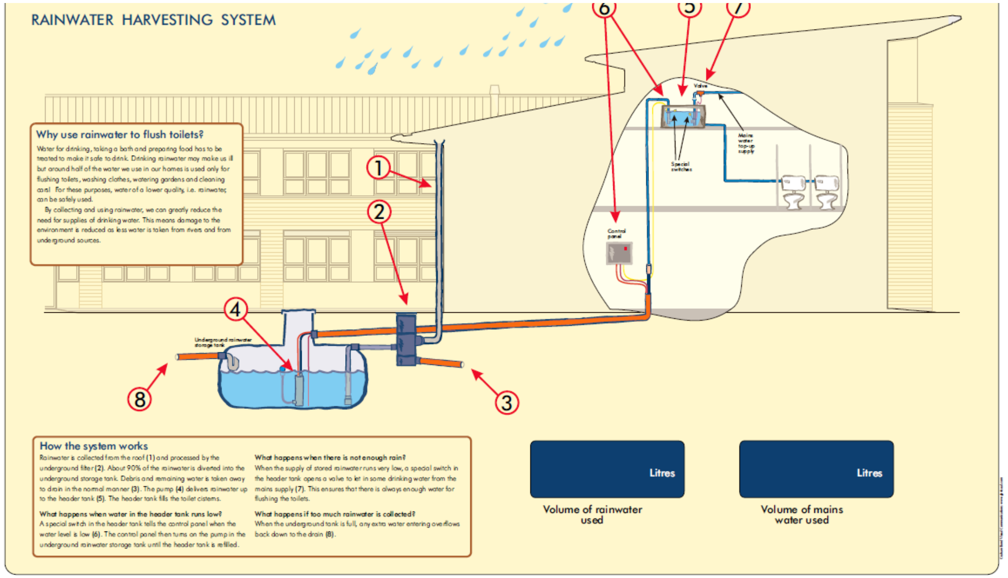
biomass

combined heat & power (CHP)

potable water

rainwater harvesting

high energy uses



BREEAM

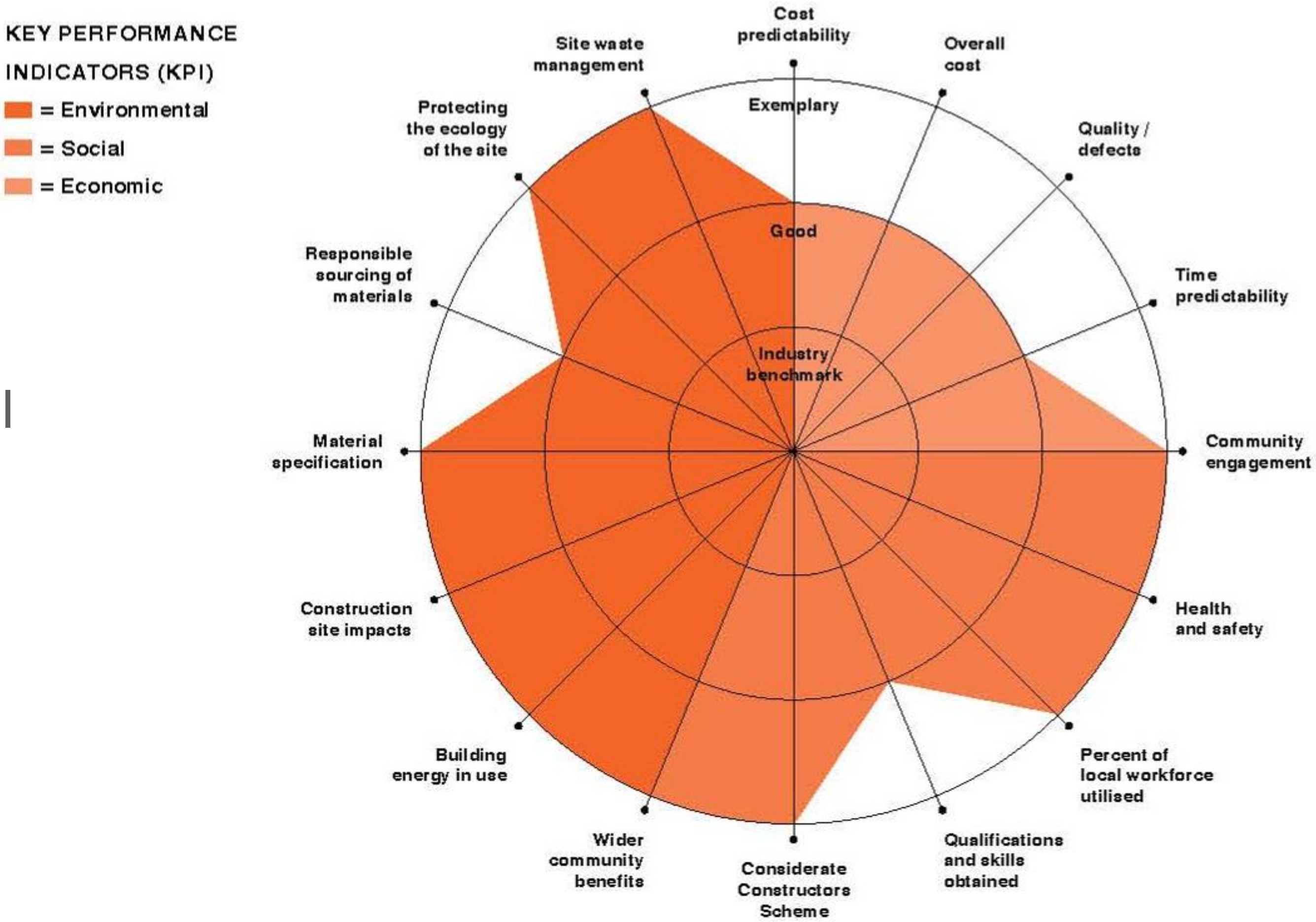
89.82%

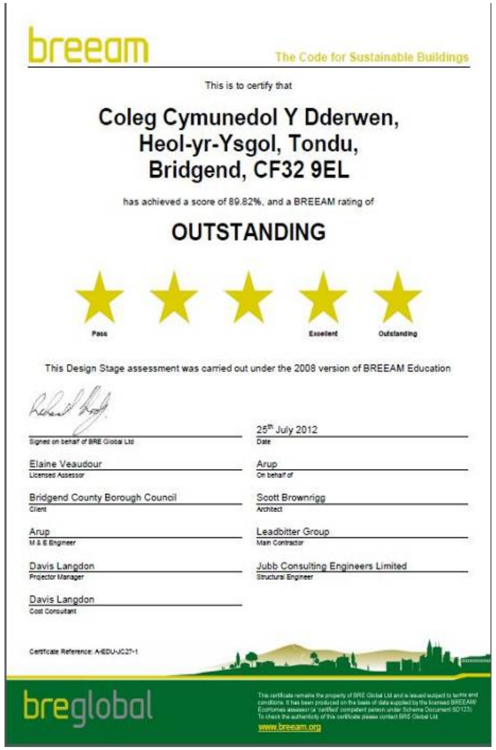
monitoring tool

DTM

materials - concrete v steel

value engineering





breeam The Code for Sustainable Buildings

This is to certify that

Coleg Cymunedol Y Dderwen, Heol-yr-Ysgol, Tondu, Bridgend, CF32 9EL

has achieved a score of 89.82%, and a BREEAM rating of

OUTSTANDING

Pass Excellent Outstanding

This Design Stage assessment was carried out under the 2008 version of BREEAM Education

Signed on behalf of BRE Global Ltd	25th July 2012 Date
Elaine Veaudour Licensed Assessor	Arup On behalf of
Bridgend County Borough Council Client	Scott Brownrigg Architect
Arup M & E Engineer	Leadbitter Group Main Contractor
Davis Langdon Projector Manager	Jubb Consulting Engineers Limited Structural Engineer
Davis Langdon Cost Consultant	

Certificate Reference: A-EDU-JC27-1

breglobal

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www.breeam.org

general successes

on **time**

on **budget**

BRE BREEAM sustainable education building of the year **award** 2013

BREEAM ***‘outstanding’***

low carbon

collaborative working

united **community** school

lessons taken forward

early **stakeholder** engagement

agree BIM protocols/ **execution plan** & M&E scope

early BREEAM Assessor appointment

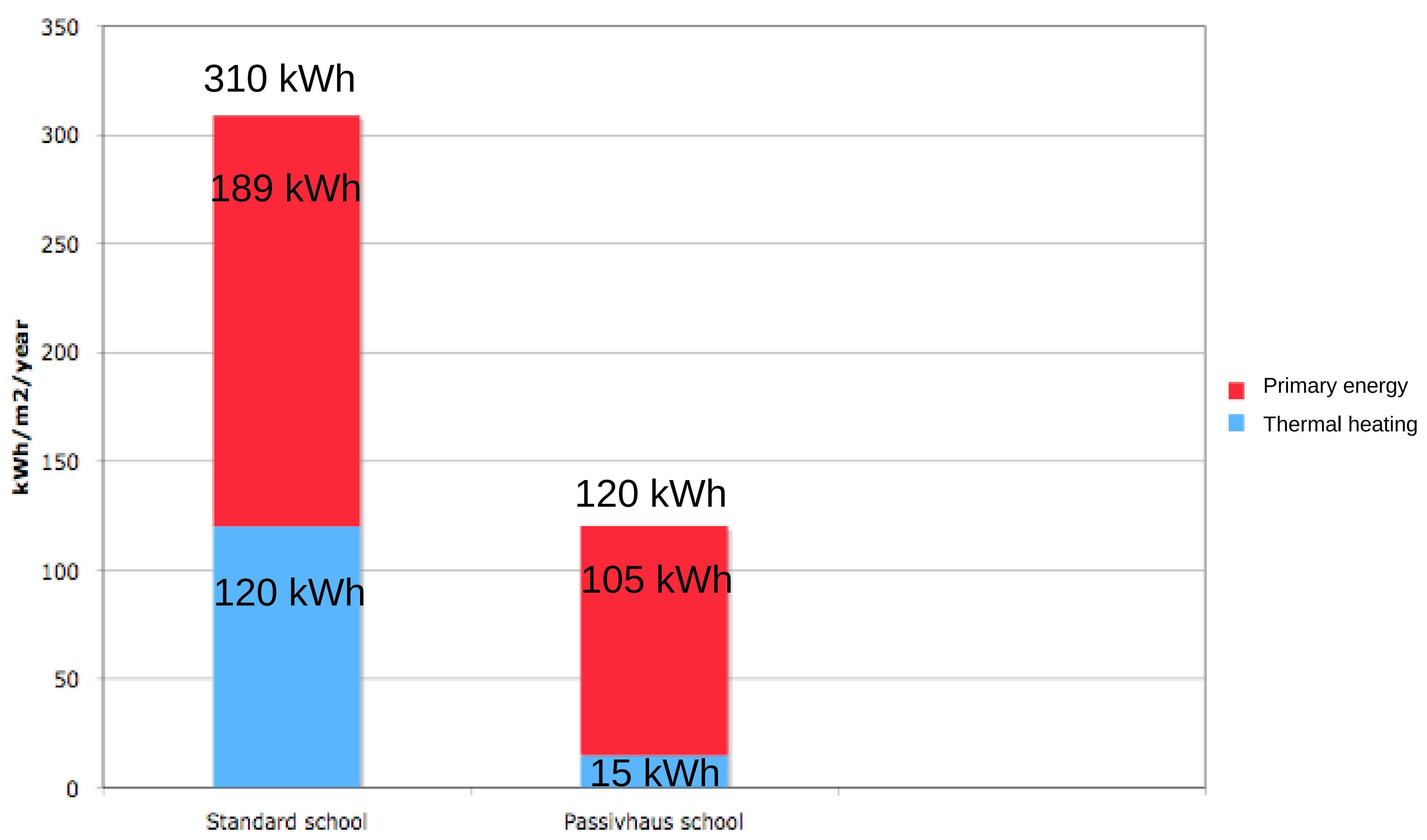
agree appropriate **design principles** at the outset

Basic principles of Passivhaus

- improve the fabric - eliminate thermal bridging, increase airtightness and window specification
- use MHVR to allow sufficient ventilation whilst avoiding loss of heat in winter
- get the orientation and form working together to maximise and control solar gain, improve daylighting and enable natural ventilation and night cooling in summer
- make heating efficient and eliminate need for cooling
- use PHPP to model and test - achieve heating of 15kWh/sqm and total primary energy of 120kWh/sqm
- enable easy and intuitive controls systems
- keep things simple

= make the basic architecture & building do all the hard work!

Passivhaus standards



Passivhaus: Oakmeadow Primary School, Wolverhampton

Architype

For Planning

ARCHITYPE

Project: Oak Meadow School

Client: WCC

Dwg Title: Ground Floor Plan

Dwg No: 6323 PL 100 | Revision: P1

Scale: [illegible] | Date: April 2016

Drawn by: AE | Checked by: AS

For Planning

ARCHITYPE

Project: Oak Meadow School

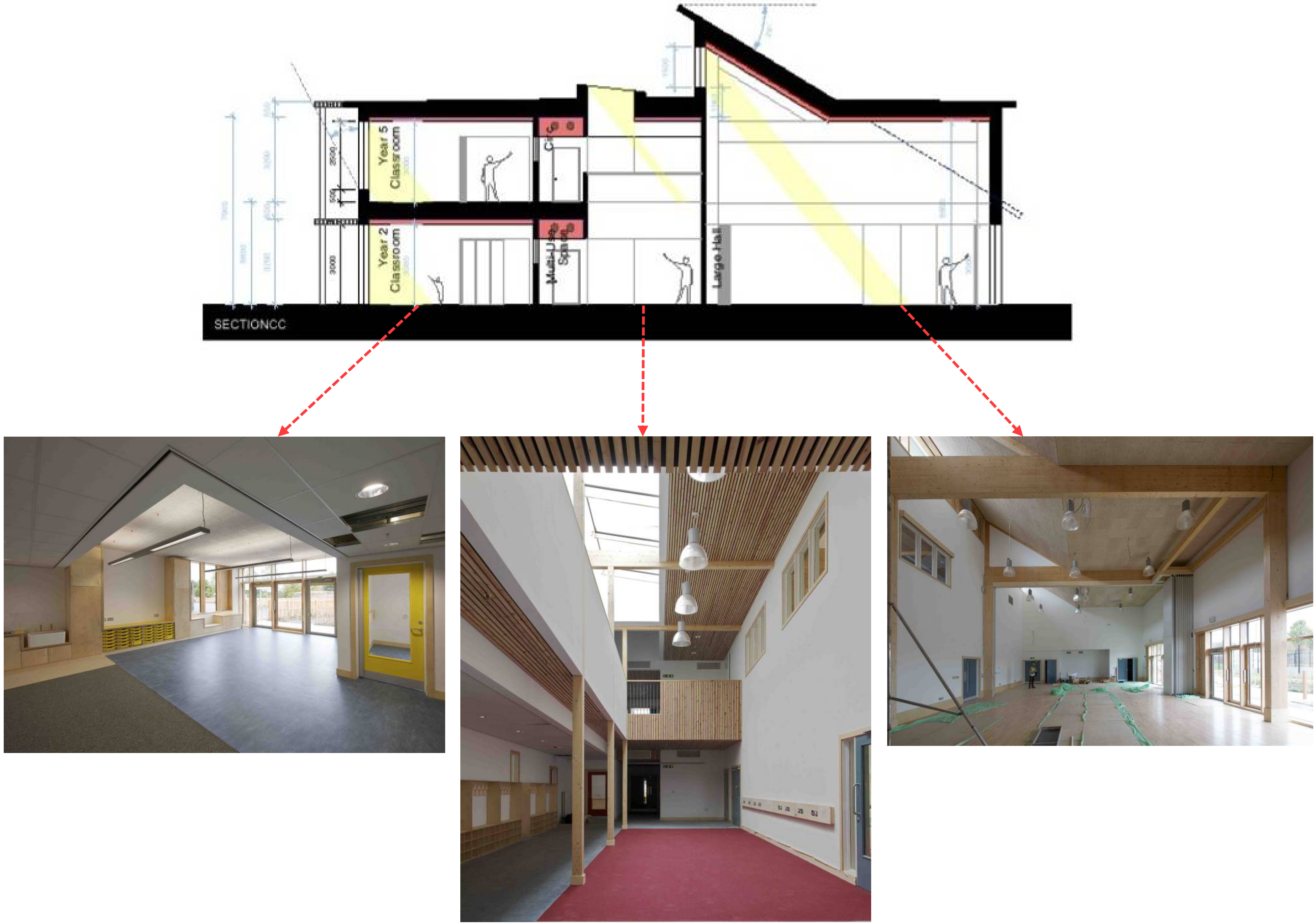
Client: WCC

Dwg Title: First Floor Plan

Dwg No: 6323 PL 101 | Revision: P1

Scale: 1:100@A1, 1:200@A3 | Date: Apr 2016

Drawn by: AE | Checked by: AS



Year 5 Classroom
Year 2 Classroom
Multi-Use Space
Large Hall
SECTIONCC


2 x 65kW boilers
25kW peak heat
demand 5x
oversized!

general successes

on **time**/on **budget** & no more than a typical primary school build

One of the first Passivhaus schools to be built in the UK

Early integration of services

Pushes energy targets harder than previously built St Luke's Primary

Early **collaborative** working – integrated total design team commitment

Focussed workshops with all key subcontractors

School is performing as predicted **within energy targets**

lessons taken forward

Soft landings handover and first year operation (self funded)

Engaging with school leadership groups on operational issues

User guides and presentations ensuring ongoing correct building use

Engaging the pupil council in energy issues

Tailor-made package for kitchen use and appliances

Make allowance for user intervention

Keep controls simple and user friendly

LCRI LOW CARBON RESEARCH INSTITUTE

LCBE | Low Carbon Built Environment

Work Package 4:

Design of Low/Zero Carbon Buildings

Low Carbon Learning

Lessons from Practice

Education buildings and the low carbon agenda

Symposium **5th** September 2013

at **WISE, Machynlleth**

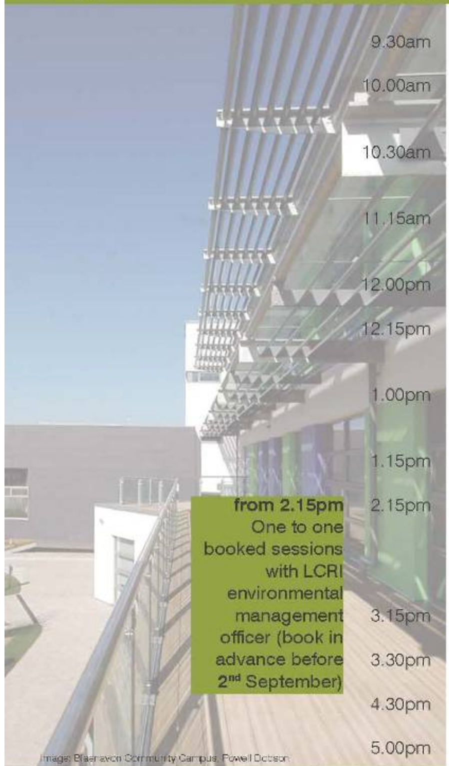


Image: Blaenavon Community Campus, Powell Dobson

9.30am	Registration
10.00am	Welcome & Introduction to Work Package 4 Policy and Future trends
10.30am	**Coleg Cymunedol Y Dderwen** Design, Procurement and Engagement **Scott Brownrigg**
11.15am	**Oakmeadow Primary** Passivhaus Schools in practice **Architype**
12.00pm	coffee break
12.15pm	**Ynysowen and Kingsmead** Developing a standardised approach **White Design**
1.00pm	Introduction to WEST and LCRI Environmental Management officer
1.15pm	Lunch
2.15pm	Discussion Workshops: 1 - **Achieving the Energy Obligations on Site** 2 - **Lessons learnt: Passivhaus vs BREEAM** 3 - **Retrofitting schools: a realistic choice?**
3.15pm	coffee
3.30pm	**WISE** Building Tour
4.30pm	Discussion & feedback
5.00pm	Close

from 2.15pm One to one booked sessions with LCRI environmental management officer (book in advance before 2nd September)

Workshop 1: Achieving the energy obligations on site & the role of the SME Leadbitter
Examining the realities, pitfalls & successes of meeting low carbon aspirations on site & exploring the opportunities and barriers for local enterprises

Workshop 2: Lessons Learnt - Passivhaus vs BREEAM Architype & Scott Brownrigg
A comparison of the procurement, targets & outcomes including a debate about the realities & costs associated with each different approach

Workshop 3: Retrofitting Schools - A realistic choice? White Design
A look at how retrofitted & extended schools must become a viable option in allowing the existing stock to contribute towards low carbon targets

Register online & choose workshop at: http://lcbe.cardiff.ac.uk/events/low-carbon-learning-lessons-from-practice/
or contact Amy Cowan t: 02920 875980 e: cowana@cardiff.ac.uk

powelldobson ARCHITECTS • URBANISTS

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opco

SCOTT BROWNRIGG

dru-w

ERDF Llywodraeth Cymru Welsh Government
Ewrop & Chymru: Buddsoddi yn eich dyfodol
Cronfa Datblygu Rhanbarthol Ewrop
Europe & Wales: Investing in your future
European Regional Development Fund

General Lessons:

- Building form, orientation and good design will do the hard work
- **Early engagement** of client and design teams critical to understanding of aspirations throughout process
- **Soft landings** process normally taken on by contractors – consideration & cost should be given from very start of project – include FM team
- Importance of identifying **roles & responsibilities**
- **Prioritise energy use targets** – safeguard and use in conjunction with wider benefits (BREEAM & PH combined?)
- Consider adapting standards to incorporate wider benefits
- RIBA Plan of Work 2013 – lack of emphasis on sustainability checkpoints
- Cost & energy use not the only marker for a successful sustainable school
- Interrogate standards and **consider a flexible approach to benchmark standards**, e.g. combination of PH & BREEAM requirements, to suit your school's long term needs

What about Cost??

•Safeguard budget for improved fabric against life cycle savings

•Low carbon aspirations to be 'locked-in' to contract - not becoming optional in value engineering processes

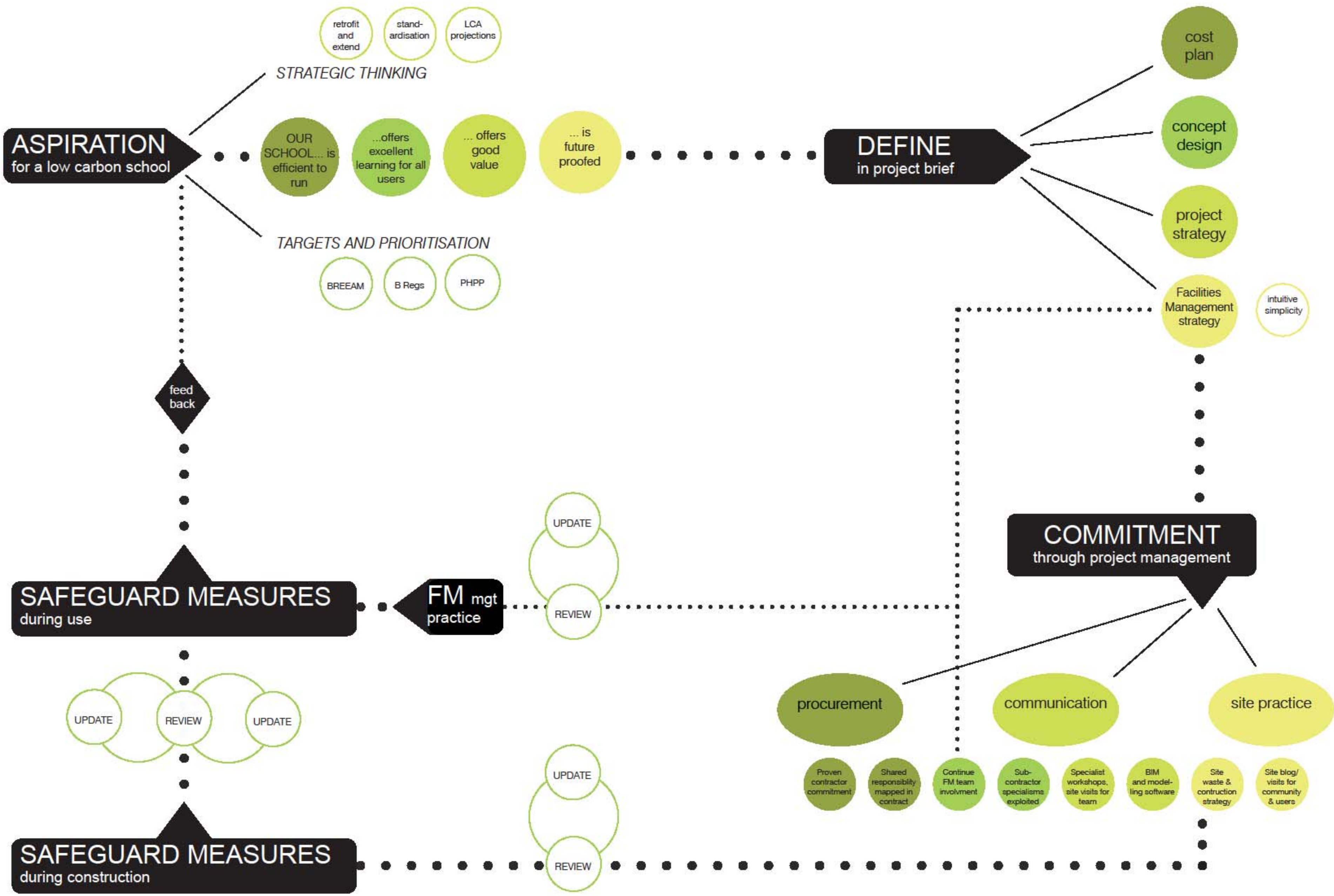
•Is the government's baseline £1400m2 realistic?

•Case study schools approx £1750-£1800m2

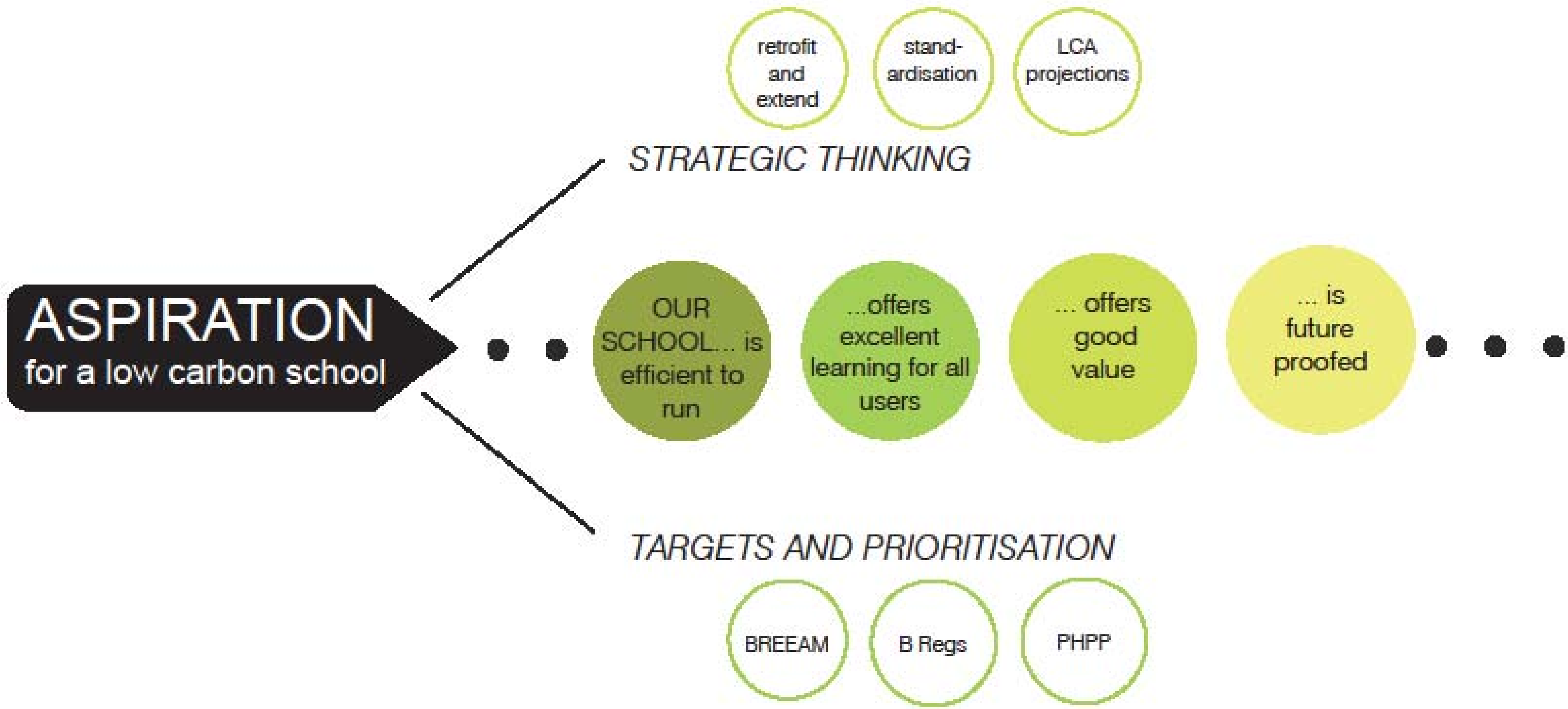
•Further investigation in to cost ongoing

•Need contractors and client teams to be open and share knowledge about actual costs

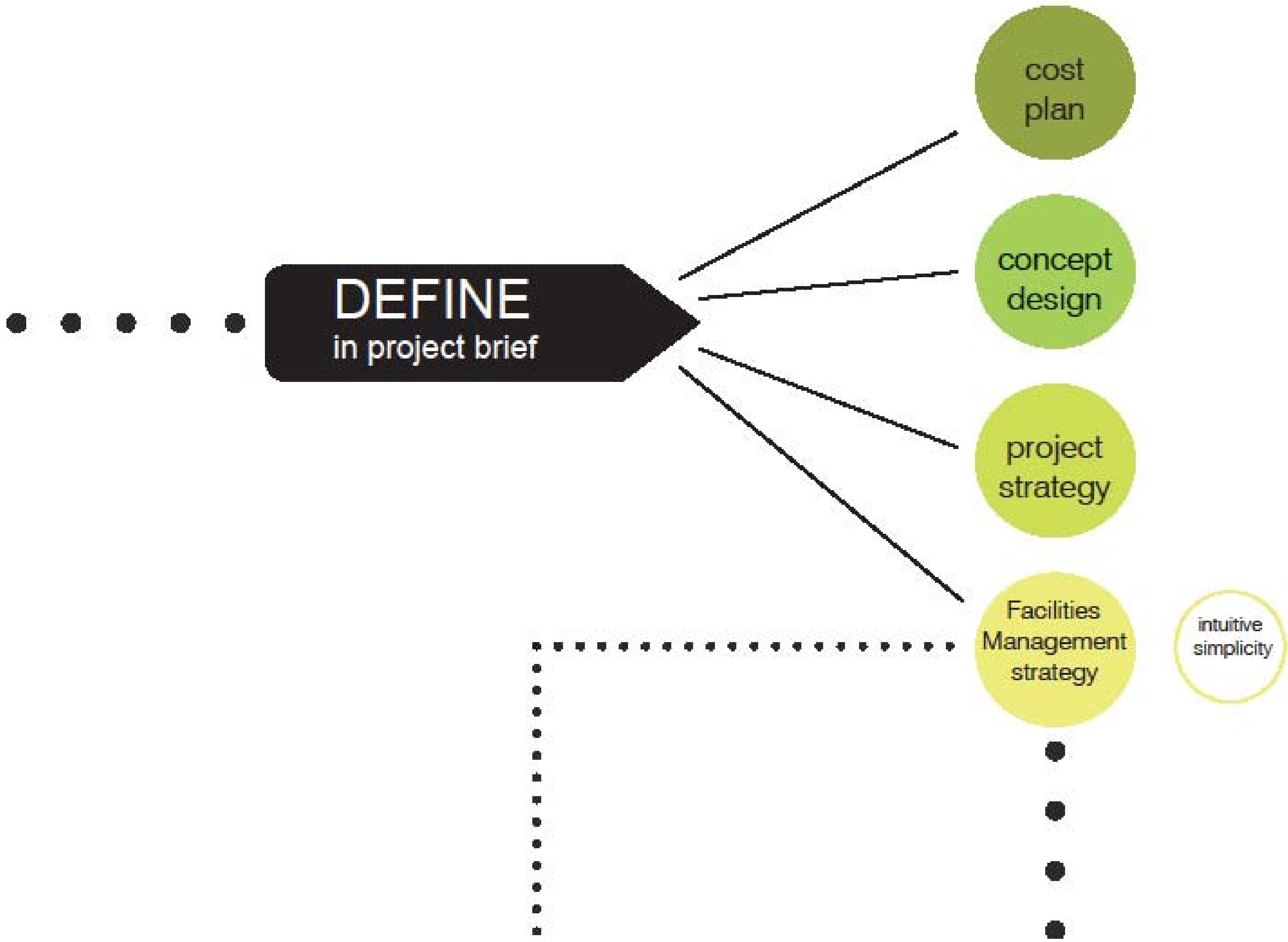
Locking in Low Carbon Design



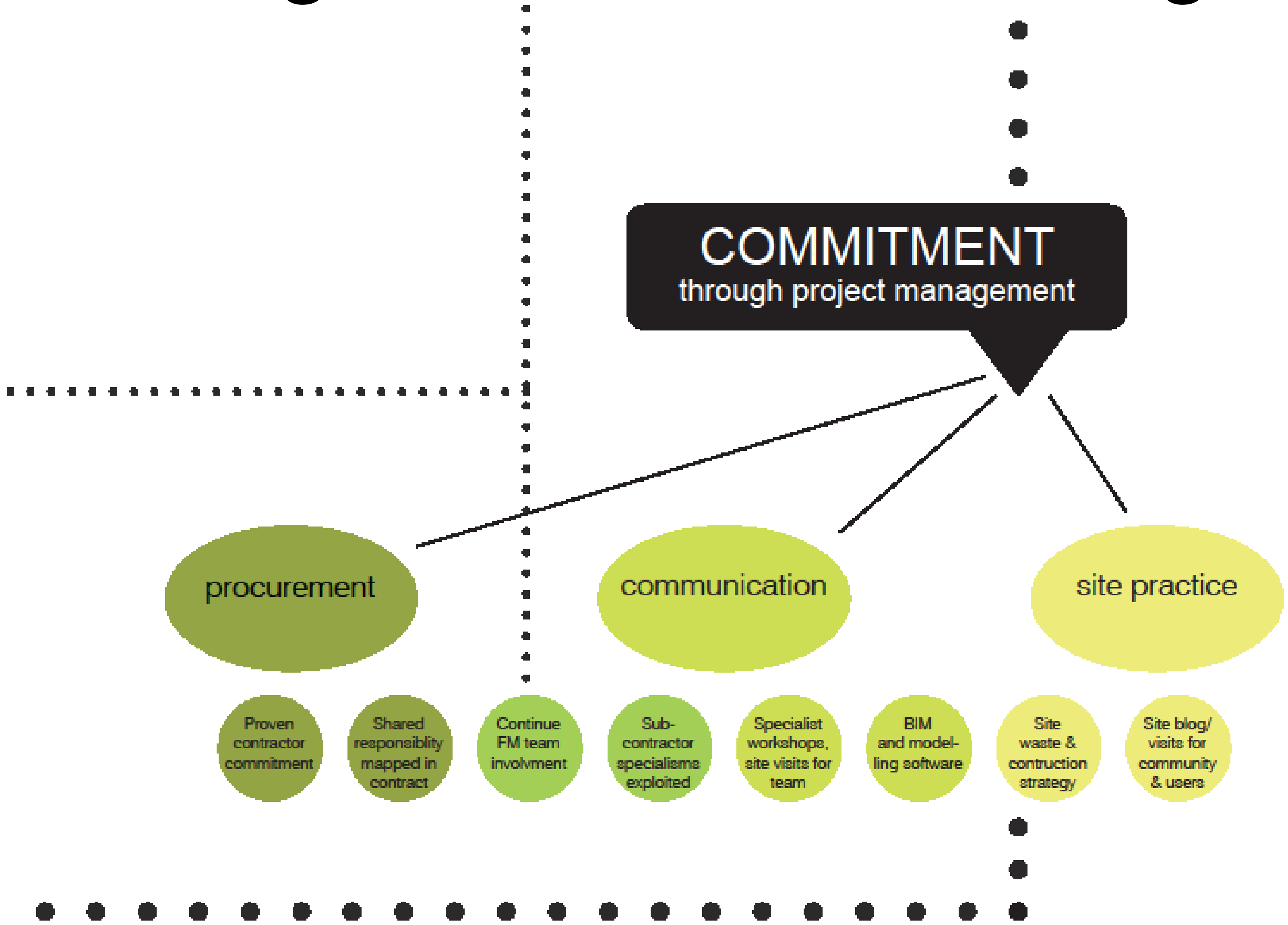
Locking in Low Carbon Design



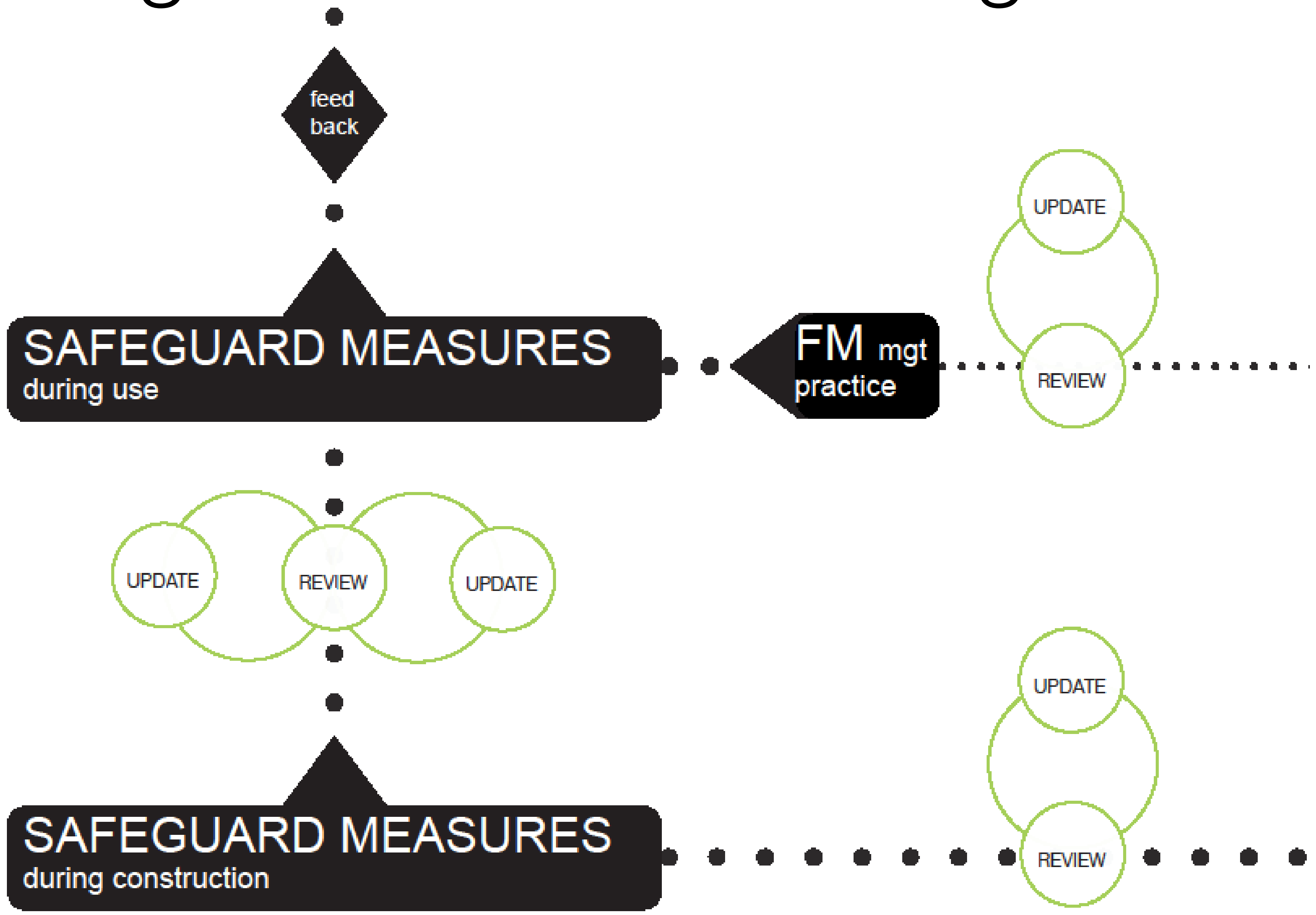
Locking in Low Carbon Design



Locking in Low Carbon Design



Locking in Low Carbon Design



Locking in Low Carbon Design

Process map – draft proposal