



Healthy Buildings: POE and Materials

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Associate

ARCHITYPE

POE



Healthy Materials



A healthy community



Wolverhampton Schools



UEA Enterprise Centre



Shaldon Road Bristol

Delivering Healthy Buildings

Twyford Barn
Upper Twyford
Hereford

Unity Wharf
13 Mill Street
London

Colme Place
1 St Colme Street
Edinburgh

Practice



Architype's Origins:

- Working with self builders using Segal method - modular timber elements, low tech, ecological solutions
- A real concern for the experience of building users
- Focus on efficiency of buildings in use

Purpose: To design life enhancing, genuinely sustainable architecture

Origin

The Performance Gap

- Buildings typically using 3-5 times more energy than predicted





2008 St. Luke's
KTP with Oxford Brookes

2009 The Willows
KTP with Oxford Brookes

2011 Bushbury Hill
KTP with Coventry University

2011 Oak Meadow
KTP with Coventry University

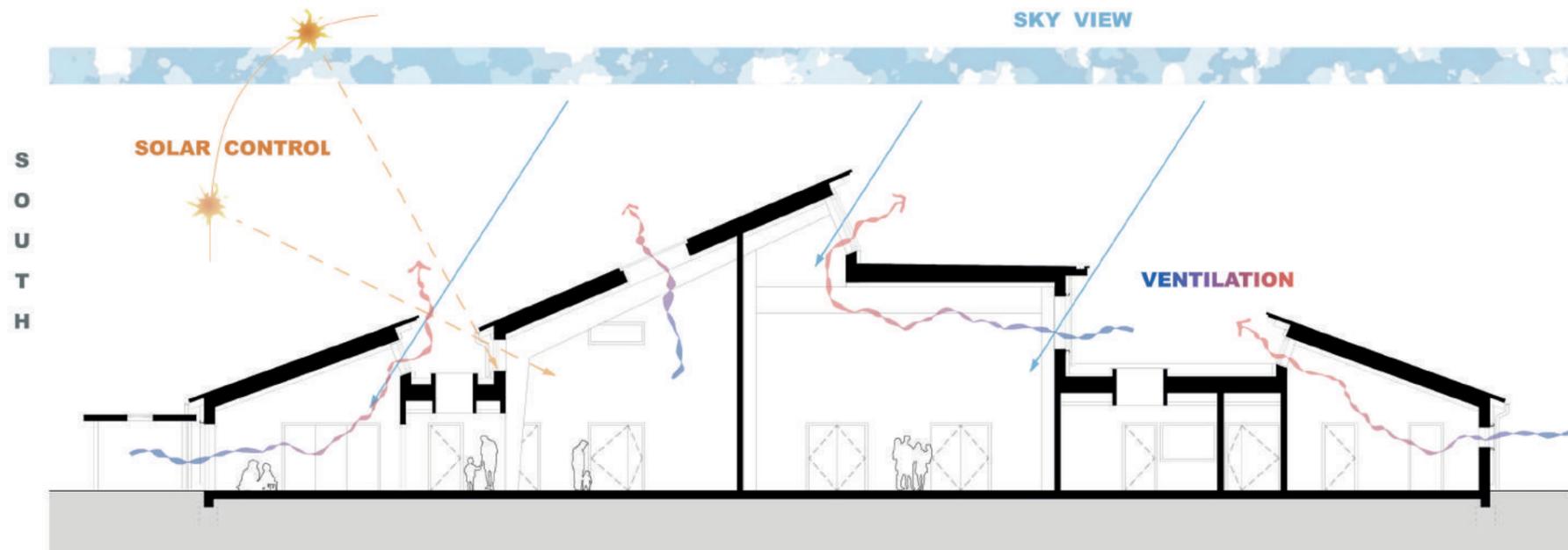
2013 Wilkinson
KTP with Coventry University

Building Regulations & BREEAM

First generation Passivhaus

Second generation Passivhuas

Evolution through POE



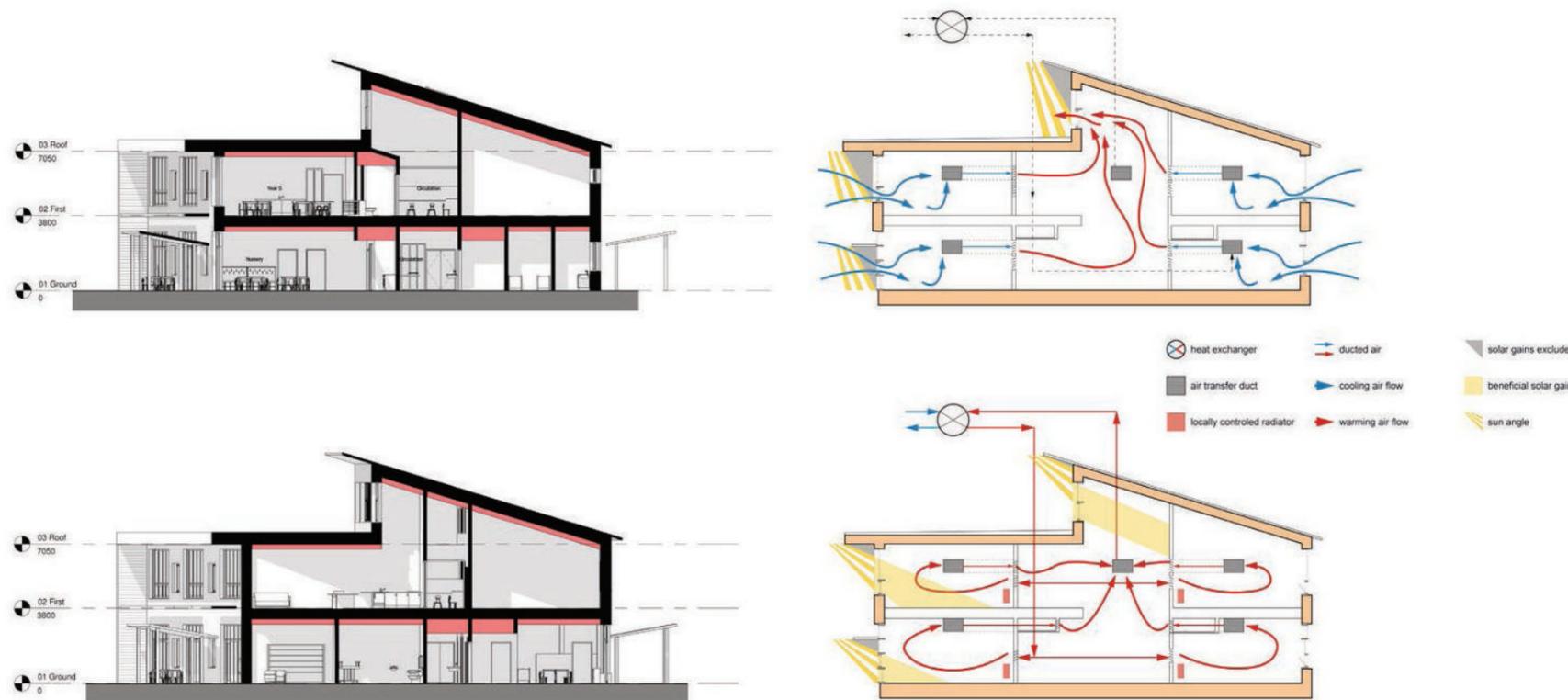
St. Luke's Primary School 2006-8

Lessons learnt from BREEAM schools:

- peaks in CO2 despite well designed natural ventilation strategy
- issues with thermal performance of fabric - cold bridging and air tightness
- poor energy performance of appliances
- operability issues - particularly relating to complex BMS controls

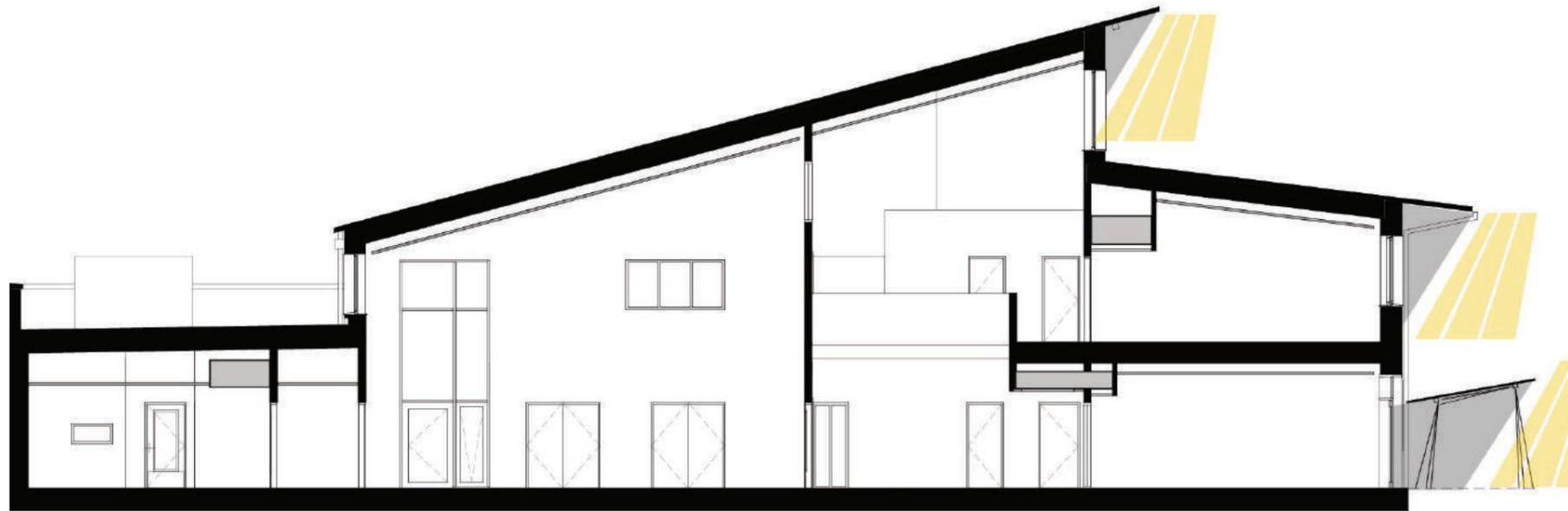
First Generation Passivhaus Schools:

- MVHR - improved air quality and retained heat
- improved thermal performance - thermal bridges and airtightness
- reduced energy consumption



Bushbury Hill Primary School 20011

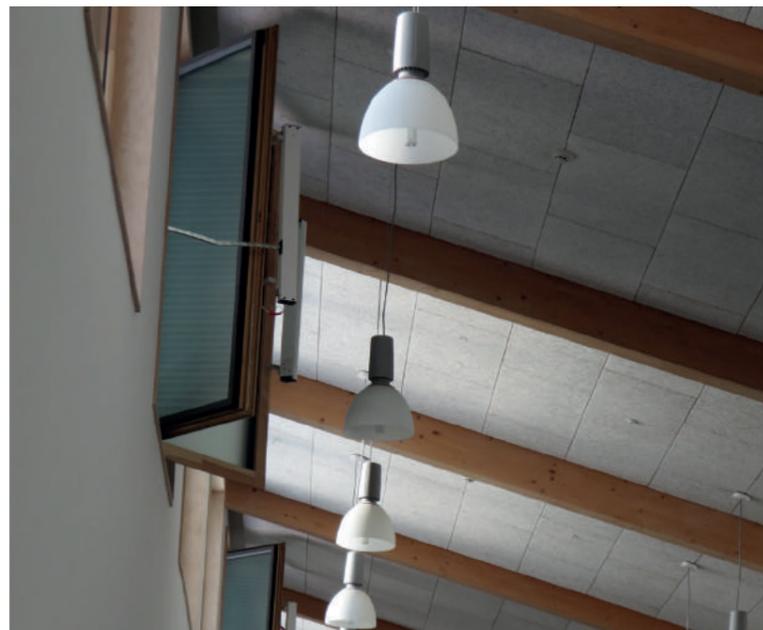
Lessons learnt



Wilkinson Primary School 2013 - summer

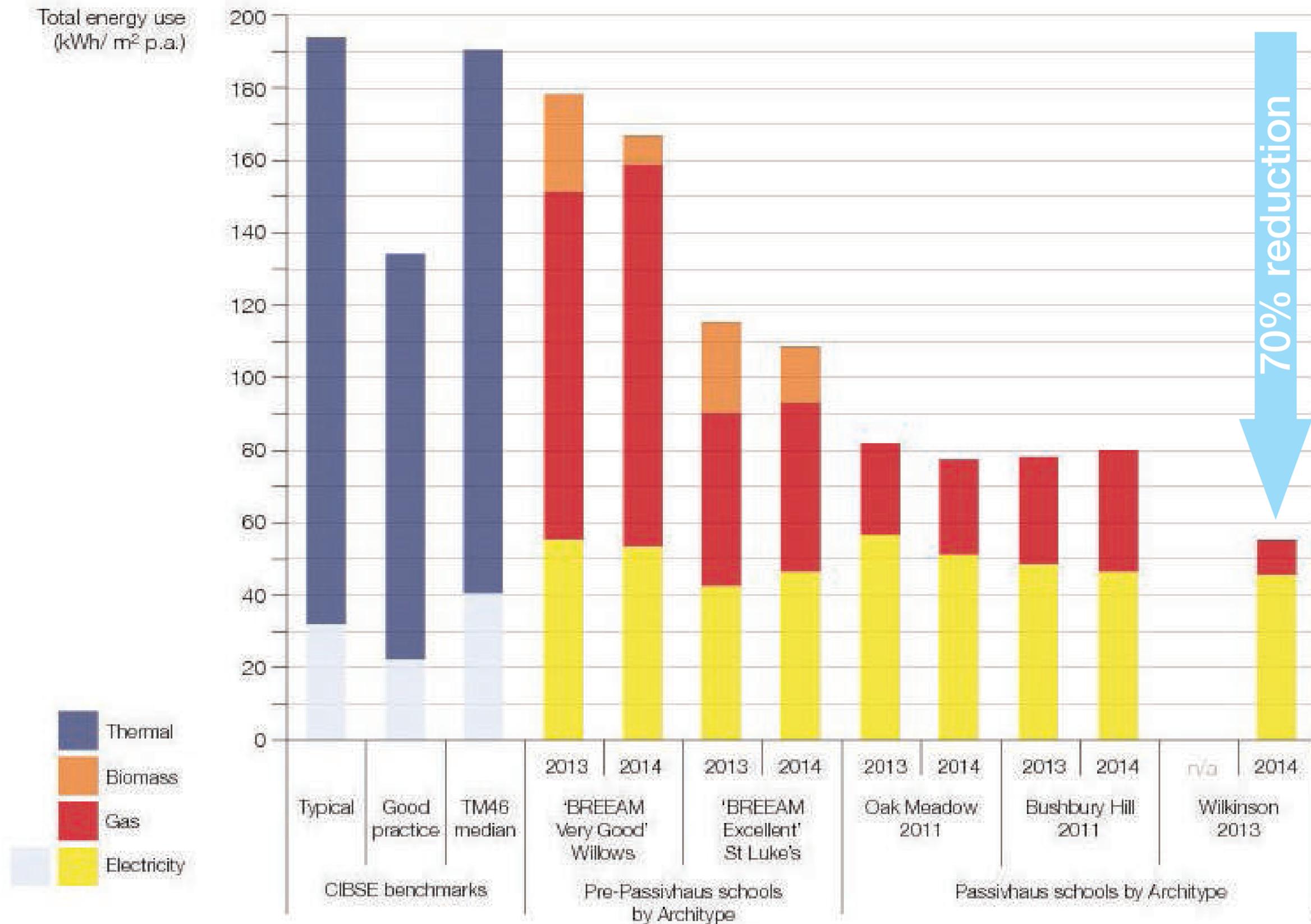
Lessons learnt from first generation Passivhaus schools:

- simplification of building envelope, refined window sizes and more solar shading
- using manually controlled night vents to reduce reliance on high level actuators
- simplification of BMS controls and better ongoing support for the client



Lessons learnt

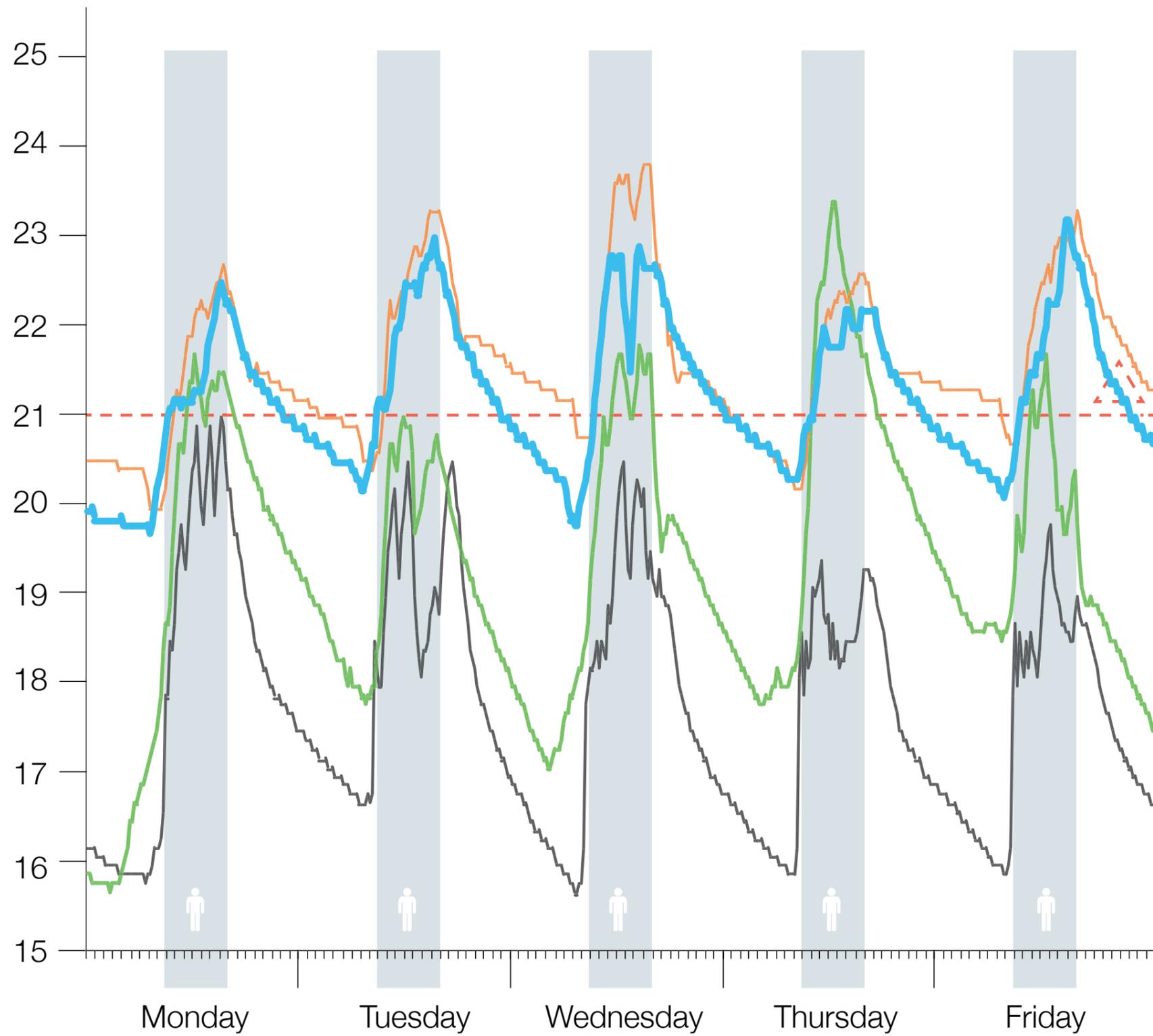
Total energy use
(kWh/ m² p.a.)



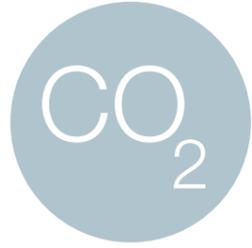


Air
Temperature
(°C)

- Wilkinson
2nd generation
PH / 2013
- Bushbury Hill
1st generation
PH / 2011
- St Luke's
pre-PH / 2009
- Conventional
1970s
- Occupied hours
9:00 - 16:00
- Lower limit

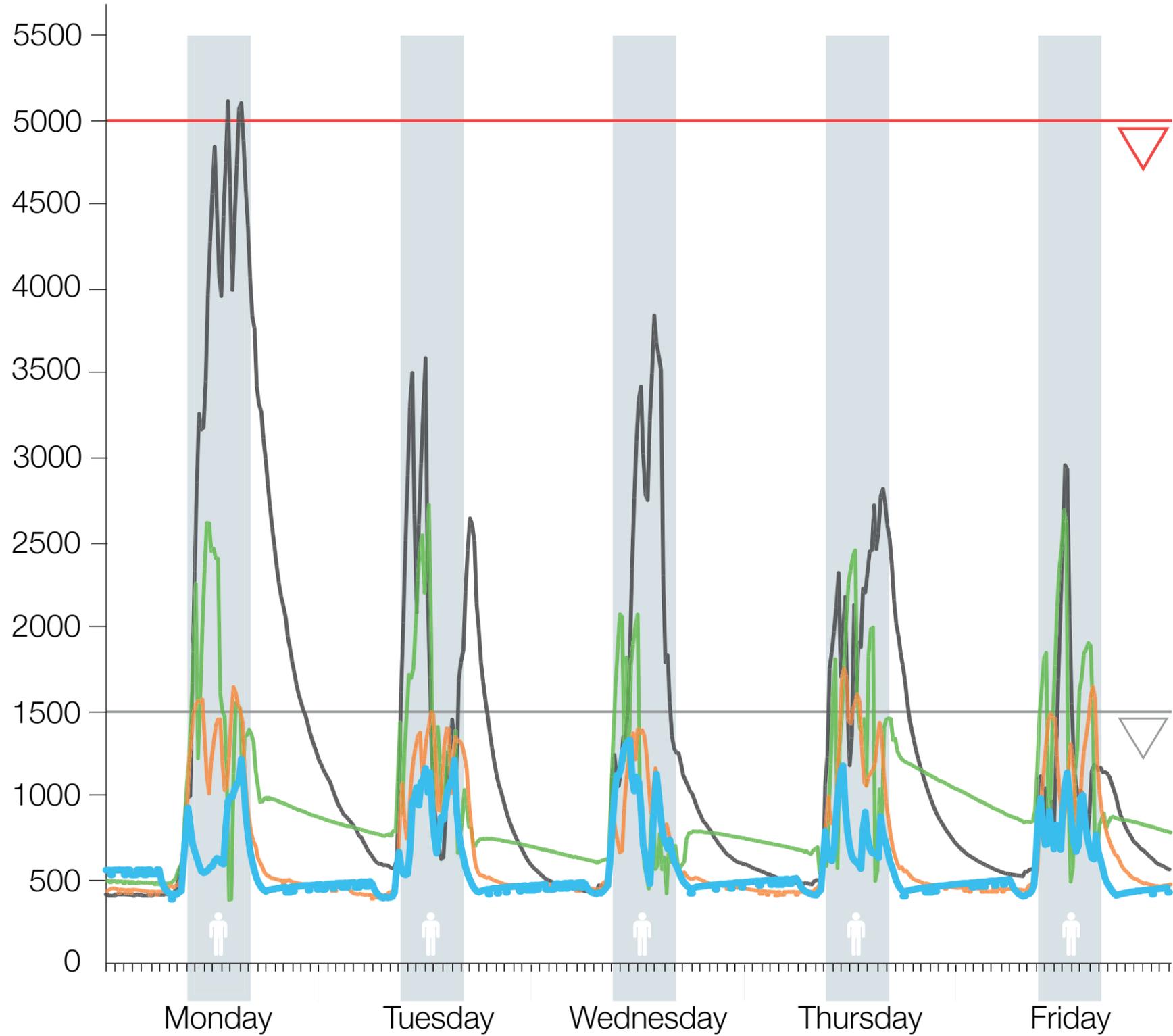


1st - 5th December 2014



CO₂ concentration (ppm)

- Wilkinson 2nd generation PH / 2013
- Oak Meadow 1st generation PH / 2011
- Willows pre-PH / 2011
- Conventional 1970s
- Occupied hours 9:00 - 16:00
- Max limit (BB101)
- Average limit (BB101)



1st - 5th December 2014



Our approach to designing healthy, low energy building has evolved through POE

- We have arrived at Passivhaus; a robust approach to building fabric and ventilation
- Achieving healthier and more comfortable environments and lower energy bills for clients
- Our approach to healthy buildings can be demonstrated to our clients through our research

BUT we want to learn more.....

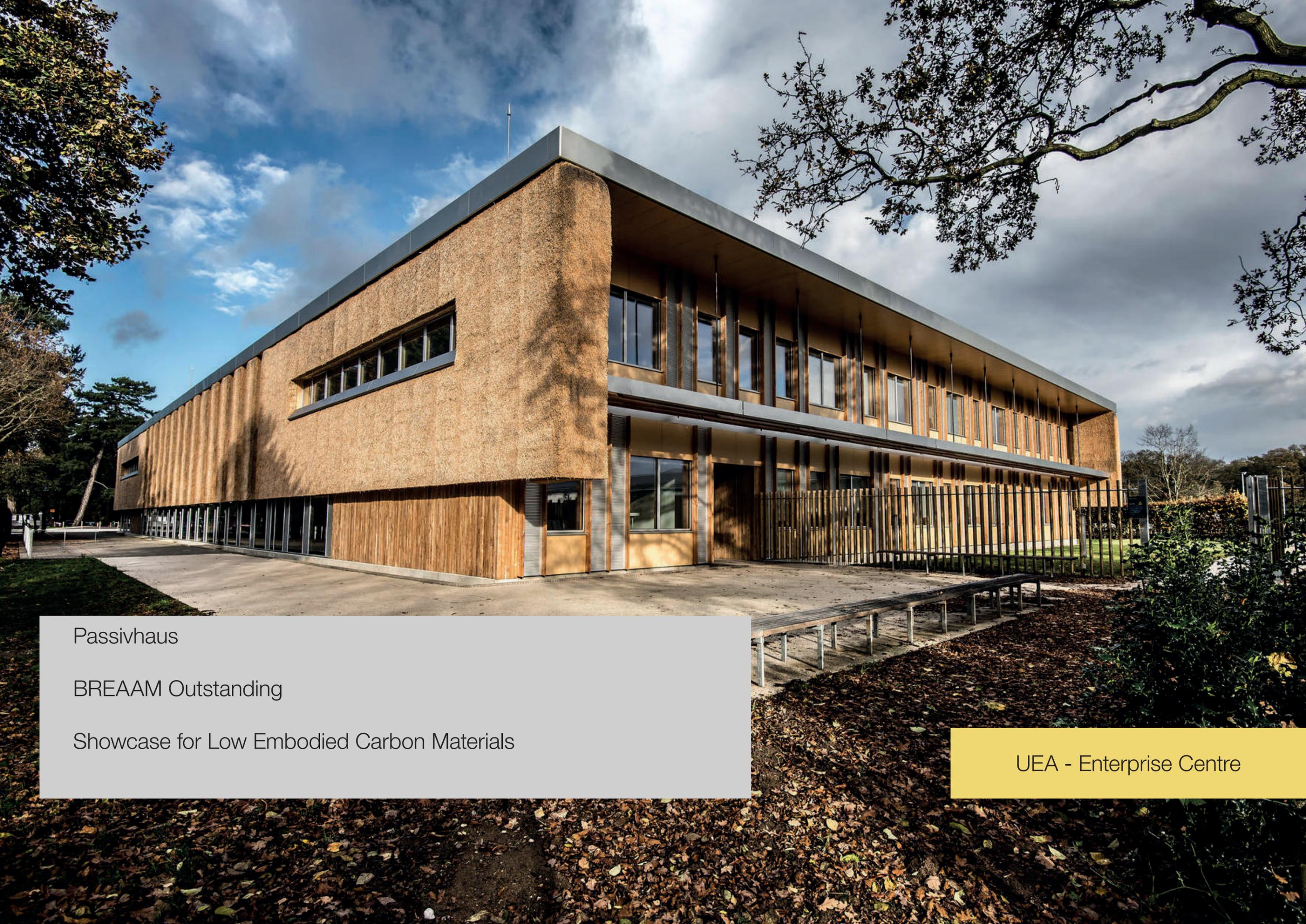
Where next?



Indoor Air Quality (IAQ) and the role of material specification for internal finishes

Can we demonstrate the effects of our approach through research and are there lessons to be learnt?

Where next?



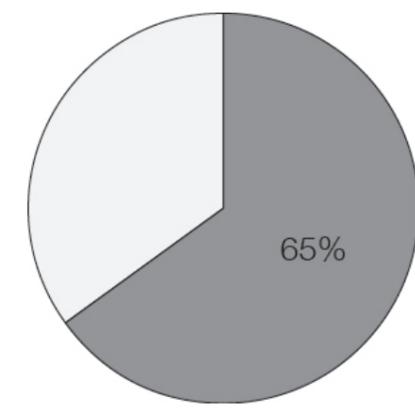
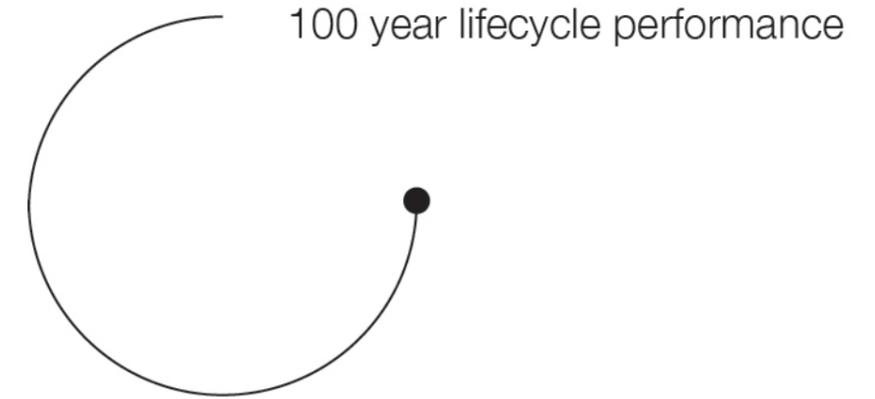
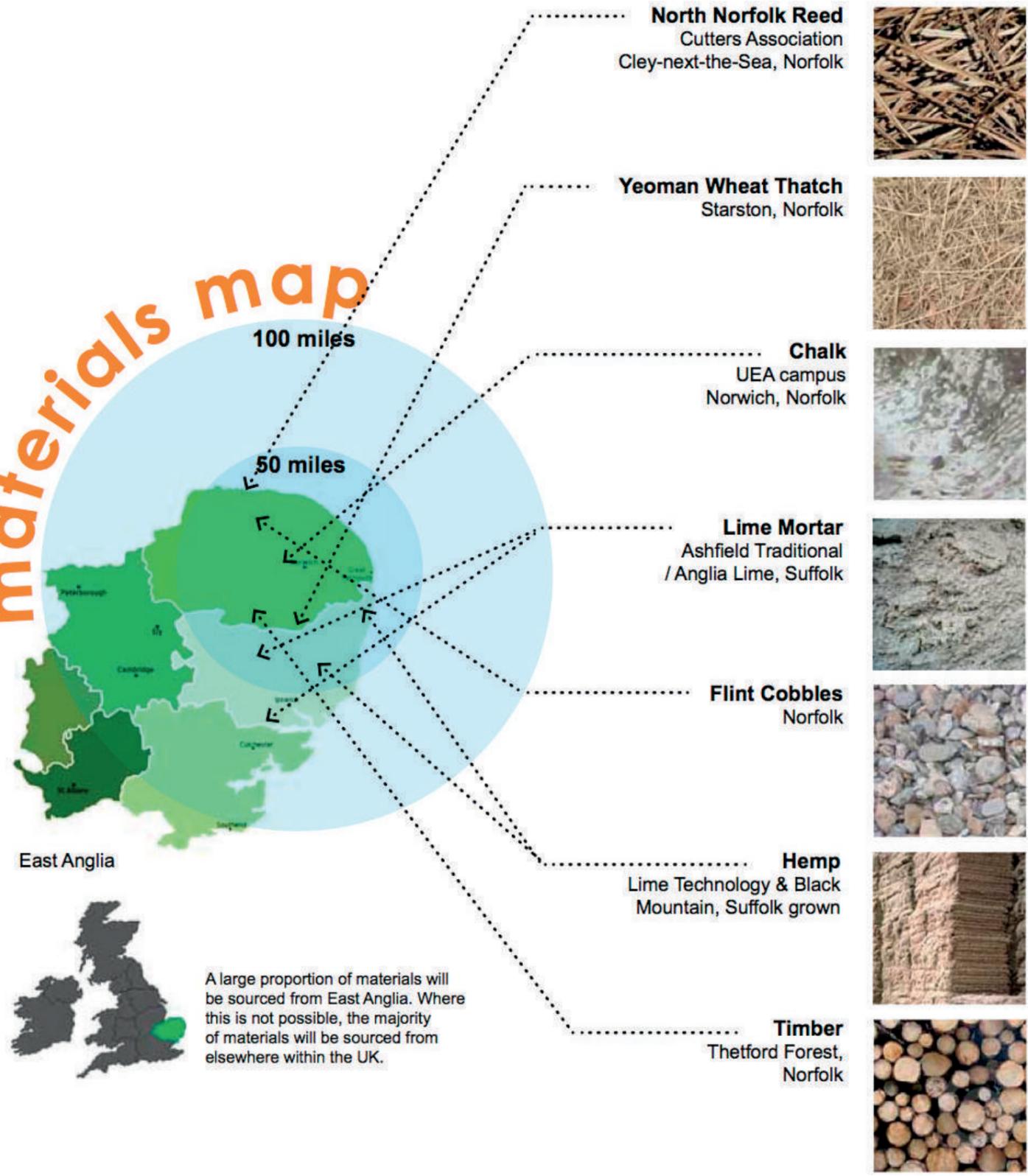
Passivhaus

BREAAM Outstanding

Showcase for Low Embodied Carbon Materials

UEA - Enterprise Centre

materials map



65% reduction in lifecycle emissions when operational and embodied carbon are assessed together over the 100 years compared to a conventional university building

Embodied Carbon



Industry



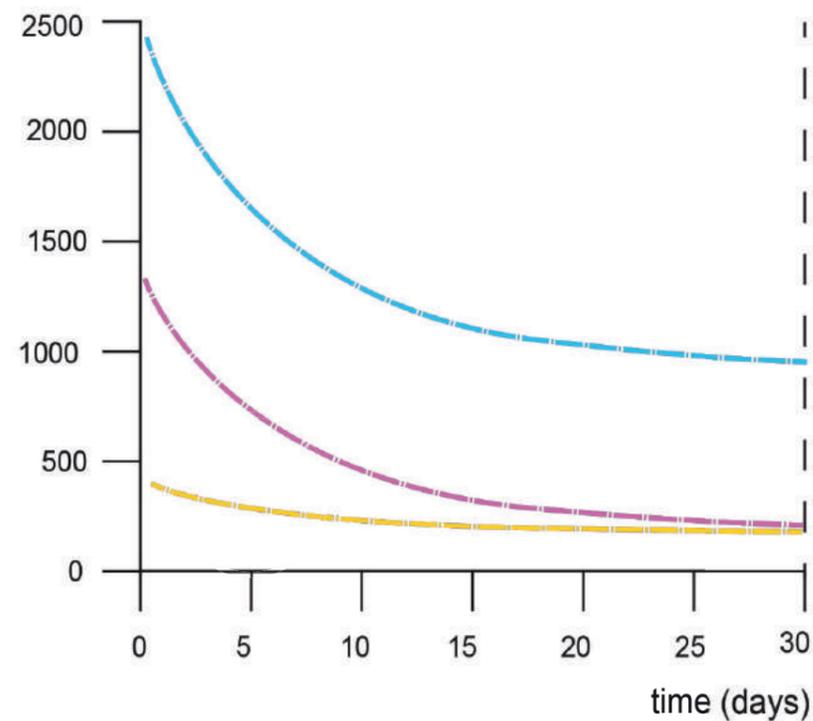
Materiality

Indoor Air Quality - Materials

- identification of critical compounds
- emission characteristics of materials - most materials emit VOC's but type and magnitude vary
- once identified these can be eliminated/decreased with ventilation
- Understanding the effects of human activity on air quality - for example printing, cooking and the use of cleaning products can give risk to peaks in toxic emissions
- Understanding how effective MVHR intake air filters are in polluted areas

emission rates
of example
flooring
materials
($\mu\text{g m}^{-2} \text{h}^{-1}$)

— PVC
— linoleum
— rubber



Graph reproduced from Wilke et al. (2004)

Where next?

Indoor Air Quality - additional metrics

- Particulates
- VOC's
- Nitrogen dioxide - particularly relevant to inner city sites
- Carbon Monoxide



Eltek transmitter IAQ110

- CO₂ (ppm)
- Temperature (°C)
- Relative humidity (%)
- PM₁, PM_{2.5}, PM₁₀ (µg/m³)
- TVOC (ppm)
- NO₂ (ppm)
- CO (ppm)

Co-funding an engineering doctorate:



Where next?



A Healthy Community



SLOPING SITE



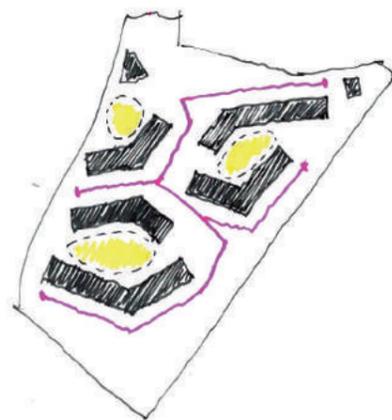
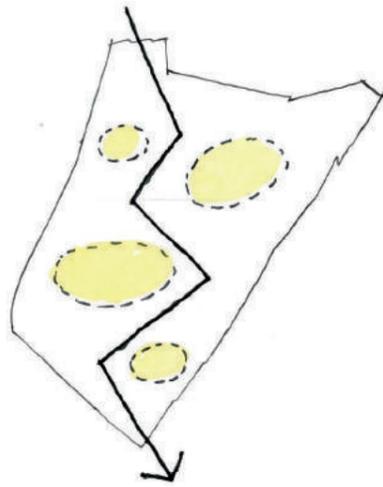
SOCIALLY CONDUCTIVE NEIGHBOURHOOD

~~SELF-BUILD~~
MADE IN
BRISTOL

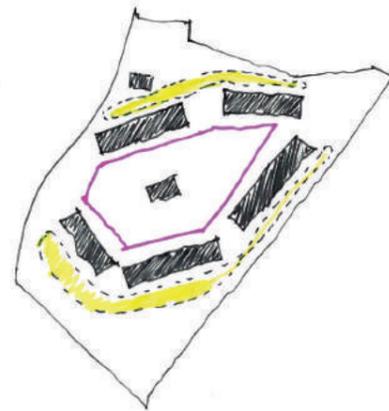
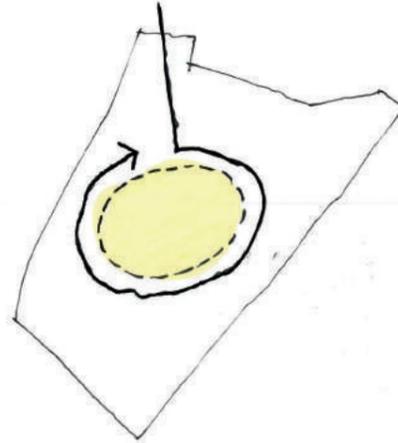
BORN FROM CONTEXT

Brief

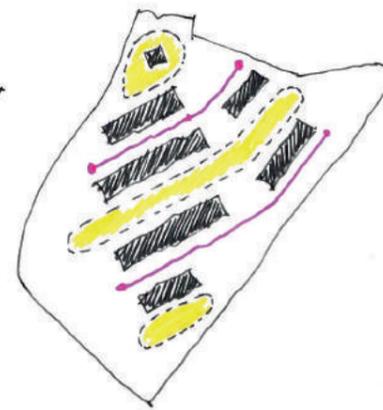
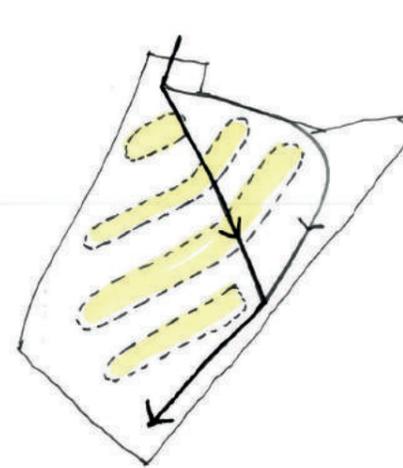
Option 1
Neighbourhood clusters



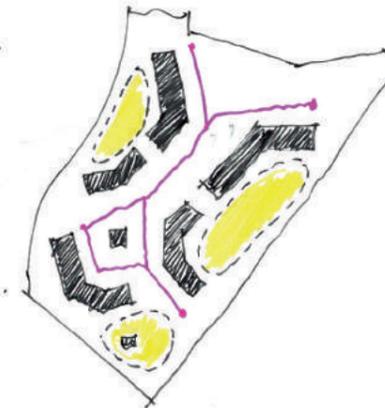
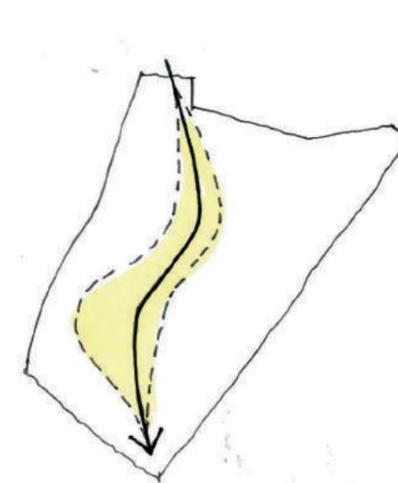
Option 2
Central hub



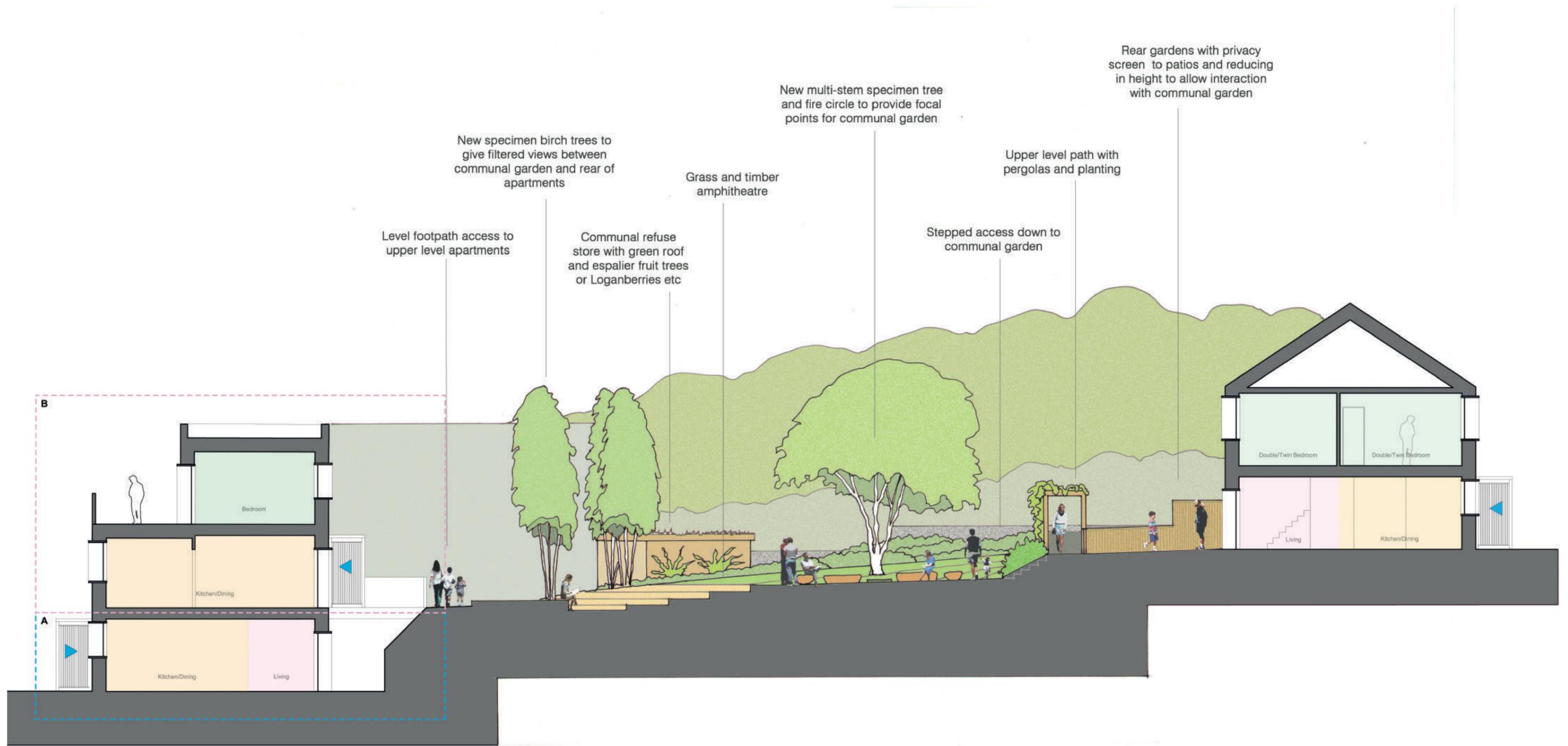
Option 3
Stepped community



Option 4
Main boulevard



Community at the centre



Low Energy Homes



Common House



Landscape



Creating opportunities for social interaction so the community knows one another.

“placing responsibility in the hands of future inhabitants, the physical process of construction awarded communities with lasting friendships as well as a sense of pride and ownership.”

Walter Segal

BCLT



Thankyou