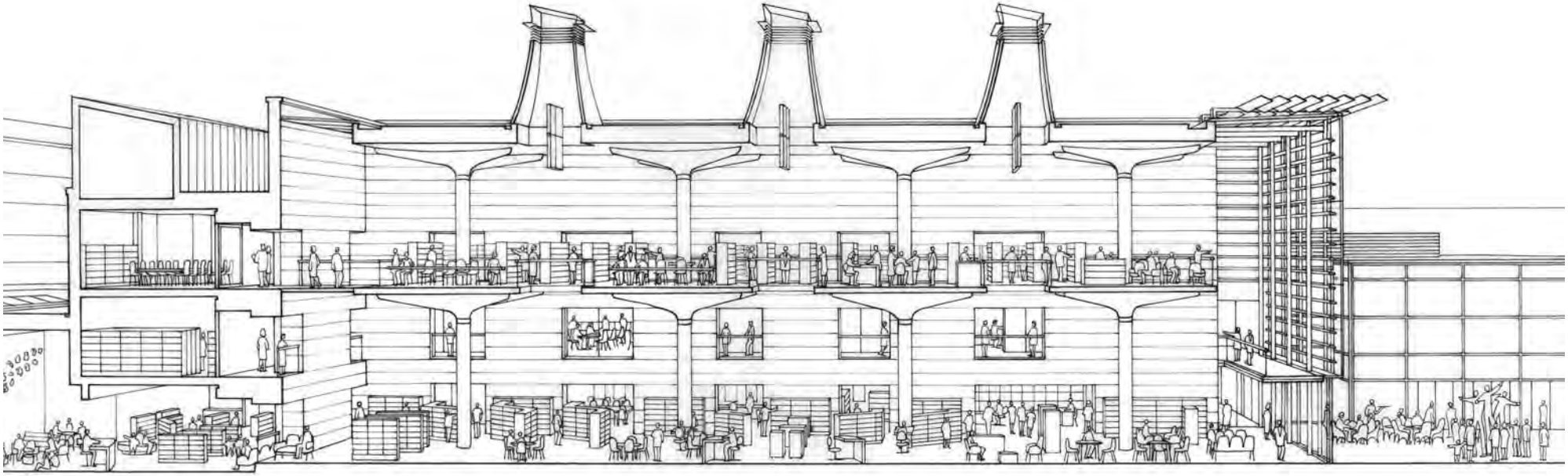
Carbon Zero In The Real World

Presentation to Constructing Excellence
Sussex Club

19th March 2015




LCE architects
design management consultancy



Brighton Library

Completed 2003.

BREEAM 'Excellent'.

- Highly insulated.
- Passive solar gains through south facing glazing.
- Thermal mass.
- Natural light.
- Natural ventilation.
- Rainwater harvesting.

Nominated for the Stirling Prize for Architecture 2004.

Designed in collaboration between LCE Architects and Rab Bennets Architects.

Remains one of the UK's lowest Carbon Public Buildings.

But it is not Carbon Zero because in 2003 Carbon Zero was too expensive and too difficult (if not impossible) to achieve in practice on an inner city site.

- Health and happiness
- Equity and local economy
- Culture and community
- Land use and wildlife
- Sustainable water
- Local and sustainable food
- Sustainable materials
- Sustainable transport
- Zero waste
- Zero carbon

ONE PLANET LIVING

BioRegional
solutions for sustainability

Principles [edit]

- Zero energy—The project is designed to use only energy from renewable sources generated on site. There are 777 square metres (8,360 sq ft) of solar panels. Tree waste fuels the development's cogeneration plant (downdraft gasifier) to provide district heating and electricity. The gasifier is not being used, because of technical implementation problems, though the technology has been and is being used successfully at other sites.
- High quality—The apartments are finished to a high standard to attract the urban professional.
- Energy efficient—The houses face south to take advantage of solar gain, are triple glazed, and have high thermal insulation.
- Water efficient—Most rain water falling on the site is collected and reused. Appliances are chosen to be water-efficient and use recycled water when possible. A "living machine" system of recycling waste water was installed, but is not operating.
- Low-impact materials—Building materials were selected from renewable or recycled sources within 35 miles (56 km) of the site, to minimize the energy required for transportation.
- Waste recycling—Refuse-collection facilities are designed to support recycling.
- Transport—The development works in partnership with the United Kingdom's leading car-sharing operator, City Car Club. Residents are encouraged to use this environmentally friendly alternative to car ownership; an on-site selection of vehicles are available for use.
- Encourage eco-friendly transport—Electric and liquefied-petroleum-gas cars have priority over cars that burn petrol and diesel, and electricity is provided in parking spaces for charging electric cars.
- A higher reported quality of life, with a strong sense of community

Street in BedZED

Performance

Monitoring conducted in 2003[2] found that BedZED had achieved these reductions in comparison to UK averages:

- Space-heating requirements were 88% less.
- Hot-water consumption was 57% less.
- The electrical power used, at 3 kilowatt hours per person per day, was 25% less than the UK average; 11% of this was produced by solar panels.[3] The remainder normally would be produced by a combined-heat-and-power plant fueled by wood chips, but the installation company's financial problems have delayed use of the plant.
- Mains-water consumption has been reduced by 50%, or 67% compared to a power-shower household.
- The residents' car mileage is 65% less.

BedZED buildings

Problems

A review of the BedZed development in 2010[4] drew mainly positive conclusions. Residents and neighbours were largely happy. However, a few significant failures were highlighted, for example:

- the biomass wood chip boiler (biomass gasifier) was no longer in operation and the back up power source, a gas boiler, was now used.[4] The downdraft wood chip gasifier CHP (combined heat and power) had reliability problems due to technical failures and the intermittent schedule of operation (no night time operation) imposed by the local authority.[5]
- the 'Living Machine' water recycling facility had been unable to clean the water sufficiently. The cost of the facility also made it unviable.[4]
- the passive heating from the sunspaces had been insufficient
- despite best efforts, residents were on average still leaving an ecological footprint of 1.7 planets, which is more than the target of 1.0 planet (but much less than the UK average of 3 planets).[4]

BedZED facade at dusk


STROUDLEY ROAD
BRIGHTON
JUNCTION
skyscrapernews.com

Submission City Plan Part One

Brighton & Hove City Council's Local Development Framework

June 2013

Policy CP8 Sustainable Buildings Background Paper

Brighton & Hove City Council

One Brighton

Planning application BH2006/01761. Completed in 2009.

Location	Brighton Station sites E-F	
Description	Mixed-use development comprising of studio, 1, 2 and 3 bed flats, office and community space with private and public open spaces.	
No of flats	172 (30% affordable)	
Developer	Crest Nicholson/BioRegional Quintain	
Sold prices 2009-2010 *	**1-bed**	**2-bed**
	£225,000.00	£250,000.00
Regional average**	£185,715.00	
Standard	BREEAM Excellent	

Additional sustainability features

Zero carbon, zero waste development composed of 172 residential units. Allotments, onsite composting facilities, biomass facilities and PV arrays. Winner of the 2010 RTPI national award on the sustainability category. Biomass boiler. Sixth floor allotments.

Decision to use 50% recycled content in concrete framework taken during construction.

Viability issues

Standard agreed in Brighton Station masterplan was surpassed. Viability issues raised at planning stage resulted in additional height being negotiated.

The additional storeys, seen on the top left in wood cladding, were negotiated with the local planning authority based on justification put forward by developer that this was needed to make the delivery of this exemplary development viable.

* Estimates based on information available at Planning Register, Rightmove and Zoopla websites.

** Source: Halifax House Price Index for South East region, 2009-2010 average for new build flats.

3.11. To increase the range of affordable choices available where developers struggle to meet the higher energy targets, the *2012 Brighton & Hove Renewable and Sustainable Energy Study* recommends the establishment of 'a local mechanism to enable offsetting …in advance of the proposed Allowable Solutions mechanism within future Building Regulations'. This option is an integral part of Policy CP8.

3.12. The *2011 Zero Carbon Homes Impact Assessment* (CLG) indicates that from 2016 onwards the costs of building to zero carbon homes standard are anticipated to come down to between £3,000-£8,000 per unit.

3.13. The impact of local circumstances opportunities and priorities upon costs is also highlighted in this report which calls for a Government approach that:

'*provides flexibility to local authorities to decide how new housing in their areas should meet national minimum or whether they should be pushed towards achieving zero-carbon; and the uses of proceeds of the energy component of their local development tariff on offsite carbon reduction projects in the locality and reflecting local circumstances*' (p. 44).

3.14. It is important to emphasise, however, that these cost estimates are based on national data that does not factor in local circumstances and/or the potential for savings and income arising from the processes and decisions underpinning the design and delivery of a development.

3.15. The case studies presented on the next pages illustrate how local circumstances and other factors can generate considerably different outcomes in two neighbouring sites.

Other factors

3.16. The recently published NHBC's guide to *Designing homes for the 21st Century* examines processes and decisions in the UK and how these can be improved to achieve 'cost-effective, robust and functional low energy design'.

3.17. It suggests that processes and decisions that rely on a 'business as usual' approach are unlikely to deliver practical and cost-effective solutions for developers, in particular smaller developers.

3.18. It concludes that '*some forward thinking and coordinated processes, unnecessary complexity can be '"designed out", to the benefit of everyone who follows the design through construction and handover. However, good communication, supported by accurate calculation, drawing and modelling, is essential. … the right knowledge and skills are still being acquired*' (p. 43).

3.19. In Brighton & Hove, the impact of process and decisions upon delivery of enhanced building standards can be illustrated by the City Point and One Brighton examples. These are two developments delivered in neighbouring sites in the aforementioned New England Quarter.

3.20. Other studies (Appendix C) identify alternative factors influencing the cost of achieving higher levels of CSH and BREEAM/EcoHomes assessments. These suggest lower costs are typically associated with developments in which:

- there has been careful consideration of design and specifications at an early concept/design stage; and
- there is potential to use site-wide carbon saving technologies (e.g. CHP systems).

3.21. As the case study files on the following pages indicate, sales were successful at both City Point (prior to the 2008 economic crisis) and One Brighton (after the onset of the crisis). Both proved to be not only viable but best sellers at the time they were being marketed. However, One Brighton delivered a zero carbon, zero waste standard which is significantly higher than those underpinning City Point. One might then ask how this was possible.

3.22. In line with the NHBC's report findings, processes and decision-making supported by the right knowledge, skills and a flexible approach to planning negotiations seemed to have played an important part.

3.23. One example where economies were made during construction is the One Brighton development which benefited from opportunities to use a larger share of recycled material in the concrete elements of the structure.

One Brighton

Among the headline results are:

- Successful planning consent and marketing of UK's largest private car free development
- Pouring of greenest concrete frame in UK – post-tensioned concrete comprising 50% ground granulated blast furnace slag and use of 100% secondary aggregates
- A 67% reduction in operational carbon emissions compared to the UK's existing housing stock, with potential to achieve an 89% reduction by 2020, approaching the (near) Zero Carbon target for One Planet Communities.
- Successful introduction of the first designed-in rooftop mini-allotments, inspiring the local planning authority to introduce an award-winning Planning Advisory Note on Food and Planning.

One resident was quoted as saying: "We moved into One Brighton, sold our cars and adopted a healthier lifestyle. In 18 months we lost 35 kg between us."

The highly insulated, triple glazed buildings designed with architects Fielden Clegg Bradley Studios and built by Denne under a design and build contract are heated by woodfuel pellets. Electricity is sourced from a green power provider through the development's own energy services company.

Bioregional has also published a detailed life cycle carbon footprint for One Brighton carried out by Australia-based life cycle analysts eTool.

Overview

Sustainable Water
Consumption estimated at 109 litres per resident per day, 4% above target and 27% less than the UK housing average

Local and Sustainable Food
Rooftop allotments

Sustainable Transport
No private car parking apart from for disabled users and car club vehicles. Ample bike parking.

Zero Waste
Large on site food composter

One Brighton

- Completed in 2009.
- Achieved Eco Homes 'Excellent' – now widely agreed to be roughly equivalent to Code for Sustainable Homes level 4.
- On site pv's deliver miniscule proportion of the building's electricity needs
- Primary electricity loads met by a green energy supplier such as Ecotricity or Good Energy, bought in bulk so all residents must partake, but in effect little different to many of the rest of us – not a dedicated off site renewable energy supply.
- The 'Allotments' are approx $3m^2$ each. A standard municipal allotment plot is currently $125m^2$, historically $250m^2$.


GREEN
WASH

Table 2: Code Levels for Mandatory Minimum Standards in CO_2 Emissions	
Code Level	**Minimum Percentage reduction in Dwelling Emission Rate Over Target Emission Rate**
Level 1 (★)	10
Level 2 (★★)	18
Level 3 (★★★)	25
Level 4 (★★★★)	44
Level 5 (★★★★★)	100
Level 6 (★★★★★★)	'Zero Carbon' Home

Table 1: Summary of Environmental impact categories and issues

Categories	Issues
Energy and CO_2 emissions	Dwelling emission rate (M) Building fabric Internal lighting Drying space Energy labelled white goods External lighting Low or Zero Carbon (LZC) technologies Cycle storage Home office
Water	Internal water use (M) External water use
Materials	Environmental impact of materials (M) Responsible sourcing of materials – building elements Responsible sourcing of materials – finishing elements
Surface water run-off	Management of surface water run-off from developments (M) Flood risk
Waste	Storage of non-recyclable waste and recyclable household waste (M) Construction waste management (M) Composting
Pollution	Global Warming Potential (GWP) of insulants NO_x emissions
Health and wellbeing	Daylighting Sound insulation Private space Lifetime homes (M)
Management	Home user guide Considerate constructors scheme Construction site impacts Security
Ecology	Ecological value of site Ecological enhancement Protection of ecological features Change in ecological value of site Building footprint

(M) denotes issues with mandatory elements.

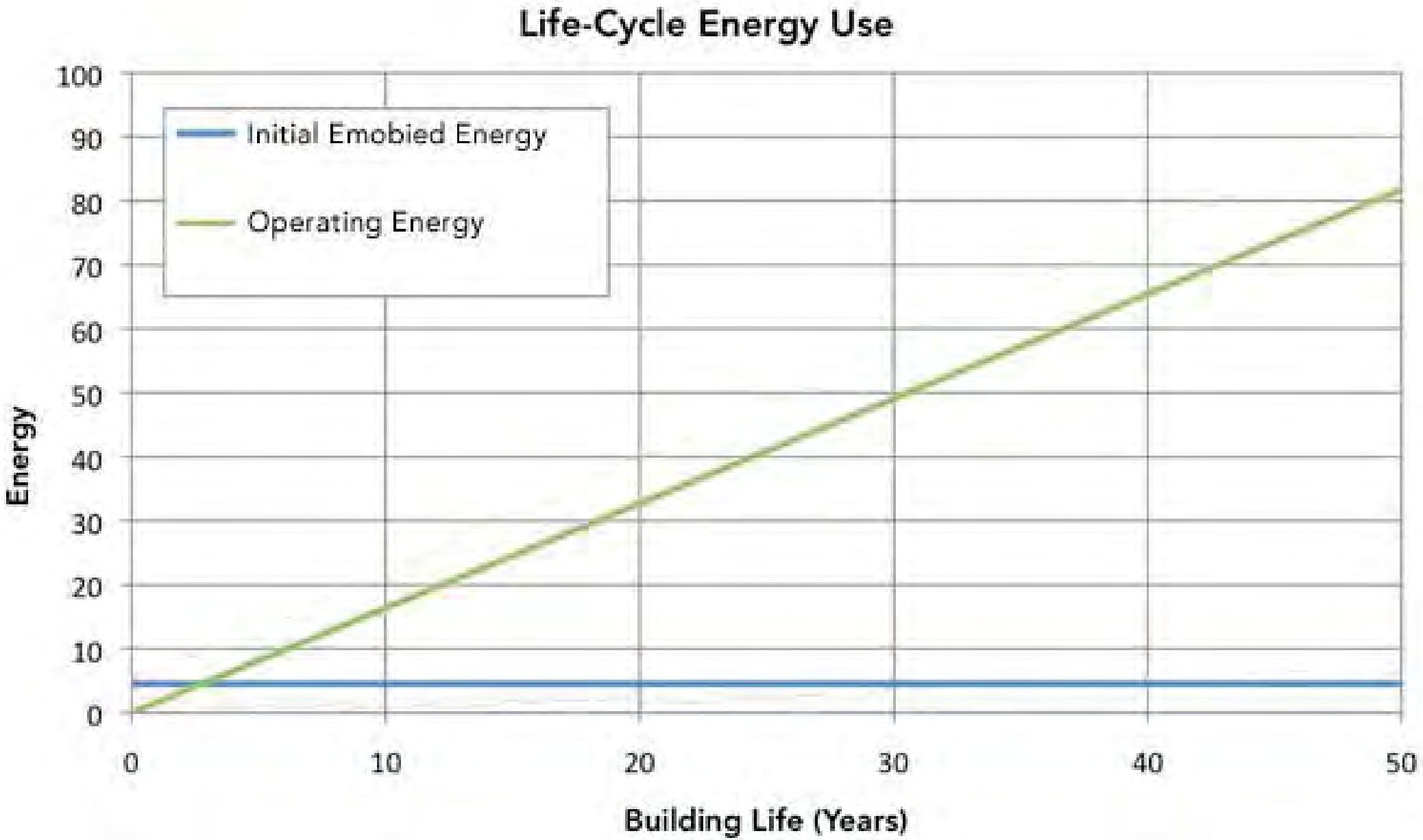

Life-Cycle Energy Use
Initial Emobied Energy
Operating Energy
Energy
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
Building Life (Years)

Table 5: Summary of environmental impact categories, issues, credits and weighting

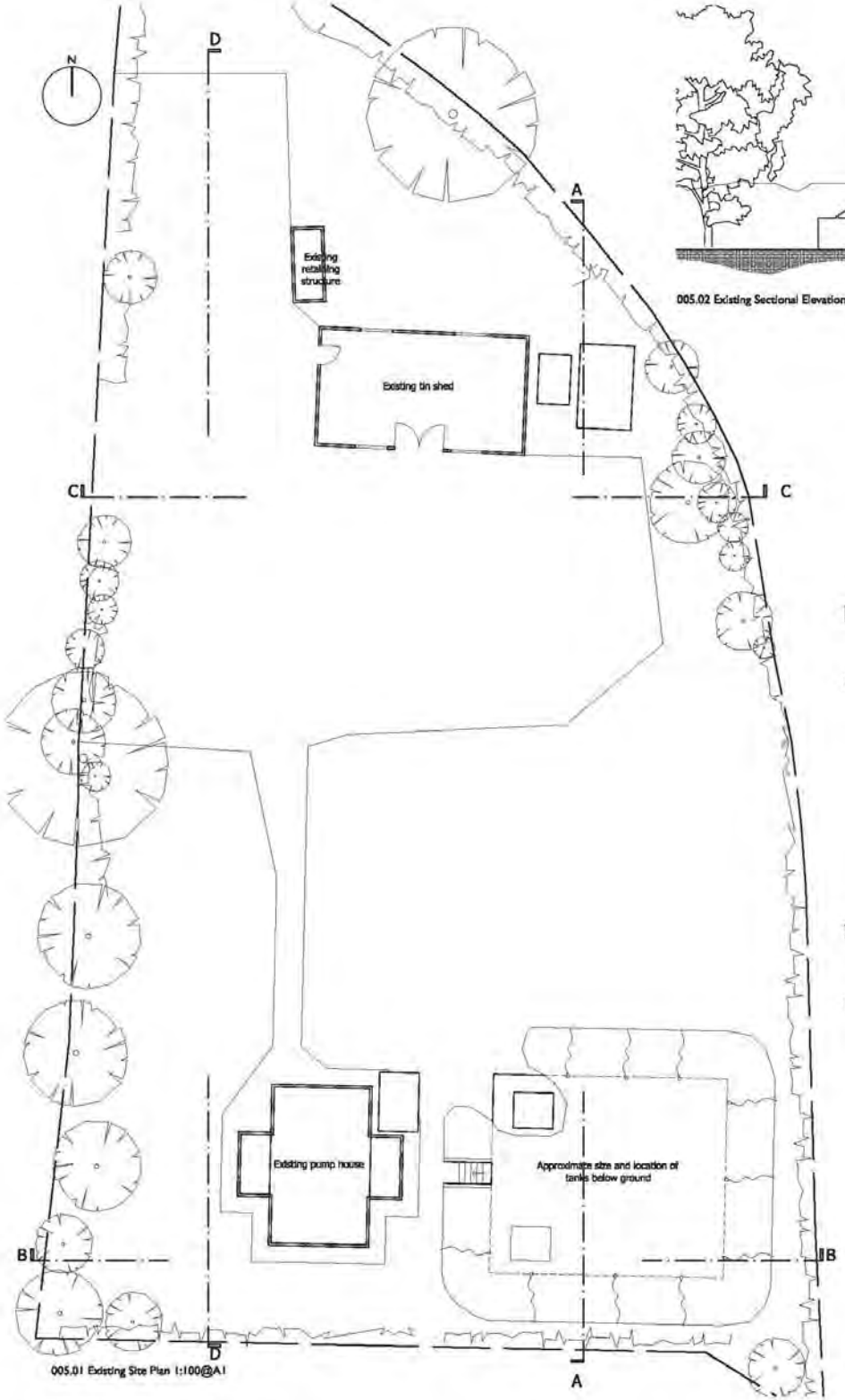
Code Categories	Available Credits	Category Weighting Factor
Energy and CO_2 Emissions		
Dwelling Emission Rate	15	
Building Fabric	2	
Internal Lighting	2	
Drying Space	1	
Energy Labelled White Goods	2	
External Lighting	2	
Low or Zero Carbon (LZC) Energy Technologies	2	
Cycle Storage	2	
Home Office	1	
Category Total	**29**	36.40
Water		
Indoor Potable Water Use	5	
External Water Use	1	
Category Total	**6**	9.00
Materials		
Environmental Impact of Materials	15	
Responsible Sourcing of Materials – Basic Building Elements	6	
Responsible Sourcing of Materials – Finishing Elements	3	
Category Total	**24**	7.20
Surface Water Run-off		
Management of surface water run-off from developments	2	
Flood Risk	2	
Category Total	**4**	2.20
Waste		
Storage of non-recyclable waste and recyclable household waste	4	
Construction Site Waste Management	2	
Composting	1	
Category Total	**7**	6.40
Pollution		
Global Warming Potential (GWP) of insulants	1	
NOx Emissions	3	
Category Total	**4**	2.80
Health & Wellbeing		
Daylighting	3	
Sound Insulation	4	
Private Space	1	
Lifetime Homes	4	
Category Total	**12**	14.00
Management		
Home User Guide	3	
Considerate Constructors Scheme	2	
Construction Site Impacts	2	
Security	2	
Category Total	**9**	10.10
Ecology		
Ecological value of site	1	
Ecological enhancement	1	
Protection of ecological features	1	
Change in ecological value of site	4	
Building footprint	2	
Category Total	**9**	12.00
Total	**104**	100.00

The Pump House
Level 6 design stage targets

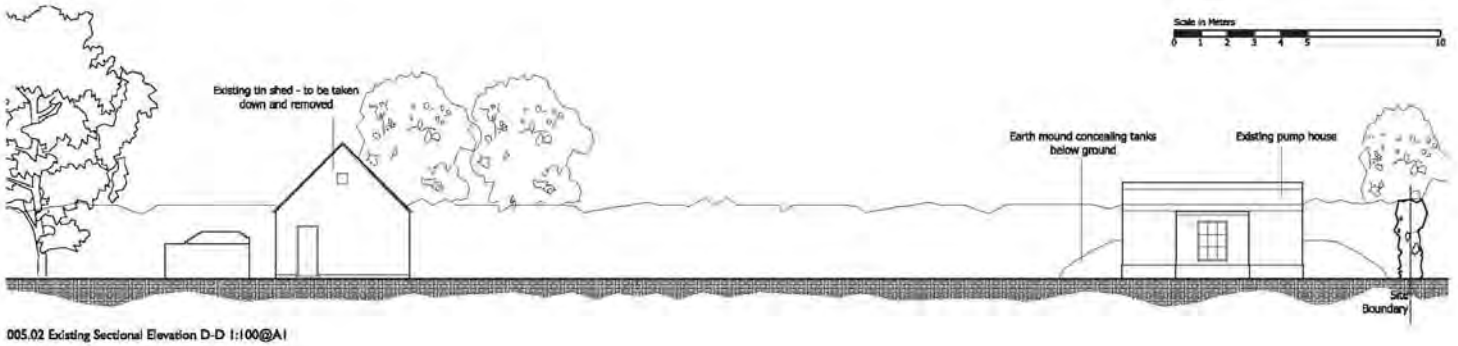
Longwood

Credit weighting		Credits sought	Max credits	Equivalent points	Category weighting	Notes
DER	Ene1	10	10			net CO2 emissions zero
Building Fabric	Ene2	9	9			achieved with calculated thermal bridging psi values
Energy Display Devices	Ene3	2	2			specify at build
Drying Space	Ene4	1	1			external and internal
White goods	Ene5	2	2			requires dishwasher
External lighting	Ene6	2	2			LEL throughout including compliant security lighting
LZC Technologies	Ene7	2	2			15% carbon reduction 10kWp PV, solar thermal & biomass
Cycle storage	Ene8	2	2			4 cycle storage
Home office	Ene9	1	1			daylighting check complete
1.17	**Total Ene**	**31**	**31**	**36.40**	**36.4**	
Indoor water	Wat1	5	5			80l/p/d
External water	Wat2	1	1			RWH with 5000l tank to washing machine and toilets.
1.50	**Total Wat**	**6**	**6**	**9**	**9**	
Environmental Impact of Mats	Mat1	13	15			Bespoke ratings for walls and windows
Responsible Sourcing basic	Mat2	6	6			Mat 2 completed, all timber FSC
Respon sourcing finishing	Mat3	3	3			Mat3 completed, all timber FSC
0.30	**Total Mat**	**22**	**24**	**6.6**	**7.2**	
Surface water run-off	Sur1	2	2			Complete
Flood risk	Sur2	2	2			FRA mandatory complete
0.55	**Total Sur**	**4**	**4**	**2.2**	**2.2**	
Waste and recyling	Was1	4	4			2 external bins - one waste , one recycling
Construction site waste	Was2	3	3			SWMP
Composting	Was3	1	1			Internal and external
0.80	**Total Was**	**8**	**8**	**6.4**	**6.4**	
GWP insulants	Pol1	1	1			POL1 checklist
Nox emissions	Pol2	2	3			Nox emmssions used for similar boiler against 10kWp PV
0.70	**Total Pol**	**3**	**4**	**2.1**	**2.8**	
Daylighting	Hea1	3	3			calcs completed
Sound insulation	Hea2	4	4			detached
Private Space	Hea3	1	1			detached
Lifetime Homes	Hea4	4	4			Design completed- checklists
1.17	**Total Hea**	**12**	**12**	**14**	**14.0**	
Home User Guide	Man1	3	3			S&C to write
Considerate Constructors	Man2	1	2			part of contract
Construction Site Impacts	Man3	2	2			part of contract management
Security	Man4	2	2			ALO/Secured by design
1.11	**Total Man**	**8**	**9**	**8.9**	**10.0**	
Eco value of site	Eco1	0	1			Devpt zone low eco value but credit not sought due to tree removal on boundary
Eco enhancement	Eco2	1	1			
Protection of eco features	Eco3	0	1			
Change in eco value of site	Eco4	4	4			Increase woodland &species rich grassland
	Eco5	0	2			
1.33	**Total Eco**	**5**	**9**	**6.7**	**12.0**	
	Total	99	107	92.3	100.0	

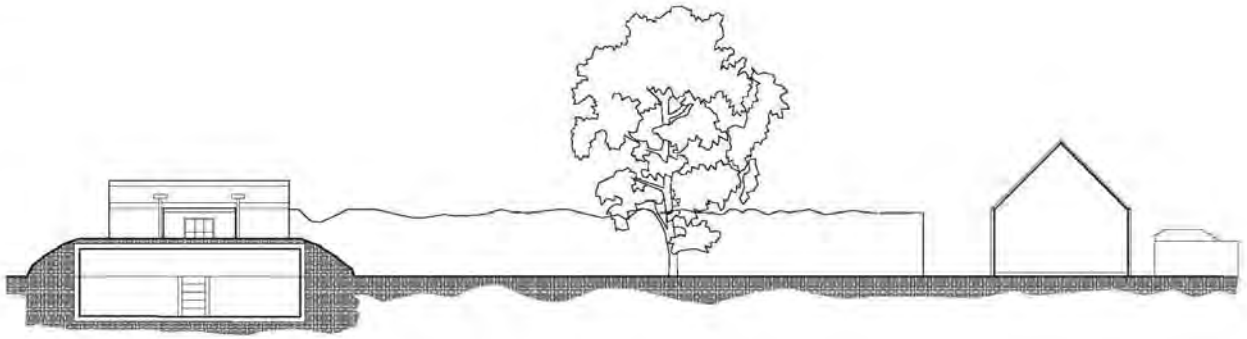
90 points threshold for level 6



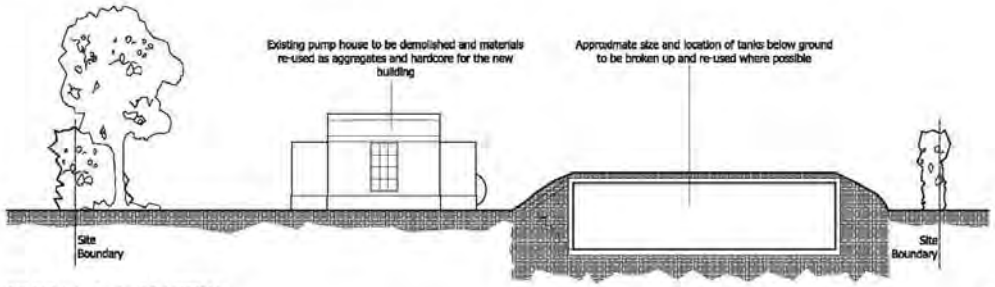
005.01 Existing Site Plan 1:100@A1



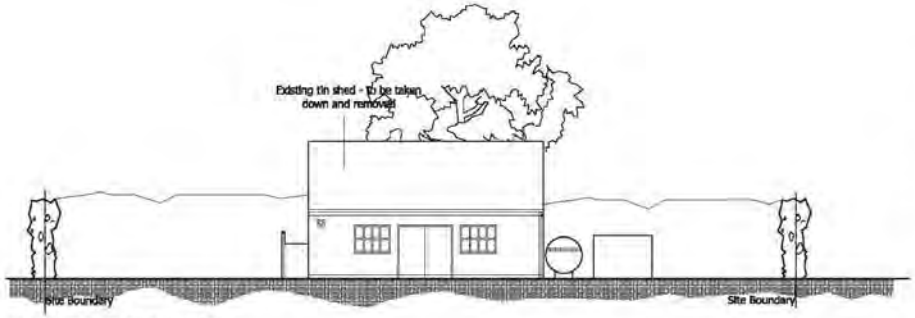
005.02 Existing Sectional Elevation D-D 1:100@A1



005.03 Existing Section A-A 1:100@A1



005.04 Existing Section B-B 1:100@A1



005.05 Existing Section C-C 1:100@A1

revision	date	description	dwn	chkd
			-	-

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e LCE.brighton@LCEarch.com w LCEarch.com ISO 9001:2000 certified

project
The Pump House
Hurstpierpoint

scale
1:100@A1
1:200@A3

date
10.01.08

client
Cleland & Sharada
Laidlay

drawn
SL

checked
AW

drawing
Existing Plans and Elevations

drawing number
06547/PA/005

revision
-

fig 3.4 Existing pump house

fig 3.5 Existing dilapidated tin shed

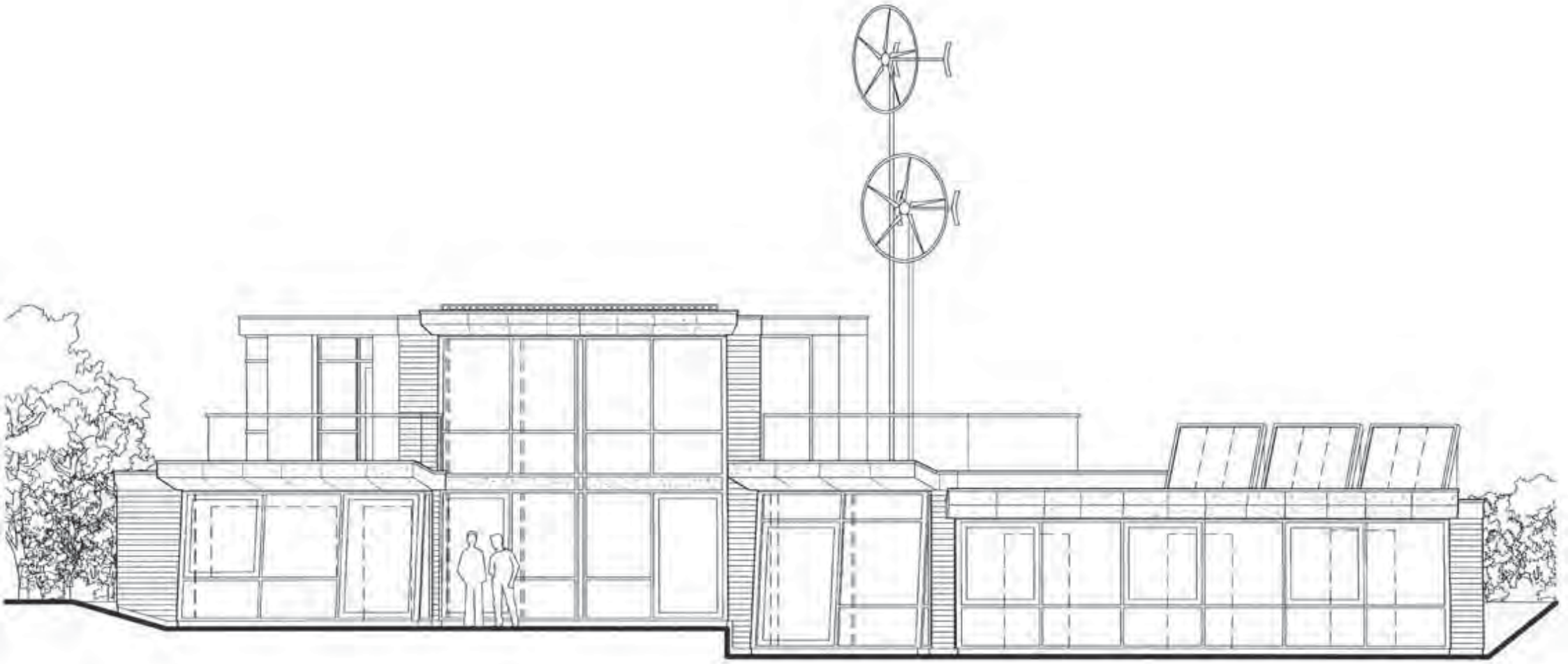
fig 3.6 Existing retaining structures, buildings and hard standing on the site

10. Isolated new houses in the countryside will require special justification for planning permission to be granted. Where the special justification for an isolated new house relates to the essential need for a worker to live permanently at or near their place of work in the countryside, planning authorities should follow the advice in **Annex A** to this PPS.

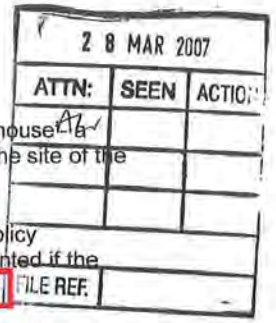
11 Very occasionally the exceptional quality and innovative nature of the design of a proposed, isolated new house may provide this special justification for granting planning permission. Such a design should be truly outstanding and ground-breaking, for example, in its use of materials, methods of construction or its contribution to protecting and enhancing the environment, so helping to raise standards of design more generally in rural areas. The value of such a building will be found in its reflection of the highest standards in contemporary architecture, the significant enhancement of its immediate setting and its sensitivity to the defining characteristics of the local area.

Design and the character of rural settlements

12. Many country towns and villages are of considerable historic and architectural value, or make an important contribution to local countryside character. Planning authorities should ensure that development respects and, where possible, enhances these particular qualities. It should also contribute to a sense of local identity and regional diversity and be of an appropriate design and scale for its location, having regard to the policies on design contained in PPS1 and supported in *By Design*[2]. Planning authorities should take a positive approach to innovative, high-quality contemporary designs that are sensitive to their immediate setting and help to make country towns and villages better places for people to live and work.



Randolph's Pumping Sketch
Hurstpierpoint
Eco House



1 This is pre-application advice on a proposal to construct a 'Ecohouse' a detached dwelling attempting to achieve zero-carbon rating, on the site of the former Randolph's Pumping Station.

2 The site is within the Sussex Downs AONB so that there is a Policy assumption against development and permission can only be granted if the dwelling is considered to fulfil the requirements of PPS7 para 11.

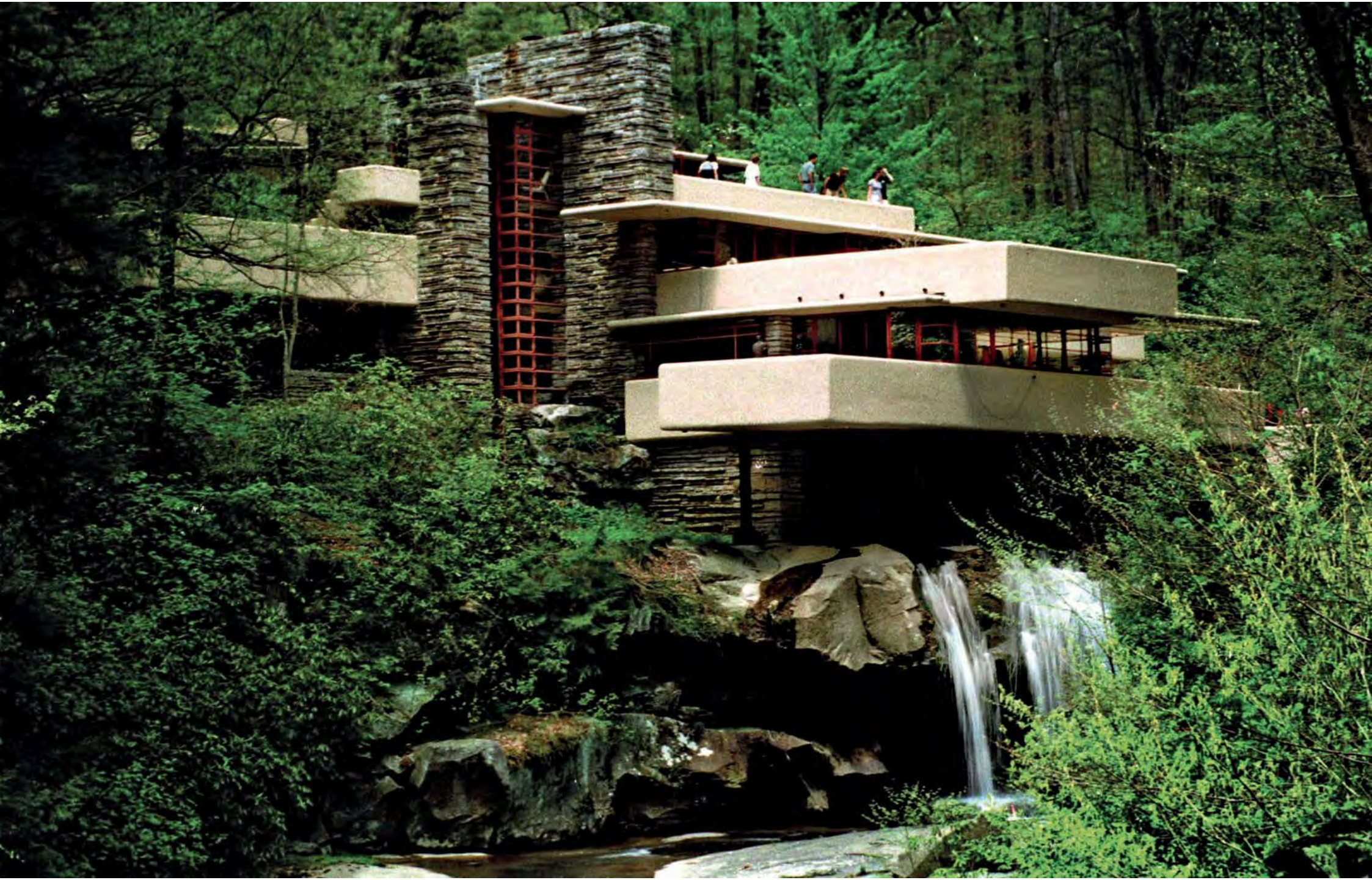
3 The design of the house is, potentially, 'truly outstanding' for the following reasons:

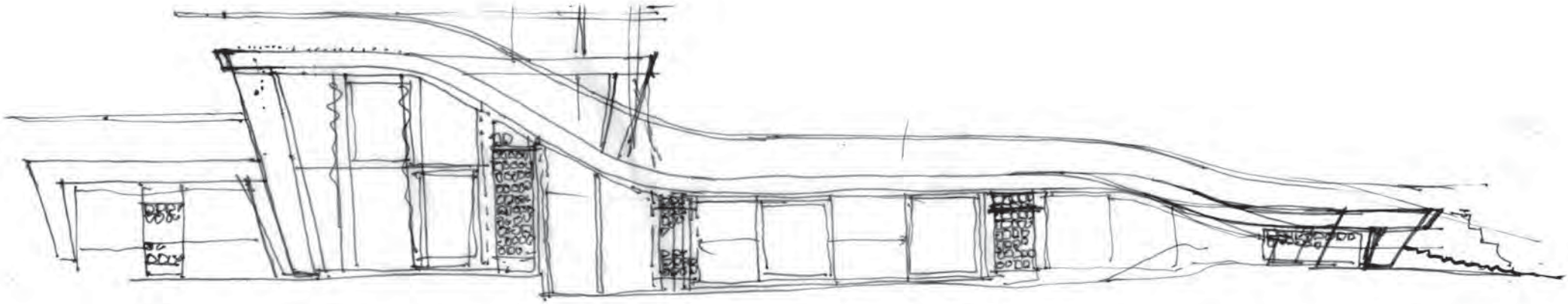
- The house is sensitive to the context. It significantly enhances its immediate setting.
- The design has excellent eco credentials and strives to be carbon neutral. The principle rooms are orientated south so that the building will benefit from passive solar heating. North facing walls have limited openings reducing heat loss. Natural ventilation could be achieved by a 'venturi' effect.
- Additional planting will augment the natural landscape.
- The house makes use of 'green' technology i.e. wood burning stove, two wind turbines and roof mounted solar panels
- The design of the house helps to raise sustainable construction standards in Mid Sussex
- The success of the design will ultimately rely on the quality of detailing but I have no reason to believe that the completed dwelling will not fulfil the potential indicated in the submission drawings. The architects were co-authors of the Brighton Jubilee Library – winner of several awards and nominated for the 2006 Stirling Prize.
- The house is an excellent example of contemporary domestic architecture.

4 The organic plan form is attractive and the designer has produced delightful interior spaces. External verandahs and roof terraces extend the interior living spaces. The house will nevertheless make minimal impact when viewed from the South Downs.

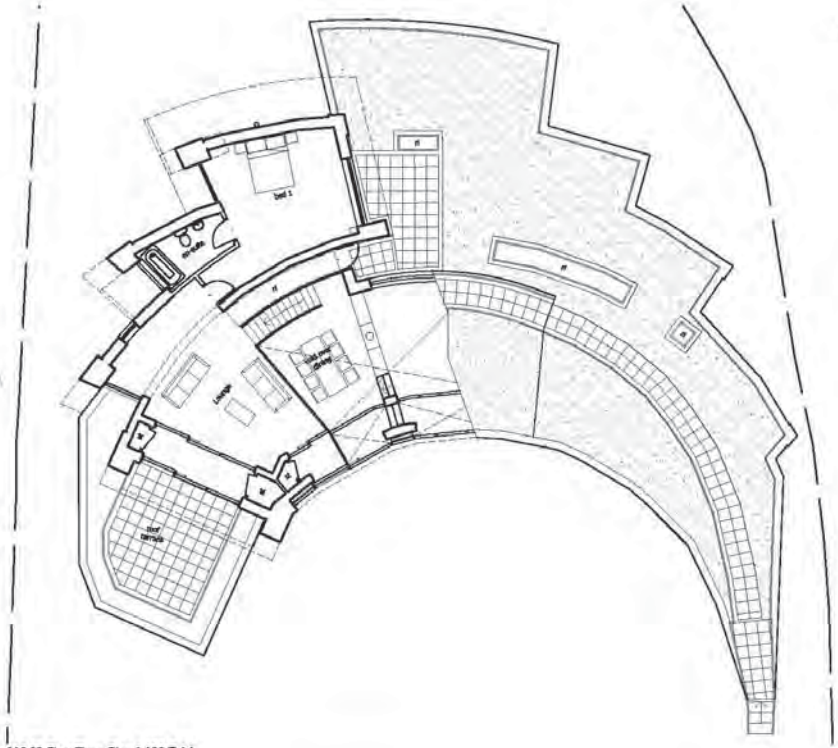
6 I support the outline design, which has exceptional qualities and the potential to comply with PPS 7 para 11. The architect must now ensure that the design goes beyond mere technical excellence to produce internal spaces and external elevations that are truly remarkable. The house must be exemplary – the 21st equivalent of a Schroeder House, Falling Water, The Sarabhai House or the Maria Short Farmhouse – all iconic houses of the 20th century.

Robert Powell
BA Dip Arch M Arch RIBA MRTPI, Architect/Urban Designer,
MSDC 27th February 2007.

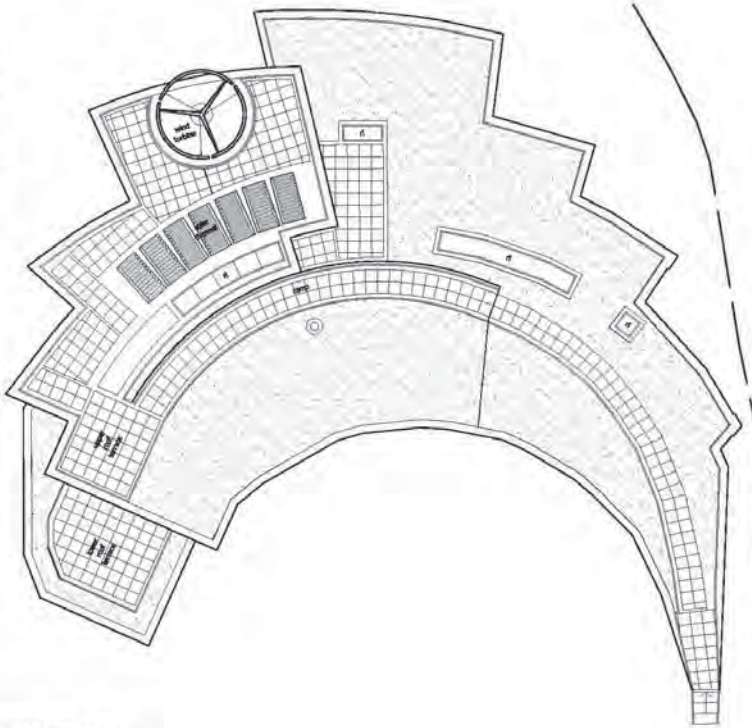




010.01 Ground Floor Plan 1:100@A1



010.02 First Floor Plan 1:100@A1



010.03 Roof Plan 1:100@A1

revision	date	description	dwn	chkd
A	04.04.08	Entrance gate added	SL	AW

LCE Architects
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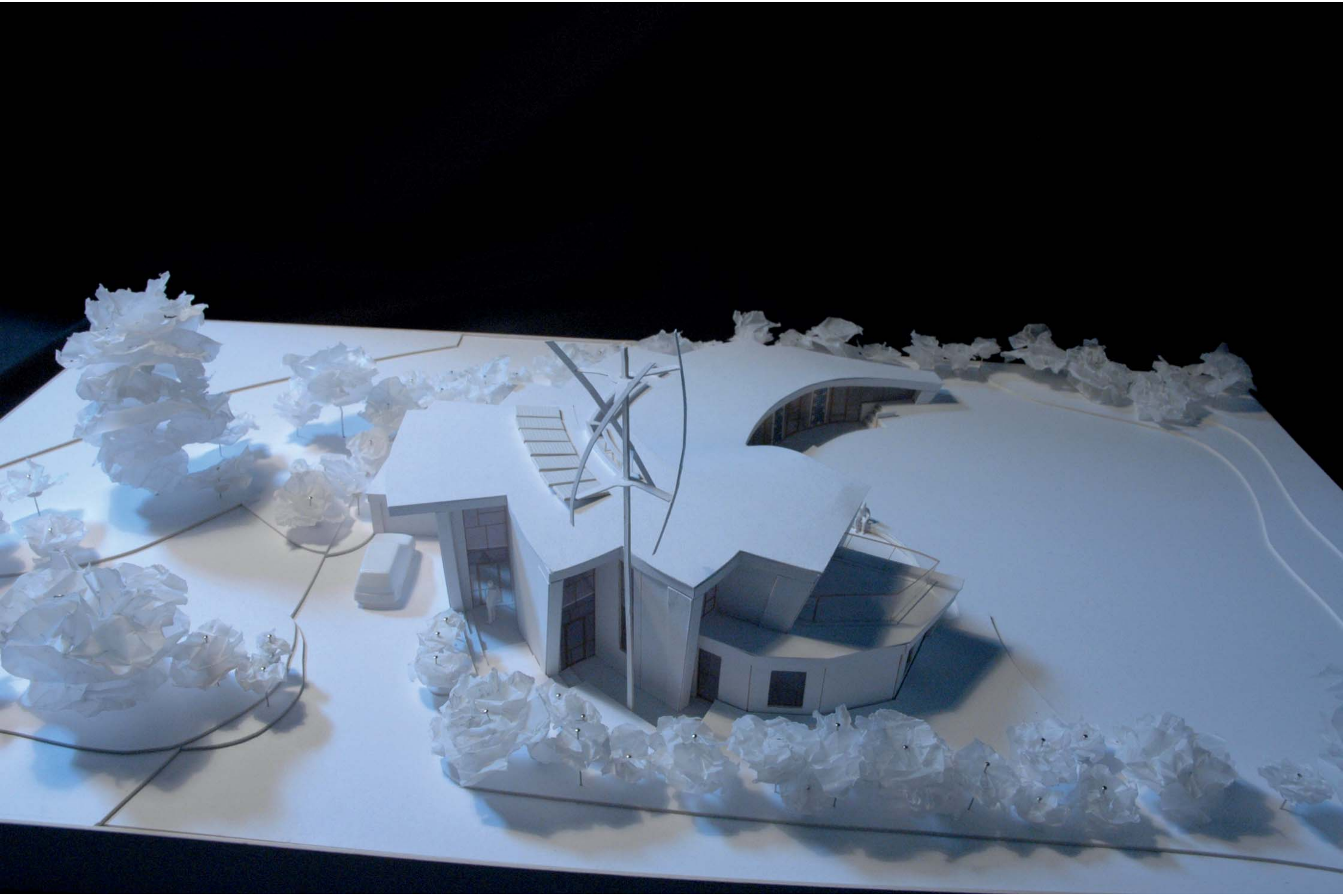
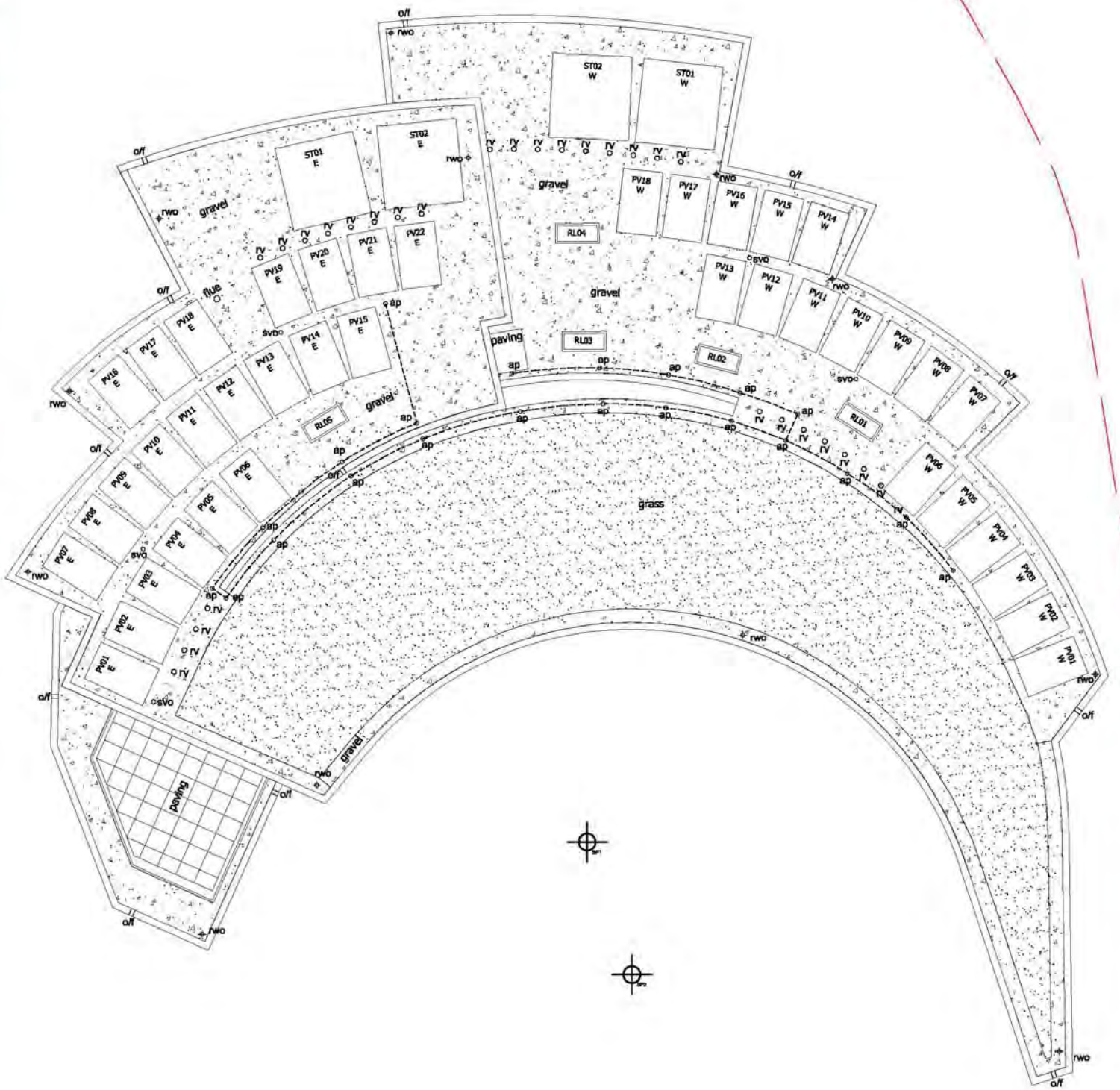
194-196 western road brighton bn1 2bb t 01273 326710 f 01273 206961
e LCE.brighton@LCEarch.com w LCEarch.com ISO 9001:2000 certified

project: The Pump House Hurstpierpoint	scale: 1:100@A1 1:200@A3
	date: 10.01.08
client: Cleland & Sharada Laidlay	drawn: SL
	checked: AW
drawing: Ground Floor , First Floor and Roof Plan	
drawing number: 06547/PA/010	revision: A



Solar Sundial showing energy yield relative to the inclination and orientation of your roof



Key to roof components/solar collectors

PV = Rooftop photo voltaic)
W = West side
E = East side
ST = Rooftop solar therm
RL = Roof light
ap = anchor point
rwo = rain water outlet
o/f = overflow
svo = soil vent outlet (see details 054.12 & 16)
rv = cold roof breather vent (see detail 054.17)

Note:

Preliminary anchor points for fall arrest system shown. Final ancor points to be positioned and fitted strictly in accordance with system manufacturers instruction.

PRELIMINARY

revision	date	description	drwn	chkd
A	18.03.14	fall arrest system note added	jf	aw

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LCE architects is a subsidiary of LCE holdings Ltd ISO 9001:2008 certified

project
The Pump House
Hurstpierpoint

scale
1:50@A1
1:100@A3

date
13.03.13

client
Cleland & Sharada
Laidlay

drawn
aw

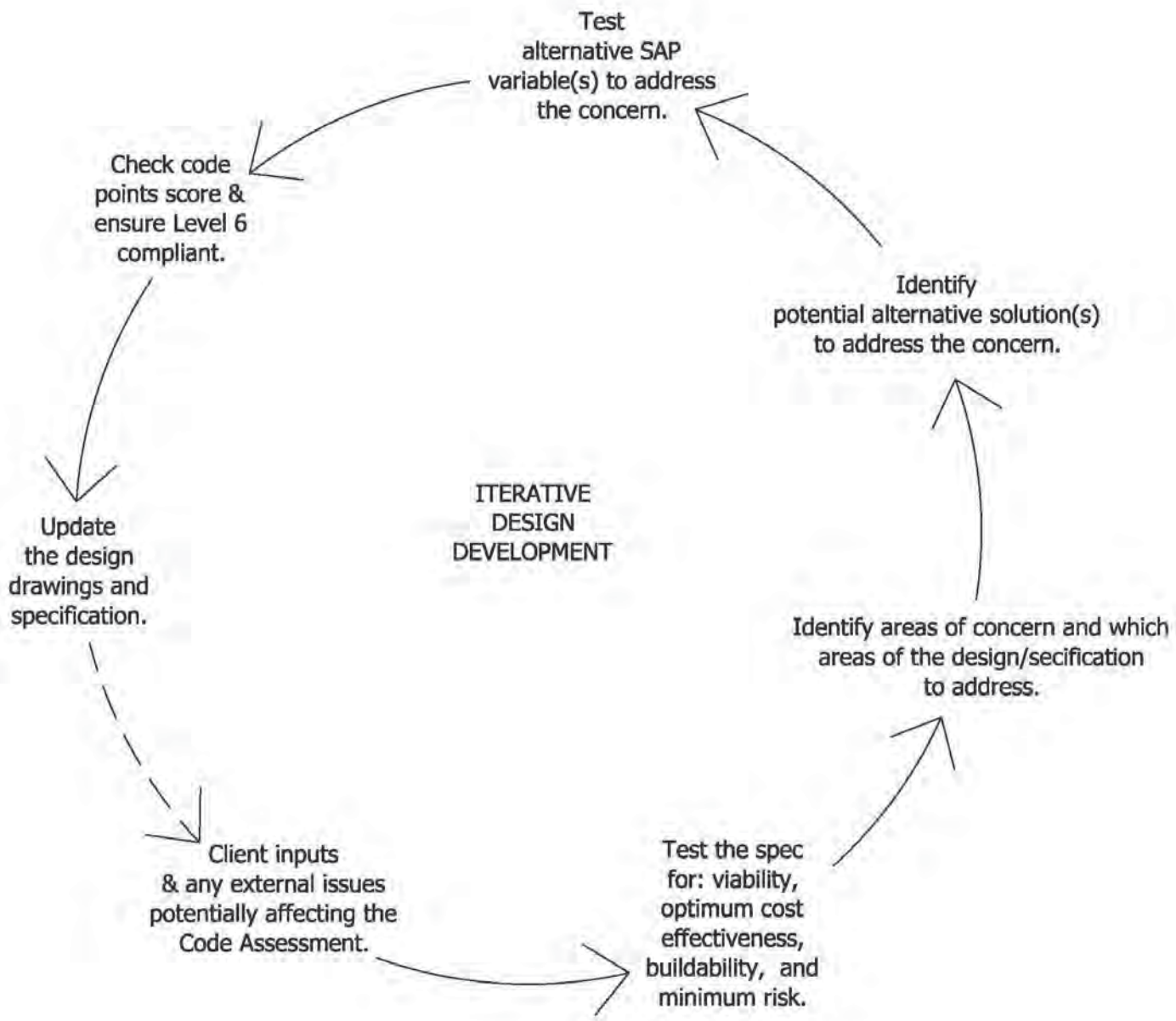
checked
AW

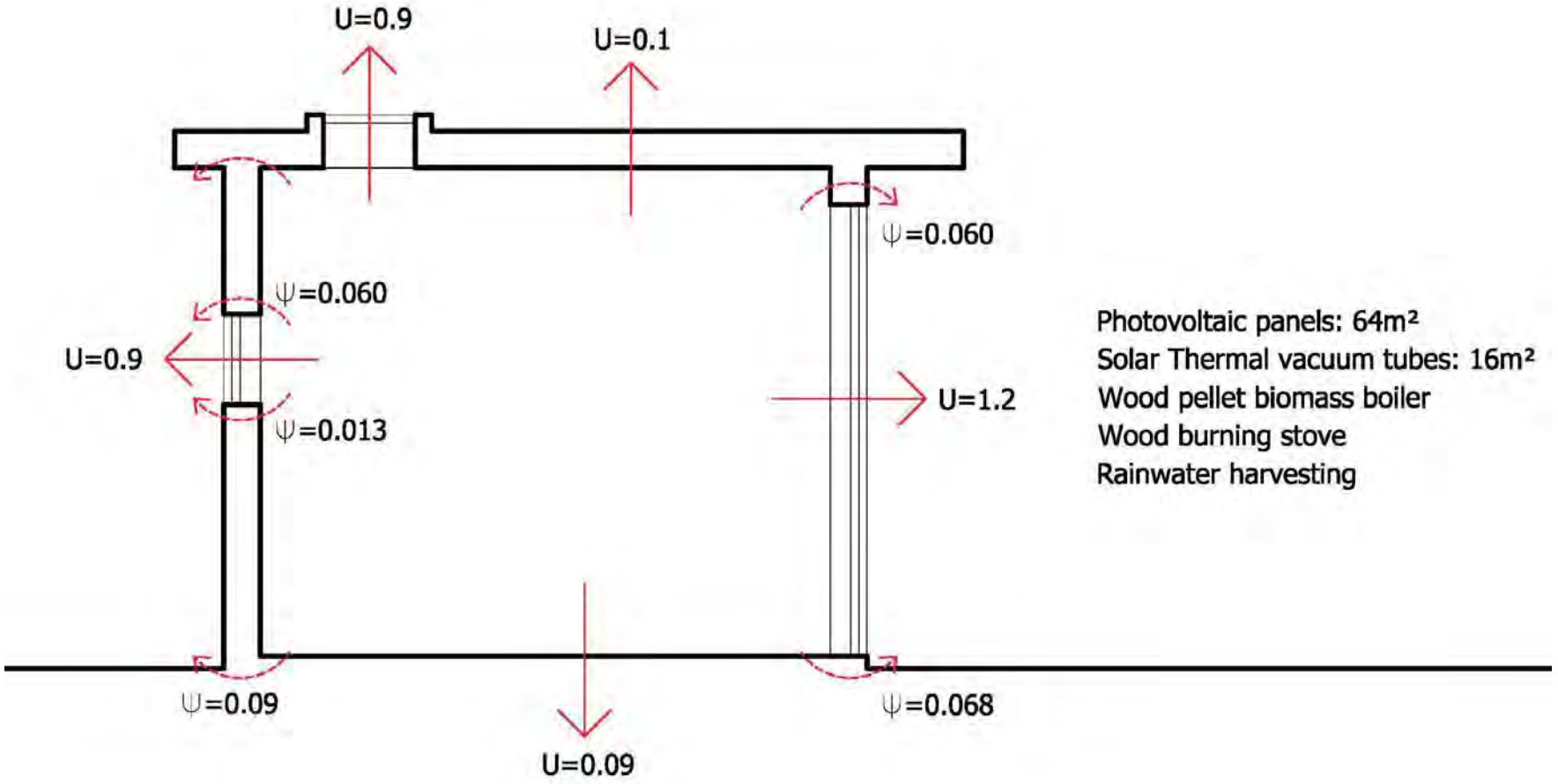
drawing
Roof Plan

drawing number
06547/CD/012

revision
A

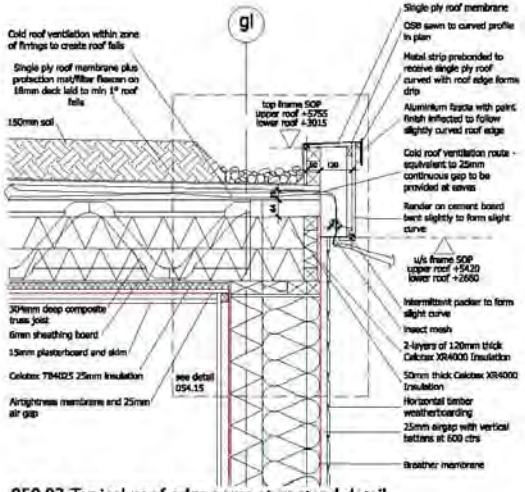
Leading Energy


Test alternative SAP variable(s) to address the concern.
Identify potential alternative solution(s) to address the concern.
Identify areas of concern and which areas of the design/secification to address.
Test the spec for: viability, optimum cost effectiveness, buildability, and minimum risk.
Client inputs & any external issues potentially affecting the Code Assessment.
Update the design drawings and specification.
Check code points score & ensure Level 6 compliant.
ITERATIVE DESIGN DEVELOPMENT

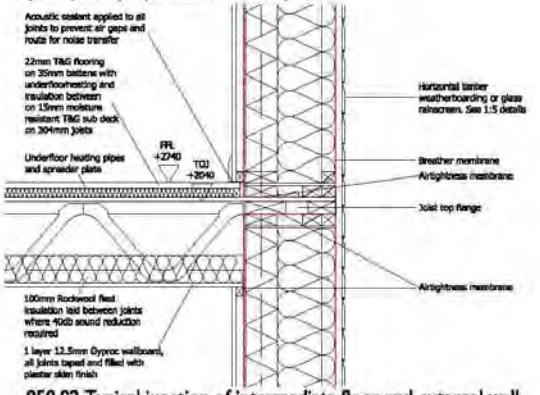


Photovoltaic panels: 64m²
Solar Thermal vacuum tubes: 16m²
Wood pellet biomass boiler
Wood burning stove
Rainwater harvesting

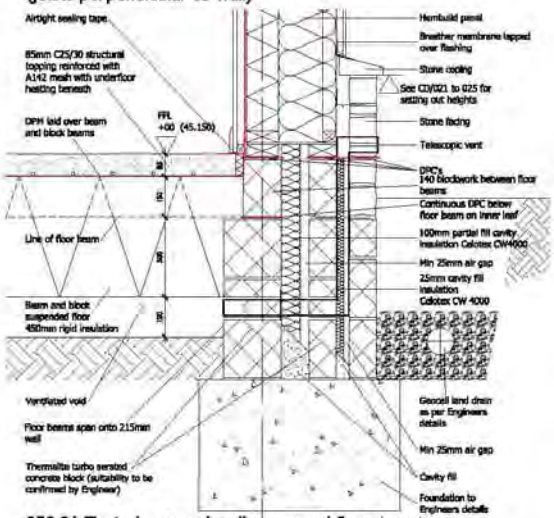
Windows	Hurstpierpoint Code 6 house
Windows W/m²K	1.20 / 0.90
Wall W/m²K	0.10
Roof W/m²K	0.10
Ground Floor W/m²K	0.09
Air Permiability m²/hr/m² @ 50 Pa	2
Thermal Bridge W/m²K	0.05
Space Heating kWh/m²/yr	39



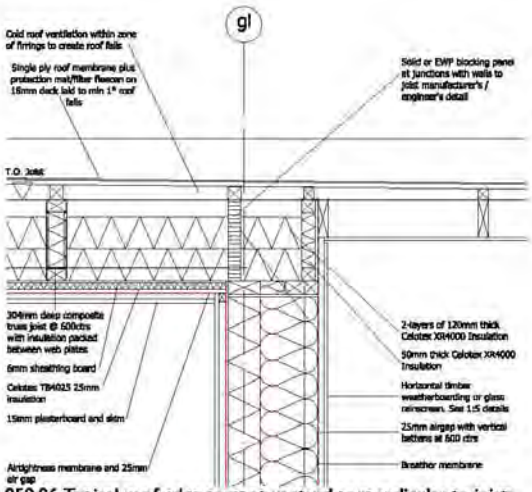
050.03 Typical roof edge parapet upstand detail (roof joists perpendicular to wall)



050.02 Typical junction of intermediate floor and external wall (joists perpendicular to wall)

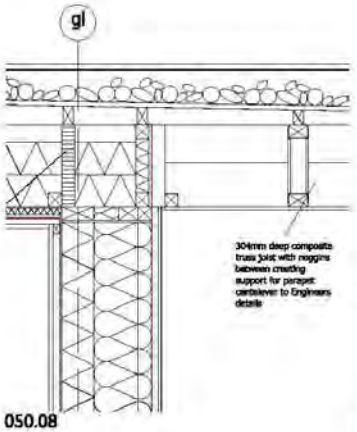


050.01 Typical external wall to ground floor junction (section taken parallel to structural beams and joists)

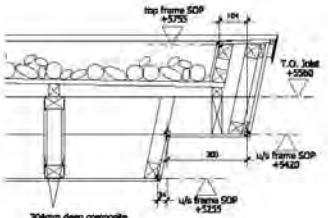


050.06 Typical roof edge parapet upstand perpendicular to joists (roof joists parallel to wall)

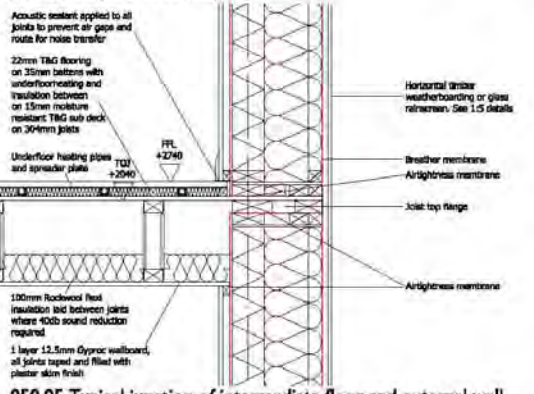
050.07



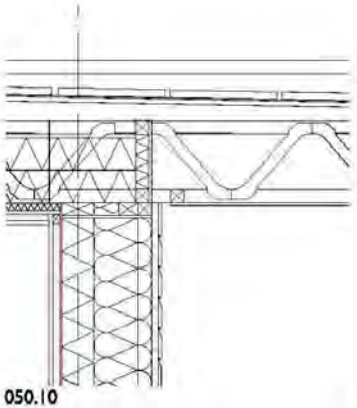
050.08



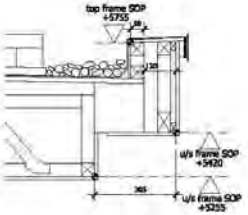
050.09



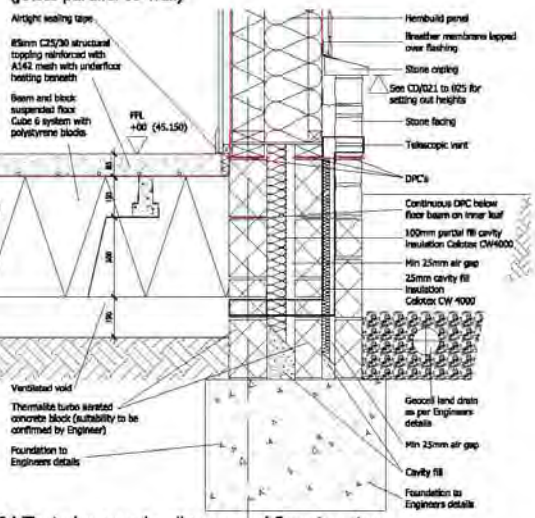
050.05 Typical junction of intermediate floor and external wall (joists parallel to wall)



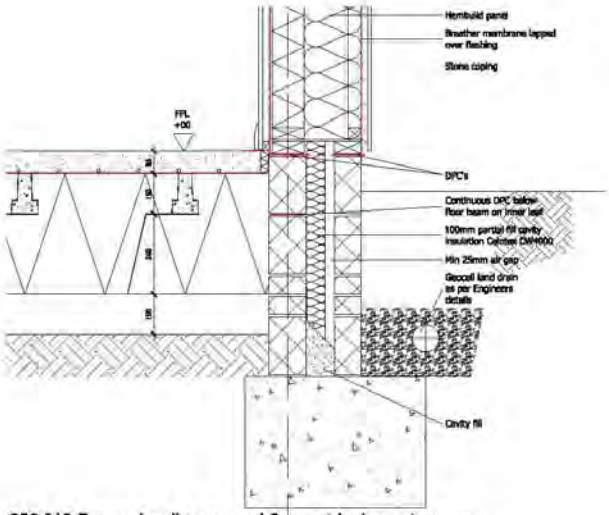
050.10



050.11



050.04 Typical external wall to ground floor junction (section taken perpendicular to structural beams and joists)



050.012 External wall to ground floor with glass rain screen

PRELIMINARY

revision	date	description	drawn	chkd
B	18.02.14	Dimensions and levels amended	jf	aw
A	18.11.13	Land drain and detail to intermediate floor added	jf	aw

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LCE architects a subsidiary of LCE Holdings Ltd ISO 9001:2008 certified

project
The Pump House
Hurstpierpoint

scale
1:10@A1
1:20@A3

date
13.03.13

client
Cleland & Sharada Laidlay

drawn
aw

checked
AW

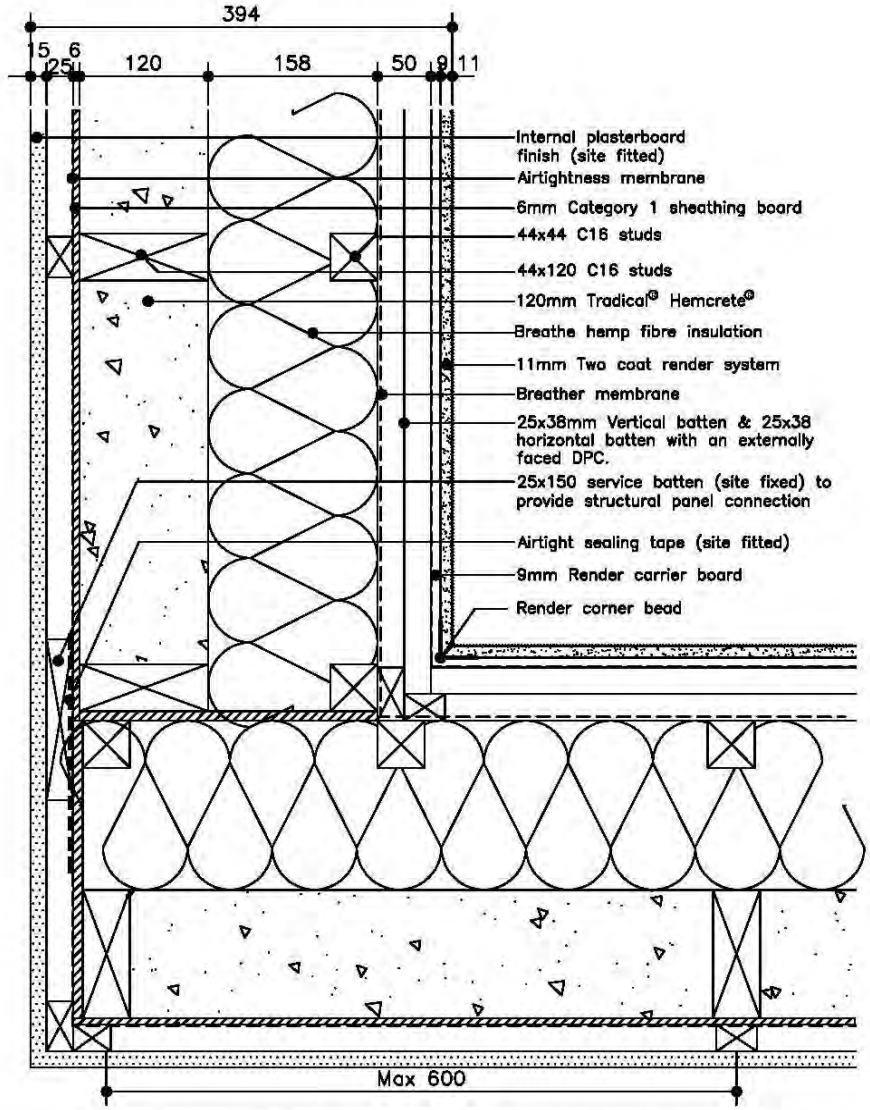
drawing
Detail Sections

drawing number
06547/CD/050

revision
B

limetechnology
Sustainable building innovation

Hembuild® standard external wall plan, plasterboard, service cavity, Hembuild® 120mm Hemcrete®, Breathe™ insulation.

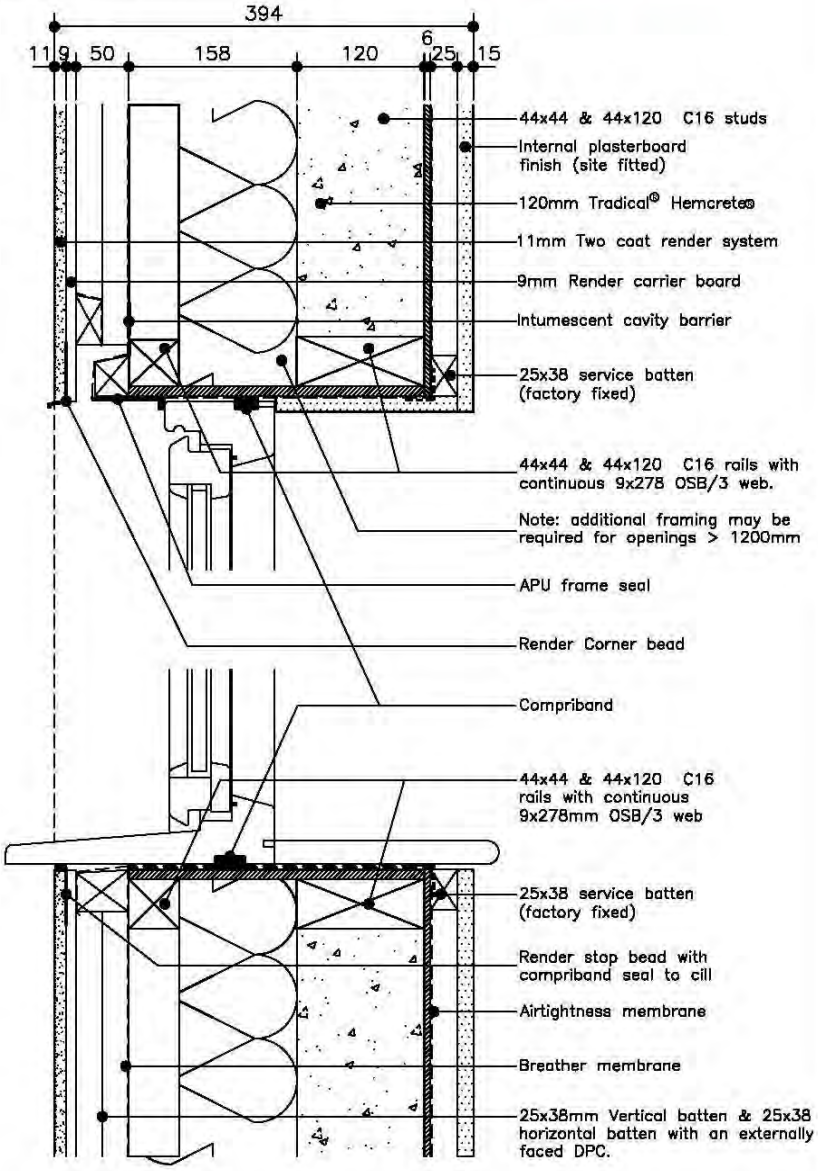


HEMBUILD® EXTERNAL WALL, INTERNAL CORNER.

					DWN	CKD	LT.3.11.2 Wall
					AD	-	

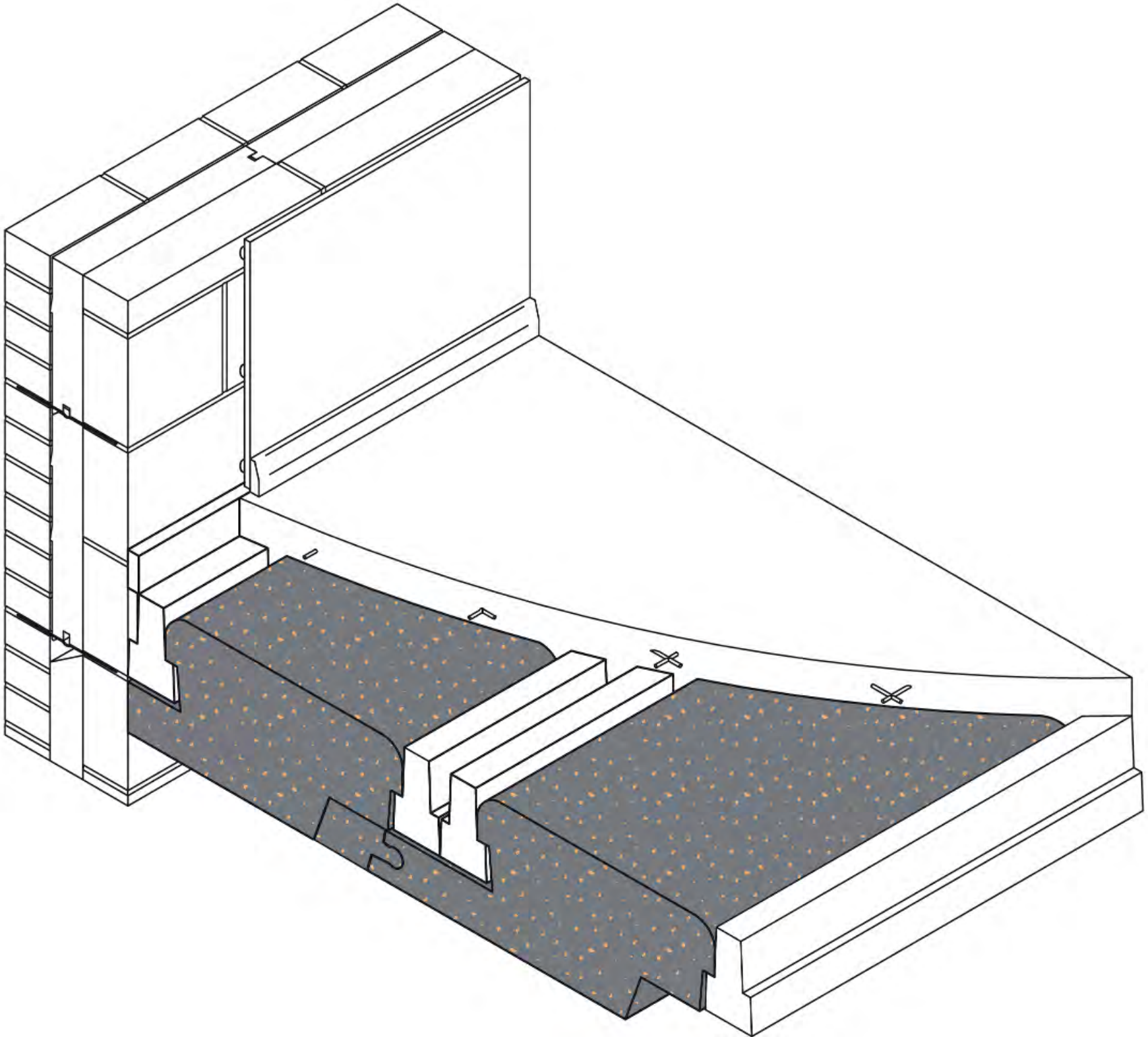
limetechnology
Sustainable building innovation

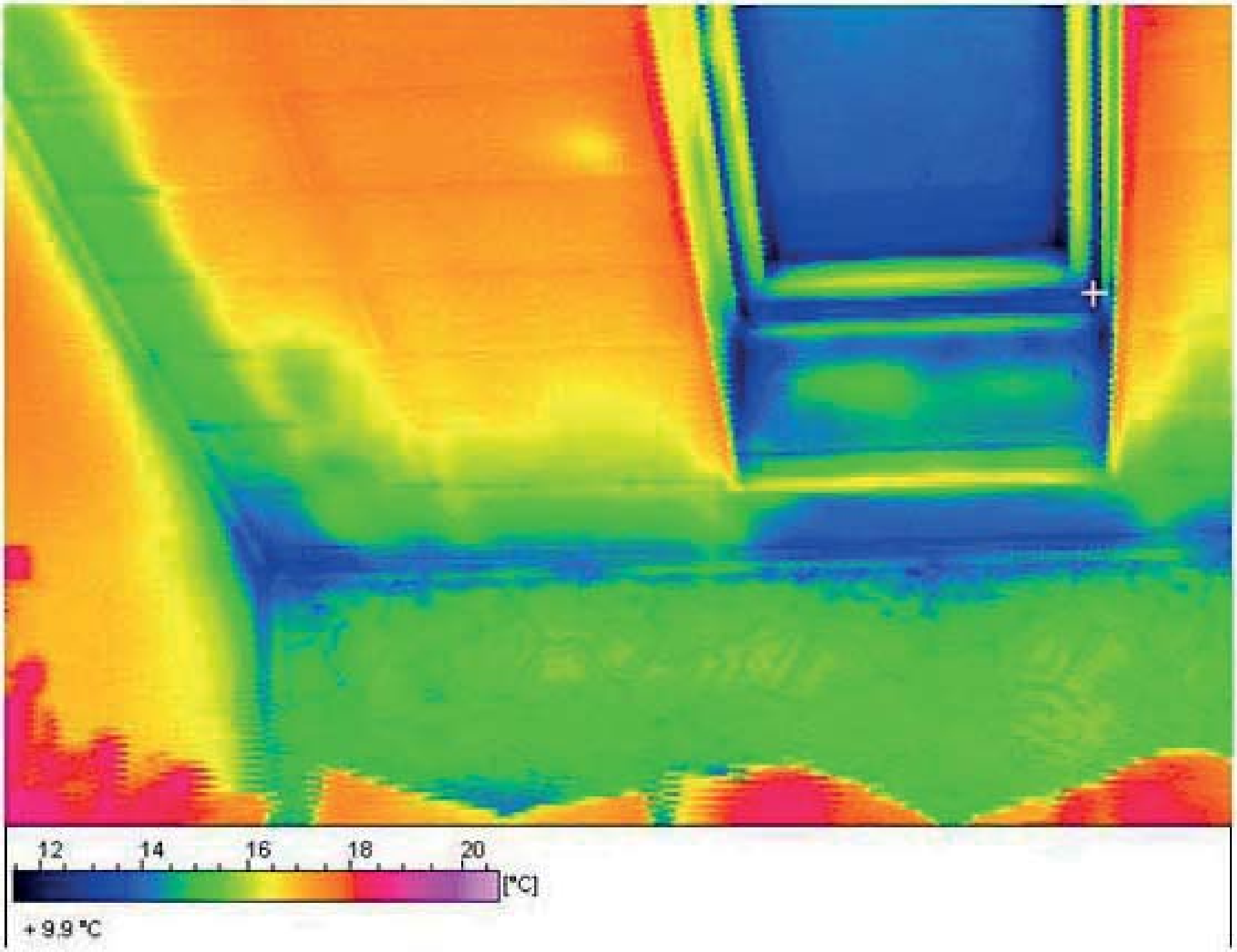
Hembuild® standard external wall plan, plasterboard, service cavity, Hembuild® 120mm Hemcrete®, Breathe™ insulation.



HEMBUILD® WINDOW SECTION - HEAD & CILL, PLATFORM FRAME.

				DWN	CKD	LT 6.12 - WINDOW HEAD AND CILL
				AD	-	




12
14
16
18
20
[°C]
+ 9.9 °C

Linear Thermal Transmittance (Ψ) and Temperature Factor (*f*)

C4Ci Consultants Construction Innovation

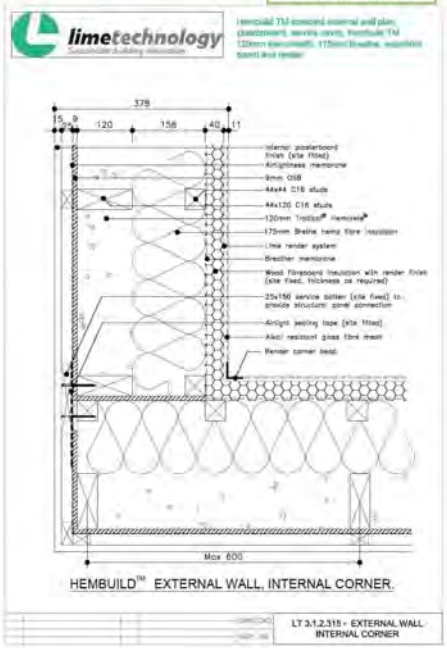
Certificate No:	*C4TM – 000860 vs.0*	Issued:	Wednesday 11 January 2012

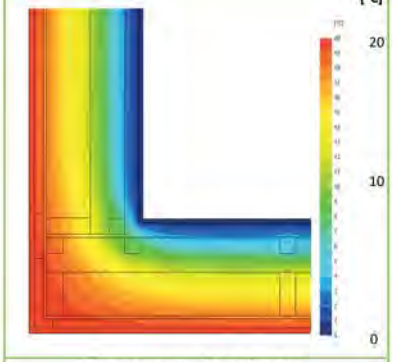
Issued to: *Ian Pritchett*
Lime Technology Limited
Unit 126,
Milton Park
Abingdon
Oxfordshire
OX14 4SA
Tel: 0845 603 1143
Fax: 0845 634 1560
www.limetechnology.co.uk

Construction Specification used for Thermal Model: *(see detail below and notes for range of applicability)*		
	External Wall:	Timber Frame, 215mm space stud, OSB, then 25mm service void
	Frame Insulation:	95mm Breathe λ=0.036, 120mm Hembuild λ=0.060
	Extra Insulation:	External to frame 40mm wood fibre board, λ=0.044
	Cladding:	11mm render, MC 55W, Baumit

Description:	**Internal Corner**	
Reference:	**E17**	**Drawing No. LT_3_1_2_315**

Junction Detail





Temperature Distribution

Linear Thermal Transmittance W/m.K	
Ψ =	**0.063**

Temperature Factor[3] for Humidity and Mould	
***f* =**	**0.976**

Calculation Prepared By: Matthew Wright *MA Physics (Oxon) PGCE*

Notes: -

-

1. The Ψ and *f* quoted are calculated for the detail drawn and described above.
2. The Ψ and *f* quoted are considered valid for U-value(s) **External Wall =< 0.19** W/m².K ***+/- 20%***, following the present guidance from B. Anderson, BRE.
3. In dwellings, a temperature factor *f* that is >0.75 would avoid the risk of mould growth.
4. Calculations have been performed in accordance with:
   - **EN ISO 10211_2007** *(British Standards)*
   - **IP 1/06** & **BR497** *(BRE Press)*

   and with reference to the following publications:
   - **EN ISO 6946** *(British Standards)*
   - **BR443** *(BRE Press)*

Linear Thermal Transmittance (Ψ) and Temperature Factor (*f*)

C4Ci Consultants Construction Innovation

Certificate No:	*C4TM – 000862 vs.0*	Issued:	Wednesday 11 January 2012

Issued to: *Ian Pritchett*
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Milton Park
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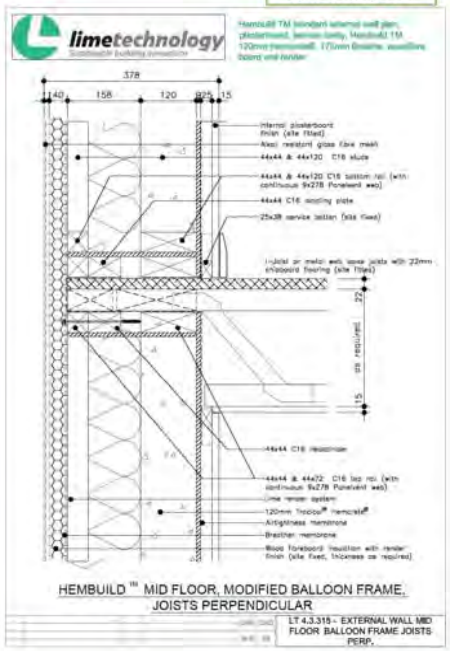
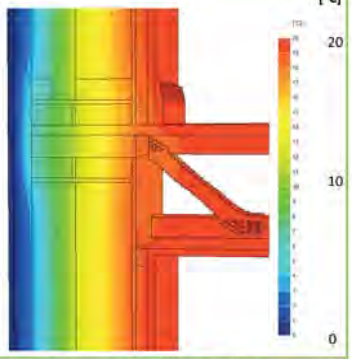
Oxfordshire
OX14 4SA
Tel: 0845 603 1143
Fax: 0845 634 1560
www.limetechnology.co.uk

Construction Specification used for Thermal Model: *(see detail below and notes for range of applicability)*		
	External Wall:	Timber Frame, 215mm space stud, OSB, then 25mm service void
	Frame Insulation:	95mm Breathe λ=0.036, 120mm Hembuild λ=0.060
	Intermediate Floor:	22mm chipboard, metal web joists, top hung
	External to Frame:	40mm wood fibre board, λ=0.044, 11mm render, MC 55W.

Description:	**Intermediate Floor**	
Reference:	**E6**	**Drawing No. LT_4_3_315**

Junction Detail





Temperature Distribution

Linear Thermal Transmittance W/m.K	
Ψ =	**0.035**

Temperature Factor[3] for Humidity and Mould	
***f* =**	**0.965**

Calculation Prepared By: Matthew Wright *MA Physics (Oxon) PGCE*

Notes: -

-

1. The Ψ and *f* quoted are calculated for the detail drawn and described above.
2. The Ψ and *f* quoted are considered valid for U-value(s) **External Wall =< 0.19** $W/m^2.K$ ***+/- 20%***, following the present guidance from B. Anderson, BRE.
3. In dwellings, a temperature factor *f* that is >0.75 would avoid the risk of mould growth.
4. Calculations have been performed in accordance with:
   - **EN ISO 10211_2007** *(British Standards)*
   - **IP 1/06** & **BR497** *(BRE Press)*

   and with reference to the following publications:
   - **EN ISO 6946** *(British Standards)*
   - **BR443** *(BRE Press)*

Linear Thermal Transmittance (Ψ) and Temperature Factor (*f*)

C4Ci Consultants Construction Innovation

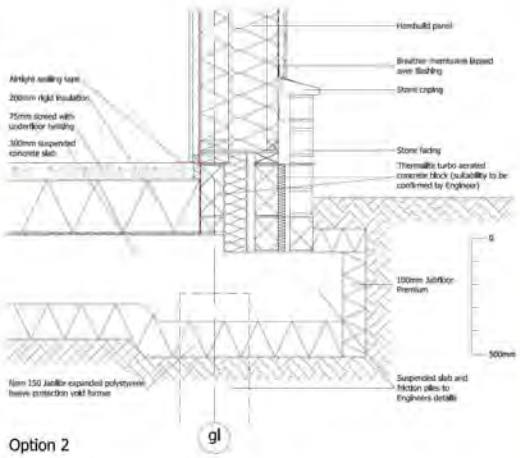
Certificate No:	*C4TM – 001666 vs. 0*	Issued:	Monday 7 October 2013

On behalf of: *Mr & Mrs Cleland Laidlay*
Issued to: Alan Wainer
164-165 Western Road
Brighton
Sussex
BN1 2BB
Tel: +44 (0)1273 206 710
Email: alan.wainer@LCEarch.com
www.LCEarch.com

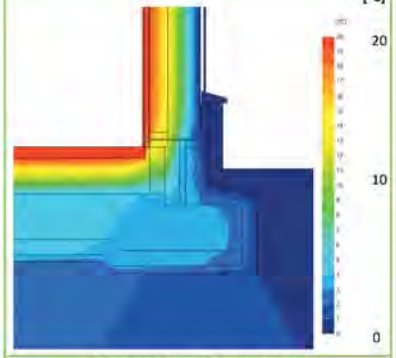
General Construction Specification: (see detail below for full construction)		
	Main/Load Beaing::	Hempcrete with 'Breathe' wood fibre under rainscreen
	Insulation:	Interstitial Hempcrete (λ=0.025) 120mm, 'Breathe' (λ=0.036), 215mm
	Ground Floor:	75mm screed, 220mm PU, beam and block: 25 mm perimeter ins.
	Footings:	Aircrete footings onto cast in situ ring beam, wrapped in EPS

Description:	Ground Floor Suspended, aircrete footings, Hempcrete wall	
Reference:	E5	06547 suspended floor options.pdf

Junction Detail



Option 2



Temperature Distribution

Linear Thermal Transmittance W/m.K	
Ψ =	0.070

Temperature Factor[3] for Humidity and Mould	
f =	0.959

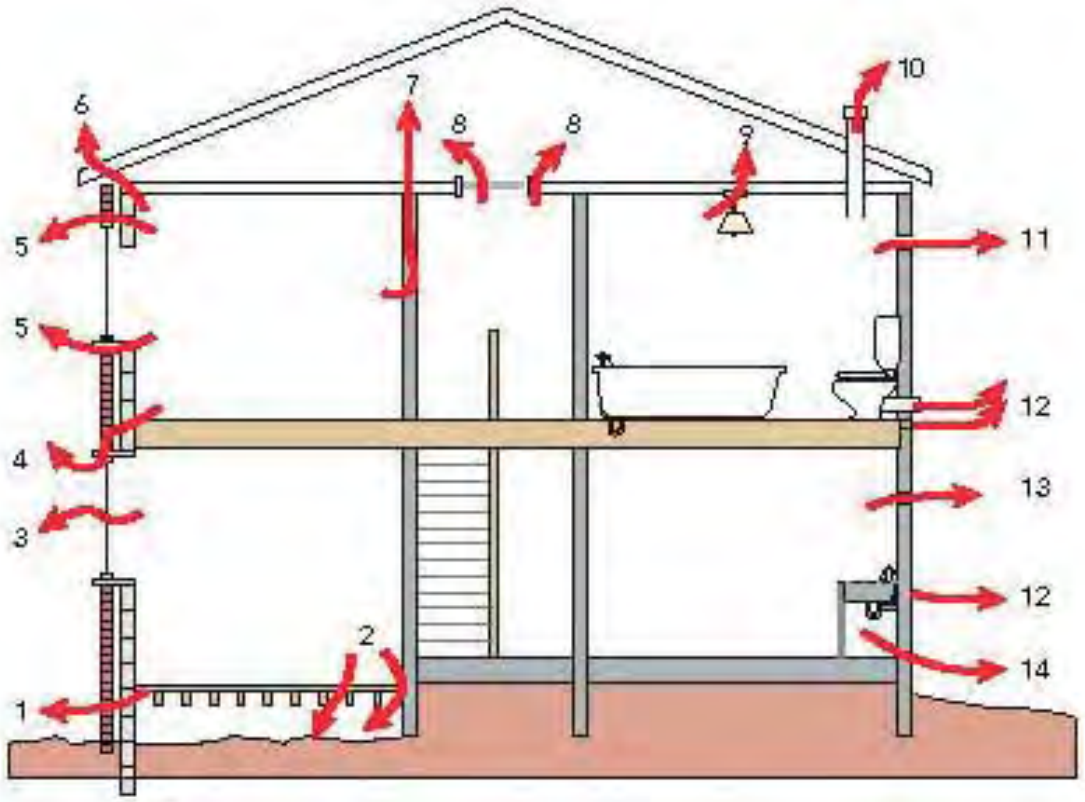
Calculation Prepared By: Matthew Wright *MA Physics (Oxon) PGCE*

Notes: ***Calculation based upon internal heat loss areas, applicable in UK Building Regulations and SAP calculations, but not PHPP.***

1. Ψ and *f* are only valid for the detail drawn and described above.
2. The Ψ and *f* quoted are considered valid for U-value(s) ***Wall<= 0.14 Ground Floor>= 0.06*** $W/m^2.K$, (allowance of ***+/- 20%***, following the present guidance from B. Anderson, BRE, correspondence dated 24/02/2012, for the UK market). The use of different claddings may affect the U-value slightly, but will have no material impact on the calculated values used here, in this case.
3. In dwellings, UK regulations stipulate that a temperature factor, *f*, that is >0.75 would avoid the risk of mould growth.
   For other nations, jurisdictions and climates, please consult the local building regulations that apply for avoiding mould and condensation.
   (For example, typical requirements may be: Netherlands: 0.65; Switzerland: 0.75; Belgium: 0.7; Germany: 0.7; Finland: 0.87. *French, German and other standards often do not indicate a single number for acceptable risk, but are dependent on circumstances.*)
4. Calculations have been performed in accordance with:
   - **EN ISO 10211_2007** *(British Standards)*
   - **IP 1/06** & **BR497** *(BRE Press)*

   and with reference to the following publications:
   EN ISO 6946 *(British Standards)*
   BR443 *(BRE Press)*

Windows	2013 Part L1A minima	2016 ballanced FEES	Hurstpierpoint Code 6 house	Passivhaus Standard
Windows W/m²K	1.60	1.20	1.20 / 0.90	0.85
Wall W/m²K	0.30	0.15	0.10	0.15
Roof W/m²K	0.20	0.13	0.10	0.15
Ground Floor W/m²K	0.25	0.13	0.09	0.15
Air Permiability m²/hr/m² @ 50 Pa	10	5	2	1
Thermal Bridge W/m²K	0.08	0.05	0.05	0.01
Space Heating kWh/m²/yr	120	46	39	15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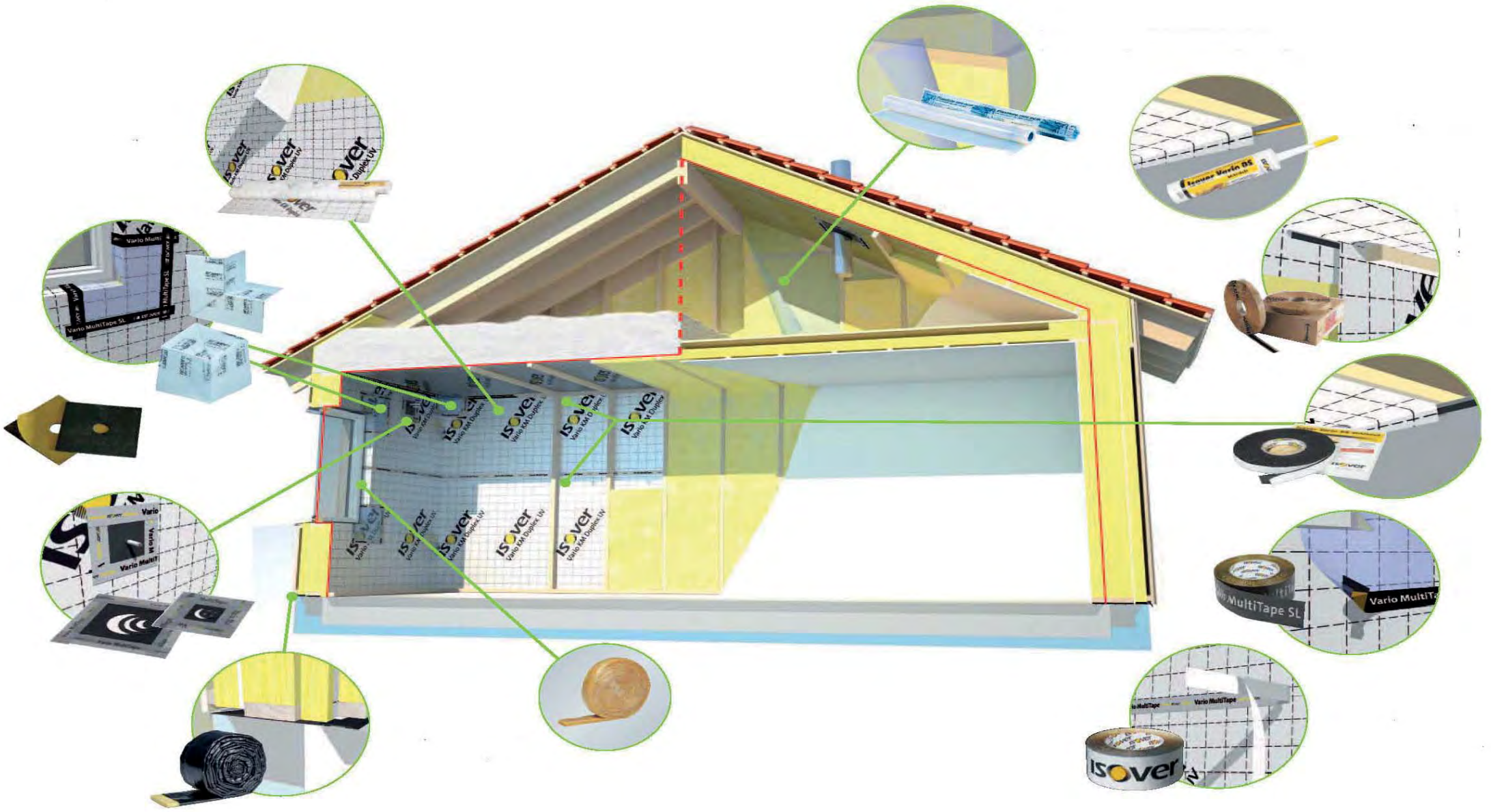
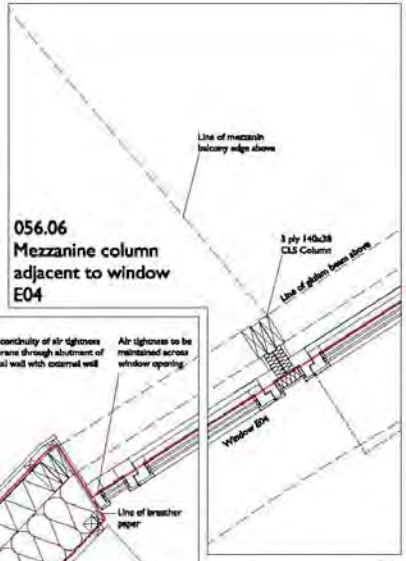
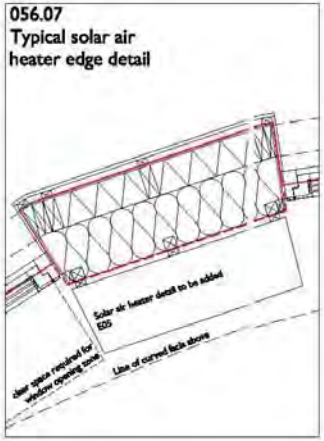
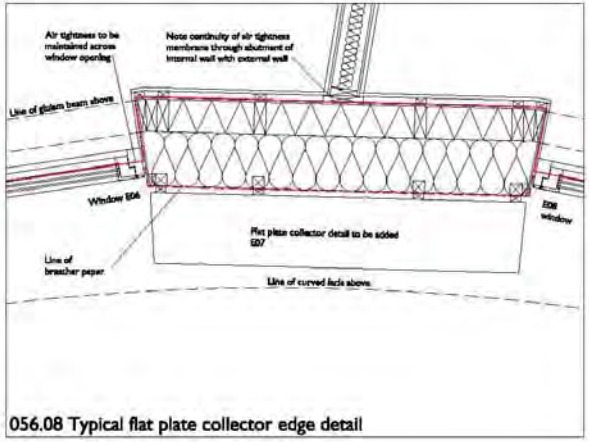

Vario MultiTape SL
Vario MultiTape SL
Vario MultiTape
isover



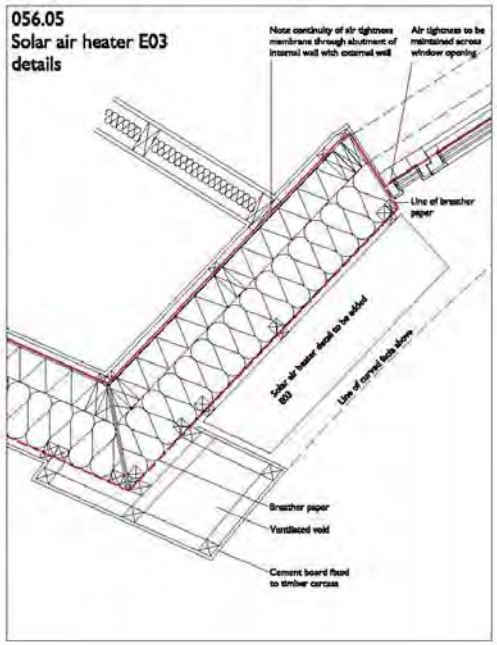
056.06
Mezzanine column adjacent to window E04



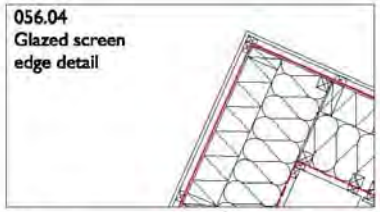
056.07
Typical solar air heater edge detail



056.08 Typical flat plate collector edge detail



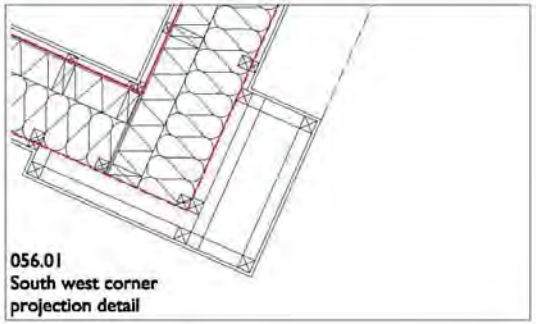
056.05
Solar air heater E03 details



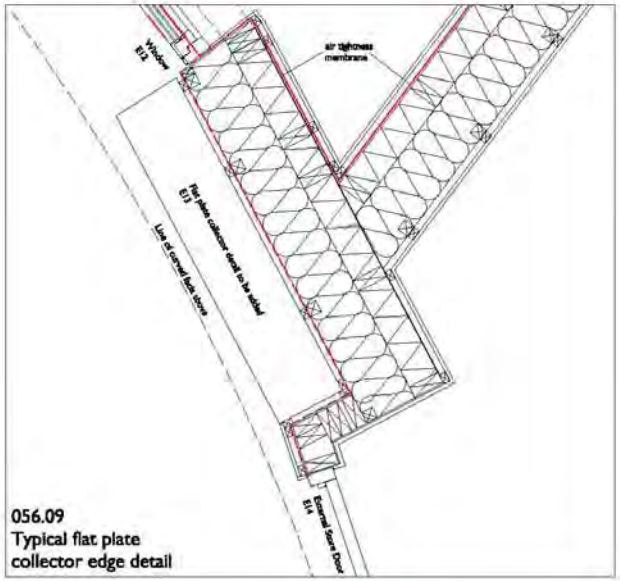
056.04
Glazed screen edge detail

056.03
Glazed screen edge detail

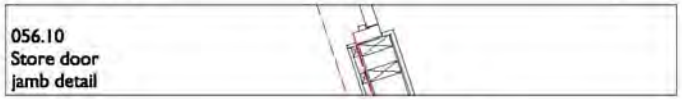
056.02
Typical window jamb detail



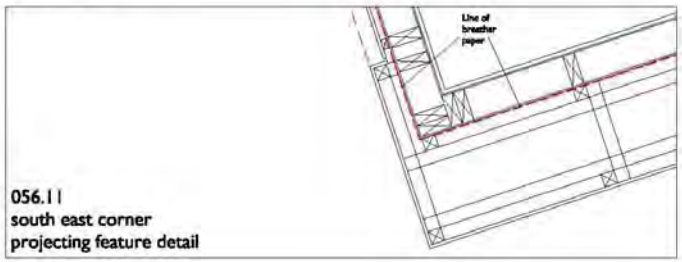
056.01
South west corner projection detail



056.09
Typical flat plate collector edge detail



056.10
Store door jamb detail



056.11
south east corner projecting feature detail

Scale in Meters
0 0.5 1

Note:

See drawings 06547/CD/051 and 052 for sectional details through the south facade.

PRELIMINARY

revision	date	description	dwn	chkd

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LCE architects is subsidiary of LCE holdings Ltd ISO 9001:2008 certified

project
The Pump House
Hurstpierpoint

scale
1:10@A1
1:20@A3

date
30.10.13

client
Cleland & Sharada
Laidlay

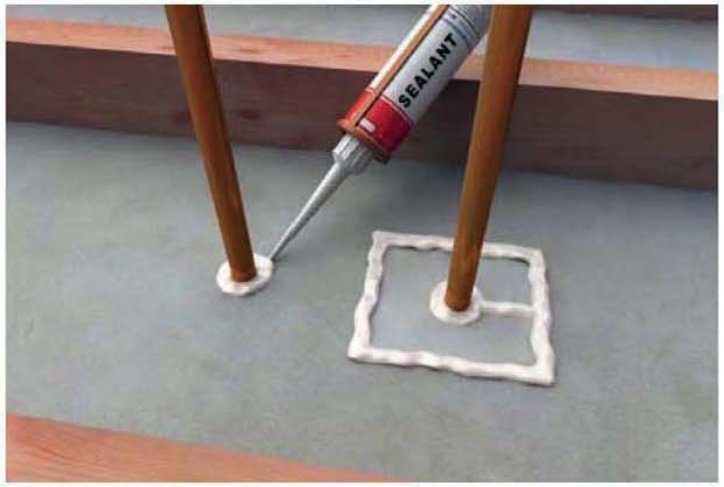
drawn
JF

checked
AW

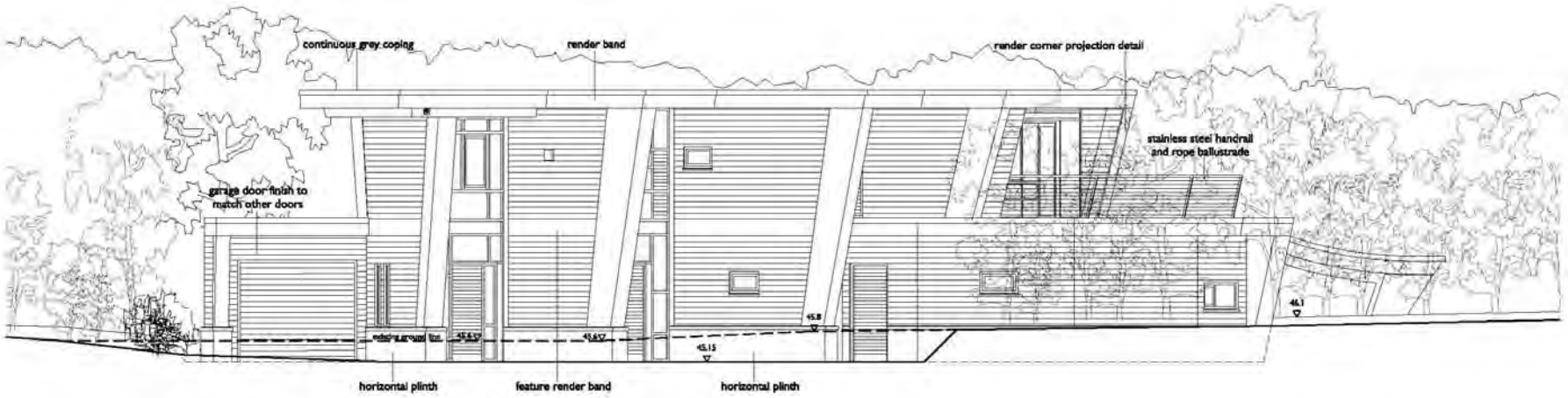
drawing
Details Plan Ground Floor
South Side

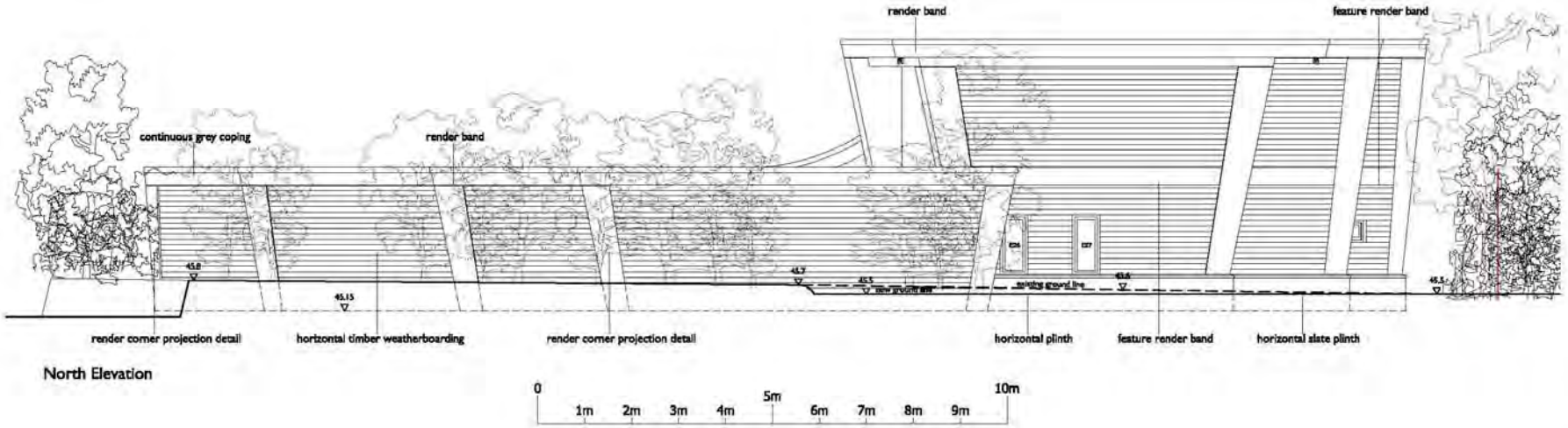
drawing number
06547/CD/046

revision
-


SEALANT


The Larch House
Ty Llarwydd





North Elevation

0 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

PRELIMINARY

revision	date	description	dwn	chkd

LCE architects UK
design management consultancy

164-165 Western Road Brighton BN1 2BB
T 01273 208710 F 01273 208601 E info@LCEarch.com W LCEarch.com
LCE architects is subsidiary of LCE holdings Ltd ISO 9001:2008 certified

project
The Pump House
Hurstpierpoint

scale
1:50@A1
1:100@A3

date
13.03.13

client
Cleland & Sharada
Laidlay

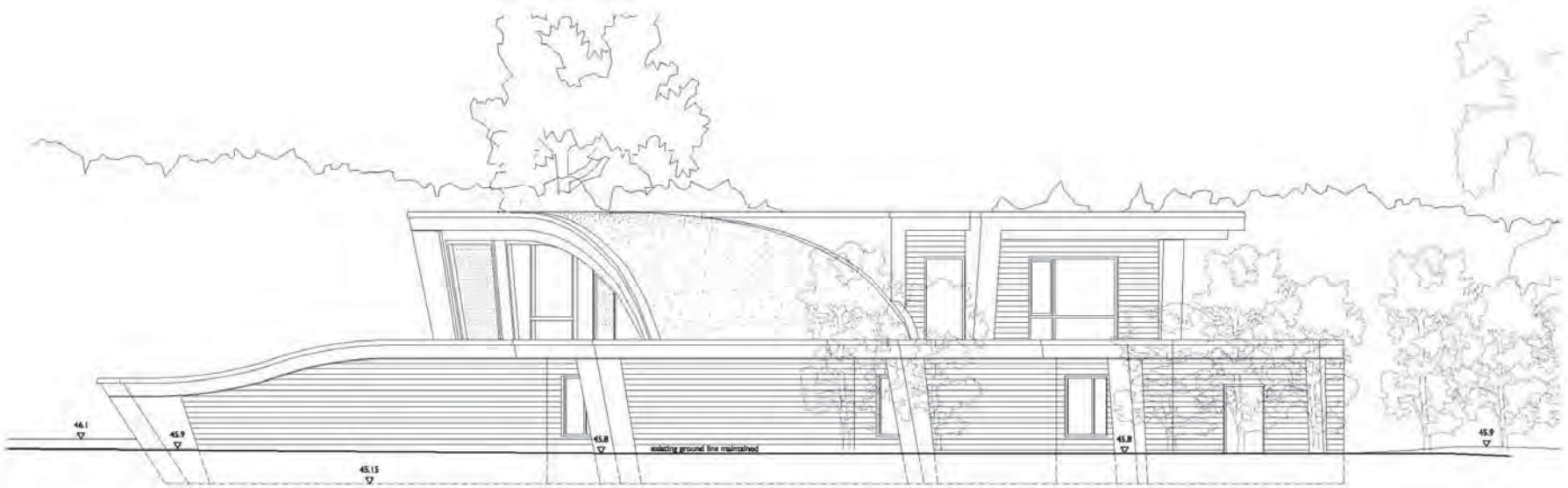
drawn
ihw

checked
AW

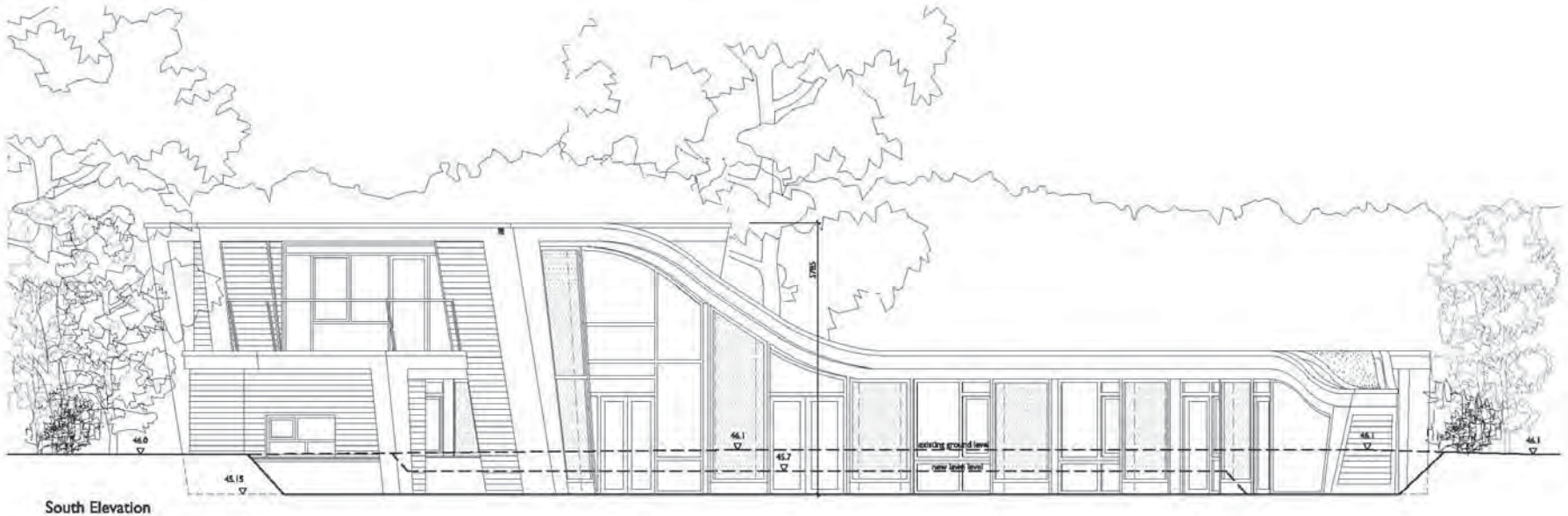
drawing
Elevations
North and West

drawing number
06547/CD/30

revision
-



East Elevation



South Elevation

0 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

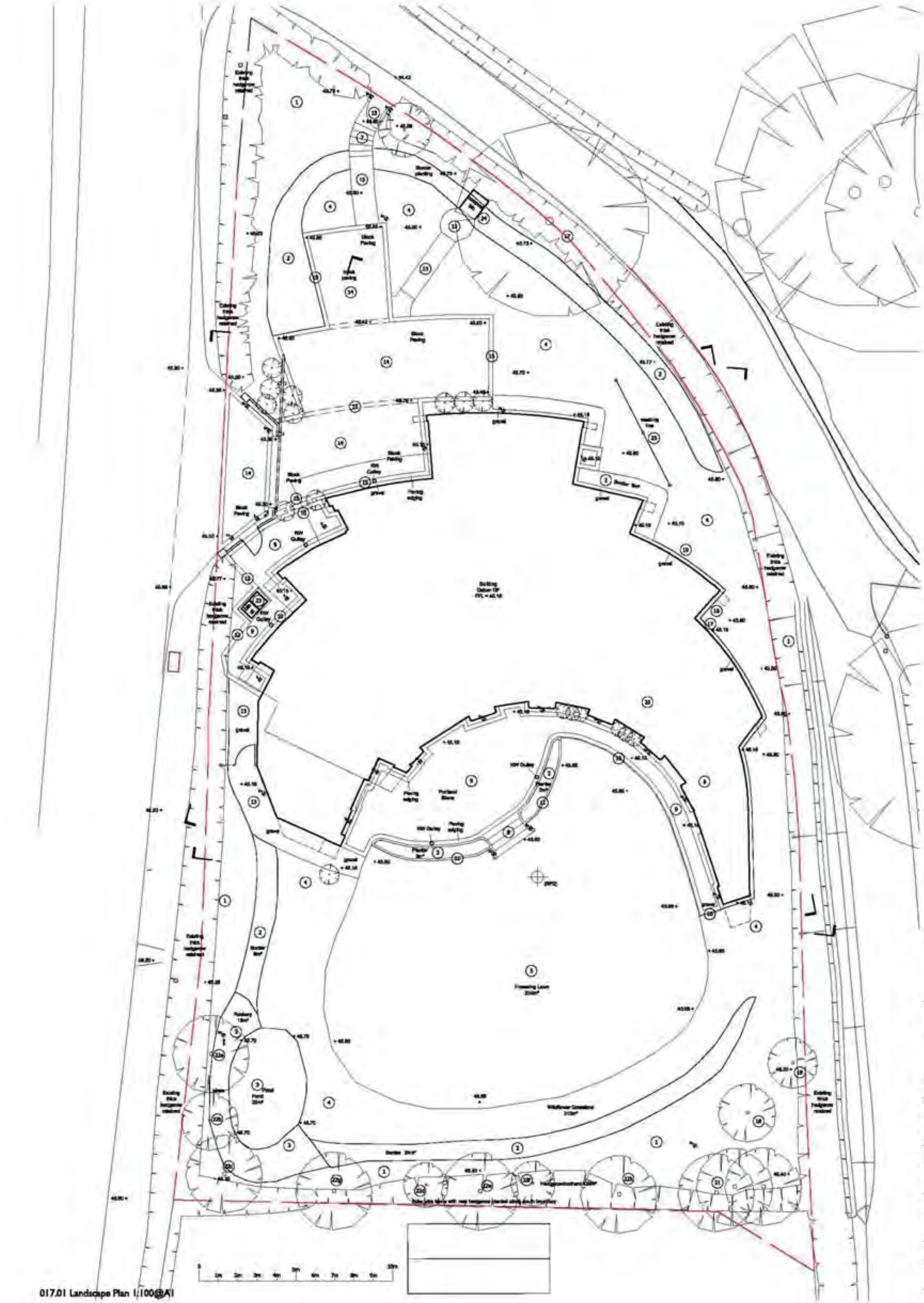
PRELIMINARY

revision	date	description	dwn	chkd

LCE architects UK
design management consultancy

164-165 Western Road Brighton BN1 2BB
T 01273 208710 F 01273 208601 E info@LCEarch.com W LCEarch.com
LCE architects is subsidiary of LCE Holdings Ltd ISO 9001:2008 certified

project: The Pump House Hurstpierpoint	scale: 1:50@A1 1:100@A3
	date: 13.03.13
client: Cleland & Sharada Laidlay	drawn: BW
	checked: AW
drawing: Elevations South and East	
drawing number: 06547/CD/031	revision: -



017.01 Landscape Plan 1:100@A1

KEY

1. Orchard/hedgerow (see note i.)
2. Herbaceous/medicinal borders & Herb planter (see note i.)
3. Pond and rockery (see note i.)
4. Wildflower grassland (see note i.)
5. Flowering lawn (see note i.)
6. Green roof (see note i.)
7. Block paved steps
8. Paved garden steps
9. Paved area
10. Paved edging
11. Stone planter
12. Retaining wall
13. Bonded gravel path
14. Block paving
15. Edging / feature wall
16. Bird boxes (House Martins)
17. Bird boxes (Robins, Tits)
18. Re-location of trees
19. Bat box
20. Bumble-bee house
21. Existing trees retained
22. New tree
22a Acer palmatum var. dissectum 'Seiryu' (Japanese Maple) height 4m
22b Quercus rubra (Oak) height 12m
22c Prunus sargentii (Sargent's Cherry) height 12m
22d Euonymus europaeus (Red Cascade) height 4m
22e Fagus sylvatica (Beech) height 12m
22f Cornus kousa var chinensis (Dogwood) height 7m
22g Acer rubrum (Maple) height 20m
22h Quercus coccinea (Oak) height 20m
23. Bin Store (see note ii. below)
24. Home Composting (see note iii. below)
25. External clothes line

External light
Security light
CCTV / Intercom Panel
Double Power Socket.

Notes:

(i.) Planting to be as set out in Appendix 6 and 7 of EcoCensus Ecology Report. Sowing/planting to take place in accordance with the table below (which also shows the page numbers within the report where seed mix lists + sowing and growing instructions are located)

Planting category	Planting schedule appendix 6	Sowing and growing guide appendix 7	Planting season
1. Orchard/hedgerow	[illegible]	[illegible]	October 2014
2. Herbaceous/ medicinal borders & Herb planter	[illegible]	[illegible]	March 2015
3. Pond and rockery	[illegible]	[illegible]	August 2014
4. Wildflower grassland	[illegible]	[illegible]	October 2014
5. Flowering lawn	[illegible]	[illegible]	October 2014
6. Green roof	[illegible]	[illegible]	October 2014

(ii.) Bin Store - 3No wheelie bins as per local authority collections scheme (1No rubbish, 1No unsorted recycling) collected fortnightly each 240litres (1070high x 580 wide x 740 deep). See 06547 CD010 for internal bins.

(iii.) Home Composting Facilities - Min 330litre specifically designed composting container with lid, sited in accordance with manufacturers instructions.

PRELIMINARY

revision	date	description	dwn	chkd
C	10.01.14	Trees amended and front gate design amended	aw	
B	07.01.14	Trees amended and front gate design amended	aw	
A	03.01.14	Tree species added and front gate design amended	aw	

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project: The Pump House Hurstpierpoint
scale: as shown
date: 10.01.08
client: Cleland & Sharada Laidlay
drawn: CL
checked: AW
drawing: Landscape Plan
drawing number: 06547/CD/006
revision: C

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What does carbon zero mean?

Definition of Zero: the mathematical symbol **0** denotes the absence of all magnitude or quantity

0 carbon refers to **0** carbon dioxide emissions.

- To comply across **all** sectors: all industrial sources of CO_2 must be converted to run on zero carbon emitting energies.
- Scientific reality: if any industrial pollution CO_2 is added to the atmosphere stabilisation of atmospheric CO_2 cannot happen.
- The **end** of the fossil fuel energy era: all fossil fuel energy must be replaced by 100% non polluting renewable energy.

The changing definitions of carbon zero

Since **2006,** the government has been gradually tightening Building Regulations Part L with the objective to achieve zero carbon homes by **2016.**

Originally “Zero Carbon Home” was defined as one with no carbon emissions.

In **2011** government relaxed this definition by extracting **“unregulated energy”**

Between **2012** & **2014** government started examining “cost effective” ways of meeting proposed **2016** standards.

In parallel with Building Regulations, a new standard **“Code for Sustainable Homes”** was launched in December **2006**

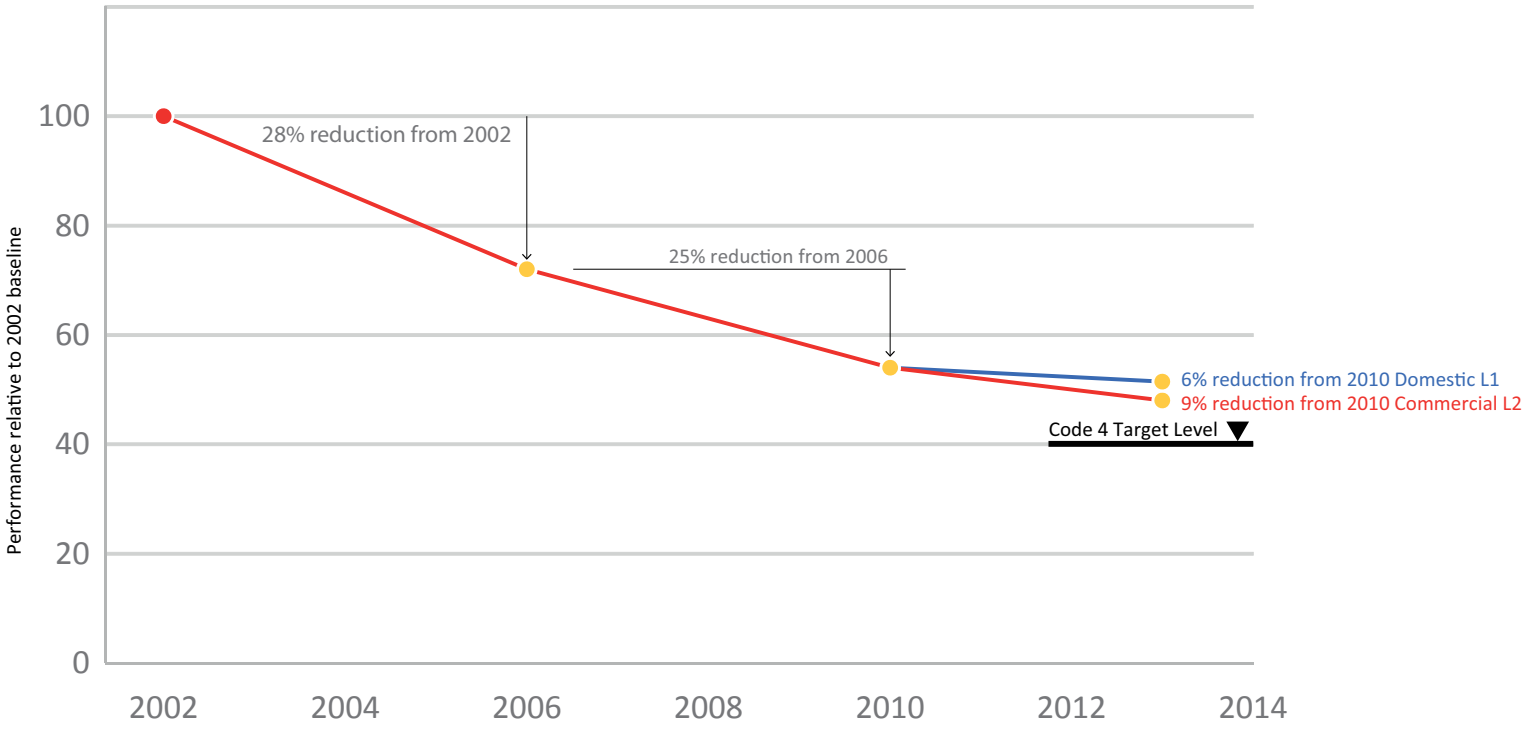
The changing definitions of carbon zero

Code Level	Current energy standard (Percentage improvement over 2006 Part L)	When change to regulations should take place	Comment
1	10%		-
2	18%		-
3	25%	2010	25% (on schedule)
4	44%	2013	6% (Code 4 delayed to 2016)
5	100% regulated emissions		70% onsite +30% allowable solutions (unregulated energy omitted)
6	zero carbon onsite - 100% onsite plus appliances (equivalent to approximately 150% in total)	2016	“Zero Carbon Home” -70% onsite + allowable solutions to reach zero carbon

Where are we now?

Changes to Part L 2013

- Introduction of Fabric Efficiency Standards (FEES)
- 6% Domestic improvements to Part L1
- 9% Commercial improvements to Part L2
- Not reached target of Code 4



Where are we now?

9% Commercial improvements to Part L2 is actually an aggregated figure across building types

Building Type	Target Reduction for Notional Building over 2010
Distribution warehouse	4%
Deep plan office AC	12%
Retail warehouse	8%
Shallow plan office AC	13%
Hotel	12%
School	9%
Small warehouse	3%

Unregulated Energy

Included

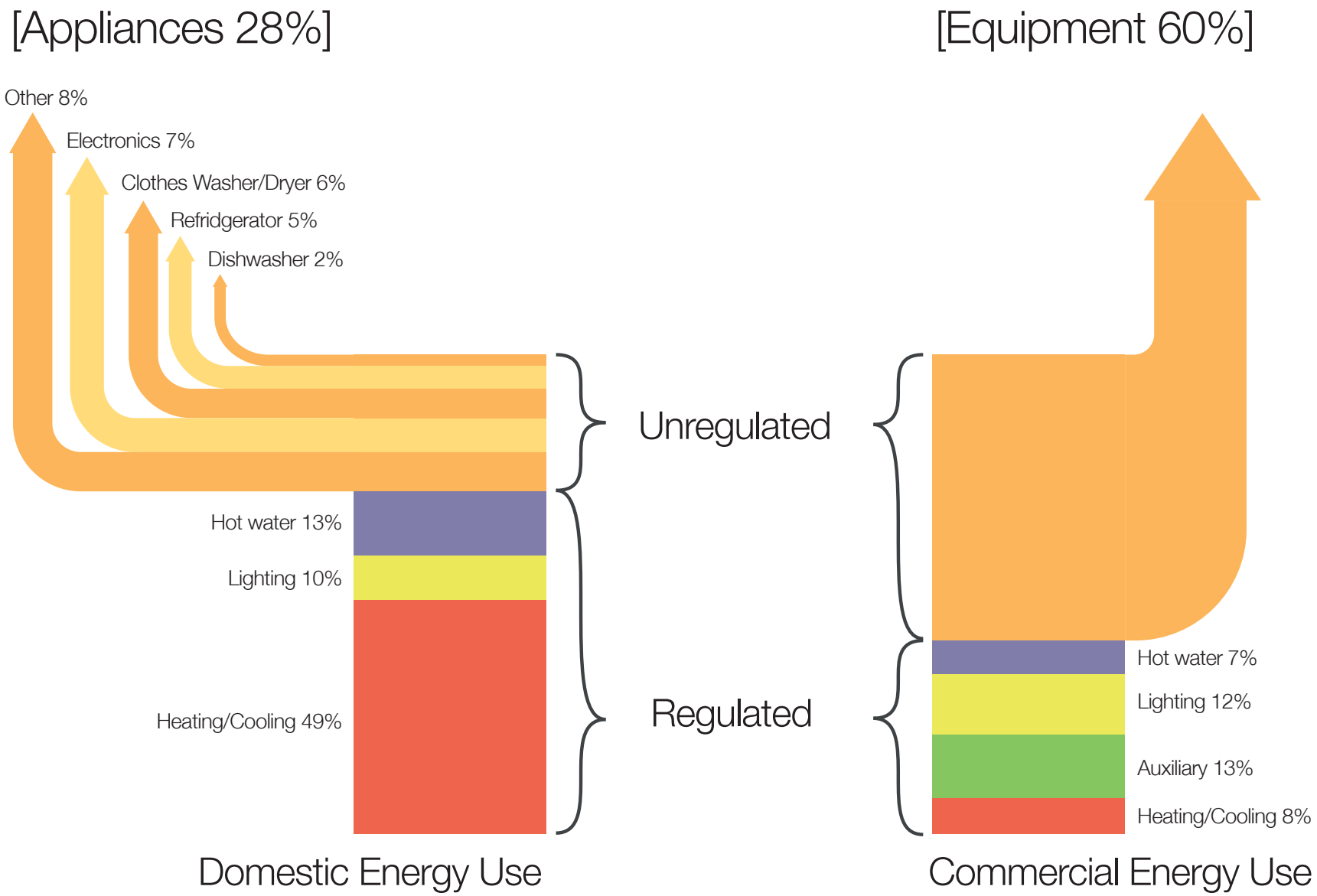
Regulated electricity: space heating, hot water, lighting and ventilation

Excluded

Unregulated electricity: appliances including cooking equipment

	Annual carbon emission
2010 Part L home	4.0 tonnes per year
Genuine carbon zero home	0.0 tonnes per year
Remove need for unregulated electricity	+1.7 tonnes

Unregulated Energy



2016, FEES and Carbon Compliance

Infrastructure Bill June 2014 sets “zero-carbon” home standard at Level 5 of the Code for Sustainable Homes, but permitting developers to build to Level 4 by using **allowable solutions** to achieve Level 5.

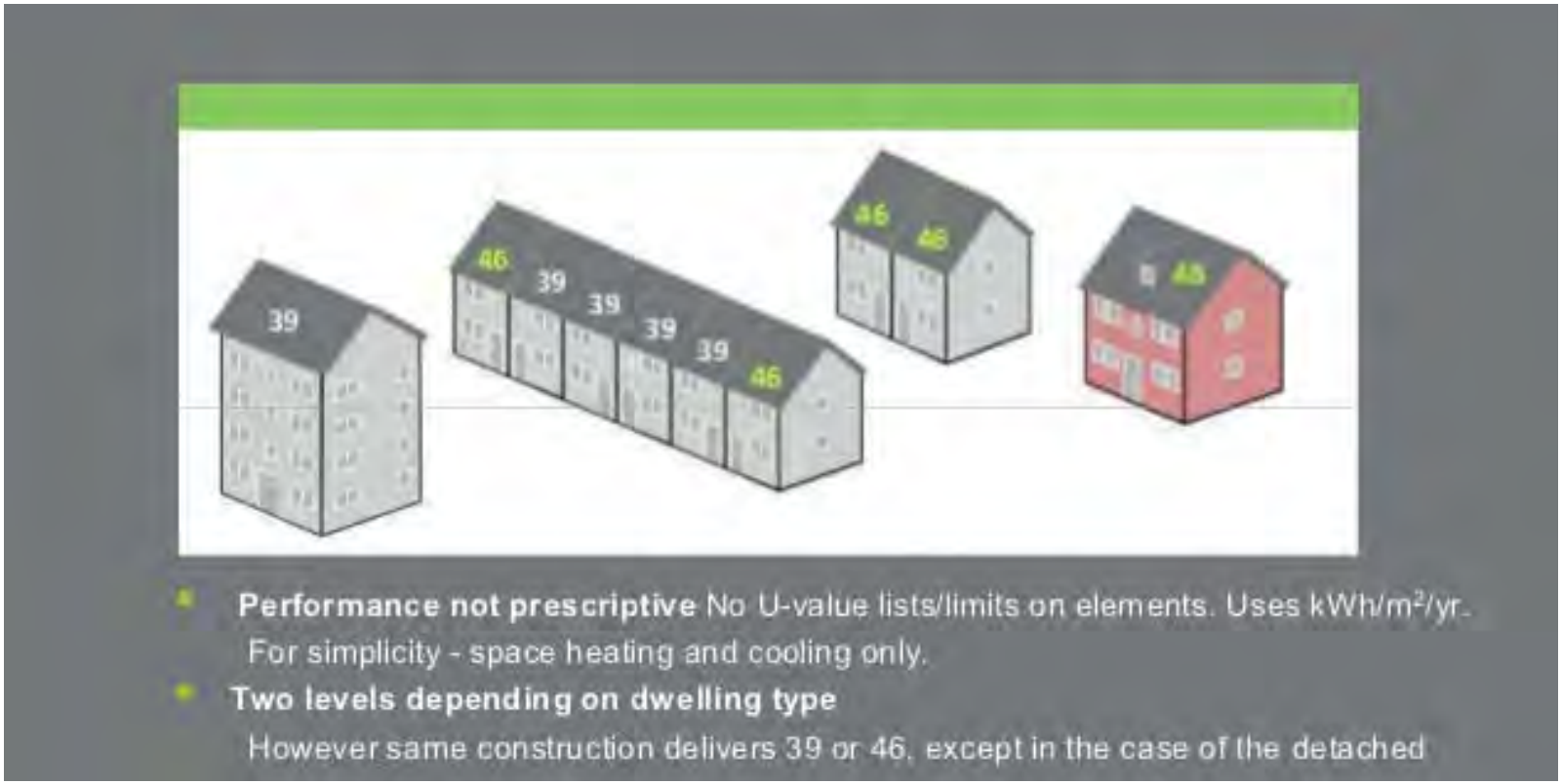
So current definition of “zero carbon” home where CO2 emissions from regulated energy use are limited or mitigated by a combination of three factors:

1. on-site energy efficiency measures (insulation/low energy heating systems)
2. on-site zero carbon technologies (solar panels)
3. off-site measures to deal with any remaining emissions

2016, FEES and Carbon Compliance

1. Achieving minimum **Fabric Energy Efficiency Standards (FEES)** based on space heating and cooling:

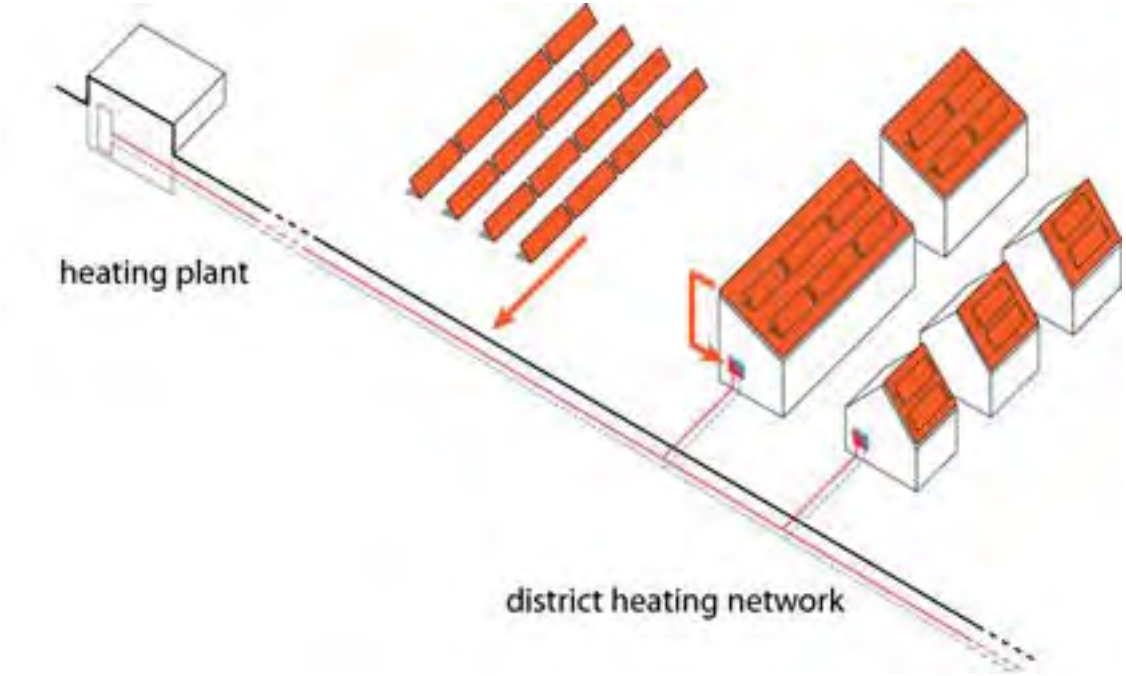
   39 kWh/m^2/year for apartments and mid-terraced houses.
   46 kWh/m^2/year for end of terrace, semi-detached and detached houses.



2016, FEES and Carbon Compliance

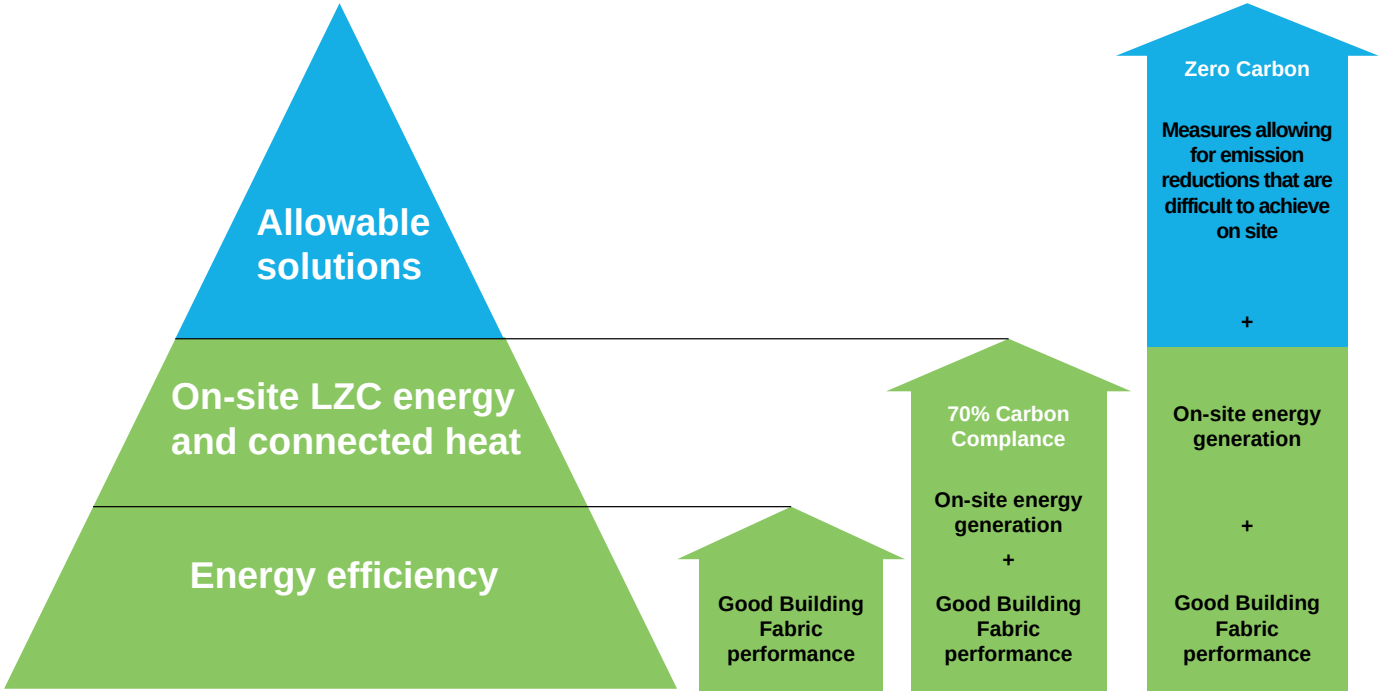
2. Using low and zero carbon technologies and connected heat networks to limit on site built emissions:

- 10 kg CO2(eq)/m^2/year for detached houses.
- 11 kg CO2(eq)/m^2/year for attached houses.
- 14 kg CO2(eq)/m^2/year for low-rise apartments.



2016, FEES and Carbon Compliance

3. Where not possible to reduce regulated CO2 emissions to zero using these on-site measures (1 & 2 above), remaining carbon emissions can be mitigated through **allowable off-site solutions**.



The Zero Carbon Hierarchy

Allowable Solutions

Still lacking in detail

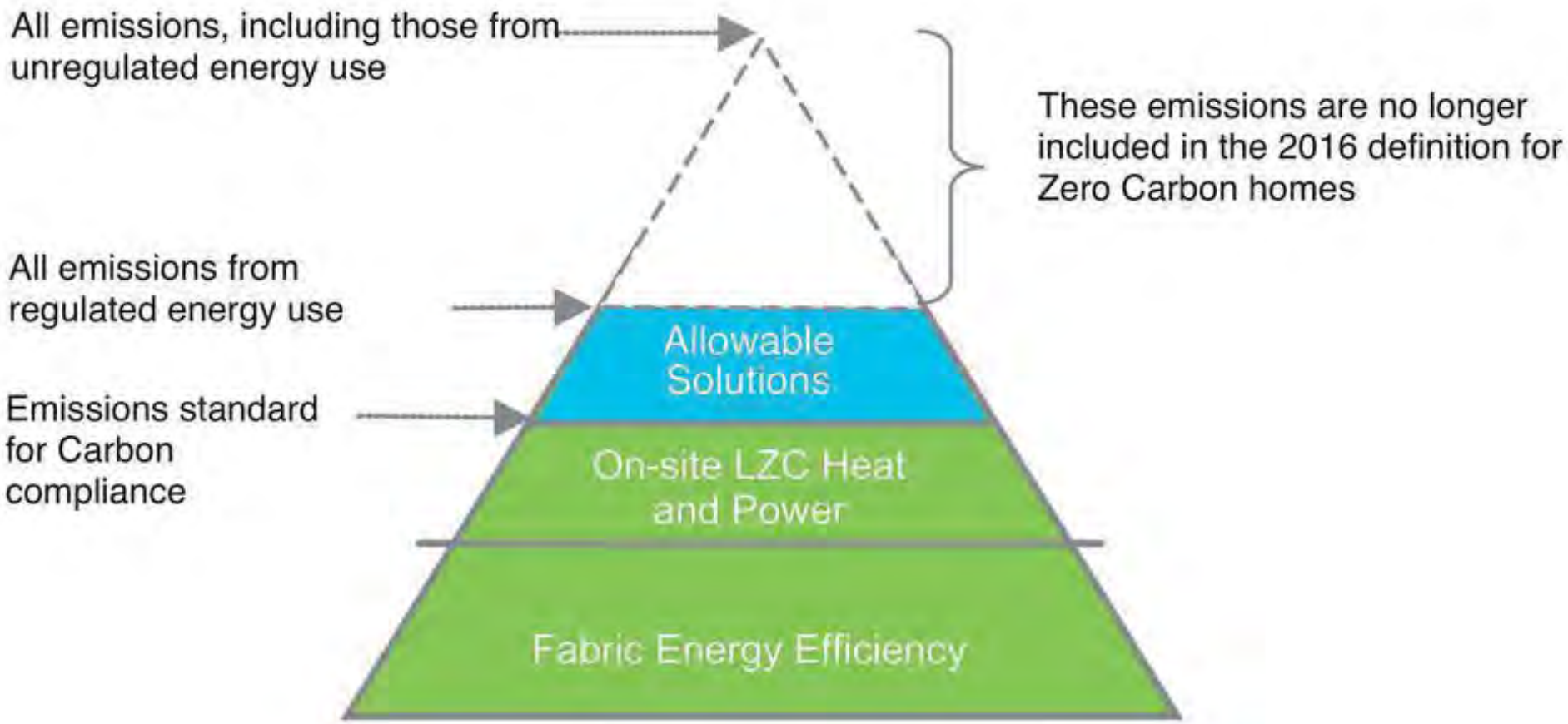
Small sites will be exempt – how small?

Potential Delivery Routes

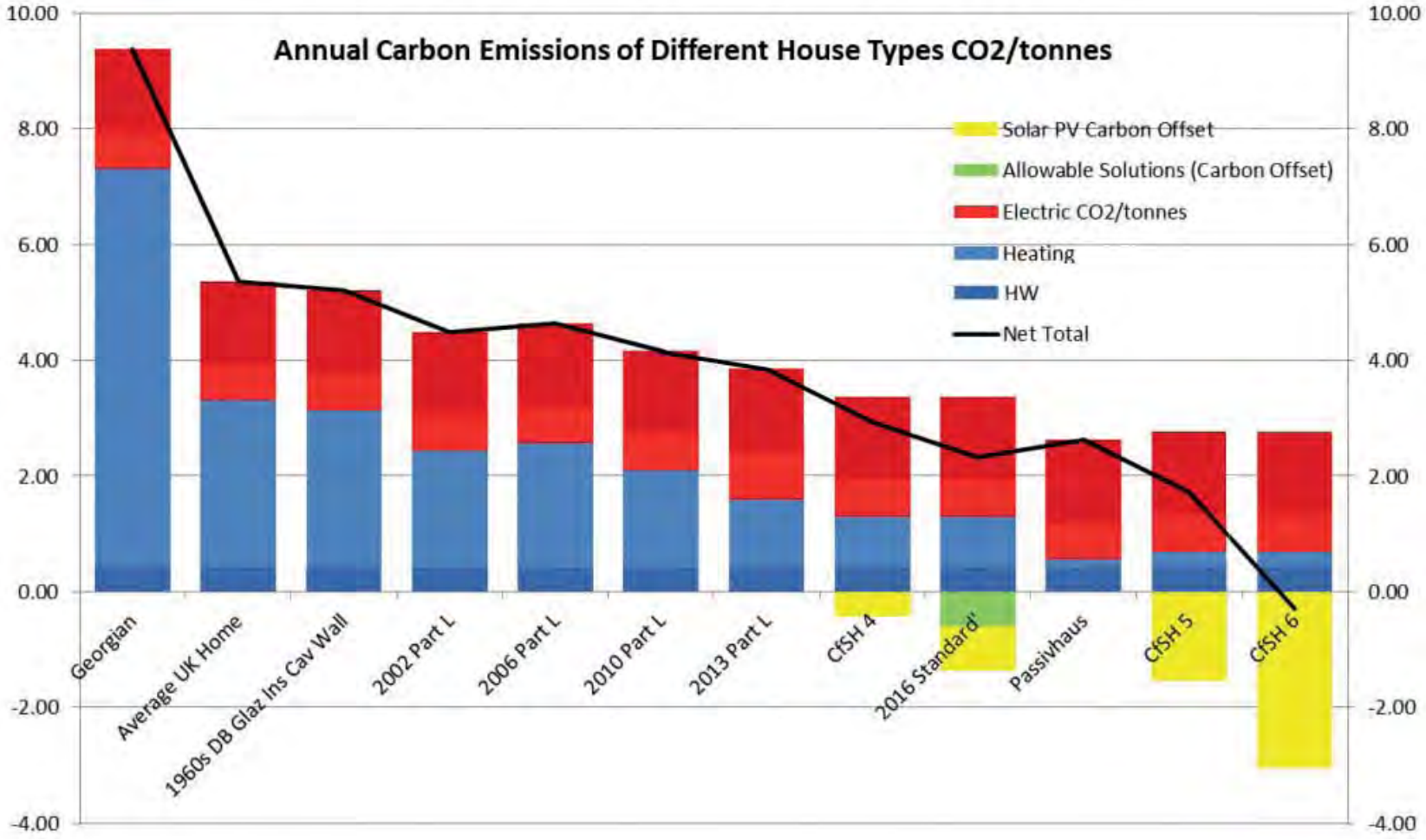
1. 100% on-site or connected measures
2. Developer free to choose and develop off-site actions
3. Contracting with third party Allowable Solutions provider
4. Payment to a fund investing in abatement projects

Currently no decision on price of carbon per tonne.

Allowable Solutions



Context: Performance of Different House Types



Impact of past and future standards for an average semi-detatched house of 92m^2

Context: Environmental and Economic Cost Benefits of Different House Types

House Type	Tonnes per year	Ave. Annual fuel bill
Georgian House	9.5	
Average UK House	5.6	£1,400
2010 Standards	4.0	
2013 Standards	3.5	£900
Anticipated 2016 standards	2.3	
Code level 5	1.7	£100
Code Level 6	0	

Postscript - The Code and new planning proposals

The current framework: “jumbled up mix of overlapping and contradicting policies and regulations”

Housing Standards Review seeks to resolve this:

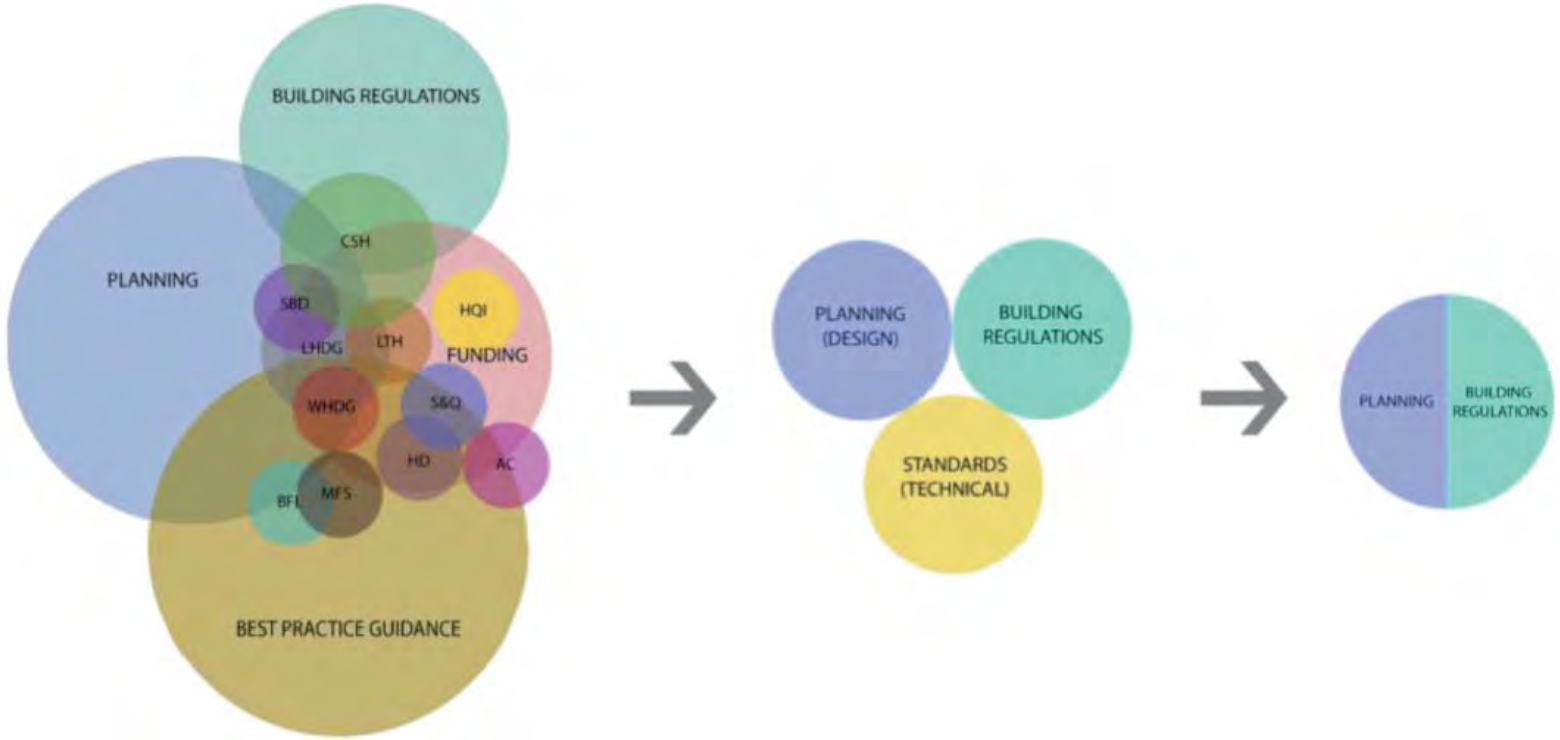
- reduce bureaucracy and costs
- reform and simplify the framework
- make the house building process easier to navigate
- reduce contradictions and overlaps
- allow local choice (“within sensible parameters”)

Postscript - The Code and new planning proposals

DCLG has laid out timeline:

Spring 2015: New regulations to be introduced in form of a planning statement.

After this, Code is wound down and Local Authorities (LAs) less able to enforce specific sustainability and energy requirements for planning



as now stage 1 stage 2

Postscript - The Code and new planning proposals

October 2015: New Approved Documents kick in, incorporating part of the Code as mandatory & additional.

LAs select and consolidate optional standards

October 2016: new Planning and Energy Act to target "zero carbon" for all developments
As it stands, only five sustainability categories carried over from current regulations:

- Energy
- Water
- Access
- Security
- Space

At the moment no other regulations or standards proposed. All other current sustainability criteria – such as ecology, material use and flood risk – will be removed.

Building Control will be responsible for ensuring sustainability measures are implemented on site.

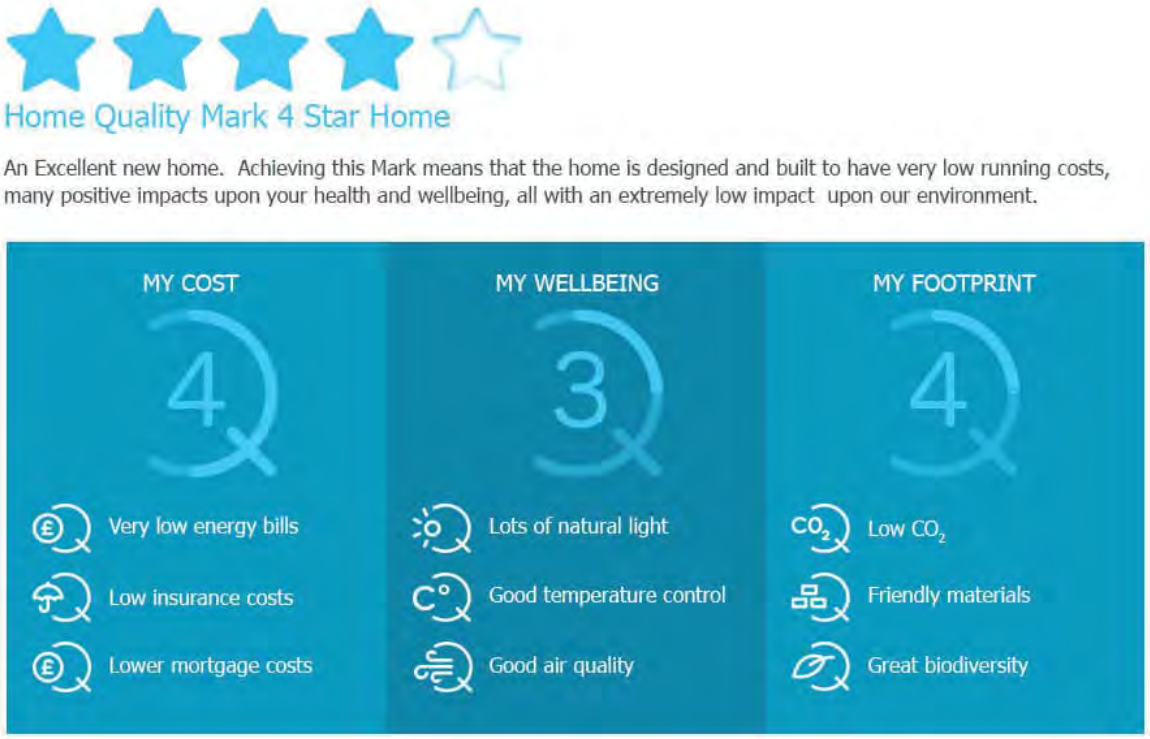
BRE and the Home Quality Mark

BRE has just launched (6th March 2015) their new voluntary code:

The Home Quality Mark

Critical issues identified as:

- resilience to adverse and extreme weather
- mental and physical health & wellbeing of occupants
- resource efficiency
- increased biodiversity
- low energy, water and maintenance costs
- improved connectivity

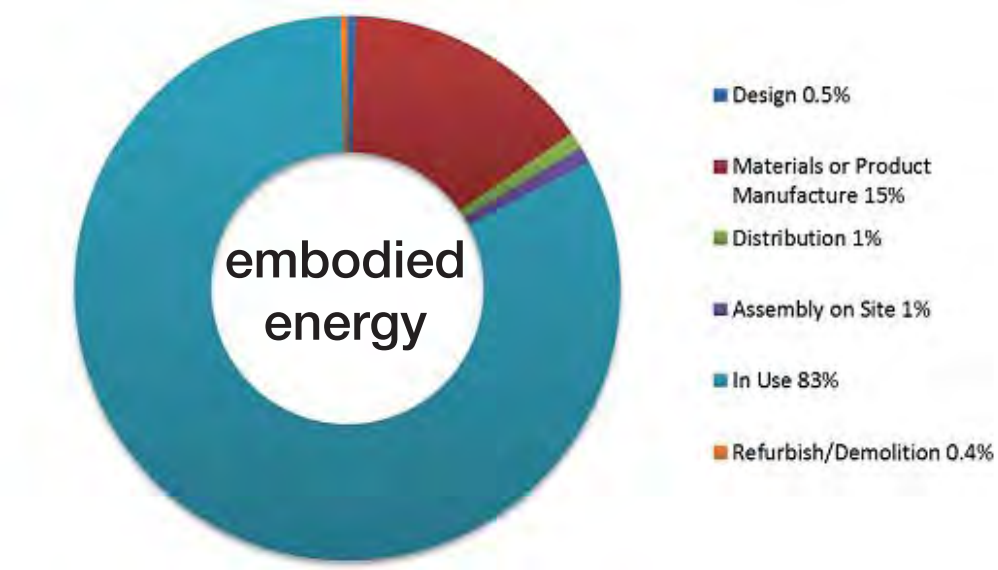


Concerns

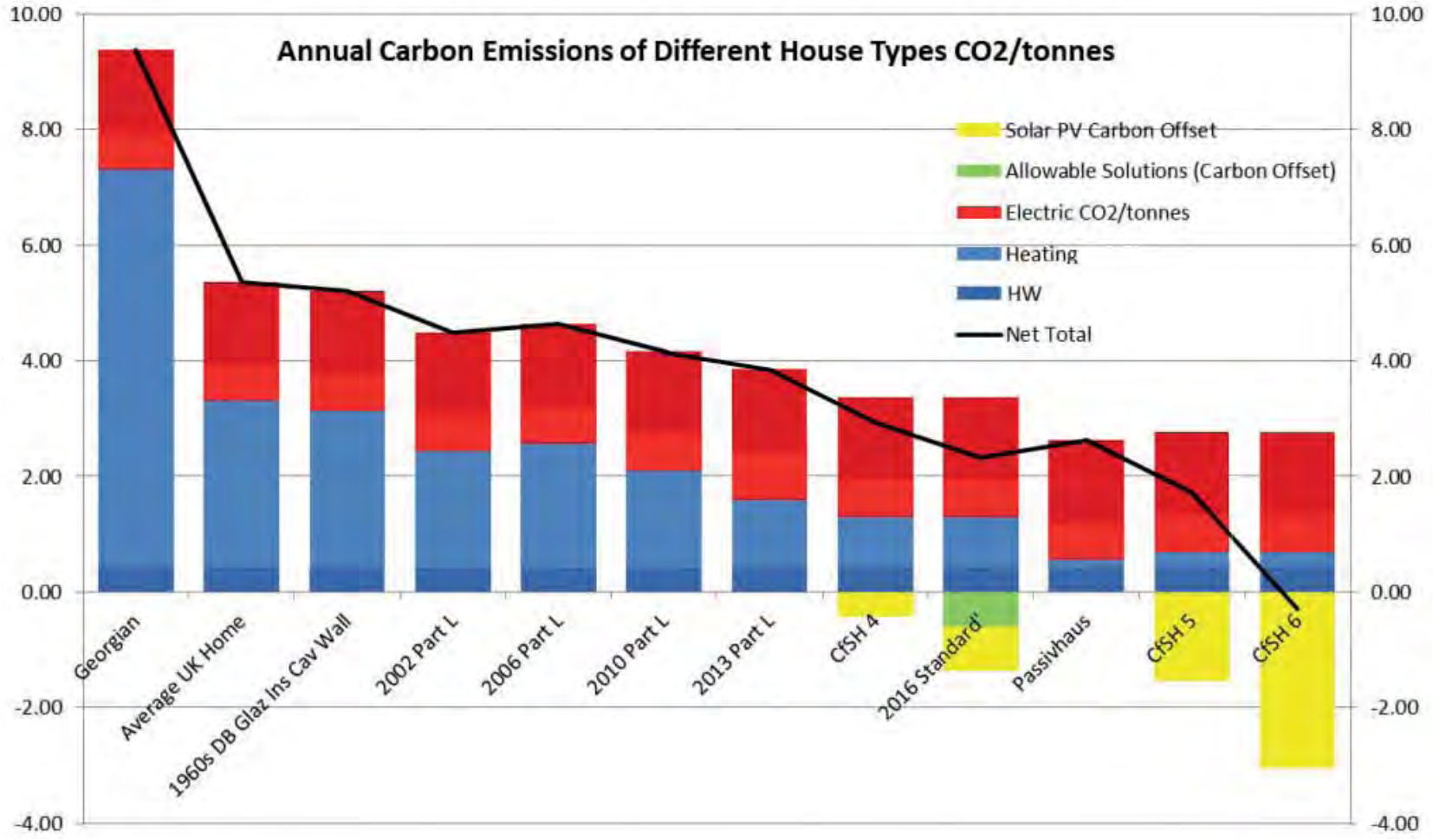
- Standards in no way reach carbon zero
- Having set carbon zero at such low level how do you improve moving toward 2020, 2050 etc; carbon zero +, carbon zero ++?
- Impact on global warming
- Standards further watered down before 2016.
- Separates design from carbon zero.
- Easy for Developers to adopt ‘allowable solutions’ rather than carbon compliance standards.
- Occupiers may find energy bills higher than expected from zero-carbon home (with inclusion of allowable solutions charges).

Concerns

- Current proposal to exclude small sites.
- No definition on size of “small” sites
- Does not take account of embodied energy.
- Not clear how long-term maintenance and future alterations to be regulated.
- What of measures to deal with predicted and actual energy performance.
- Is the time-frame for change realistic.



New homes account for 1% of total housing stock each year



Impact of past and future standards for an average semi-detatched house of 92m^2

The science for obtaining unlimited cheap clean energy from nuclear fusion is understood.
All we need is for mankind to invest enough money in the research to make it a reality.

However, we spend more in the west on pet grooming products than we do on research into nuclear fusion as a mass energy source.

One can’t help wondering if we have have our priorities right.

Thank you

LCE architects

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