Cost of Zero Carbon and the Performance Gap
&
Updates from Welsh Government

Mecure Holland House, Cardiff

Thursday 19th June 2014

ADEILADU ARBENIGRWYDD YNG NGHYMRU

CONSTRUCTING EXCELLENCE IN WALES

Grŵp Carbon Isel / Di-garbon Cymru
Wales Low / Zero Carbon Hub

Welcome

Emma Thomas

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Constructing Excellence in Wales

Llywodraeth Cymru
Welsh Government

www.cymru.gov.uk

Allowable Solutions for Wales?

Francois Samuel

Building Regulations

17th June 2014

Cardiff

Background

- 2012 Part L consultation proposals recognised zero emissions on site may be not be practical

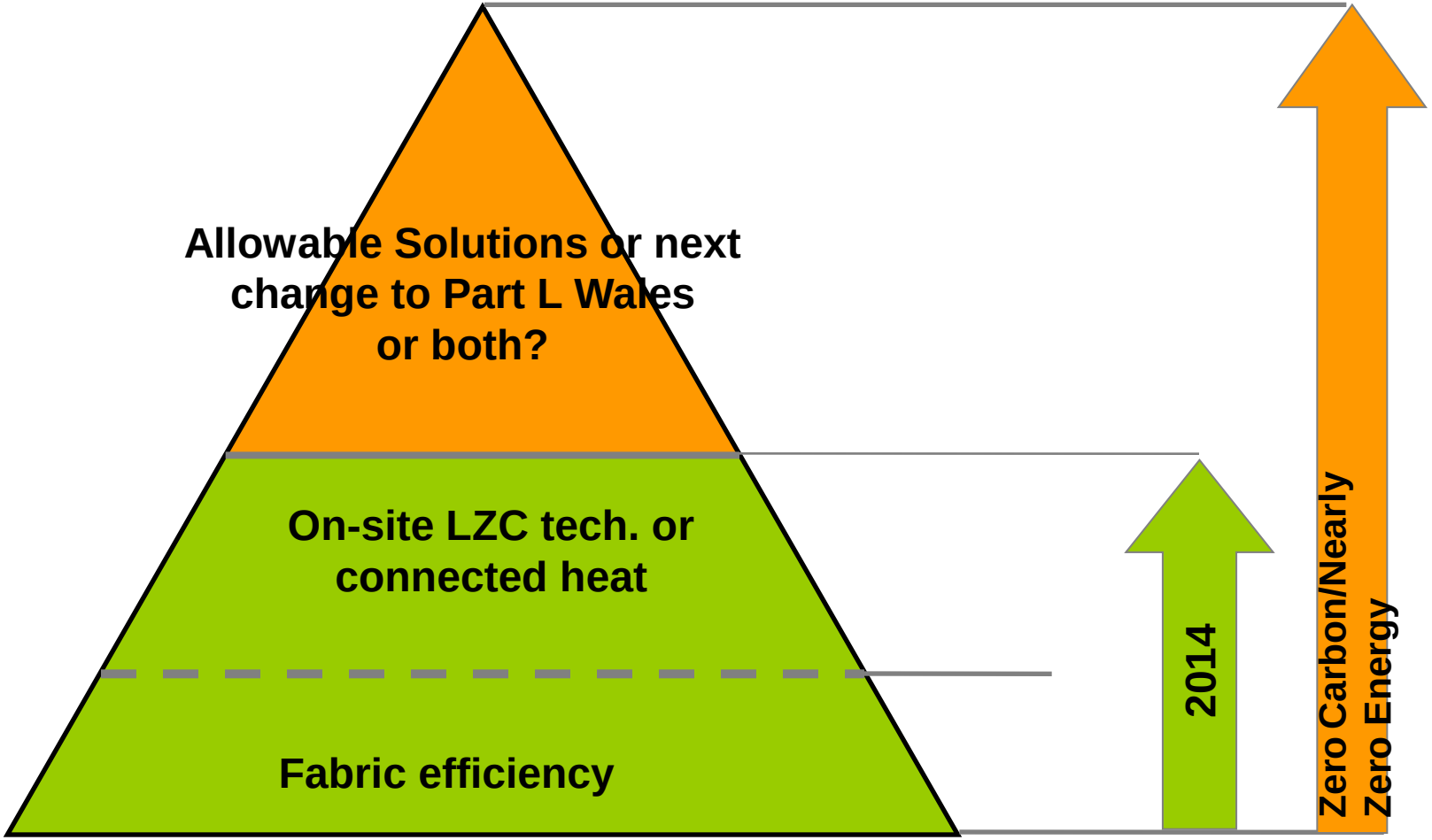
- No specific zero carbon target but an aspiration and a contribution to the 3% annual reduction target

- WG Commitment to further review of Part L 2016

- Welsh interest in Allowable Solutions but what do they mean?

- DCLG 2013 consultation

Zero Carbon/Nearly Zero Energy



Queen’s speech

- Infrastructure Bill to amend the Building Act 1984
- England’s next target Code 4
- Creates powers, the details go in Building Regulations
- If Wales had powers implementation would be down to WG
- Discussing with DCLG

Code 4?

- WG consulted on Code 4 as the 25% improvement on 2010 option (44% on 2006)

- Not as cost effective in NPV terms as 40% due to natural ventilation base+renewables

- AIMC4 project – Code 4 with no renewables but some additional technology - could this be mainstreamed from 2016?

- What role renewables?

DCLG 2013 consultation proposals

Principles:

- Housebuilder choice and flexibility in how residual emissions are met
- Consistent with functional requirement nature of Bregs
- AS should be cost effective and administration overheads minimised

DCLG 2013 consultation proposals

Menu of choices:

1. Undertaking 100% of carbon abatement on site or through connected measures (*e.g.* a heat network);

2. Meeting the residual emissions requirement themselves through off-site carbon abatement actions – the ‘do-it-yourself’ e.g. improving other existing buildings (*e.g.* retrofit installations), renewable heat or energy schemes

3. Contracting with a third party Allowable Solutions private/public sector provider for them to deliver carbon abatement measures sufficient to meet the house builders’ obligations.

DCLG 2013 consultation proposals

4. Making a payment to a fund which invests in projects which will deliver carbon abatement on their behalf. The payment would be based on a fixed price which would be subject to periodic review.

DCLG 2013 consultation proposals

Under option 3 three potential models for third parties to provide Allowable Solutions projects or measures for house builders have been identified:

a) a direct transaction with a third party (bilateral arrangement);
b) contracting through a simple register/matching service; or
c) contracting through a brokerage service.

DCLG 2013 consultation proposals

- Price ceiling for options 3 and 4 (£30,60,90/tonne)

- Questions:
  - Traded/non traded sectors?
  - Built environment only?
  - Spacial limitations – UK, England, locality?

DCLG proposals

complementarity. Not displace projects supported separately by other government programmes, double subsidy;

market additionality. Projects or measures would be those which would not otherwise have been brought forward by the market because of delivery barriers. This recognises that there is a deadweight risk;

• **cost effectiveness.** This would be achieved by setting a ceiling price *i.e.* a house builder would not need to pay above this price. Competition would operate to deliver Allowable Solutions projects and measures below this price;

DCLG 2013 consultation proposals

- **carbon impacts**. Allowable Solutions measures would need to be capable of delivering verifiable carbon savings at a cost effective price; and

- **spatial criteria.** Allowable Solution projects should be demonstrably of benefit to the citizens of the United Kingdom, and Allowable Solutions projects should take place in the United Kingdom.

What does this mean for Wales?

If we are to have an offsetting mechanism in Wales it will be more efficient to be part of a wider scheme but:

- Would a flexible system of housebuilder choice suit our needs – welsh payments spent in England but swings and roundabouts? English payments spent in Wales – synergy with Eco?
- Are the scheme options – English, Welsh , a Hybrid?
- Is this the end of on-site improvement?
- Very early days

And what about Nearly Zero Energy Buildings?

- No agreed definition yet
- How would cost optimality affect targets, would on site standards deliver NZEB, deliver residual energy largely from renewable sources?
- ZCH/NZEB comparison

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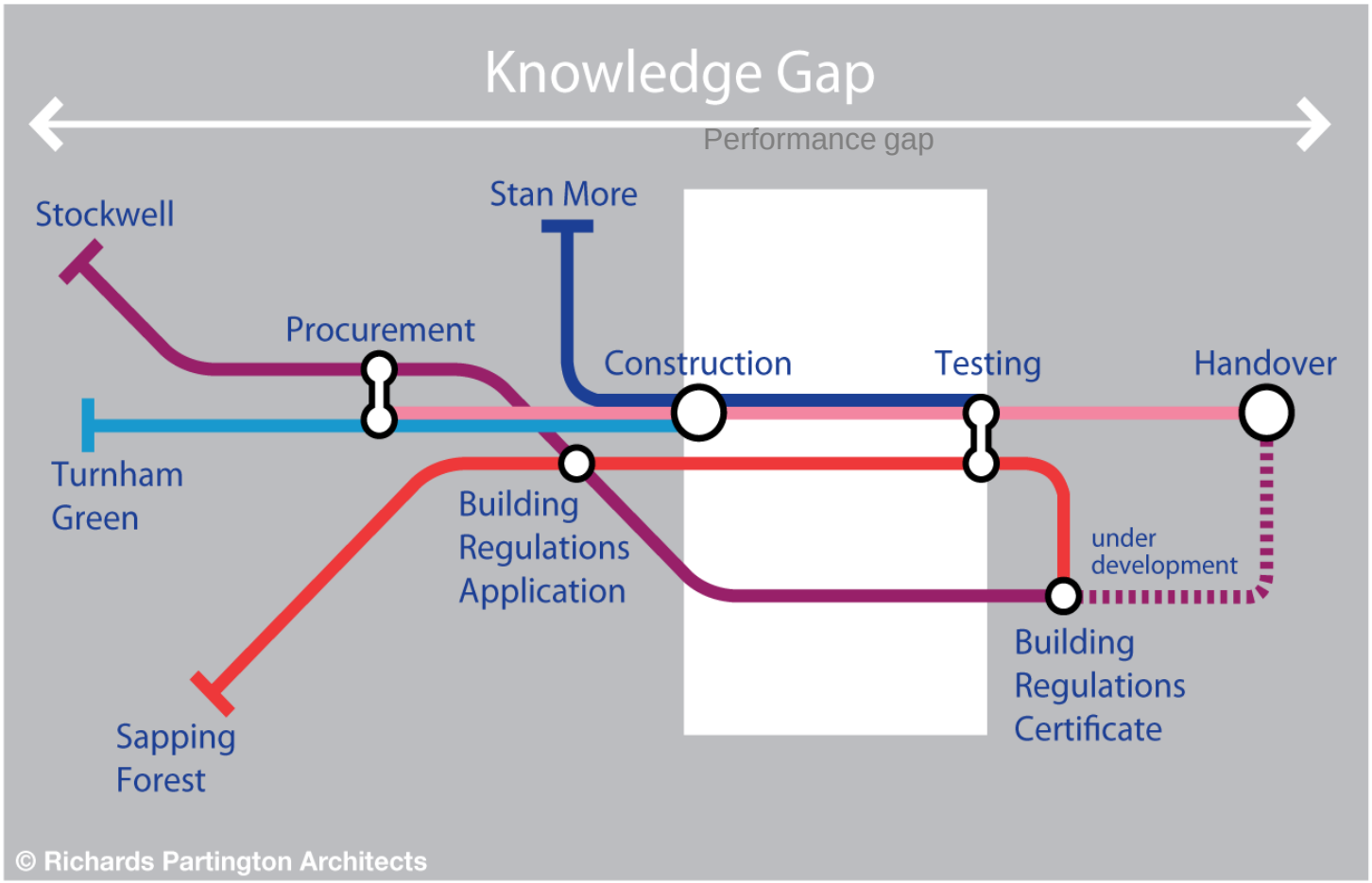
PERFORMANCE GAP: INITIAL FINDINGS AND RECOMMENDATIONS

Rob Pannell
June 2014

ZERO CARBON HUB

Mending the gap by 2020



Key to lines

- Designers
- SAP Assessor
- Manufacturer's Information
- Sub Contractor Design
- House Builder

Overview

- Introduction to the issues
- Why this is important to industry
- Current ZCH project
- Indications for the future

Background & Evidence

Evidence assembled for CC4TNH

Measured v Predicted whole-house fabric performance

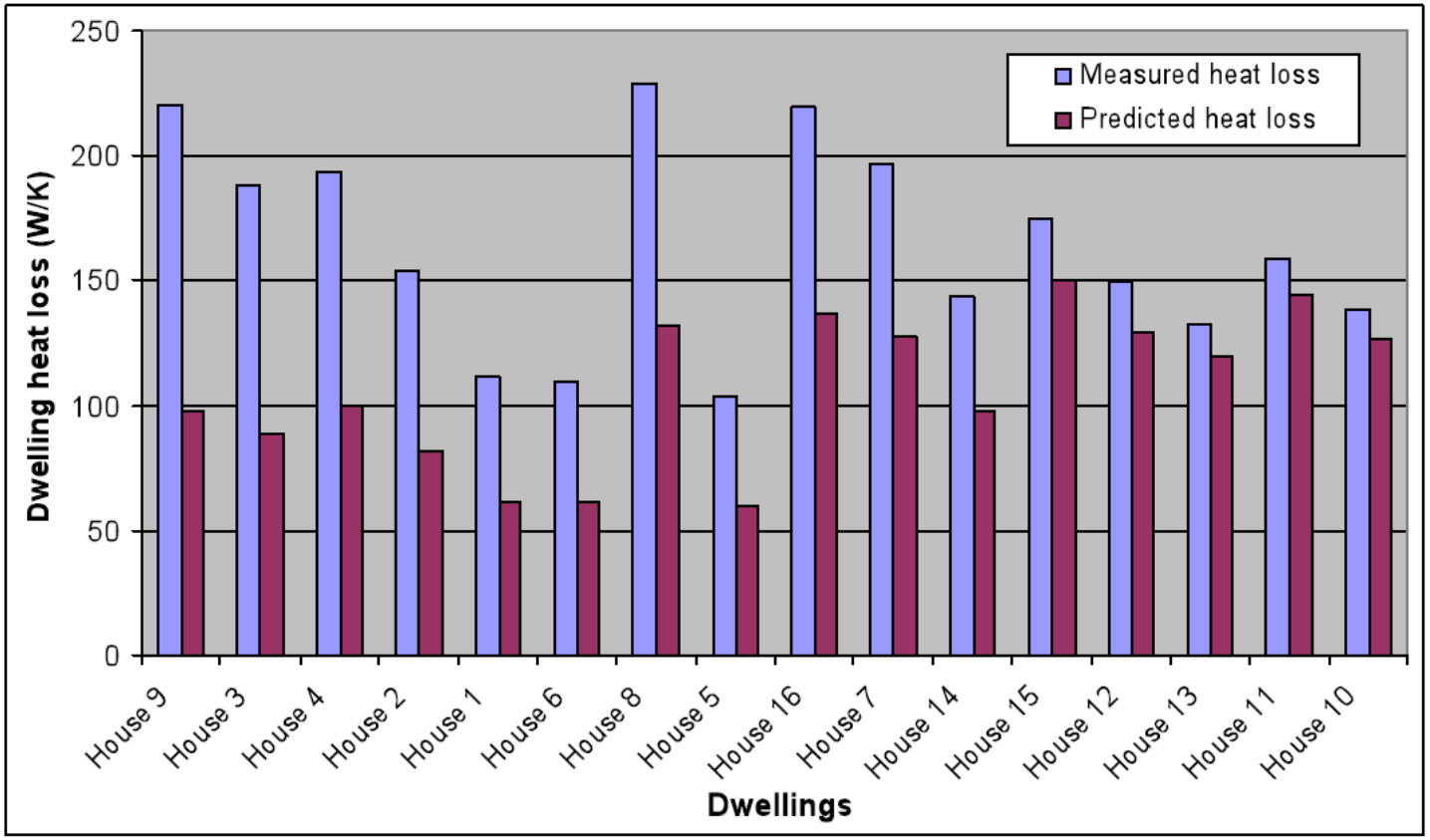


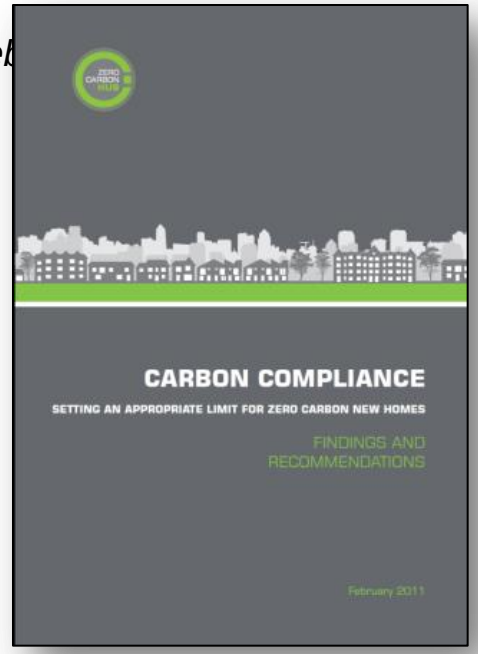
Figure 1 Measured v Predicted whole house heat loss for 16 dwellings[4]

Closing the performance gap

Carbon Compliance report:

> *From 2020 the test results distribution should demonstrate that at least 90% of all dwellings would meet or perform better than the designed energy / carbon performance.*

Feb



The journey:

- 2013 -> 2016 -> 2020

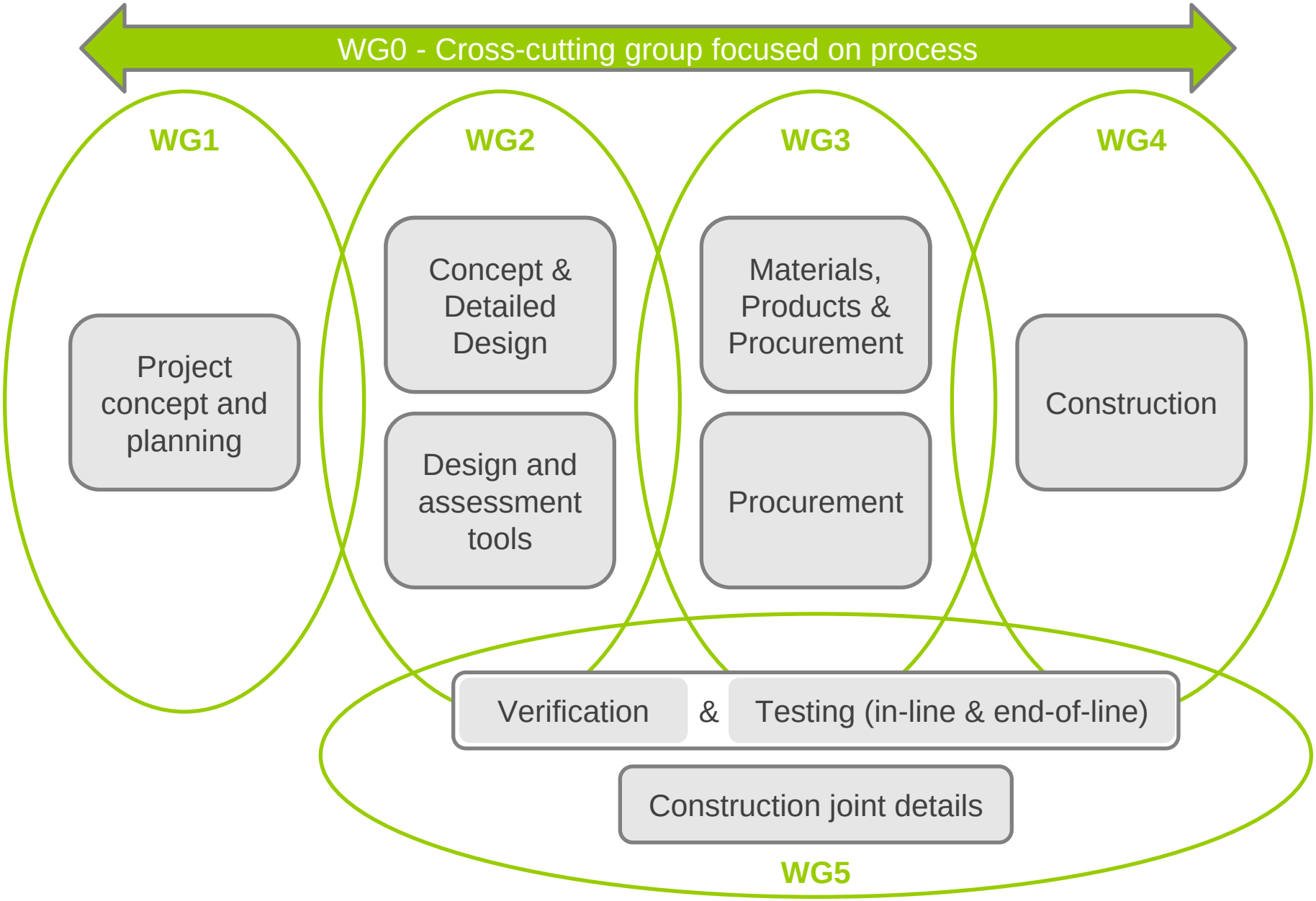
Aims and objectives

- To improve the as-built performance of new homes and enable the 2020 ambition to be met
- Collate and develop all strands of work in this area

What are we trying to do?

- Find solutions that suit industry & government
- Preferably at no extra cost

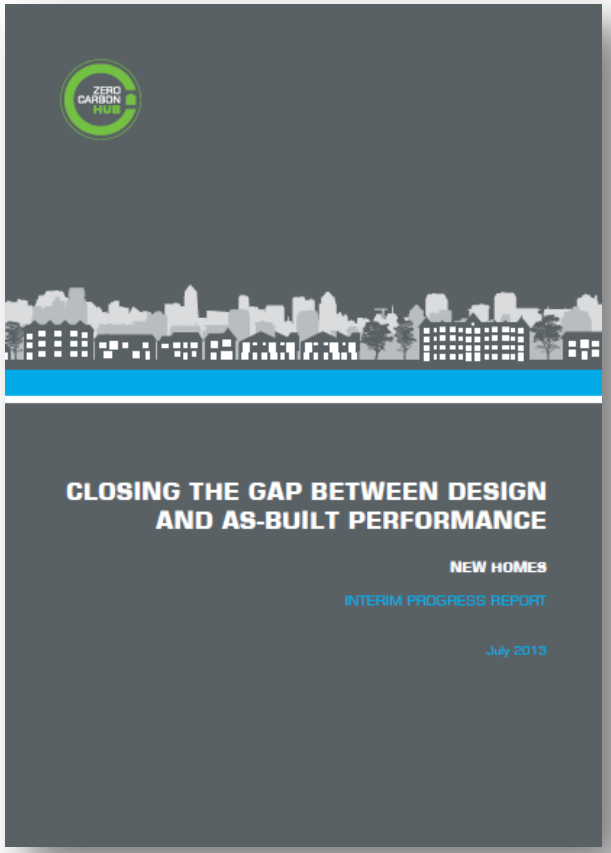
Work Group interaction

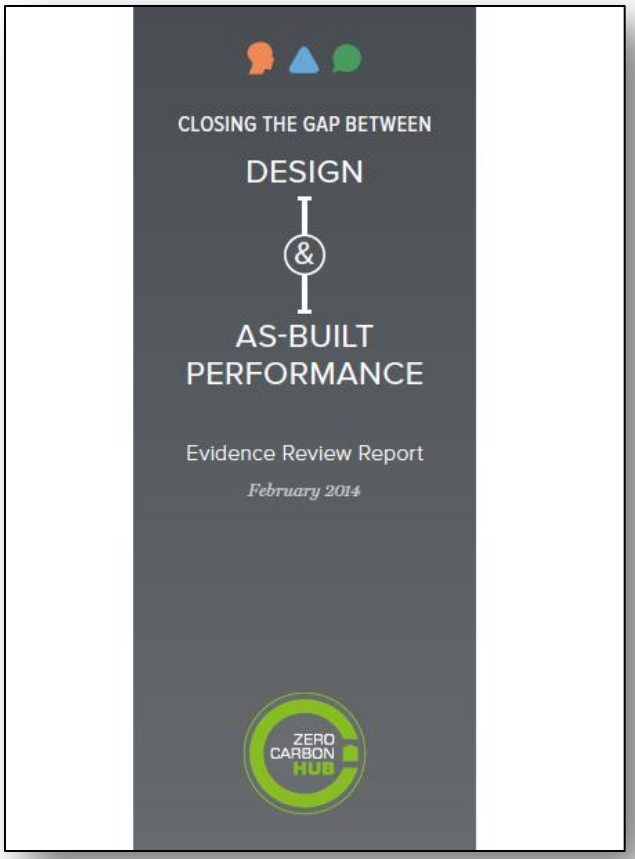


Why it's important to industry

- Improving quality throughout the process
- Improving occupant satisfaction
- Levelling the 'playing field'
- Improving links between parts of industry to reduce overall costs
- An alternative to Regulation

The Performance Gap Project





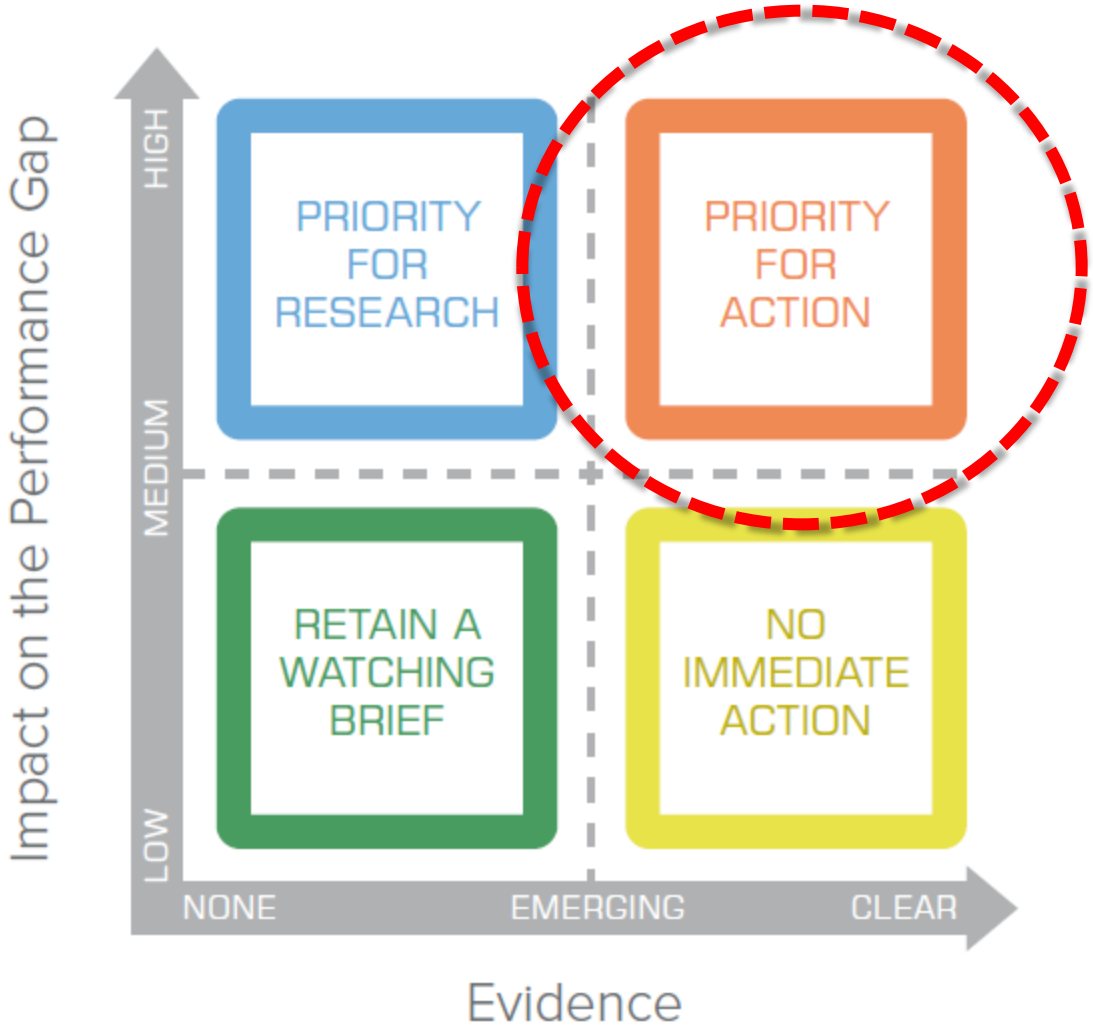
Literature Review

- 100 reports / documents
- Academic, industry, laboratory and field trials

Housebuilding Process Review

- Interviews, Design Review & Construction Walkthrough
- SAP Process analysis and input sensitivity
- Looking for good practice as well as bad!

Evidence / Impact matrix



CROSS-CUTTING THEMES

KNOWLEDGE & SKILLS

RESPONSIBILITY

COMMUNICATION

AS-BUILT PERFORMANCE - PRIORITY FOR ACTION

CONCEPT DESIGN & PLANNING

Limited understanding of impact of early design decisions on energy performance

PROJECT PROGRESSION

Developing commercially viable process controls towards 2020

SPECIALIST WORK GROUPS

Speculative Builders

Design and Build

Feedback and performance

Research programme

- Moving to solutions

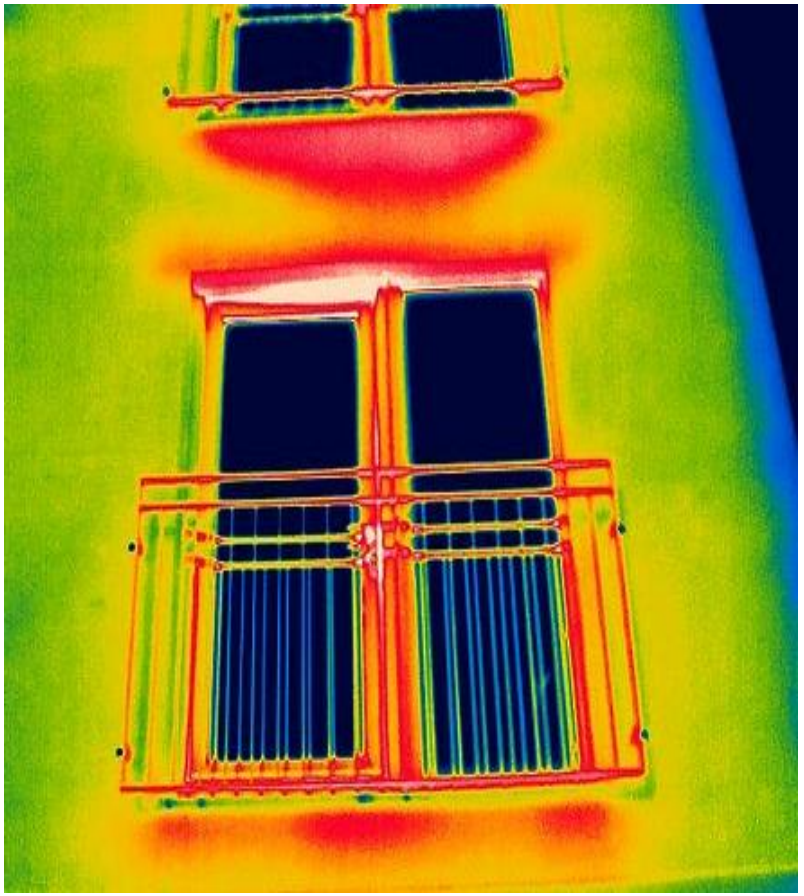
Feedback and performance

Thermographic imaging

- Internal & external images of the building fabric taken during the co-heating testing
- Carried out early in the morning to minimise distortion to surface temperatures

Observations

- Thermographic images reveal weaknesses in the build and design
- Analysis must be carried out by an **“experienced”** person



Feedback and performance

In-situ U-value measurement

- Heat flux testing carried out during co-heating test in one flat in each block
- Heat loss measured across north-facing external walls and also party walls

Observations

- The difference in measured and calculated to create U-values

Feedback and performance

Co-heating observations

- Test must be carried out in Nov – Feb - considered the suitable period
- Active sites are difficult to maintain controlled temperature in adjacent units

Observations on results

- Measured heat loss was greater than calculated heat loss

We need ‘inline’ and ‘end of line’ techniques

Photographic survey of construction

Record of actual construction

Method

- Document the construction process
- Additional photography to support air pressure tests, co-heating and commissioning

Observations

- Construction stage for analysis of thermography results at a later stage

(Specific problems observed must be communicated to site personnel)

Construction images

MVHR Installation and Commissioning

MVHR Installation and Commissioning

Lessons Learnt

Lessons Learnt: Design stage

- Better integration of design, materials, services & construction required
- Information to site should include integrated construction information
- Effective product development by materials and systems industries required
- Designs must allow for ease of use by occupants
- Simple, easily accessible and instinctive user controls required

Lessons Learnt: Design and construction stage

- Updates to SAP methodology and guidance have an impact on ‘predicted’ performance
- In-use performance attributes of materials should be used as inputs

Procurement

- Substitution of specified items is a risk to intended performance

Skills and knowledge

- Enhanced skills required for: planners, designers, energy assessors, product developers, procurers, constructors, installers, commissioners, inspectors

Lessons Learnt: Construction stage

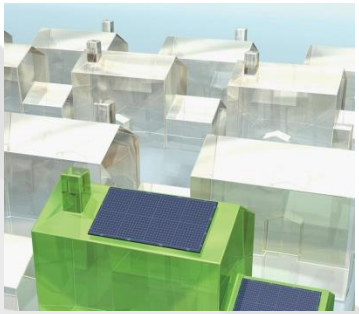
- Coordination between design and installation teams required
- Additional site supervision may be required, especially for new technologies
- Inspection by Building Control to ensure compliance at different intermediate stages may be needed

Thank You

Rob Pannell

Zero Carbon Hub





Delivering Zero Carbon Homes

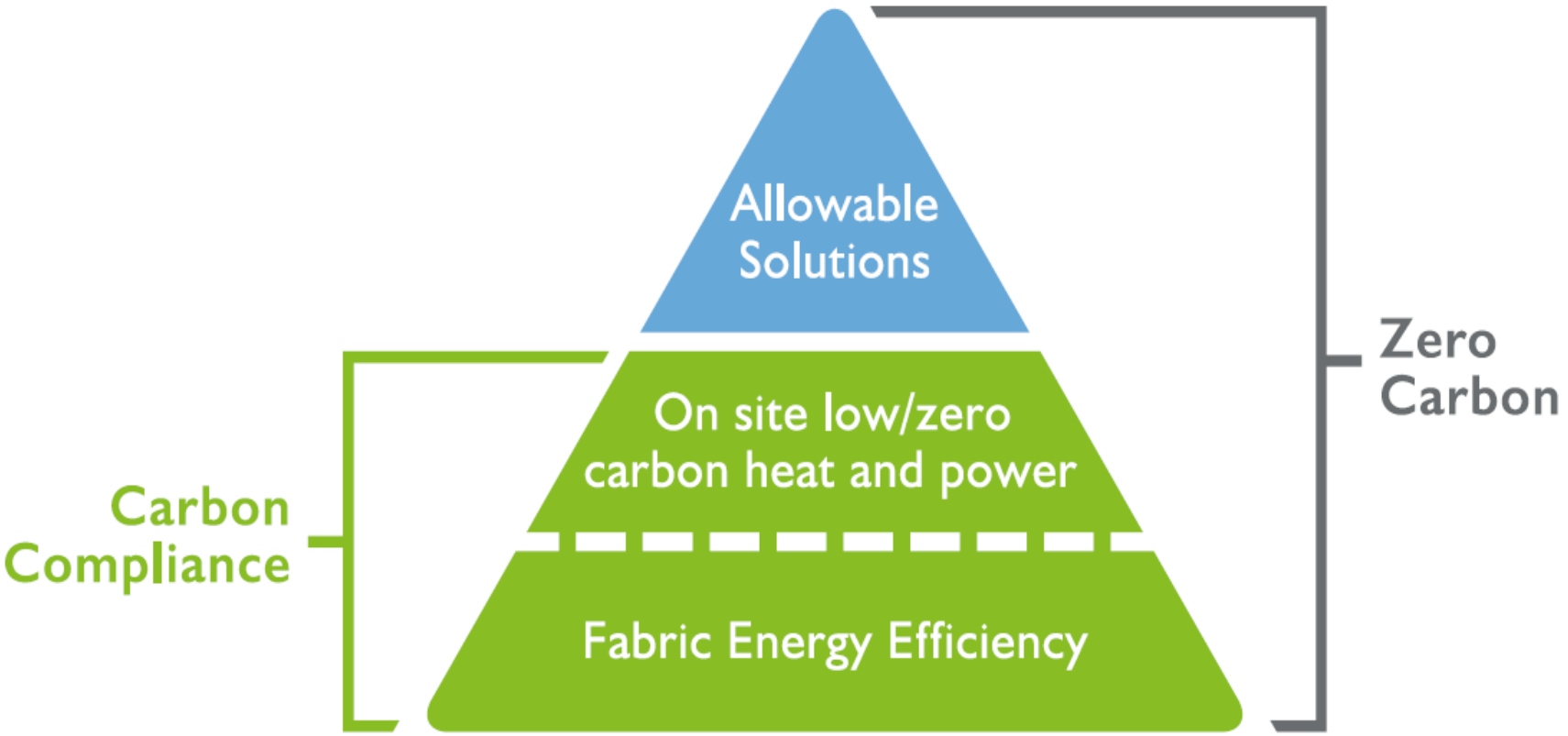
The Cost of Zero Carbon

19th June 2014

Overview

- The evolving zero carbon standard
- New research and cost analysis
- Projections to 2020

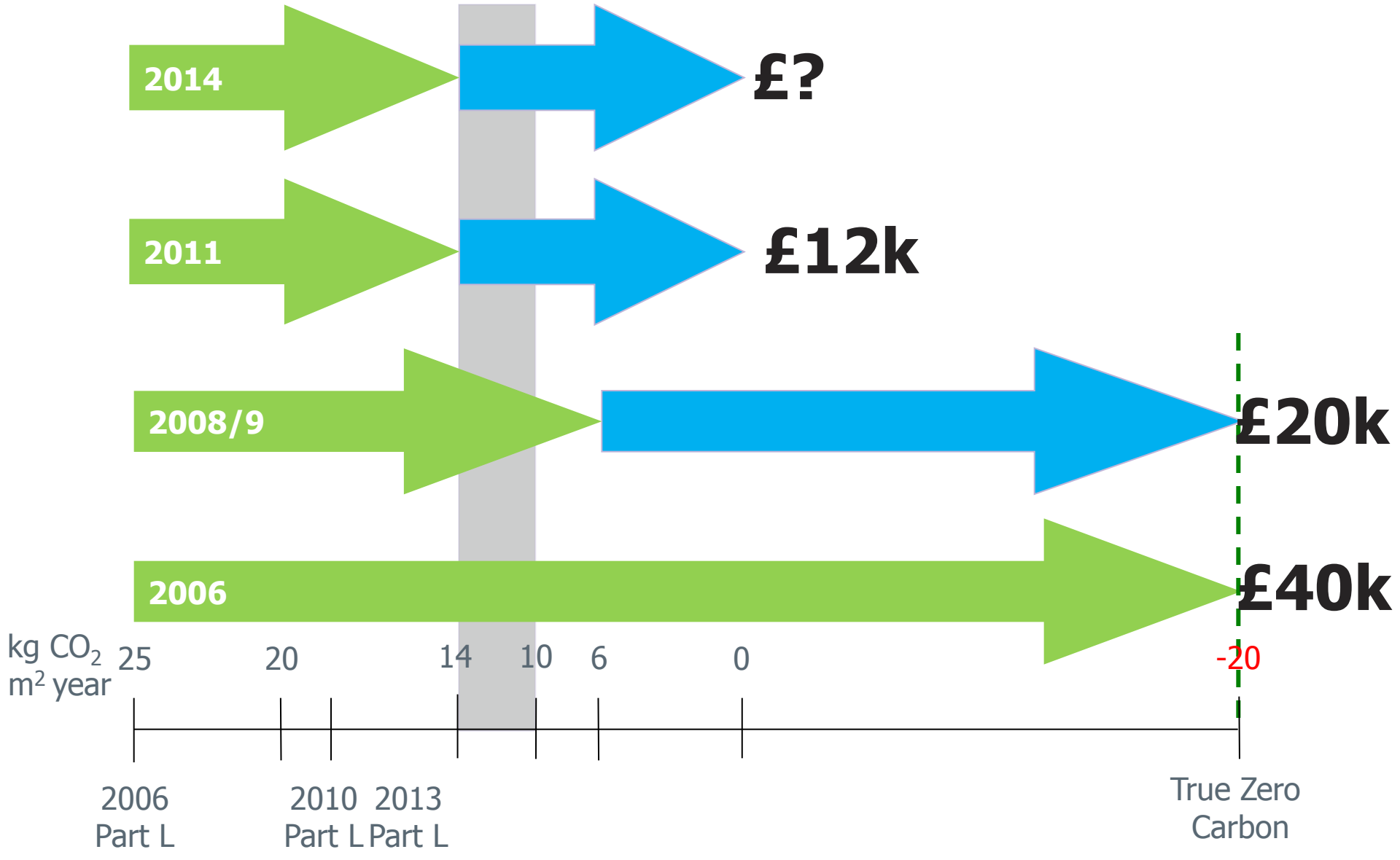
Key elements



Current performance standards

HOUSE TYPE	FABRIC ENERGY EFFICIENCY STANDARD (FEES)	CARBON COMPLIANCE STANDARD[1]	OVERALL ZERO CARBON STANDARD
Detached	46 kWh/m²/year	10kg CO_2/m²/year	0kg CO_2/m²/year
Semi-detached	46 kWh/m²/year	11kg CO_2/m²/year	0kg CO_2/m²/year
Mid-terraced	39 kWh/m²/year	11kg CO_2/m²/year	0kg CO_2/m²/year
Apartments (low-rise)	39 kWh/m²/year	14 kg CO_2/m²/year	0kg CO_2/m²/year

Costs - detached house



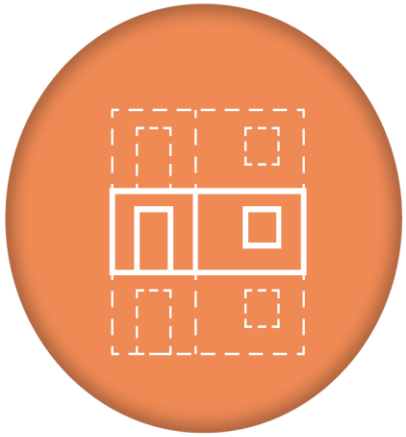
2014 COST UPDATE

Four benchmark house types

Detached houses
118 m^2

End terrace / semi-detached houses
76 m^2

Mid terrace houses
76 m^2



Apartments (low-rise)[7]
Average floor area 56.5 m^2

Four fabric standards

	2010	2013	FEES	Advanced
External walls	0.22-0.18	0.18	0.15-0.18	0.15
Floor	0.18-0.13	0.13	0.13-0.15	0.15
Roof	0.15-0.13	0.14	0.13	0.11
Windows	1.4	1.4	1.2-1.4	0.8
Doors	1.2	1.2	1.0-1.2	1.0
Air tightness	5-6	5.0	~5	1.0
Thermal bridging	ACDs / ECDs	+/- ECD's	+/- ECDs	+ ECD's
Ventilation	Natural	Natural	Natural	MVHR

Four heat and power options

PV	SHW	ASHP	Gas
			

Allowable Solutions

CAP of 30 x £60 per tonne CO_2

Assumptions

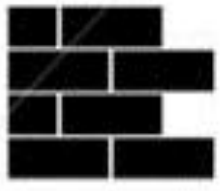
Q2 2013

Traditional construction

>100

Prelims	OHP	Contingency
12%	4%	5%

Average for E&W



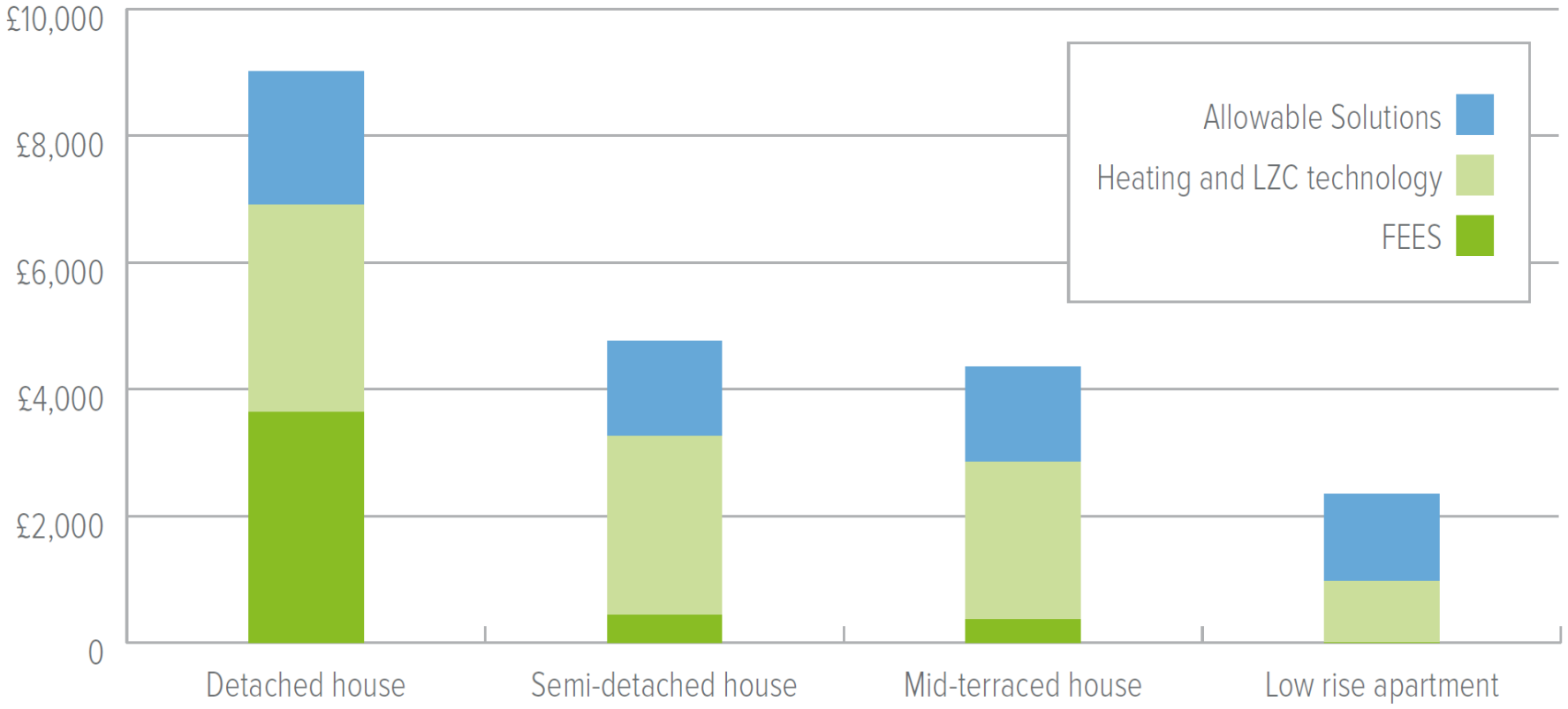
Benchmark costs – over Part L1a 2010

FEES + Gas + PV

	Detached	Semi detached	Mid Terrace	Low Rise Apt
e/o cost	**£9,000**	**£4,800**	**£4,400**	**£2,400**
Range	£8,500 - £9,500	£4,500 - £5,100	£4,100 - £4,600	£2,300 - £2,500
Per m^2	**£76**	**£62**	**£57**	**£43**

Breakdown of additional cost

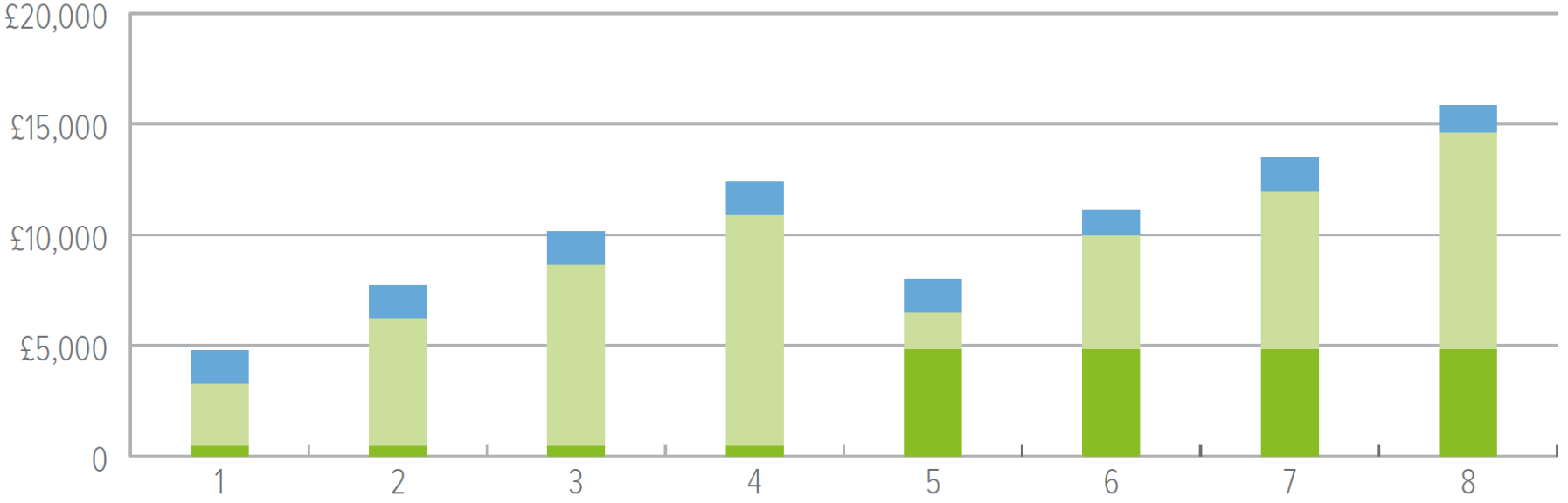
Cost over Part L1A 2010



Housetype

Other compliance options – Semi detached

Cost over Part L1A 2010



FEES				ADVANCED			
GAS		ASHP		GAS		ASHP	
-	SHW	-	SHW	-	SHW	-	SHW
PV + ALLOWABLE SOLUTIONS							

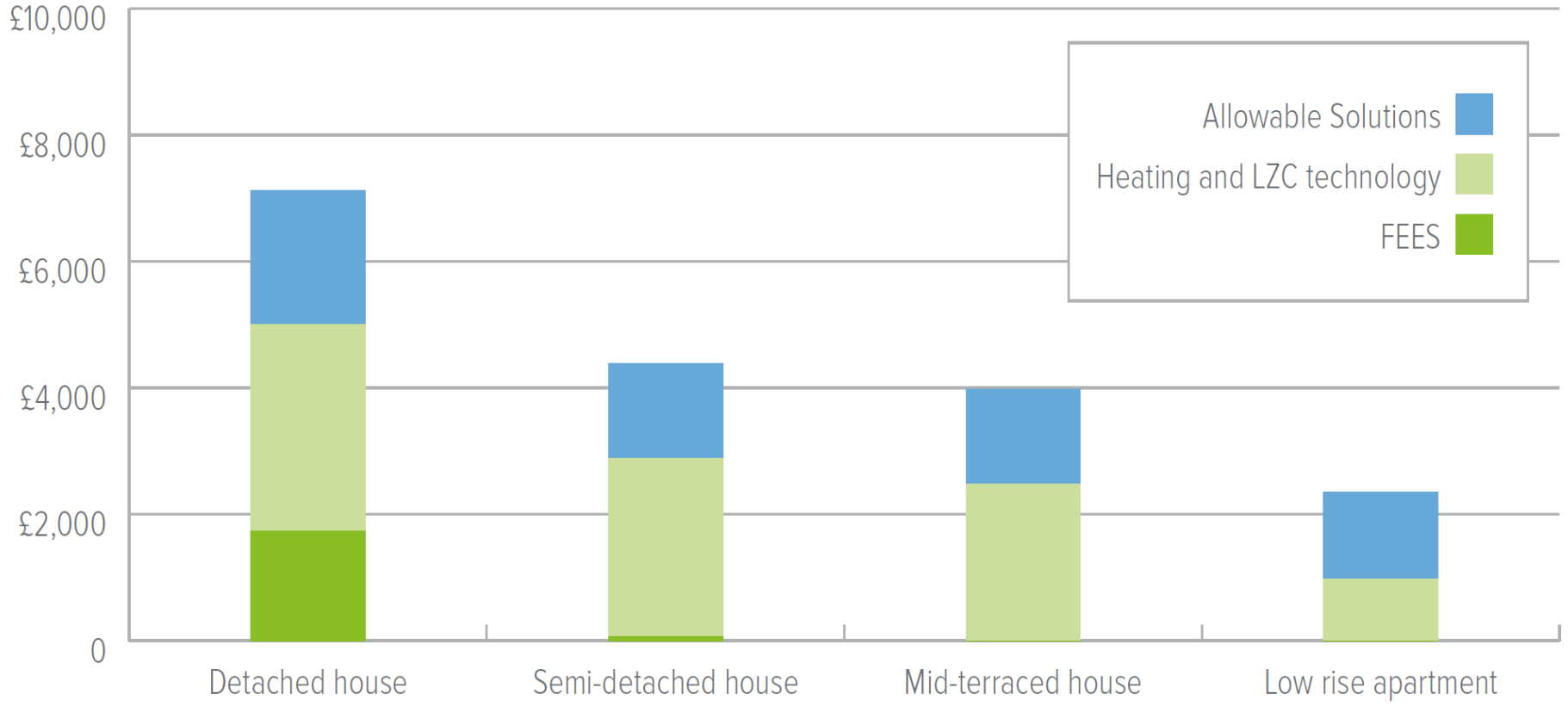
Benchmark costs – over Part L1a 2013

Still FEES + Gas + PV

	Detached	Semi detached	Mid Terrace	Low Rise Apt
e/o cost	**£7,100**	**£4,400**	**£3,900**	**£2,300**
Range	£6,700 - £7,500	£4,100 - £4,700	£3,700 - £4,200	£2,200 - £2,400
Per m^2	**£60**	**£58**	**£51**	**£43**

Breakdown of additional cost

Cost over Part L1A 2013



Housetype

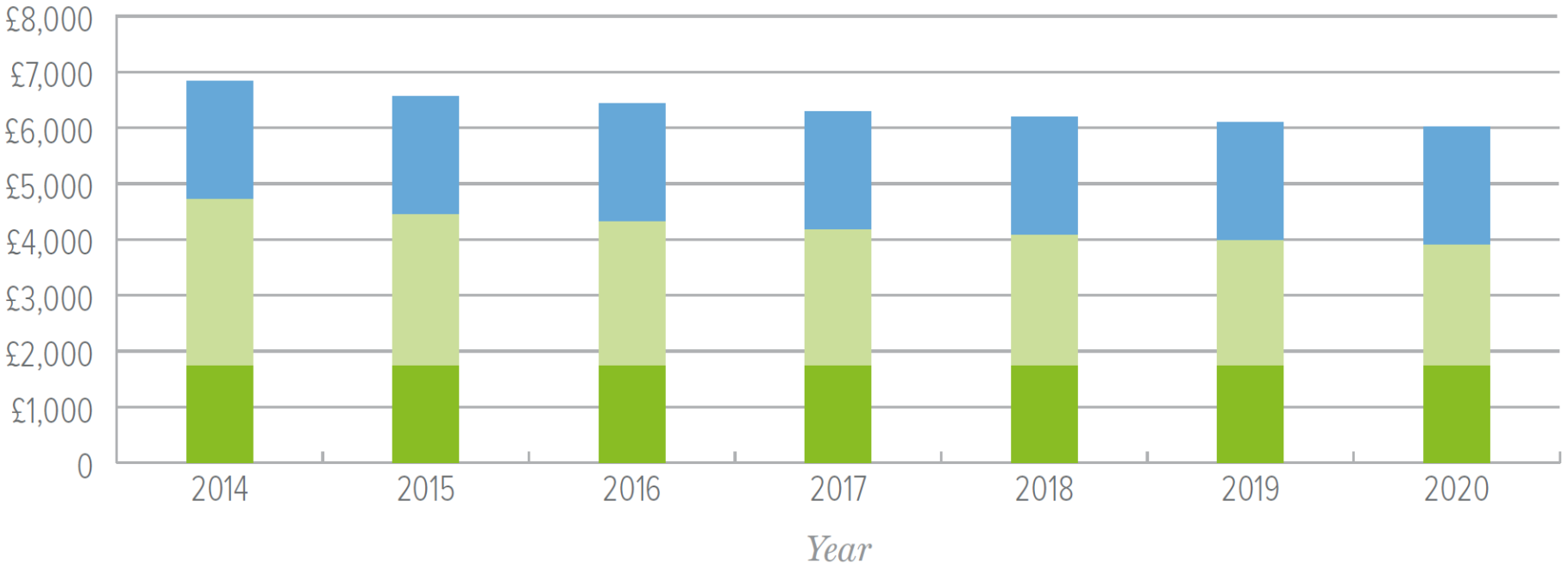
TRENDS TO 2020

Cost trend - Assumptions

Element	Assumption	% of 2013 Capital Cost						
		2014	2015	2016	2017	2018	2019	2020
Insulation Doors and windows Gas Heating	No learning - relatively mature technology	100	100	100	100	100	100	100
ASHP	DECC – medium scenario	99	99	98	97	97	96	95
SHW	DECC – medium scenario	99	97	96	95	94	93	91
PV fixed	DECC – medium scenario	95	90	84	76	73	70	68
PV variable	DECC – medium scenario	90	81	77	74	71	68	66
Air tightness and thermal bridging	Estimated costs of design, calculations and site supervision will reduce over 5 years. Additional costs for materials **not subject to cost reductions**	80	60	40	20	0	0	0

Cost trend results – Detached

Cost over Part L1A 2013



Summary

- Costs continue to reduce but still significant
  - £2-£7k over Part L 2013 notional spec
- Further reductions
  - £2-£6k by 2020 mostly through reduced PV costs
- Per m^2 costs increase highest for detached houses
  - high fabric spec + more exposed surface
- Further work
  - Focus on smaller house builders (<100 homes per year)

sweett

Thank you