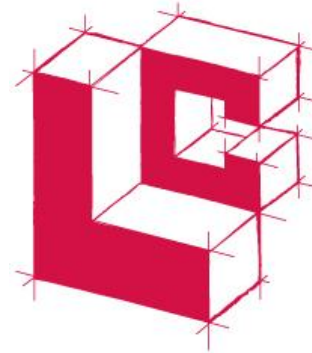


Future Construction and innovation

Prof Sean Smith

Overview

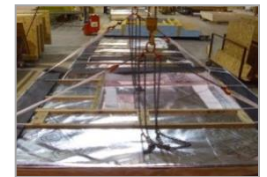
- Offsite report
- Markets
- Standards
- Codes
- Energy – *needs a re-think?*
- Reuse & EA



BUILDING
TECHNOLOGIES
G A T E W A Y

Offsite Construction Sector Review

- Project funded by the Scottish Government
- Housing and buildings systems
- Focus on manufacturing value
- Categorisation systems
- System build – 2D and 3D
- Sector outputs and profile
- Profile within next 5 years
- Exports and International markets
- B-2-B Supply chains
- Future support and needs of the sector



Key future factors

Important regarding:

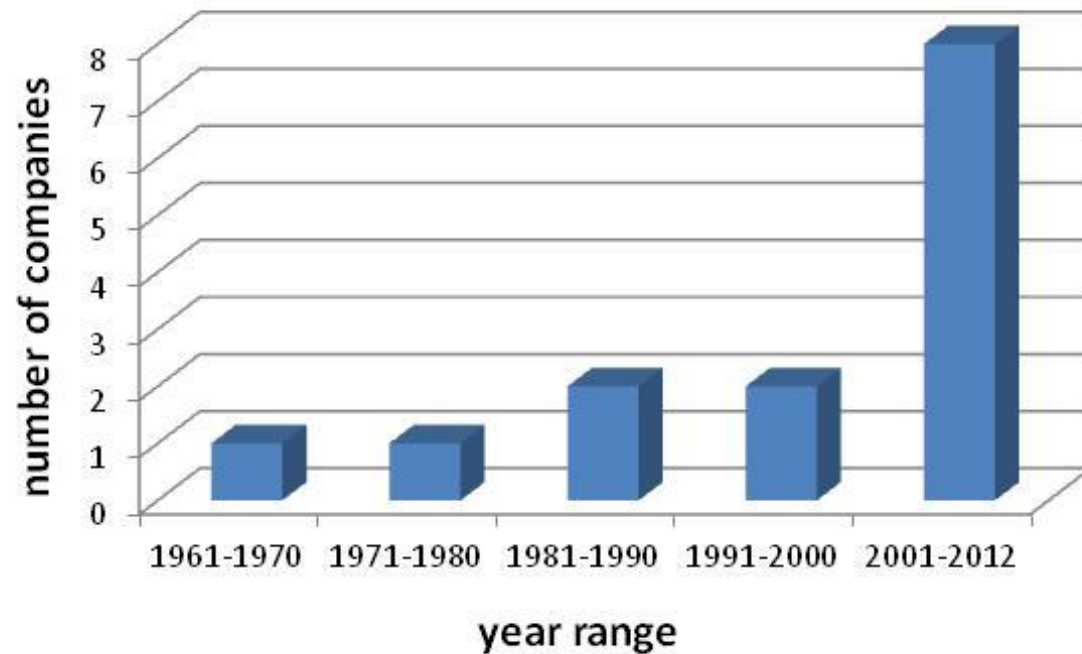
- Current housing demand and waiting lists
- Future housing needs
- Demographic changes and lifetime homes
- High value manufacturing sector
- Quality and building performance
- Zero waste targets
- Future skills pressures from retrofit sector affecting new build
- Productivity increase versus traditional approaches
- Offsite sector needs
- Export and international potential

Study Process

- Range of companies interviewed
- Visits to manufacturing facilities
- Small to large manufacturers
- Design, critical supply element companies
- Analysing future innovation and design developments
- 15 offsite manufacturing facilities within the study



Entry year into Offsite Manufacturing










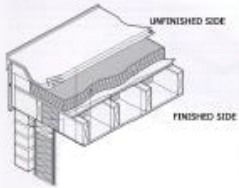



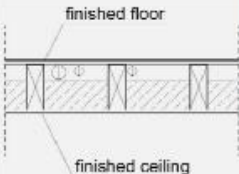




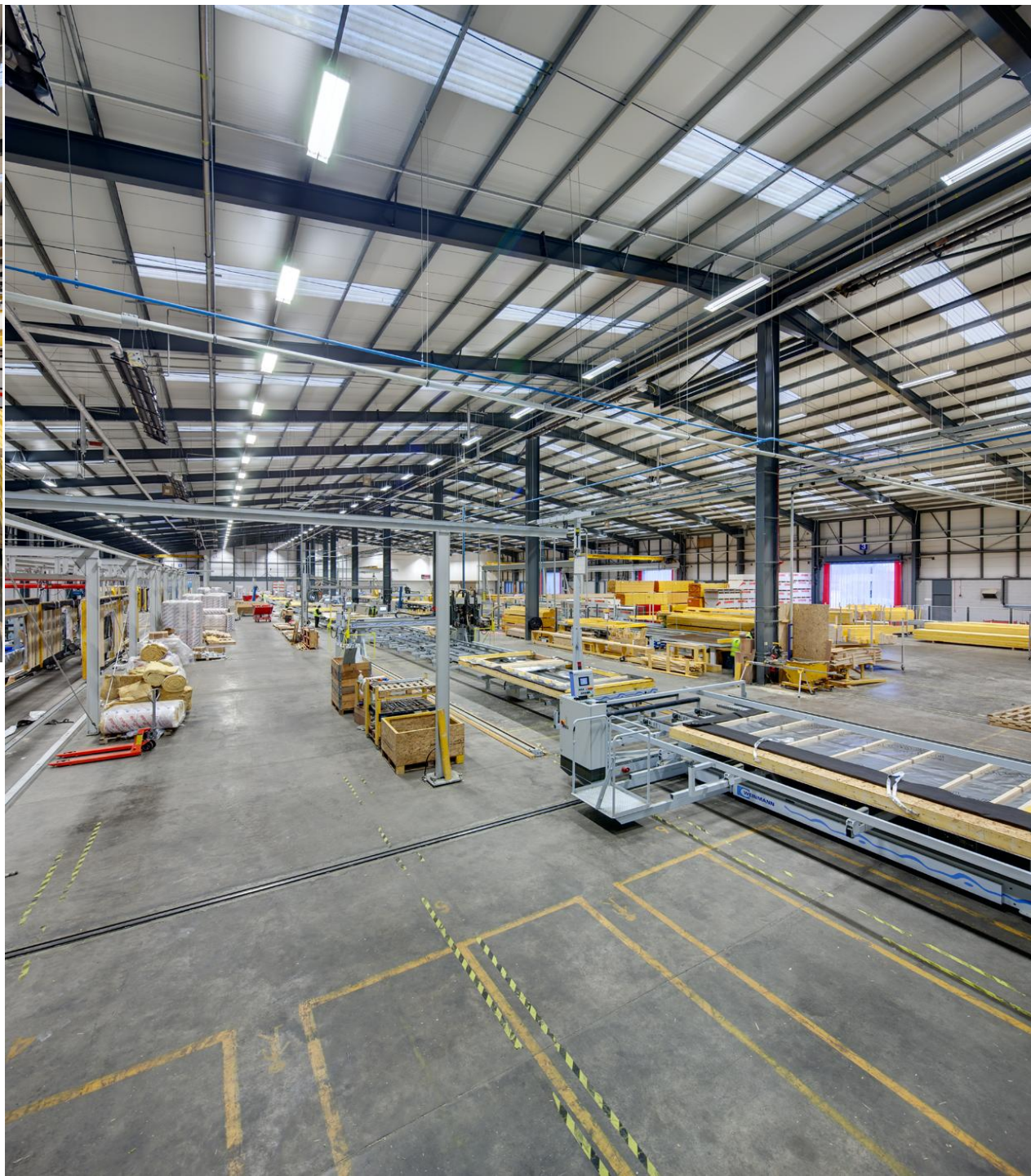
Categorisation

Offsite profiles

- 2D sheathed
- 2D Sheathed and pre-insulated (reduces Green Deal clashes)
- Services
- Wall linings
- 3D Volumetric / Modular
- Insulated and lined
- Services and fully lined
- Range of specifications on offer
- Standard and Bespoke

Categorisation of offsite construction
for domestic and non-domestic building standards

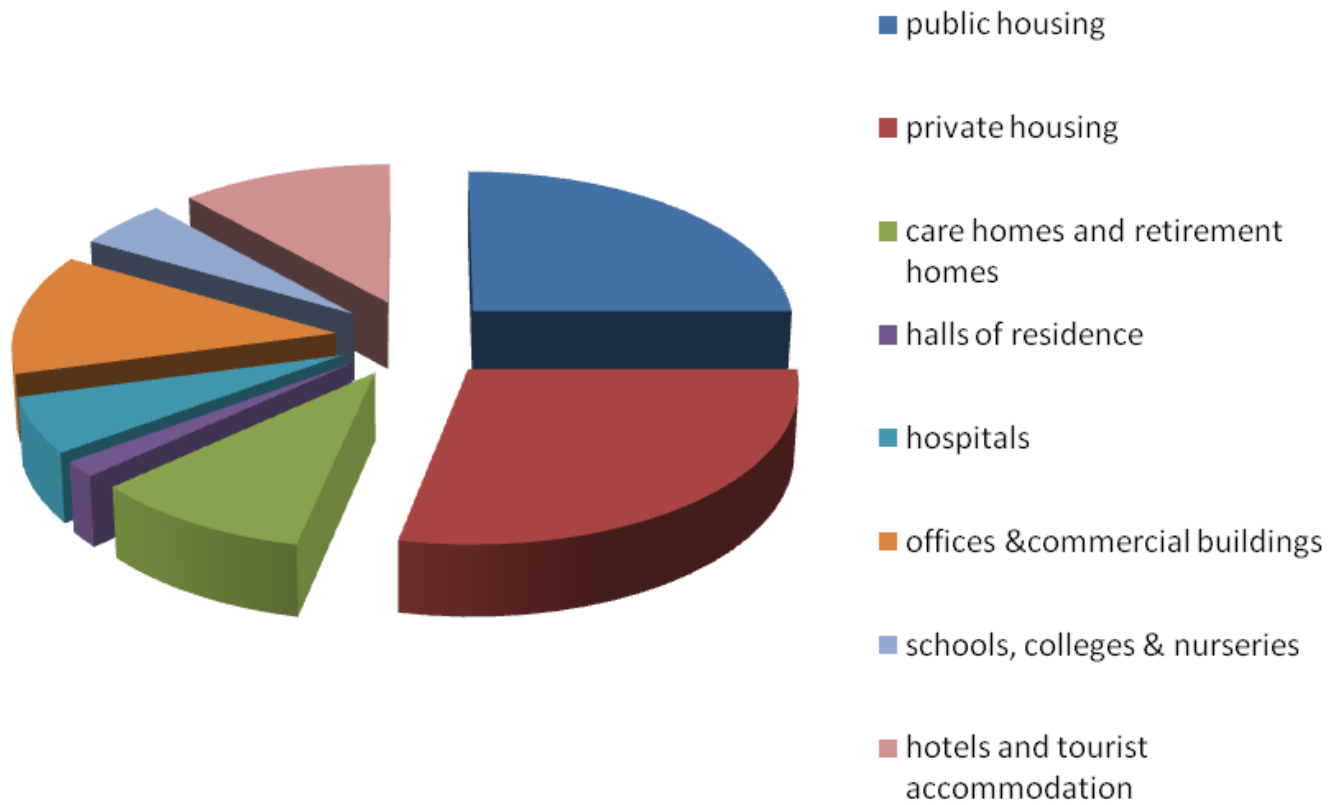
		CATEGORIES							
		2-D Elements					3-D Modules		
		walls		floors		Roofs			
SUBCATEGORIES	0		Uninsulated open panels: with first skin on only one side (e.g. OSB on one side of timber panels).		Uninsulated floor panels with decking only on one side and exposed joists/beams.		Uninsulated open panels: with first skin on only one side (e.g. OSB on one side of timber panels).		Uninsulated modules whose surfaces have first skin on only one side.
	1		Insulated open or closed panels without finished linings (e.g. SIPs).		Insulated floor panels without finishes.		Insulated open or closed panels without finished linings.		Insulated modules without finished linings.
	2		Insulated closed panels finished on one side (either internally or externally).		Insulated floor panels finished on one side (either upper or lower side).		Insulated closed panels finished on one side (either internally or externally).		Insulated modules with finished lining on one side (either internally or externally).
	3		Insulated closed panels fully finished internally and externally, with integration of services (i.e. with electrical and mechanical services, windows and doors).		Insulated floor panels fully finished on the upper and lower sides, with integration of services (i.e. with electrical and mechanical services).		Insulated closed panels fully finished internally and externally, with integration of services (i.e. with electrical and mechanical services, windows).		Modules fully finished on all sides, with integrated services (i.e. with electrical and mechanical services, windows and doors).



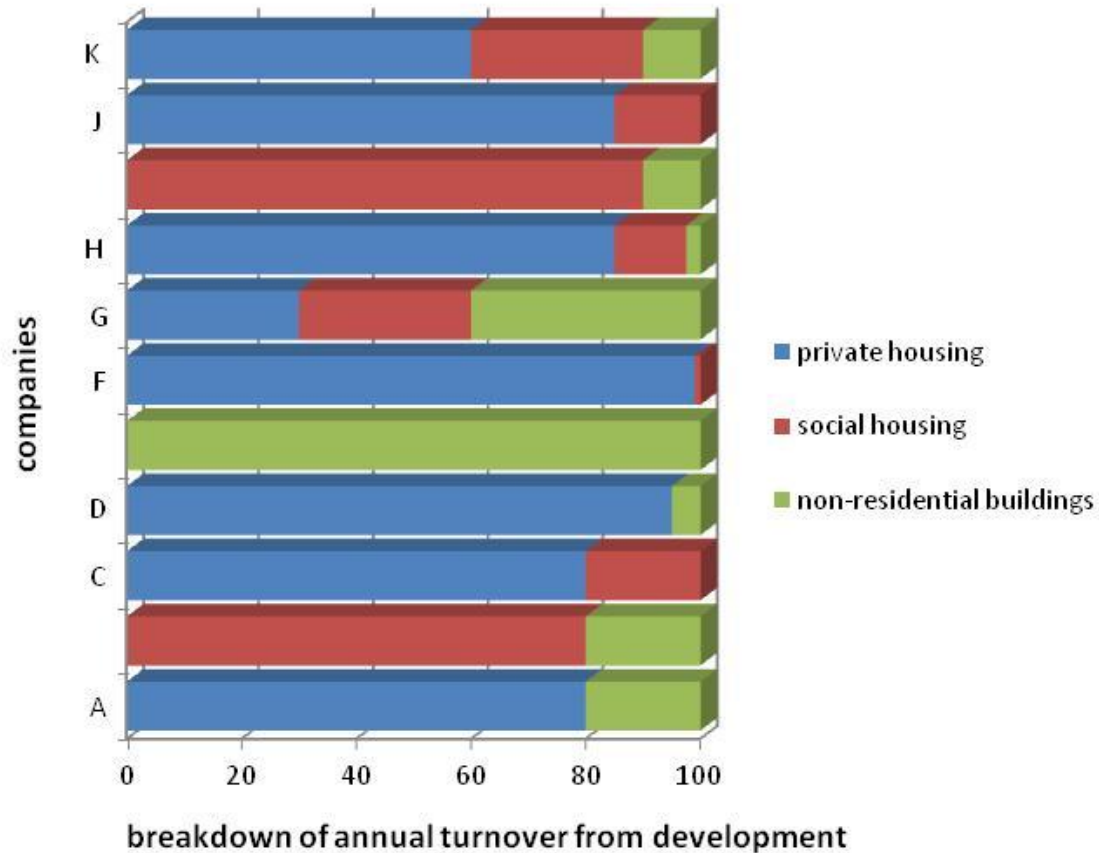
CCG
OSM

IQ System

Market profile for companies interviewed



Example profile for 10 companies



B-2-B Supply Chains

Based on companies interviewed

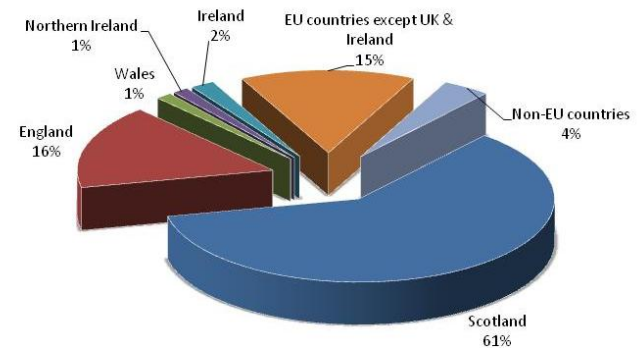
79% of B-2-B supply chains based within UK

Cost reductions and better partnerships +ve outcome

Quality control and avoidance of substitution products

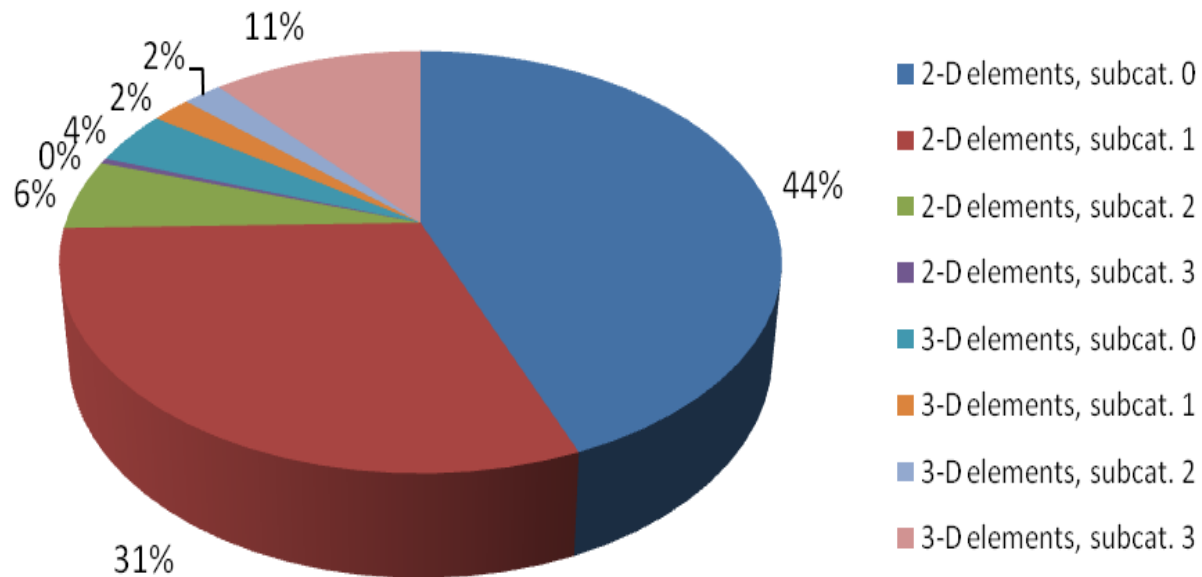
Tracking outputs / performance and R&D

Many products via Scottish supply chain originally stemmed from England (*approx 45%*)



Scottish Offsite Categories Portfolio

Based on companies interviewed



Advantages of Offsite

Based on companies interviewed

Companies were asked what they perceived were the **main advantages of offsite** construction. Ranked in priority and grouped across the companies interviewed, these were:

- 1) Higher levels of quality assurance and predictability
- 2) Better control of costs and margins
- 3) More stable business process (employees, product component supply)
- 4) Opportunities for process improvement, innovation and R&D

Areas of Technical Investment

Based on companies interviewed

When asked “what were the current **main areas of technical investments** for offsite”, these included:

- Building envelope advancements (structure, acoustic and thermal)
- Process improvement and communication technology implementation
- Implementation of standardised systems and accredited details (e.g. robust details)
- Product certification and European approvals

Future Direction and Support

Based on companies interviewed

Future Government strategy to support the offsite sector were identified by the companies as follows:

- **Regulation and Standards** - inclusion of Offsite construction as a category within **CfSH** (England) and **Section 7**(Scotland): **Sustainability**
- **Procurement processes** which recognise the positive impact of offsite construction: better quality control, reduced waste, reduced vehicles to site better quality and substantially less remedial works
- Grants and support for **manufacturing plant and equipment and support for innovation**, research and development
- Establishment of an **offsite training academy** which would assist future sector delivery growth, low carbon skills, building performance and support waste reduction plans.

Acknowledgements

ISC wish to thank:

All the companies who participated in this study

The company staff who took part in the interview sessions

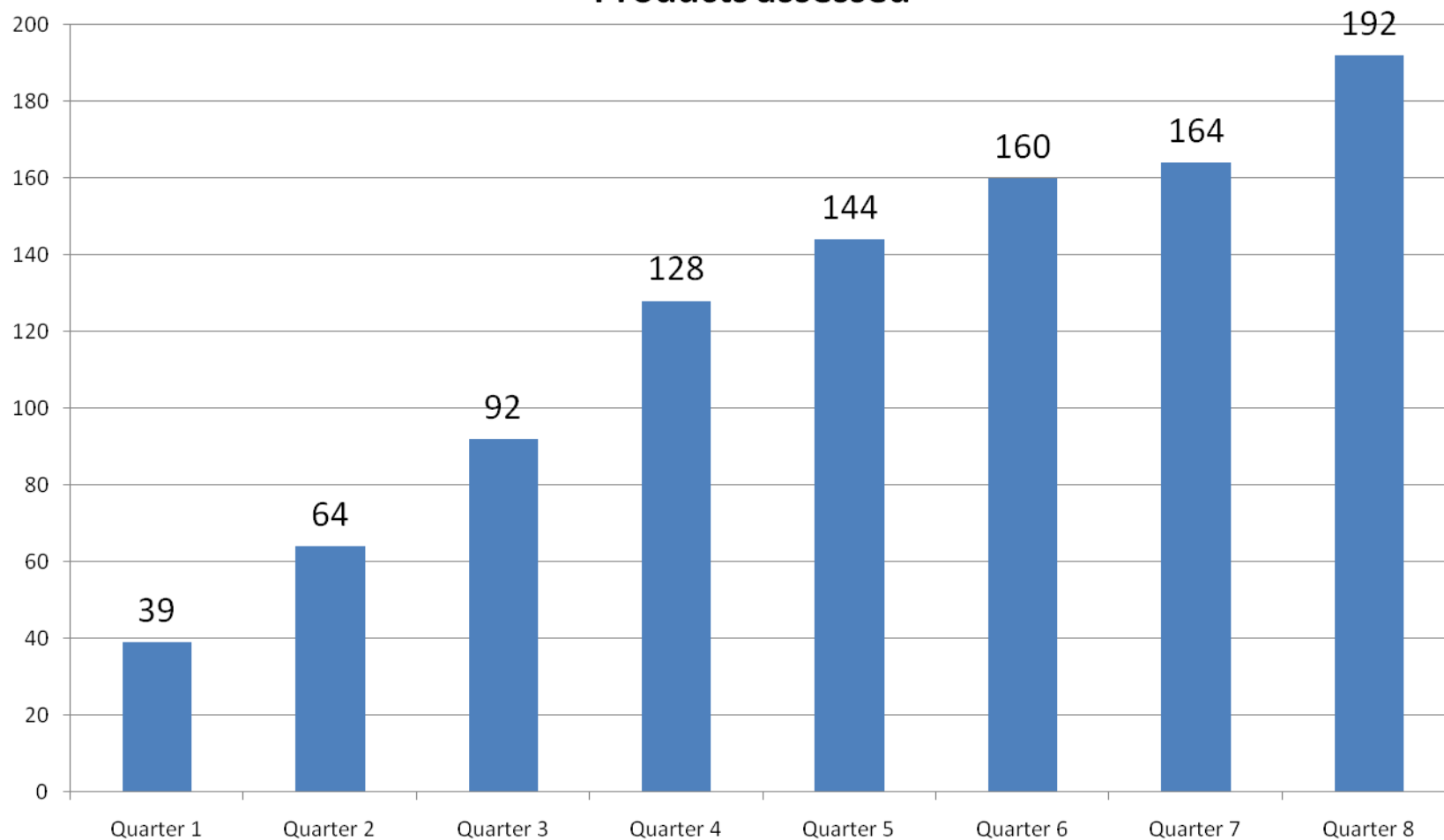
Scottish Government for funding this study

Scottish Enterprise who facilitated and supported this study

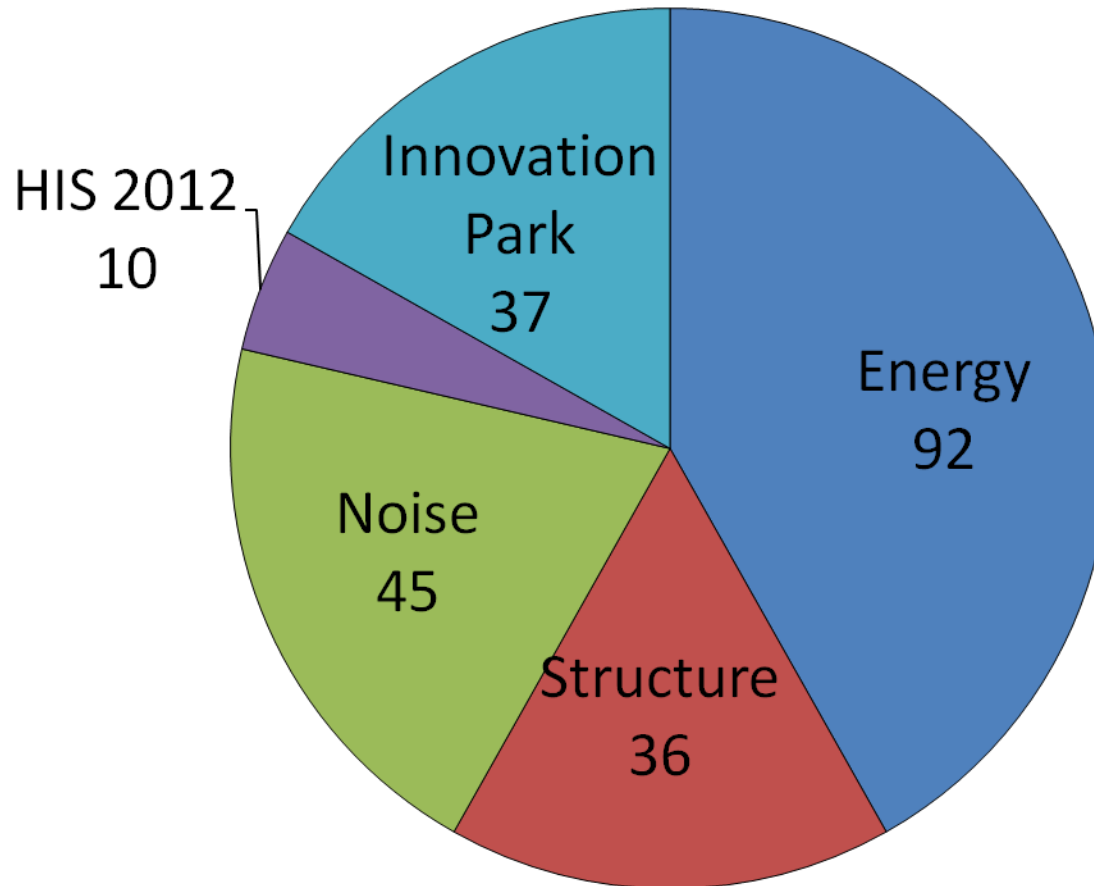
Low Carbon Building Technology Gateway (2010-12)

www.lcbt-gateway.org

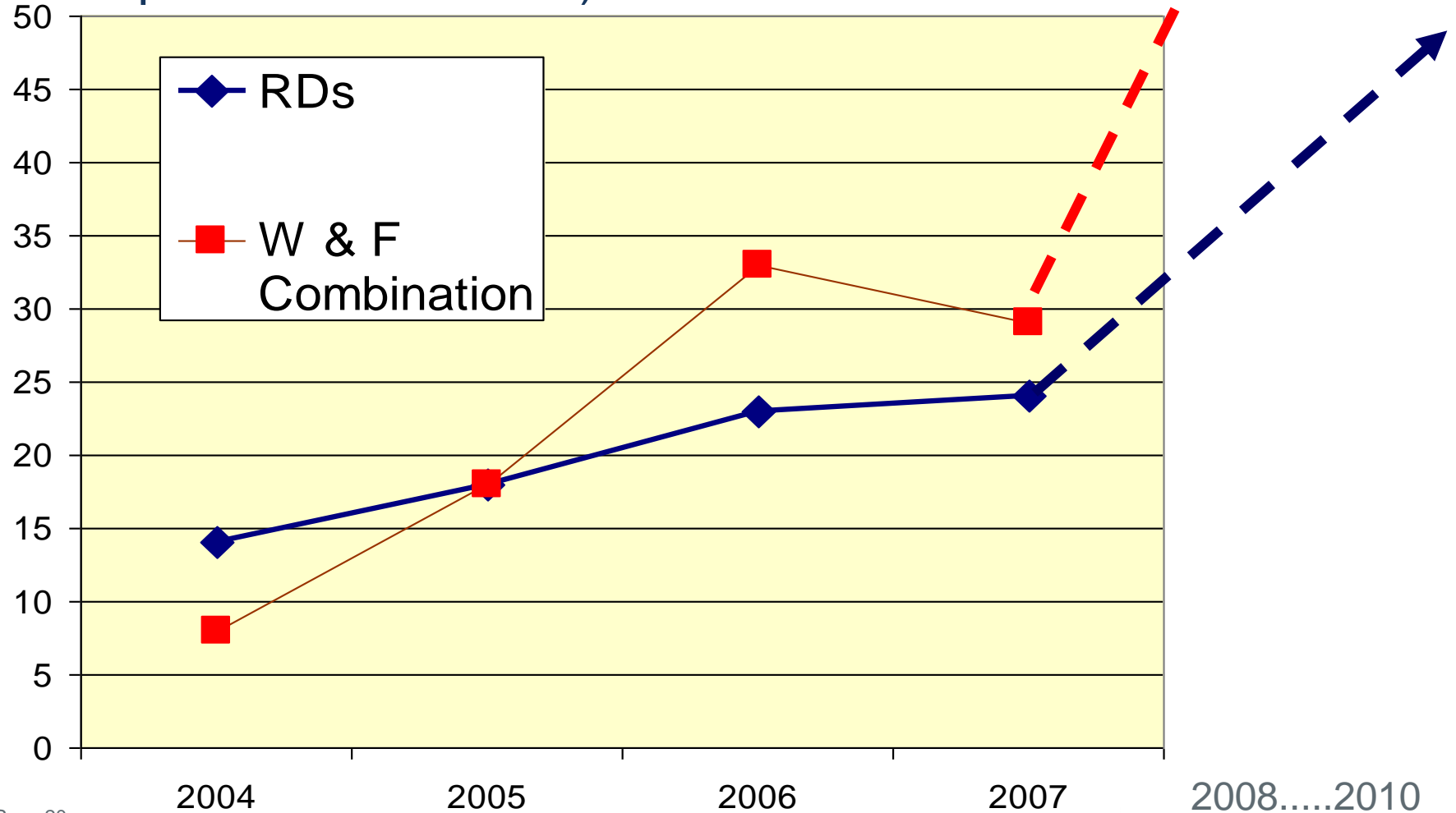
Products assessed



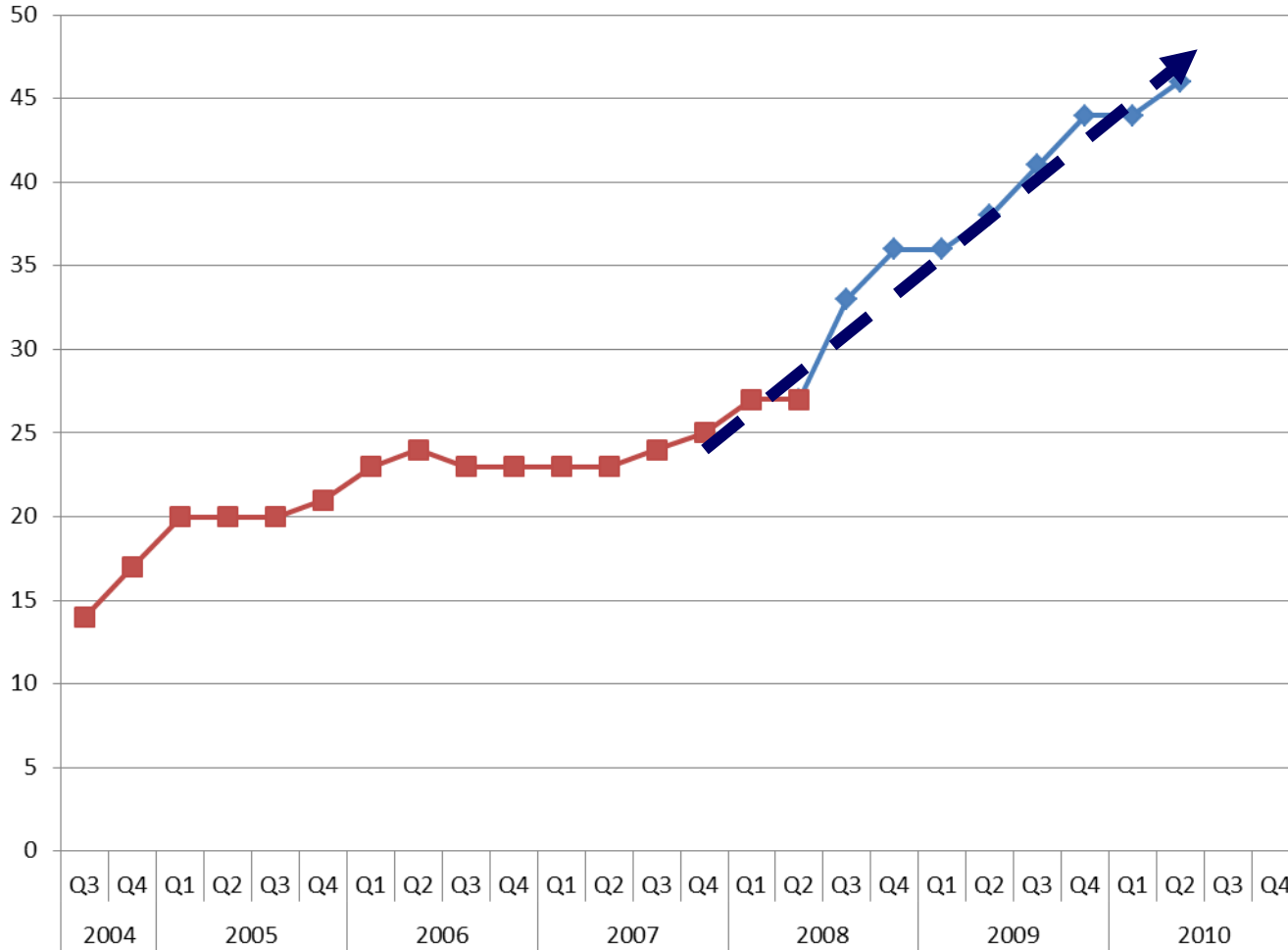
Low Carbon Building Technology Gateway (2010-12)
www.lcbt-gateway.org



Robust Details (Part E) & Combinations (future predictions in 2007)



Actual New RDs over time



Lots of choice

Many wall and
floor
combinations to
choose from

Robust
performance

Feedback loop
to proprietary
RD owners

Markets

Bank lending very restrictive and will become worse with Basel *III*

Pensions, Insurance and Investment organisations keen to invest long term 20-30 years

New Bonds coming forward into housing (mid market rent) and for retrofit (New build – strong focus on offsite)

Energy market drivers and carbon reduction targets.....but..lets wait to see what happens to 2013 targets!

Standards

CE Marking: Many product companies still to catch up, new products coming forward may hit “bottleneck” due to other industry sectors catching up with existing products

ISO – 16717 proposals

Possibly the most important change to building performance criteria....significant implications for products and system to deliver acoustic performance – may come into effect end of the decade.

Codes / Guidance

CfSH

Will it still look the same later next year?

Section 7: Sustainability (Scotland)

Small funds available if building to “silver” level.

Branded Systems

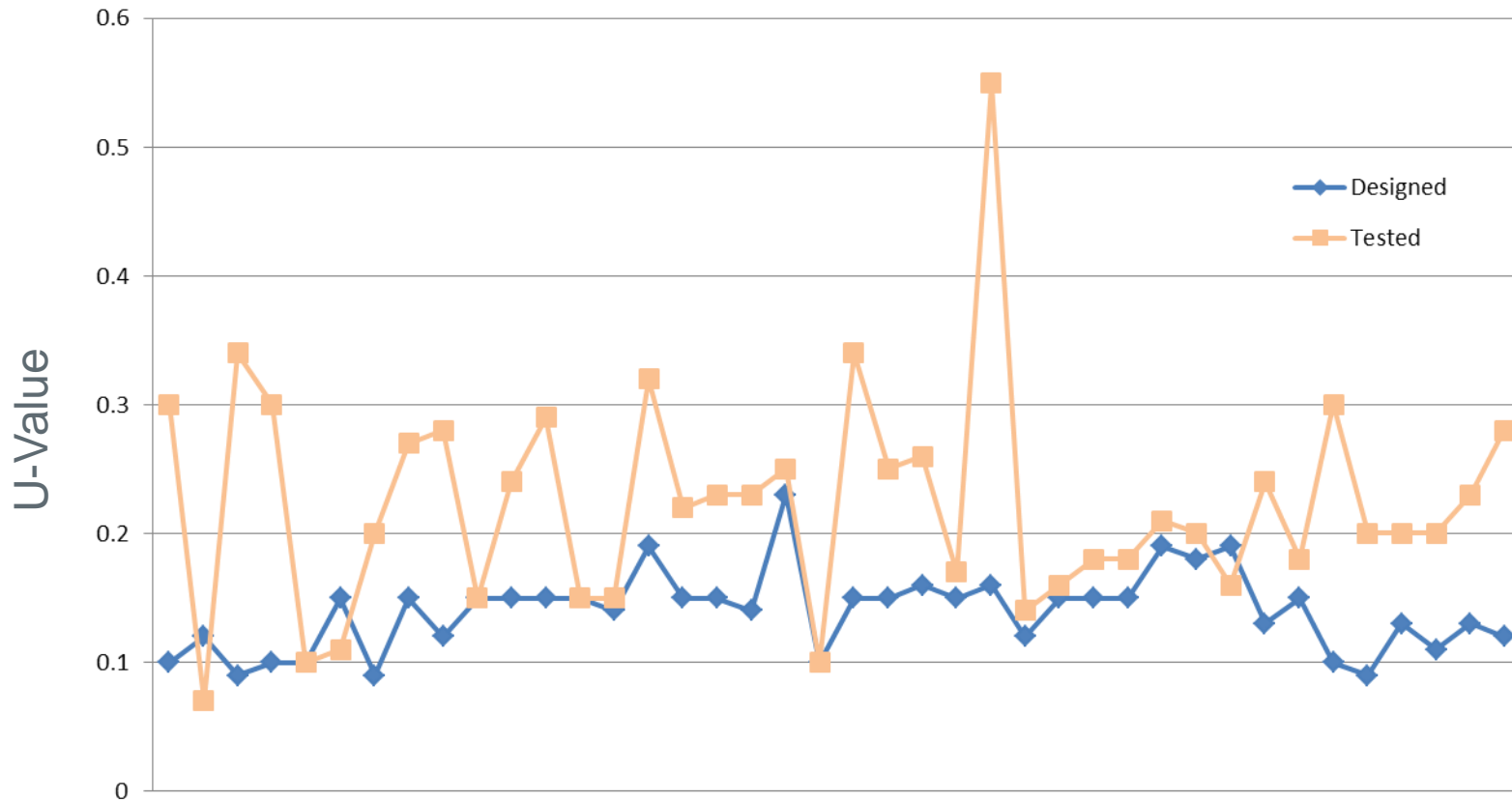
Sustainability drivers leading to “branded systems”.

(IQ, Sigma, Val-U-Therm) – perhaps as energy costs continue to rise these may become new marketing jargon when selling homes and for resell market in future.

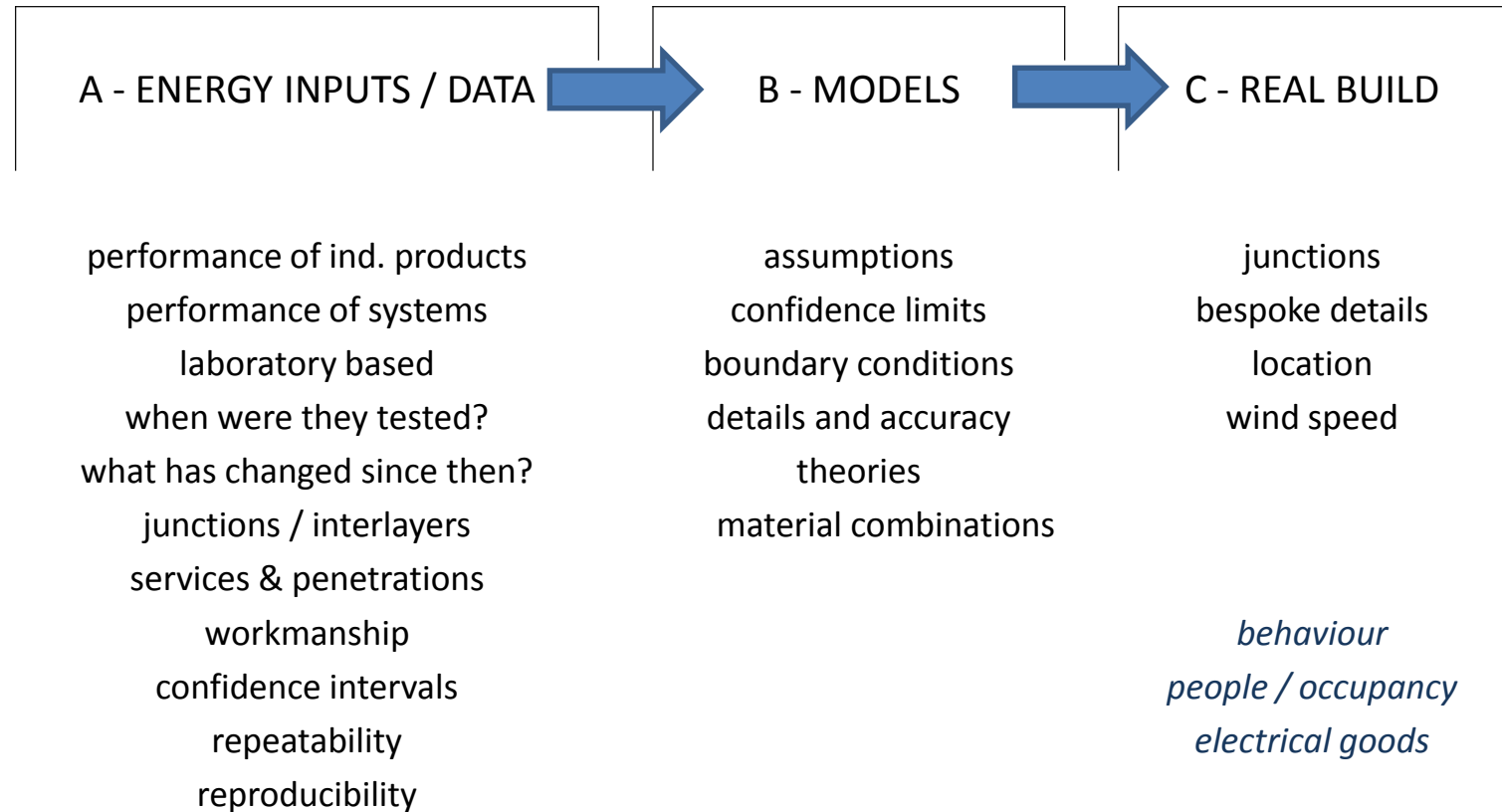
Green Deal !!!

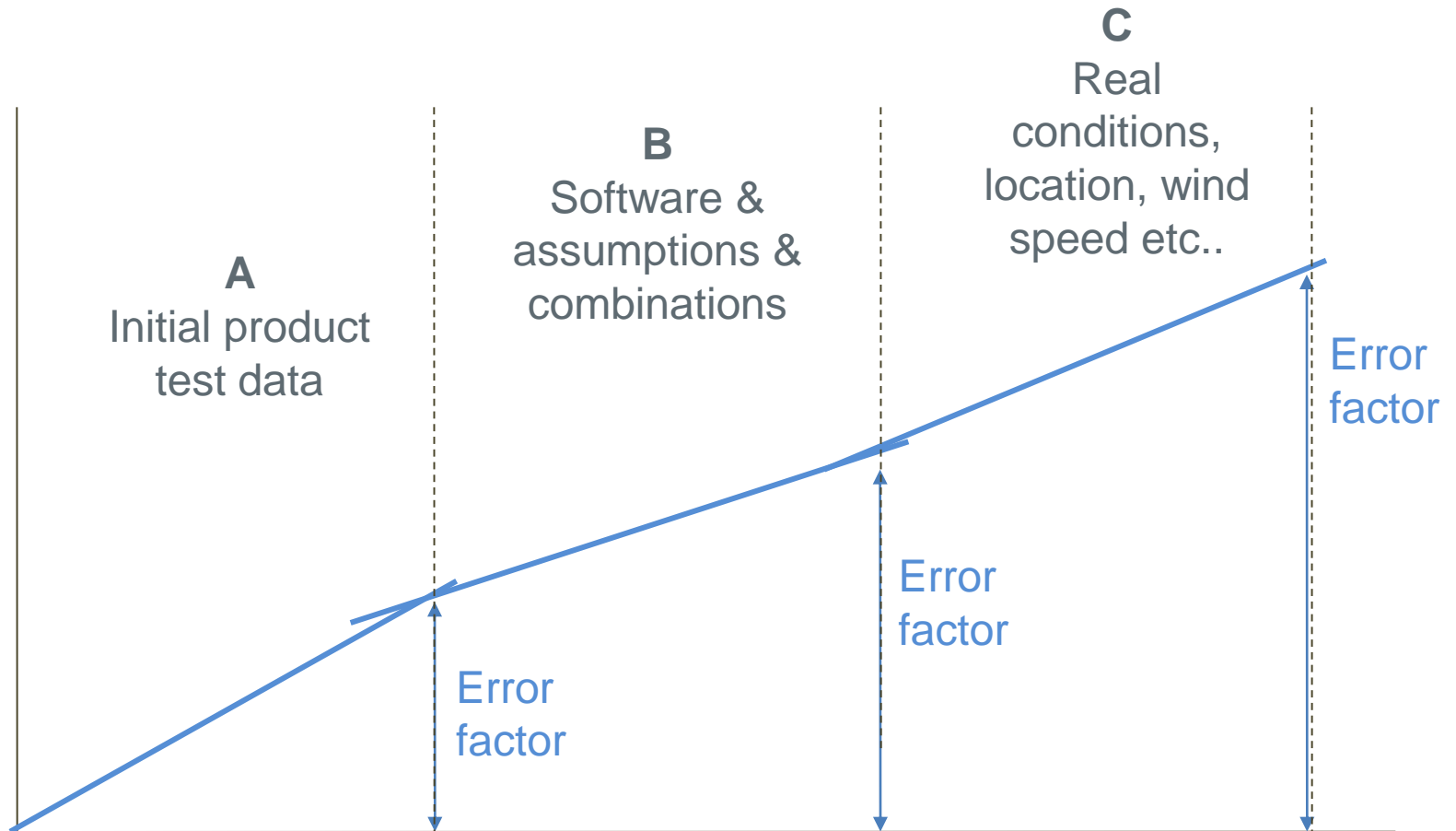
Has opened up new information on real buildings energy performance

Predicted *versus* Measured U-Values



Energy: Prediction v Reality (new build)





After a revision of the above tested results in comparison with the predicted as designed values; it has been concluded that the standard calculation methodology needs reviewing given the variations in many of the building elements as built results. Calculated values show much lower results while the actual as built values analysed using in-situ methods of monitoring show higher thermal transmission values which would indicate a higher energy loss. There were some values that were very close to the predicted values while some exceeded the predicted values; regardless of this, the majority of the tested values proved to be worse than the predicted.

Alternative approach

- 1) Field assessment of external envelope systems (walls, roofs, floors) – measured U-values
- 2) Statistical group – determines typical boundary conditions for “standard detail”
- 3) Update software systems using benchmark “field data”
- 4) Delay regulatory energy changes until the industry has this more robust data

PIR / PUR – Potential of Waste Crumb Material

TIMBER FRAME SHEATHED CAVITY

A) Empty main cavity - MINERAL WOOL between studs

D) POLYURETHANE CRUMB – FULL FILL INSULATION IN MAIN CAVITY

	$D_{nT,w} (+C_{tr})$
A	69(57)
D	71(58)



PIR / PUR – Potential of Waste Crumb Material

		Cavity	Between studs	External wall	$D_{nT,w}$	$D_{nT,w} + C_{tr}$
Timber frame sheathed cavity	A	Empty	Mineral wool	Mineral wool	69	57
	C	Mineral wool	Mineral wool	Mineral wool	67	55
	D	Polyurethane crumbs	Mineral wool	Mineral wool	71	58
Timber frame unsheathed cavity	E	Empty	Mineral wool	Mineral wool	62	55
	F	Polyurethane crumbs	Mineral wool	Mineral wool	63	54

Also tested on blockwork

LWA and Aircrete – with very positive results

Acknowledgements to:
Green Grinder – Bill Reilly
BRUFMA
NHBC Foundation
ZWS / WRAP



End of Presentation

www.napier.ac.uk/isc