ukpassivhaus conference 2012

PreFabhaus
mmc and low carbon housing

Modern methods appropriate for hybrid construction

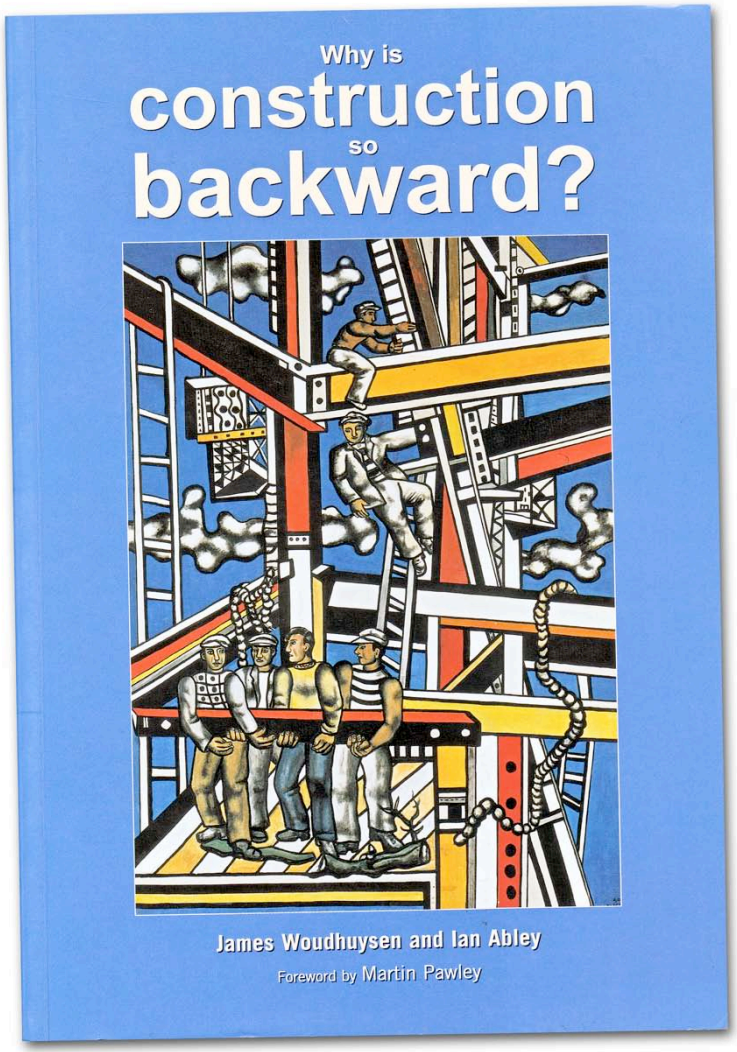
Dr Michael Crilly, Studio UrbanArea LLP, Newcastle
Professor Mark Lemon, IESD De Montfort University, Leicester

Studio UrbanArea LLP

DE MONTFORT UNIVERSITY

"… prefabrication must deliver an urbanism that people will prefer over patterns of development from the past. Housing must be designed for prefabrication so as to be: larger … better … sharper …. cheaper … faster … smarter … and easier"

(Woudhuysen 2004)



Kevin McCloud says that homes in Britain are built using 'primitive' construction techniques.

Grand Designs guru blasts 'Noddy homes'

by Alice O'Keeffe and Rob Sharp

KEVIN McCloud, who as the presenter of *Grand Designs* remains unflappable in the face of architectural disasters, eccentric developers and curmudgeonly construction workers, has been left defeated and angry after the collapse of his latest project.

The designer has been forced to shelve plans to build a village of 16 homes setting a 'high benchmark of architectural quality' for affordable housing.

'The last thing I want to see is more bloody Noddy homes,' McCloud said. 'I want to prove to developers that it is possible to make affordable, sustainable housing to exemplary architectural standards. Unfortunately, the construction industry in this country is wedded to deeply conservative methods.'

The *Grand Designs* team had planned to invite architects to submit innovative ideas for the homes, to be built in Cornwall. The emphasis was on environmental sustainability, low cost and quick construction. A series of the Channel 4 show was to be devoted to the process of designing and constructing the village.

The project was inspired by Deputy Prime Minister John Prescott's plans to build thousands of houses costing less than £60,000 across the country. But it was called off after the withdrawal of property developer Midas Homes, which owns the land.

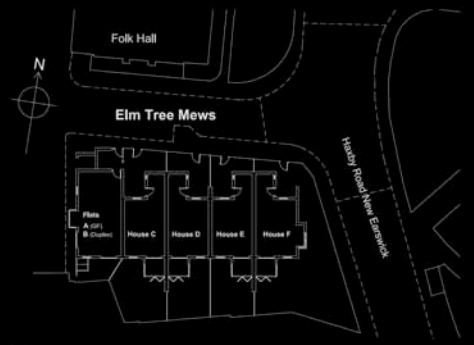
'In other countries you see modern housing which is enriching and beautifully well-built as well as affordable,' said McCloud. 'In Britain we're still building houses based on Roman techniques. Affordable housing is generally poorly built.'

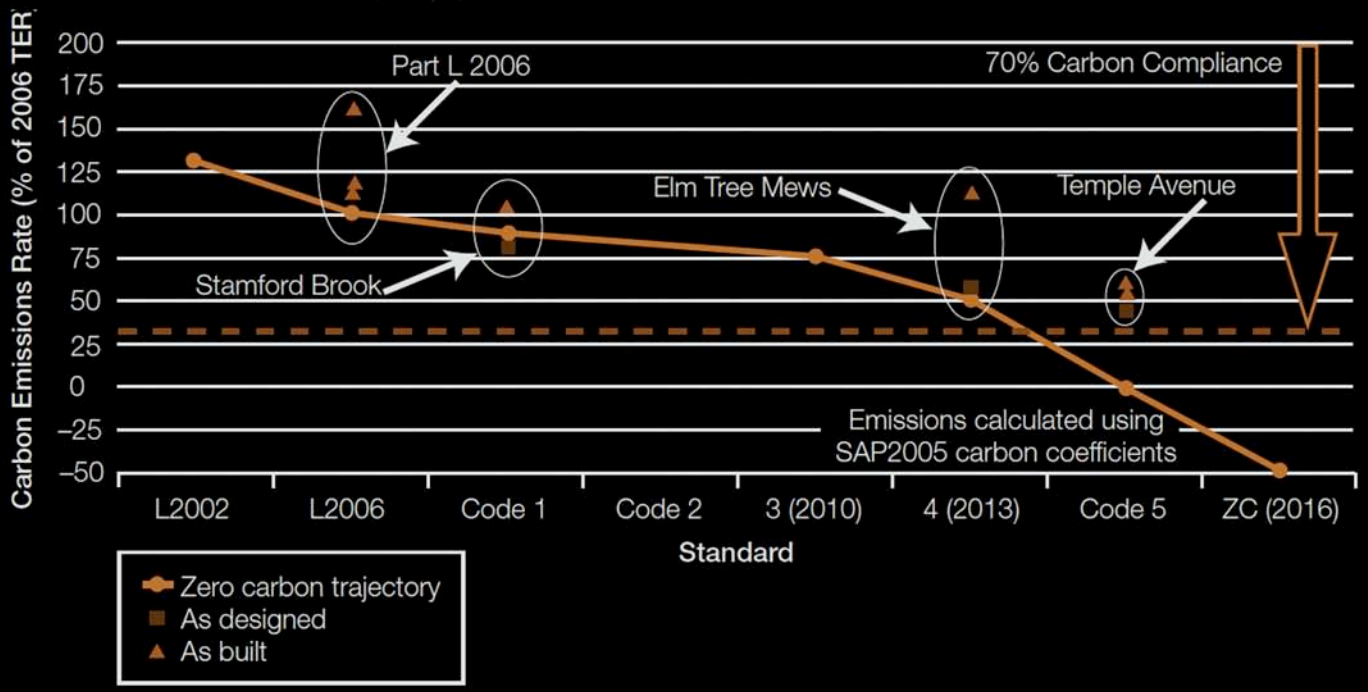
Midas Homes got cold feet after realising that the designs generated by the programme wouldn't resemble standard mass-produced houses, reports the *Architects' Journal* this month.

'The house-building industry in this country is very traditional, and when they began to realise how radical the designs might be they got very nervous,' said architect Chris Wise, who was on the expert panel assembled for the programme. No one from Midas Homes was available for comment.

McCloud says his chances of finding an alternative backer are 'probably zero', but insists that the plans will eventually go ahead. 'I'm determined to see it built, and if I have to take more risks myself then I will,' he said.

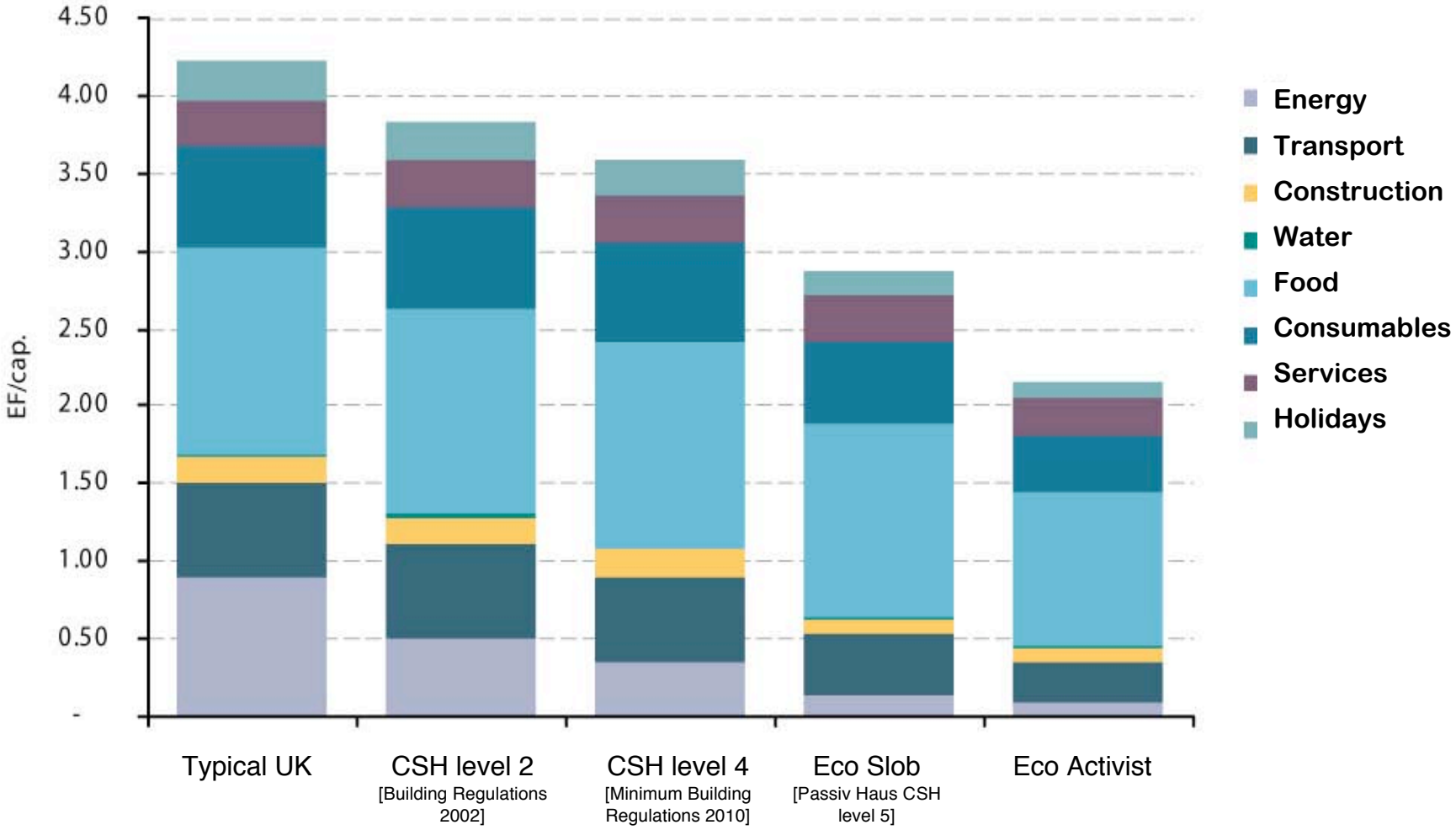
‘implementation gap’ - quality control during construction





As-designed and as-constructed performance of Elm Tree Mews in the context of other studies and the regulatory trajectory to zero carbon. From: Bell, Malcolm *et al.* [November 2010] *Low Carbon Housing: Lessons from Elm Tree Mews* [Joseph Rowntree Foundation, York].

‘implementation gap’ - behaviour of occupants



An analysis of four different UK housing types and the associated Ecological Footprint of the residents, combining the indirect impacts of consumption, including the impact of construction – ARUP / SEI 2006.

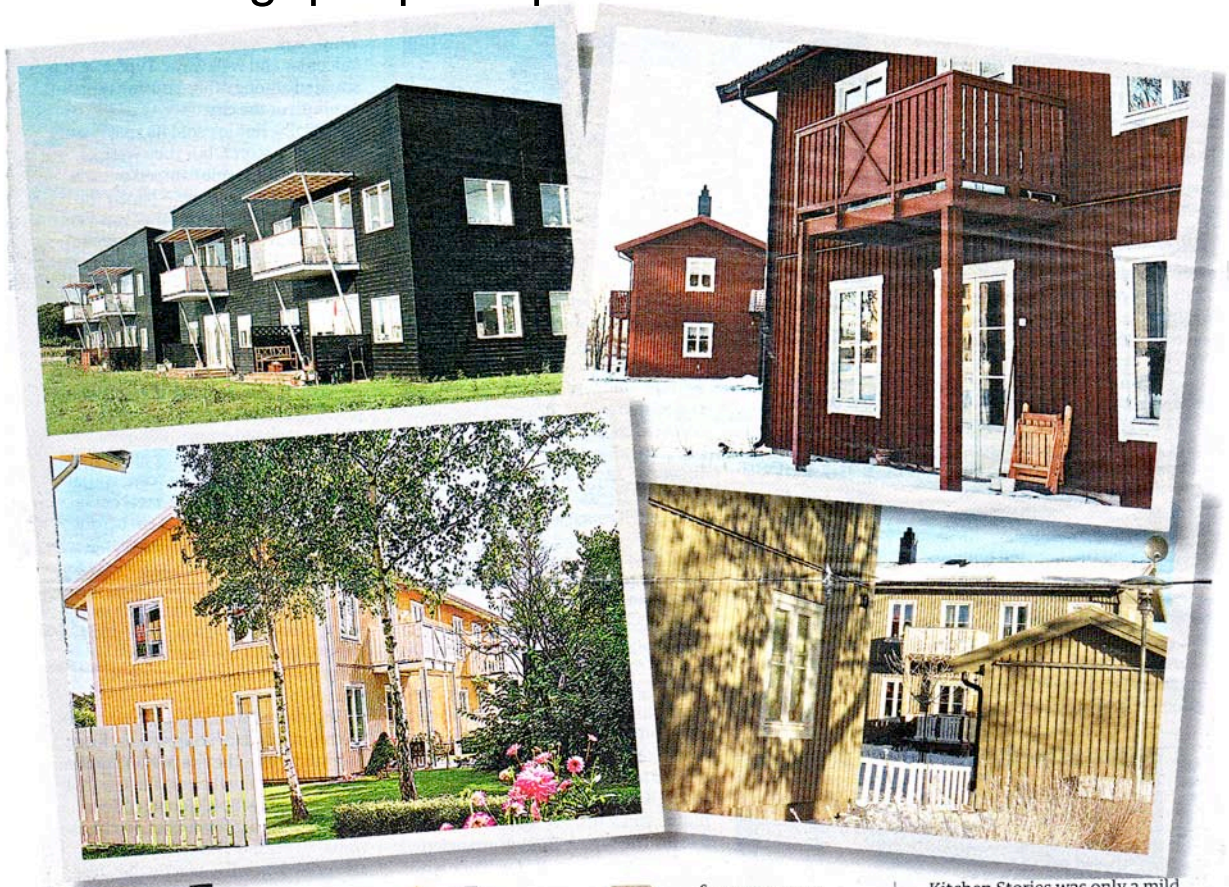
‘implementation gap’ - behaviour of occupants

	kWh per person/ day	Actual kWh per dwelling/ year	Predicted kWh per dwelling/ year (Arup)	kWh per m²/ year
BedZED average 56 monitored homes	**3.4**	**2579**		**34.4**
Owner occupied 26 monitored homes	3.6	2809		30.3
Shared ownership 15 monitored homes	3.3	2074		32.1
Social housing 15 monitored homes	3.2	2687		43.6
1 bed 17 monitored homes	3.7	1896	1700	34.0
1-2 bed 3 monitored homes	2.9	2770		46.6
2 bed 14 monitored homes	2.9	2662	1900	40.2
2 bed (north-facing) 5 monitored homes	5.4	3400		42.9
3 bed 14 monitored homes	2.9	2680	2700	24.6
4 bed 3 monitored homes	3.8	4040	2800	28.6

Heat Consumption 2007	kWh/ person/ day	kWh/ dwelling/ year	kWh/ m²/ year
BedZED average 64 monitored homes	**5.2**	**3,526**	**48.0**
Owner occupied 30 monitored homes	4.9	3,466	37.1
Shared ownership 17 monitored homes	5.3	3,536	54.0
Social housing 17 monitored homes	5.6	3,621	61.2
1 bed 20 monitored homes	6.7	3,047	56.8
1-2 bed 3 monitored homes	6.3	5,974	100.6
2 bed 14 monitored homes	3.2	2,828	42.8
2 bed (north-facing) 6 monitored homes	7.1	4,011	50.7
3 bed 18 monitored homes	4.5	3,813	34.9
4 bed 3 monitored homes	4.5	4,830	34.2

Comparative electricity and heating consumption according to tenure and house type and compared to modeled / predicted consumption. From: BioRegional [July 2009] *BedZED seven years on: The impact of the UK’s best known eco-village and its residents* [BioRegional Development Group, Sutton].

‘implementation gap’ - perception of non standard construction



Welcome to Ikeatown

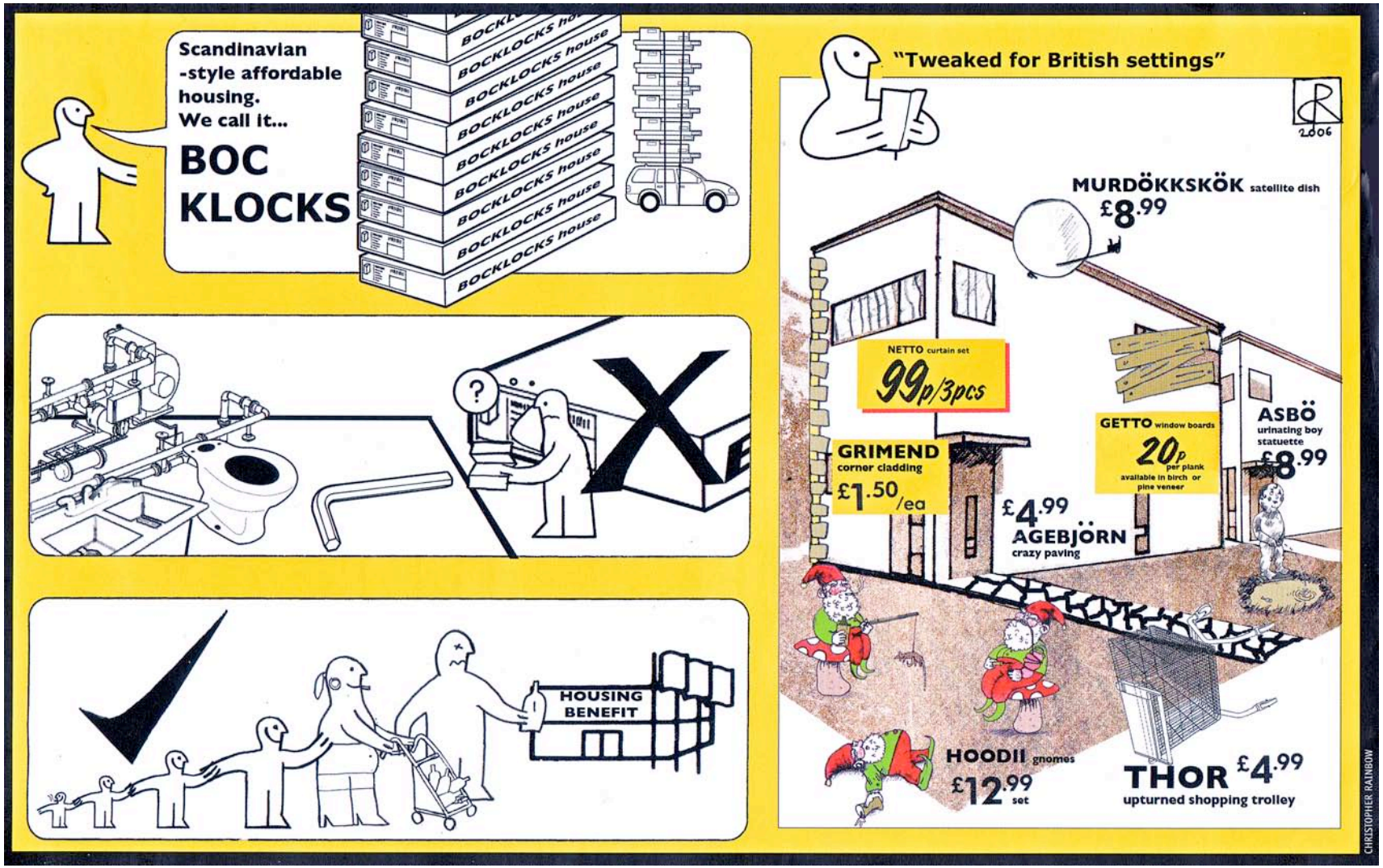
Is this the future of British housing?
As Ikea's readymade homes hit the
Steve Rose travels to Sweden
mple life in a 'flat-pack' village

A few years ago, a delightfully surreal movie came out called Kitchen Stories, in which a team of 1950s Swedish home economists crossed the border en masse and installed themselves in the kitchens of Norwegian bachelors. Their objective was to analyse domestic routines, in a very Scandinavian quest to maximise the efficiency of “the modern housewife”. The film’s defining image was of a strait-laced Swede with a clipboard sitting in the corner of a kitchen, studying a Norwegian making his breakfast.

Kitchen Stories was only a mild exaggeration of actual studies carried out in Sweden. Today, half a century on, it’s no great stretch to imagine the people from Ikea doing the same when they were devising BoKlok.

BoKlok (pronounced “book look”, Swedish for “smart living”) is Ikea’s biggest idea yet. Having seized the market for affordable home furnishings in the past decade, the Swedish retail giant is now planning to provide the homes themselves. They’ve already built some 3,500 BoKlok dwellings across Scandinavia – and now they’re coming to the UK.

‘implementation gap’ - perception of non standard construction



Lessons on low carbon housing & modern methods of construction
(series of public sector initiated ‘proof of concept’ projects on zero carbon passivhaus)

Designed for Manufacture
(Office of the Deputy Prime Minister & English Partnerships)

Carbon Challenge
(Homes and Communities Agency)

Retrofit for the Future
(Technology Strategy Board)

Collected lessons

Lessons on low carbon housing & modern methods of construction

Designed for Manufacture 60K Homes - Competition Audit
(Office of the Deputy Prime Minister & English Partnerships)

‘designed for manufacture’ - integrated process

(knowledge transfer - design, supply chain, construction, occupation)

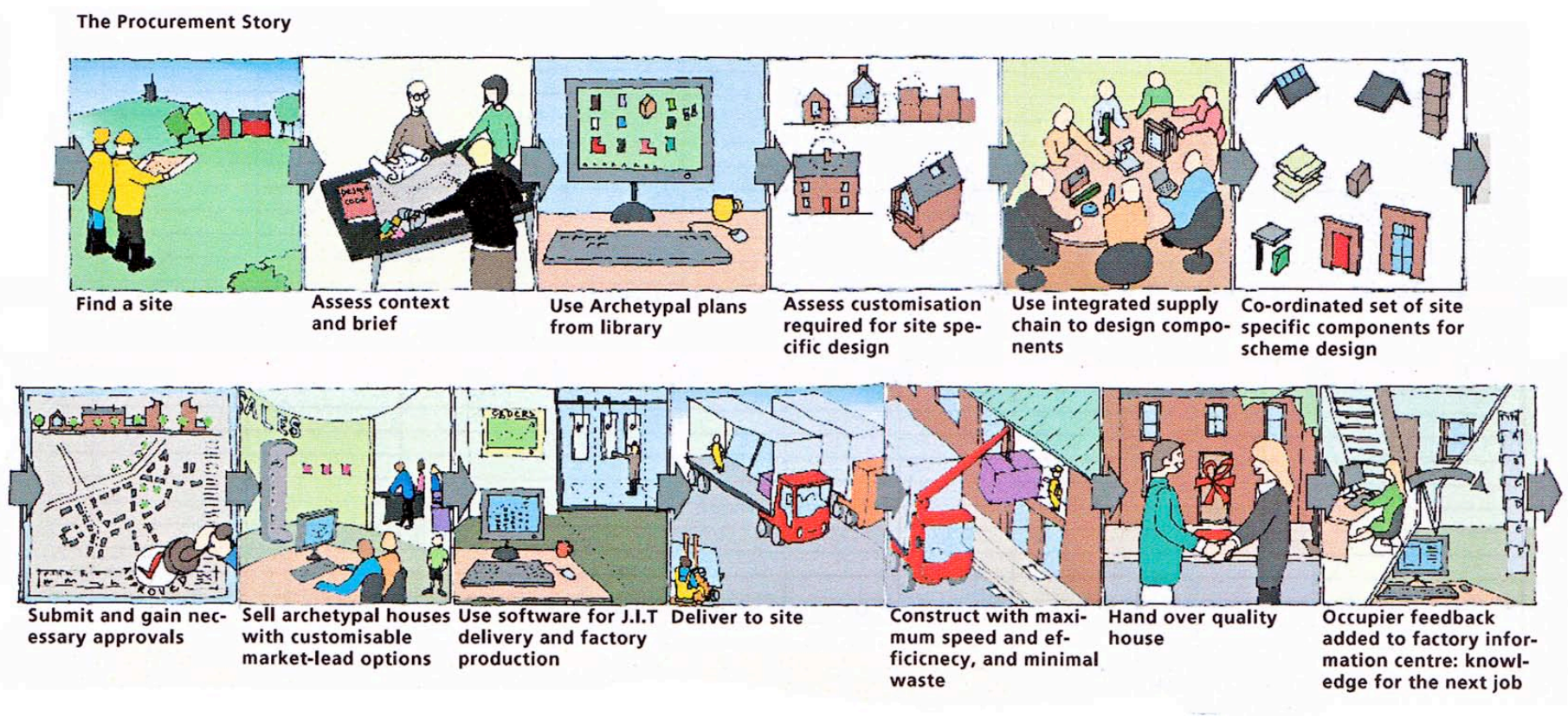


Image: Advance Housing.

‘designed for manufacture’ - flexible systems

(flexible specialisation)

Image: Countryside Properties.

Quality and sustainability audit of the *Designed for Manufacture* developments

‘designed for manufacture’ - affordable construction

Image: Crest Nicholson.

‘designed for manufacture’ - speed with cost control

7 Days Later...

GREEN SUBDIVISIONS are the vaporware of the home-building industry. But northwest of London, British developers are pulling one off on a scale that Americans are still only mocking up in Photoshop. The site, dubbed Oxley Woods, already features 90 eco-friendly homes, with 55 more planned to fill its seven acres. The factory-made dwellings make good on prefab's promise of low cost and quick construction. They take as little as $118,000 and seven days to erect: five in the plant and a day and a half onsite, where crews slide and screw together the modular pieces. (Electrical, plumbing, and other finishing work takes another four weeks.) Manufacturing the major components offsite reduces waste and makes it easier to use green materials, like insulation from recycled paper and lumber harvested from sustainably managed forests.

But the biggest advantage is improved build quality. The same precision manufacturing that makes an Ikea bookshelf easy to assemble makes the Oxley Woods homes nearly airtight. But that doesn't mean they aren't well-ventilated. Each abode has an environmentally responsible cherry on top: A self-contained unit called an EcoHat controls circulation with a tiny 10-watt fan, pushing out stale air and drawing in fresh stuff, which is then solar-heated to warm the house. Maybe they could ship some of these gems over the pond—the US housing market could use a breath of fresh air. —*Andrew Blum*

Comprising as few as 25 panels, Oxley Woods' two- to five-bedroom homes are manufactured at a factory in five days and trucked to the build site, where a crew assembles the pieces in less than two days.

Lessons from *Designed for Manufacture*
(Office of the Deputy Prime Minister & English Partnerships)

Significant reduced labour on site & during construction
Quality control & improved tolerances / interfaces
Cost efficiency only achieved with the use of a prototype - need to factor in ‘lead-in time’
Positive safety benefits [25% lower rate of site incidents]
Integrated team & project management delivers best results

Potential for mainstreaming

Lessons on low carbon housing & modern methods of construction

Carbon Challenge - pPod South Bank, Peterborough
(Homes and Communities Agency)

"… we are learning a lot, which is the whole purpose of the Challenge. The best work is being taken by developers who are taking an open approach, sharing mistakes and successes."

Lomas, Jane [September 2008] Carbon Challenge: Testing Level 6. *Carbon Challenge Bulletin*, English Partnerships.

THE Carbon CHALLENGE

The challenge to build quality sustainable homes

The Carbon Challenge has been launched by Government to accelerate the housebuilding industry's response to climate change by fast-tracking the creation of a number of zero and near zero carbon communities. The key objective is to raise the environmental performance of new communities while still delivering quality and high standards of design.

The Challenge aims to equip the development industry with the skills and technology needed to meet the 10-year environmental goals being set by Government for new housing development. In particular, it will act as a testing ground for the Government's Code for Sustainable Homes and the new Planning Policy Statement on climate change.

Run by national regeneration agency English Partnerships on behalf of Communities and Local Government, the Challenge will be a successor to the Design for Manufacture Competition, which successfully demonstrated how to build sustainable well-designed, affordable, quality homes.

What is a zero and near zero carbon development?

Zero carbon means no net carbon emissions from all energy uses in the home – so the amount of energy taken from the national grid is less than or equal to the amount put back through renewable technologies. This equates to Level 6 of the Code for Sustainable Homes and will qualify for Stamp Duty relief.

Near zero carbon means no net carbon emissions in relation to core Building Regulations energy performance specifications relating to heating, hot water, ventilation and lighting. This equates to Level 5 of the Code for Sustainable Homes.

The choice of a zero or near zero carbon target for any development depends on location, site characteristics and size of the community.

How many homes are being created and where?

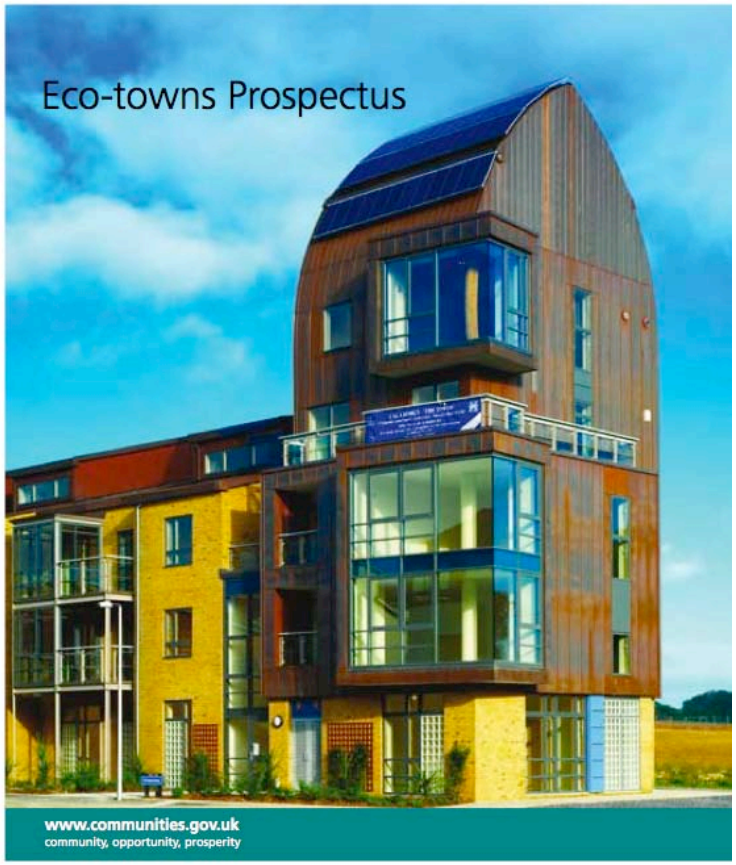
The Carbon Challenge will be an on-going initiative with development sites coming on stream throughout the programme. In addition to sites that English Partnerships will make available directly to developers, the Challenge will also call for local authorities, Regional Development Agencies (RDAs), other public-sector land owners and private-sector developers to identify sites that could contribute to the initiative. Those taking part in the Challenge will be right at the forefront of implementing and shaping the way that homes of the future are built.

In the first year of the Challenge, it is expected that a total of around five major public and private-sector sites will be identified. Each must be capable of supporting at least 200 homes to ensure a critical mass, allowing the installation of shared energy systems and other features that will contribute to a zero or near zero carbon footprint to each new settlement.

1. Greenwich Millennium Village, London and Thames Gateway
2. William Verry / Weberhaus and Make Architects' design for the Aylesbury Design for Manufacture site
3. Start on site at Oxley Park Design for Manufacture site, Milton Keynes by George Wimpey

www.englishpartnerships.co.uk/carbonchallenge

Communities and Local Government



‘carbon challenge’ - integrated design

(testing the *Code for Sustainable Homes* Level 6)

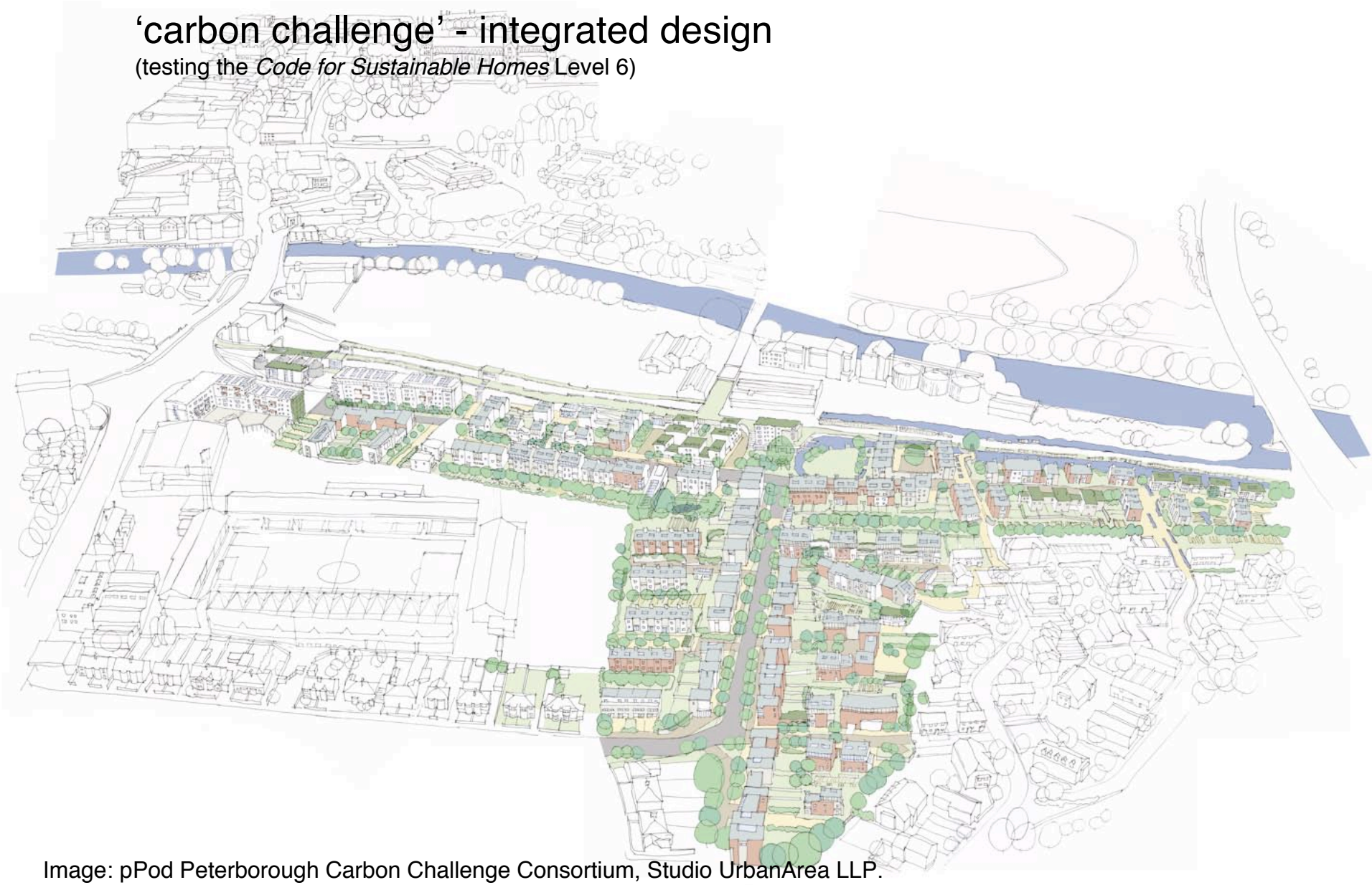


Image: pPod Peterborough Carbon Challenge Consortium, Studio UrbanArea LLP.

‘carbon challenge’ - integrated design

(Prototype Plot ‘M’ - the Hamptons)

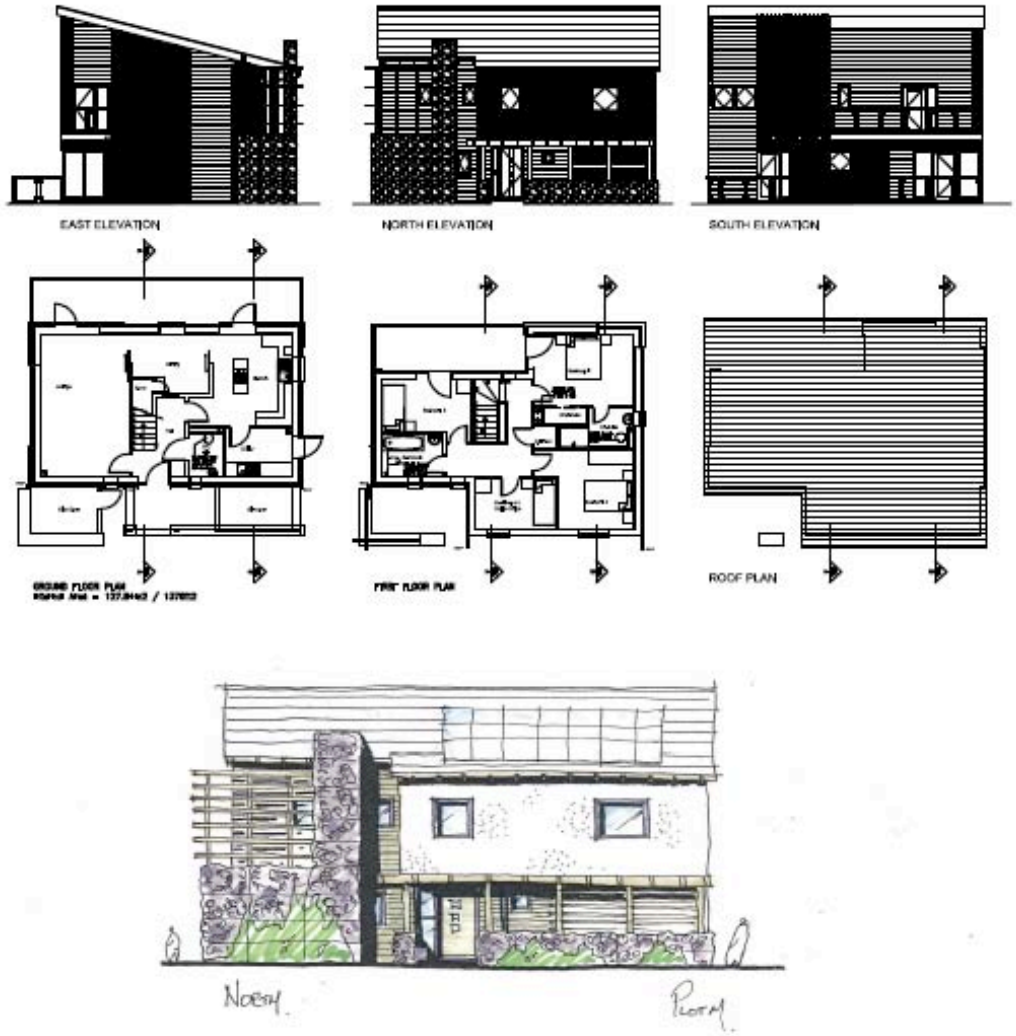


Image: pPod Peterborough Carbon Challenge Consortium, Browne Smith Baker Architects.

‘carbon challenge’ - fabric first costing

(Prototype Plot ‘M’ - the Hamptons)

Completed prototype Code for Sustainable Homes Level 6
(FEE - Fabric only excluding renewable energy provision)
Image: Morris Homes.

Lessons from *Carbon Challenge*
(Homes and Communities Agency)

Significant scale issues in design and management
Supply chain and on-site factory
Lifestyle concerns more dominant at neighbourhood level
CSH 6 still requires lifestyle and behavioural change
Unexpected financial implications for mortgage availability

Potential for mainstreaming

Lessons on low carbon housing & modern methods of construction

Retrofit for the Future - Newcastle & Leicester
(Technology Strategy Board)

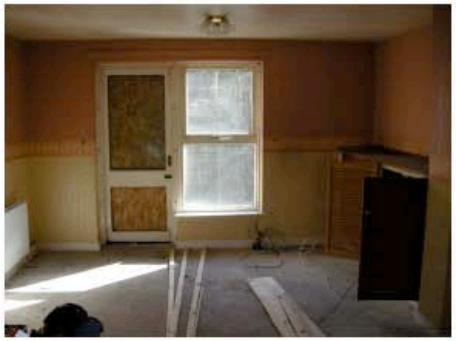
UK Social Housing Sector - 4.5m homes
Over 400 Expressions of interest nationally
197 Stage one – Design
87 Stage two – Implementation Retrofitting

‘retrofit for the future’ - Greenford Road, Newcastle

(property survey)

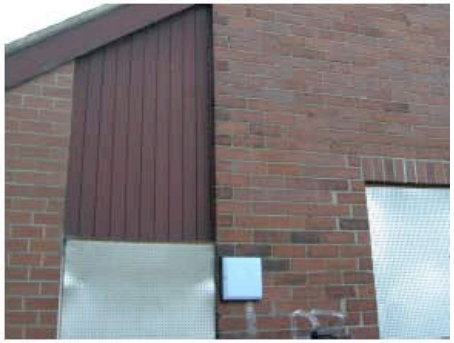










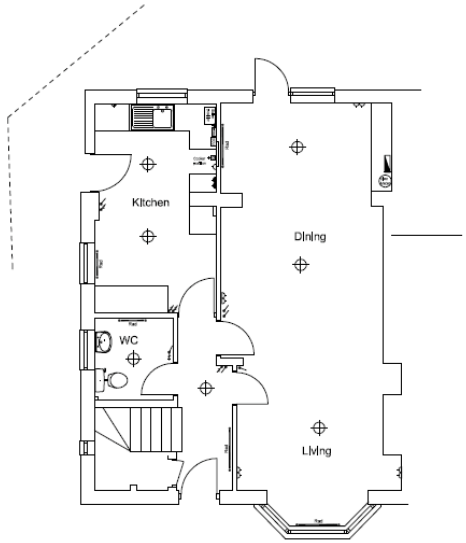
Newcastle City Council

Greenford Road, Pottery Bank

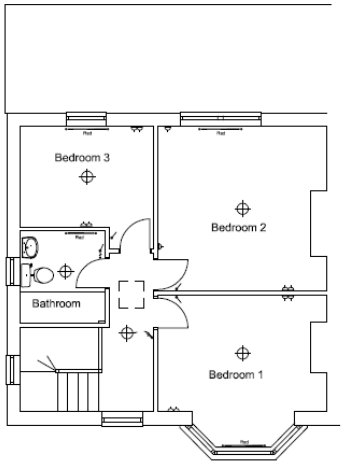
Front (North) Elevation

Gable (East) Elevation

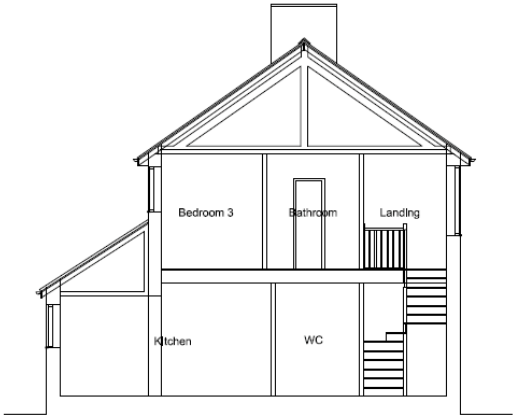
Rear (South) Elevation



Ground Floor



First Floor



REVISIONS

Newcastle City Council

RetroFit for the Future - 44 Greenford Road, Newcastle NE6

Existing Plans, Elevations & Section

1:50 @ A1 | 12.10.09 | PD/AM

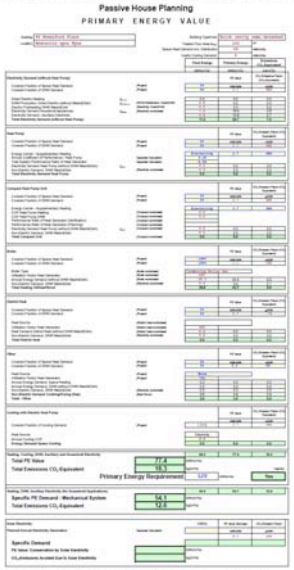
The Design Studio Silverbeck Court Stokesley Business Park Stokesley Middlesbrough TS9 5PT
T: 01642 715783 F: 01642 715781 E: info@oksarchitects.com W: www.oksarchitects.com

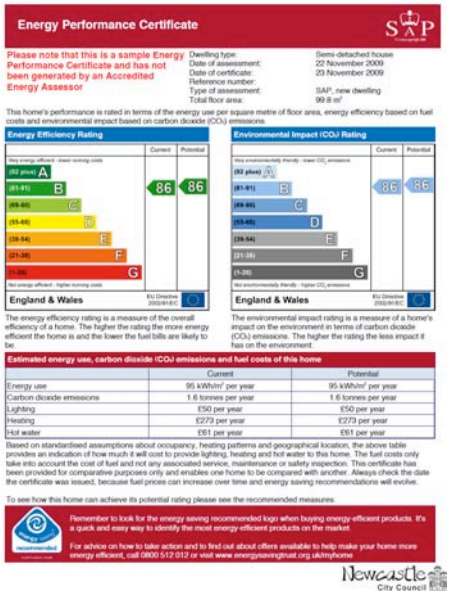
Project No 09,098

Drawing 44GR-P1 Rev /

Newcastle City Council

Greenford Road, Pottery Bank
Extracts from PHPP 2007 Summary and SAP Energy Performance Certificate, modelled for the retrofit proposals

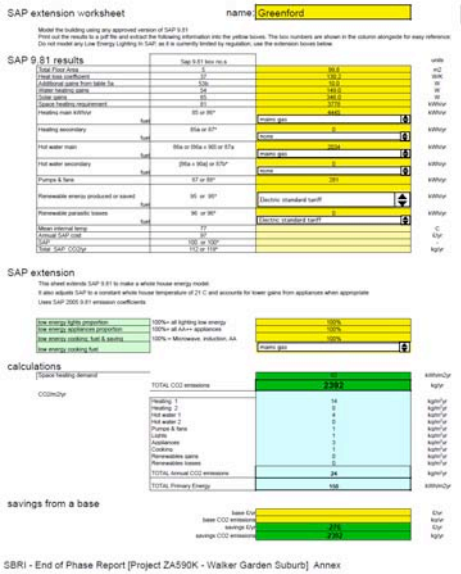


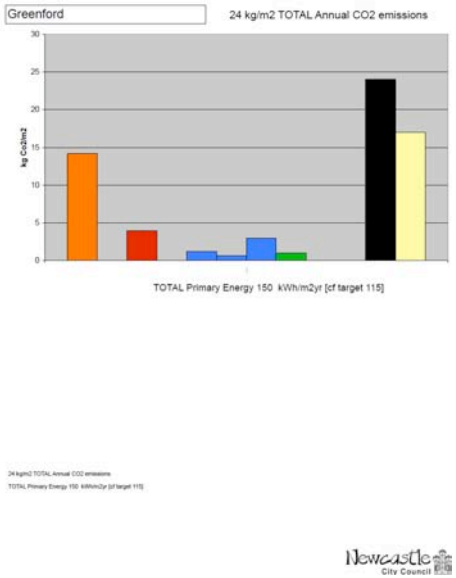


SBRI - End of Phase Report [Project ZA590K - Walker Garden Suburb] Annex

Newcastle City Council

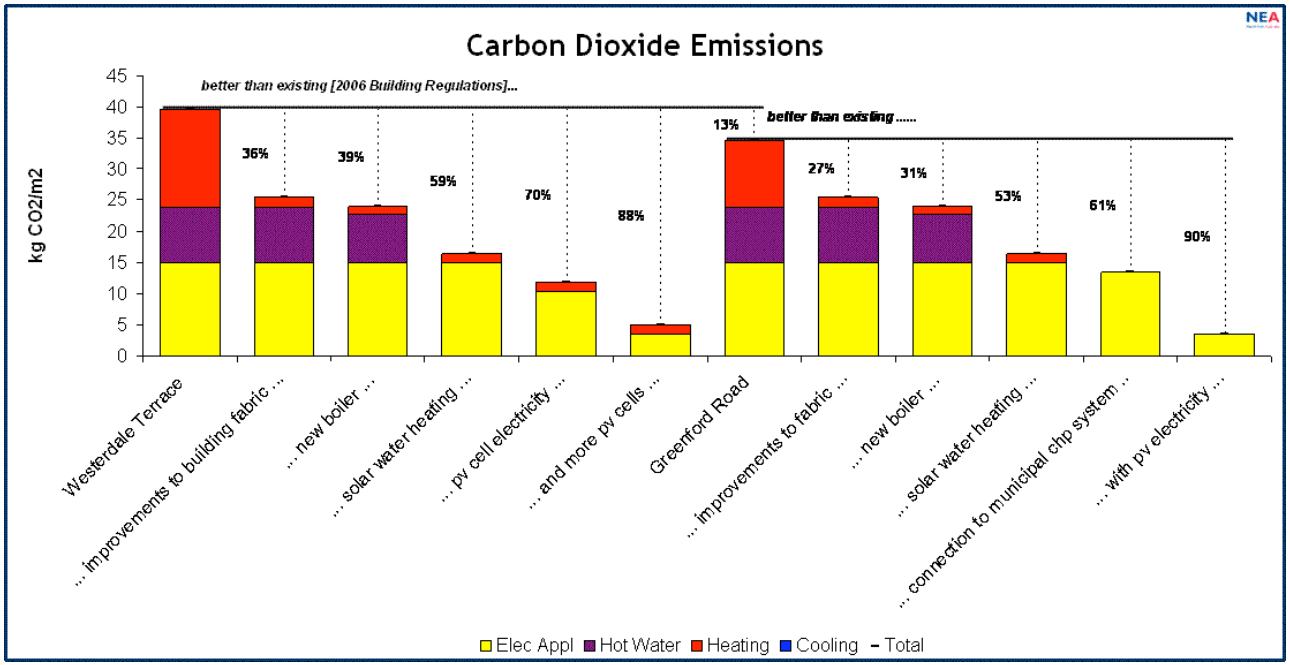
Greenford Road, Pottery Bank
Extract from SAP Extension worksheet

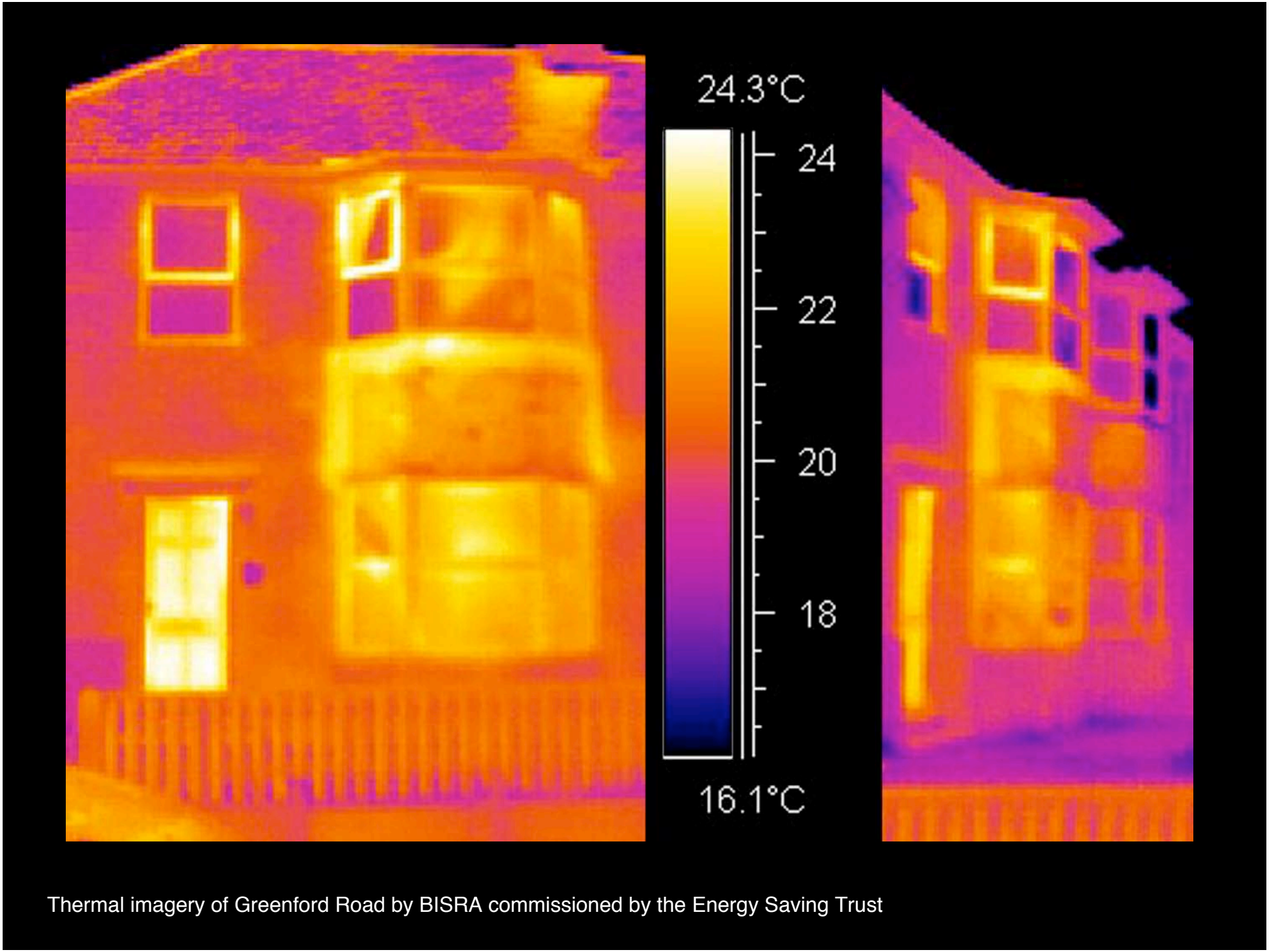




SBRI - End of Phase Report [Project ZA590K - Walker Garden Suburb] Annex

Newcastle City Council





Thermal imagery of Greenford Road by BISRA commissioned by the Energy Saving Trust


passiVebaY
NO SMOKING FOOD OR DRINK

Image: DKS Architects.

Detailed design by DKS Architects & Datum

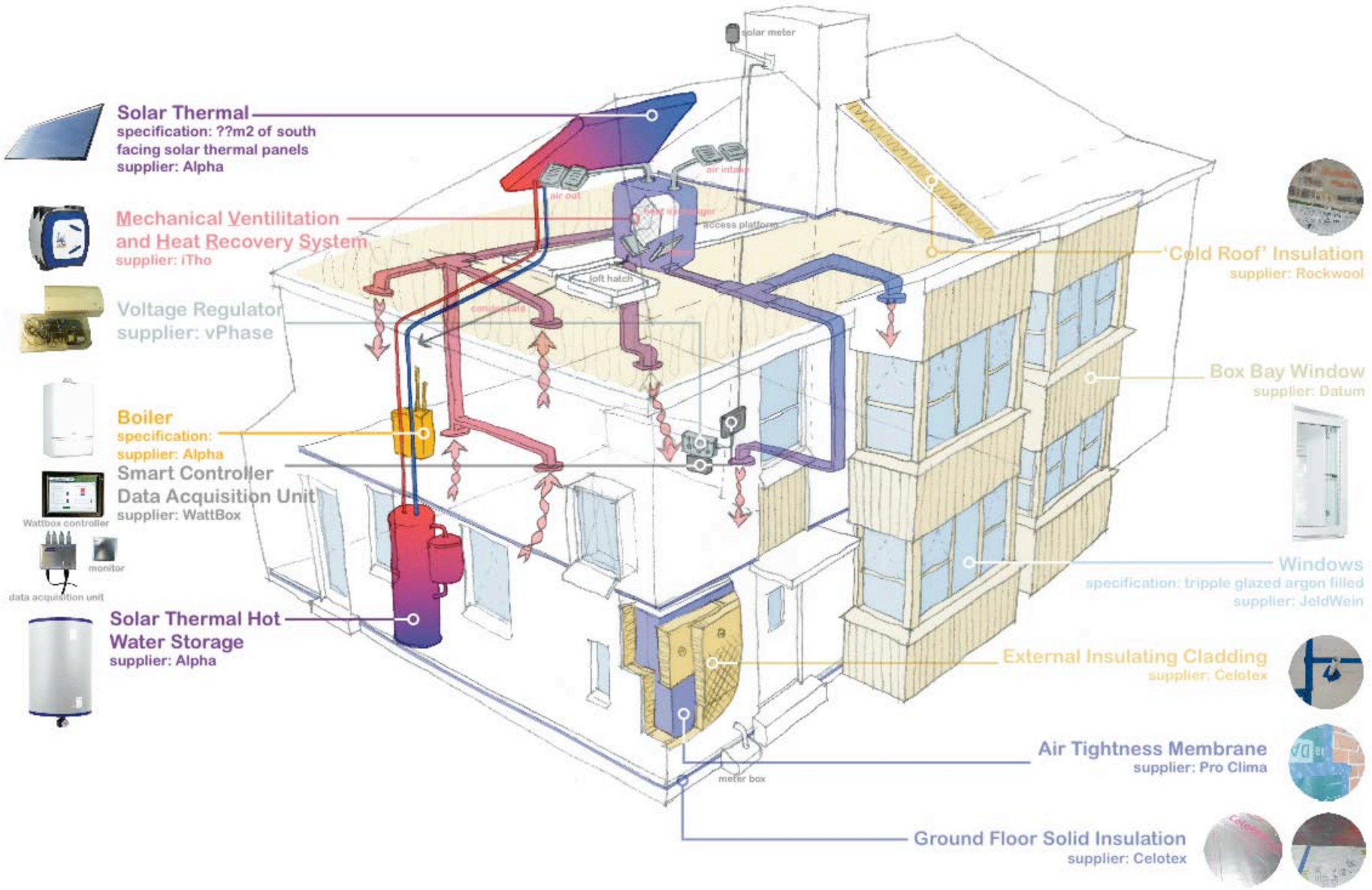
Removal of existing bay window on 44 Greenford Road with external and internal preparation.

Preparation of joints at roof, first floor and ground levels for new bay window.

Window fixing prior to lifting.

The big lift!

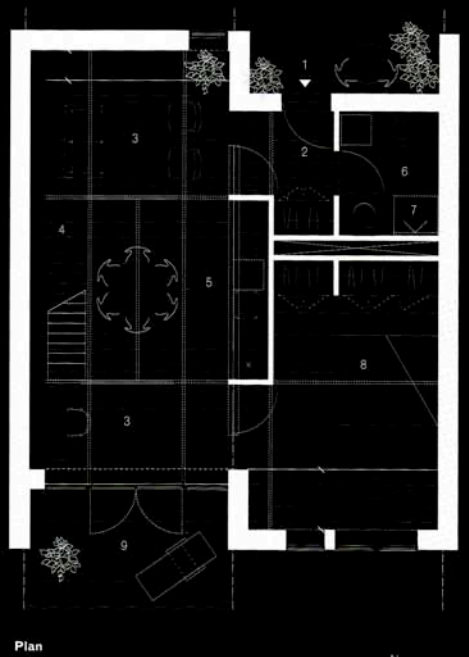
Installed in 30 minutes.

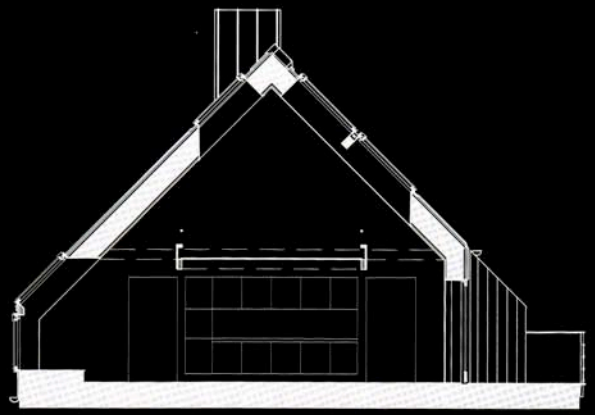


Building user guide summary of ***services*** and ***fabric*** improvements for 44 Greenford Road. Image: Studio UrbanArea LLP

Retrofit for the future - Project Cottesmore, Leicester

Initial concepts for project Cottesmore, Leicester.





Images of northern European prototype SOLTAG “sun roof”, a prefabricated roof refurbishment solution funded through the European Commission’s 6th Framework in partnership with Velux; from Guzowski, Mary [2010] *Towards Zero Energy Architecture: New Solar Design* [Laurence King, London]. Reported to achieved a primary energy demand of 60 kWh/m2/a that can all be met through solar PV.

59 Cottesmore Road Proposed

Image: East Midlands Housing Association.


‘retrofit for the future’ - Cottesmore Road, Leicester
(internal insulation)


RECTICEL
RECTICEL insulation
RECTICEL insulation

Roof pod. Images: EnviroHomes & East Midlands Housing Association.


Cleveland Crane Hire
ROLAND HILL LTD
NL57 TKK

Roof pod footing to terrace walls.

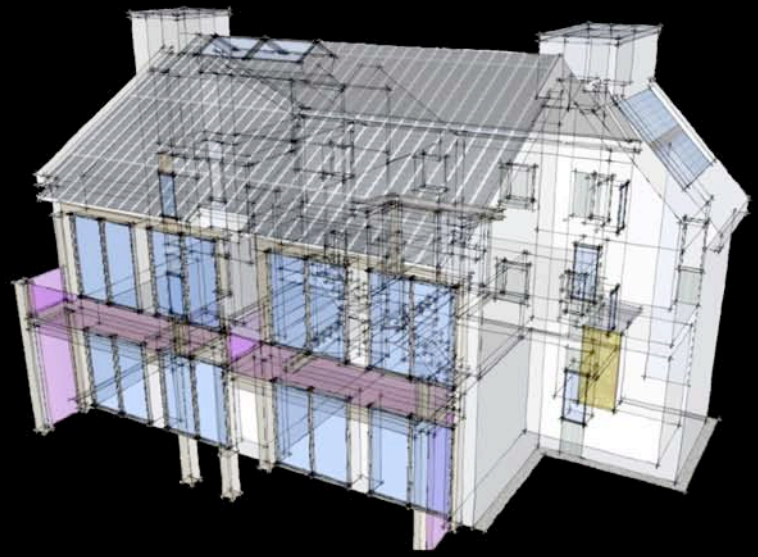
Roof pod.

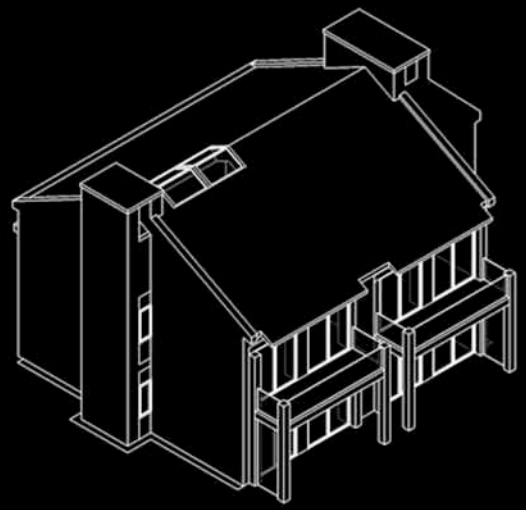
Lessons from Retrofit for the Future - Newcastle & Leicester
(Technology Strategy Board)

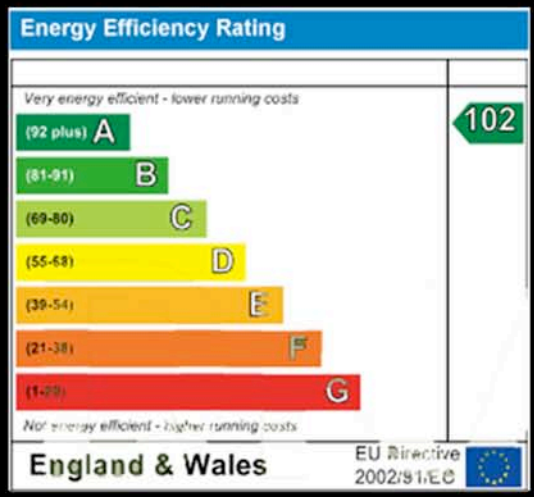
Hybrid internal and external solutions appropriate
Significant economies of scale if approach is rolled out
Change required in industry for new prototypes
On site speed balanced by lead-in time for prototypes - reduced disturbance for occupied properties
Cost benefit has to be considered for appropriate specifications
Integrated team & project management delivers best results
Need to keep monitoring - tenant satisfaction

Potential for mainstreaming

B&Q Retrofit project, Southampton - roof pod prototype to ‘product’.






Energy Efficiency Rating
Very energy efficient - lower running costs
(92 plus) A
(81-91) B
(69-80) C
(55-68) D
(39-54) E
(21-38) F
(1-20) G
Not energy efficient - higher running costs
102
England & Wales
EU Directive 2002/91/EC

Collected lessons and questions

Honest understanding of different lessons & motivations
Public sector ‘prototypes’ into commercial ‘products’
Integrated supply chain plus skills training
All zero carbon housing / *passivhaus* requires behavioural change
Integrated design includes occupants and RP managers
Linked capital and revenue costs in financing

Potential for mainstreaming?
Make ‘non-standard’ standard

Thank you

Professor Mark Lemon
Institute of Energy and
Sustainable Development
e: mlemon@dmu.ac.uk

dmu.ac.uk
DE MONTFORT
UNIVERSITY
LEICESTER

Dr Michael Crilly
Director, Studio UrbanArea LLP
e: michael@urbanarea.co.uk
w: urbanarea.co.uk

Studio UrbanArea LLP
2 King Street, Quayside, Newcastle upon Tyne NE1 3UQ
studio@urbanarea.co.uk www.urbanarea.co.uk