ZERO CARBON HUB & SAINT GOBAIN

Providing Information to the Building Industry

Rob Pannell, Managing Director, Zero Carbon Hub
This session will:

• Highlight what is meant by ‘Zero Carbon Homes’
• Offer guidance on achieving targets
• Provide insights on risks to our industry
• Provide solutions to your construction questions
• Indicate the cost of achieving zero carbon
• Provide design guidance
The Zero Carbon Hub
PURPOSE AND STRATEGIC OBJECTIVES

Facilitate the mainstream delivery of low and zero carbon homes working across boarders

- Provide leadership and create confidence
- Reduce risk
- Disseminate information
NOT OPEN FOR BUSINESS
THE EFFECTS OF CLIMATE CHANGE

Increase in the number of extremely warm days
Winter: 6-12 days/year
Summer: 12-30 days/year
1998–2007 was the warmest decade on record.

2009 – 5th warmest globally and 14th warmest in the UK.

2012 Hottest day ever in Scotland and wettest June in the UK.

2013 Wettest winter ever recorded.

We are here (ish)
Culprits: most CO2 from buildings stems from heating. Houses are particularly energy-inefficient.
VIABILITY
UK Government
And European Policy
& the
Zero Carbon Agenda
THE ZERO CARBON STORY

• Budget 2013 confirmed Government commitment to Zero Carbon homes.

• Europe requires ‘nearly zero energy’ buildings from 2019. This position is already set out in Building Regulations.

• Part L 2013 - an important ‘technical’ step – strikes a balance between Zero Carbon and growth commitments

• Housing Standards Review (energy) is part of the approach
The Zero Carbon Hierarchy.

Energy efficiency

On-site low/zero carbon energy (and connected heat)

Allowable solutions

Building fabric performance

Carbon Compliance = On-site heat and power generation

Zero Carbon = Solutions addressing the carbon emission reductions that are difficult to achieve on site

- 95% Complete
- 75% Complete
- 5% Complete
ZERO CARBON HOME v CODE 5 HOME

2016 Zero Carbon Home

- Fabric Energy Efficiency
- On-site LZC Heat and Power
- Allowable Solutions

Code 5 Home

- Fabric Energy Efficiency
- On-site LZC Heat and Power
CODE LEVEL 5 HOMES
THE ENERGY EFFICIENCY STANDARD

Building Fabric:
- U-values
- Thermal mass

Thermal Bridging

Air-permeability

Orientation, solar gains,
- Glazing proportion
PASSIVE HOUSE WALL SECTIONS

Concrete

Brick and Block

The PassivHouse manual
JOURNEY TO ZERO CARBON

% of homes built

- 2006 Part L
- 2010 Part L
- 2013 Part L
- 2016 Part L
- 2020

Zero Carbon
2016 CARBON COMPLIANCE

Energy Efficiency Standard
- Building fabric U-values
- Thermal bridging
- Air permeability
- Thermal mass
- Solar, metabolic, lighting & appliance gains

Carbon Compliance Standard
- Heating/cooling appliances
- Mechanical ventilation
- Hot water
- Active controls
- Fixed lighting
- All LZC technologies
ALLOWABLE SOLUTIONS

Calculated over 30yrs

Investment in offsite LZC (financial return)

Continue FABRIC FIRST & carbon compliance onsite

Export LZC heat to existing stock

Offsite LZC electricity with direct physical connection

Efficient appliances and controls

Improve existing stock fabric

Section 106 credit

2016 Allowable solutions

NEW RESIDENTIAL SOLUTIONS FROM SAINT-GOBAIN
DEVELOPMENT LAYOUTS

Site Conditions:
- Access
- Location (regional weather)
- Ground conditions
- Flood risk
- Existing trees, water bodies etc.
- Local energy resources – source for biomass, wind conditions etc.
- Existing district heating network

Planning:
- Dwelling type mix/ density
- Built form considerations - roof pitch, building height etc
- PV and solar panels
- Local Renewable targets

Site Layout:
- Dwelling types
- Design for solar technologies:
  - Orientation for solar technology
  - Roof pitch
  - Over-shading

Other:
- Localism

What is the Energy Strategy?
COST OF ZERO CARBON HOMES

Current proposal
£?

Revised proposal 2008/9
£20k per home

Original definition
£40k per home

Reduction on 2006 Part L
25% 33% 70% 100% ~150-200%

Code 3 Code 4 ‘Code 4½’ Code 5

True Zero Carbon

Carbon Compliance
Allowable Solutions

£40k per home

£20k per home

£?
Annual Household Energy Spend

<table>
<thead>
<tr>
<th>4-bed Detached house</th>
<th>£2,379</th>
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<tbody>
<tr>
<td>3-bed Semi-detached house</td>
<td>£1,621</td>
</tr>
<tr>
<td>3-bed Mid-terrace house</td>
<td>£1,388</td>
</tr>
<tr>
<td>1-bed Ground floor flat</td>
<td>£915</td>
</tr>
<tr>
<td>Victorian with modern day improvements</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>New Build built to 2006 regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-bed Semi-detached house</td>
</tr>
<tr>
<td>3-bed Mid-terrace house</td>
</tr>
<tr>
<td>1-bed Ground floor flat</td>
</tr>
<tr>
<td>Future 2016 aspirations</td>
</tr>
</tbody>
</table>

£504
£361
£405
£346

Indicative costs and savings calculated using Zero Carbon Hub house types modeled in NHER Plan Assessor 5.3/5.4 (SAP2009) with projected energy costs taken from DECC published figures.
VENTILATION AND INDOOR AIR QUALITY
Mmmm?
DOES IT DO WHAT IT SAYS ON THE TIN?
OAPs 'could die in Green Deal homes': Energy saving scheme could leave homes dangerously overheated

Temperatures could reach dangerous levels in some homes fitted with energy-saving measures like insulation, installed under Green Deal scheme

Point of scheme was to save winter fuel bills and protect the environment

But experts are warning that heat that builds up in the day does not easily dissipate at night and leads to poor air quality, which could kill

The elderly and infirm as well as people living on the top floor of 1960s tower blocks and modern detached houses are most at risk
I’d love a new home
... Soon please !!
Delivering Low Energy Homes

Part L 2013 & Future FEES Solutions

Stacey Temprell
Residential Sector Director
Saint-Gobain
16,000+ Employees

400,000 Products

1000+ Distribution Sites

30+ Businesses

£3.2bn Sales

80 Manufacturing Plants
An unparalleled breadth and depth of network
Part L: History

- 2002: elemental approach
- 2006: whole house approach (SAP/SBEM) 20% CO$_2$ reduction
- 2010: 25% CO$_2$ reduction (over 2006)
- 2013: Dwellings
  - Consultation 8% or 26%
  - **Actual 6% on aggregate**
- 2013: Non-Dwellings
  - Consultation 11% or 20%
  - **Actual 9% on aggregate**
Part L 2013: More than just CO$_2$

- Second target to hit based on **energy**
- Called Target Fabric Energy Efficiency (TFEE)
- Same metric as used to define Zero Carbon
- Focus on the Fabric of the building
  - U-values of Walls, floors, Roofs, Doors & windows
  - Thermal Bridging
  - Air tightness
Part L 2013: New Notional Building

• Simple route to compliance
• Published for the first time within Part L documents in ‘Section 5 Model Designs’
• Promotes a Fabric First approach
• Flexibility allowed however a great place to start
Part L 2013: Where *not* to start

Limiting Fabric U-values

- Part L1A 2013 states:

  “...to satisfy the TER and the TFEE (Target Fabric Energy Efficiency), the building specification needs to be considerably better than the stated limiting values.....”
## Notional recipe starting point

<table>
<thead>
<tr>
<th>Element</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>External walls</td>
<td>0.18 W/m(^2) k</td>
</tr>
<tr>
<td>Party walls</td>
<td>0.00 W/m(^2) k</td>
</tr>
<tr>
<td>Floors</td>
<td>0.13 W/m(^2) k</td>
</tr>
<tr>
<td>Roofs</td>
<td>0.13 W/m(^2) k</td>
</tr>
<tr>
<td>Windows, roofed windows, glazed rooflights &amp; glazed doors</td>
<td>1.4 W/m(^2) k &amp; g-value 0.63</td>
</tr>
<tr>
<td>Air-tightness</td>
<td>5.0</td>
</tr>
<tr>
<td>Linear thermal transmittance</td>
<td>Better than standard ACD’s</td>
</tr>
<tr>
<td>Ventilation type</td>
<td>Natural (extract fans)</td>
</tr>
<tr>
<td>Heating systems</td>
<td>Mains gas, boiler (SEDBUK 2009 89.5% efficient)</td>
</tr>
<tr>
<td>Low energy lighting</td>
<td>100%</td>
</tr>
</tbody>
</table>
The approaches detailed within this guide are representative of what could be used for compliance.

Examples based on the typical homes as used by the Zero Carbon Hub on the Fabric Energy Efficiency Standard (FEES) and the definition of zero carbon homes.
Saint-Gobain: 
A Design Guide to Part L 2013

- All of the examples in this guide are developed from a single base specification based on a typical specification from a UK based Housebuilder.
- The base specification reflects current good practice, that is, what can be achieved with readily available materials and common construction methods.
- The base specification assumes that homes will have natural ventilation (provided by a combination of trickle vents, opening windows and intermittent/continuous extractor fans) and to allow for the variation in air permeability results the target has been set at 7m³/h.m²@50Pa
  - This figure can be readily achieved for both masonry and timber frame construction.

For each of the 4 house types, three frame options are given: medium dense blockwork, aircrete blockwork and timber frame

Within each frame option, 3 scenarios are used as follows:

**Scenario A**
- This scenario is based on the premise that dwellings can be designed using mains grid gas services and therefore make use of a standard condensing boiler (SEDBUK rated).
- This scenario has an air-permeability target of 5.0 (m³/hr/m²), linear thermal transmittance Y-values of 0.05 (W/m²K) and elemental U-values designed according to 'Fabric First' principles (see below), including an improved window U-value of 1.2W/m²K.

**Scenario B**
- This scenario is based on the premise that dwellings are being constructed in rural areas where mains grid gas is not available. In this scenario, services are typically provided by LPG and/or electric and make use of renewable technologies (e.g. a flue gas heat recovery system for LPG).
- This scenario has an air-permeability target of 5.0 (m³/hr/m²), linear thermal transmittance Y-values of 0.05 (W/m²K) and elemental U-values designed according to 'Fabric First' principles (see below), including an improved window U-value of 1.2W/m²K.

**Scenario C**
- This scenario is based on the premise that dwellings are being constructed in rural areas where mains grid gas is not available. In this scenario, services are typically provided by LPG and/or electric and make use of renewable technologies (e.g. a flue gas heat recovery system for LPG).
- This scenario has an air-permeability target of 5.0 (m³/hr/m²), linear thermal transmittance Y-values of 0.05 (W/m²K) and elemental U-values designed according to 'Fabric First' principles (see below), including an improved window U-value of 1.2W/m²K.

The guide takes each frame type in turn and looks at each of the above scenarios (A-C) to result in the indicative design values needed for the dwelling to achieve the new Approved Document L1A (2013).
Achieving These Solutions

• Each solution has to be constructed correctly to achieve the fabric performance:
  – On-site inspection regimes paramount
  – Champions required
    • E.g. Airtightness Champion

• Construction culture and behaviour require change
Achieving These Solutions: Factors Affecting Wall Performance

- Gaps between insulation and inner leaf can reduce performance
- Damaged insulation, not taken to meet roof insulation
- Wall tolerance
- Cavity boards to prevent mortar falling
Achieving These Solutions: 
**Follow Recommendations**

- Guidance is based on testing - e.g. Plaster dab positions
- U-Values - Triple up: the thermal bridge significantly increases by 50 times that of insulation (Timber noggins)
- Metal through walls
  - Don’t use steel lintels from one side to another
  - Try to separate or use thermal laminate
Achieving These Solutions: Ground Floor Technicalities

- Understand specified materials
  - Drying out times: more concrete = greater drying time
- 2 common issues with traditional (thick) screeds & floor installations: Shrinkage & Curling
- Solutions
  - Pour first / power float finishes / Thin screeds (e.g. Weber)
Achieving These Solutions:
*Roof Technicalities*

- Pinch points on roof eaves
- Bobtail trusses reduce mineral wool compression & improves thermal bridging
- Sequencing of installation
  - Eaves to be done before completion of breather membrane
Thank you
Any questions?