ZERO CARBON HUB

Policy context, research & guidance

Ross Holleron, Projects Director
Introduction

Aims of this session:

- Review of current policy position
- European context
- Indication of future risks
- Examples of practical guidance
PURPOSE AND STRATEGIC OBJECTIVES

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

- Provide leadership & create confidence
- Reduce risk
- Disseminate information
Where are you?

Low energy homes
UK Government, European Policy & the Zero Carbon Agenda
The journey so far....

2007
Building a greener future: policy statement

2008
UK GBC standard unattainable on many sites

Jul 2008
ZCH created

March 2011
New Government Regulated CO₂ only

PartL2010
No FEES
SAP2010
FEES

PartL2013
6% improvement FEE considered

2013
AS consultation launched

2016
All new homes to be zero carbon ??

2019/2020
EU Nearly Zero Energy Buildings
Government Policy

Zero Carbon 2016
Housing Standards Review

○ Chapter 5 – Energy
  ○ A ‘building regulations only’ approach to delivering the Zero Carbon Homes standard from 2016
  ○ 63% agreed that this is the way forward
  ○ Similarly content with changes to the CSH (Energy)

○ Planning and Energy Act 2008

Transitional period – LA ability to influence EE up to 2016?
An interesting time for new build homes....

Open for each member state to define:

- *nearly or very low*
- *very significant extent*
- *on-site or near-by*

EPBD Article 2, NZEB definition:

[...] 'nearly zero-energy building' means a building that has a very high energy performance [...]. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby [...].
nZEB – Cost Optimal Review

- Reviewed every 3 years
- Next cycle is 2017

<table>
<thead>
<tr>
<th>Reference Home - Semi</th>
<th>Example specification</th>
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<tr>
<td>Wall</td>
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<td>Window</td>
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<tr>
<td>Floor</td>
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<tr>
<td>Heating System</td>
<td>Gas 90%, weather comp., zone control, interlock</td>
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<tr>
<td>Air tightness</td>
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<tr>
<td>Thermal Bridging</td>
<td>0.09 W/m²K</td>
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**Primary Energy** 117 kWh/m²/year

Reference Building – May 2013 report
## Wider EU ambition for nZEBs (kWh/m²/yr)

<table>
<thead>
<tr>
<th>Member State</th>
<th>Full Definition in Place</th>
<th>Numerical Indicator</th>
<th>Share of Renewable Energy</th>
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<td>United Kingdom</td>
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Denmark = 20  
Belgium = 45  
France = 40 - 65  
Austria = 160  
Part L 2013 = ~ 120 maybe??

Figure 2: Status of development of the applied NZEB definition in the different Member States
How well are we achieving low energy homes?
Build Costs
**Additional Cost of Zero Carbon Homes**

- **2006 Part L**: 25 kg CO₂/m²/year
  - Reduction on 2006 Part L: 25%
  - Code 3: 25% CO₂
- **2010 Part L**: 20 kg CO₂/m²/year
  - Code 4: 33% CO₂
- **2013 Part L**: 14 kg CO₂/m²/year
  - ‘Code 4½’: 70% CO₂
- **2015**: 10 kg CO₂/m²/year
  - Code 5: 100% CO₂
- **Revised definition 2008/9**: 6 kg CO₂/m²/year
  - Code 4½: 70% CO₂
- **Revised definition 2011**: 20 kg CO₂/m²/year
  - Code 5: 100% CO₂
- **Original definition**: 70 kg CO₂/m²/year
  - Code 6: ~150-200% CO₂

**Carbon Compliance**
- **2008/9**: £20k per home
- **2011**: £10k per home
- **2015**: £5k? per home

**Allowable Solutions**
- **2013 Part L**: £40k per home
- **2016 Part L**: £20k per home
- **2015**: £10k per home
- **2016 Part L**: £5k? per home

**True Zero Carbon**
- £40k per home
Annual Household energy spend....

- 4-bed Detached house: £2,460
- 3-bed Semi-detached: £1,670
- 3-bed Mid-terrace house: £1,430
- 1-bed Ground Floor Flat: £940

- Victorian with some modern day improvements
- New Build built to 2013 regulations
- New Build 2016 aspirations
The Performance Gap

Found cross-cutting themes:

- **KNOWLEDGE & SKILLS**
- **RESPONSIBILITY**
- **COMMUNICATION**
How is the u-value calculated?

Can’t assume same thickness across entire roof

- Reduced space above joists makes installation of full insulation thickness impossible despite this being assumed in SAP calculation.
- 500mm roof insulation specification on 18° roof pitch.
- Design Assumed:
  - Wall ties
  - Compressed edge seal
  - Insulation

- 90% of sites visited:
  - Window in wrong position
  - U & G values wrong
Common themes on site
Site Posters - Fabric and Services

Fabric
1  Groundworks
2  Beam and Block Floor
3  Door Threshold
4  Cavity Wall – partial fill
5  Cavity wall – full fill
6  Floor Joists
7  Separating wall
8  Lintels
9  Windows
10 Bay windows
11 Projecting windows
12 Eaves
13 Roof
14 Dryline
15 Ventilation
16 Heating / hotwater
17 Finals
Unintended consequences
Ventilation – delivery improvements

Mmmm?
Overheating – a few numbers

- 20%
- 1 in 3
- 9°C
- £100,000
- 2,000
- 7,000
- 100
Are Housing Providers looking out for risk factors?

Services design

Thermal mass / purge

Secure ventilation

Shading
How is delivery being checked?

Figure 32.
Types of process used to ensure that measures to mitigate the risk of overheating are implemented
(Total number of individual respondents = 72)
Opportunities and risks

- **Performance gap** – moving to solutions
- **Ventilation** – encouraging best practice
- **Overheating** – understanding the issues
Practical guidance
The Fabric Energy Efficiency Standard

Building Fabric:
- U-values
- Thermal mass

Thermal Bridging

Air-permeability

Orientation, solar gains,
Glazing proportion
DON’T PANIC!

Concrete

Brick and Block

LOW ENERGY

KNOW HOW
Part L 2013 has a % relaxation built into the calculation procedure.
Part L 2013 – Where to start?

- Guidance available for masonry and timber frame
- Provides practical ‘recipes’ to fine tune
- Select the route to best suit your experience / supply chain
### 1.3 Detached house

#### Option 1: Default thermal bridging

<table>
<thead>
<tr>
<th>Elements</th>
<th>Specification</th>
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<tbody>
<tr>
<td>External wall</td>
<td>0.15 W/m²K</td>
</tr>
<tr>
<td>Roof</td>
<td>0.13 W/m²K</td>
</tr>
<tr>
<td>Ground floor</td>
<td>0.14 W/m²K</td>
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<tr>
<td>Windows</td>
<td>0.8 W/m²K</td>
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<tr>
<td>Doors</td>
<td>1.2 W/m²K</td>
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<tr>
<td>Air permeability</td>
<td>6 m³/h·m²·Pa50Pa</td>
</tr>
<tr>
<td>Thermal bridging</td>
<td>0.15 W/m²K</td>
</tr>
</tbody>
</table>

#### Renewables

- e.g. Solar thermal: 2.0 m² flat plate solar panels
- or PV: 0.6 kWp (4.8 m²)

#### Option 2: Special attention to thermal bridging with renewables

<table>
<thead>
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<th>Elements</th>
<th>Specification</th>
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<td>Roof</td>
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<td>Ground floor</td>
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<td>Windows</td>
<td>1.4 W/m²K</td>
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<tr>
<td>Doors</td>
<td>1.2 W/m²K</td>
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<tr>
<td>Air permeability</td>
<td>6 m³/h·m²·Pa50Pa</td>
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<tr>
<td>Thermal bridging</td>
<td>0.078 W/m²K</td>
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</tbody>
</table>

#### Renewables

- e.g. Solar thermal: 2.0 m² flat plate solar panels
- or PV: 0.6 kWp (4.8 m²)

#### Option 3: Special attention to thermal bridging with enhanced fabric

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<td>Roof</td>
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<td>Windows</td>
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<tr>
<td>Doors</td>
<td>1.2 W/m²K</td>
</tr>
<tr>
<td>Air permeability</td>
<td>6 m³/h·m²·Pa50Pa</td>
</tr>
<tr>
<td>Thermal bridging</td>
<td>0.078 W/m²K</td>
</tr>
</tbody>
</table>

#### Renewables

- e.g. Solar thermal: Not required
- or PV: Not required

#### Option 4: Special attention to thermal bridging with MVHR

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<th>Elements</th>
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<td>Roof</td>
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<tr>
<td>Ground floor</td>
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<tr>
<td>Windows</td>
<td>1.4 W/m²K</td>
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<tr>
<td>Doors</td>
<td>1.2 W/m²K</td>
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<tr>
<td>Air permeability</td>
<td>3 m³/h·m²·Pa50Pa (see page 27)</td>
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<tr>
<td>Thermal bridging</td>
<td>0.078 W/m²K</td>
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</tbody>
</table>

#### Renewables

- e.g. Solar thermal: Not required
- or PV: Not required

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**Thermal bridging: key junctions to consider**

- Ground floor perimeter (34%)
- Lintel (26%)
- Gable (11%)
- Jamb (10%)
- Eaves (7%)
- All other junctions (12%)

**Impact of each junction (%):**

- Ground floor perimeter: 34%
- Lintel: 26%
- Gable: 11%
- Jamb: 10%
- Eaves: 7%
- All other junctions: 12%
Common themes on site
Site Posters - Fabric and Services

Fabric
1. Groundworks
2. Beam and Block Floor
3. Door Threshold
4. Cavity Wall – partial fill
5. Cavity wall – full fill
6. Floor Joists
7. Separating wall
8. Lintels
9. Windows
10. Bay windows
11. Projecting windows
12. Eaves
13. Roof
14. Dryline
15. Ventilation
16. Heating / hotwater
17. Finals
FOUNDATION / GROUNDWORKS

PROBLEM TO AVOID
INSULATION MISSING BELOW DPC

INSULATION MISSING

OUTSIDE

INSULATION

BLOCK

INSIDE

PLAN OF SUB FLOOR VENT BLOCKING INSULATION

PERISCOPE VENT SECTION

WHAT TO DO?

- Keep cavity and liner block smooth and free of 'mortar spots' (1)
- Fix insulation below DPC level to depth shown in drawing (2)
- Fit insulation boards tight to blockwork with no air gap (3)
- Install cavity tray over insulation (4)
- Use blocks with correct thermal conductivity

GOOD PRACTICE

Continuous insulation below floor level

CAVITY WALL

PROBLEM TO AVOID
GAPS IN INSULATION

INSULATION NOT TIGHT TO WALL FACES DUE TO ROUGH SURFACE

GAPS BETWEEN ADJACENT BOARDS = HEAT LOSS

WHAT TO DO?

1. Protect cavity and insulation from mortar droppings
2. Smooth mortar joints to allow insulation board tight against block
3. Install insulation tightly butted with no gaps
4. Cut insulation tight to cavity closers, lintels and cavity trays

GOOD PRACTICE

Continuous insulation below floor level
**WINDOW INSTALLATION**

**Problem to Avoid:** Windows installed forward of design position

**What to Do?**
1. Close the cavity with tightly packed insulation (1)
2. Insulation to window revealed (2)
3. Window fitter to provide non-standard large cill (3)
4. Overlap frame with cavity as much as possible - minimum 30mm
5. Check trickle vent sizes as design
6. Less than 10mm tolerance around window frame and structural opening

**Good Practice:** A large overlap with cavity will improve thermal performance. For improved air tightness, use air barrier tapes between the window/door and structure

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**EAVES**

**Problem to Avoid:** No insulation at eaves

**What to Do?**
1. Install rigid insulation to top of the wall plate (1)
2. Truss design to accommodate space for insulation of eaves - 300mm to best practice (2)
3. Lay mineral wool insulation into eaves (3)
4. Cut insulation around eaves intact (4)

**Option 1**

**Option 2**

**Good Practice:** Install insulation before eaves are inaccessible
**ZERO CARBON HUB BUILDERS' BOOK**

**VENTILATION**

- **Problem to Avoid:** Poorly specified and installed ductwork
  - Flexi duct too long
  - Ductwork not connected

**WHAT TO DO?**
- Install rigid ductwork for extract fans, and minimise use of flex ductwork.
- Install air to commission fans to part F domestic ventilation compliance guide.
- Commissioning sheets to be provided to site manager.
- Check noise of fan is not excessive.
- Check ducts to outside are fully insulated.
- Clearly label the ventilation controls.

**GOOD PRACTICE**
- Specialist or manufacturer to commission fans.

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**FINALS**

- **Problem to Avoid:** Air leakage as sealant does not last
  - Missing skirting
  - Sealant seal in vulnerable position

**WHAT TO DO?**
- Check insulation in roof is continuous and installed correctly at eaves.
- Do not rely on sealant as an air barrier – build tight and purge cost or plaster instead.
- Trim all doors to achieve a clear gap between finish and door of 10mm; 25mm where no floor covering provided.
- Inform SAP assessor of voids as items fitted that were not included in the design or specification e.g. fireplace, downlights, electric radiator.

**GOOD PRACTICE**
- Final inspection to use eyeball test to pick up on missing insulation.
- Notify SAP Assessor of changes to original design.
A quick review of your thinking

- Does the ‘Builders’ Book’ style of guidance work?
- How important is thermal bridging to you?
- In what way will today’s event influence your next project?
Thank you

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