EnerPHit

The new Passivhaus refurbishment standard from the Passivhaus Institute

Melissa Taylor, Passivhaus Trust

March 2011
EnerPHit

• The Passivhaus Trust
• What is EnerPHit?
• Why is EnerPHit needed?
• EnerPHit criteria
• Passivhaus retrofit
• Cost benefit
• Passivhaus retrofit UK
• What’s next?
The Passivhaus Trust

The Passivhaus Trust is:

1: A not-for-profit organisation

2: A subsidiary company of the AECB

3: The UK affiliate of the PassivHaus Institute, through the International Passive House Association (iPHA)
Aims & objectives

The Passivhaus Trust aims to:

1: Preserve the integrity of Passivhaus standards and methodology

2: Promote Passivhaus principles to the industry and Government

3: Undertake research and development on Passivhaus standards in the UK
Activities

The Passivhaus Trust runs a core programme:

1: Research and guidance
   - technical working groups
   e.g. UK weather data

2: Education and training
   - introductory events, site visits
   & technical masterclasses

3: Policy, lobbying & promotion
   - relationship of PH to UK policy
   e.g. zero carbon definitions
Founder members

Architype
Bere:architects
Bramall Construction
Brooks Devlin
EBS Elk Ltd
ECD Architects
Ecology Building Society
Hanse Haus
Hastoe Housing Association
Internorm Windows
ISG Pearce
Isover St Gobain
Kingspan
Knauf Insulation UK
Pilkington
Prewett Bizley Architects
Profine
Scottish Passive House Centre
Willmott Dixon Re-Thinking
What is EnerPHit?

“Quality-Approved Energy Retrofit with Passive House Components”

The goal was to create a standard for an economically and ecologically optimal energy retrofit, for old buildings that cannot achieve Passive House Standard with reasonable effort. (PHI)
Why is EnerPHit needed?

Fixed aspects of existing buildings

- Existing architecture
- Fixed form
- Fixed orientation
- Windows
- Existing occupants
- Neighbouring houses
- Planning and conservation issues
Why is EnerPHit needed?

**Benefits of Passivhaus refurbishment**
Increased insulation and airtightness improve thermal comfort and reduce risk of surface condensation and mould growth, by increasing surface temperatures and controlling moisture.

**Challenges of PH refurbishment**
- Conservation issues and external insulation
- Space requirements of internal insulation
- Space requirements for ventilation systems
- Risks of interstitial condensation
Certifying refurbishment

Passivhaus certification options for domestic refurbishment

1. Certification as “Quality-Approved Passive House” based on the same criteria as new buildings

2. Certification as”Quality-Approved Energy Retrofit with Passive House Components” - EnerPHit
   - Certification based on performance criteria
   OR - Certification based on individual components

Process
- Energy balance to be calculated using PHPP
- Certification only if modernisation to Passivhaus level would not be practicable or cost effective
- Only buildings in cool and moderate central European climates are covered presently
# EnerPHit Performance Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>New Build</th>
<th>Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q_H$ Specific Space heat demand</td>
<td>max. 15kWh/(m²a)</td>
<td>max. 25kWh/(m²a)</td>
</tr>
<tr>
<td>Pressurisation test result $n_{50}$</td>
<td>max. 0.6h⁻¹</td>
<td>max. 1.0⁻¹</td>
</tr>
<tr>
<td>$Q_P$ Entire Specific Primary Energy Demand</td>
<td>max. 120kWh/(m²a)</td>
<td>max. 120kWh/(m²a) ($(Q_H - 15$kWh/(m²a)) \times 1.2$)</td>
</tr>
<tr>
<td>Frequency of overheating (over 25 degrees)</td>
<td>max. 10%</td>
<td>max. 10%</td>
</tr>
<tr>
<td>Water activity of interior surfaces $a_w$</td>
<td>max. 80%</td>
<td></td>
</tr>
<tr>
<td>Building Component</td>
<td>Retrofit criteria</td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>External wall</td>
<td>External insulation $U \leq 0.150\text{W/(m}^2\text{K)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal insulation $U \leq 0.300\text{W/(m}^2\text{K)}$</td>
<td></td>
</tr>
<tr>
<td>Roof or top floor ceiling</td>
<td>$U \leq 0.120\text{W/(m}^2\text{K)}$</td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>$U_W^{\text{installed}} \leq 0.85\text{W/(m}^2\text{K)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$g - 1.6\text{W/(m}^2\text{K)} \leq U_g$</td>
<td></td>
</tr>
<tr>
<td>External door</td>
<td>$U_D^{\text{installed}} \leq 0.80\text{W/(m}^2\text{K)}$</td>
<td></td>
</tr>
<tr>
<td>Thermal bridges</td>
<td>No linear thermal bridges with $\Psi &gt; +0.01\text{W/(m}^2\text{K)}$ or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>punctiform thermal bridges with $\chi &gt; +0.04\text{W/(m}^2\text{K)}$</td>
<td></td>
</tr>
<tr>
<td>Ventilation</td>
<td>$\eta_{\text{HR,eff}} \geq 75%$</td>
<td></td>
</tr>
<tr>
<td>Electrical efficiency of ventilation system</td>
<td>$\leq 0.45\text{Wh/m}^3$</td>
<td></td>
</tr>
</tbody>
</table>
Passivhaus refurbishment

Gunzburg (Bayern)
Detached family house
Annual heat requirement: 15kWh/m²/a
Airtightness: n₅₀ = 0.45/h
Primary energy requirement 83kWh/m²/a
Passivhaus refurbishment

Hoheloogstraße Ludwigshafen
Renovation of two multi family block
Renovation of one using Passivhaus component, almost achieves new build standard.

Calculated heating demand: 16kWh/m²/a
Measured consumption: 14kWh/m²/a
Passivhaus refurbishment

Tevesstraße Frankfurt
Renovation of two multi family blocks
Renovation using Passivhaus components.

Energy

Calculated heating demand of existing building: 290kWh/m²/a

Calculated heating demand of refurbished building: 17kWh/m²/a

Measured consumption of refurbished building: 20kWh/m²/a
### Cost Benefit

<table>
<thead>
<tr>
<th>108m² wall</th>
<th>Typical old external wall (only renewal of plaster)</th>
<th>Moderately insulated external wall</th>
<th>PH insulation levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual energy costs</td>
<td>786 €/a</td>
<td>277 €/a</td>
<td>71 €/a</td>
</tr>
<tr>
<td>Production costs</td>
<td>4320 €</td>
<td>6480 €</td>
<td>8640 €</td>
</tr>
<tr>
<td>Annual repayment with interest</td>
<td>164 €/a</td>
<td>246 €/a</td>
<td>328 €/a</td>
</tr>
<tr>
<td>Annual total costs</td>
<td>950 €/a</td>
<td>523 €/a</td>
<td>399 €/a</td>
</tr>
</tbody>
</table>

NB Insulation without attention to airtightness and thermal bridges risks interstitial condensation

Table from Passipedia article ‘Don’t save on the insulation’ available at [http://passipedia.passiv.de/passipedia_en/](http://passipedia.passiv.de/passipedia_en/)
Some Passivhaus Trust members undertaking refurbishment projects

• Anne Thorne Architects
• bere:architects (talking later)
• ECD Architects
• Prewett Bizley Architects (talking later)
• Simmonds Mills
Passivhaus refurbishment UK

Retrofit for the Future, London

- Passivhaus principles applied to social housing
- Whole house strategy
- Use of Passivhaus components
- Rear of building externally insulated

Anne Thorne Architects
Passivhaus refurbishment UK

Retrofit for the Future, Stoke on Trent

• Aiming for EnerPHit standard.
• Airtightness target challenging to achieve
• Use of natural materials for insulation and finishes - hygroscopic/ vapour-permeable, and low embodied energy

Anne Thorne Architects
Passivhaus refurbishment UK

Retrofit of 1950s & 1960s social housing

- Aiming for EnerPHit standard
- Potential 80% reduction in energy consumption
- Tenants in place during process

bere:architects
What’s next?

The standard is still in the pilot phase - 2 certified buildings so far, both 1950’s German apartment buildings

More buildings are currently in the process of being certified. PHI have received certification requests from the UK, but have not yet started work on them.

The final standard will be available to all accredited Passivhaus certifiers after this year’s International Passivhaus conference.

The Passivhaus Institute have plans to expand the standard to non-domestic refurbishments, as part of the EU project ‘Efficient Energy for EU Cultural Heritage’ (3ENCULT).

Passivhaus Trust plans for Passivhaus retrofit working group.