EnerPHit
The new Passivhaus refurbishment standard from the Passivhaus Institute

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EnerPHit

• What is EnerPHit?

• Why is EnerPHit needed?

• How? - EnerPHit criteria

• Passivhaus retrofit - testing EnerPHit

• Cost benefit

• Passivhaus retrofit UK

• What’s next?
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, and widely varying conditions

Existing architecture

Fixed form

Fixed orientation

Windows

Existing occupants

Neighbouring houses

Planning and conservation issues
Why is EnerPHit needed?

Benefits of Passivhaus refurbishment
Improvements to insulation, airtightness, thermal bridges and ventilation will result in increases to surface temperatures and controls moisture. Thereby improving thermal comfort, and reducing the risk of surface condensation and mould growth.

Challenges of PH refurbishment
Conservation issues and external insulation
Space requirements of internal insulation
Space requirements for ventilation systems
Risks of interstitial condensation
Airtightness targets
Unavoidable thermal bridges (particularly floor to external wall junction)
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
Certifying refurbishment

Process

EnerPHit certification is presently only applicable:

- For homes where modernisation to Passivhaus level would not be practicable or cost effective
- For homes in cool and moderate central European climates
- For homes where at least 75% of insulation to external walls is externally applied. (future changes to EnerPHit criteria will allow for internal insulation. In theory, internally insulated retrofits can be assessed under Passivhaus criteria, but almost all certified Passivhaus buildings are externally insulated)
- Energy balance calculated using PHPP
# 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. $15\text{kWh/(m}^2\text{a)}$</td>
<td>max. $25\text{kWh/(m}^2\text{a)}$</td>
</tr>
<tr>
<td>Pressurisation test result $n_{50}$</td>
<td>max. $0.6\text{h}^{-1}$</td>
<td>max. $1.0\text{h}^{-1}$</td>
</tr>
<tr>
<td>$Q_P$ Entire Specific Primary Energy Demand</td>
<td>max. $120\text{kWh/(m}^2\text{a)}$</td>
<td>max. $120\text{kWh/(m}^2\text{a)} +((Q_H-15\text{kWh/(m}^2\text{a)})\times1.2)$</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></td>
<td>max. $80%$</td>
</tr>
</tbody>
</table>
## EnerPHit component criteria

<table>
<thead>
<tr>
<th>Building Component</th>
<th>Limit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opaque exterior components to outdoor air (except roof)</td>
<td>$U \leq 0.150 \text{W/(m}^2\text{K)}$</td>
</tr>
<tr>
<td>Roof or top floor ceiling</td>
<td>$U \leq 0.120 \text{W/(m}^2\text{K)}$</td>
</tr>
<tr>
<td>Opaque exterior components to soil and unheated basement</td>
<td>$f \cdot U \leq 0.150 \text{W/(m}^2\text{K)}$ where $f$: “reduction factor - soil” from PHPP “Ground” page</td>
</tr>
<tr>
<td>Windows</td>
<td>$U_{\text{W installed}} \leq 0.85 \text{W/(m}^2\text{K)}$</td>
</tr>
<tr>
<td>Ventilation system</td>
<td>$\eta_{\text{heat recovery,efficiency}} \geq 75%$ (incl. line losses)</td>
</tr>
<tr>
<td>Electrical efficiency of ventilation system</td>
<td>$\eta_{\text{electrical efficiency}} \leq 0.45 \text{Wh/m}^3$</td>
</tr>
<tr>
<td>Airtightness</td>
<td>Limit value: $n_{50} \leq 1.0 \text{h}^{-1}$; target value $n_{50} \leq 0.6 \text{h}^{-1}$</td>
</tr>
</tbody>
</table>

EnerPHit limit values for the most important individual building components. If the exact component values are achieved in a retrofit, the building as a whole usually has a heating demand of 30 to 40 kWh/m²/a

*(Renovating with Passive House components, Zeno Bastian, Innsbruck 2011)*
Passivhaus refurbishment

Gunzburg (Bayern)
Detached family house
Annual heat requirement: 15kWh/m²/a
Airtightness: $n_{50} = 0.45/h$
Primary energy requirement 83kWh/m²/a
Testing EnerPHit

Hoheloogstraße Luwigshafen
Renovation of two multi family blocks
Renovation of one using Passivhaus components, almost achieves new build standard.

Calculated heating demand: 16kWh/m²/a
Measured consumption: 14kWh/m²/a
Testing EnerPHit

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></th>
<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><strong>Annual energy costs</strong></td>
<td></td>
<td>786 €/a</td>
<td>277 €/a</td>
<td>71 €/a</td>
</tr>
<tr>
<td><strong>Production costs</strong></td>
<td></td>
<td>4320 €</td>
<td>6480 €</td>
<td>8640 €</td>
</tr>
<tr>
<td><strong>Annual repayment with interest</strong></td>
<td>164 €/a</td>
<td>246 €/a</td>
<td>328 €/a</td>
<td></td>
</tr>
<tr>
<td><strong>Annual total costs</strong></td>
<td>950 €/a</td>
<td>523 €/a</td>
<td>399 €/a</td>
<td></td>
</tr>
</tbody>
</table>

Table from Passipedia article ‘Don’t save on the insulation’ available at [http://passipedia.passiv.de/passipedia_en/](http://passipedia.passiv.de/passipedia_en/)

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

It is important to consider the starting point of a retrofit. Fully gutting a property or working around existing occupants.
Some Passivhaus Trust members undertaking refurbishment projects

- Anne Thorne Architects
- bere:architects
- ECD Architects
- Prewett Bizley Architects
- Simmonds Mills
Passivhaus refurbishment UK

Retrofit for the Future project in London

- Mid-terrace, solid wall
- Mix of internal (to front) & external insulation (to rear)
- Innovative ‘interface’ details

Prewett Bizley Architects
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
Passivhaus refurbishment UK

Retrofit of 1950s & 1960s social housing

- Aiming for EnerPHit standard - air test result at Tower Hamlets was 1.7ach, but specific heat demand is still below 25kWh/m²/a (discussing with PHI)
- Potential 80% reduction in energy consumption
- Tenants in place during process

bere:architects
The first refurbishment in the UK to be formally certified under the EnerPHit standard. Over the past two years it has used 80% less gas and 45% less electricity than an equivalent sized home, whilst maintained at 21°C throughout the heating season.
What’s next?

Launched at the International Passivhaus conference this year, the EnerPHit standard is now available to all accredited Passivhaus certifiers, but still at and early stage.

Two block of flats have been certified in Germany as part of the pilot phase, and Grove Cottage recently became the first UK project to be certified.

PHI is currently in the process of certifying several projects in Germany, the UK and Ireland. Other certifiers may be working on additional projects.

A certification process for EnerPHit-designated insulation systems will soon be available. This will include connection details recommended for renovated buildings, including thermal bridge loss coefficients, removing the need for calculations.

PHI is aiming to publish an EnerPHit handbook in 2011.
What’s next?

3ENCULT - ‘Efficient Energy for EU Cultural Heritage’

As part of the current EU project, the Passive House Institute have plans to expand the standard to:

• non-domestic refurbishments (to be launched in 2012)
• buildings with interior insulation
• other climate zones

A variant of PHPP will be specifically designed for modernisations, likely to include:

• easy determination of whether the EnerPHit criteria have been achieved
• tools for calculating the financial consequences of individual insulating measures
• possibility of depicting individual stages of a step-by-step modernisation in the same PHPP
What next?

- Join the Passivhaus Trust
  www.passivhaustrust.org.uk
  The Passivhaus Trust plans a Passivhaus retrofit event later in the year

- Come to the UK Passivhaus conference on October 24th and 25th 2011, at the Barbican London
  http://www.ukpassivhausconference.org.uk/home