UPGRADING EXISTING HOMES FOR ZERO CARBON
RADICAL RETROFITTING
BART HOMMELS
Introducing Yours Truly

- Name: Bart Hommels
- Applied physicist working on particle detectors
- Started DIY home improvements and got carried away
RETROFITTING FOR ZERO-CARBON
OFFSETTING AND THE GRID CARBON INTENSITY

SAP UPDATE 2019: FROM 510 TO 280 G CO2/KWH
RETROFITTING - OPTIONS
IMPROVING THE FABRIC - DIY

MOST COST EFFECTIVE FOR LABOUR INTENSIVE JOBS
ENERGIESPRONG - PRE FAB

IMAGE: ENERGIESPRONG.EU
Retrofit: by who?

energiesprong

DIY

cost-effectiveness

owner/occupier involvement
RETROFITTING FOR ZERO CARBON: HOW TO DO IT
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: EnerPhit / EuroPhit
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: EnerPhit / EuroPhit
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: EnerPhit / EuroPhit
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: **EnerPhit / EuroPhit**

<table>
<thead>
<tr>
<th>EPC Energy Label vs Energy Usage kWh/m² per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
</tr>
<tr>
<td><strong>B</strong></td>
</tr>
<tr>
<td><strong>C</strong></td>
</tr>
<tr>
<td><strong>D</strong></td>
</tr>
<tr>
<td><strong>E</strong></td>
</tr>
<tr>
<td><strong>F</strong></td>
</tr>
<tr>
<td><strong>G</strong></td>
</tr>
</tbody>
</table>

**EPC Energy Label**

- **A** (EPC A): <32 kWh/m² per annum
- **B** (EPC B): 65 kWh/m² per annum
- **C** (EPC C): 100 kWh/m² per annum
- **D** (EPC D): 135 kWh/m² per annum
- **E** (EPC E): 170 kWh/m² per annum
- **F** (EPC F): 200 kWh/m² per annum
- **G** (EPC G): >200 kWh/m² per annum

**EnerPhit / EuroPhit**

- **15**: Passivhaus
- **25**: EnerPhit
- **33-65**: EPC A
- **50**: Low Energy Standard

**Current Building Regs: EPC B**
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: EnerPhit / EuroPhit

Avoiding *lock-in*
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: **EnerPhit / EuroPhit**

- Avoiding *lock-in* requires
- **A whole-house plan**

---

**Heat Losses**

- Windows: 16%
- Roof: 12%
- Floor: 11%
- Wall: 10%
- Doors: 9%
- Thermal Bridges: 7%
- Infiltration: 5%
- Ventilation: 22%

---

<table>
<thead>
<tr>
<th>Net surface (m²)</th>
<th>U value W/m²K</th>
<th>Heat Loss W/K</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.0</td>
<td>0.60</td>
<td>10.8</td>
</tr>
<tr>
<td>3.1</td>
<td>0.30</td>
<td>0.9</td>
</tr>
<tr>
<td>2.0</td>
<td>1.60</td>
<td>3.2</td>
</tr>
<tr>
<td>2.9</td>
<td>1.60</td>
<td>4.6</td>
</tr>
<tr>
<td>1.6</td>
<td>1.60</td>
<td>2.6</td>
</tr>
<tr>
<td>30.2</td>
<td>0.14</td>
<td>4.2</td>
</tr>
<tr>
<td>0.0</td>
<td>0.80</td>
<td>0.0</td>
</tr>
<tr>
<td>1.8</td>
<td>0.80</td>
<td>1.4</td>
</tr>
<tr>
<td>1.0</td>
<td>1.60</td>
<td>1.5</td>
</tr>
<tr>
<td>7.9</td>
<td>0.14</td>
<td>1.1</td>
</tr>
<tr>
<td>0.0</td>
<td>1.60</td>
<td>0.0</td>
</tr>
<tr>
<td>2.0</td>
<td>1.60</td>
<td>3.2</td>
</tr>
<tr>
<td>3.1</td>
<td>0.30</td>
<td>0.9</td>
</tr>
<tr>
<td>10.4</td>
<td>0.11</td>
<td>1.1</td>
</tr>
<tr>
<td>1.4</td>
<td>1.40</td>
<td>2.0</td>
</tr>
<tr>
<td>15.5</td>
<td>0.10</td>
<td>1.6</td>
</tr>
<tr>
<td>5.9</td>
<td>0.11</td>
<td>0.5</td>
</tr>
<tr>
<td>10.4</td>
<td>0.16</td>
<td>1.7</td>
</tr>
<tr>
<td>19.8</td>
<td>0.26</td>
<td>5.1</td>
</tr>
</tbody>
</table>

**Ceilings**

- 18.8 0.14 2.6
- 8.7 0.14 1.2
- 2.0 0.14 0.3
- 20.0 0.11 2.2
- 20.0 0.11 2.2
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: EnerPhit / EuroPhit

Avoiding lock-in requires a whole-house plan, including lots of detail.
Fighting chance for zero CO2 when aiming for Passivhaus retrofit standards: EnerPhit / EuroPhit

Avoiding *lock-in* requires

A *whole-house plan*, including lots of

*detail*. Involve the

*owner/occupier* who probably knows the property better than anybody else.
WHAT IS HOLDING US BACK?
DOES IT PAY FOR ITSELF?
We like loft insulation:
We like loft insulation: Clear Benefits
We like loft insulation: Clear Benefits Cheap
We like loft insulation: Clear Benefits
Cheap Simple
We like loft insulation: 
Clear Benefits 
Cheap 
Simple 
Non-Disruptive
We like loft insulation:
Clear Benefits
Cheap
Simple
Non-Disruptive

Excellent awareness
Eco....


Image: http://woodenfloornewinsen.blogspot.com

Image: http://woodenfloornewinsen.blogspot.com

Image: http://woodenfloornewinsen.blogspot.com

Image: http://woodenfloornewinsen.blogspot.com

Image: http://woodenfloornewinsen.blogspot.com

Image: http://woodenfloornewinsen.blogspot.com

Image: http://woodenfloornewinsen.blogspot.com

comfort
RESULTS

AND A BIT OF SHOWING OFF
1945 Built small semi-detached, very much British standard
1945 Built small semi-detached, very much British standard
1945 Built small semi-detached, very much British standard

**WW75 CO2 footprint**

- Red: electricity @ 510
- Blue: gas @ 230

Y-axis: tonne/yr

Years: '11-'12, '12-'13, '13-'14, '14-'15, '15-'16, '16-'17, '17-'18, '18-'19, projection

**Solar PV & water heating**
1945 Built small semi-detached, very much British standard
1945 Built small semi-detached, very much British standard
1945 Built small semi-detached, very much British standard
1945 Built small semi-detached, very much British standard
SUMMARY
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:

• INCREASED AWARENESS
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:

• INCREASED AWARENESS
• A RATIONAL, DETAILED APPROACH
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:

• INCREASED AWARENESS
• A RATIONAL, DETAILED APPROACH
• RADICAL MEASURES
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:

- INCREASED AWARENESS
- A RATIONAL, DETAILED APPROACH
- RADICAL MEASURES
- OWNER/OCCUPIER INVOLVEMENT
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:

- INCREASED AWARENESS
- A RATIONAL, DETAILED APPROACH
- RADICAL MEASURES
- OWNER/OCCUPIER INVOLVEMENT

RESULTING IN
SUMMARY

WHAT RETROFITTING FOR ZERO CO2 NEEDS:

• INCREASED AWARENESS
• A RATIONAL, DETAILED APPROACH
• RADICAL MEASURES
• OWNER/OCCUPIER INVOLVEMENT

RESULTING IN
SUMMARY
WHAT RETROFITTING FOR ZERO CO2 NEEDS:

- INCREASED AWARENESS
- A RATIONAL, DETAILED APPROACH
- RADICAL MEASURES
- OWNER/OCCUPIER INVOLVEMENT

RESULTING IN

COMFORTABLE HOMES NOT COSTING THE EARTH