Dwellings Energy Assessment Procedure (DEAP) for Building Regulations Compliance

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Presentation

- Part L Compliance
  - CO₂ Limitation
  - Heat Loss Limitation etc.
  - Other provisions

- Building Energy Rating

- HER vs. DEAP

- DEAP Demonstration (?)

- Possible Trouble Spots

- Further Information
Main EPBD requirements relevant to dwellings

- Energy performance standards
- Energy performance of buildings methodology
- Feasibility alternative energy systems
- Building Energy Rating (BER)
EPBD: Responsibilities/Implications for Building Control

- Building Regulations Part L compliance
- Building Energy Rating
- Alternative Energy Systems assessment
Technical Guidance
Document L
TGD L 2002: Dwellings

Limitation of Heat Loss through the Building Fabric

- Elemental Heat Loss Method
  - OR
  - Overall Heat Loss Method
  - OR
  - Heat Energy Rating

- Reducing Cold Bridging
  - AND
- Reducing Air Infiltration

Other Provisions

- Heating controls
  - AND
- Insulating DHW, pipes, ducts
Implementing Legislation

Building Regulations (Amendment) Regulations 2005

DEAP

Part L
Heat Loss Limitation

European Communities (Energy Performance of Buildings) Regulations 2006
TGD L 2006: Dwellings

Limitation of CO₂ Emissions

Limitation of Heat Loss through the Building Fabric

Other Provisions
New Requirements – Main Changes

- Primary Energy

- \( \text{CO}_2 \) Emissions Rating: MPCDER
  - “Reference House” concept
  - **NB.** Secondary heating (10%) must be included for Part L compliance assessment – but not necessarily for BER

- Building Energy Rating: BER
Twin role of DEAP

Primary energy kWh/m²/year

→ CDER kg CO₂/m²/year

→ BER

Options for improvement:
- Insulation
- Glazing
- Heating systems
- Controls
- Lighting
- Boilers
- Renewables
Part L

Limitation of CO2 Emissions

DEAP (Dwellings Energy Assessment Procedure)

Downloadable from
www.sei.ie/epbd
Limitation of CO$_2$ Emissions

• Building Regulation
  • CO$_2$ emissions associated with energy use for space heating, water heating, ventilation and lighting of a new dwelling should be limited as far as is reasonably practicable.

• TGD L 2006 ed
  • The Carbon Dioxide Emission Rate (CDER) associated with the energy use for space heating, water heating, ventilation and lighting for an actual dwelling, should be less than the Maximum Permitted CO$_2$ Emission Rate (MP CDER) for a reference dwelling.

• “Reference dwelling” is specified in Appendix C of TGD L

• Compliance demonstrated using national methodology DEAP

• Demonstration of compliance not restricted to any specific body
<table>
<thead>
<tr>
<th>Element or system</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size and shape of dwelling</td>
<td>Same as actual dwelling</td>
</tr>
<tr>
<td>Opening areas (windows, rooflights and doors)</td>
<td>25% of total floor area, or sum of exposed roof and wall area, whichever is the lesser</td>
</tr>
<tr>
<td>Walls</td>
<td>One opaque door of area 1.85 m², any other doors fully glazed</td>
</tr>
<tr>
<td>Floors (ground or exposed)</td>
<td>U = 0.27 W/m²K</td>
</tr>
<tr>
<td>Roofs</td>
<td>U = 0.25 W/m²K</td>
</tr>
<tr>
<td>Windows, rooflights and glazed doors</td>
<td>U = 0.16 W/m²K</td>
</tr>
<tr>
<td>Opaque door</td>
<td>U = 2.2 W/m²K</td>
</tr>
<tr>
<td>Living area fraction</td>
<td>U = 3.0 W/m²K</td>
</tr>
<tr>
<td>Shading and orientation</td>
<td>Same as actual dwelling</td>
</tr>
<tr>
<td>Number of sheltered sides</td>
<td>All glazing orientated E/W; average overheating</td>
</tr>
<tr>
<td>Allowance for thermal bridging</td>
<td>2</td>
</tr>
<tr>
<td>Ventilation system</td>
<td>0.11 x total exposed surface area</td>
</tr>
<tr>
<td>Air permeability – Basic Air Change Rate</td>
<td>Natural ventilation with intermittent extract fans</td>
</tr>
<tr>
<td>Chimneys</td>
<td>0.5 air changes per hour</td>
</tr>
<tr>
<td>Other Open flues</td>
<td>One</td>
</tr>
<tr>
<td>Extract fans</td>
<td>None</td>
</tr>
<tr>
<td>Main space and water heating system,</td>
<td>3 for dwellings with floor area greater than 100 m²</td>
</tr>
<tr>
<td>including system controls and fuel used</td>
<td>2 for smaller dwellings</td>
</tr>
<tr>
<td>Secondary space heating</td>
<td>Generally as for actual dwelling</td>
</tr>
<tr>
<td>Boiler efficiency as for actual boiler or 78%</td>
<td>Where space and/or water heating by renewable sources provided in actual building, the following assumptions should be used for the calculation of MPCDER for reference dwelling:</td>
</tr>
<tr>
<td>Where space and/or water heating is met by main space and water heating system.</td>
<td></td>
</tr>
<tr>
<td>Where renewable sources meet the main space and/or water heating need, the alternative space and/or water heating system as set out in Table 38 below should be assumed for calculation of MPCDER.</td>
<td></td>
</tr>
<tr>
<td>The same as applied in calculation of CDER of actual dwelling.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 38: Assumed space and/or water heating for reference dwelling (when renewable source provides main space and/or water heating for dwelling being assessed)

<table>
<thead>
<tr>
<th>Element or system</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating fuel (space and water)</td>
<td>Mains gas</td>
</tr>
<tr>
<td>Boiler</td>
<td>Efficiency 78%</td>
</tr>
<tr>
<td></td>
<td>room-sealed</td>
</tr>
<tr>
<td></td>
<td>fanned flue</td>
</tr>
<tr>
<td>Heating system and controls</td>
<td>Boiler and radiators; Timer + TRVs with boiler interlock</td>
</tr>
<tr>
<td>(when renewable source provides main space heating)</td>
<td></td>
</tr>
<tr>
<td>Hot water system (when renewable source provides main</td>
<td>Stored hot water, heated by boiler</td>
</tr>
<tr>
<td>water heating)</td>
<td></td>
</tr>
<tr>
<td>Hot water cylinder</td>
<td>separate time and temperature control for space and water heating</td>
</tr>
<tr>
<td>Primary water heating losses</td>
<td>120 litre cylinder insulated with 35 mm of factory applied foam</td>
</tr>
<tr>
<td></td>
<td>Primary pipework not insulated, cylinder temperature controlled by thermostat</td>
</tr>
</tbody>
</table>
Information required for DEAP

Dwelling dimensions

New build

Existing buildings

Assessor Tape Measure
Information required for DEAP

Ventilation Rates (Heat Losses)
Information required for DEAP

Fabric Heat Losses

Elemental U-values
Information required for DEAP

Hot Water System
- Electric immersion heater
- Single point heater
- Boiler
- Community heating
- Heat pump
- Solar collector
Heat Gains:
Internal heat gains from people and equipment + Solar Gains

Information required for DEAP
Information required for DEAP

Heating System Efficiency

HARP Database
Information required for DEAP System

Heating Responsiveness and Controls
kgCO₂/m²/year → CDER (TGD L)
kWh/m²/year → BER

Dwelling dimensions
Ventilation Rates
Hot Water System
Fabric Heat Losses
Heat Gains

HARP Database
Building dimensions

Fabric Heat Losses

Hot Water System

Heat Gains

Lighting

Ventilation Rates

Boiler/HS Controls Efficiency

kgCO₂/m²/year → CDER (TGD L)

kWh/m²/year → BER
Part L
Limitation of Heat Loss through the Building Fabric
Limitation of Heat Loss through the Building Fabric

Elemental Heat Loss Method or Overall Heat Loss Method

Requirement does not vary from TGD L 2002
## Maximum average elemental U-Value (W/m\(^2\)K) - Table 2, TGD L 2006

<table>
<thead>
<tr>
<th>Fabric Elements</th>
<th>New Buildings &amp; Extensions to Existing Buildings</th>
<th>Material Alterations to, or Material Changes of Internal Existing Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitched roof, insulation horizontal at ceiling level</td>
<td>0.16</td>
<td>0.35</td>
</tr>
<tr>
<td>Pitched roof, insulation on slope</td>
<td>0.20</td>
<td>0.35</td>
</tr>
<tr>
<td>Flat roof</td>
<td>0.22</td>
<td>0.35</td>
</tr>
<tr>
<td>Walls</td>
<td>0.27</td>
<td>0.60</td>
</tr>
<tr>
<td>Ground Floors</td>
<td>0.25</td>
<td>-</td>
</tr>
<tr>
<td>Other Exposed Floors</td>
<td>0.25</td>
<td>0.60</td>
</tr>
<tr>
<td>External doors, windows and rooflights</td>
<td>2.20(^1)</td>
<td>2.20</td>
</tr>
</tbody>
</table>

**NOTE:**
Applicable if the combined area of external door, window and rooflight openings does not exceed 25% of floor area.
Floor Insulation
U-value 0.25W/m²K

Thickness of similar material required: 100mm
Roof Insulation
U-value 0.16W/m²K

Thickness of similar materials required
250-300mm
Walls -
U-value 0.27W/m²K

Thickness of similar materials required
100-150mm
Part L
Other Provisions
Reducing cold bridging

Reducing air infiltration

Heating control

Insulation of hot water storage vessels, pipes & ducts
Building Energy Rating
Dwellings that APPLY for planning permission after 1 January 2007 need a BER before they are offered for sale.
Building Energy Rating (BER)

- Calculated using DEAP
- BER relates to primary energy kWh/m²/y
- No minimum standard
- Linear Scale
- Must be produced by Registered BER Assessor
- Valid 10 years unless changes are made to building
Provisional Building Energy Rating

- ADDITIONAL requirement if selling off-plans
- When the dwelling is completed, a BER certificate that represents the buildings as constructed must be supplied to the purchaser
- Same scale as a BER
- Valid for up to 2 years
BER Assessment Process for NEW Dwellings

Building Owner engages BER assessor to conduct assessment

Assessor Completes Assessment Locally and obtains BER Number

Assessor Submits Assessments to SEI

SEI Validates Submission, Releases for Publication on Web Site

Public Data

Private Data

BER Certificate printed

Advisory Reports are standardised and can be printed from SEI website

Building Control Authority is entitled to demand copy of BER cert.
Worked example:
96m² semi-detached house

Insulation: as in TGD L
Main Heating: Gas boiler; efficiency 78%
Secondary Heating: Open Fire

DEAP Result
BER (primary energy): 156 kWh/m²/y; C1
CDER (CO₂): 33 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)
Worked example: 96m² semi-detached house

Insulation: as in TGD L
Main Heating: Gas boiler; efficiency 78%
Secondary Heating: Open Fire

DEAP Result
BER (primary energy): 156 kWh/m²/y; C1
CDER (CO₂): 33 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)

Specification Variation
Main Heating: Electric Heating

Revised DEAP Result
BER (primary energy): 207 kWh/m²/y; C3
CDER (CO₂): 49 kg/m²/y
Conformance TGD L MPCDER: yes (60 kg/m²/y)
Worked example:
96m² semi-detached house

Insulation: as in TGD L
Main Heating: Gas boiler; efficiency 78%
Secondary Heating: Open Fire

DEAP Result
BER (primary energy): 156 kWh/m²/y; C1
CDER (CO₂): 33 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)

Specification Variation
Main Heating: Wood pellets boiler, 78%

Revised DEAP Result
BER (primary energy): 156 kWh/m²/y; C1
CDER (CO₂): 15 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)
Worked example: 96m² semi-detached house

Insulation: as in TGD L
Main Heating: Gas boiler; efficiency 78%
Secondary Heating: Open Fire

DEAP Result
BER (primary energy): 156 kWh/m²/y; C1
CDER (CO₂): 33 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)

Specification Variation
Main Heating: Gas condensing boiler, efficiency 91%

Revised DEAP Result
BER (primary energy): 140 kWh/m²/y; B3
CDER (CO₂): 30 kg/m²/y
Conformance TGD L MPCER: yes (33 kg/m²/y)
Worked example: 96m² semi-detached house

Insulation: as in TGD L
Main Heating: Gas boiler; efficiency 78%
Secondary Heating: Open Fire

DEAP Result
BER (primary energy): 156 kWh/m²/y; C1
CDER (CO₂): 33 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)

Specification Variation
Reduce heat loss on all elements by 25%

Revised DEAP Result
BER (primary energy): 138 kWh/m²/y; B3
CDER (CO₂): 29 kg/m²/y
Conformance TGD L MPCDER: yes (33 kg/m²/y)
Example improvements
96m² Semi-detached house:
Initial BER 156 kWh/m²/y

- Insulation: 25% higher than TGD L (138 kWh/m²/y)
- Main Heating: Gas boiler efficiency 91% (124 kWh/m²/y)
- Secondary Heating: Condensing gas fire efficiency 85% (111 kWh/m²/y)
- Change orientation SE/SW (104 kWh/m²/y)
- 100% efficient lighting (97 kWh/m²/y)
- Solar panel 4m² (83 kWh/m²/y)
- PV powered solar panel (81 kWh/m²/y)
- Draught lobby (80 kWh/m²/y)
- Time and Temperature zone control (77 kWh/m²/y)
- Heating system weather compensator (76 kWh/m²/y)
- Hot water primary circuit losses reduced insulating primary pipe work & fitting cylinder thermostat (74 kWh/m²/y)
Documentation of Information

- BER Certificates are valid for up to 10 years and all dwellings will require BER if offered for sale/rent after January 2009.

Exercise Due Care
- Building owner and assessor sign contract
- Assessment limitations or caveats should be discussed and documented
- Building Owner and Assessor co-sign an “Information Form” that document agreement of input information that is included in an assessment
Comparison of (former) HER and DEAP results
## HER vs DEAP Comparisons

<table>
<thead>
<tr>
<th>Project name</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>H6</th>
<th>H7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Type</td>
<td>Detached 2 Storey, Timber</td>
<td>GSHP, Solar/Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Area</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>490</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m³/yr</td>
<td>Gross (x Area)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic MPHER (Ref) kWh/m²/yr</td>
<td>91.78</td>
<td>18062</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic HER (HoT) kWh/m²/yr</td>
<td>64.75</td>
<td>11331</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Improvement</td>
<td>29.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average U Value (HER)</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## HER – DEAP Comparison

### HER vs DEAP Summary of Results

<table>
<thead>
<tr>
<th>DEAP Summary (kWh/m²/yr)</th>
<th>H1 Rating</th>
<th>H2 Rating</th>
<th>H3 Rating</th>
<th>H4 Rating</th>
<th>H5 Rating</th>
<th>H6 Rating</th>
<th>H7 Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td></td>
<td>B1</td>
<td>B2</td>
<td>B1</td>
<td>B1</td>
<td>B1</td>
<td>B2</td>
</tr>
<tr>
<td>HER Summary (% Reduction MPHER)</td>
<td>66.6%</td>
<td>60.7%</td>
<td>51.2%</td>
<td>83.6%</td>
<td>57.7%</td>
<td>64.1%</td>
<td>62.3%</td>
</tr>
</tbody>
</table>

- **Average weighted DEAP Rating**: 69.4 **B1**
- **Average weighted HER Reduction**: 70.9%
- **Average Weighted DEAP CO₂ Reduction**: 35.3%
- **Average Weighted HER CO₂ Reduction**: 66.0%
Comparison of DEAP and MPHER Methodology

HER – DEAP Comparison

Comparison of DEAP and MPHER Methodology

<table>
<thead>
<tr>
<th>DEAP Summary (kWh/m²/yr)</th>
<th>HER Summary (% MPHER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td></td>
</tr>
</tbody>
</table>

Reduction (% MPHER)

- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%
Methodology Recap

• HER Method
  • Heat Energy Consumption calculated for applicant house - based on Delivered Energy
  • Energy Result Expressed as % MPhER
  • CO₂ emissions not explicitly considered
Methodology Recap

- DEAP Method
  - Total Energy Consumption for Heat, Ventilation and Light calculated for applicant house - based on Primary Energy
  - Reference House (TGD L Appendix C) calculates MPCDER in background
  - BER expressed in kWh/m²/yr
  - CDER expressed as % MPCDER
DEAP Walkthrough
DEAP communication with National Administration System

Access by type of user

DEAP Client

NAS

National Administration System

DEAP DB

DEAP Appl.

NAS DB

Assessors

General Public

Administrators
Possible Trouble Spots
DEAP – Ventilation

- Are there chimneys on the plans?
  - Heat loss must be accounted for.
- MVHR
  - If ventilation with heat recovery, are there permanent vents?
  - Is this good practice?
- Specific Fan Power
  - Default value is 2 W/l/sec
  - Require manufacturer’s statement to use an alternative value (App. Q)
- Air tightness
  - Have to accept default values until house is built.
  - Cannot enter air change values
Air Permeability Summary

Air Permeability: All Units

- Air perm. (m³/h per m²)
- Best Practice
- Good Practice
- House of Tomorrow

Construction Type:
- Masonry
- Timber Frame
Insulation and air tightening at the Floor / Wall joint

Procedure

1. Fold down blue Tyvek membrane to overlap wall Air Leakage Barrier.
2. Stable to wall.
3. Tape all joints.
DEAP – Fabric Losses

- **Glazing**
  - Does orientation agree with plans?
  - Do glazed areas agree with plans?
  - Are U-values realistic (for the description given)?
  - Is the fraction of glazing to floor area reasonable (c 25%)?

- **Elements**
  - Are U-values realistic (for the description given)?

- **Thermal Bridging**
  - Default is 0.11 (total Fabric area) for TGD L compliant Buildings.
  - Anything else requires Robust detailing or Appendix K calculations.
3.3 U-values of elements adjacent to an unheated space

The procedure for treatment of U-values of elements adjacent to unheated space is described in IS EN ISO 6946 and IS EN ISO 13789.

The following procedure may be used for typical structures (no measurements are needed of the construction providing an unheated space, just select the appropriate $R_u$ from Tables 3.1 to 3.4 below).

$$U = \frac{1}{\frac{1}{U_o} + R_u}$$

where: $U$ = resultant U-value of the element adjacent to unheated space, W/m$^2$K;

$U_o$ = U-value of the element between heated and unheated spaces calculated as if there were no unheated space adjacent to the element, W/m$^2$K;

$R_u$ = effective thermal resistance of unheated space from the appropriate table below.
DEAP – Hot Water

• If main space heating does not use a combi-boiler then
  • Storage is required

• If Solar panels are employed then
  • Is storage volume adequate?
  • Is there proof that the panel is PV powered.

• Circuit Losses
  • Do they correspond with Table 3?
Table 2: Factors to be applied to losses for cylinders, thermal stores and CPSUs

<table>
<thead>
<tr>
<th>Type of water storage</th>
<th>Temperature Factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for manufacturer's declared loss</td>
<td>for calculated loss</td>
</tr>
<tr>
<td>Cylinder</td>
<td>0.60 (^{a(b)})</td>
<td>0.60 (^{a(b)})</td>
</tr>
<tr>
<td>Storage combi boiler, primary store</td>
<td>n/a</td>
<td>Store volume ≥ 115 litres: 0.82 Store volume &lt; 115 litres: 0.82 + 0.0022 (\times) ((115 - V))</td>
</tr>
<tr>
<td>Storage combi boiler, secondary store</td>
<td>n/a</td>
<td>Store volume ≥ 115 litres: 0.60 Store volume &lt; 115 litres: 0.60 + 0.0016 (\times) ((115 - V))</td>
</tr>
<tr>
<td>Hot water only thermal store</td>
<td>0.89 (^{c})</td>
<td>1.08 (^{c(d)})</td>
</tr>
<tr>
<td>Integrated thermal store and gas-fired CPSU</td>
<td>0.89 (^{c})</td>
<td>1.08 (^{c(d)})</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electric CPSU: winter operating temp.</th>
<th>85°C</th>
<th>90°C</th>
<th>95°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.09</td>
<td>1.15</td>
<td>1.21</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes:

a) Multiply Temperature Factor by 1.3 if a cylinder thermostat is absent.
b) Multiply Temperature Factor by 0.9 if there is separate time control of domestic hot water (boiler systems only).
c) Multiply Temperature Factor by 0.81 if the thermal store or CPSU has separate timer for heating the store.
d) Multiply Temperature Factor by 1.1 if the thermal store or CPSU is not in an airing cupboard.

Source: SAP 2005
**Table H1: Default collector parameters**

<table>
<thead>
<tr>
<th>Collector type</th>
<th>$\eta_0$</th>
<th>$a_1$</th>
<th>Ratio of aperture area to gross area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evacuated tube</td>
<td>0.6</td>
<td>3</td>
<td>0.72</td>
</tr>
<tr>
<td>Flat plate, glazed</td>
<td>0.75</td>
<td>6</td>
<td>0.90</td>
</tr>
<tr>
<td>Unglazed</td>
<td>0.9</td>
<td>20</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Table H2: Annual solar radiation, kWh/m²**

<table>
<thead>
<tr>
<th>Tilt of collector</th>
<th>Orientation of collector</th>
<th>South</th>
<th>SE/SW</th>
<th>E/W</th>
<th>NE/NW</th>
<th>North</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td></td>
<td>963</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15°</td>
<td></td>
<td>1036</td>
<td>1005</td>
<td>929</td>
<td>848</td>
<td>813</td>
</tr>
<tr>
<td>30°</td>
<td></td>
<td>1074</td>
<td>1021</td>
<td>886</td>
<td>736</td>
<td>676</td>
</tr>
<tr>
<td>45°</td>
<td></td>
<td>1072</td>
<td>1005</td>
<td>837</td>
<td>644</td>
<td>556</td>
</tr>
<tr>
<td>60°</td>
<td></td>
<td>1027</td>
<td>956</td>
<td>778</td>
<td>574</td>
<td>463</td>
</tr>
<tr>
<td>75°</td>
<td></td>
<td>942</td>
<td>879</td>
<td>708</td>
<td>515</td>
<td>416</td>
</tr>
<tr>
<td>Vertical</td>
<td></td>
<td>822</td>
<td>773</td>
<td>628</td>
<td>461</td>
<td>380</td>
</tr>
</tbody>
</table>

**Table H3: Overshading factor**

<table>
<thead>
<tr>
<th>Overshading</th>
<th>% of sky blocked by obstacles</th>
<th>Overshading factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy</td>
<td>$&gt; 80%$</td>
<td>0.5</td>
</tr>
<tr>
<td>Significant</td>
<td>$&gt; 60% - 80%$</td>
<td>0.65</td>
</tr>
<tr>
<td>Modest</td>
<td>$20% - 60%$</td>
<td>0.8</td>
</tr>
<tr>
<td>None or very little</td>
<td>$&lt; 20%$</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Note: Overshading must be assessed separately for solar panels, taking account of the tilt of the collector. Usually there is less overshading of a solar collector compared...*
DEAP – Gains, Heat Use and Controls

- Will the owner really use 100% energy efficient lighting?
- Is the living area fraction realistic?
- Is the control category and responsiveness factors correct (e.g. underfloor heating)?
- Is the correct Thermal Mass Selected?
Table 11: Thermal mass categories for the dwelling

<table>
<thead>
<tr>
<th>Category</th>
<th>AmAf</th>
<th>AmAf</th>
<th>Heat capacity per unit floor area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[-]</td>
<td>[-]</td>
<td>[MJ/m² K]</td>
</tr>
<tr>
<td>Low</td>
<td>0</td>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>Medium-low</td>
<td>0.5</td>
<td>0.5</td>
<td>0.14</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
<td>1</td>
<td>0.20</td>
</tr>
<tr>
<td>Medium-high</td>
<td>2</td>
<td>2</td>
<td>0.32</td>
</tr>
<tr>
<td>High</td>
<td>3.5</td>
<td>3.5</td>
<td>0.50</td>
</tr>
</tbody>
</table>

AmAf = Area of thermally massive elements divided by total floor area
UF: for calculation of utilisation factor
IH: for calculation of effect of intermittent heating

Table 11a: Thermally massive and thermally light constructions

The layers given below are those nearest the internal surface of the construction.

**Thermally massive constructions:**
- Dense plaster on clay brickwork or solid concrete blockwork.
- Plasterboard-on-dabs on clay brickwork or solid concrete blockwork.
- Plaster or plasterboard-on-dabs on hollow concrete blockwork.
- Concrete or screed floor, either bare, laminated, tiled, carpeted, or with wood laid directly on concrete/screed.
- Dense plaster on aerated concrete blockwork or aerated concrete slab.

**Thermally light constructions:**
- Plasterboard ceiling below joists or rafters, with insulation or air space between the joists.
- Plasterboard wall with insulation behind (timber-frame walls and masonry walls with internal insulation fall in this category).
- Plasterboard-on-dabs on aerated concrete blockwork or aerated concrete slab.
- Suspended timber floor.
- Windows and doors.
DEAP – Energy requirements

- Do efficiencies compare well with HARP, SEDBUK or Tables 4a and 4b?
- Are there chimneys on the plans?
  - Secondary must be employed
  - Fuel must be specified (assume solid multi-fuel for default)
- Heatpumps
  - COP must be realistic (< 400%) and must be lower for water heating aspect (c 250%)
  - Submit Air-source HP’s to reality check
  - Make sure that “renewable sources for space heating” is checked. Otherwise a favourable MPCDER will be delivered.
DEAP – Additional Considerations

• If a heat recovery system is the primary heat source for a building, where does the original heat come from?

• Fractions, Proportions (decimals - 0.XY) and Percentages (whole numbers - XY.Z ) are required to be entered at various times. Ensure they are correctly used.

• Look out for “omitted” values
  • Secondary heating
  • Water storage volume
  • Forgotten chimneys
  • U-values
  • Thermal Bridging Percentage

• Will an oil boiler really use wood pellets as its fuel ?!
Conclusion
EPBD: Recap

- Minimum building energy performance standards (new homes)
- Minimum energy performance standards for major renovations ("material alterations")
- Building Energy Rating (BER) and Advisory Report - new & existing homes when constructed, sold or rented
- Feasibility assessment of alternative energy systems (new buildings >1,000m² e.g. apartment blocks)
- Energy Rating and Labelling
DEAP summary

- Calculates Primary Energy use for space and water heating, pumps, fans and lighting
- CO₂ Emissions Rating: MPCDER [Building Regulations]
  - “Reference House” concept
  - NB. Secondary heating (10%) must be included for Part L compliance assessment – but not necessarily for BER
- Building Energy Rating: BER [Building Owners]
- Software version interfacing with National Administration System
Further Information

Promoting and assisting the development of sustainable energy

Energy Performance of Buildings Directive (EPBD)

The EU Directive on the Energy Performance of Buildings (EPBD) contains a range of provisions aimed at improving energy performance in residential and non-residential buildings, both new-build and existing.

The EPBD obliges specific forms of information and advice on energy to be provided to building purchasers, tenants and users. The intention is that this information and advice will help consumers to make informed decisions leading to practical actions to improve energy performance.

As part of the Directive, a Building Energy Rating (BER) certificate, which is effectively an energy label, will be required at the point of sale or rental of a building, or on completion of a new building. The BER will be accompanied by an “Advisory Report” setting out recommendations for cost-effective improvements to the energy performance of the building. However there will be no legal obligation on vendors or prospective purchasers to carry out the recommended improvements.

From 1 January 2007 new dwellings that applied for planning permission on or after 1 January 2007, will require BER before they are offered for sale or rent. This requirement will be extended to all new non-residential buildings in July 2008 and to existing buildings offered for sale or rent in January 2009.

Please click on image to enlarge.