

# Building Regulations Part L 2010

Steve Rufus

Principal Engineer

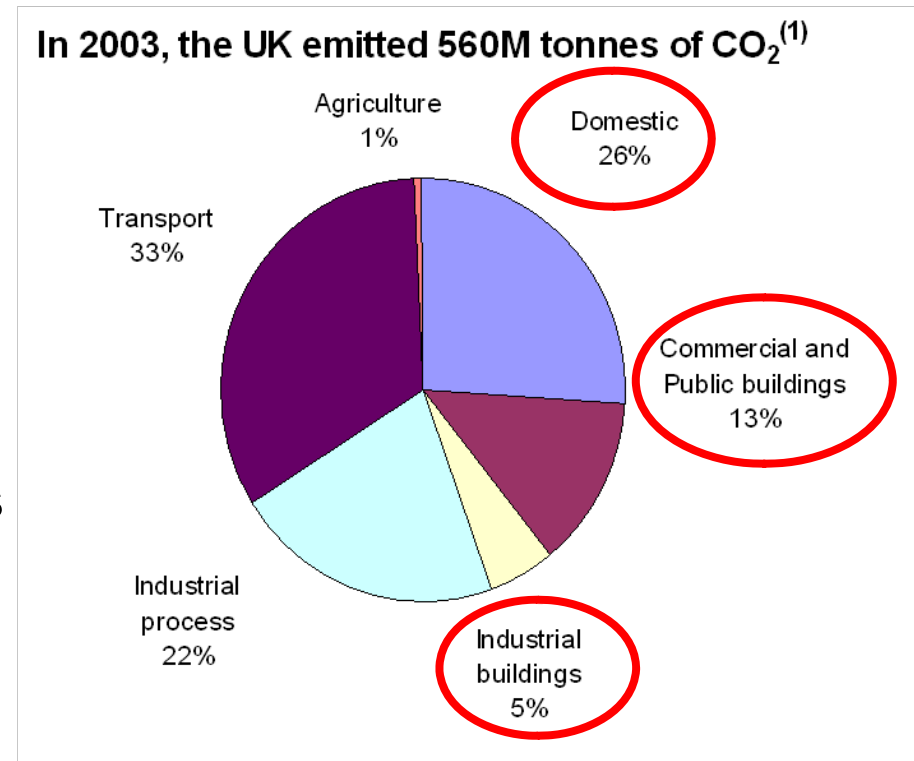
Property Management Division

Dorset County Council

01305 225236



- Climate Change Act: reduce emissions by 80% by 2050
- Buildings account for 45% of UK carbon emissions
- Also security of supply and fuel poverty issues
- Reduce usage of a diminishing resource
- Raising energy efficiency standards via Building Regulations is key
- Ensure health standards not compromised



(1) Source: Energy White Paper, 2007



- Criterion 1: Meet whole building carbon dioxide target (BER/DER  $\leq$  TER)
- Criterion 2: Limits on design flexibility (backstops)
- Criterion 3: Limiting effects of solar gain
- Criterion 4: Quality of construction & commissioning
- Criterion 5: Providing information / O&M instructions

**No changes proposed**

However:-

New regulatory requirement for CO<sub>2</sub> emission rate calculations to be submitted before the start of building work along with a list of the specifications used in the calculations

This is in addition to the CO<sub>2</sub> emission rate calculation required to be submitted after completion of the work

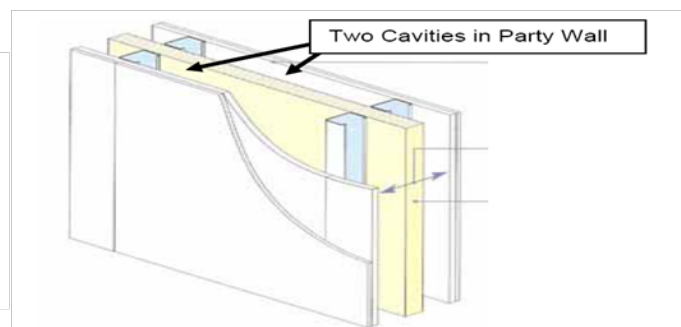
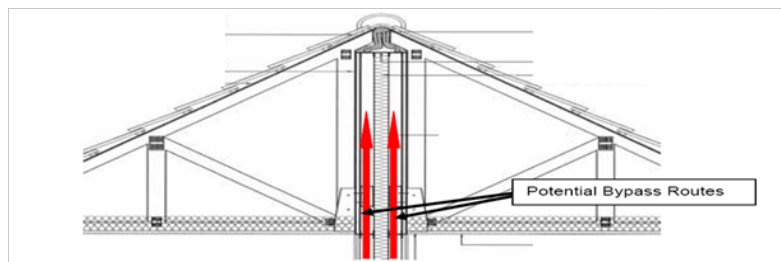
*This design stage calculation and list of specifications will assist Building Control in confirming what is being built aligns with the claimed performance.*

*The Approved Document sets out how compliance software input data could link to the list of specifications and highlights those features of the design that are critical to achieving compliance.*



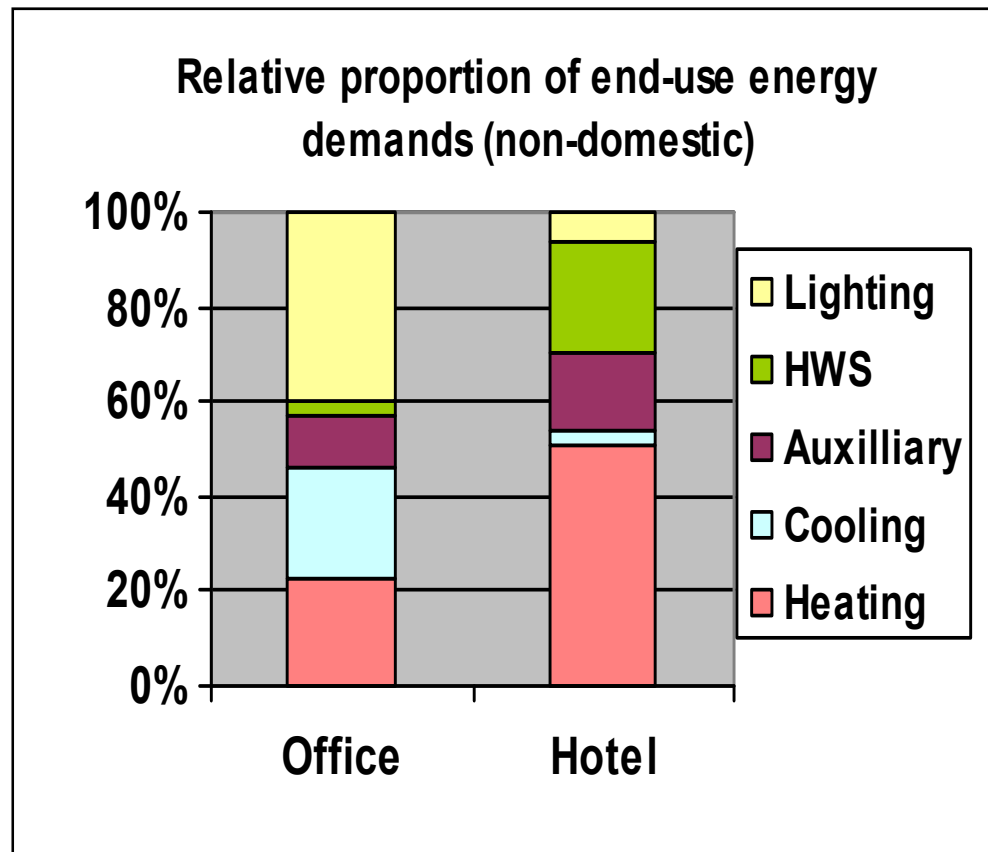
# Criterion 1: New Homes

- A “flat 25%” improvement for every new home calculated using SAP2009
- CO<sub>2</sub> target (TER) set by reference to a 2002 notional dwelling with additional improvement of 25% relative to 2006 standards
- Secondary heating only counted as part of the dwelling emission rate (DER) when actually installed or provided for
- Credit allowed wherever low energy lamps actually installed in fixed lighting locations
- Notional dwelling now includes party wall heat loss of zero



# Criterion 1: New Non Domestic Buildings

- An “Aggregate 25%” improvement for new build stock rather than per building
- Takes into account the difficulties/opportunities of improving energy efficiency in different types of building based on relative cost effectiveness of making improvements to typical components
- Some buildings deliver more than 25%, some less – optimised to deliver national target of 25% when applied across build mix



# Projected Mix of Buildings

| <b>Non-domestic building type</b> | <b>% of mix</b> | <b>CO2 reduction</b> |
|-----------------------------------|-----------------|----------------------|
| Shallow plan (heated only)        | 1               | 22%                  |
| Shallow plan (Air conditioned)    | 1               | 40%                  |
| Deep plan (Air conditioned)       | 40              | 26%                  |
| Warehouse                         | 33              | 34%                  |
| Hotel                             | 6               | 16%                  |
| School                            | 4               | 27%                  |
| Retail                            | 12              | 21%                  |
| Supermarket                       | 2               | 26%                  |



# Criterion 1: New Non Domestic Buildings



- 2010 notional building with improved building fabric and HVAC specifications and with no improvement factor
- Side-lit, roof-lit and no-lit classes of notional building determined by activity type assigned to zones in actual building
- Heating fuel and seasonal efficiency in notional building varies as a function of the fuel used in the actual building
- Management feature credits for aM&T and power factor correction retained. Variable speed pumps. Demand control for ventilation. Bivalent energy systems.
- Calculated using SBEM 2010 or approved Dynamic Simulation Models (DSMs)



# Criterion 1: 2010 Notional Building

|   | “Roof-lit” | “Side-lit” |
|---|------------|------------|
| Roofs (u-value)   | 0.18       | 0.18       |
| Walls (u-value)   | 0.26       | 0.26       |
| Floors (u-value)  | 0.22       | 0.22       |
| Windows, doors and rooflights (u-value)                 | 1.8        | 1.8        |
| Air permeability  | 5          | 5          |
| Lighting (lm/W)*  | 55         | 55         |
| Multiburner radiant system (thermal/radiant efficiency) | 86%/65%    | -          |
| Central mechanical ventilation (SFP)                    | 1.8        | 1.8        |
| Fan coil units (SFP)                                    | -          | 0.5        |
| Gas boilers (seasonal efficiency)                       | 90%        | 88%        |
| Cooling (SEER)**  | 4.5        | 4.5        |
| DX Cooling (SEER)                                       | -          | 3.5        |



- **SAP2009** for new dwellings
- **SBEM2010** iSBEM v4.1a (Nov 15<sup>th</sup> 2010) or approved DSMs for non-domestic buildings
- Improved calculation of auxiliary energy for HVAC and improved lighting procedures
- Rationalisation of building types linked to planning classes with simplified activity types below this
- Convergence of results from SBEM and DSMs
- Updated weather data
- New CO<sub>2</sub> emission factors



| <b>Fuel:</b>            | <b>2006 kgCO<sub>2</sub>/kWh</b> | <b>2010 kgCO<sub>2</sub>eq/kWh</b> |
|-------------------------|----------------------------------|------------------------------------|
| <b>Mains Gas</b>        | <b>0.194</b>                     | <b>0.198</b>                       |
| <b>Heating Oil</b>      | <b>0.265</b>                     | <b>0.274</b>                       |
| <b>Wood Pellets</b>     | <b>0.025</b>                     | <b>0.028</b>                       |
| <b>Grid Electricity</b> | <b>0.422</b>                     | <b>0.517</b>                       |
| <b>Displaced Elec.</b>  | <b>0.568</b>                     | <b>0.529</b>                       |



## Criterion 2: Limits of Design Flexibility

- Criterion 2 sets minimum levels of energy efficiency for building fabric and services
- Intent is that CO<sub>2</sub> targets cannot be achieved through renewables alone
- Some strengthening of backstops
- Emphasis on quality of construction, thermal bridging and fixed building services
- However more stringent values will be required to meet higher 2010 CO<sub>2</sub> targets



# Criterion 2: Fabric Backstops

**Table 4: Limiting fabric parameters**

|  |   |
|--|---|
| Roof   | 0.25 W/m <sup>2</sup> .K                          |
| Wall   | 0.35 W/m <sup>2</sup> .K                          |
| Floor  | 0.25 W/m <sup>2</sup> .K                          |
| Windows, roof windows, rooflights <sup>3</sup> , curtain walling & pedestrian doors <sup>1,2</sup> | 2.2 W/m <sup>2</sup> .K                           |
| Vehicle access and similar large doors   | 1.5 W/m <sup>2</sup> .K                           |
| High usage entrance doors  | 3.5 W/m <sup>2</sup> .K                           |
| Roof ventilators (inc. smoke vents)  | 3.5 W/m <sup>2</sup> .K                           |
| Air permeability   | 10.0 m <sup>3</sup> /h.m <sup>2</sup> at<br>50 Pa |

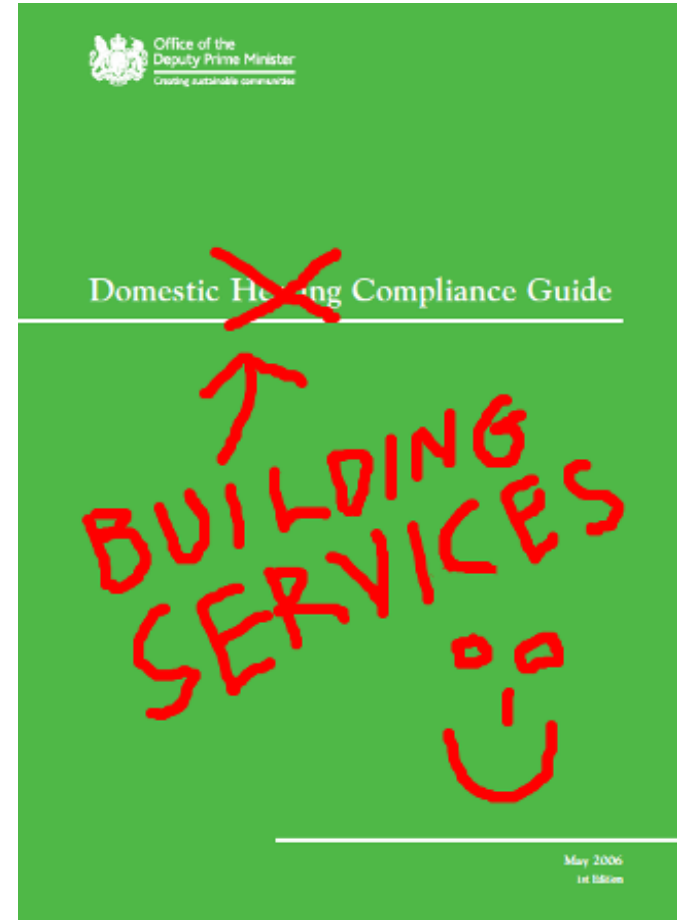
<sup>1</sup> Excluding display windows and similar glazing. There is no limit on design flexibility for these exclusions but their impact on CO<sub>2</sub> emissions must be taken into account in calculations.

<sup>2</sup> In buildings with high internal heat gains, a less demanding area weighted average U-value for the glazing may be an appropriate way of reducing overall CO<sub>2</sub> emissions and hence the BER. If this case can be made, then the average U-value for windows can be relaxed from the values given above. However values should be no worse than 2.7 W/m<sup>2</sup>.K.

<sup>3</sup> The relevant rooflight U-value for checking against these limits is that based on the developed area of the rooflight, not the area of the roof aperture.



- Two domestic and non-domestic compliance guides set energy efficiency standards for building services
- Limit design flexibility for new build
- Standards raised compared with earlier editions of guides and updated in line with BS ENs
- Non-domestic guide has new sections on lighting and circulator pumps
- Includes guidance on installation and commissioning



## **Biomass boiler system efficiencies**

- 65% (<20.5kW gravity fed)
- 75%(automatic pellet/woodchip)

## **Heat pumps**

- COP raised from 2.0 to 2.2
- Minimum seasonal performance factor

## **Air-distribution**

- Lower maximum specific fan power
- Greater range of system types
- Heat recovery requirement, with minimum recovery efficiencies for system

## **Chiller plant**

- Greater range of chiller types
- Minimum SEERs increased

## **Internal lighting – new and existing**

- Minimum efficacy 55 luminaire lumens per circuit-watt (with control factors)

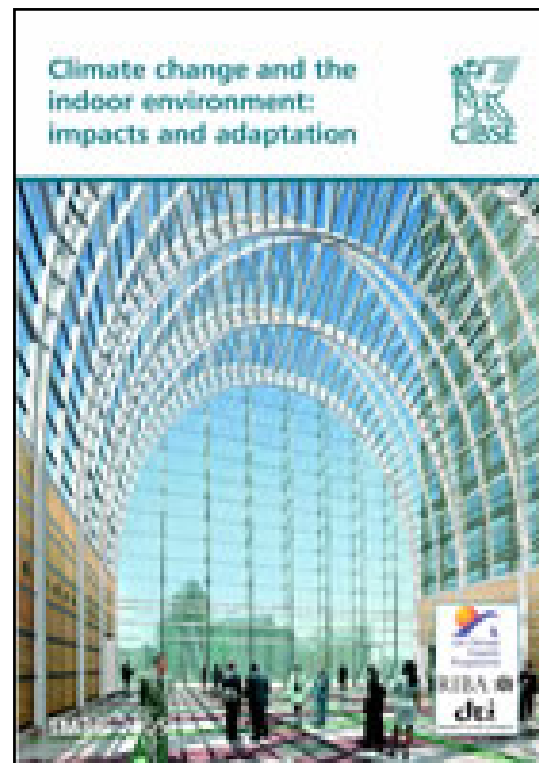
## **Heating system circulators and water pumps**

- Europump Labelling Scheme A to G rating
- Variable speed as appropriate



## Non-domestic

- New approach to limiting solar gains in non-domestic buildings.
- Limit on solar gain per unit area of façade, applies to both naturally ventilated and air conditioned spaces.
- Will require that good solar protection where highly glazed facades are proposed.



|            | Quality calc | Buildability | Checks made   | $\Psi$ -margin     |
|------------|--------------|--------------|---|--------------------|
| ACD Scheme | ✓            | ✓            | <ul style="list-style-type: none"> <li><math>\psi</math>-value calculated by “accredited expert” calculator</li> <li>Independent assessment of buildability &amp; robustness</li> </ul> | 0%                 |
| Private    | ✓            | x            | <ul style="list-style-type: none"> <li>Accredited calculation</li> <li>No independent assessment of buildability</li> </ul>   | + 0.02 W/mk or 25% |
| None       | x            | x            | <ul style="list-style-type: none"> <li>No accreditation</li> </ul>  | + 0.04 W/mk or 50% |



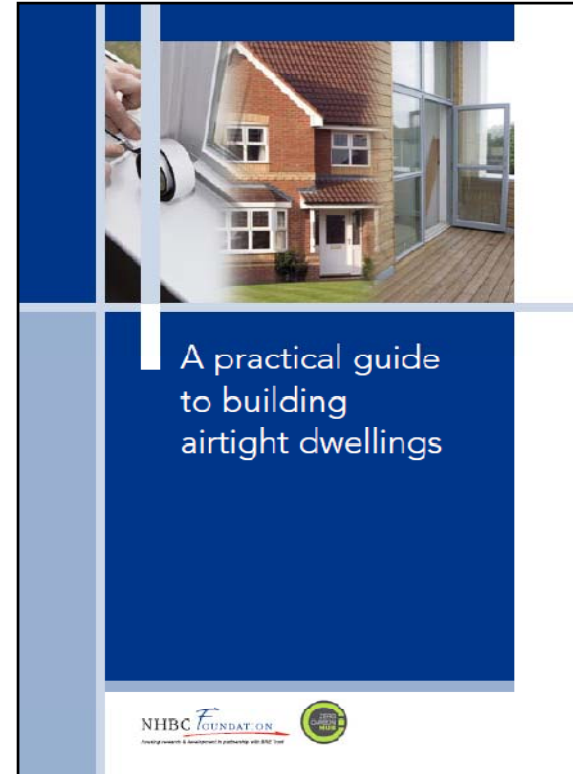
# Criterion 4: Building Performance (Airtightness testing)

Increase in sampling rate (~ doubled)  
for domestic developments

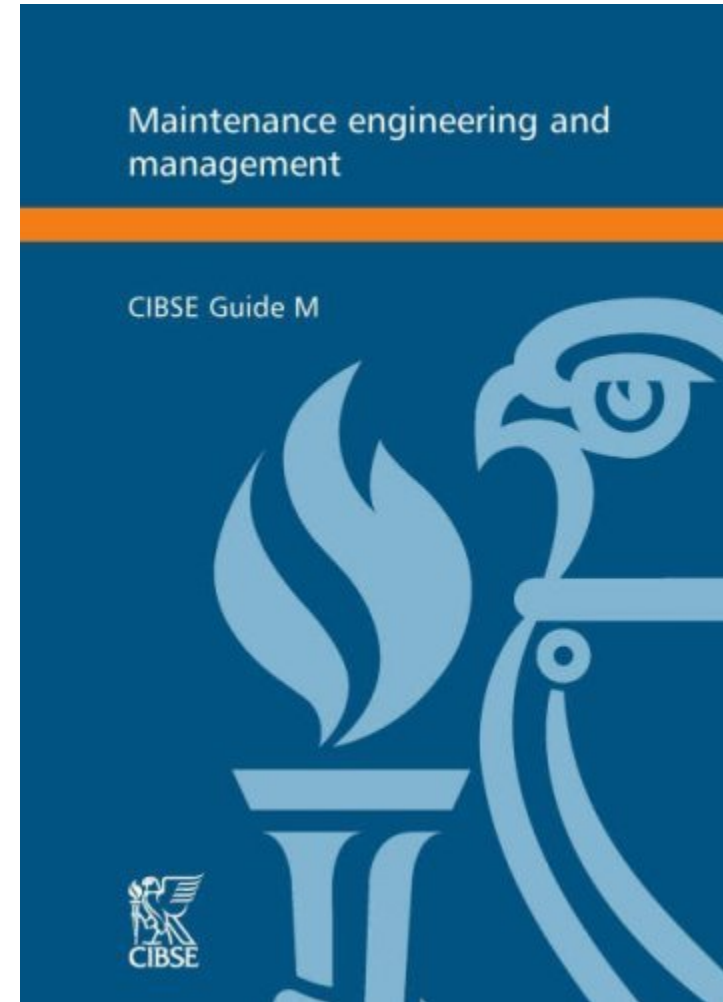
Change to 'Test method B' from  
ATTMA Guide - trickle vents  
temporarily sealed rather than just  
closed - better test of building  
envelope

Separate ATTMA Guides for domestic  
and non-domestic

Alternatives for small housing  
developments and very large  
buildings



- Commissioning schedules and methods to be provided with the design stage submission.
- Proof required that systems have been commissioned to the required levels. CIBSE guide M given as an appropriate method of compliance
- Details required within 5 days of completion.



# Criterion 5: Provision of Information



- Information on how to use and maintain the building efficiently
- Logbooks for non domestic buildings
- The data used to calculate the TER and the BER should be included
- Improvement recommendations to be provided with the on-construction EPC
- EPC required for New Build and extensions also if controlled building services or thermal elements are altered.

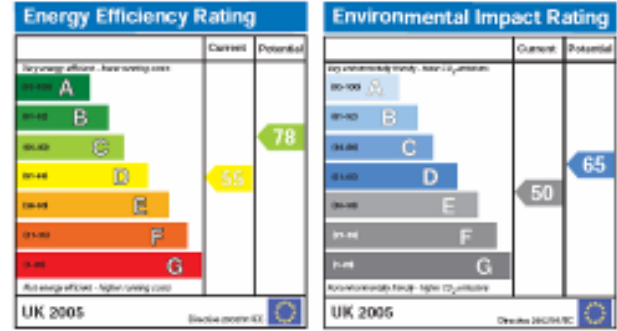
## Section H: Energy Performance Certificate Save money, improve comfort and help the environment

The following report is based on an inspection carried out for:

|   |   |               |  |                                     |
|---|---|---------------|--|-------------------------------------|
| Address:<br>100 Any Street,<br>Any Town,<br>Anywhere, AB1 0CD | Building type:<br>Whole or part of building | Home<br>Whole | Certificate number:<br>Date issued:<br>Assessment method:<br>Name of inspector:<br>Date of inspection: | XXXX<br>XXXX<br>SAP<br>XXXX<br>XXXX |
|---|---|---------------|--|-------------------------------------|

### This home's performance ratings

This home has been inspected and its performance rated in terms of its energy efficiency and environmental impact. This is calculated using the UK Standard Assessment Procedure (SAP) for dwellings which gives you an energy efficiency rating based on fuel cost and an environmental impact rating based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is, and the lower the fuel bills will be. The environmental impact rating is a measure of the home's impact on the environment. The higher the rating the less impact it has on the environment.

### Typical fuel costs and carbon dioxide (CO<sub>2</sub>) emissions of this home

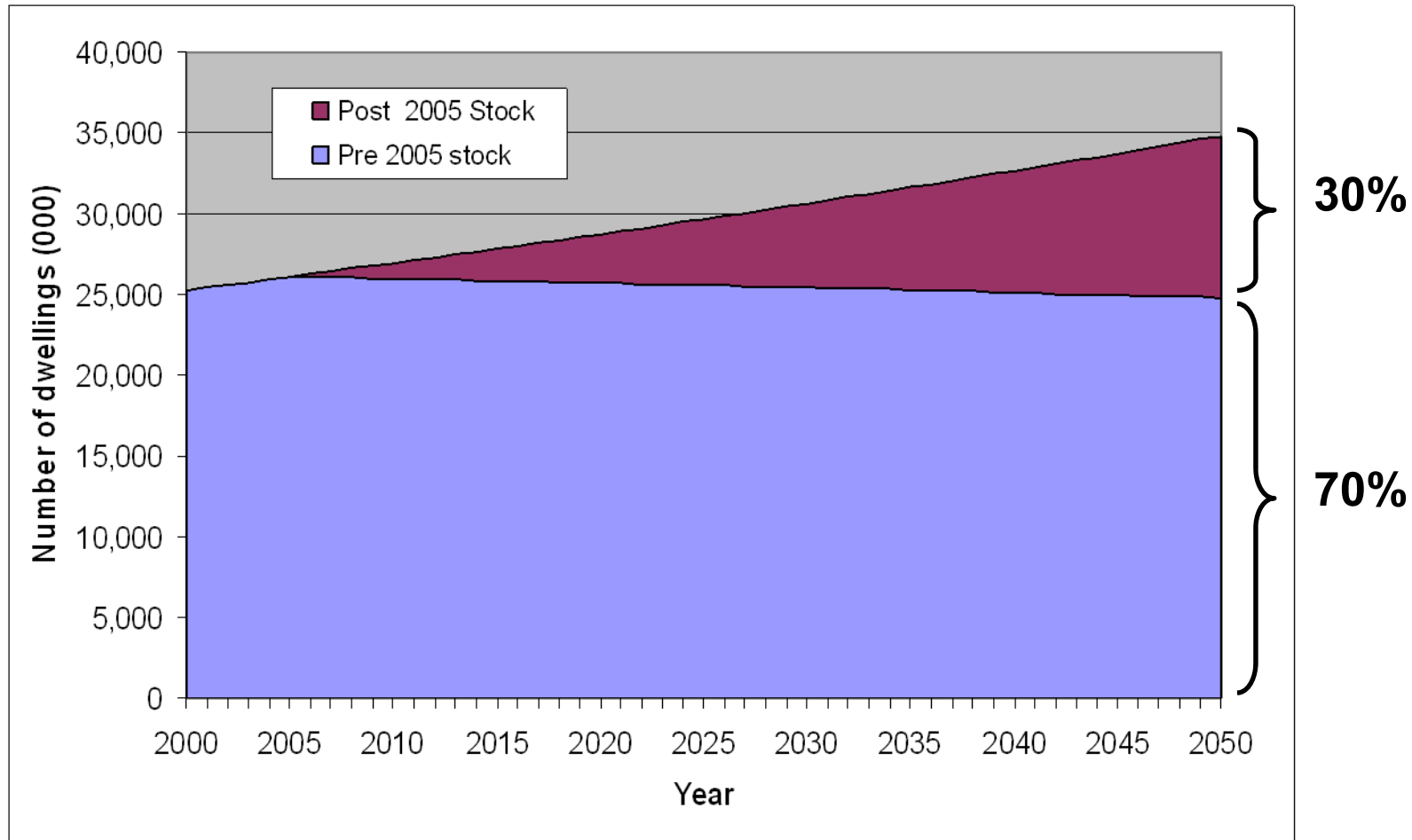
This table provides you with an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs and carbon dioxide emissions are calculated based on a SAP assessment of the actual energy use that would be needed to deliver the current level of comfort in this home, using typical occupancy assumptions, which are described on page 4. The energy use includes the energy used in producing and delivering the fuels to the home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection costs. The costs have been provided for guidance only as it is unlikely they will match actual costs for any particular household.

|                          | Current                         | Potential                       |
|--------------------------|---------------------------------|---------------------------------|
| Energy use               | xxx kWh/m <sup>2</sup> per year | xxx kWh/m <sup>2</sup> per year |
| Carbon dioxide emissions | xx tonnes per year              | xx tonnes per year              |
| Lighting                 | £xxx per year                   | £xx per year                    |
| Heating                  | £xxx per year                   | £xxx per year                   |
| Hot water                | £xxx per year                   | £xxx per year                   |

To see how this home's performance ratings can be improved please go to page 2



# Importance of Existing Stock



Source: Housing Statistics – ODPM 2004



- Important to cut carbon footprint from new build but most buildings in 2050 will still be existing ones i.e. pre 2010 standards
- General strengthening of replacement standards
- Building Services Compliance Guides set minimum standards for new and replacement services in existing buildings
- Capture more work – e.g. swimming pool basins inside buildings U-value of 0.25 W/m<sup>2</sup>.K as calculated according to BS EN ISO 13370
- Extensions continue to use elemental approach but can trade-off or use SAP/SBEM for greater flexibility
- Additional “trigger” for consequential improvements for buildings over 1000m<sup>2</sup> including of increase in habitable / conditioned area or controlled services
- Regulation 9 amended to clarify when an extension is a conservatory or porch that is not exempt from the energy efficiency requirements and amended guidance is given
- More focused guidance for thermal elements.



- Changes to come into effect from 1 October 2010 except for:
  - Work already (physically) commenced
  - Where no notification and contract in place before 1 October 2010 so long as work commenced by 1 April 2011 (competent person schemes, Schedule 2B)
  - Building notice, full plans, initial notice or plans certificate given to a local authority before 1 October 2010 and carried out in accordance with the plans or notice given, so long as work commenced by 1 October 2011

cSBEM (consultation simplified building energy model) Released June 2009.

Draft software with limited functions.

SBEM v 4.1a released on 15<sup>th</sup> November 2010.

Use from October 2010

[www.2010ncm.bre.co.uk](http://www.2010ncm.bre.co.uk)

- **Mountjoy Special School**
- 1940m<sup>2</sup>, hall, hydro pool specialist class rooms and areas.
- Very Good insulation levels, :-
- Walls 0.1, Roof 0.1, Floor 0.15  
Windows 1.6
- Lighting control
- Condensing gas fired boiler.
- 140m<sup>2</sup> of PV
- cSBEM v1.0
- Notional 62.65 TER 31.46
- BER 30.87



## Mountjoy cSBEM v1.0 results

| System                                      | Notional<br>KgCO2/m2/yr | TER   | BER   | %Reduction<br>Assume 2006<br>as 24% | Additional<br>%<br>reduction |      |
|---|-------------------------|-------|-------|-------------------------------------|------------------------------|------|
| Gas Fired Boilers                           | 62.65                   | 31.46 | 37.29 | 47.61                               | 33%                          | Fail |
| Biomass Boiler                              | 62.65                   | 34.96 | 36.7  | 47.61                               | 28%                          | Fail |
|   |                         |       |       |                                     |                              |      |
| Gas Fired Boilers<br>+140m <sup>2</sup> PVs | 62.65                   | 31.46 | 30.57 | 47.61                               | 33%                          | Pass |
| Biomass Boiler<br>+60m <sup>2</sup> PVs     | 62.65                   | 34.96 | 34.15 | 47.61                               | 28%                          | Pass |

## Swanage Children's Centre

140m<sup>2</sup>, Two main crèche areas plus ancillary areas.

Highly Insulated, Walls 0.1/0.13, Roof 0.13, Floor 0.12 Windows 1.2

Lighting control

Condensing gas fired boiler.

SBEM 3.4a

Notional 33.91 TER 25.88 BER 19.12

EPC 25 A rated.



| Calc Version  | System              | Notional | TER   | BER   | %Reduction<br>Assume 2006 as<br>24% | Additional<br>% reduction |                           |
|---------------|---------------------|----------|-------|-------|-------------------------------------|---------------------------|---------------------------|
| SBEM<br>3.4a  | Gas fired<br>boiler | 33.91    | 25.88 | 19.12 | 25.88                               | 0                         | Pass<br>EPC 25<br>A rated |
| cSBEM<br>v1.0 | Gas fired<br>boiler | 45.98    | 27.58 | 28.07 | 35.70                               | 25                        | Fail                      |
| SBEM<br>v4.0  | Gas fired<br>boiler | 20.58    | 20.58 | 19.93 | 25.88                               | 20                        | Pass<br>EPC 24<br>A rated |



## Puddletown First School

1023m<sup>2</sup>, Two form entry 150 pupils.

Good insulation levels, :-

Walls 0.17, Roof 0.13, Floor 0.15 Windows 1.7

Lighting control

Condensing gas fired boiler.

SBEM 3.4a

Notional 22.8 TER 17.3

BER 11.4



Ratings - Puddletown Replacement School Feasibility Study -

General Project Database Geometry Building Services Ratings Building Navigation

Building Regulation check

England and Wales Building Regulations Part L

Building Rating Calculation Logs Calculation Errors

|          | Heating | Cooling | Auxiliary | Lighting | Hot Water | Total |           |
|----------|---------|---------|-----------|----------|-----------|-------|-----------|
| Actual   | 21.82   | 0       | 2.04      | 7.9      | 15.13     | 46.88 | kWh/m2/yr |
| Notional | 57.51   | 0       | 1.32      | 21.2     | 11.09     | 91.11 | kWh/m2/yr |

**1. CO2 emissions mandatory requirement**

BER  kgCO2/m2/yr

Notional  kgCO2/m2/yr

IF  LZC

TER  kgCO2/m2/yr

Pass CO2 **YES**

**2. Additional checks required by approved documents:**

[View Approved Document Checks](#)

Calculation progress: HVAC type 1 - Zone 16 of 16

Click to check object assignments, there are NO CRITICAL un-assignments in

Ratings - Puddletown Replacement School Feasibility Study -

General Project Database Geometry Building Services Ratings Building Navigation

Building Regulation check

England and Wales Building Regulations Part L 2010

Building Rating Calculation Logs Calculation Errors

|          | Heating | Cooling | Auxiliary | Lighting | Hot Water | Total |           |
|----------|---------|---------|-----------|----------|-----------|-------|-----------|
| Actual   | 20.32   | 0       | 4.44      | 18.95    | 9.6       | 53.31 | kWh/m2/yr |
| Not 2002 | 54.89   | 0       | 2.38      | 37.68    | 12.15     | 107.1 | kWh/m2/yr |
| Not 2010 | 20.37   | 0       | 2.24      | 17.84    | 6.21      | 46.66 | kWh/m2/yr |

**1. CO2 emissions mandatory requirement**

BER  kgCO2/m2/yr

**FLAT (Not 2002) AGGREGATE (Not 2010)**

Notional   kgCO2/m2/yr

TER   kgCO2/m2/yr

Pass CO2 **YES** **NO**

**2. Additional checks required by approved documents:**

[View Approved Document Checks](#)

Calculation progress: Building Regulation check completed

Click to check object assignments, there are NO CRITICAL un-assignments in the project

Click on text below for...



Ratings - Puddletown Replacement School Feasibility Study -

General | Project Database | Geometry | Building Services | Ratings | Building Navigation

Building Regulation check

England and Wales Building Regulations Part L 2010

Building Rating | Calculation Logs | Calculation Errors

|          | Heating | Cooling | Auxiliary | Lighting | Hot Water | Total |           |
|----------|---------|---------|-----------|----------|-----------|-------|-----------|
| Actual   | 20.32   | 0       | 4.44      | 18.95    | 9.6       | 53.31 | kWh/m2/yr |
| Not 2002 | 54.89   | 0       | 2.38      | 37.68    | 12.15     | 107.1 | kWh/m2/yr |
| Not 2010 | 20.37   | 0       | 2.24      | 17.84    | 6.21      | 46.66 | kWh/m2/yr |

1. CO2 emissions mandatory requirement

BER  kgCO2/m2/yr

FLAT (Not 2002) AGGREGATE (Not 2010)

Notional   kgCO2/m2/yr

TER   kgCO2/m2/yr

Pass CO2

2. Additional checks required by approved documents:  
[View Approved Document Checks](#)  
 Calculation progress: Building Regulation check completed

Click to check object assignments, there are NO CRITICAL un-assig

iSBEM v4.0.a - Ratings - Puddletown Replacement School Feasibility Study -

General | Project Database | Geometry | Building Services | Ratings | Building Navigation | About iSBEM

Building Regulation check

England and Wales Building Regulations Part L 2010

Building Rating | Calculation Logs | Calculation Errors | Supporting Documents

|          | Heating | Cooling | Auxiliary | Lighting | Hot Water | Total |           |
|----------|---------|---------|-----------|----------|-----------|-------|-----------|
| Actual   | 25.77   | 0       | 2.99      | 17.35    | 9.29      | 55.4  | kWh/m2/yr |
| Notional | 41.21   | 0       | 0.88      | 15.18    | 6.2       | 63.47 | kWh/m2/yr |

1. CO2 emissions mandatory requirement

BER  kgCO2/m2/yr

Notional  kgCO2/m2/yr

TER  kgCO2/m2/yr

Pass CO2

2. Additional checks required by approved documents:  
[View Approved Document Checks](#)  
 Calculation progress: Building Regulation check completed

Click to check object assignments, there are NO CRITICAL un-assignments in the project

Click on text below for...

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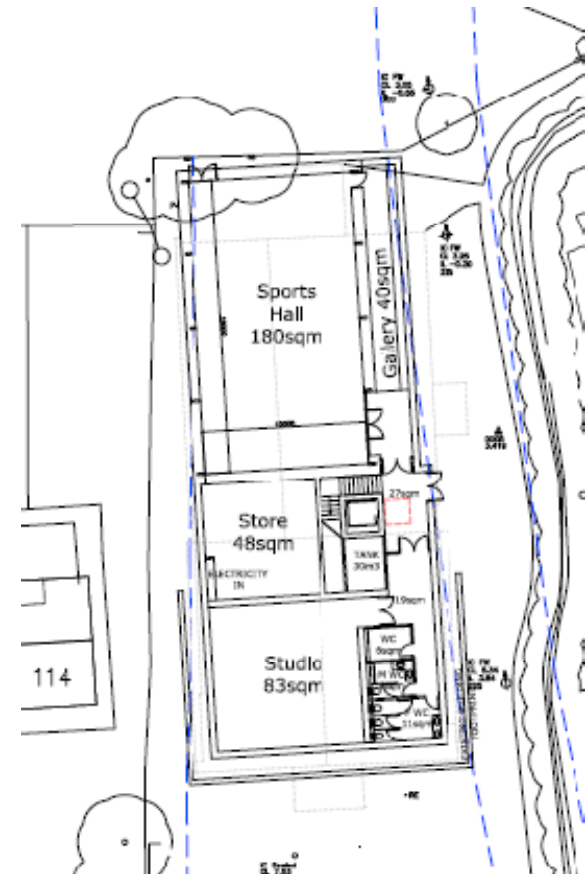
| Version    | System                                    | Notional | TER   | BER   | Additional % reduction |           |
|------------|---|----------|-------|-------|------------------------|-----------|
| SBEM 3.4a  | Gas fired boiler                          | 22.8     | 17.3  | 11.4  | 0                      | 2006 Pass |
| SBEM 3.4a  | Biomass Boiler                            | 22.8     | 17.81 | 5.18  | 0                      | 2006 Pass |
| cSBEM V1.0 | Gas fired boiler                          | 37.49    | 17.34 | 19.32 | 31                     | 2010 Fail |
| cSBEM V1.0 | Biomass Boiler                            | 37.49    | 18.22 | 19.9  | 26                     | 2010 Fail |
| cSBEM V1.0 | Gas fired boiler<br>+40m <sup>2</sup> PVs | 37.49    | 17.34 | 17.32 | 31                     | 2010 Pass |
| cSBEM V1.0 | Biomass Boiler<br>+30m <sup>2</sup> PVs   | 37.49    | 18.22 | 17.9  | 26                     | 2010 Pass |



| Version    | System           | Notional | TER   | BER   | Additional % reduction |           |
|------------|------------------|----------|-------|-------|------------------------|-----------|
| SBEM 3.4a  | Gas fired boiler | 22.8     | 17.3  | 11.4  | 0                      | 2006 Pass |
| cSBEM V1.0 | Gas fired boiler | 37.49    | 17.34 | 19.32 | 31                     | 2010 Fail |
| SBEM V4.0  | Gas fired boiler | ~        | 17.69 | 17.35 |                        | 2010 Pass |
| SBEM 3.4a  | Biomass Boiler   | 22.8     | 17.81 | 5.18  | 0                      | 2006 Pass |
| cSBEM V1.0 | Biomass Boiler   | 37.49    | 18.22 | 19.9  | 26                     | 2010 Fail |
| SBEM V4.0  | Biomass Boiler   | ~        | 9.31  | 11    |                        | 2010 Fail |



- **STEPS Youth Centre**
- 800m<sup>2</sup>, Sports hall, studio, lounge and ancillary areas.
- Good insulation levels, :-
- Walls 0.2, Roof 0.16, Floor 0.15 Windows 1.7
- Lighting control
- Condensing gas fired boiler.
- SBEM 3.4a
- Notional 37.5 TER 28.4
- BER 19.3
- EPC 25 A rated



# STEPS

| Version       | System           | Notional | TER   | BER   | Additional % reduction |              |
|---------------|------------------|----------|-------|-------|------------------------|--------------|
| SBEM<br>3.4a  | Gas fired boiler | 37.57    | 28.4  | 19.3  | 0                      | 2006<br>Pass |
| SBEM<br>3.4a  | Biomass Boiler   | 37.57    | 29.5  | 13.7  | 0                      | 2006<br>Pass |
| cSBEM<br>V1.0 | Gas fired boiler | 51.78    | 25.7  | 28.61 | 31                     | 2010<br>Fail |
| cSBEM<br>V1.0 | Biomass Boiler   | 51.78    | 26.73 | 28.49 | 26                     | 2010<br>Fail |
| SBEM<br>V4.0  | Gas fired boiler |          | 22.9  | 33.47 | 31                     | 2010<br>Fail |
| SBEM<br>V4.0  | Biomass Boiler   |          | 13.55 | 26.22 | 26                     | 2010<br>Fail |



- Early involvement at feasibility stage
- More time to develop energy strategy and Part L compliance.
- Building Regs application will be later than current project time tables.
- Cost implications, future costs, FITS & RHI
- Hand over time table much more critical

