



Energy Efficiency Requirements in the UK Building Codes

By Mark Gorgolewski

The UK government has set out how the UK will attempt to meet its Kyoto target of a 12.5% savings in greenhouse gas emissions by 2010. Their program recognizes the need for higher energy efficiency performance standards for buildings, which are responsible for 46% of UK carbon dioxide emissions.

Following a lengthy review process with much industry involvement, the government has finally published a consultation paper that sets out proposals for changes to Part L of the Building Regulations which deals with energy efficiency. The aim of the proposals is to reduce carbon dioxide emissions from buildings by up to 25%.

The consultation paper contains specific proposals for changes that, if accepted, will be introduced immediately (coming into force in late 2001). Further improvements will be implemented 18 months later. Proposals for possible future changes in 2005 and 2007 are mentioned in the document for discussion purposes.

A significant change is to bring more work on existing buildings within the definition of "building work" in the Regulations. This recognizes the

need to improve the energy efficiency of existing buildings. Thus, in future, changes such as replacing windows and upgrading boilers will have to meet the same requirements as for new buildings. Furthermore, work such as substantial alterations to cladding, will have to meet the new air-tightness and insulation requirements.

For new dwellings the main changes include:

- ☛ Significantly improved R-values, which will require considerably higher levels of insulation. These will be introduced in two stages: the first in late 2001 and the second 18 months later. The table shows the existing and proposed requirements.
- ☛ Higher insulation standards for dwellings with electric or poor efficiency gas and oil heating systems.
- ☛ A whole house "Carbon Index" as an alternative method of demonstrating compliance. This involves a calculation of predicted space and hot water fuel use.
- ☛ Use of effective thermal values.
- ☛ Certification of heating and hot water systems to show that they have been correctly installed and commissioned, and the provision of operating and maintenance instructions for users.
- ☛ A minimum number of energy efficient lights (such as compact fluorescent lamps without integral ballast) in each dwelling, and automatic controls for external lighting.
- ☛ A requirement for increased standards of detail design and site workmanship to improve real building performance and to reduce thermal bridging and improve air-tightness.

At this stage, the proposals do not include mandatory air-tightness testing of dwellings. Until recently in the UK there has been little attention paid to air-tightness, so average air change rates for new houses are about 9 to 10 ach @ 50 Pa. However, the proposals require that air-tightness be considered by the designer and builder, and either "Robust Details" will need to be adopted, or an air-infiltration pressure test carried out. The proposed air-tightness standard (10 m³/m²/hr @ 50 Pa) is not very demanding, but in some cases more attention to detailing and construction practice

Existing and Proposed RSI-value requirements (W/m²K)

Element	Current Regs	Stage 1 (2001)		Stage 2 (2003)	
		Carbon efficient heating*	Other heating	Carbon efficient heating*	Other heating
Walls	0.45 (12.6)	0.35 (16)	0.31 (18.2)	0.30 (18.8)	0.27 (21)
Floors	0.45 (12.6)	0.30 (18.8)	0.27 (21)	0.25 (22.7)	0.22 (25.8)
Pitched roof - insulated ceiling joists	0.25 (22.7)	0.20 (28.5)	0.18 (31.5)	0.16 (35.4)	0.16 (35.4)
Pitched roof - insulated rafters	0.30 (18.8)	0.25 (22.7)	0.22 (25.8)	0.20 (28.5)	0.18 (31.5)
Flat roof	0.35 (16)	0.25 (22.7)	0.22 (25.8)	0.25 (22.7)	0.22 (25.8)
Windows	3.30 (1.7)	2.20 (2.58)	2.00 (2.8)	2.00 (2.8)	1.80 (3.1)

* The 'Carbon efficient heating' figures apply only when efficient gas or oil fired heating systems are to be used. For electric, solid fuel, or inefficient gas and oil heating, the lower U-value requirements in the 'Other heating' columns apply

Bracketed numbers are Imperial R-value equivalents, rounded off

will be needed. It is likely that air-tightness testing will become mandatory for dwellings within 4 to 5 years, and more demanding targets will be set.

The Building Research Establishment is working with representatives from the construction industry to develop a set of "Robust Details" for residential construction that will be published as an advisory document. Use of these details will be seen as satisfying requirements for thermal bridge detailing and air-tightness. Other, non-standard, details will need to demonstrate compliance by calculation and testing.

Similar improvements are proposed for non-residential construction. Additional changes include:

- Mandatory air-tightness testing for all buildings with a floor area more than 1,000 m².
- Performance standards to avoid solar overheating by appropriate window size and placement, and the use of shading devices.
- Improved performance standards for mechanical systems.
- Improved performance standards for lights.
- New performance standards for air-conditioned or mechanically ventilated buildings more than 200 m² in floor area. For offices this will be based on a "Carbon Performance Index". The initial compliance levels will be set at current "typical" performance, and will be aimed at eliminating the worst current practices.
- Requirements for checking the "as built" performance of buildings more than 1,000 m² in area to ensure they match design specifications. This may include surveys with infrared cameras to show thermal bridging, or certification by qualified installers. There are also requirements for remedial action in the event of failure.
- Certification of commissioning procedures for HVAC in line with CIBSE codes of good practice.
- Provision of an operation, service and maintenance log book, which includes information on the maintenance history and how to operate the building.
- Sub-meters to permit measurement of energy use.

Overall, these are considerable improvements over the current requirements. It is likely that these proposals, along with other initiatives, will result in a move away from the ubiquitous masonry cavity wall construction. A variety of alternative construction methods such as timber and steel fram-

ing, structural insulated panels, insulated concrete forms, externally insulated masonry and others may become more attractive.

However, there is still much ambiguity about how the proposals will be implemented. There are a number of issues that are disappointing or still unclear that will make a significant difference in the impact of the final proposals. These include:

- Large tradeoffs are still allowed between envelope elements and the heating system. Thus, low R-values are allowed if these are compensated for by better standards in other elements or by a higher efficiency heating system.
- Low R-values are allowed in return for smaller windows. This will tend to lead to increased electrical use for lighting and reduce passive solar gains. The energy performance of many dwellings could worsen if the glazing ratio is reduced from 25% to 15% and the wall R-value is increased to 12.
- As currently set out, the "combined" U-value calculation method is unclear. It is important that realistic values be used for the proportion of thermal bridging area in an element. The example calculation for a wood-frame wall in the consultation paper assumes that the framing forms only 9.5% of the wall area. This is unrealistic as it does not include the wall plates, cripple studs and un-insulated first floor areas. UK research suggests 15% is more realistic, while the Canadian Model National Energy Code uses 19%.
- The air-tightness standards are not very demanding and represent average air infiltration standards for new UK housing. Thus, in the short term the proposals are unlikely to lead to a serious reappraisal of construction practice to improve air-tightness, which would lead to the inclusion of an unbroken air barrier next to the insulation as is required in Canada. It is likely that, for the time being, many poor practices, such as plasterboard on dabs without any effective air barrier and cold air penetrating to the warm side of the insulation will continue.

The consultation document and other supporting documents are available on the Internet at:

www.construction.detr.gov.uk/consult/eep/index.htm

Mark Gorgoloweski is a registered architect in the UK with extensive experience with energy efficiency in the residential sector.