

CASE STUDY: ENGLAND AND WALES (PART L 2006) ENERGY CODE

1. THE POLICY

Part L (2006) of the England and Wales Building Regulations (Conservation of Fuel and Power) came into effect in April 2006, superseding the 2002 version. Part L (2006) is based on the requirements of the EU "Energy Performance in Buildings Directive" (EPBD) which required member states to introduce a standardized method for assessing the energy efficiency of new buildings, based on modeled energy performance. The regulation includes provisions for energy use in design (through prescriptive requirements and performance based modeling) and in construction (through the use of pressure testing, as a measure of a building's standard of construction). There are, however, no specific requirements pertaining to energy use in operation.

Non-residential Buildings

The 2006 revision marked a departure from previous versions, by mandating that a performance based methodology be used to demonstrate compliance. Mandatory provisions are still retained in the code, to ensure that the building's shell and systems are sufficiently energy efficient. Compliance with the energy component of Part L must be demonstrated by meeting five key criteria, as follows:

1. The calculated CO₂ building emissions rate (BER), as designed, must not be greater than the target emission rate (TER). The target varies between a 23.5% and 28% reduction in annual CO₂ emissions, depending on the servicing strategy of the building. For non-residential buildings the calculations are performed by the SBEM (Simplified Building Energy Model), using free Government designed software. Approved 3rd party simulation packages may be used to assess energy performance in more complex buildings which cannot be effectively modeled using the free SBEM software. Standard thermal templates for the appropriate building and room type must be used in the calculation to normalize the standard for all buildings, and so not to advantage or disadvantage buildings with atypical energy load patterns. Only energy components which can be influenced directly by the design team are included in the CO₂ emissions calculation; process and receptacle loads are excluded.
2. Building shell and systems performance specifications must be within prescribed limits set out within the code, with differing requirements for residential and non-residential buildings.
3. Areas of a building not served by cooling systems must include appropriate passive control measures to limit solar gain.
4. The performance of a building as constructed (based on energy modeling) must be consistent with the predictions made in the 'as designed' BER calculation, prior to the building receiving building control approval. To demonstrate compliance, a BER calculation must be carried out post construction and must include the results of air pressure tests carried out on the completed building, along with any changes to the building made during the construction. *Note, this requirement does not constitute an assessment of a building's energy performance 'in operation'.*
5. Satisfactory information must be provided in operations and maintenance instructions and a building logbook to enable building occupants to achieve energy efficient performance.

For non-residential buildings, large extensions (of greater than 100m² and 25% of the total floor area of the existing building) are treated as new buildings and must meet the requirements for new construction outlined above. All other extensions must meet the prescriptive performance requirements in the code.

For buildings over 1,000m², renovation may require improvements to be made to existing services in areas of the building not otherwise affected by construction, such as upgrading the building shell or installing more efficient HVAC equipment. Increases in the capacity of heating or cooling systems automatically requires that improvements be made to the thermal elements (such as the installation of new windows or insulation), provided the improvements are technically, functionally and economically feasible. There is no cost limit on such improvements, but they should be shown to have a payback period of less than 15 years.

Residential Buildings

New residential buildings must meet the same five criteria for energy efficiency as non-residential buildings. For Criterion 1, calculations must be made to demonstrate that the annual CO₂ emissions of the dwelling (DER) exceed the target emissions rate (TER) using the SAP (Standard Assessment Procedure) 2005 methodology for determining CO₂ emissions. Free government approved SAP software must be used to perform the calculation.

For extensions, conversions or alterations, a prescriptive approach to demonstrate compliance is allowed, whereby limiting values for shell performance and equipment efficiencies outlined in the code must be met.

Post Construction (In Operation) Performance

Part L (2006) does not include any specific provisions for post occupancy assessment related to a building's ongoing energy performance (the requirements of Criterion 4 as outlined above relate only to the modeled energy performance of the constructed building). As part of the Government's requirements under the EPBD, however, mandatory Energy Performance Certificates (EPCs) for all buildings and Display Energy Certificates (DECs) for large public buildings were introduced in 2008.

An EPC must be produced at the completion of each new building or at the point of sale or lease of an existing building. The EPC will be based on the building's Asset Rating, which is the inherent energy performance of the building (i.e. the energy associated with fixed building services, such as heating, cooling, lighting and ventilation but not including process or receptacle loads) as determined by performance based computational modeling for non-residential buildings, or through a prescriptive home inspection survey for residential dwellings. As such the EPC does not reflect the operation or maintenance of the building and its energy systems. The EPC must be produced by an accredited assessor using a standard methodology and software, and is valid for a maximum of 10 years. A Recommendations Report must accompany the EPC, giving the owner and occupiers guidance as to how they might improve the energy performance of the building. There is, however, no mandatory requirement to implement any of the recommendations.

Display Energy Certificates (DECs) apply to large public buildings, defined as buildings with a total useful floor area over 1,000m² and occupied by public authorities or by institutions providing public services to a large number of persons. The DEC must be on prominent public display and is valid for one year. It must include advice on improving the building's energy efficiency, but there is no mandatory requirement to implement the recommendations. The DEC is based on the building's Operational Rating, which is determined from the actual metered energy consumed by the building and includes small power, lighting, heating, cooling, ventilation and all other energy consuming services. The DEC must be produced by an accredited assessor, based on a standard methodology. Although only mandatory for public buildings, commercial organizations may elect to display certificates.

2. ENERGY EFFICIENCY POTENTIAL

2.1. Policy Uptake

Part L (2006) of the England and Wales Building Regulations covers all new construction and extensions, conversions or alterations to buildings in the countries of England and Wales.

2.2. Carbon Savings Potential

A detailed regulatory impact assessment was carried out to assess the cost and benefits of the introduction of the standard. As the regulations mandate reductions in carbon emissions as opposed to energy use, benefits are presented in terms of carbon. By 2010, it is estimated that Part L (2006) will yield carbon savings as follows:

Area of saving	Annual carbon saving
Residential new construction	87,000 metric tons (~320,000 kg CO ₂)
Non-residential new construction	143,000 metric tons (~524,000 kg CO ₂)
Residential extensions	10,000 metric tons (~37,000 kg CO ₂)
Non residential extensions and renovations	256,500 metric tons (~950,000 kg CO ₂)

3. COST OF IMPLEMENTATION

3.1. Program Cost

The code was written in conjunction with two technical consultants; Faber Maunsell was responsible for the research and development, and the Building Research Establishment (BRE) developed the Government's free SBEM software and compliance methodology. Research and development costs were approximately £1.25MM (~\$2.25MM). As the SAP methodology (and Government compliance software) was already required under the 2002 regulations, no additional costs were associated with its use in the 2006 regulations. SBEM was estimated to have cost around £500,000 (~\$900,000) to develop, with ongoing maintenance and development costs of up to

£50,000 (~\$90,000) per year. Approximately £500,000 (~\$900,000) was also budgeted for providing industry education and training.

3.2. Cost to the Developer

Construction Costs

Government forecasts in 2006 predicted marginal increases in new building costs as a result of the new regulations. Housing costs were expected to rise from approximately £600 (~\$1,000 or ~0.4% of new housing costs) for mid terrace houses, to £1,200 (~\$2,200 or ~0.5% of new housing costs) for detached houses and bungalows. This is corroborated in practice by Peter Redgwell of Countryside Properties PLC, who estimates that the 2006 regulations have increased development costs by around £1,000 (~\$1,800 or ~0.4% to ~0.5% of new housing costs) per unit.

For non dwellings, additional construction costs attributed to Part L (2006) were estimated at £28.91/m² (~\$4.80/sf) for commercial and public buildings and £10.32/m² (~\$1.72/sf) for industrial buildings, representing an increase in total construction costs of 1.9% and 1.6% respectively. The increase in costs for renovation projects was estimated at £11.84/m² (~\$1.98/sf) for commercial and public buildings and £8.11/m² (~\$1.35/sf) for industrial buildings.

Training Costs

It was also noted that all sectors of the industry would have to bear training costs associated with becoming familiar with the technical requirements and methods of compliance associated with Part L (2006). A Government estimate of the additional first year training costs to the industry was approximately £9.5MM (~\$17.1MM, or ~about 0.017% of the annual construction industry value). This was expected to significantly reduce beyond after the first year, once the industry was up to speed with the requirements of the regulations, though specific ongoing industry costs are unknown.

Ongoing Industry Compliance Costs

For new dwellings, no additional costs were predicted as energy performance calculations were already required for dwellings in the 2002 version of the regulations.

For non dwellings, additional costs to developers were created through the new, performance based compliance procedures, though these costs vary depending on the size and complexity of buildings. This view was confirmed by Neil Pennell of Land Securities, who believed that these costs were generally accepted by the developer community and were absorbed without impeding development progress. It was additionally noted by Pennell that the benefits of the performance based approach to design outweigh the additional financial burden that the methodology brings. Government estimates suggested that the additional compliance costs to the industry associated with following a performance base compliance path would be around £11MM (~\$19.8MM or ~0.07% of total annual commercial construction costs) per year.

4. ADMINISTRATIVE FEASIBILITY

4.1. Administering Agency

The code was written by CLG in conjunction with two technical consultants, Faber Maunsell and the Building Research Establishment (BRE). Enforcement and compliance assessment of the code is overseen by local jurisdiction building control officers.

4.2. Ease of Initiation

Staff at Faber Maunsell described the implementation process as being “very difficult”; chiefly due to the requirement to follow a performance based route to compliance using carbon emissions as the basis for calculations. Staff at Land Securities believe they and their peer group were generally well prepared for the implementation of the regulations, because of the long lead time prior to implementing the code. According to staff at Countryside Properties, the residential market was less well prepared for the changes to the regulations, particularly the smaller developers who described the process of adapting to the new regulations as a “significant undertaking” due to the requirements for a more scientific process to be followed to achieve compliance.

4.3. Educational Outreach Requirements

A large scale implementation and dissemination program was conducted from July 2005, nine months before the regulations came into effect.

Malcom Hanna of Faber Maunsell, who headed the development of CLG’s training package, noted that key

industry professionals who would be impacted by the regulatory changes were identified and targeted for priority training. Building control officers were one such target, as they would be significantly impacted by changes to the way that compliance is demonstrated (for example having to assess and approve performance calculations).

A significant amount of training was held over the 18 month period surrounding the implementation of the code. At the start of the process, a “Train the Trainers” program was held, with eight CLG workshops conducted for key industry representatives who would be involved in the dissemination of training across the industry. Attendees were provided with CLG approved training material to use in training sessions, thus ensuring that accurate and consistent training sessions were held across the construction sector.

Additional industry wide training included the following:

- Seminars for Building Control Body (BCB) managers and staff.
- Speaking engagements at public events held by professional institutions.
- An e-learning CD on new performance standards and compliance procedures was issued free of charge to all BCB operational staff to enable them to become familiar with the new performance standards and compliance procedures. .
- An email helpdesk system was also set up to provide assistance to those using the new calculation methods.
- Training seminars were held by various construction industry organizations on the impact of the new regulations on their members.

Total industry training costs for the first year preceding policy implementation was estimated to be approximately £10MM (~\$18MM or ~0.017% of the annual construction industry value), of which approximately £500,000 (~\$900,000) was incurred directly by CLG with the remaining absorbed across the industry through corporate training and development budgets.

5. STAKEHOLDER IMPACTS

5.1. Acceptability to the Building Industry

The Government’s Energy White Paper entitled “Our energy future – creating a low carbon economy”, published in 2003, was the first notice that stakeholders received of the upcoming major revision to Part L. Numerous formal and informal industry consultations, comprising of 6 separate working groups, each of 20-40 people, were held over the two year development period to minimize any negative impact of the new regulations. Research was also undertaken by CLG’s technical consultants, Faber Maunsell, to determine performance targets which were in line with the Government’s carbon targets under the Kyoto Protocol, while also being realistically achievable (in terms of both technical requirements and cost) by the industry.

It was recognized that all sectors of the construction industry would be affected by the regulatory changes, from building owners, tenants and facilities managers, to designers, product manufactures, building control bodies and construction firms. Anecdotal evidence indicates that there was some initial concern about the loss of the prescriptive approach, particularly among architects who believed that this gave certainty in the design process. MEP Engineers, however, believed that having a single route to compliance would remove ambiguity. It was noted by staff at Faber Maunsell that now, two years since the introduction of the regulations, the industry would likely resist any moves to introduce simpler prescriptive routes to compliance, because of the benefits to building design (and to the construction industry as a whole) that the performance based approach creates. It was also recognized that some product industries, such as the window and glazing industry, would need time to revise their product designs to accommodate the new performance standards, and that builders would need some time to improve sealing during construction and fit-out. Provisions within the regulations therefore allowed for some relaxation of standards in the first 18 months after implementation.

According to Steve Irving of Faber Maunsell, the requirement to move to a performance based approach was a “culture shock” to the industry, although there was recognition it was the correct path to achieve the Government’s carbon reduction targets. Staff at developer Land Securities believe that the regulations provided a wake up call to the industry to review its practices for designing and constructing buildings. Consensus between developers and those involved in the development of Part L (2006) suggests that it has catalyzed an industry wide shift in design and construction practices and processes that will ease the burden on future revisions. These periodic revisions to the code are expected to require improvements in building performance of 25% at four-year intervals.

6. REFERENCES

Steve Irving, David Ross and Malcolm Hanna, Faber Maunsell (Technical Consultants to CLG)
Peter Redgwell, Countryside Properties (residential)
Neil Pennell, Land Securities (commercial)

7. NOTES

Where British Pounds has been converted into US Dollars, an exchange rate of \$1.8 / £1 has been assumed.