Energy Policy 36 (2008) 4580–4583

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

The impact of EU policies on energy use in and the evolution of the UK built environment ☆

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ARTICLE INFO

Available online 15 October 2008

Keywords:
Energy efficiency
Energy services directive
Energy performance in buildings directive

ABSTRACT

Energy use in buildings is influenced by a variety of factors in complex ways. Historically, in the UK the efficiency of energy use in buildings has not been a major consideration in their design. Now policy concern with climate change is changing this, because buildings have come to be perceived as the locus of energy use with the highest cost-effective energy savings potential. In the UK, the energy efficiency of the building stock is rather low. The paper focuses largely on energy use in the UK's existing building stock and the two main European Union Directives which affect it: the Energy Performance in Buildings Directive and the Energy Services Directive. The Directives are complex, and there are a number of supporting programmes set up by the European Commission to aid their implementation. Even so, they have been implemented in differing ways in different European countries, and implementation remains patchy. The Directives have the potential to be a major influence on the evolution of the UK's built environment, but their effect will depend on the details of the Directives' implementation and enforcement, many of which are not yet clear.

1. Introduction

A building is much more than a 'thermal envelope' that transmits or conserves energy, or a locus for indoor energy consumption. The built environment, and the buildings which comprise it, are a fundamental part of a country's culture and heritage. They are likely to have evolved over centuries in response to local climate, topography, materials, history, security concerns and a host of other factors. These factors are likely to continue to be important influences on how they evolve in the future, and new factors may also come into play.

One new factor is the strengthening global impulse to reduce greenhouse gas emissions (GHGs) in order to mitigate future climate change. The most important GHG is carbon dioxide (CO_2), and most CO_2 is emitted by energy use, from the burning of fossil fuels. Buildings are responsible for about 40% of EU energy demand, and it is estimated that currently available energy-efficiency measures could cost-effectively save around 28% of this. EU policy has therefore identified increased energy efficiency for buildings as a key objective of EU energy and climate policy (CEC, 2006). Two key Directives and some supporting documents have been produced in order to achieve it. This policy could have a significant influence on the built environment, and buildings, in the UK, and this paper will describe it in some detail. But it should always be remembered that many other factors will influence how the built environment will evolve. Note too that different EU Member States will implement the policy in different ways, according to local priorities and perceptions. Its influence in other countries may be different from that in the UK.

Beyond the EU, the most important international influence on the UK built environment is undoubtedly the UN Framework Convention on Climate Change (UNFCCC) and the various measures that have been, and will be, adopted under it. However, the main effect of this global agreement will be to influence how the European regulatory environment in respect of climate change develops, which in turn will be the main direct influence on the UK built environment. Indeed, it is likely that the UNFCCC was a major influence in the development of the two European Directives discussed in some detail below. The rest of this brief paper therefore focuses exclusively on the European influence on the UK built environment.

2. The built environment as a system

The built environment consists of buildings, and of a network of interlocking infrastructures for energy supply (and sometimes generation), water and sewerage, telecommunications, transport,

☆ While the Government Office for Science commissioned this review, the views are those of the author(s), are independent of Government, and do not constitute Government policy.

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doi:10.1016/j.enpol.2008.09.006

and waste management. Green infrastructure plays a key role in several of these functions and provides opportunities for recreation, amenity and exercise (RCEP, 2007). Urban design is the process of seeking to deliver these buildings and infrastructures in ways that cost-effectively meet human needs and wants. Because these needs and wants differ between individuals and groups, urban design is inevitably a politically mediated process. In the UK an important role in this process is played by the planning system.

Historically, energy and considerations of climate change have not played an important role in UK urban design, in the provision of the various infrastructures of the built environment, or in the design or construction of buildings. The result is that most UK built environments, most notably the buildings and transport systems that provide the dominant focus of this paper, are considerable consumers of energy.

A clear distinction needs to be drawn between new and old built environments. Changing existing buildings and transport systems is more difficult, and tends to cost more, than designing new built environments with the desired functionality. However, the durability of mind-sets, aspirations and institutions is illustrated by the fact that the great majority of new built environments have buildings that consume more energy, and facilitate or require a greater level of car-dependence, than is consistent with current climate change concerns.

3. Transport in the built environment

The issue of urban transport is one of great public resonance, complexity and controversy. Since the Treaty of Rome (1958), European transport policy has focused on free movement of persons and goods. Its prime objectives are the completion of the internal market for transport, ensuring good air quality, the deployment of major networks in Europe, spatial management, improved safety and the development of international cooperation.

This European focus has largely been outside the scope of this paper. But how urban transport systems evolve has enormous relevance to whether built environments become low-energy and low-carbon environments. Because the top-level European energy and climate targets do not distinguish between particular sources of carbon or uses of energy, it is always possible that EU regulation will be introduced to help meet the targets. This paper will not speculate as to how this might come about, or what the regulations might be. However, it may be noted that just as building regulations now refer to or specify 'zero-carbon' or 'carbon-free' buildings, so it is perfectly possible to envisage 'carbon-free transport zones', the mobility needs of which are entirely provided for by zero-emission vehicles and facilities for walking or cycling, combined perhaps with nearby local access for a wide range of services. There are currently no European regulations specifically seeking to achieve such outcomes. Their possibility in the future will be referred to in the final section of this paper.

4. Buildings in the built environment

Buildings are the aspect of the built environment for which most EU regulation has been adopted, and which are the main focus of this paper. There are two main EU regulatory instruments in this area: the Energy Performance of Buildings Directive (EPBD), and the Energy End-Use Efficiency and Energy Services Directive (ESD). The second of these, as its name suggests, goes well beyond buildings, but is very relevant to them. These Directives will be briefly reviewed in turn.

4.1. The EPBD (European Parliament and Council 2003)

The EPBD was adopted in December 2002 and is the main legislative instrument affecting energy use and efficiency in the buildings sector in the EU. It explicitly seeks to tap the potential for energy savings in the buildings sector, which is the sector with the highest cost-effective energy savings potential. However, it is a complex Directive to implement. Buildings are very different across Europe, which makes it difficult to have a common approach at EU level. Multiple difficulties were encountered during the preliminary phase, between 2003 and 2006, of transposing this legislation into national law, and they continue to affect implementation. Two years after the deadline for the transposition (January 2006), most Member States have transposed the Directive into national law, but its practical implementation is not necessarily ensured. In most Member States, complementary legislation is still being developed or in the course of being approved.

The Directive is designed to promote the energy performance of buildings through the introduction of a framework for an integrated methodology for measuring energy performance; the application of minimum energy performance standards in new buildings and certain renovated buildings, and regular updating of these; energy certification for and advice on new and existing buildings; and the inspection and assessment of boilers and heating and cooling systems. The requirements of the Directive ensure that all buildings are potentially subject to at least one requirement in the EPBD. Its biggest potential impact is its requirement for new and existing buildings to have an Energy Performance Certificate when sold or rented, and for existing buildings over a certain size to upgrade their energy performance when being renovated.

However, there are many different kinds of buildings and their energy performance is affected by many different factors. It is necessary to consider the detail of EPBD to appreciate that its potential impact is complex.

4.1.1. Buildings covered by the EPBD

All new buildings have to meet minimum energy performance requirements. For those with a floor area greater than 1000 m^2, alternative systems of heating and energy generation must be considered at the design stage. All new buildings are required to introduce Energy Performance Certificates. In addition, for existing buildings with a floor area greater than 1000 m^2 and undergoing a major renovation, the building's energy performance needs to be updated when technically, economically and functionally feasible. All such buildings are required to introduce Energy Performance Certificates when the whole building or apartments or units are sold or rented.

4.1.2. The key legal requirements

Member States are required by Article 3 of the Directive to adopt a methodology at either the national or regional level to calculate the energy performance of buildings on the basis of a general framework outlined in the annex of the Directive. The energy performance is to be expressed by the amount of energy, estimated or actually used, to satisfy the needs of the building. For new buildings and major renovations in some Member States this involves changing the methodology for building regulations from one based solely on requirements for elements of a building to a more holistic approach.

Article 4 requires Member States to set minimum energy performance requirements for buildings, with the possibility of differentiating between new and existing buildings and between different building types. The requirements have to be reviewed at

regular intervals, not exceeding five years, 'to reflect technical progress'. Articles 5 and 6 set out the necessary measures to be taken in new and existing buildings, respectively, to ensure that minimum energy performance requirements are met. The listed measures apply to all new buildings. Requirements for upgrading energy performance apply to existing buildings of over 1000 m^2 and can be set for either the entire renovated building or for renovated systems or components. New building developments over 1000 m^2 are required to consider the technical, environmental and economic feasibility of decentralised energy supply systems based on renewables, combined heat and power (CHP), district heating or cooling and heat pumps.

Article 7 provides that whenever a building is constructed, sold or rented out, a certificate detailing its energy performance must be made available to a prospective owner or tenant. The certificates have a maximum validity of 10 years. They must refer to energy performance standards such as current building regulations, or to benchmark comparisons with similar types of building. Perhaps more crucially, the Energy Performance Certificate must include recommendations on cost-effective measures that could improve the building's energy performance. For buildings with a floor area greater than 1000 m^2, where public services are provided and which are visited by a large number of persons, the Energy Performance Certificate is to be displayed in a location which is both accessible and visible to the public. There has been some debate, which is not totally resolved, on the definition of institutions providing public services to a large number of persons, and whether this includes private buildings.

Air-conditioning systems above a certain size must be regularly inspected (Article 9). Boilers must either be regularly inspected, or advice be provided to users that will enable the boilers to be properly maintained (Article 8). Certification and inspection activities related to the Directive must be undertaken in an independent manner by qualified or accredited experts (Article 10). In addition to the legal requirements placed on Member States, the Directive places duties on the European Commission (Article 11), including the evaluation of the Directive in the light of experience.

4.2. The ESD (European Parliament and Council 2006)

The purpose of this Directive is to encourage energy efficiency through the development of a market for energy services and the delivery of energy-efficiency programmes and measures to end-users. The Directive covers most forms of energy sold to end-users, including transport fuels. The Directive has a number of different elements intended to increase energy efficiency:

Energy targets: Member States must plan to achieve a minimum annual energy savings target of 9% by the ninth year in the period from 2008 to 2016. Each national government has to produce separate energy-efficiency action plans (EEAPs) by 2007, 2011 and 2014. The energy savings targets are indicative and not legally binding.

The exemplary role of the public sector: Member States' public sector bodies and agencies are obliged to take an exemplary role in improving energy efficiency. Examples of good practice might include using cost-effective energy-efficiency measures across their own building stock, transport fleets and equipment, or publishing investment and purchasing guidelines on energy efficiency and energy savings in public sector contracting.

Involving energy companies and expanding energy services: Member States are required to place energy-efficiency obligations on energy distributors or retailers. There are a number of options which they can utilise, ranging from involving the energy distributors or the retail sales companies in energy-efficiency activities, through to letting distributors and suppliers contribute part of their revenues to funds for energy efficiency. These obligations, while placed on energy companies, do not necessarily require activities on their part. The actions may be carried out by other market actors such as independent Energy Service Companies (ESCOs).

Energy performance contracting and third-party financing: The Directive also encourages the use of instruments such as energy performance contracting and third-party financing, and requires Member States to remove any existing regulations that restrict or impede such contracts.

Energy audits, *funds and metering*: The Directive also addresses:

- *Energy audits*: Member States are required to ensure the availability of independent and high quality energy auditing.
- *Energy-efficiency funds*: The Directive encourages Member States to establish energy-efficiency funds to promote energy auditing and financial instruments for energy savings, especially in sectors with higher transaction costs and higher risks.
- *Metering*: The Directive requires member states to ensure that meters and systems measure customers' actual energy consumption both accurately and frequently and that billing is informative, sufficiently frequent and based on actual energy consumption.

Measurement and verification of energy savings: A significant part of the Directive is concerned with the measurement, monitoring and verification of end-use energy savings.

The Directive allows Member States to choose from a range of policy tools the ones which they feel would most help them to meet their energy saving target. In view of the buildings sector's significant and cost-effective energy saving potential, this is of particular importance. The ESD means that all countries must ensure that quality energy audits are available to inform building owners of energy saving opportunities. Mechanisms such as loan funds and subsidies for individual homeowners used to finance energy saving investment by building owners need to satisfy the usual requirements of EU law, for example in respect of competition.

4.3. Implementation and impact of European regulations

EU Member States may be expected to implement European regulations on buildings and the built environment in very different ways. Implementation may be difficult and patchy. This was recognised by the European Commission itself, which set up a range of programmes to help Member States with implementation issues and to share experiences. They include a Concerted Action addressing specific issues, the EPBD Buildings Platform and SAVE demonstration projects, all introduced as part of the Commission's 'Intelligent Energy-Europe' programme. But despite these difficulties, a European survey of national experts in October 2007 found that around 90% of the respondents expected the EPBD to contribute to national climate change objectives and the modernisation of the housing stock (ENR, 2008). A study modelling the housing stock in the EU-15 and the likely impact of the EPBD found that it might be expected to reduce CO_2 emissions by 34 million tonnes per year, and that this could be doubled if the EPBD was extended to cover the whole housing stock (Petersdorff et al., 2006).

However, there is always some doubt as to whether energy and carbon savings modelled in advance will actually be achieved. For example, one of the major elements of the EPBD is the requirement for certain buildings to have an Energy Performance

Certificate. Gram-Hanssen et al. (2007) explored the extent to which such a certificate might lead to the actual implementation of identified energy saving measures, by interviewing 10 householders in Denmark, where the energy labelling of buildings had been compulsory for 10 years, and 10 in Belgium, where energy labelling was not yet mandatory. They found that many factors influenced whether a householder would actually implement improvements in energy efficiency identified as part of the labelling process, and that a combination of favourable factors, unique for each household, was required for them to do so. The end result was that most recommendations for improvements were not implemented. In an earlier piece of work, Bartiaux et al. (2006) had found that only 11% of recommended measures had been implemented in 40 surveyed households in Belgium a year after they had been surveyed, even though the households had requested the survey.

In the UK it is clear that the letter of the EPBD and ESD will be observed in law, but it is very unclear how effective the various provisions that the UK Government has put in place in response to the Directives will be (see, for example, Lowe and Oreszczyn, 2008). With regard to smart meters, the 2007 Energy White Paper (DTI, 2007) expressed the expectation that all UK homes will have smart meters within a decade, but, while metering trials continue, nothing has yet been done to implement this expectation.

In conclusion, European regulation in respect of buildings plays an important role in ensuring that all Member States at least address certain issues, within a certain conceptual policy framework and over a specified period. It also provides a forum for the exchange of policy experiences, successes and failures. However, the transposition of the EPBD into national legislation has been much slower than anticipated. Despite this the Commission will seek during 2008 to strengthen the existing EPBD. There may be proposals to make energy performance requirements on new buildings more stringent, to lower the area threshold (currently 1000 m^2) when major renovations must also address the energy efficiency of the existing building, and possibly a requirement for Member States to introduce inspection regimes for new buildings and major refurbishments so that they comply with national building regulations.

Although in early 2008 the UK still had not transposed all aspects of the EPBD into law, the pace of compliance was accelerating, and the Department of Communities and Local Government (CLG) is now of the view that transposition into law is complete (Personal Communication CLG to Foresight, July/August, 2008). Whether this will significantly affect the UK built environment depends on how purposefully the regulation is implemented, and what arrangements are made for monitoring and enforcement, to ensure compliance. As Lowe and Oreszczyn (2008) make clear, current UK regulatory practice in these respects leaves much to be desired. Without improvements in these areas, it is very doubtful that buildings will deliver the large carbon emission reductions that are necessary if the ambitious overall emissions reduction targets now being put into statute through the Climate Change Bill are to be achieved.

5. The European influence on the evolution of the UK built environment

Buildings are the only area of the UK built environment now affected by European regulation. These regulations refer to their energy performance and are unlikely to have a major impact on the look of the UK built environment. There could be much more noticeable impacts on the way the UK built environment evolves if European regulations start targeting either urban transport or the low-carbon energy supply potential of the built environment, for example by encouraging urban wind turbines, photovoltaic cells, solar thermal panels on buildings or other microgeneration technologies.

In respect of transport, a number of European cities are experimenting with various ways of reducing congestion and CO_2 emissions from traffic, or of improving air quality. Two examples are the London congestion charge and the mayor's bicycle experiment in Paris.[1] Were the European Commission to seek to generalise such experiments across Europe, they could be expected to have a radical impact on the evolution of the UK's urban environments.

The EPBD requires microgeneration options to be considered for new buildings, but there is no suggestion that they are mandatory. But the EU now has ambitious targets for renewable energy and energy efficiency. Microgeneration may become a requirement at least for new buildings in order to make a contribution towards meeting these ambitions.

Any Directives in respect of transport or microgeneration would take a number of years to prepare and negotiate, even if they were to be considered desirable by the European Commission. For the moment the main impact on the UK built environment from European regulation seems likely to be through the implementation of the EPBD, supplemented by the ESD. Delayed implementation and uncertainties about enforcement mean that their effectiveness in reducing energy use and carbon emissions for the UK building stock remains an open question.

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[1] Both these policies are too recent to have yet penetrated the academic literature, but have been the result of considerable journalistic comment, the best overview of which in respect of the London congestion charge is the Wikipedia entry (http://en.wikipedia.org/wiki/London_congestion_charge#Business) (consulted 10 April 2008), while Bennhold (2007) gives a flavour of the Paris bicycle initiative.