The current issue and full text archive of this journal is available at
www.emeraldinsight.com/1756-1450.htm

A comparative analysis of implementation of the Energy Performance of Buildings Directive in the Mediterranean

Alan Abela, Mike Hoxley and Paddy McGrath
Nottingham Trent University, Nottingham, UK, and
Steve Goodhew
Nottingham Trent University, Nottingham, UK and
University of Plymouth, Plymouth, UK

Abstract

Purpose – The Energy Performance of Buildings Directive (EPBD) 2002/91/EC introduced various obligatory requirements intended to achieve the reduction of use of energy resources in buildings. This directive had to be transposed into national legislation by the EU member states. Concurrently the European Committee for Standardisation developed a number of technical standards to assist member states to define the methodology for the calculation of the energy performance of buildings. The purpose of this paper is to present a comparative review of the relationship between the European directive and the standards, and the different country legislation and methodologies that have been implemented in Malta, Italy, Spain and Cyprus.

Design/methodology/approach – The analysis is based on a review of national legislation in the four states. Reference is also made to publications by the Concerted Action for the EPBD and to related publications by the national bodies responsible for the implementation of the EPBD. These include the Ministry for Economic Development in Italy, the Ministry of Commerce, Industry and Tourism in Cyprus, the Ministry for Resources and Rural Affairs in Malta, and the Ministries of Industry Tourism and Commerce and of Housing in Spain.

Findings – This paper analyses and compares the implementation of the directive using the above-mentioned sources. In so doing, it focuses on general principles rather than on the specific technical requirements for the calculation method in the various states. The paper then considers the implementation of these general principles within each state before finally drawing conclusions about whether legislation relating to the original Directive 2002/91/EC is meeting its objectives and the implications relating to the requirements of the recast Directive 2010/31/EC.

Research limitations/implications – The introduction of the directive in the states considered has taken place slowly and gradually over the last three to four years. There are few publications relating to the actual implementation of the directive, and this limits the possibility of comparison of sources.

Originality/value – The relationship between the EPBD and the milder climate experienced in the Mediterranean is considered to be of great importance, particularly since world temperatures are slowly rising. However, it is acknowledged that insufficient research has been carried out on the energy performance of buildings in this region. This paper investigates the existing legal structures that have been put into place to implement the EPBD and the effectiveness of this implementation to date.

Keywords Housing, Mediterranean, Energy certificates, EPBD

Paper type Research paper

International Journal of Law in the Built Environment
Vol. 5 No. 3, 2013
pp. 222-240

1756-1450
DOI 10.1108/IJLBE-11-2012-0025

1. Introduction

The European Energy Performance of Buildings Directive (EPBD) 2002/91/EC introduced various obligatory requirements intended to achieve a reduction in the use of energy resources in buildings and, consequently, the reduction of the environmental impact of energy use in buildings. Article 7 of the directive formally specified the current European requirement for the energy certification of buildings. In order to implement this requirement, a general framework for establishing a methodology of calculation of the total energy performance of buildings became necessary. A total of 30 European (EN) standards and 24 international (EN ISO) standards were drafted in order to define the necessary procedures to be introduced following the ratification of the EPBD. The European Committee for Standardisation (CEN) standards to support the EPBD were successively published in the years 2007 and 2008. Their role was to provide a common European concept and common methods for energy performance certification (Van Dijk, 2009). In 2010, a recast of the EPBD 2010/31/EC was adopted by the European Parliament and the Council of the European Union in order to strengthen the energy performance requirements and to clarify and streamline some of the provisions from the 2002 Directive.

From the outset a number of EU member states found difficulty in the transposition of the EPBD and some are still struggling with practical implementation issues (Dascalaki *et al.*, 2012). The transition from the methodologies presented in the standards to the calculation procedures developed by the member states has resulted in large differences in the final energy performance of buildings calculation procedures across countries (Van Dijk, 2010).

Apart from the technical and legislative difficulties in the transposition and implementation of the EPBD, compliance and control are essential for the successful operation of the directive. Three factors have been identified which impact on the effectiveness of a successful compliance and control strategy (Poel and van den Brink, 2009), namely:

(1) The existing legal and regulatory system in the member state. In states where the legal responsibility is delegated to regions, the federal legal structure should facilitate implementation for the regions. In such states centralised implementation is unlikely and diversity in compliance and control instruments can occur.

(2) Cultural aspects related to the interaction between the citizen and the state. In some countries strict enforcement is the common approach, while in other countries control schemes may be based on self-regulation.

(3) The political and economic policy of the government. The current national objectives might not necessarily coincide with the objectives of the EPBD.

A study of building legislation carried out by the International Energy Agency (Laustsen, 2008) identified substantial differences in how prescriptive requirements are implemented in the Northern and Southern parts of Europe. In the north of Europe the requirements are quite strict, while in the south these requirements are more varied, and generally less demanding than for similar climates in, for example, the USA.

Technical requirements for the reduction of energy consumption in the Mediterranean region are generally acknowledged to be more complex due to the existence of an air-conditioning load as well as a heating load (Asdrubali *et al.*, 2008).

Most of the energy certification methodologies proposed and implemented in other central and Northern European states are only suited for the winter season. Researchers have found that even the simplified methods described within the EN ISO 13790 (2008) Standard seem to produce results that are in better agreement when they are used for heating energy use calculations rather than cooling energy use calculations (Kokogiannakis *et al.*, 2007). Southern European countries have reported that they have no form of labelling or market infrastructure for low energy buildings or passive houses (Mlecnik *et al.*, 2010).

This research examines the implementation of the directive in four Mediterranean states, Italy, Malta, Cyprus, and Spain. Malta and Cyprus are the two southernmost EU states and Cyprus is also located in the east Mediterranean. Spain and Italy were selected as their Southern regions also form part of the southernmost borders of the EU, and Spain is located in the west Mediterranean. Malta and Cyprus are two of the smallest EU states whilst Italy and Spain are the fourth and fifth largest EU states by population. The four states were selected to be representative of the Southern borders of the EU. Although a general overview is taken, the focus of this work is on the state of implementation of the section of the directive relating to the energy certification of residential property. The rationale for focussing on residential property is that energy consumption in the residential sector shows the greatest variance between north and south Europe, whereas the performance and typology of buildings in the commercial sector is considerably more uniform across the building stock (Perez-Lombard *et al.*, 2010). The residential sector is also the largest component of the building stock, with residential floor space accounting for 75 percent of Europe's buildings (BPIE, 2011).

The primary purpose of this research is to identify the salient features of the state of implementation of the EPBD in the four selected states. However, the paper also explores the potential impact of difficulties in implementation on the acceptance of energy performance certificates (EPCs) in the residential sector. These more general issues are of particular relevance to energy certification in a Mediterranean climate.

The analysis is based on a review of national legislation in the four states. Reference is also made to publications by the Concerted Action EPBD and to related publications by the national bodies responsible for the implementation of the EPBD. These include the Ministry for Economic Development in Italy, the Ministry of Commerce, Industry and Tourism in Cyprus, the Ministry for Resources and Rural Affairs (MRRA) in Malta, and the Ministries of Industry Tourism and Commerce and of Housing in Spain. Where available, the published opinion of national professional associations has also been consulted.

This paper analyses and compares the implementation of the directive using the above-mentioned sources. In so doing, it focuses on general principles rather than on the specific technical requirements for the calculation method in the various states. The paper then considers the implementation of these general principles within each state before finally drawing conclusions about whether legislation relating to the original Directive 2002/91/EC is meeting its objectives and the implications relating to the requirements of the recast Directive 2010/31/EC.

2. The directives

The original EPBD 2002/91/EC specified four key requirements, namely:

(1) the general framework for a methodology of calculation of the integrated energy performance of buildings;

(2) the application of minimum requirements on the energy performance of new buildings and large existing buildings that are subject to major renovation;

(3) energy certification of buildings; and

(4) regular inspection of boilers and of air-conditioning systems in buildings.

The EPBD concerned both the residential and the tertiary sector (commercial buildings, public buildings, etc.). The intention was to cover all aspects of energy efficiency in building for an integrated approach, taking account of aspects such as the building envelope, heating and cooling installations, lighting installations, and the position and orientation of the building. EPCs became mandatory whenever buildings were constructed, sold or rented out.

The main effects on the residential sector were the application of the minimum requirements to new construction in this sector, and the requirement for energy certificates on the sale or renting out of property. The requirement for certificates with energy classes brought about the widespread introduction of energy labelling to the residential property market. The impact and/or effectiveness of the requirement for regular inspection of boilers and air-conditioning system is less clearly understood and not particularly well documented.

A key driver for implementing energy efficiency measures are building standards, through which energy-related requirements are incorporated during the design or retrofit phase of a building. Whilst a few individual Member States already had some form of minimum requirements for thermal performance of building envelopes, the EPBD was the first major attempt requiring all Member States to introduce a general framework for setting building energy requirements based on a "whole building" approach.

The recast EPBD 2010/31/EC introduced more stringent requirements for the energy performance of buildings with a new emphasis on the cost optimisation of energy-related regulations. The minimum requirements introduced in the original Directive now have to be shown to be cost optimal. There is a requirement that all new buildings must be "nearly zero-energy" by 2020. According to the directive, a "nearly zero-energy" building should have a very high-energy performance and the very low amount of energy required should be covered "to a very significant extent" by energy from renewable sources. At pre-construction stage, for all buildings regardless of size, consideration must be given to "alternative high-efficiency systems", particularly district heating and renewable energy systems. Technical building systems (heating, hot water, air conditioning, and large ventilation systems) must meet performance requirements which include their intrinsic energy performance, sizing, installation and commissioning. An EPC is to be issued whenever a building is constructed, sold or rented. The EPC must include current legal standards and benchmarks and the EPC energy label must appear in all advertisements for selling or renting.

The timetable for the introduction of the cost optimal methodology and reporting on the policy for the introduction of nearly zero-energy buildings commences from 2013. Transposition of the recast Directive is in its early stages in most member states.

3. Italy

In Italy both the national and the regional governments are jointly responsible for technical standards and building regulations relating to energy. As a consequence,

there are two levels of standards and regulations, a national level that establishes the national minimum energy performance requirements and a regional or local level that could be more onerous. There are a total of 20 regions which are classified into five climatic zones (Antinucci *et al.*, 2011).

A differential consequence of this regional independence is that a number of regions have not yet implemented a certification scheme (Antinucci *et al.*, 2011). The majority of these regions are in the South of Italy. According to statistics published by the Comitato Termotecnico Italiano Energia e Ambiente (CTI), ten regions have not yet published legislation for the implementation of the certification methodology for buildings (CTI, 2012).

3.1 Legislation

The EPBD 2002/91/EC was ratified in Italy by Legislative Decree No. 192 of the 19 August 2005, which was subsequently amended by Legislative Decree No. 311 of the 29 December 2006. Together, these established the general framework for the implementation of the directive and updated the performance requirements for new buildings. These two decrees were supplemented by Legislative Decree No. 115 of the 30 May 2008 that defines the qualifications of the professionals involved; by Presidential Decree No. 59 of the 2 April 2009 that defines the technical standards to be used for the calculations; and by a Ministerial Decree issued by the Ministry for Economic Development on the 26 June 2009 establishing the national guidelines for the energy certification of buildings. The Ministerial Decree (2009) defines the calculation methodology for the assessment of the energy performance of buildings in accordance with the national standard UNI TS 11300 (2008a).

More recently, the Legislative Decree No. 28 of the 3 March 2011 introduced new requirements for the display of energy certificates of buildings placed on the market for sale or lease as from the 1 January 2012. The latest Ministerial Decree of the 22 November 2012, published on the 25 January 2013 defined the inspection requirements for boilers and air-conditioning equipment. This Ministerial Decree (2012) also removed the possibility for property owners to issue a certificate through "self-declaration".

3.2 Technical standard

Several CEN documents were adopted as Italian standards. The UNI TS 11300 (2008b) series of technical specifications was developed to define the national calculation method for determining energy performance of buildings and is divided into four parts:

(1) Determination of the thermal energy demand of the building in summer and winter.

(2) Determination of the primary energy requirements for winter heating and domestic hot water production.

(3) Determination of primary energy requirements for summer air conditioning.

(4) Use of renewable energies and alternative methods of generation for space heating and domestic hot water preparation.

The standard also defines three different methods for the calculation of the primary energy for heating, cooling and domestic hot water. The first is a detailed method applicable for all building typologies. The second is a simplified method for the

calculation of the energy performance of existing residential buildings with a net area below 3,000 m^2. The third method is applicable to residential buildings with a net area below 1,000 m^2, using an even simpler method.

The standard proposes three different types of energy assessment:

(1) *Design assessment.* The calculation is performed on the basis of design data whilst assuming continuous operation of the building and the technical systems.

(2) *Standard assessment.* The calculation is performed on the basis of the as-built data for the building and the plant, whilst assuming continuous operation of the building and the technical systems.

(3) *Assessment in actual conditions.* The calculation is performed on the basis of the as-built data for the building and the plant, whilst assuming the actual operating schedules for the building occupancy and technical systems.

A simplified reference calculation tool, DOCET, was developed by ENEA (the Italian National Agency for New Technologies, Energy and the Sustainable Economic Development) together with ITC-CNR (Construction Technologies Institute – The Italian National Research Council) as a reference energy performance calculation method for residential buildings. This tool was further developed in 2010 by ITC-CNR into DOCET^{PRO}. The software is based on the simplified monthly method (Belussi *et al.*, 2010).

3.3 Implementation

Due to the regional autonomy mentioned earlier, there are currently a total of ten defined regional systems. The Italian National Institute of Statistics reports a total of 29 million dwellings in 2012, out of which five million dwellings are unoccupied. The mean total living area per dwelling is 96 m^2. Nearly, 80 percent of residential buildings were constructed prior to 1981. Single family (detached) houses are estimated to account for approximately 25 percent of the residential building stock in Italy (Corrado *et al.*, 2012).

Claims over the number of certificates issued vary from over two million calculated in 2010 (Antinucci *et al.*, 2011) to a much lower value of below one and a half million actually registered as at 1 January 2012 (CTI, 2012). According to the latter statistics, over half of the certificates registered in Italy were submitted in the Lombardy region, and just three regions (Lombardy, Emilia Romagna, and Piedmont) account for 87.5 percent of certificates registered (the inhabitants of these three regions account for under one third of the total population). Up to 1 January 2011 895,951 certificates were registered, out of which 500,000 had been registered in the Lombardy region (CTI, 2011). During 2010, 204,000 building permits for dwellings were issued in Italy[1], and 611,000 sales of dwellings were registered (European Mortgage Federation (EMF, 2012)). No official data on the quantity of rental agreements could be identified. Clearly, outside the regions of Lombardy, Emilia Romagna and Piedmont, EPCs are not being issued every time a property is constructed, sold or leased.

[1] Over the period 2009-2011, investment in new housing units decreased by 35.5 percent according to figures by the Italian Association of Construction Firms (ANCE, 2012).

3.4 Compliance

Italy is one of the two Mediterranean states currently undergoing infringement procedures in connection with the EPBD. In 2010, the European Commission formally requested Italy to comply with the directive. The Commission felt that Italian legislation on EPCs for buildings did not comply with the requirements of the directive and that Italy had not adopted any measures regarding the requirement to carry out regular inspections of air-conditioning systems in order to evaluate their performance (European Commission, 2010). Again in 2011 the commission informed Italy about its lack of compliance with the relevant rules (European Commission, 2011a). Although the Italian authorities had taken additional measures, the commission considered that the Italian legislation still did not fully comply with the EU requirements. Specifically, the commission felt that the Italian law did not ensure that every new owner or tenant of a building receives information on the future energy costs or recommendations on how to improve the energy performance of the building in a cost-effective manner. Furthermore, Italy had still not put in place the necessary measures to ensure regular inspections of air-conditioning systems. These inspections should ensure the optimal performance of the systems and should include advice on possible improvements and on alternative solutions. Finally, in 2012, the commission decided to refer Italy to the EU's Court of Justice for failure to fully comply with Directive 2002/91/EC on the energy performance of buildings (European Commission, 2012). The Commission considered Italian legislation was not in line with the provisions on EPCs, and that Italian authorities had not yet communicated any implementing measures regarding inspections of air-conditioning systems. An infringement procedure had previously been opened in 2006 against Italy due to the incomplete and incorrect transposition of the directive (European Commission, 2012). Despite several letters of formal notice and reasoned opinions to the Italian authorities, the commission indicated that the Italian legislation is still not in compliance with the directive and initiated infringement procedures.

A specific peculiarity of the Italian legislation was the facility for property owners to issue a certificate through "self-declaration". This option existed under paragraph 9 of the Ministerial Decree of the 26 June 2009. The Commission was of the opinion that this did not comply with the rationale of the directive. The most recent Ministerial Decree of the 22 November 2012 removed this facility and introduced the measures for inspection of boilers and air-conditioning systems, thus enabling Italy to comply fully with the directive.

Quality control systems for the energy certificates throughout the regions are in their early stages, either about to commence, or operating on a trial basis (CTI, 2012).

4. Cyprus

The implementation of the EPBD in Cyprus is the responsibility of the Energy Service Division of the Ministry of Commerce, Industry and Tourism. The Energy Service Division has developed and implemented a certification scheme with a single methodology for both residential and non-residential buildings. Certification of both categories of building became mandatory in 2010.

4.1 Legislation

In Cyprus, the transposition of the EPBD into national law was achieved through the Law for the Regulation of the Energy Performance of Buildings of 2006-N.142

(1)/2006 and its Amending Law No. 30 (1)/2009 (RICS, 2009). Secondary legislation has been issued for the regulation of various aspects of the directive, such as the national methodology, the minimum requirements for energy performance, the certification procedure for buildings, the inspection procedure for boilers and air-conditioning systems, and the qualifications of experts and inspectors.

4.2 Technical standard

The core of the methodology for the calculation of the annual energy use for space heating and cooling is the monthly quasi-steady state method defined by the EN ISO 13790 Standard. In addition, the methodology makes use of a number of other standards developed for the EPBD and outlined in the CEN Technical Report 15615 (2008) Umbrella Documents. The actual calculation tool was based on interface for the Simplified Building Energy Model (iSBEM) developed by the Building Research Establishment (BRE) for the Department of Communities and Local Government in the UK (RICS, 2009). This methodology was developed further by the BRE in conjunction with the Energy Service Division of the Ministry of Commerce, Industry and Tourism in Cyprus so as to meet the specific requirements of the Cypriot building stock and climate. The software tool provided by the Energy Service Division for the certification is SBEM-CY (Simplified Building Model Cyprus).

The Cypriot calculation methodology relies on the use of a notional building, i.e. a building which has the same geometry, location, building function, and size as the actual building, but with parameters such as insulation values, heating system efficiency, internal gains, etc. substituted by reference values. The methodology performs two calculations, one on the actual building and one on the notional building, the latter providing a benchmark. The ratio of the primary energy of the actual building to that of the notional building is used to provide the classification of the actual building.

Cyprus is divided into four climatic zones. These zones are the lowland, coastal, semi-mountainous and mountainous areas (Panayiotou *et al.*, 2010).

4.3 Implementation

The total building stock of Cyprus consists of over 240,000 occupied homes out of a total of approximately 400,000 residences. A sample survey established a mean area per residence of 172.9 m^2. The majority of building stock in Cyprus was constructed from 1971 onwards (Panayiotou *et al.*, 2010).

The requirement for an EPC is linked to the issue of a building permit for construction works through the Roads and Buildings Regulation 429/2006 which makes it mandatory to submit an EPC to the building authority prior to the issue of a building permit. This ensures that an EPC is issued for all new buildings. However, it is not obligatory to convert the original EPC, which is a design certificate, to an as-built EPC with actual data on completion of the building. This was thought to involve higher costs for the consumer and be a more onerous administrative burden for the building authorities (Panayiotou *et al.*, 2010).

One of the minimum requirements for the energy performance of new buildings is their classification as a class B or better, implying that the new building should achieve a better energy performance than the notional building, as class B is equivalent to between 0.5 and 1 times the energy performance of the notional building.

Approximately, 2,000 certificates were issued during 2010 which was the first year of operation of the scheme (Xichilos and Hadjinicolaou, 2011). The total number of building permits issued for dwellings in 2010 amounted to 8,777, while the number of contracts of sale for dwellings in 2010 was 8,299 (EMF, 2012). Whilst 2010 was the first year of introduction of the EPC scheme, the number of buildings constructed, sold, and leased, is well in excess of the number of certificates issued.

4.4 Compliance

A quality assurance scheme operated by the ESD checked 16 percent of all certificates issued which were flagged as requiring additional verification and just over 30 percent of these were cancelled (Xichilos and Hadjinicolaou, 2011).

5. Malta

The implementation of the EPBD in Malta is the responsibility of the Building Regulations Office of the MRRA, although the legal authority is vested in the Malta Resources Authority (MRA). The putting into practice of the certification methodology commenced during 2011 and only certificates for residential property have been issued so far.

5.1 Legislation

Malta implemented the EPBD by means of Legal Notice 261 of 2008 (Malta Resources Authority Act – Chapter 423) Energy Performance of Buildings Regulations, 2008. This legislation superseded Legal Notice 238 of 2006 but keeps the former technical guidelines on the *Minimum Requirement on the Energy Performance of Buildings*. The new legislation transposed all of the directive's clauses to national law.

5.2 Technical standard

The Energy Performance Rating of Dwellings in Malta (EPRDM) methodology for the energy certification of residential property was developed locally by the Buildings Regulation Office in accordance with the EN ISO 13790 Standard, using the steady state monthly method (Building Regulation Office (BRO, 2009)). The methodology for non-residential property was also based on the iSBEM model developed by the BRE. This methodology was developed further by the BRE, in conjunction with the MRRA in Malta, so as to meet the specific requirements of the Malta building stock and climate. The software tool provided for the certification of non-residential property is SBEM-MT (Simplified Building Model Malta).

Whilst both methodologies provide an energy rating in terms of kg CO_2 per m^2 of floor area, the energy rating for residential property is an absolute value in numerical terms whereas the rating for non-residential property is a scale from A to G, based on the comparison between the rated property and a notional property with the same geometry, location, building function, and size, but with parameters such as insulation values, heating system efficiency, internal gains, etc. substituted by reference values.

5.3 Implementation

Houses built during the British colonial period (1800-1964) constitute nearly one third of the current housing stock (National Statistics Office, Malta, 2010). A sample of newly built dwellings establishes a mean floor area of 136 m^2 (Abela, 2012).

Statistics for 2005 indicate a total of 139,178 (71 percent) occupied dwellings, 10,028 (5 percent) holiday homes, and 43,108 (23 percent) vacant dwellings in Malta (National Statistics Office, Malta, 2005). Out of the occupied dwellings a total of 123,195 (91 percent) are terraced houses (57,037), maisonettes (32,206), or flats (33,952). Since flats and maisonettes are predominantly terraced, it can be concluded that detached and semi-detached properties constitute approximately 9 percent of total occupied dwellings. This is significantly less than the EU average which is 34.3 percent for detached houses and 23 percent for semi-detached houses in 2009 (Eurostat, 2011).

Although the EPC is required for the issue of a building permit for construction works, the building authority is not obliged to refuse the issue of a permit if the certificate is not presented. The main drive for the issue of certificates appears to be related to property transfers. The methodology for the certification of non-residential buildings is currently being rolled out and training of experts in the certification methodology commenced in the first half of 2012. Approximately, 250 certificates were issued for residential property in 2011 with a total of 500 certificates registered as at September 2012. Building permits issued in Malta for dwellings during 2010 accounted for 4,444 new units, while 6,038 property sales were recorded during 2010 (EMF, 2012). The property sales include both dwellings and other properties. Rental agreements are not registered in Malta. There is clearly no relationship between the actual number of properties constructed, sold and leased, and the number of EPCs issued.

5.4 Compliance and certification

In the Maltese islands the project architect has the legal obligation to verify that the building design meets or exceeds the national minimum energy performance requirements when submitting an application for new construction to the Malta Environment and Planning Authority (MEPA) and this has been a legal obligation since January 2007 (MRRA, 2011). At the same time, the owner is obliged to commission an energy performance assessor to produce a design rating EPC for the building. In the case of large developments MEPA refers the project designs for specific consultation on energy performance and use to the MRA among other entities. The MRA has to refer the designs to the BRO which assesses the project designer's calculations and reports to see whether the buildings meet the minimum requirements. If the latter are not met the BRO sends its feedback to the project architect requesting appropriate revisions (MRRA, 2011).

When MEPA issues the planning permission, the project architect follows on by supervising the project throughout its construction and finishing phases. When the finishing has reached its final stages the owner should commission an energy performance assessor to produce the mandatory EPCs based on the asset rating energy performance. The latter is obtained from calculations that depend on the useful floor area, building function, type of building fabric and external finishes that would at least meet the minimum requirements.

The EPCs are quality checked for accuracy of content and recommendations by the BRO as the central EPC database is held at the same office. The BRO also scrutinises all MEPA applications and requests design rating EPCs from the building owners when applications for building permits are validated and accepted by MEPA. A formal quality control system is not in place and no analysis of the accuracy of the submitted certificates is available. A statistical survey of the certificates submitted in 2011 concluded that the certification methodology applied in Malta provides

a reasonable approximation of the actual pattern of energy use in dwellings. The results obtained from this analysis both matched actual data and fell within the bands indicated by other regions with a similar climate (Abela *et al.*, 2012).

6. Spain

The implementation of the EPBD is the responsibility of the Ministry of Industry, Tourism and Commerce and of the Ministry of Housing. The Spanish regions are independently responsible for the registration, inspection and control of EPCs. The EPC is valid for a maximum period of ten years. This may be shortened by the individual regions, although none have done so as yet.

6.1 Legislation

The transposition of the EPBD in Spain has been achieved through the following Royal Decrees:

- Royal Decree 314/2006 of the 17 March, approving the Technical Building Code (CTE).
- Royal Decree 47/2007 of the 19 January, approving the basic procedure for the energy certification of new buildings.
- Royal Decree 1027/2007 of the 20 July, approving the Thermal Building Regulations (RITE).

Legislation for the energy certification of existing buildings is required to complete the transposition of the EPBD but this has not yet been enacted. A draft Royal Decree was published in 2012 defining the basic procedure for the energy certification of existing buildings. This draft also updates the core Technical Document of Royal Decree 314/2006.

6.2 Technical standard

The Technical Building Code is the regulatory framework governing the basic quality requirements that must be met by buildings, including their installations, in order to comply with the basic safety and habitability regulations. The code stipulates the basic requirements for each of the basic regulations for "structural safety", "fire safety", "safe use", "health, hygiene and environmental protection", "protection against noise", and "energy saving and thermal insulation", and provides procedures for accrediting compliance.

The Technical Building Code has been criticised for imposing a series of disjointed limitations on the different aspects of building energy consumption (building envelope energy demand, HVAC installations, illumination), without providing effective limitations on the aggregate or partial building primary energy consumption (Casals, 2006).

Spain is divided into 17 autonomous regions and two autonomous cities. There are 12 permitted permutations of the five winter climates and the four summer climates.

The EPC defines the global energy rating on the basis of CO_2 emitted per unit floor area per annum. For residential buildings, this is compared to a series of reference values that are defined according to the climatic zone and the property type.

The official building energy certification procedure CALENER was developed by IDEA (Institute for Energy Diversification and Saving). The procedure has two versions,

one for residential and small non-residential buildings, and the other for large non-residential buildings. The calculation engine for CALENER is the DOE-2.2 program developed by the Lawrence Berkeley National Laboratory and James J. Hirsch and Associates of the USA. The original DOE-2 program was developed in 1982 and predates considerably the CEN standards which define the calculation methods for the EPBD. The program simulates hourly performance of a building and can be compared to the detailed hourly dynamic simulation method defined in the EN ISO 13790 Standard.

The use of software other than the reference CALENER is subject to the approval of the same by the Advisory Committee for Energy Certification of Buildings. This approval is in accordance with the criteria set out in Document Acceptance Conditions for Alternative Procedures Implementation.

According to the 2001 Census of Population and Housing there were just under 21 million dwellings out of which three million dwellings were vacant. These increased to over 24 million dwellings in 2006, providing accommodation for approximately 16 million households (VIB, 2011).

The number of certificates issued is considered to be low, with under 2,000 certificates registered by the end of 2010 (Alvarez, 2011). The EPC is to be performed during the design phase, in order to obtain the building permit. The building energy rating is then confirmed on completion of the construction. The responsibility for compliance and control rests with the regional government. 91,509 building permits were issued in Spain during 2011, and a total of 495,684 property sale transactions were recorded (EMF, 2012). Take-up of EPCs is extremely low in comparison to the quantity of property transactions and new buildings.

6.3 Control

There are three different laws that could be applicable depending on which part of the regulations has not been fulfilled. If the building does not comply with the requirements specified in the CTE, the applicable law would be the Building Act (Law 38/1999). In this case the different actors participating in the construction process are liable for the defects that compromise the stability of the building during ten years and for defects that compromise its habitability (e.g. insulation, service installations, etc.) during three years. This law obliges the firms or individuals participating in the construction to obtain insurance cover against the possible defects that could arise during the use of the building.

When the building installations do not comply with the requirements specified in the RITE, the applicable law would be the Industry Law (Law 21/1992) which states different penalties ranging from economic fines to suspension of activities.

If the EPC has not been issued according to the building project or the final building the applicable law would be the General Law for the Defence of Consumers and Users (Law 26/1984). This could result in administrative penalties which would not substitute the possible civil or penal responsibilities which will be applicable. The formulation and registration of an EPC does not imply the fulfilment of the CTE and the RITE (Molina and Alvarez, 2009).

6.4 Compliance

Spain is the second of the two Mediterranean states currently undergoing infringement procedures in connection with the EPBD. In 2010, the European Commission formally

requested Spain to comply with the directive. The Commission indicated that it felt that Spain had not yet adopted a methodology for calculating energy performance or a certification scheme that covers all existing buildings and that the Spanish system for the inspection of boilers did not cover installations which existed before the legislation entered into force (European Commission, 2010). In 2011, The Commission decided to refer Spain to the EU's Court of Justice for failure to fully comply with Directive 2002/91/EC on the energy performance of buildings (European Commission, 2011b). The Commission is maintaining that under Spanish law, the adopted methodology for calculating the energy performance of buildings and the requirements for handing over an EPC are applicable only to new buildings and existing buildings undergoing a major renovation, when the EPBD requires establishing a methodology and certificates for all types of buildings. Furthermore, the commission considers that Spain still has not put in place the necessary measures to establish a regular inspection regime for boilers.

7. Discussion

Although there is considerable variety in the methodology of implementation of the EPBD in the four countries examined, it is quite clear that there are a number of common difficulties.

Evidently one of the major hurdles has been the actual transposition of the directive into national legislation, with two out of the four countries forming part of this study currently facing infringement procedures for failing to have done so completely, a full eight years after the enactment of the original Directive. Whilst it would be presumptuous to assume a complete understanding of the reasons for this alleged failure to transpose the directive, the following could be considered as contributory factors:

- It is clear from all member states that the enactment of legislation for the definition of technical requirements is not straightforward. Despite their purportedly open and available procedures, both science and legality are experienced in popular culture as arcane, impenetrable and often un-interpretable (Silbey, 2008). The notion that science can determine public policy leads to differences of viewpoint and interpretation within the scientific community (Rayner, 2006). The transition from scientific principles to legal tools emphasises the distinction between the descriptive nature of science and the normative process of law.
- The different requirements of the directive could be perceived as having different socio-economic priorities, and specifically the requirements for inspection of boilers and air-conditioning systems have not been considered as important as the articles relating to the energy performance and certification of buildings.

Implementation of the directive has been slow to commence, and none of the four countries can claim to have a high level of take-up of the requirement for energy certificates. Whilst such circumstances are sometimes considered a characteristic "Southern problem" of non-compliance with EU environmental law, this view has been found to ignore the general causes of implementation failure and non-compliance which arise from the nature and content of EU policies (Pridham, 1996). Case studies on the implementation of different EU environmental policies have indicated that all states face similar problems of compliance if an EU policy does not fit their legal and administrative structures (Borzel, 2000).

Clearly regional implementation in Italy and Spain is more complex to roll out and enforce than the single region approach taken in Malta and Cyprus, albeit for significantly smaller countries. Regional differences in implementation within a country may complicate enforcement and diminish the level playing field. Regional implementation in Italy has resulted in a small number of regions making full use of the directive, whilst other regions have either not yet implemented a certification system or have transposed the necessary legislation without applying it fully. The best practice example of Lombardy, Emilia Romagna and Piedmont has not been taken up by other Italian regions. In Spain, Malta, and Cyprus, the implementation of the directive does not exhibit regional variations, with the main shortcoming in Spain being the lack of definition of a methodology for the certification of existing buildings. In all three states, however, enforcement of the requirement for an energy certificate is low or non-existent, as evidenced by the low number of certificates registered, amounting to a total of under 5,000 for all three states in 2010. This is in sharp contrast to the 710,000 certificates registered in Lombardy up to the end of 2011 (CTI, 2012).

From a technical viewpoint, the countries all made use of the CEN standards and/or existing technical solutions in order to develop the national methodology. The late introduction of the CEN standards in relation to the implementation dates for the original EPBD meant that most north European states developed their own methodologies prior to the approval of the final version of the standards. In contrast, the south European states used the CEN standards to develop their methodologies, possibly due to the later timing as well as the scarcity of building energy regulations prior to the introduction of the EPBD.

8. Conclusions

The introduction of the relevant legislation to implement the EPBD in Italy, Cyprus, Malta and Spain was not straightforward. None of these states had experience in energy-related building regulation, and the administrative structures for inspection for compliance were not already established. The construction sector is noted for its resistance to change and the directive could have been and probably was viewed as an external imposition disturbing the status quo.

Different approaches to compliance and control have been taken. The most demanding sanction is generally to obstruct the process of construction or utilisation of new or majorly renovated buildings by withholding the building permit. The effectiveness of this approach strongly depends on the type and scope of control. In view of the relative newness of the various certification systems, the effectiveness of the control systems cannot be assessed at this stage. However, the number of certificates issued to date does seem to indicate that enforcement is lacking. There is no correlation whatsoever between the number of properties constructed, sold, or leased in these four states and the number of EPCs issued.

A more recent barrier to the implementation of energy certification and compliance with the EPBD is the current European economic crisis which has severely affected the construction sector in Southern Europe. Production levels in the construction industry in Italy for 2012 are reported to be 25 percent less than in 2008, and construction of homes has dropped by 40 percent (ANCE, 2012). Similar figures are reported in Spain, Cyprus and Malta. The poor economic performance of the sector is certainly a disincentive to introduce new measures which, although intended to improve the

quality of the housing market, could be considered as additional overhead costs in the short-term. On the other hand, implementation of the directive does offer the possibility of job creation opportunities in energy certification, in a sector where unemployment is high and still growing.

The EPCs have the potential to become a reliable source of information about the energy performance of the building stock in member states. For this to happen, it would be essential to have a common understanding of the methodology and the implementation of the EPBD, as well as of the key parameters displayed on the EPC. At present, it appears that the value of the EPC as a marketing tool has not been realised in the Southern Mediterranean. It has not been established whether this is a result of "Southern" reluctance to comply with EU directives, or whether the energy performance of buildings is of reduced economic and sociological significance in milder climates.

All member states are undergoing a review of their existing EPBD legislation in order to meet the new requirement of the revised EPBD. It is likely that the Mediterranean states can benefit as their relatively newer structures are more flexible to the modifications required by the recast Directive. The authors are currently researching the different certification methodologies applied in Southern Europe (Malta, Italy, Spain, Cyprus) in order to establish whether these provide an accurately calculated value of energy demand in Southern Mediterranean housing. As outlined in the above paper, the application of these certification methods is relatively recent and with the implementation of the recast EPBD, and the revision of the CEN standards on which the methodologies are based, it is opportune to analyse the existing procedures and identify their strengths and weaknesses. There is no question about the fact that improving the energy performance of buildings is one of the key factors in reducing our dependency on fossil fuels. However, in the four countries investigated above, the validity of the EPC as a tool to improve building energy performance has not been acknowledged to date.

References

Abela, A. (2012), "Development of national benchmarks for energy certificates for residential property in Malta", *Defining Contributions: Inspiration Driving Original Research RPC Postgraduate Conference, Nottingham Trent University Library, Nottingham, Friday, 18 May*, pp. 7-11.

Abela, A., Hoxley, M., McGrath, P. and Goodhew, S. (2012), "An investigation into the practical application of residential energy certificates", paper presented at the Sustainability in Energy and Buildings SEB 12 Conference, Stockholm, 3-5 September.

Alvarez, M.G. (2011), "Implementation of the EPBD in Spain: status in November 2010", *Concerted Action – EPBD Country Report*, European Union, available at: www.buildup.eu/system/files/content/Spain.pdf (accessed 9 June 2012).

ANCE (2012), *Strategia Energetica Nazionale*, Associazione Nazionale Costruttori Edili, Rome, 25 September.

Antinucci, M., Varalda, G., Macaluso, M. and Marenco, L. (2011), "Implementation of the EPBD in Italy: status in November 2010", *Concerted Action – EPBD Country Report*, European Union, available at: www.buildup.eu/system/files/content/Italy.pdf (accessed 9 June 2012).

Asdrubali, F., Bonaut, M., Battisti, M. and Venegas, M. (2008), "Comparative study of energy regulations for buildings in Italy and Spain", *Energy and Buildings*, Vol. 40, pp. 1805-1815.

Belussi, L., Danza, L. and Meroni, I. (2010), "DOCET^{PRO} energy certification and diagnosis software on web platform", paper presented at RICS COBRA, Royal Institution of Chartered Surveyors, Paris, 2-3 September.

Borzel, T.A. (2000), "Why there is no 'southern problem': on environmental leaders and laggards in the European Union", *Journal of European Public Policy*, Vol. 7 No. 1, pp. 141-162.

BPIE (2011), *Europe's Buildings Under the Microscope*, edited by Atanasiu, B. *et al.*, Buildings Performance Institute Europe, Brussels.

BRO (2009), *Energy Performance of Residential Dwellings in Malta*, Building Regulations Office, Valletta.

Casals, X.G. (2006), "Analysis of building energy regulation and certification in Europe: their role, limitations and differences", *Energy and Buildings*, Vol. 38, pp. 381-392.

CEN TR 15615 (2008), "Explanation of the general relationship between various CEN standards and the Energy Performance of Buildings Directive", Umbrella document.

Corrado, V., Ballarini, I. and Corgnati, S.P. (2012), *National Scientific Report on the TABULA Activities in Italy*, available at: www.building-typology.eu/downloads/public/docs/scientific/IT_TABULA_ScientificReport_POLITO.pdf (accessed 27 September 2012).

CTI (2011), *Attuazione della certificazione energetica degli edifici in Italia – Rapporto 2011*, edited by Boffa, C., Riva, G., Dall"O, G. and Murano, C., Comitato Termotecnico Italiano Energia e Ambiente, Milan.

CTI (2012), *Attuazione della certificazione energetica degli edifici in Italia – Rapporto 2012*, edited by Boffa, C., Riva, G., Dall"O, G. and Murano, C., Comitato Termotecnico Italiano Energia e Ambiente, Milan.

Dascalaki, E.G., Balaras, C.A., Gaglia, A.G., Droutsa, K.G. and Kontoyiannidis, S. (2012), "Energy performance of buildings – EPBD in Greece", *Energy Policy*, Vol. 45, pp. 469-477.

Decree of the President of the Republic (Italy), No. 59 (2009), Decree of the President of the Republic (Italy), No. 59 of the 2 April 2009, "Implementation of Directive 2002/91/EC on the energy performance of buildings".

Directive 2002/91/EC (2002), "Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings", *Official Journal of the European Union, L Series*, Vol. 1, 4 January, pp. 65-71.

EMF (2012), *A Review of Europe's Mortgage and Housing Markets*, edited by Bouyon, S. and Bartus, K., European Mortgage Federation, Brussels.

EN ISO 13790 (2008), *Energy Performance of Buildings – Calculation of Energy Use for Space Heating and Cooling*, ISO, Geneva.

European Commission (2010), Press release IP/10/1561 "Energy performance of buildings: the commission asks Italy and Spain to ensure full compliance with European legislation", available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1561&format=HTML&aged=1&language=EN&guiLanguage=en (accessed 9 June 2012).

European Commission (2011a), Press release IP/11/1100 "Energy performance of buildings: Italy is requested to comply with European legislation", available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/1100&format=HTML&aged=1&language=EN&guiLanguage=en (accessed 9 June 2012).

European Commission (2011b), Press release IP/11/1447 "Energy performance of buildings – commission refers Spain to court", available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/447&format=PDF&aged=0&language=EN&guiLanguage=en (accessed 9 June 2012).

European Commission (2012), Press release IP/12/1411 "Energy performance of buildings – commission refers Italy to court", available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/411&format=PDF&aged=0&language=EN&guiLanguage=en (accessed 9 June 2012).

Eurostat (2011), *European Commission Housing Statistics*, available at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Housing_statistics#Type_of_dwelling (accessed 27 September 2012).

Kokogiannakis, G., Clarke, J. and Strachan, P. (2007), "Impact of using different models in practice – a case study with simplified methods of ISO 13790 standard and detailed modelling programs", *Proceedings of 10th IBPSA Conference on Building Simulation, Beijing*.

Laustsen, J. (2008), "Energy efficiency requirements in building codes, energy efficiency policies for new buildings", International Energy Agency Paper, OECD/IEA, France.

Law 21/1992 (1992), The Spanish Industry Act of the 16 July 1992, published in the Official Gazette.

Law 26/1984 (1984), The Spanish Act for the Defence of Consumers and Users of the 19 July 1984, published in the Official Gazette.

Law 38/1999 (1999), The Spanish Building Act of the 5 November 1999, published in the Official Gazette on the 6 November 1999.

Legal Notice of the Maltese Parliament, No. 238 (2006), Legal Notice of the Maltese Parliament, No. 238 of the 1 November 2006, "Minimum requirement on the energy performance of buildings regulation".

Legal Notice of the Maltese Parliament, No. 261 (2008), Legal Notice of the Maltese Parliament, No. 261 of 2008, "Energy performance of buildings regulations".

Legislative Decree of the Italian Parliament, No. 28 (2011), Legislative Decree of the Italian Parliament, No. 28 of the 3 March 2011, "Implementation of Directive 2009/28/EC on the promotion of the use of energy from renewable sources".

Legislative Decree of the Italian Parliament, No. 115 (2008), Legislative Decree of the Italian Parliament, No. 115 of the 30 May 2008, "Implementation of Directive 2006/32/EC on end-use energy efficiency and energy services".

Legislative Decree of the Italian Parliament, No. 192 (2005), Legislative Decree of the Italian Parliament, No. 192 of the 19 August 2005, "Implementation of Directive 2002/91/EC on the energy performance of buildings".

Legislative Decree of the Italian Parliament, No. 311 (2006), Legislative Decree of the Italian Parliament, No. 311 of the 29 December 2006, "Amendments and additions to Decree 19 August 2005, n. 192, implementing Directive 2002/91/EC on the energy performance of buildings".

Ministerial Decree (2009), *Linee Guida Nazionali per la Certificazione degli Edifici* (*National Guidelines for Energy Certification of Buildings*), Ministry of Economic Development, Official Gazette, Rome.

Ministerial Decree (2012), "Modifica del decreto 26 giugno 2009, recante", *Linee guida nazionali per la certificazione energetica degli edifici* (*Modifications to the National Guidelines for Energy Certification of Buildings*), Ministry of Economic Development, Official Gazette, Italy.

Mlecnik, E., Visscher, H. and van Hal, A. (2010), "Barriers and opportunities for labels for highly energy-efficient houses", *Energy Policy*, Vol. 28, pp. 4592-4603.

Molina, J. and Alvarez, S. (2009), "Impact, compliance and control of energy legislation: the case of Spain", paper presented at International Workshop on Impact, Compliance and Control of Energy Legislations, Brussels, Belgium, 1-2 September, available at: www.asiepi.eu/fileadmin/files/WP3/14_Spain.pdf (accessed 11 June 2012).

MRRA (2011), "Implementation of the EPBD in Malta: status in November 2010", *Concerted Action – EPBD Country Report*, European Union, Ministry for Resources and Rural Affairs, Malta, available at: www.buildup.eu/system/files/content/Malta.pdf (accessed 9 June 2012).

National Law for the Regulation of Roads and Buildings (2009), amendmentL.30 (I)/2009, published in the Official Gazette, Cyprus on the 3 April 2009.

National Law for the Regulation of the Energy Performance of Buildings (2006), L.142(I)/2006, published in the Official Gazette, Cyprus on the 3 November 2006.

National Statistics Office, Malta (2005), *Census of Population and Housing 2005 – Volume 2: Dwellings*, National Statistics Office, Valletta.

National Statistics Office, Malta (2010), *Household Budgetary Survey 2008*, National Statistics Office, Valletta.

Panayiotou, G., Maxoulis, C.N., Kalogirou, S.A., Florides, G.A., Papadopoulos, A.M., Neophytyou, M., Fokaides, P.A., Georgiou, G., Symeou, A., Hadjinikolau, N. and Georgakis, G. (2010), "Cyprus building energy performance methodology: a comparison of the calculated and measured energy consumption results", paper presented at CESB10, Central Europe Towards Sustainable Building, Prague.

Perez-Lombard, L., Ortiz, J. and Pout, C. (2010), "A review on buildings energy consumption information", *Energy and Buildings*, Vol. 40, pp. 394-398.

Poel, B. and van den Brink, L. (2009), "Approaches and possible bottlenecks for compliance and control of EPBD regulations", Information Paper P178 of ASIEPI Project, European Commission, available at: www.buildup.eu/system/files/content/P178_Synthesis_report_EPBD_approaches_and_bottlenecks_ASIEPI_WP3.pdf (accessed 9 June 2012).

Pridham, G. (1996), "Environmental policies and problems of European legislation in southern Europe", *South European Society and Politics*, Vol. 1 No. 1, pp. 47-73.

Rayner, S. (2006), "Editorial: what drives environmental policy?", *Global Environmental Change*, Vol. 16, pp. 4-6.

RICS (2009), *Towards an Energy Efficient European Building Stock*, Institution of Chartered Surveyors, available at: www.joinricsineurope.eu/uploads/files/EPBD3onlineguide.pdf (accessed 9 June 2012).

Roads and Buildings (Energy Performance of Buildings) Regulations, Κ.Δ.Π.429/2006 (2006), published in the Official Gazette, Cyprus on the 17 November 2006.

Royal Decree of Spain No. 47 (2007), "Procedimiento básico para la certificación de eficiencia energética de edificios de nueva construcción" ("National basic procedure for energy certification of new buildings").

Royal Decree of Spain No. 314 (2006), "Código Técnico de la Edificación, CTE" ("The building technical code").

Royal Decree of Spain No. 1027 (2007), "Reglamento de Instalaciones Térmicas en los Edificios, RITE" ("Regulation of thermal systems in buildings").

Silbey, S.S. (2008), *"Introduction" in Law and Science*, Vol. 1, Ashgate, Aldershot, pp. ix-xxvii.

UNI TS 11300 (2008a), "Energy performance of buildings part 1: calculation of energy use for space heating and cooling".

UNI TS 11300 (2008b), "Energy performance of buildings part 2: calculation of primary energy and energy performance for heating plant and domestic hot water production".

Van Dijk, D. (2009), *Background, Status and Future of the CEN Standards to Support the Energy Performance of Buildings Directive* (*EPBD*), TNO Built Environment and Geosciences, Delft.

Van Dijk, D. (2010), *Set of Recommendations: Towards a Second Generation of CEN Standards Related to the Energy Performance of Buildings Directive* (*EPBD*), TNO Built Environment and Geosciences, Delft.

VIB (2011), *Use of Building Typologies for Energy Performance Assessment of National Building Stock – Existent Experience in Spain*, Valencian Institute of Building, Valencia.

Xichilos, C. and Hadjinicolaou, N. (2011), "Implementation of the EPBD in Cyprus: status in November 2010", *Concerted Action – EPBD Country Report*, European Union, available at: www.buildup.eu/system/files/content/Cyprus.pdf (accessed 9 June 2012).

Further reading

Directive 2010/31/EU (2010), "Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)", *Official Journal of the European Union, L Series*, Vol. 153 18 June, pp. 13-35.

Corresponding author

Alan Abela can be contacted at: alan.abela2010@my.ntu.ac.uk