CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

EPBD implementation in Spain

STATUS AT THE END OF 2012

Author

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1. Introduction

The implementation of the Directive 2002/91/EC on the Energy Performance of Buildings (EPBD) in Spain is the responsibility of the Ministry of Industry, Energy and Tourism, and of the Ministry of Public Works and Transport. The Institute for Energy Diversification and Saving (IDAE) also contributes to this process.

Since the publication of the EPBD, Spain has worked to implement its transposition into national law. The initial transposition of this Directive consisted of the following Royal Decrees:

> Royal Decree 314/2006, of the 17th of March, approving the Technical Building Code (TBC).
> Royal Decree 47/2007, of the 19th of January, approving the basic procedure for the energy certification of new buildings.
> Royal Decree 1027/2007, of the 20th of July, approving the Thermal Building Regulations, modified by the Royal Decree 1826/2009, of the 27th of November.

A new Royal Decree was published in April 2013, replacing the Royal Decree 47/2007, for the legislation regarding the energy certification of existing buildings, taking into consideration the 2010/31/EU Directive (recast EPBD). The Royal Decree 235/2013 of the 13th of April, and the update of the Thermal Building Regulations with the Royal Decree 238/2013 of the 13th of April, were also published.

Moreover, a revision process of the current regulations is almost completed, involving the TBC. The revised regulations are expected to be published before the end of 2013.

In parallel, the roadmap to guide Spain towards the objectives established in the recast EPBD in terms of all new buildings becoming Nearly Zero-Energy Buildings (NZEB) from the year 2020 onwards, is already under way.

2. Energy performance requirements

The transposition of the EPBD related to the Energy Performance (EP) requirements consists of the Royal Decree 314/2006 approving the TBC. It sets the minimum requirements that must be met by all new buildings (residential, non-residential, public and private buildings), as well as by existing buildings undergoing a renovation of more than 25% of their area.

2.1 Progress and current status

With the enforcement of the TBC in 2006, building energy efficiency received a large boost. This basic standard consists of 5 documents:

> CTE DB HE1 – Limitation of energy demand.
> CTE DB HE2 – Performance of thermal installations (RITE).
> CTE DB HE3 – Energy efficiency in lighting installations.
> CTE DB HE4 – Minimum solar contribution for hot sanitary water.
> CTE DB HE5 – Minimum photovoltaic contribution for electric power.

National Website www.idae.es

These documents set the minimum requirements in comparison with the previous regulations. For example, for Madrid, the differences in those minimum requirements are shown in Table 1.

The revision which is currently under way should lead to a new TBC before the end of 2013. This revision constitutes the framework for the cost-optimal requirements. The first leap in the requirements will take place in 2013, as a first step on the way leading to NZEB in the year 2020; the second one will take place in 2016.

2.2 Format of national transposition and implementation of existing regulations

The document CTE DB HE1 replaced the former regulation, NEB-CT-79, on the thermal conditions of buildings, considerably tightening the requirements demanded for the building envelope. As an example, in the case of Madrid, the maximum thermal transmittance for the facade was cut back from 1.20 W/m^2.K to 0.66 W/m^2.K.

The CTE DB HE2, despite being part of the TBC, is, for historical reasons, usually dealt with as an independent document: the Regulation on Building Thermal Installations, known as RITE. As a result of the EPBD, this document, whose former version dated back to 1998, was revised in 2007, introducing the concept of periodic inspections on energy efficiency to be implemented by the Autonomous Communities.

The document was modified by the Royal Decree 1826/2009, which introduced winter and summer limit temperatures for indoor air in administrative, commercial and public buildings when fossil energy is used to heat or cool the building: 21 ºC for winter and 26 ºC for summer. It is also required to display these temperature values in a visible place on these buildings. In addition, the modification introduced the obligation of using a mechanism to keep the doors of all building parts directly connected with the street closed, when fossil energy is being used, to condition the building.

The CTE DB HE3 defines requirements on lighting, limiting the minimum energy efficiency of the tertiary building lighting systems. For so doing, the concept of the Energy Efficiency Value of the Installation (VEEI) is introduced. VEEI is the relation between the lamp power plus auxiliary equipment, the illuminated surface and the average maintained illuminance. The minimum value of this factor is limited as a function of the use of the various rooms in the building.

For the first time, the use of Renewable Energy Sources (RES) became compulsory in order to meet part of the energy needs of buildings, either to produce sanitary hot water (for both residential and non-residential buildings), as set forth in the CTE DB HE4, or to produce electric power in tertiary buildings as set in the CTE DB HE5. As this requirement is included in the TBC 2006, which is a national regulation, the use of RES in new buildings is mandatory in the whole Spanish territory.

Compliance with the requirements of this document is compulsory for any new building; its usage is not allowed in case of non-compliance. Each region manages

Table 1: Differences in thermal conductance for Madrid, NBE-CT-79 and TBC 2007.

Component	NBE CT 79	TBC (CTE 2007)
Roof	0.9	0.61
Light building facade (<200 kg/m^2)	1.2	0.69
Heavy building facade (>200 kg/m^2)	1.4	0.69
Forged on open space	0.8	0.69
Wall in contact with unheated local	1.6	0.69
Floor/roof in contact with unheated local	1.2	0.69
Floor		0.69

Table 2: VEEI limits.

Group	Differentiated activity areas	VEEI Limit
No representing areas	Warehouses, archives, technical rooms, kitchens	5
	Common areas	4.5
	Parkings	5
	Administrative areas	3.5
	Classrooms and laboratories	4
	Hospital rooms	4.5
	Diagnostic rooms	3.5
	Sports areas	5
	Transport station platforms	3.5
	Exhibition halls	3.5
	Other indoor areas	4.5
Representing areas	Common areas	10
	Transport stations	6
	Common areas in residential buildings	7.5
	Administrative areas	6
	Religious areas	10
	Halls, auditoriums, etc.	10
	Hotel rooms	12
	Hotels and restaurants	10
	Shops and stores	6
	Shopping centers	8
	Shops and small businesses	10
	Libraries, museums and art galleries	6
	Other indoor areas	10

Existing buildings		New buildings	
Residential	Non-residential	Residential	Non-residential
4 buildings: 2 single-family 2 multifamily	**2 buildings:** Educational Office	**6 buildings:** 3 single-family: detached, semi-detached, terraced 3 multifamily: isolated building, building between adjacent buildings, building occupying a whole block	**4 buildings:** Office Commercial Cultural activities Sport facilities

Table 3: Buildings selected for the cost-optimal study.

the schedules and inspection procedures to ensure compliance with inspections of thermal installations.

2.3 Cost-optimal procedure for setting EP requirements

Cost-optimal levels are being calculated as established in articles 4 and 5 of the recast EPBD and in the Delegated EC Regulation 244/2012. The cost-optimal study consists of: selection of reference buildings, selection of measures/variants, calculation of the energy demand of the building with measures/variants, calculation of costs, calculation of energy consumption, and cost-optimal calculation for the microeconomic and macroeconomic studies. Finally, comparison with the minimum building energy requirements will be carried out.

The main factors taken into account for the selection of the reference buildings have been:

> a database containing the typical characteristics of existing buildings;
> typical new buildings built in Spain;
> compactness of the building.

Table 3 shows the buildings selected for the study.

Twelve climatic zones have been considered in the cost-optimal study, because there are different building energy requirements depending on the climatic zone. For each climatic zone, the study included each type of building placed in different orientations.

The packages of measures or variants are the result of the combination of several individual measures.

The energy demand is calculated with a calculation engine based on an hourly multi-zone method, using several assumptions and the modelling scale of the official Spanish calculation tools. Thousands of cases have been calculated in the cost-optimal study, in order to obtain a sufficient number of cases as to determine the cost-optimal energy level for each type of building in each climatic zone. So far, most of the cost-optimal calculations have been already completed, and further analysis and comparison with the building energy requirements are still under way. The first results indicate that the cost-optimal levels are more demanding than the current minimum requirements in the regulations. Since the current energy requirements set in the Code 2006 are being updated, the results of the cost-optimal study are expected to be implemented in the near future. More cost-optimal studies should be conducted in the future, in order to take into account other parameters which might be relevant in certain areas or climatic zones, such as adaptive comfort.

As a conclusion, in a country like Spain, cost-optimal levels may vary significantly from one climatic zone to another. Consequently, different measures/variants for the optimal cost can be found if the analysis is on cooling, heating, or both. In warm areas, cooling and demand on domestic hot water and/or lighting become relevant, and might be responsible for most of the energy consumption.

The cost-optimal study showed that the interest rate used for the financial study of cost-optimal levels must be realistic, because the results on cost-optimality are very sensitive to this parameter.

2.4 Action plan for progression to NZEB

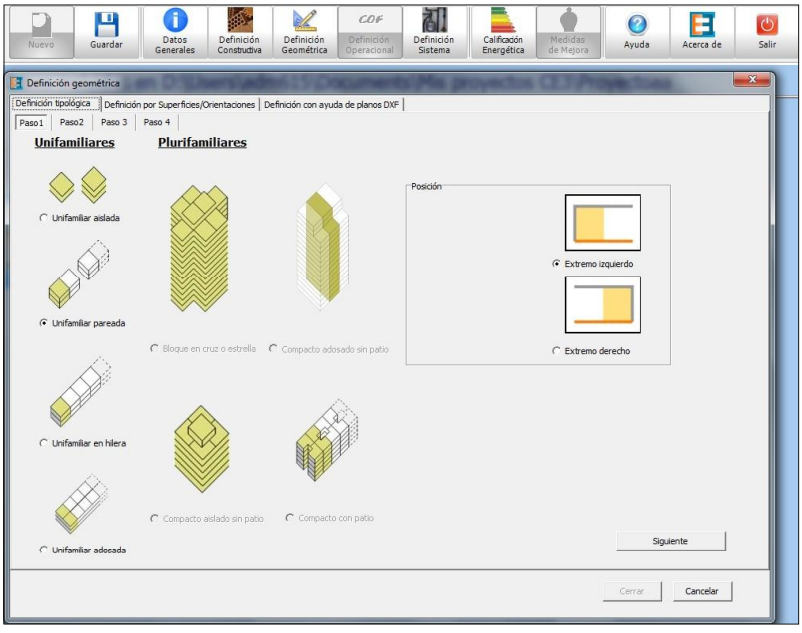
The regulatory approach of the building code to the NZEB requirements will be

done in a gradual way, based on the results of cost-optimal studies, which are virtually completed.

The updating of the building energy requirements in order to approach the 2020 target is planned in two steps. The first updating of the current energy Code 2006 (CTE- DB HE) will be accomplished during 2013. This will represent a major change in the manner of considering the building energy efficiency requirements with regard to the current requirements, and a substantial reduction of the energy demand and maximum consumption values, if compared to those of the building Code 2006 (in many cases, over 50%).

A second updating is expected to be accomplished in the period 2016-2017. Then, a regulatory definition of NZEB and the respective requirements will be established, in accordance with the recast EPBD, and will become mandatory after December 2018 for new buildings occupied and owned by public authorities, and by 2020 for all new buildings. An intermediate value of building energy efficiency between the values of 2013 and those of NZEB will also be established, which will be mandatory until new requirements regarding NZEB come into force. The conduction of cost-optimal studies in the years to come will be crucial in order to adjust the minimum requirements associated to NZEB.

Figure 1: Software programmes for existing building certification.



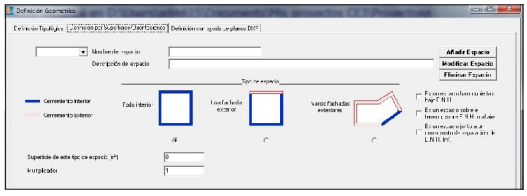
3. Energy performance certificates

According to the Royal Decree 235/2013 on the Energy Certification of Buildings, the Autonomous Communities are in charge of the registration, inspection and control of the Energy Performance Certificates (EPCs). All the legislation in force can be downloaded from the websites of the ministries in charge of the EPBD.[1,2,3]

3.1 Progress and current status on sale or rental of buildings

The certificate for new buildings came into force in November 2007. CALENER is the name of the software that implements the official calculation methodology.

The Royal Decree 235/2013 transposes the recast EPBD, in relation to the energy certification of existing buildings. This is a key point to reduce the energy consumption of the housing stock. To support the technical certifying officers (Qualified Experts (QE) who must be architects or engineers authorised to sign building projects) responsible for the energy certification of existing buildings, IDAE has published two new procedures for the energy certification of existing buildings, establishing the official calculation methodology for EPCs (named CE3 and CE^{3}X). The procedures for existing buildings account for the assessment of energy efficiency measures, both from technical and economical point of view. This analysis is stated in the final report issued by the indicated software programmes.



1 *www.codigotecnico.org*
2 *www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/RITE/Paginas/InstalacionesTermicas.aspx*
3 *www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/Paginas/certificacion.aspx*

Since August 2012, the two software procedures, CE3 and CE^{3}X, are already recognised as official documents, according to the procedure established by the Ministry of Industry, Energy and Tourism, and the Ministry of Public Works. These free programmes, along with their manuals, can be downloaded from the website of the Ministry of industry, Energy and Tourism.[1]

Both include specific modules according to the type of the building:

> housing 'ViV';
> small and medium tertiary 'PYMT';
> great tertiary 'GT'.

Each of the programmes has been available to technical certifiers and citizens in general, together with the necessary technical documentation for correct understanding and use:

> user manual;
> technical foundations manual;
> examples of application for the three typologies (ViV, PYMT, GT);
> guide for the preparation of the energy certificate.

Both procedures enable the energy certification of existing residential buildings, as well as of small and large tertiary buildings, establishing a degree of energy efficiency based on CO_2 emissions and primary energy consumption, arising from consumption related to heating, cooling, water heating, ventilation and lighting needs.

The energy label classifies the buildings on a scale from G (least efficient building) to A (most efficient building). Additionally, computer tools CE3 and CE^{3}X provide energy efficiency improvement measures, and enable the definition of sets of measures by the technical certifying officer, as well as the realisation of an economic analysis of these measures from the aspects of investment costs, energy savings achieved and actual building energy bills.

With this information, the building owner can assess and voluntarily undertake actions of renovations in order to improve the building energy rating. Finally, the tools automatically generate a certificate that indicates the energy label, along with the new letter after applying the improvement measures.

The report of the official EPC that is currently approved for the energy certification of existing buildings may be seen in Figure 2.

As stated, the global energy rating is assessed according to the CO_2 emitted per unit floor area per year [kgCO_2/m^2.year], as well as the primary energy consumption [kWh/m^2.year]. Moreover, there are partial ratings depending on the demand and energy consumption for the various energy-consuming services (heating, cooling, sanitary hot water and lighting for tertiary buildings).

The calculated values are compared with a series of reference values that vary according to the local climate, and with a reference building of the same shape, which abides by the building energy regulations, depending on whether it is a new or existing building, or a residential or non-residential one.

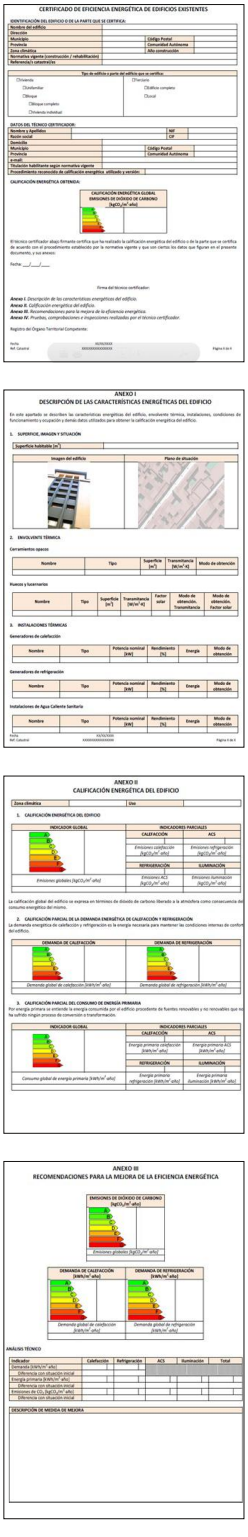
The new building energy certification procedure, called CALENER, developed with IDAE's sponsorship and following CEN standards to a large extent, is now also adapted for the certification of existing buildings, so that there are three procedures for the EP certification of existing buildings.

Registration, costs and sanctions

The registration of the energy certificates, as well as the quality control to be applied on the certificates, fall within the competence of the Autonomous Communities. Some communities have so far legislated on this issue, whereas others have legislation drafts which will be enforced in the near future.

There is neither a fixed cost nor an administrative tax applied to certificates at national level, but Autonomous Communities can establish the aforementioned tax. For instance, Castile and Leon have done so in the Regional Law 10/2009, establishing a cost in terms of €/m^2, which depends on the size and type of the building (0.40 €/m^2 for residential blocks, 0.97 €/m^2 for single-family houses, 0.79 €/m^2 for small non-residential

Figure 2: Extract of the official EPC for existing buildings.



1 www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Paginas/documentosreconocidos.aspx

Figure 3: Practical Guide of Energy.

buildings, and 0.89 €/m^2 for big tertiary buildings). This administrative tax varies between a minimum of 150 € for single-family houses and a maximum of 1,200 € for large tertiary buildings. Extremadura also charges an administrative cost of 21.79 € per registered certificate.

The cost of the certificates is established by the market. For new projects, the cost is usually integrated in the price charged by the designer and the project manager to the promoter of the building. For existing buildings, there is not yet experience on the cost of certification. Nevertheless, the estimates by the Administration show costs from 40 €/ apartment for blocks of flats, to 250 € for detached houses, and 0.5 €/m^2 for tertiary buildings. Nevertheless, these prices will be fixed by the market.

The external control carried out on the project certificates and on the finished building project includes a verification of the information specified in the project, what was really executed in the building works, and a comparison with the data introduced in the certificate. Apart from this control, the regional Administration is also entitled to an independent inspection of any certificate, should it be deemed necessary.

Sanctions specified in the Royal Decree 235/2013 are established in the Law 26/1984, whose recast text is published in the Legislative Royal Decree 1/2007. They range from 3,005.06 € to 601,012.10 €, and are related to consumer protection.

The sanctions in this law are going to be completed with a new law about sanctions concerning the EP certification; the new law is under preparation. Examples of actions that could lead to a penalty are: false information on the EPC, not giving the EPC to the buyer or tenant, not registering the EPC, advertising a false EPC, or not placing the energy label in an advertisement, etc..

Figure 4: Information campaigns in Spain.

3.2 Progress and current status on public and large buildings visited by the public

The current legislation requires that public buildings must obtain a certificate of energy efficiency.

Buildings or parts of buildings of a public authority, occupying a total useful floor area over 500 m^2 and frequently visited by the public, have currently the obligation to possess the EPC. If the floor area of the building exceeds 250 m^2, this obligation is mandatory from the 9th of July 2015 onwards.

Moreover, all buildings occupied by public authorities, with a total useful floor area over 250 m^2, must exhibit an EPC label in a prominent place.

All buildings frequently visited by the public, other than those owned or occupied by public authorities, with a total useful floor area greater than 500 m^2, must display an EPC label in a place clearly visible to the public.

The EPC may be issued by competent qualified technicians, according to the Royal Decree 235/2013, and in case of public buildings, by employees of public administration.

3.3 Implementation of mandatory advertising requirement – status

The EPC label will always be included in any offer, promotion and advertising concerning the sale or lease of the building or building unit, according the Royal Decree 235/2013.

3.4 Information campaigns

Specific information campaigns have been conducted for citizens with the objective to explain the aims of the building energy rating, as well as the rest of the features related to the building energy certification.

Furthermore, various conferences on the introduction and promotion of the building energy certification have taken place in all the Autonomous Communities, addressed both to the professionals in the sector and to citizens. In like manner, IDAE takes part in many sectorial fairs promoting, among other issues, the building energy certification.

IDAE's website and the website of the Ministry of Industry, Tourism and

Commerce, provide information on the building energy certification, as well as on the basic rating procedures and the recognised energy certification documents. The publication called 'Guia Practica de la Energia. Consumo eficiente y responsable' (Practical Guideline on Efficient Energy Consumption) informs the citizens about the building energy certification.

IDAE has published a collection of 12 guides called 'Calificacion de Eficiencia Energetica de Edificios' (Building Energy Efficiency Rating), describing the basic certification procedures, as well as the energy rating scale.

Apart from these specific campaigns, there were others of a more general nature that raise the awareness on energy saving in Spain. At national level, the brand 'Save Energy' was created, largely visible through the sponsorship of the Spanish national football team and of other events such as the Spain Cycling Tour, where the jersey of the race leader was also sponsored.

IDAE is developing a specific plan for the training and information on the energy certification of existing buildings. This plan was launched in 2012, and is dedicated to the training of certifying technicians, real estate agents, and citizens.

4. Inspection requirements - heating systems, air-conditioning

The energy efficiency inspection of cold and heat generators is regulated by the Regulation of Thermal Installations in Buildings, compulsory for all heat generators with a nominal heating capacity over 20 kW, and for all cold generators whose nominal capacity is over 12 kW.

4.1 Progress and current status on heating systems

Inspections are intended to analyse and assess the performance of the installation. Thermal Building Regulations, to be applied nationwide, establishes the minimum intervals for inspections of heat generators, depending on the kind of fuel used and the nominal capacity of the installation. The periodicity of the inspections may be increased if the Autonomous Community where the buildings are located chooses to do so, but currently all the Autonomous Communities in Spain are using the periodicity established in the national legislation.

Figure 5: Information campaigns in Spain.

4.2 Progress and current status on AC systems

The periodicity of the inspections for cold generators is not the same nationwide, and it is up to each regional Administration to fix the periodicity of these inspections. The Royal Decree 1027/2007 only establishes that periodicity must depend on the rated output of the generators (between 12 kW and 70 kW, and more than 70 kW). As an example, the periodicity set by the Autonomous Community of Navarre in the Formal Order 242/2009 is given in Table 4.

Galicia has reduced the periodicity for cold generators with a capacity higher than 70 kW to 2 years since the 24th of February 2010.

4.3 Any other relevant information

An inspection of the whole installation it is to be performed every 15 years according to the national regulations. The first inspection should be conducted at the same time as the first inspection of the heat or cold generator, and every 15 years thereafter.

The various Autonomous Communities have regulated the content of the energy efficiency inspections of thermal installations. Some Autonomous Communities have already regulated the

Table 4: Periodicity of heating systems.

Thermal Capacity [kW]	Fuel	Minimum periodicity
20 ≤P≤70	Gas and renewables	Each 5 years
	Other	Each 5 years
P>70	Gas and renewables	Each 4 years
	Other	Each 2 years

Table 5: Periodicity of AC systems.

Thermal Capacity [kW]	Minimum periodicity
12 ≤P≤70	Each 5 years
P>70	Each 3 years

Figure 6: Inspection guide.

detailed content of these inspections, taking into account the relevant CEN standards, which include the assessment of some aspects such as document registration, performance of the energy efficiency demands, evaluation of the generators output, safety conditions of equipment. These inspections also include a report on the installation, and a proposal of the improvement measures of the aforementioned safety.

IDAE, in collaboration with the Spanish Technical Association of Air-Conditioning and Refrigeration (ATECYR), published a collection of guides about energy saving and efficiency in buildings, including some on the energy efficiency inspection of heating and cooling installations.

Quality Assurance (QA)

The external control of the inspection also falls within the competence of the Autonomous Communities, which can decide on the type of controls to apply and the penalties to be imposed in case of finding deficiencies.

For the external control, the Autonomous Communities can count on authorised agents - which may be accredited bodies or organisations for the building regulatory field and its thermal installations - or independent technicians qualified by each Autonomous Community. The procedure to obtain this authorisation as qualified technician is defined by each Autonomous Community for its territorial scope. The Autonomous Communities that have regulated the external control make use of the so-called building quality control bodies, i.e., private companies that are hired by the Administration to perform that task. The specific requirements can vary from one region to another, but usually they include a series of technical and economical reliability requirements (experience, civil responsibility insurance, sufficient human resources). Autonomous Communities such as Galicia, Extremadura or Castilie – La Mancha have regulated the requirements set to the external control bodies in greater detail.

5. Conclusions and future plans

The adoption of the Energy Performance of Buildings Directive (EPBD) has significantly increased the number of requirements that buildings in Spain must meet. Nonetheless, the Royal Decree 235/2013 on the energy certification of existing buildings is still necessary to fully transpose the EPBD recast. This Royal Decree endows the energy certification of existing buildings with a regulatory framework. The next logical step will be to combine the subsidies of the Energy Saving and Efficiency Plan with the improvement of the building energy rating. In addition, given the compulsory consolidation of the recast EPBD, the Energy Performance (EP) requirements for buildings will have to be tightened in order to meet the cost-optimal requirements set forth therein. This revision will have to tighten the compulsory requirements for the building thermal envelope and the performance of thermal installations, as well as the efficiency demanded of lighting systems. The demands regarding the integration of Renewable Energy Sources (RES) should also be enlarged. A precise definition of a Nearly Zero-Energy Building (NZEB) will have to be developed for the different Spanish climatic zones, taking into account the heating and cooling demands, the use of the building, etc..

This process of revision of the current regulations (RITE) and the rules concerning the Energy Performance Certificate (EPC) has already started. The Spanish normative will be tightened gradually, to achieve the NZEB objective by 2020.

The legislation related to the certificate registration and the external control will also be extended to all the Autonomous Communities, which are also working in coordination with the ministries and a group created specifically to address issues concerning the building energy certification.

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The content of this report is included in the book “Implementing the Energy Performance of Buildings Directive (EPBD)”, ISBN 978-972-8646-27-1,

More details on the IEE Programme can be found at
ec.europa.eu/energy/intelligent

This individual report and the full book of national reports 2012 can be downloaded from www.epbd-ca.eu and also from www.buildup.eu