



CONCERTED ACTION ENERGY PERFORMANCE OF BUILDINGS

EPBD implementation in Spain

Status in December 2016

AUTHORS

Aitor Domínguez Martín

NATIONAL WEBSITES

www.mincotur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/Paginas/certificacion.aspx

1. Introduction

The transposition of the Directive of Energy Performance of Buildings began in Spain through legislative documents, published between 2006 and 2007, which pertain to the construction of new buildings, the design, execution and maintenance of thermal installations, and energy performance certification.

This first normative version has been revised and adapted over several years up to 2013, and updates of each of these documents have been republished again, in particular:

- RD 235/2013 on the Energy Certification of Buildings;
- RD 238/2013 on Thermal Installations of Buildings;
- The Technical Building Code, Order 1635/2013 of the Ministry of Development.

Since 2014, the main modifications are related to the basic methodology of calculating the energy performance of buildings. Royal Decree 235/2013 established both obligations and the appropriate mechanisms for the proper monitoring of the certification system in Spain, experts authorised to issue energy performance certificates (EPCs), the EPC registration system, control and inspection of certificates, as well as the obligations that involve the use of EPCs.

This document included references to the established methodology in Spain, published as Recognised Documents in the Official Website of Certification. The methodology was adapted to European Standards in 2014, thereby also addressing the problems which were detected through past experience.

Finally, in 2016, part of these documents was further adapted to improve processes, make the methodology more transparent, and eliminate barriers to new technological systems. One of the main changes that occurred was the inclusion of a second indicator for energy performance, complementing the CO₂ emissions indicator with one for non-renewable primary energy consumption.

2. Current Status of Implementation of the EPBD

The Spanish administration considers the transposition of the EPBD completed through the definition of appropriate mechanisms to achieve the set targets.

All aspects necessary for the correct transposition have been analysed and implemented through different actions, among which are normative, formative, and informative measures as well as public support plans and policies.

However, work continues to improve each of these processes in order to resolve the barriers and challenges that have arisen in recent years.

2.1. Energy performance requirements: NEW BUILDINGS

Energy performance requirements for new buildings in Spain are regulated through the Technical Building Code (CTE, Figure 1). This document is the guide and normative reference document for the construction and renovation of buildings in Spain.



Figure 1. Efficiency section in Technical Building Code document.

The document regulates both public and private buildings without distinction, including differentiated requirements for residential and non-residential buildings, and adapting the requirements in a differentiated way, based on knowledge of the national building stock.

In particular, since 2007, this CTE document includes five (5) specific sections related to energy performance requirements and renewable energy that must be considered during the construction of new buildings, as described in the 2002 directive.

The update was carried out in 2013, since it is mandatory to perform an update every 5 years, tightening these energy performance requirements.

2.1.i. Progress and current status of new buildings

With the publication of the CTE update in Spain in 2013, through the Order of the Ministry of Development 1635, three main changes were made to the previous Technical Code:

- Stricter energy performance requirements were established, increasing the requirements for both public and private buildings.
- The indicator system was modified and adapted to incorporate a new indicator for non-renewable primary energy consumption, which was recommended by European standards for energy performance published in 2008 and 2009.
- The requirements for the contribution of renewable energy sources to buildings were increased. The document increased the requirements for the contribution of renewable energy from solar thermal, and attempted to eliminate the technological barriers that had been detected up to now, which could hinder the implementation of the different renewable generation systems in new construction projects.

2.1.ii. Format of national transposition and implementation of existing regulations

Minimum requirements for the energy performance of buildings are established in Spain in the following document (CTE):

www.codigotecnico.org/index.php/menu-que-cte.html

This document contains the mandatory requirements to be followed, but it needs complementary guidelines which would allow for a better application of the regulatory requirements and a better understanding of the requirements by professionals.

These documents and guidelines can be found on the official website of the CTE in Spain, and in particular:

www.codigotecnico.org/index.php/menu-ahorro-energia.html

General methodology

The basic methodology adopted by the Spanish administration is common for both the energy performance certification of buildings and the establishment of minimum requirements for the construction of new and the renovation of existing buildings. In particular, it follows the specifications set out in the EPBD.

Following five years of operation, the methodology established in the regulatory reviews of 2013 tries to include some of the basic aspects set out in the European Standards for calculating energy performance, published in 2008.

Among others, the calculation methodology was corrected and partially adapted to consider European standards, as well as the use of indicators for different building typologies.

In general, Spain's calculation methodology is included in five (5) official computer software programmes, which are mandatory for energy certification, and are a very useful tool for compliance with the CTE.

The steps to be followed by this calculation methodology, and therefore by the computer software, are: firstly, to calculate the energy demand, both thermal and for domestic hot water and lighting; then, to calculate the energy consumption of the systems necessary to cover the demand. These calculations are made by integrating the building's needs on an hourly basis, and by a transitory time-scale regime.

With the above, the final energy consumption is calculated and extrapolated to non-renewable primary energy consumption and CO₂ emissions; these two indicators are finally evaluated and established by regulations.

Since the energy simulation software in Spain calculates the final energy consumption, it is necessary to have adequate conversion factors to obtain the non-renewable primary energy consumption and CO₂ emissions.

The primary energy factors and the methodology for obtaining them are published in the official document:

www.mincotur.gob.es/energia/desarrollo/EficienciaEnergetica/RITE/Reconocidos/Reconocidos/Otros%20documentos/Factores_emision_CO2.pdf

The electricity conversion factor is based on real data on fossil fuel energy consumption and energy generated from alternative sources. For the power plants of electricity production in Spain, it includes the energy losses during transportation and distribution. The statistical data of consumption used to generate this document includes the last seven (7) seasons. This document is also updated every five (5) years.

Cost Optimal

The limits established in the 2013 CTE for the consumption of non-renewable primary energy and for energy demand, were based on the Spanish cost-optimal calculations as foreseen in the EPBD. This document included cost-optimal calculations for all the building types included in the current regulations, for both residential and non-residential buildings, and for all climatic zones of Spain.

All new buildings in Spain, as well as buildings being rehabilitated, meet the CTE's established requirements, as this is mandatory for obtaining a building permit. It is thus not possible to build a building without complying with those regulations.

2.1.iii. Action plan for progression to NZEB for new buildings

The roadmap established in Spain for the construction and promotion of NZEB implies the compliance with the current CTE. These requirements have been demonstrated through the corresponding analysis of cost-optimal calculations, which indicates the most suitable and more restrictive possibilities according to what is considered state-of-the-art as well as the cost of implementing different construction solutions.

The roadmap establishes and provides for a revision of the limit values contained in the CTE in 2018, prior to the first phase of the NZEB entering into force according to the EPBD. Regarding the scope of planning

and promoting the construction of NZEB, the Spanish administration has published two additional documents including regulatory developments: the Housing Plan of the Ministry of Development, and the Renovation Strategy of the Spanish Building Stock, following the requirement established in the Energy Efficiency Directive.

Both documents are published in the following links:

www.fomento.gob.es/portal-del-suelo-y-politicas-urbanas/sistema-de-informacion-urbana/enlaces-relacionados/plan-estatal-de-vivienda-y-rehabilitacion/presentacion

www.fomento.gob.es/el-ministerio/planes-estrategicos/estrategia-a-largo-plazo-para-la-rehabilitacion-energetica-en-el-sector-de-la-edificacion-en-espana

The Housing Plan analyses the Spanish building stock and establishes guidelines to promote the evolution towards a more efficient sector. It contributes to reactivating the real estate sector, which is fundamental for the promotion of the rehabilitation of buildings, and to regenerating urban or rural areas.

In parallel, the Renovation Strategy analyses the existing building stock, as well as the needs of the stock in the field of renovation, including renovation scenarios in order to meet the established requirements for both national and international commitments.

2.1.iv. Requirements for systems and / or building components for new buildings

The energy performance requirements for heating, cooling and domestic hot water generation systems are regulated in Spain through the Regulation of Thermal Installations of Buildings (RITE), and those for lighting in non-residential buildings through the CTE.

www.boe.es/boe/dias/2007/08/29/pdfs/A35931-35984.pdf

The RITE is a technical document of a regulatory nature; therefore, it is mandatory to obtain installation permits for the use of thermal energy systems. It regulates, among others, the following aspects:

- requirements for the correct dimensioning and assembly of thermal systems;
- minimum performance of heat generating systems, cooling and domestic hot water;
- the mechanism and periodicity of safety and energy performance inspections.

This document was updated and published in 2013 through Royal Decree 238/2013, and a new update is planned in five (5) years' time.

2.II. Energy performance requirements: EXISTING BUILDINGS

Energy performance requirements for the renovation of existing buildings are also regulated in the CTE. According to the CTE, deep renovations in Spain must comply with the energy performance requirements established for the construction of new buildings. For partial renovations, the requirements vary according to the parts of the building that are being renovated.

2.II.i. Progress and current status of existing buildings

The 2013 revision of the CTE was in line with the requirements established in the previous document of 2007, though effectively tightening them up, mainly because the requirements for deep renovations were set to be the same as for new buildings. This section will analyse the requirements for the partial renovation of buildings.

In general, it can be considered that the maximum and minimum limit values of the 2013 CTE for partial renovations of buildings are similar to the limit values that newly constructed buildings had in the CTE of 2007. These values have been obtained based on the cost-optimal calculations made by the Spanish administration.

This change implies a tightening of requirements, which is also reflected into the actual construction trends identified in recent years. The building sector has been able to incorporate new components into buildings, taking advantage of the progress that had to be made for the construction of new buildings, and applying it now to the renovation of existing buildings.

2.II.ii. Plans to improve the existing building stock

Since there is a large stock of buildings with low energy performance, the main objective in Spain, in terms of the energy performance of buildings in recent years, has been to establish a renovation standard with high performance criteria.

This effort is translated into action plans, based on public support, and a Renovation Strategy, which have led to the energy renovation of buildings to meet the CTE requirements. This criterium also defines the current NZEB levels in Spain, which means efforts are centred around the transposition of the building stock towards NZEB levels.

Current Renovation Support Plans which relate to building renovations are the following:

- the National Government Building and Renovation Support Plan of the Ministry of Public Works;
- the IDAE PAREER support line.

National Government Building and Renovation Support Plan

The National Government Building and Renovation support plan is developed through collaboration agreements with the Autonomous Communities, which include, among others, actions for the renovation of buildings and neighbourhoods. In particular, they aim to reduce the energy demand of buildings, with a focus on the building envelope, wall insulation, roofs and floors, and window replacement.

www.fomento.gob.es/arquitectura-vivienda-y-suelo/programas-de-ayudas-a-la-vivienda/programa-de-fomento-de-eficiencia-energetica-y-sostenibilidad-en-viviendas

The targets are single-family housing and buildings. A 20% - 35% reduction in the global annual energy demand for heating and cooling is required and public support ranges between 40% and 75% of the final investment.

Regarding PAREER grants

PAREER grants exist exclusively to improve the energy performance of buildings and the incorporation of renewable energy. The programme includes aid for the improvement of the thermal envelope of the building, the replacement of cooling, heating and domestic hot water generation systems with high efficiency ones, as well as the installation of renewable energy systems using geothermal or biomass fuel.

The plans to improve and increase the national renovation of existing buildings according to the EED (Energy Efficiency Directive), are developed in the Renovation Strategy, prepared and submitted by the Ministry of Public Works and Development, which envisages the lines of public support previously described. This document includes different alternatives and possible scenarios for the evolution of the building stock based on the actions carried out.

2.II.iii. Regulation of system performance, distinct from whole building performance

The analysis of the performance of thermal generation systems in Spain is carried out through the Regulation of Thermal Installations of buildings. One of the main aspects that has been improved in recent years, and that is helping to renovate the thermal generation systems, is the PAREER¹ support line.

This programme has a specific section that encourages the replacement of thermal generation systems with more efficient ones, with aid of up to 30% for large-scale replacements. This aid has proved to be effective due to the high volume of applications received in recent years.

The evaluation mechanism to check the effectiveness of this aid programme is based on the energy rating; to qualify for aid, it is necessary to improve the energy performance rating of the building by at least one energy class. Therefore, it has a dual benefit: it encourages energy performance certification beyond sale and rental purposes, while at the same time encouraging the revitalisation of the sector, with the replacement of high-performance systems in thermal generation.

2.II.iv. Encouragement of intelligent metering

The aid programmes support energy improvement measures only if the energy performance rating of the building shows an improvement of at least one energy class. The actual improvement of the energy performance must be shown, analysed and tested by the official certification programme. Therefore, in order to achieve the necessary improvement to qualify for aid support and opt for the grants, one of the aspects to consider is the inclusion of intelligent metering systems. Intelligent metering is thus indirectly encouraged through the above-mentioned aid programmes.

2.II.v. Financial instruments and incentives for existing buildings

In order to encourage and promote the implementation of renovation actions that favour energy savings, the improvement of energy performance, the use of renewable energy and the reduction of carbon dioxide emissions in existing buildings, the Spanish administration, through the Institute for Energy Diversification and Savings (IDAE), launched a specific programme of support and financing endowed with economic funds. This programme also served to achieve the objectives established in Directive 2012/27/EU on energy

efficiency, and created opportunities for growth and employment in different economic sectors, especially in the construction sector, to favour urban regeneration.

2.II.vi. Information campaigns / complementary policies

To achieve the planned energy savings and energy performance of buildings in Spain, annual communication campaigns have been highlighting the most critical aspects and their related potential.

Following this line, the Institute for Diversification and Energy Savings (IDAE) holds yearly communication campaigns which are published and broadcast via television media, press and radio (Figure 2).

The link to one of the communication campaign programmes is indicated here:

www.idae.es/ahorra-energia/campanas-y-acciones-de-acompanamiento



Figure 2. IDAE advertising campaigns.

2.III. Energy performance certificate requirements

The status regarding building energy performance certification in Spain is currently being analysed. Once the relevant legal documents are published, and the corresponding systems for registration, control and inspection of EPCs throughout the Autonomous Communities are fully in place, first results on building energy performance certificates will become available.

2.III.i. Progress and current status on sale or rental of buildings and EPCs

The Spanish regulation establishes obligations to certify residential and commercial buildings in an indistinct manner, provided that a purchase or rental transaction of the building is made. In the case of public buildings, the obligation since 2015 includes all those with a size above 250 m².

The information of the energy performance certificates (EPCs) is collected and registered in each of the seventeen (17) Autonomous Communities and in the two (2) Autonomous Cities of Spain; thus, nineteen (19) official EPC registries have been established.

The regional registries originally obtained information directly from the EPC issued in paper format and collected information on building owners, certifiers, and the physical location and identification of the building, as well as information on the overall qualification obtained. The information collected nowadays from the EPCs has changed substantially since 2016, when the certification software was updated to generate a digital file with building information that included partial indicators on consumption, emissions, and construction characteristics of the buildings, as well as the power generation systems and improvement measures.

All this information is included in the EPC databases, but there is not yet an integrated database that aggregates the information from the nineteen registers into one single database. Therefore, each regional registry compiles its specific report on the state of the certificates, and the reports are published every six (6) months on the official certification website.

www.mincotur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/Documentos/Paginas/documentosInformativos.aspx

There are currently three million issued EPCs, covering both new and existing buildings (Figure 3).

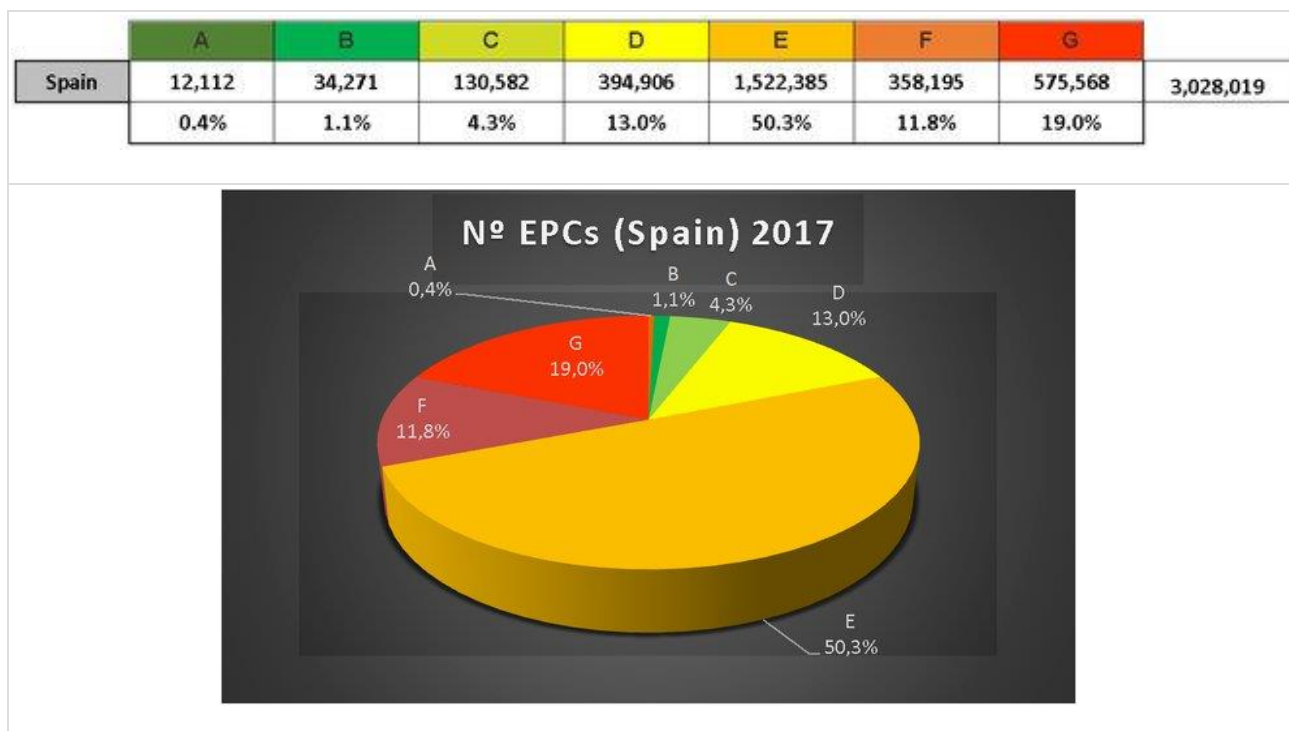


Figure 3. Number of registered certificates (Dec 2017) (source: CCAA registration).

2.III.ii. Quality Assurance of EPCs

In addition to incorporating EPC information into their databases and issuing the registered energy performance label, the aforementioned Autonomous Communities registries are also responsible for control and inspection works.

Control and inspection of EPCs has been established in a differentiated manner in each region, while maintaining basic requirements, such as establishing a statistical control based on the obtained qualifications, as well as establishing mechanisms to prioritise some controls and carrying out inspections in several stages with several degrees of depth.

The current situation is that 100% of the certificates are automatically controlled, thanks to computer mechanisms that evaluate all the certificate data, and generate automatic notices about certificates that do not correspond with reasonable average parameters.

Additionally, a document control is carried out on nearly 50% of the certificates using complementary information.

There are also specific inspection mechanisms that reach 0.5% of the certificates in terms of information review and improvement measures, and a deep inspection system, with a visit to the building, which occurs 0.05% of the time.

The number of inspections and controls as of 2017 are given in Table 1.

Document Control	Visits to the property	Verification of Competent Technicians	Inspection and Control of Advertising	Completed Inspections	Sanctions
1,392,880	15,140	27,029	9,084	1,211	545

Table 1. Number of inspections and controls as of 2017 in Spain.

2.III.iii. Progress and current status of EPCs on public and large buildings visited by the public

The obligation to obtain an EPC for public buildings when its total useful area exceeds 500 m² dates from June 2013. As of 9 July 2015, the obligation for public buildings stands when the total useful area is greater than 250 m², and from 31 December 2015 when the total useful area exceeds 250 m² and is under lease.

The obligation also stands for privately-owned buildings that are frequented visited by the public, when they are sold or rented.

The registration, control and inspection system for this type of building is the same as for the rest of the buildings, and there are no specific additional measures for compliance.

2.III.iv. Implementation of mandatory advertising requirement - status

The obligation to show the energy performance label follows the same calendar and the same pattern as that for obtaining it, according to article 13 of RD 2015/2013.

In Spain, it is mandatory that sale or rent advertisements of buildings include the energy performance label. This requirement is contained in Law 8/2013 on sanctions in the field of energy performance, as one of the cases that may imply economic sanctions. No additional actions have been undertaken in order to explicitly assess compliance with this requirement.

2.IV. Inspection requirements - heating systems, air conditioning

Following the requirements established in the EPBD, Spain has developed an inspection system for thermal installations which is published in the Regulation on Thermal Installations of Buildings.

2.IV.i. Report on equivalence of model A and B for Heating Systems

The inspection system in Spain has been implemented since 1998 through Royal Decree 1751, although the 1980 regulation already referred to the inspection of energy consumption in AC installations, prior to the publication of the first Directive of Energy Efficiency in Buildings (EPBD). Since Spain had already established a system of specialised technicians and inspectors, the most appropriate option for Articles 14 and 15 of the said Directive was to maintain and improve the existing inspection systems.

After the publication of the Directive, the national regulations have been adapted and the inspection of AC systems currently pertains to the following aspects:

- initial inspections;
- periodic energy performance inspections;
- complete periodic inspections.

The mechanism is customised within the Autonomous Communities (Figure 4).

The company or entity that carries out the inspection must issue a certificate of inspection that becomes part of the documentation of the installation; this certificate must follow a specific model established by the different Autonomous Communities.

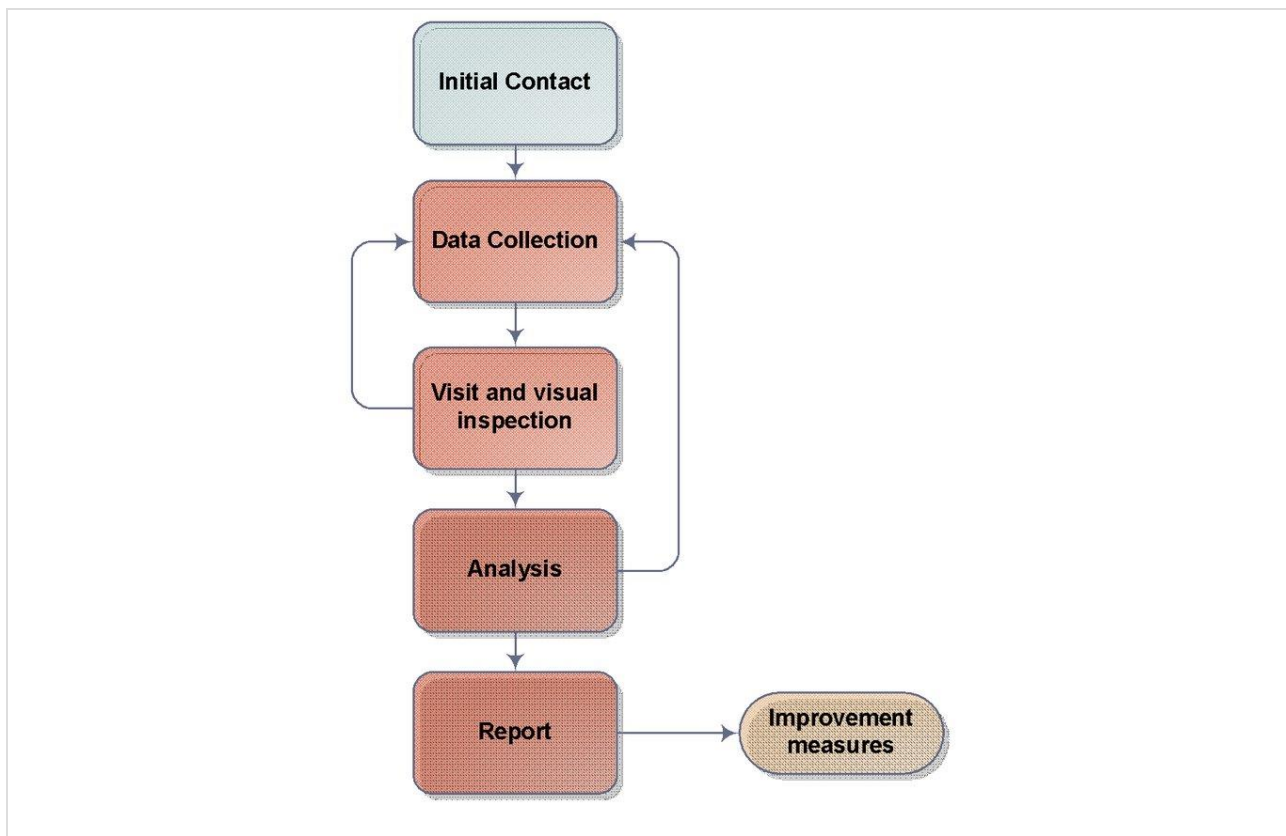


Figure 4. Established scheme for inspection.

2.IV.ii. Progress and current status on heating systems

Due to the territorialisation and competences regarding inspections in the Autonomous Communities in Spain, the current situation of heating inspection systems in buildings is different for each of the seventeen Communities and two Autonomous Cities.

The main actions carried out to improve the energy performance of the systems are based on training courses, as well as on specific aids for the replacement of low performing systems with others of high efficiency, namely the previously described PAREER².

2.IV.iii. Progress and current status on AC systems

The Regulation of Thermal Installations holds the owners of the installations responsible for the mandatory inspection of their thermal installation (Article 25).

At present, AC systems with a rated power equal to or greater than 12 kW must be inspected. The objective of these inspections is to verify the level of energy performance of fixed thermal installations aimed at the health and well-being of citizens.

The agents and inspection entities in Spain, which also cover heating systems, are the Autonomous Communities, which establish the procedures for the accreditation of entities and agents for their realisation. This accreditation obtained in an Autonomous Community allows in any case the performance of technical inspections in any part of the national territory (Article 29).

Accredited agents usually are:

- authorised control organisations;
- competent technicians accredited by an accredited entity for the certification of persons;
- maintenance companies.

In the case of Madrid, the link is as follows:

www.madrid.org/cs/Satellite?c=CM_Tramite_FA&cid=1354361028204&definicion=ComunicacionesDeclaraciones&language=es&pagename=ComunidadMadrid%2FEstructura&pid=1109265444835&segmento=1&tipoServicio=CM_Tramite_FA#.V-DfaYhF9Uk.facebook

Following the established procedure, the owner of the system selects the agent or inspection entity of his choice from a public list of qualified or accredited experts, companies or entities, which is updated by the Autonomous Community.

The Autonomous Communities themselves have control systems over the inspections, as well as the agents, companies or entities that carry them out.

2.IV.iv. Enforcement and impact assessment of inspections

Enforcement and penalties

There is no specific registry that holds the aggregate information of the nineteen (19) national inspection bodies.

Quality control of inspection reports

A number of explanatory and consultation guides have been developed to support specialised technicians in providing higher quality AC systems. The guides are published on the official website of the Regulation of Thermal Installations of buildings:

www.mincotur.gob.es/energia/desarrollo/EficienciaEnergetica/RITE/Reconocidos/Paginas/IndexDocumentosReconocidos.aspx

The guides are summarised in Table 2.

Guides	Links
Maintenance of thermal installations	<u>Mantenimiento de instalaciones térmicas</u>
Procedures for determining the energy efficiency of water chillers and autonomous air treatment equipment	<u>Procedimientos para la determinación del rendimiento energético de plantas enfriadoras de agua y equipos autónomos de tratamiento de aire</u>
Design and calculation of the thermal insulation of pipes, appliances and equipment	<u>Diseño y cálculo del aislamiento térmico de conducciones, aparatos y equipos</u>
Cooling towers	<u>Torres de refrigeración</u>
Periodic energy efficiency inspection procedure for boilers	<u>Procedimiento de inspección periódica de eficiencia energética para calderas</u>
Consumption accounting	<u>Contabilización de consumos</u>
Central sanitary hot water	<u>Agua caliente sanitaria central</u>
Thermal biomass installations in buildings	<u>Instalaciones de biomasa térmica en los edificios</u>
Practical guide on centralised heating and domestic hot water installations in residential buildings	<u>Guía práctica sobre instalaciones centralizadas de calefacción y agua caliente sanitaria (ACS) en edificios de viviendas</u>
Design of efficient heating plants	<u>Diseño de centrales de calor eficientes</u>
External climatic conditions of the project	<u>Condiciones climáticas exteriores de proyecto</u>
ASIT guide for solar thermal energy	<u>Guía ASIT de la energía solar térmica</u>
Savings and recovery of energy in AC installations	<u>Ahorro y recuperación de energía en instalaciones de climatización</u>
Design of closed-circuit geothermal exchange systems	<u>Diseño de sistemas de intercambio geotérmico de circuito cerrado</u>
AC installations with autonomous equipment	<u>Instalaciones de climatización con equipos autónomos</u>
Water conditioning installations	<u>Instalaciones de climatización por agua</u>
Selection of fluid transport equipment. Pumps and fans	<u>Selección de equipos de transporte de fluidos. Bombas y ventiladores</u>

Table 2. Published guides on control, design and inspection.

Impact assessment / Costs and benefits

There is no economic analysis and impact on that matter.

3. A success story in EPBD implementation

One of the best-case success stories considered in Spain, due to its impact on compliance with the EPBD, is the PAREER-CRECE³ support programme (Figure 5).



Figure 5. PAREER-CRECE support programme.

This programme has been created to encourage and promote the implementation of reform actions that favour energy savings, the improvement of energy efficiency, the use of renewable energy and the reduction of carbon dioxide emissions in existing buildings.

It has been designed to create opportunities for growth and employment in different economic sectors, especially in the construction sector, to favour urban regeneration.

The management of this programme lies with the Institute for the Diversification and Savings of Energy (IDAE), which has managed the programme with funds worth 200 million €.

The programme is designed to encourage the renovation of buildings, including the following actions:

- improvement of the energy performance of the thermal envelope;
- improvement of the energy performance of thermal and lighting installations;
- replacement of conventional energy in thermal installations by biomass;
- replacement of conventional energy in thermal installations by geothermal energy.

The criterium established to evaluate and limit the technical quality of the renovations is the energy performance rating. The actions supported must improve the total energy performance rating of the building by at least one (1) energy class measured in the scale of carbon dioxide emissions (kg CO₂/m².year).

Each project can opt for two types of support:

- financing
- repayable loans

The characteristics of the aids are included in Table 3.

TYPOLOGY		MAXIMUM SUBSIDY	MAXIMUM LOAN
ENERGY EFFICIENCY	TYPOLGY 1. Improving the energy performance of the thermal envelope	30%	60%
	TYPOLGY 2. Improvement of the energy performance of thermal and lighting installations	20%	70%
RENEWABLES	TYPOLGY 3. Substitution of conventional energy in thermal installations by biomass	25%	65%
	TYPOLGY 4. Replacement of conventional energy in thermal installations by geothermal energy	30%	60%

Table 3. Typologies and support of the PAREER-CRECE programme.

The results of the programme have involved requests for help that have exceeded 235 million € through more than 1,500 projects that are currently being executed.

To date, 377 cases have been evaluated, which involve improving the energy efficiency of:

- 14,768 homes;
- 1,787 rooms in 12 hotels.

It is estimated that a final energy saving of 7,487 toe / year will be achieved through said projects.

A success story is the renovation of the "Oscar" Building in San Sebastián de los Reyes (Madrid) (Figures 6 and 7).

The action consisted of the renovation of the thermal envelope in a building of 80 existing housing units.



Figure 6. Renovation works "Oscar" building in San Sebastián de los Reyes (Madrid).

The building was constructed in 1991 under a 1979 regulation for thermal insulation; with assistance from the programme for the energy renovation of existing buildings, PAREER-CRECE of the IDEA, 80 millimetres of expanded polystyrene insulation was installed. All windows were renovated and now achieve transmittance values of $U = 1.8 \text{ W} / \text{m}^2 \text{ K}$. The shell has also been insulated, and the lighting systems of common areas and garages have been replaced by LED lighting.

The result has been a two (2)-energy class improvement in the EPC rating, from an E to a C, with an estimated final energy saving of 44% and a reduction in primary energy demand of 53%.

This project has had a total cost of 1.06 million € and has received a subsidy of 240,000 €.



Figure 7. "Oscar" building in San Sebastián de los Reyes (Madrid) after rehabilitation.

4. Conclusions, future plans

The transposition of the EPBD in Spain is generally considered to be completed. For many of the specific actions that this Directive specifies, efforts have been made to publish the legal provisions that regulate it, in any case adapting them to the characteristics of the buildings in Spain, as well as to climatic and construction characteristics, and to the characteristics of professional sectors in charge of carrying out the necessary work to achieve the objectives.

In this sense, many of the difficulties encountered while implementing a roadmap which allows the achievement of the objectives while assessing both economic and social impacts, have been resolved in recent years.

After several years of operation of the first legislative publications which regulate the construction of new buildings, including renovation, inspection systems and the energy performance certification of buildings, the first positive results are beginning to show. Revisions have been made every five years, solving many of the problems with localised barriers and giving rise to a new normative package published in 2013. Forthcoming challenges are expected to be addressed in 2018 and 2019.

Future plans include the continuation of actions that are reporting energy savings in the building sector, while also reviewing the minimum performance values according to the latest cost-optimal calculations. Plans will also involve solving barriers related to energy performance certificates, improving their quality and expanding their use, as well as increasing the awareness and knowledge around building energy performance, with defined objectives for 2020 based on NZEB.

Endnotes

1. Programa De Ayudas Para La Rehabilitación Energética De Edificios Existentes (PAREER)
2. Programa De Ayudas Para La Rehabilitación Energética De Edificios Existentes (PAREER)
3. Programa De Ayudas Para La Rehabilitación Energética De Edificios Existentes 2 (PROGRAMA PAREER-CRECE)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 692447.

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the views of the European Commission. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.