PART 2

STANDARDISING EUROPEAN EPCs

THE CASE OF RESIDENTIAL BUILDINGS

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ESREI BY OID
EUROPEAN SUSTAINABLE REAL ESTATE INITIATIVE

EDITORIAL

By ESREI
Steering Committee

Following a summer of extreme climate events against the backdrop of a global energy crisis, and an autumn dominated by the question of reducing energy consumption, the issue of buildings' energy performance is more relevant than ever. What are the ways to quickly and effectively improve the energy consumption of buildings in Europe? How can we reduce buildings' dependence on fossil fuels? How can renovations be carried out while maintaining social equity?

These questions motivated the European Commission's proposal to revise the Energy Performance Building Directive (EPBD), and its most concrete expression: Energy Performance Certificates (EPCs). In this new instalment, the European Sustainable Real Estate Initiative (ESREI), driven by OID, extends the analysis of EPCs in Europe that featured in our first publication, this time with **a focus on residential EPCs**. In Europe in 2020, **housing was responsible for 27% of final energy consumption, 40% of gas demand, and 11.8% of CO_2 emissions**, making it a priority area for energy renovation and decarbonisation.

The EPBD recast modifies EPCs to make them the cornerstone of the energy transition for buildings. In this study we therefore compare national EPC practices in the light of the new EPBD requirements, similar to performance thresholds (NZEB, nZEB, minimum performance standards).

With the spectacular hike in energy prices, the housing energy transition is as indispensable as it is complex! We therefore aim our study at pan-European actors managing residential portfolios, in order to help them stay on course to implement the housing transition.

INTRODUCTION

At COP21 in 2015, the European Union, its Member States, and other countries committed to reaching carbon neutrality by 2050. Several laws and strategies have since been rolled out in Europe with the aim of reaching this common objective, including the **Green Deal and the "Fit for 55" legislative package**. The building sector represents 40% of energy consumption and 36% of greenhouse gas emissions, making it the biggest consumer and emitter at European Union scale. Improving the energy performance of buildings in all European countries therefore constitutes an important cornerstone of strategies to reach the decarbonisation targets set at EU level.

The Energy Performance of Buildings Directive (EPBD) introduced the energy performance certificate (EPC) system in the mid-2000s, in order to measure the performance of the building stock and promote more efficient buildings. Since then, the EPBD has undergone several revisions and EPCs have progressively become a mandatory reference at different stages in the lifecycle of a building. The various Member States have in the meantime applied their own regulations based on the EPC system. Featuring in the EU Taxonomy and certain national strategies and regulations, the EPC has become an important indicator of energy performance, with each EPBD revision providing more details on requirements, and introducing new ones.

This study is part of a three-volume publication on European EPCs. The first part presented the European regulations in force and made an initial comparison. This second part looks at EPCs in the residential sector. The third part will focus on office buildings.

The OID here presents the second part, featuring a detailed **comparison of European EPCs for residential buildings in the panel of selected countries, i.e. Germany, France, the United Kingdom, Italy, Spain, Luxembourg, Denmark, Belgium and the Netherlands**. Because of the share of energy consumption and GHG emissions attributed to them, residential buildings are a priority for energy renovation and decarbonisation. The surge in the cost of energy and the discomfort of summer temperatures also mean that housing is concerned by issues of social justice and adaptation to climate change.

What evaluation methods and scopes are implemented in residential EPCs? What national and European requirements are associated with this energy performance indicator? What potential improvements would ensure more effective deployment? These are some of the questions that this second study by the ESREI programme attempts to answer.

SUMMARY

THE EPBD: A CRUCIAL FRAMEWORK FOR EPCs

ENERGY PERFORMANCE AND DECARBONISATION ISSUES

The Energy Performance Building Directive 2002/91/EC was adopted in late 2002 and came into force on 4 January 2006 for all Member States. The directive is part of the general European Union policy aimed at improving the economy's energy efficiency and complying with the Kyoto Protocol defined in 1997.

The directive centres on the building sector, which is a huge energy consumer and emitter of greenhouse gases (GHG) in Europe, by defining the application of minimum energy performance requirements for buildings. It also establishes a general method to calculate energy performance and anticipates its certification by independent experts. **The 2002 directive has been revised twice, in 2010 and 2018**, to align energy efficiency ambitions with the target of reducing the carbon intensity of the EU building stock by 2050. The framework established by the EPBD therefore aims at the building sector as a whole, covering both new and existing buildings of all types.

The main aim of EPCs is to make the estimated energy performance of a building clear and comparable for all future owners and tenants. To achieve this, EPCs feature a summary of the estimated annual energy requirements in kilowatt-hours of primary energy per square metre, and a comparison of the results with reference values for similar buildings according to a scale. **The widespread use of EPCs in recent years has made them a public policy instrument**: EPCs are employed to measure the extent of the building stock's energy efficiency, to stimulate renovation (like the phasing-out of energy bands G and F from the French rental market), and to (re)direct property investments towards the most energy-efficient products.

RESIDENTIAL EPCs IN THE EPBD

As a European directive, the EPBD is transposed into the different national legal frameworks of the EU Member States. The table shows for each country the year at which energy performance certification, made mandatory by the EPBD, was transposed into the national leglislation for residential buildings.

	Year of national implementation of the EPBD
Germany	2002
United-Kingdom *(EN&WA)*	2006 to 2008
United-Kingdom *(ST)*	2003 to 2008
United-Kingdom *(N-IRE)*	2006 to 2008
Italy	2005
Spain	2006 to 2007
The Netherlands	2008
France	2002
Luxembourg	2007 to 2008
Belgium *(FLA)*	2004
Belgium *(WA)*	2007
Belgium *(BRU)*	2007
Denmark	2006

Tab. 1: Introduction of residential EPCs in national or regional legislations of 9 European countries. Source: CA EPBD.

From one country to the next, the integration of European recommendations and obligations in national legislation was neither linear nor simultaneous, and each country has taken a different amount of time to adapt to the requirements. While national transposition dates were fairly close for non-residential buildings, they took place later for public buildings.

STATE OF PLAY FOR THE NEXT REVISION

The rising role of EPCs in the EU has revealed shortfalls relating to both the methods employed and the reliability of results, which motivated the European Commission to **standardise the measure in a suggested recast of the EPBD published on 15 December 2021** and currently in the process of being approved.

Faced with the limitations resulting from an absence of European standardisation of EPCs, and echoing the strategy of the Renovation Wave that started in 2020 (announcing a doubling of the renovation rate by 2030) and the "Fit for 55" legislation package, **the proposed EPBD recast aims to clarify this tool for measuring energy performance and performance targets for 2050.**

The main developments include a new requirement for energy consumption to be expressed as primary energy in the format kWh/(sqm.year), accompanied by a stipulation of whether its origin is renewable or not.

In addition, the proposed revision introduces the obligation to establish **minimum energy performance thresholds for the entire EU property stock**, aligned on band E for residential buildings in 2033. The validity of EPCs in bands D to G will also be reduced from ten to five years.

At the other end of the energy scale, **the EPBD targets the concept of NZEB (Nearly Zero Energy Buildings) to standardise the A energy band by 2026.** NZEB status is defined based on a table of maximum consumption thresholds for different European countries. The different consumption thresholds recommended in the EPBD revision will have to be indicated in future EPCs in order to ensure comparability.

The definition of a ZEB also involves calculating a global warming potential (GWP) indicator over the entire lifecycle and including it in the building's energy performance certificate. The ZEB requirement should apply from 1 January 2027 to public buidings, from 2030 to all new buildings, and from 1 January 2027 to all new buildings occupied or owned by public authorities.

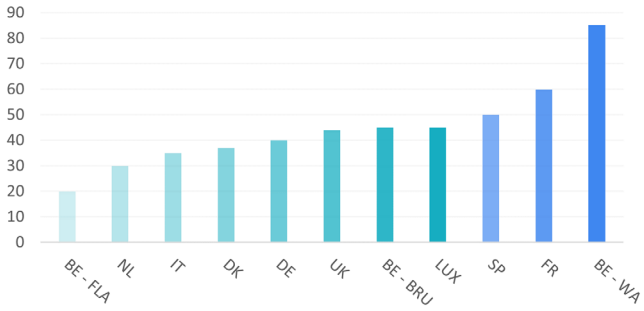

Fig. 1: NZEB standards taken from the BPIE 2020 online conference (except UK from a 2015 BPIE publication) for residential buildings in kWh/sqm per year.

Similarly, EPCs will feature a renovation passport with step-by-step details of the renovation required to reach the NZEB threshold and the related costs and cost-effectiveness. Member States will be required to establish extensive renovation strategies to bring the entire building stock to the level of zero emissions by 2050. To achieve this goal, a calendar is established gradually phasing out the most inefficient energy bands in national property markets, in addition to the economical renovation recommendations previously included in the 2010 and 2018 revisions.

Lastly, Member States will have to create national databases open to the public on energy performance, which will be transferred to the EU Building Stock Observatory.

EPCs will also become more transparent and reliable, and play a key information role in the renovation of EU buildings.

RESIDENTIAL EPCs: TECHNICAL FRAMEWORK

Having established the general framework for EPCs, and their transformation into a central tool for energy renovation in housing, in the second part of this study, we compare the existing regulations and methods applying to residential EPCs in Europe.

GENERAL COMPARISON

The differences and similarities of residential EPCs should be related to the broad guidelines of the EPBD, since the energy performance of a building is "*determined on the basis of calculated or actual energy use and shall reflect typical energy use for space heating, space cooling, domestic hot water, ventilation, built-in lighting and other technical building systems*" in the version currently in force.

The directive stipulates the range of consumption items to be considered and authorises two types of methodology (see tab.2 below):

- A method based on the calculated energy consumption (known as "asset rating "), which uses software to make a theoretical estimation,
- A method considering actual energy consumption over a given period compared with the floor area of the building.

	Asset rating method	Actual consumption method (from bills)
Consumption items	Heating, cooling, hot water, ventilation, lighting and auxiliary equipment.	Theoretically: heating, cooling, hot water, ventilation, lighting and auxiliary equipment. **In practice**: **all consumption**, unless sub-meters available.
Principle	Considers the physical characteristics of the building: - geographic **location**, **orientation** and **compactness** of the building's energy-losing surfaces; - heated surface, **thickness of walls**, **nature of insulation**, **thermal bridges**; - number and efficiency of **apparatus** (heating and ventilation), on-site; - **external input** (solar radiation) and **internal input** (heat from domestic apparatus and occupants).	**Annual average consumption data** from energy bills (inc. electricity, gas, fuel oil) of the building over a **representative time period**.
Occupation	**Standard scenarios** depending on the surface and time period (day / night, week / weekend, etc.)	**Actual**, depending on the number of people and the duration of occupation represented by energy bills.
Data source	- Plans & technical documentation - On-site visits	Energy bills
Reliability and comparability of results	**Estimated** **One building comparable with another (if same type)**	**Actual, depending on usage** **Incomparable**

Tab. 2: Comparison of technical criteria for both types of methodology used to calculate EPCs.

TWO METHODS TO MEASURE ENERGY CONSUMPTION: WHAT ARE THE CONSEQUENCES?

While seemingly similar, the two methods used to calculate the energy performance of buildings authorised by the EPBD nevertheless generate very different results for the same building due to the place given to **usage**.

In fact, the calculated (asset rating) method is based on an objective analysis of the physical characteristics of the building envelope applying a standard occupation scenario, whereas the actual consumption method is based on the total energy consumption (from energy bills) in relation to the floor area.

Most buildings are not equipped with sub-metering to distinguish different types of consumption, such as heating, ventilation and lighting, and so the energy performance is calculated by adding up all of the consumption featuring on energy bills, including domestic appliances and computers, which considerably increases the final amount.

In addition, the large difference in the scope taken into account for the calculation means that the two methods cannot be compared. The asset rating method determines the potential performance of the building, supported by physical and technical components that constitute potential levers for improving the building's energy performance. The actual consumption method takes significant account of the usage of the building, meaning that the main lever of action in this case is changing user behaviour.

From a legal point of view, as its name indicates, the EPBD is a directive, which means that, unlike a regulation, it is not directly transposed into Member States' legislation. Each country can therefore interpret the directive as it sees fit when adopted in national law, which explains some of the differences observed between countries. Nevertheless, while a degree of interpretation is left to the discretion of states, it is limited by the obligation to apply "*their national calculation methodology following the national annexes of the overarching standards*" .

These standards cover all aspects of a building's energy performance, from the definition of external physical variables to the calibration of internal physical parameters, and including the definition of the general framework for energy ratings (EN ISO 52003-1).

By construction, the asset rating method is particularly subject to the following variables:

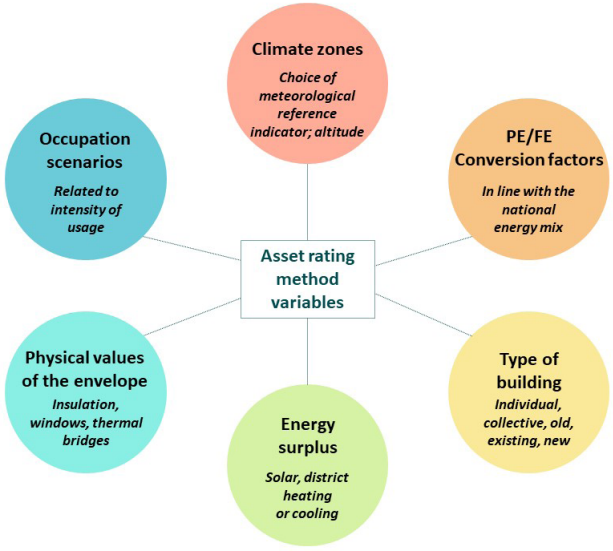

Fig. 2: Variables of the asset rating method.

While physical parameters are difficult to change from one country to the next, like an envelope's heat transfer coefficients, other variables are highly dependent on the cultural and political context, which varies between countries. Occupation scenarios therefore relate to lifestyles and the intensity of usage accepted in housing (average number of people per household, surface per inhabitant), while the definition of climate zones, and in particular the primary and final energy conversion factors, are determined by the states.

PRIMARY ENERGY/FINAL ENERGY: THEIR EFFECT ON BUILDINGS

Final energy designates the energy actually consumed by the user of a building. It corresponds to the values recorded on meters and invoiced.

Primary energy corresponds to the energy that comes from natural resources, before processing. In addition to the final energy consumed, it takes into account the energy required for the production, storage, transport and supply of final energy. It is calculated by adding up all of the energy required to obtain a unit of final energy.

This distinction is particularly relevant for electricity. Losses are considerable with classic means of thermal production (gas, coal) and nuclear power, which negatively impacts the conversion rate. In contrast, wind and solar power have a conversion rate of 1.

The choice of electric conversion coefficient is therefore far from neutral and depends on political decisions in terms of the electricity mix. Consequently, it makes it hard to compare energy ratings following national electricity mixes.

All of the countries in our sample apply a calculation method based on the calculated requirement, apart from Germany, which still applies a specific method to existing buildings.

Concerning energy bands, the United Kingdom, Spain and Italy do not present energy performance on a graduated scale in kWhPE/(sqm.year), but instead apply a relative scale. The performance of the building in question is compared to a reference building.

The United Kingdom for example rates energy performance on a scale from 0 (very inefficient) to 100 (highly efficient), and uses no other unit.

The other six countries presented here mainly employ two types of unit:

- kWhPE/(sqm.year), independently from the energy source,
- kWhPE/(sqm.year), stipulating whether the energy source is non-renewable (Italy and Spain) or fossil energy (Netherlands).

Unlike the other countries, Germany initially expresses energy performance in terms of final energy, but then converts it into primary energy so that it features on the EPC in the format recommended by the EPBD.

	Calculation method newbuilds *(name)*	Calculation method existing *(name)*	Unit(s)
FR *Diagnostic de Performance Energétique*	**Calculated requirements** *(method 3 CL)*	**Calculated requirements** *(method 3 CL)*	. kWhPE/(sqm.year) . kgCO2/(sqm.year)
UK *Domestic Energy Performance Certificate*	**Calculated requirements** *(Standard Assessement Procedure)*	**Calculated requirements** *(Reduced Data SAP)*	No unit
DE *Energieausweiss*	**Calculated requirements**	**Calculated requirements and measured consumption** of the last 3 years *(EnEG2014, GHG since 2020)*	kWhFE/(sqm.year), converted into kWhPE/(sqm.year)
NL *Energielabels*	**Calculated requirements** *(Méthode BENG)*	**Calculated requirements**	kWhPE/(sqm.year) in fossil energy
BE. - Wallonia *Certificat de Performance Energétique du Bâtiment*	**Calculated requirements**	**Calculated requirements**	kWhPE/(sqm.year)
BE. - Brussels *Certificat de Performance Energétique du Bâtiment*	**Calculated requirements**	**Calculated requirements** *(UNI/TS 11300 with possible simplifications)*	kWhPE/(sqm.year)
BE. - Flanders *EPC Construction/EPC Residentiel*	**Calculated requirements**	**Calculated requirements**	kWhPE/(sqm.year)
IT *Attestato di Prestazione Energetica*	**Calculated requirements** *(UNI/TS 11300)*	**Calculated requirements** *(UNI/TS 11300 with possible simplifications)*	No unit (kWhEPnren/(sqm.year) = non-renewable primary energy per sqm per year, relative to a reference building)
SP *Certificado de Eificiencia Energetica*	**Calculated requirements**	**Calculated requirements**	. No unit (kWhEPnren/(sqm.year) = non-renewable primary energy per sqm per year, relative to a reference building) . kgCO2eq/(sqm.year)
LU *Passeport énergétique*	**Calculated requirements**	**Calculated requirements**	.kWhPE/(sqm.year) for annual energy consumption and heating requirements .GHG emissions in CO2 eq.
DK *Energimærket*	**Calculated requirements** *(BE 2018)*	**Calculated requirements**	kWhPE/(sqm.year) for annual energy consumption

Tab. 3: Main criteria of the EPCs for housing in different European countries. This table indicates the calculation methods used for newbuilds and for existing buildings in each country, and unit(s) used to indicate the energy performance.

ENERGY BANDS

The number of energy bands featuring in the EPC differs in each country, ranging from 7 to 18 different bands. In addition, the top and bottom thresholds of these ratings are not based on identical indicators in all countries, some of which apply a threshold in kWhPE/(sqm.year), while others employ percentages of consumption compared to a reference building (Italy, Spain and the United Kingdom) or final energy units (Germany).

In order to compare energy bands, we start by taking a look at the different thresholds of the bands in kWh per sqm per year, for the countries where the information available is comparable for residential buildings. The European countries studied have a very different number of bands, like Belgium (Brussels-Capital region), which applies a very high number of bands (18 in total), compared to the other countries, where the residential EPC mostly features from 7 to 11 energy bands. For the remaining countries presented here, the number of bands also varies, including a labelling difference for the highest band (which varies from A to A+++++ or A2020 depending on the country) and the lowest band (F, G, H or I depending on the country). This variation in the scale of the most efficient buildings on one side and the least efficient on the other can illustrate a difference in the market standard, or more generally in the overall performance of the building stock in the countries considered.

As well as the varying number of bands depending on the country studied, the thresholds in kWh per sqm per year

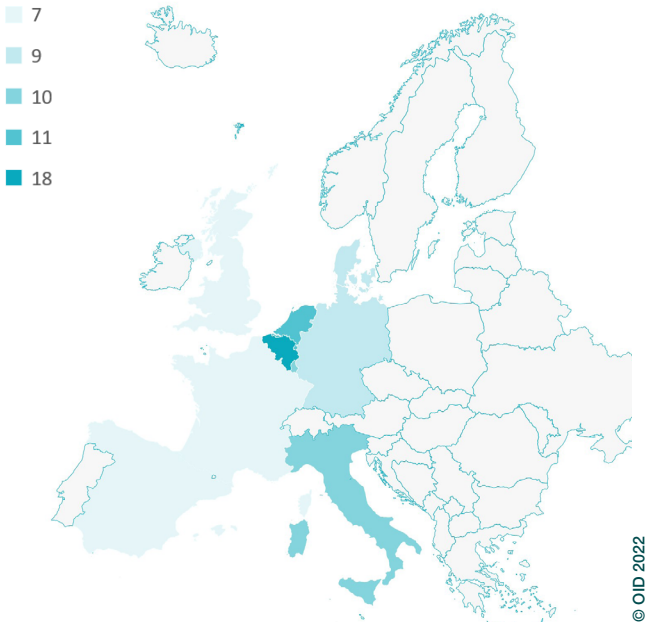

Fig. 3: Number of energy labels in residential EPCs accross Europe.

employed to delimit the bands are not always consistent. As an example, a comparison of the French EPC band C with other countries shows that it is the equivalent of an EPC A or B in the Netherlands, EPC B in Flanders and Wallonia, EPC C to D+ in the Brussels- Capital region, EPC C or D in Denmark, and EPC E or F in Luxembourg. The French EPC band C is equivalent to an EPC band D, E or F in Germany, but this country uses final energy to set its energy thresholds. There is therefore no standardisation, and a building with a given consumption level could obtain much higher or lower energy labels from one country to another depending on the EPC requirements.

	[kWh/(sqm.year)]	≤ 0	≤ 100	≤ 200	≤ 300	≤ 400	≤ 500	> 600
France	*Primary energy consumption*		A	B	C	D	E	F	G	
Germany	*Final energy consumption*		A+	A	B	C	D	E	F	G	H
Netherlands	*Primary fossil energy consumption*	A++++	A+++	A++	A+	A	B	C	D	E	F	G
Belgium - Flanders	*Primary energy consumption*		A+	A	B	C	D	E	F	
Belgium - Wallonia	*Primary energy consumption*		A++	A+	A	B	C	D	E	F	G
Belgium - Brussels-Capital	*Primary energy consumption*		A++	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E	E-	F	G
Luxembourg *(Apartment blocks)*	*Primary energy consumption*		A+	A	B	C	D	E	F	G	H	I
Luxembourg *(Houses)*	*Primary energy consumption*		A+	A	B	C	D	E	F	G	H	I
Denmark *(Apartment blocks)*	*Primary energy consumption*	A2020	A2015	A2010	B	C	D	E	F	G

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Tab. 4: Energy bands and their thresholds in several Member States that employ measurement scales in kWh/(sqm.year) for residential buildings.

TAXONOMY: THRESHOLDS OF A AND C BANDS

The EU Taxonomy, formalised by regulation 2020/852, establishes the main operating principles to define a sustainable activity through six key environmental objectives pursued by this regulation.

To date, the taxonomy has stipulated the technical criteria relating to two of the six environmental objectives, i.e. climate change mitigation and climate change adaptation.

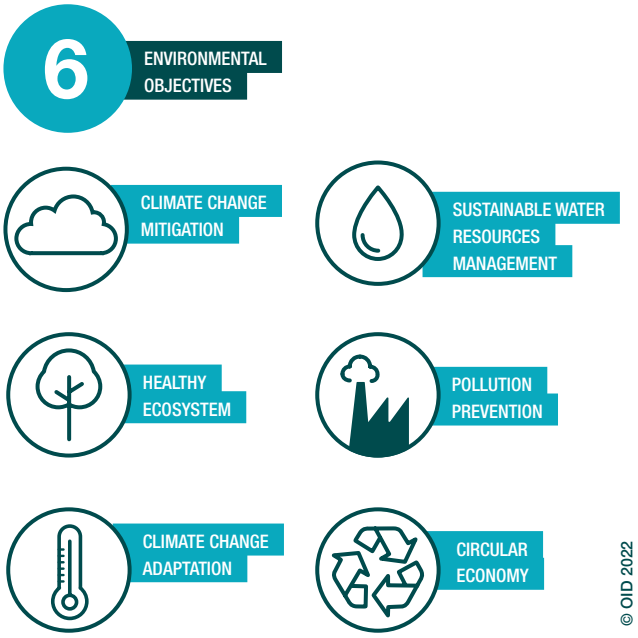


Fig. 4: Environmental objectives of the EU Taxonomy.

Along with the environmental objectives, an economic activity is considered to be sustainable on an environmental level if it also aligns with one of the six environmental objectives, without doing significant harm to the other five.

Relating to the mitigation objective, the group of European experts has published several criteria that apply to property players. For example, concerning the construction of new buildings, one of the substantial contribution criteria for mitigating climate change relates to the building's primary energy demand, which must be at least 10% lower than the NZEB threshold in force in the country.

ALIGNEMENT CRITERIA FOR EU TAXONOMY

An economic activity can be considered as environmentally sustainable if it fulfills the following three conditions:

- Makes a substantial contribution to one of the objectives (Substantial Contribution Criteria - SCC);
- Does not harm one of the other objectives (Do No Significant Harm criteria – DNSH);
- Respects minimum social safeguards.

Similarly, for property management activities ("7.7 Acquisition and ownership of buildings"), the criterion of substantial contribution to mitigation requires either possessing an A energy rating, or ranking in the top 15% of the most energy-efficient buildings. A minimum C-band is also required by DNSH criteria.

Criteria and thresholds are likely to change with the EPBD recast, unveiled by the European Commission on 15 December 2021 and currently under negotiation. The recast includes a new definition of the NZEB criterion, now called "Net Zero Emission Building", with common NZEB performance thresholds for each main European climate zone (see the right-hand column of the table below for a summary). Energy ratings are also set to evolve: band A should now correspond to the NZEB threshold, while band G will gather the 15% most energy-consuming buildings in the local market.

Fig. 5: Lower threshold of label A for residential buildings EPCs in Europe.

	Energy Unit	Mitigation criterion - SCC Current A Class *in kWh/(m².an)*	Mitigation criterion - DNSH Current C Class *in kWh/(m².an)*	EPBD recast's NZEB threshold *in kWh/(m².an)*
DE	Final energy	50	c. 100	65
FR	Primary energy	70	c. 170	60
DK	Primary energy	70	c. 170	60
UK	Primary energy	RELATIVE SCALE	RELATIVE SCALE	NOT INCLUDED
NL	Fossil Primary energy	160	c. 250	65
BE - Wallonia	Primary energy	80	260	65
BE - Brussels	Primary energy	45	150	65
BE - Flanders	Primary energy	100	300	65
LUX	Primary energy	40	80	65
IT	Non renewable Primary energy	RELATIVE SCALE	RELATIVE SCALE	60
SP	Non renewable Primary energy	RELATIVE SCALE	RELATIVE SCALE	60

Tab. 5: Thresholds of the NZEB standard defined by the EPBD. Note: the NZEB performance threshold is understood to be gross of any solar gain.

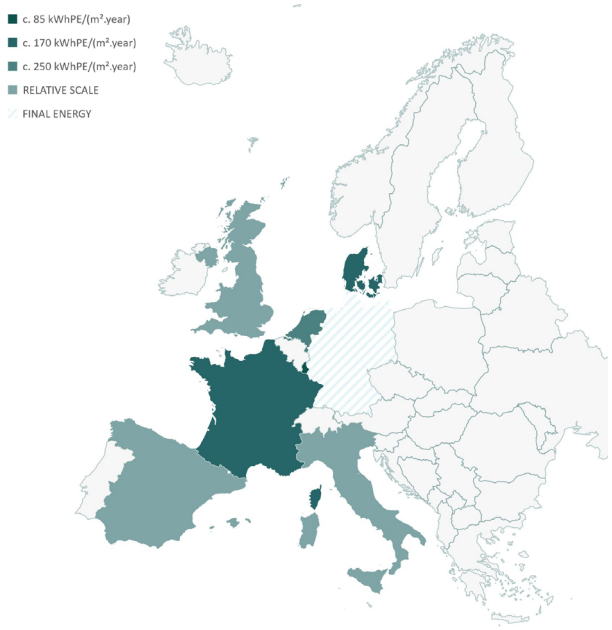


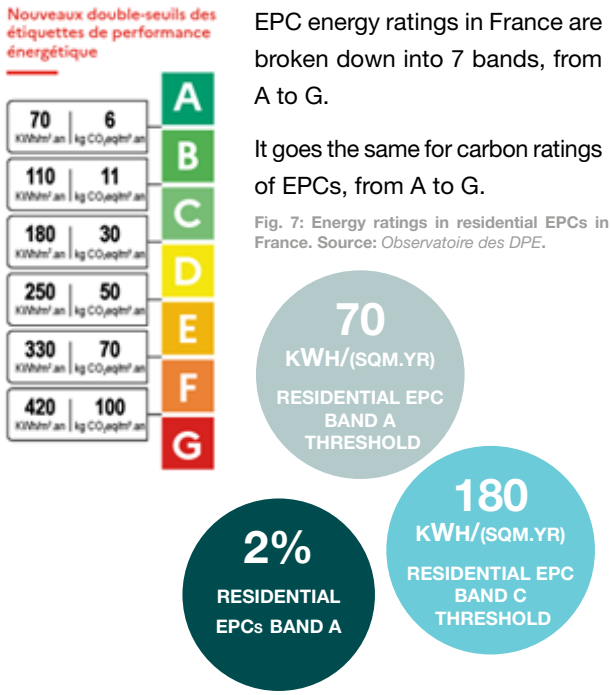
Fig. 6: Lower threshold of label C for residential buildings EPCs in Europe.

Following our analysis of the methodologies and variables in residential EPCs on a technical level, the third part proposes a benchmark for residential EPCs for each country in the sample studied.

OVERVIEW OF EUROPEAN RESIDENTIAL EPCs

FRANCE

ENERGY RATINGS



EPC energy ratings in France are broken down into 7 bands, from A to G.

It goes the same for carbon ratings of EPCs, from A to G.

Fig. 7: Energy ratings in residential EPCs in France. Source: *Observatoire des DPE*.

GENERAL CRITERIA

- Type of energy measured: primary energy per sqm per year (kWhPE/(sqm.year)),
- Scope of consumption considered: heating, hot water, ventilation, lighting and auxiliaries.

French EPCs feature two scales, one of which measures energy performance, while the other considers environmental performance, in other words, GHG emissions (in $kgCO_2$/sqm.year). The band ultimately allocated is the least efficient rating of the two scales.

The residential EPC in France is also subject to enforceability since 1 July 2021: it is possible to contest the legal responsibility of the certifying body if the input data used in the calculation are incorrect.

METHOD

In French EPCs, the level of performance is calculated on the basis of the "calculated requirement", using the so-called 3CL method (*Calcul de la Consommation Conventionnelle des Logements*).

SPECIFIC RULES

A reform of residential EPCs came into force in July 2021, with old and new EPCs temporarily overlapping: EPCs carried out before 2018 will no longer be valid in 2023, and those carried out between 2018 and 2021 will no longer be valid in 2025.

In addition, a calendar of rental prohibitions is established by the Act on Climate and Resilience (*Loi Climat et Résilience*) published in August 2021:

- 2022 : Rent freeze for F- and G-band housing,
- 2025 : Prohibition to rent G-band housing,
- 2028 : Prohibition to rent F-band housing,
- 2034 : Prohibition to rent E-band housing.

DATABASE

The French EPC database is that of the *Observatoire des DPE* (EPC observatory), managed by the French environment and energy management agency, ADEME.

COVERAGE RATE

On 1 July 2021, 2,710,980 EPCs were recorded for 30,434,000 main residences, which is a coverage rate of about 8.9% (*developpement-durable.gouv.fr*).

BREAKDOWN

Out of the 30 million main residences on 1 January 2022, the government estimates that about 1.5 million (5% of the stock) consume a low level of energy (corresponding to bands A and B of the EPC). However, it estimates that about 5.2 million dwellings (or 17% of main residences) consume high levels of energy (corresponding to EPC F and G bands). The most common band is D (32% of buildings), while C and E bands represent respectively 24% and 22% of these buildings.

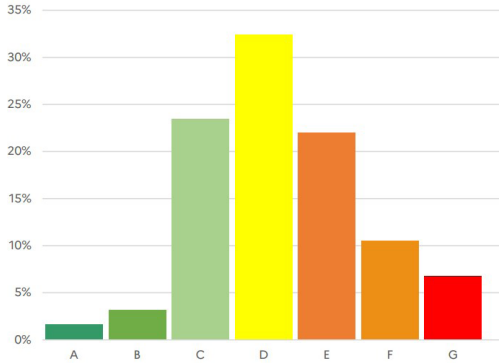


Fig. 8: Breakdown of energy labels for residential EPCs in France. Source: *Observatoire des DPE*.

LUXEMBOURG

Only one type of Energy Performance Certificate (EPC) exists for residential buildings in Luxembourg. The EPC was not affected by changes to energy performance requirements in 2016, so that the bands remain the same, making it easy to compare EPCs delivered on the building market.

ENERGY RATINGS

In Luxembourg, the rating system comprises nine energy bands (A to I) for each indicator of the Luxembourgian EPC, i.e. primary energy, thermal insulation and greenhouse gas emissions.

Buildings are therefore given a triple rating (e.g. A-A-A for the most energy-efficient buildings).

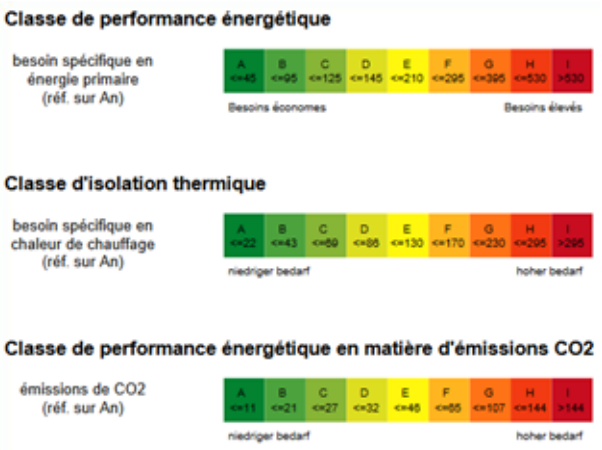


Fig. 9: Rating of the 3 energy performance indicators of the residential EPC in Luxembourg (from top to bottom : energy performance, thermal insulation and environmental performance). Source: 1nergie.lu

GENERAL CRITERIA

Luxembourg energy performance certificates are based on different criteria for each type of indicator:

- The energy performance rating is based on the total primary energy requirement, which takes into account the building's thermal envelope, and technical equipment used for heating, cooling, ventilation, humidification, lighting and domestic hot water, and auxiliary equipment. It also takes into account the environmental aspect of the energy carrier used.
- The thermal insulation rating is determined according to the index of the heating requirement. This index considers the thermal quality of the walls, roofs, flooring and windows, and the type of construction, quality of workmanship (airtightness) and orientation of the building.
- For the environmental performance criterion, an emissions factor is allocated to the different usages (heating, hot water, auxiliary equipment) in order to determine the performance in $kgCO_2$/sqm.year.

45
KWH/(SQM.YR)
RESIDENTIAL EPC BAND A THRESHOLD

125
KWH/(SQM.YR)
RESIDENTIAL EPC BAND C THRESHOLD

METHOD

The EPC is evaluated using software modelling based on the characteristics of the envelope and equipment. The usages input into this modeling are: heating, cooling, hot water, ventilation, lighting, humidification, and auxiliary usages. The EPC also considers the energy carrier used.

The EPC evaluates three characteristics of the building (called "bands"), each of which is rated on a scale from A (most efficient) to I (least efficient):

- Primary energy,
- Thermal insulation,
- GHG emissions.

The most efficient buildings receive a triple A rating (A-A-A) considering the three bands. Band A designates passive buildings, and B designates low-energy buildings.

SPECIFIC RULES

Since 2017, new residential buildings must correspond to a building with almost no energy consumption (NZEB = Nearly Zero Energy Building). In general, NZEB corresponds to the AAA energy rating. However, some conditions relating to the place of construction can lead to variations in these energy bands.

DATABASE AND COVERAGE

To this date, the OID did not found open data to inform on the coverage rate or the breakdown of energy bands in residential EPCs in Luxembourg.

SPAIN

Spanish regulations establish certification requirements for residential and commercial buildings without distinction, provided that a purchase or rental transaction has been carried out for the building.

Information relating to energy performance certificates (EPCs) is collected and recorded in each of the 17 autonomous communities and in the two autonomous Spanish cities, making a total of 19 official EPC registers.

Originally, regional registers obtained information directly from the EPCs delivered in paper format and gathered information on the building owners, certifiers, the physical location and identification of the building, and information on compliance certificates. Energy certification is regulated by the new royal decree No.390/2021.

ENERGY RATINGS

The Spanish EPC ratings range from A to G, making 7 energy bands. Buildings are rated according to their energy performance based on the following scale.

Calificación de eficiencia energética del edificio	*Índices de calificación de eficiencia energética*
A	C1 < 0.15
B	0.15 ≤ C1 < 0.50
C	0.50 ≤ C1 < 1.00
D	1.00 ≤ C1 < 1.75
E	C1 > 1.75 y C2 < 1.00
F	C1 > 1.75 y 1.00 ≤ C2 < 1.50
G	C1 > 1.75 y 1.50 ≤ C2

Tab. 6: Energy ratings in residential EPCs in Spain. Source: gmsarquitectura.com

The ratings operate in relation to a C1 or C2 index according to the category, which designates the ratio between the value of the indicator for the building to be certified and the value of the indicator for a reference building stock.

Spanish residential EPCs also rates buildings according to their carbon performance, in $kgCO_2$/sqm per year.

Fig. 10: Carbon ratings in residential EPCs in Spain. Source: gmsarquitectura.com

GENERAL CRITERIA

The performance of buildings is rated according to two indicators:

- Annual CO_2 emissions ($kgCO_2eq$/sqm per year),
- Annual consumption of non-renewable primary energy (kWh/sqm per year).

The usages considered are heating, air conditioning, hot water consumption, and ventilation.

METHOD

For new builds or for major renovations (extension and increased surface or volume of the building), the method used is referred to as the "standard calculation procedure". It involves an STD modelling (technical analysis of the envelope and systems, definition of a standard occupation profile) adjusted to the climate zone.

For old buildings, a modelling is carried out based on input data taken directly from the existing building during an inspection.

SPECIFIC RULES

Since 2021, energy performance certificates have a maximum validity of ten years, except when the energy band is G, in which case it is valid for a maximum of five years.

COVERAGE RATE

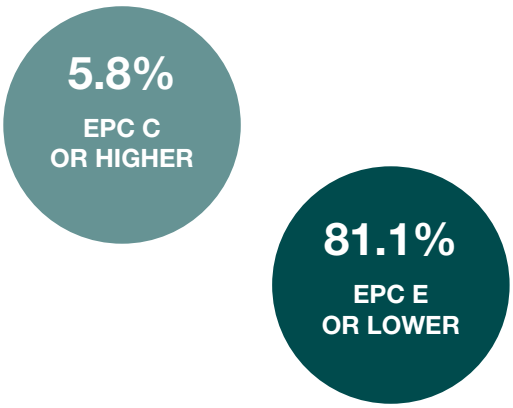
In 2014, 4% of Spanish residential buildings featured an EPC, and 7% of residential newbuilds were recorded with an EPC (Zebra 2020).

BREAKDOWN

In 2016, 3 million EPCs had been delivered, covering both new and existing buildings. The corresponding breakdown of energy bands is the following:

	A	B	C	D	E	F	G
Number of buildings	12,112	34,271	130,582	394,906	1,522,385	358,195	575,568
Breakdown	0.4%	1.1%	4.3%	13.0%	50.3%	11.8%	19.0%

Tab. 7: Breakdown of energy labels for residential EPCs in Spain. Source: CA EPBD Spain.



DENMARK

In Denmark, the energy performance certificate (EPC) is regulated by the Danish Energy Agency. Energy ratings are currently legally established by the Act on the promotion of energy savings in buildings (*Bekendtgørelse af lov om fremme af energibesparelser i bygninger*) and its order.

The country was a pioneer in energy efficiency in buildings (the first requirements date from 1961), and introduced an energy rating system in 1997 for application from 1998. A public database (SparEnergi.dk) was set up at the same time to collect EPCs.

ENERGY RATINGS

The Danish EPC bands run from A to G. The higher energy performance requirements from 2010 led to two energy bands corresponding to "low consumption" buildings (A2015) and "passive energy" buildings (A2020). In total, 9 energy bands therefore exist.

Energy efficiency rating	Numeral criteria for each class [kWh/(sqm.year)]
A2020	20.0
A2015	≤ 30.0 + 1,000/A
A2010	≤ 52.5 + 1,650/A
B	≤ 70.0 + 2,200/A
C	≤ 110 + 3,300/A
D	≤ 150 + 4,200/A
E	≤ 190 + 5,200/A
F	≤ 240 + 6,500/A
G	> 240 + 6,500/A

Tab. 8: Energy ratings in residential EPCs in Denmark. Source: CA EPBD.

GENERAL CRITERIA

EPCs are obligatory for:

- Sales and lets of buildings (residential and tertiary),
- Newbuilds,
- Public buildings over 250 sqm, on which the energy rating must be visible to the public.

Danish energy performance certificates are based on:

- The type of energy measured, primary energy per sqm per year (kWhPE/sqm per year),
- The calculation takes into account the requirements (and source) of heating, cooling, ventilation, lighting and hot water.

METHOD

EPCs are based on a theoretical simulation of the energy consumption following occupation hypotheses (application of averages for the number of users, duration of operation and consumption patterns) and weather conditions, as defined in the European standards ISO 13790 and ISO 52016. The Danish Building Research Institute (SBi) developed the paying calculation tool, *Bygningers Energibehov* 2018, known as "BE 18".

SPECIFIC RULES

The scale for establishing Danish EPCs is determined by a progressive rating system. The levels comprise a fixed threshold value and a variable value, an inverse function of the conditioned surface.

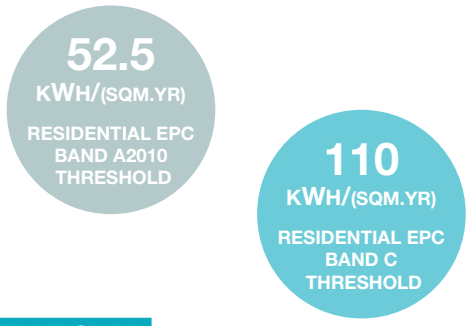
DATABASE

All EPCs are recorded in a central database administrated by the Danish Energy Agency and are available on the public website SparEnergi.dk.

COVERAGE RATE

In 2014, about 13% of the Danish residential stock had an EPC, which is over 357,000 buildings. The coverage rate of newbuilds during the same period was 32% (Zebra 2020).

At the end of 2021, the national database comprised about 900,000 EPCs for buildings of all types. The building stock features an estimated 1,650,000 units, making a coverage of around 54%.



BREAKDOWN

In 2014, 3.67% of the Danish building stock had an A-band EPC (Zebra 2020). At the same date, about 32.6% of the stock had a C-band EPC or higher. The immense majority of new buildings with an EPC possessed an A-band rating in 2014: about 94.4% of newbuilds that featured an EPC.

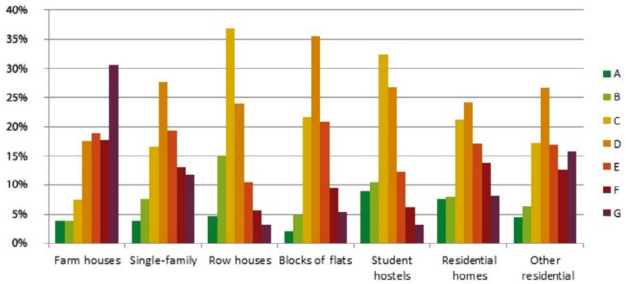


Fig. 11: Distribution of the certification classes for Danish residential buildings as registered in the current EPC schea since 2006. Source: CA EPBD, 2014.

THE NETHERLANDS

In the Netherlands, the energy performance certificate (EPC) is called the *Energielabel*. The first EPBD in 2002 was transposed into national law in 2006, in addition to the Acts of 1995. The EPC system evolved on 1 January 2015, then on 1 January 2021 when new ratings entered into force.

ENERGY RATINGS

A total of 11 energy bands from A+++ to G exist for residential buildings. The existence of numerous top ratings (higher performance than an A band) makes comparison with other countries very difficult. Indeed, the EPC A band (160 kWh/sqm per year) is the equivalent of about an EPC C band in France (180 kWh/sqm per year) and an EPC B band in Belgium (Wallonia).

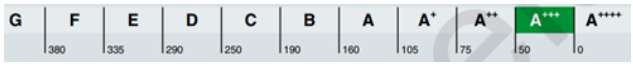


Fig. 12: Energy ratings in residential EPCs in The Netherlands. Source: RVO

160
KWH/(SQM.YR)
RESIDENTIAL EPC BAND A THRESHOLD

250
KWH/(SQM.YR)
RESIDENTIAL EPC BAND C THRESHOLD

GENERAL CRITERIA

The Dutch energy performance certificate is based on a number of criteria:

- Type of energy measured: primary energy per square metre per year (kWhPE/(sqm.year)),
- The share of renewable energy used to cover the energy requirements of the dwelling is indicated, along with the presence of solar panels and solar boilers,
- The scope of consumption corresponds to the heating demand in winter and cooling requirements in summer, in other words heating, hot water, ventilation and cooling,

It is mandatory to display energy ratings when selling, letting or delivering buildings.

METHOD

The entry into force of the new *Energielabels* in 2021 included the introduction of a new calculation. The NTA8800 method, based on European CEN standards, applies to all buildngs (new and existing, residential or otherwise).

With this new method, buildings obtain a score based for three indicators:

- Energy requirement in kWh/sqm per year,
- Primary fossil energy consumption in kWh/sqm per year,
- Share of renewable energy.

The energy rating for buildings contains an energy performance indicator. Currently, it is based on the energy index (EI). The proposed 2021 revision of the EPBD suggests that energy ratings should be expressed as an indicator of primary energy consumption in kWh/sqm per year. The current energy labels do not conform to this system. Due to the move to the new method in 2021, the required indicator can be calculated. The classification tables for energy bands need to be redefined.

DATABASE

The Netherlands possesses a public database for its EPCs: EP-Online.

COVERAGE RATE

In 2012, about 32% of Dutch residential buildings were covered by an EPC (Zebra 2020), which is about 2,191,000 buildings.

35%
EPCs BAND A OR HIGHER

BREAKDOWN

In 2012, there were 3% A++ bands, 12% A+ bands, and 20% A bands (Zebra 2020). C bands in the Dutch energy rating system concerned 29% of the building stock in 2012.

In 2014, 35% of new residential buildings with an EPC featured an A++ band (Zebra 2020), corresponding to consumption of less than 75 kWh/sqm per year. The A band concerned 3.9% of new residential buildings in 2014. Due to the Dutch energy rating system (with A, A+ and A++), over 99% of residential newbuilds in the Netherlands in 2014 had an A-band EPC (160 kWh/sqm per year) or above.

ITALY

In Italy, the energy performance certificate is known as the *Attestato di Prestazione Energetica* (APE).

The country's energy policy is partially delegated to the regions and autonomous provinces. The central government establishes a general framework. Several regions have also started to develop their own certification system.

The 2002 EPBD was transposed into national law in 2005 and 2006, and the 2010 revision was transposed in 2013 and 2015. The EPC system was introduced in 2007 for new residential buildings, and in 2007 for existing buildings.

ENERGY RATINGS

Energy bands are determined based on an index of a building's global performance expressed **in non-renewable primary energy ($EP_{gl,nren}$)**, in comparison with a scale defined according to the value of a reference building ($EP_{gl,nren,ref,standard(2019/2021)}$). This value defines the limit between bands A1 and B. The performance intervals that identify the other bands are obtained by multiplicative coefficients of a decrease/increase in the value $EP_{gl,nren,réf,standard(2019/2021)}$, as shown in the table below.

	Classe A4	$\leq 0{,}40\ EP_{gl,ren,nf,standard\ (2019/21)}$
$0{,}40\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe A3	$\leq 0{,}60\ EP_{gl,ren,nf,standard\ (2019/21)}$
$0{,}60\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe A2	$\leq 0{,}80\ EP_{gl,ren,nf,standard\ (2019/21)}$
$0{,}80\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe A1	$\leq 1{,}00\ EP_{gl,ren,nf,standard\ (2019/21)}$
$1{,}00\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe B	$\leq 1{,}20\ EP_{gl,ren,nf,standard\ (2019/21)}$
$1{,}20\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe C	$\leq 1{,}50\ EP_{gl,ren,nf,standard\ (2019/21)}$
$1{,}50\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe D	$\leq 2{,}00\ EP_{gl,ren,nf,standard\ (2019/21)}$
$2{,}00\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe E	$\leq 2{,}60\ EP_{gl,ren,nf,standard\ (2019/21)}$
$2{,}60\ EP_{gl,ren,nf,standard\ (2019/21)} <$	Classe F	$\leq 3{,}50\ EP_{gl,ren,nf,standard\ (2019/21)}$
	Classe G	$> 3{,}50\ EP_{gl,ren,nf,standard\ (2019/21)}$

Tab. 9: Rating scale for buildings based on global performance expressed in non-renewable energy EPgl, nren. Source: **Italian government**.

GENERAL CRITERIA

The Italian EPC is based on the following criteria:

- A building's energy performance is expressed as its global performance in terms of non-renewable energy EPgl,nren, in kWh/sqm per year,
- The scope of consumption comprises: heating ("winter air conditioning") ($EP_{h,nren}$), cooling ("summer air conditioning") ($EP_{c,nren}$), production of hot water (EPw, nren), mechanical ventilation ($EP_{v,nren}$), and artificial lighting ($EP_{l,nren}$).

The decree-law 63/2013 makes the EPC mandatory in the following cases: property sales, both public and private; property donations (free transfer); letting of buildings and individual accommodation; advertisements for property sales; sales of new buildings; renovations concerning over 25% of the entire building surface.

METHOD

Two procedures exist to determine the energy performance of buildings, in compliance with UNI/TS 11300 standards that can be used to determine the different energy requirements.

The standardised calculation based on input data regarding climate, standard usage, building's characteristics, and energy installations. This method is applicable to all types of building, and mandatory for newbuilds and in case of major renovation works. Meter- or inquiry-based calculations evaluate energy performance from input data metered on the building. This method can be applied to existing buildings that have not undergone significant renovation works.

In Italy, residential buildings are ranked into the following sub-categories of "residential buildings and similar":

- continuously occupied residential accommodation, such as houses and apartments (main residences), boarding schools, convents, prisons and barracks,
- occasionally occupied residential occupation,
- buildings used as hotels, boarding houses, and similar.

SPECIFIC RULES

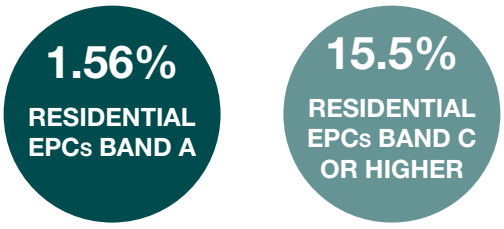
In Italy, a tax deduction can be granted in some cases regarding EPCs. The Ecobonus 110% (or Superbonus) is a tax deduction of 110% granted when energy efficiency has been improved from at least 2 bands.

DATABASE

The decree of 1st August 2015 provides for a national database for collecting data related to EPCs, heating systems and related controls and inspections. This is the National SIAPE Register, overseen by the ENEA (the national energy agency). The certifier must communicate all of the data collected, and citizens have access in an aggregated format.

COVERAGE RATE

In 2013, about 9.5% of Italian buildings featured an EPC (Zebra 2020), which is about 1,872,640 residential buildings.



BREAKDOWN

In 2014, 22.3% of residential newbuilds that had an EPC were rated band A (Zebra 2020), 41.7% band B, and 34.2% band C. However, concerning the total stock of buildings covered by EPCs in 2014, 1.56% of residential buildings were EPC A, 5.24% EPC B, and 8.72% EPC C. As a result, about 80% of residential buildings had a D-band EPC or below.

GERMANY

In Germany, the energy certificate is called *Energieausweis*. Its development began in 2004 by the *Deustche Energie Agentur* (DENA) – the German energy agency. Energy performance certficates are delivered by experts whose qualification is regulated by article 88 of the GEG (*Gebäudeenergiegesetz – GEG*) .

Two types of EPC exist in Germany: the energy consumption certificate, based on the actual consumption of a building, and the energy requirement certificate, based on a modelling of the building's requirements.

The *Länder* are responsible for applying this legislation.

ENERGY RATINGS

The german rating system comprises 9 energy bands from A+ to H.

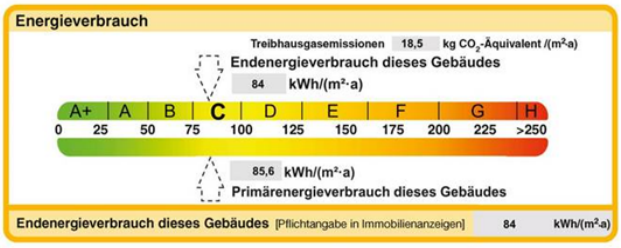


Fig. 13: Energy ratings in energy consumption for residential EPCs in Germany. Source: energieausweis-vorschau.de

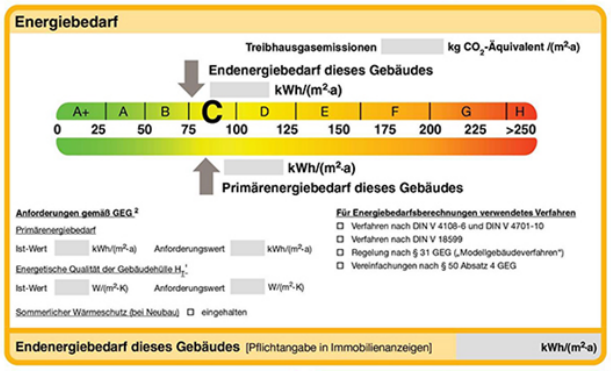


Fig. 14: Energy ratings in energy demand for residential EPCs in Germany. Source: energieausweis-vorschau.de

GENERAL CRITERIA

The German energy performance certificate is based on the following:

- Final energy consumption or modelled requirement (kW/sqm per year),
- This consumption or requirement is then converted into primary energy in order to facilitate comparison with international standards.

The German EPC is mainly centred on the energy consumption of buildings, and GHG emissions are provided for information only.

The following usages are considered:

- Heating and hot water consumption, expressed as final energy, for the energy consumption certificate,
- Heating, hot water, ventilation, lighting and cooling consumption for the energy requirement certificate.

METHOD

The two EPCs are subject to two different methods.

The energy consumption certificate is calculated from energy bills over the last 36 consecutive months. It represents annual average consumption to produce hot water and heating. This measurement is therefore dependent on the building's usages.

The energy requirement certficate is estimated based on a technical analysis of the envelope and equipment. The consumption taken into account relates to heating, ventilation, cooling, lighting and hot water (like in other countries, except that consumption is expressed as final energy). This calculation is based on a modelling and does not therefore take the building's usage into account.

SPECIFIC RULES

The obligation to display or hand over an EPC occurs later on, when presenting an apartment or building to potential buyers or tenants. If this is not respected, the owner of the building may receive a penalty from the local authority designated by the region (usually the building authority).

DATABASE

Since 1 May 2014, energy performance certificates and reports on inspections of air conditioning systems must be recorded. The recording office, *DIBt – Deutsch Institut für Bautechnik* – was created for the central collection of data. However, the database is not public.

COVERAGE RATE

In total, in 2014, for all buildings, 173,192 certficates were issued based on calculated energy demand, and 149,016 EPCs based on measured energy consumption.

According to the Zebra 2020 database, the proportion of residential buildings equipped with an EPC was 0.77% of the entire building stock.

BELGIUM

In Belgium, implementation of the EPBD is the responsibility of regional governments. While a central register collects data from all certificates along with the calculations of new building requirements, the regional public organisations must define and apply EPCs. Consequently, Flanders, Wallonia and the Brussels capital region all have specific EPCs.

In Wallonia, EPCs are known as PEBs (*Performance Energétique Bâtiment*) and exist in two formats, one for new buildings and the other for existing ones.

In Brussels, the PEB can also be broken down into a "new building" model and a "stand-alone dwelling" model for older buildings.

In Flanders, the certificates are referred to as EPCs (*Energieprestatiecertificaten*) and concern all existing residential buildings.

ENERGY RATINGS

WALLONIA

The PEB certificate in Wallonia comprises 9 energy bands from A++ to G.

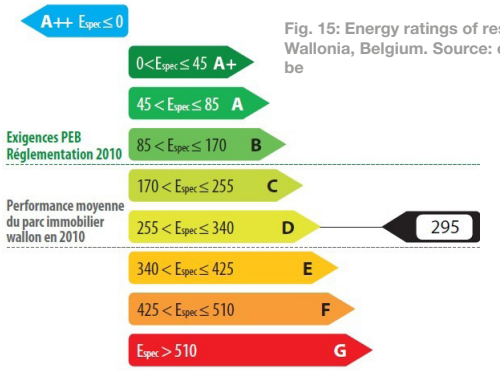


Fig. 15: Energy ratings of residential EPCs in Wallonia, Belgium. Source: energie.wallonie.be

BRUSSELS-CAPITAL

The PEB certificate in Brussels has 18 energy bands from A++ to G

Classe énergétique		kWhEP/(sqm.year)		kWhEP/(sqm.year)
A++			<	0
A+	de	0	à	15
A	de	16	à	30
A-	de	31	à	45
B+	de	46	à	62
B	de	63	à	78
B-	de	79	à	95
C+	de	96	à	113
C	de	114	à	132
C-	de	133	à	150
D+	de	151	à	170
D	de	171	à	190
D-	de	191	à	210
E+	de	211	à	232
E	de	233	à	253
E-	de	254	à	275
F	de	276	à	345
G	>	346	à	

Tab. 10: Energy ratings of residential EPCs in Brussels-Capital, Belgium. Source: environnement.brussels

FLANDERS

The EPC in Flanders is broken down into 7 energy bands from A+ to F.

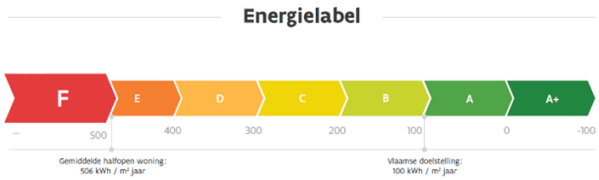


Fig. 16: Energy ratings of residential EPCs in Flanders, Belgium. Source: energiesparen.be

GENERAL CRITERIA

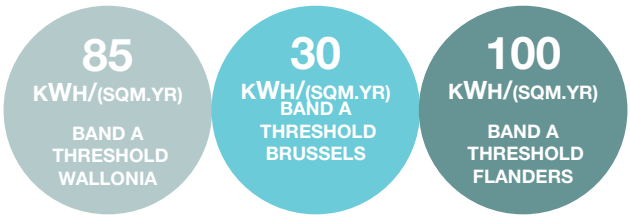
The energy performance certificate considers:

- The total theoretical consumption of the dwelling, expressed in primary energy in standard conditions,
- The heated floor area,
- The specific primary energy consumption per year per sqm.

The rating and energy score therefore depend on:

- Wall, floor and roof insulation,
- Windows and doors,
- Appliances for heating, hot water, cooling, ventilation, and also lighting for small non-residential units,
- Any existing solar installations.

For all of the regions, the certificate is valid for a maximum of 10 years.



METHOD

The energy performance certificate for the different regions is determined by an STD (technical analysis of the envelope and systems, definition of a standard occupation profile).

The band and energy rating do not take into account the behaviour of consumers or the composition of the household, which can lead to a difference with the actual consumption on electricity bills. The energy rating is calculated based on primary energy consumption, which expressees the quantity of fossil fuels (natural gas, fuel oil or coal) used by the building's equipment. For electric appliances, this also includes a significant additional difference compared to the actual energy consumption, because the energy lost during transport and production is also considered.

DATABASE

There is no public database unified at national scale in Belgium. However, a database has been identified for Wallonia.

COVERAGE RATE

FLANDERS

In 2014, around 24% of new buildings were covered by an EPC (Zebra 2020).

WALLONIA

From June 2010 to end 2016, over 395,000 certificates for existing residential buildings were recorded in the database. This represents c.26% of the building stock. It is not possible to establish how many EPCs were issued for renovated buildings because it is not required to fill in an EPC.

BRUSSELS

2016 data for the Brussels region show a sharp rise from 2014 to 2016 of this alignment with EPC requirements.

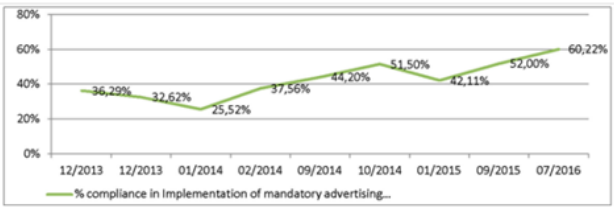


Fig. 17: Percentage of real estate advertising with the required information about EPC. Source: CA EPBD, 2016.

BREAKDOWN

FLANDERS

In 2014, 6.7% of residential newbuilds covered by an EPC were rated A, in other words, with consumption of less than 100 kWh/sqm per year. More than half of newbuilds featuring an EPC were rated B or higher (Zebra 2020).

WALLONIA

According to the database comprising all certificates (about 400,000 in February 2017), the average performance of a dwelling in Wallonia in 2016 corresponded to an EPC F band, which is a theoretical consumption of 434 kWh/sqm.year.

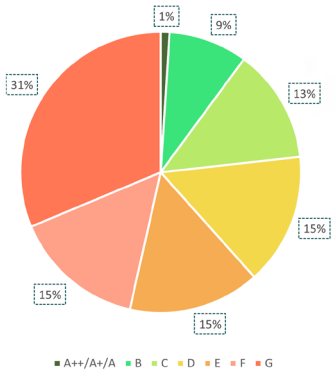


Fig. 18: Breakdown of residential buildings in Wallonia according to their energy performance label. Source: CA EPBD, 2017

UNITED-KINGDOM

In the United Kingdom, the implementation of the EPBD (Energy Performance of Buildings Directive) comes under the legislative and executive powers of the different jurisdictions (England, Wales, Northern Ireland and Scotland). Until 31 December 2011, implementation of the EPBD was common to England and Wales. In 2012, Wales became officially responsible for its own EPBD regulations, but in practice the former regulations have remained the same in both jurisdictions.

In England and Wales, the 2002 EPBD was transposed in October 2008. EPCs were gradually put in place between August 2007 and October 2008. The Building Regulations of 2010 are the transposition of the 2010 directive, following which the format of energy performance certificates (EPCs) was revised in 2012 in the Energy Performance of Buildings Regulation.

The different articles of directive 2002/91/EC were implemented in Scotland by different regulations from 2003 to 2008 (Building Act 2003, Building Regulations 2004 and 2007, etc.), and EPCs were introduced from January 2009.

In Northern Ireland, different regulations led to the implementation of the 2002 EPBD from 2006 to 2008 (Building Regulations 2006 (Statutory Rule - 2006 No. 355) and the Energy Performance of Buildings Regulations 2008 (Statutory Rule 2008 No. 170)). EPCs were put in place in stages in 2008.

ENERGY RATINGS

The EPC provides a calculated energy rating ("asset rating") of the current and potential energy efficiency of the building on a scale from A (most efficient) to G (least efficient). The potential rating shows the effect of undertaking the EPC's recommendations.

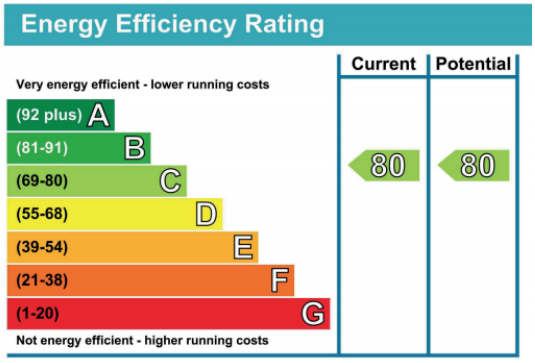


Fig. 19: energy ratings of residential EPCs in the United-Kingdom. Source : gov.uk

Fig. 20: Environmental (carbon) ratings of residential EPCs in the United-Kingdom. Source: gov.uk

The EPC also includes an Environmental Impact rating, showing the calculated current and potential CO_2 emissions from the building, on a scale from A to G. For domestic EPCs, all ratings are indexed, ranging from 0 to 100 with higher numbers indicating better performance

GENERAL CRITERIA

The current rating is based on the technical features of the building, a standardised occupancy profile, and estimated energy consumption costs.

The EPC includes an environmental impact rating based on predicted greenhouse gas emissions, and a list of cost effective energy efficiency recommendations. It also indicates the potential energy efficiency and environmental impact ratings if all recommendations were installed. For new buildings, the current and potential ratings may be identical.

Non-commercial EPCs are valid for 10 years, unless the installations or materials involved in the thermal performance of the building are changed.

Since 2013, an EPC must be provided when the building owner intends to sell or rent the building. Valid existing EPCs can be used for sale or rent, otherwise a new EPC must be obtained. Any commercial media used to advertise a property must contain the EPC energy rating. The landlord or seller must also ensure that a copy of the EPC and a Recommendations Report are shown to prospective buyers or tenants.

METHOD

For residential buildings, the energy performance certificate (Domestic EPC) is established based on an evaluation of the building's energy performance. The reference calculation method is the SAP (Standard Assessement Procedure), which is applied to new buildings. For existing buildings, a simplified version is used that requires fewer input data, called the RdSAP (Reduced Data SAP).

The following buildings are not subject to mandatory energy performance certification:

- Stand-alone buildings with a useful floor area under 50 sqm,
- Temporary buildings that are only planned to be used for two years or less,
- Buildings with low energy demand,
- Buildings sold for demolition.

SPECIFIC RULES

The Climate Change Act establishes the United Kingdom's targets for reducing GHG emissions. In December 2020 the British government produced a ten-year plan called the Energy White Paper that establishes that all housing will have to attain band C by 2035.

DATABASE

ENGLAND AND WALES

Accredited Energy Assessors must use Government approved software tools to produce regulatory outputs such as EPCs, recommendations reports, AC inspection reports, etc. Regulatory outputs are recorded on a register (which covers England and Wales) and are publicly available.

SCOTLAND

All EPCs are produced from data recorded on the Scottish EPC Register. EPCs are publicly accessible from the register using the EPC unique Report Reference Number (RRN). Regulations require that the EPC is "affixed" to the building.

NORTHERN IRELAND

Regulatory outputs (such as EPCs) are recorded on the Northern Ireland registers and are publicly available using the building's address, postcode, or the outputs' unique reference number. Selected organisations have access to limited bulk data, and anyone with an EPC can opt out of having their data publicly available.

COVERAGE RATE

In the United Kingdom, 32.5% of the residential building stock was covered by an EPC in 2014. This corresponds to around 10,696,330 residential buildings.

BREAKDOWN

In 2015, 0.15% of new buildings with an EPC featured an A band. The figure was 8.32% for B bands and 26.79% for C bands (Zebra 2020).

In 2015, for new residential buildings with an EPC, 1.3% had an A band, 77.3% had a B band, and 43.33% had a C band.

CONCLUSION

At the moment, residential buildings are the most documented assets type regarding the energy performance certification system. In spite of this, these certificates still show a major lack of harmonisation and comparability from one country to another, making the different reference systems unreadable at the European level.

While it sets down common principles since its establishment in 2002, the EPBD has left European countries considerable leeway to define their own methodology. As a result, energy performance certification varies widely in Europe and **making a clear comparison of national residential building stocks constitutes a real challenge.**

Real estate players nevertheless find themselves increasingly in need of reliable, comparable EPCs given that more and more regulations and political ambitions are making EPCs a key indicator to reach decarbonisation goals, both at European level and within the different countries.

In particular, the EU Taxonomy defines alignment criteria based on EPCs, although their concrete translation in terms of requirements varies from one country to another. This contradiction therefore highlights the need to go further in standardising the energy certification system, both in order to satisfy the established requirements, and to make comparisons easier across Europe.

The move towards standardisation is only in its early stages and constitutes a major project for the European Commission, whose proposal for a recast of the EPBD published in late 2021 includes a harmonisation of the system. From 2026, EPCs will need to follow a common model so that the entire property value chain, in particular financers, can adopt them to carry out the sector's ecological transition.

KEY FINDINGS

1. **The methodological features are more advanced and precise on residential than on other asset classes.**
2. **Residential EPCs are becoming key political tools to enact transition in residential buildings.**
3. **National transition actions build on these EPCs for the residential sector.**
4. **The EPBD recast aims at reducing the gap between countries regarding EPC notation and regulations. Yet some major differences, in methodologies and thresholds, remain.**
5. **The transition to be made on EPCs is all the more essential in view of the evolution of energy prices.**

RESOURCES

Concerted action on energy performance of Buildings - Implementation of the EPBD in:

- France
- Italy
- Spain
- Luxembourg
- Denmark
- The Netherlands
- Germany
- Wallonia
- Flanders
- Brussels-Capital
- United-Kingdom

Data tool Zebra 2020

OID, EU TAXONOMY : GUIDELINES FOR ITS APPLICATION IN REAL ESTATE, 2021

OID, ESREI Resources Centre

European Commission, EU climate strategies & targets

BPIE, The make-or-break decade: Making the EPBD fit for 2030

BPIE, Energy performance certificates across Europe**, 2014**

European Commission, EU Buildings Factsheets

European Commission, EU Building Stock Observatory

EUR-Lex, Energy Performance of Buildings Directive 2018

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ABOUT

OID (the Green Building Observatory) is an independant space for discussions between actors of the real estate industry, on sustainable development. Our purpose is to imagine responsible real estate. OID has more than a hundred members and partners, among them the leaders of commercial real estate in France over the whole value chain. OID is an association contributing to the rise of ESG topics in France and abroad, through an action programme in the field and towards the public sector.

The European Sustainable Real Estate Initiative (ESREI) is a programme launched by OID to extend its work to study European countries. Due to their international development, real estate companies need to fully understand how their counterparts in European countries deal with ESG issues and what the regulations are for each of them. The ESREI programme launched during the second half of 2021 is tackling these issues.

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