PART 1

STANDARDISING EUROPEAN EPCs

A CRUCIAL STEP FOR THE ENERGY TRANSITION IN THE BUILDING SECTOR

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ESREI BY OID
EUROPEAN SUSTAINABLE REAL ESTATE INITIATIVE

EDITORIAL

By ESREI
Steering Committee

The European Union has set a target to almost totally decarbonise the building sector by 2050, which raises the question of buildings' energy performance. The sector in fact represents 40% of energy consumed and 36% of GHG emissions according to the European Commission.

Asset managers, investors, funders, bankers, property managers, valuers, members of the technical and legal departments: all the value chain will have to take responsibility to accelerate change and meet the objective. It is indeed time for action !

What is the best way of undertaking the immense energy renovation project needed to reach these objectives? One solution is to employ reliable measurement and guidance tools, such as Energy Performance Certificates (EPCs), which are part of a common toolkit used by European countries for the last twenty years.

The stakes are particularly high given that the EU Taxonomy, whose aim is to establish a common reference system to qualify – including for buildings – sustainable property and real estate projects, is partly based on a rating system centred on EPCs. However, despite continuous improvements since their creation in 2002, European EPCs are still not easily comparable between countries. General standardisation is therefore necessary across the whole continent if climate targets are to be met.

Our study analyses definitions, scopes and developments concerning EPCs in the following nine countries: France, United Kingdom, Germany, Italy, Spain, Netherlands, Belgium, Luxembourg and Denmark. This analysis is published by the European Sustainable Real Estate Initiative (ESREI), led by the OID, whose objective is to monitor and decode changing regulations in Europe, compare the practices of real estate professionals at European scale, and provide them with common tools.

This study is part of a three-volume publication on European EPCs. Following this first volume, the ESREI intends to publish two more studies providing a detailed comparison of European EPCs in the sample countries selected. They will respectively concern residential buildings and office buildings.

INTRODUCTION

With the signature of the Paris Agreement, the European Union committed to reaching carbon neutrality by 2050, as did its Member States and other countries. In early 2020, it began **rolling out the EU Green Deal through a number of laws and strategies, accompanied by the "Fit for 55" plan**, which comprises a set of legislative measures to bring down European greenhouse gas (GHG) emissions by 55% in 2030 compared to 1990 levels.

Buildings are the highest consumer and generator of emissions in the European Union, making up 40% of energy consumption and 36% of GHG emissions. As a result, making buildings more energy efficient is a crucial challenge to reach decarbonisation and economic targets. With this aim in mind, **in 2002 the EU Energy Performance of Buildings Directive (EPBD) introduced an energy performance certificate (EPC) system.** With the various revisions of the EPBD, EPCs have progressively become a mandatory reference at different stages of a building's life cycle, such as when it is constructed, (re)sold, or let.

Since the publication of the EPBD, the different EU Member States have applied their own regulations based on the EPC system established by the directive. For rules such as EU Taxonomy and various national strategies and regulations, EPCs are frequently employed to indicate energy performance, in particular since each EPBD revision gives more details on requirements and introduces new ones.

How did this evaluation system, initially only intended as an indicator, end up becoming a corner stone of energy transition regulations in Europe? What evaluation methods and scopes are involved? What obstacles remain to ensure its effective deployment? These are the questions that this first study on EPCs in Europe sets out to answer.

This study is part of a three-volume publication on European EPCs. It responds to a need for concise information on the EU regulations in force regarding energy performance certificates for buildings. The study provides the definition of EPCs that features in the EPBD, looks at the different regulations at European and national levels, and compares EPCs in different EU countries. Following this first volume, OID intends to publish two more studies to make a more detailed comparison of European EPCs in selected countries. They will respectively concern residential buildings and office buildings.

SUMMARY

THE EPBD: A STRUCTURING FRAMEWORK FOR MORE ENERGY-EFFICIENT BUILDINGS

When environmental issues emerged concerning the building sector, actors immediately began to look at the energy performance of their buildings. The EPBD was part of this movement dating from the early 2000s, and was designed to give an account of the energy consumption of the EU building stock. The directive opened the way for other objectives, such as driving efficient renovations and supporting the decarbonisation of buildings.

THE EPBD : FROM INDICATING ENERGY PERFORMANCE TO DECARBONISING BUILDINGS

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

The directive focuses on the building sector, which is Europe's highest energy consumer and GHG emitter. **It defines the application of minimum energy performance requirements for new buildings and large existing buildings undergoing renovation work**. The directive also provides a general method for calculating buildings' energy performance and establishes certification of the method by independent experts, although it leaves concrete application to the discretion of Member States.

The 2002 directive has been revised twice, in 2010 and 2018, extending energy efficiency ambitions to meet the target of decarbonizing the EU building stock by 2050. Its exhaustive definition of the notion of the energy performance of buildings is : "*the calculated or measured amount of energy needed to meet the energy demand associated with a typical use of the building*". The directive states that it can be determined based on the actual or calculated energy consumed, employing a clear numerical indicator of primary energy use, expressed in kWh per sqm per year.

The successive revisions of the text have included the **introduction of the concept of NZEBs (Nearly Zero-Energy Buildings)**, applying minimum performance requirements for existing buildings, whose thresholds are determined by the Member States (EPBD 2010); the obligation to establish long-term renovation strategies for the entire building stock; and most recently, the introduction of requirements concerning the deployment of infrastructure for electro-mobility in buildings and smart meters in new buildings or buildings undergoing significant renovation work (EPBD 2018).

The framework established by the EPBD therefore targets the entire building sector, including newbuilds and existing stock, and covering all types of buildings.

The EPBD introduces NZEBs (Nearly Zero-Energy Buildings), in other words "*a building that has a very high energy performance*" for which "*the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources*". This building standard needs to be reached by 2050 in order to ensure the decarbonisation of the sector (EPBD 2010).

In addition to the concept of ZEBs, Zero Emission Buildings (ZEBs) have since been introduced into the directive. Similar to NZEBs, these buildings must have "*very high energy performance*" and "*the very low amount of energy still required has to be fully covered by energy from renewable sources*". However, unlike the concept of NZEB, which is left to the interpretation of Member States, the performance of ZEBs is here objectively defined according to a table of maximum consumption thresholds for each major climate zone of the EU, provided in Annex III of the legal text.

A NEED TO INDICATE THE ENERGY PERFORMANCE: THE BIRTH OF THE EPC

One of the most concrete embodiments of the EPBD is the energy performance certificate (EPC), which constitutes the corner stone of energy and environmental ambitions for buildings at both national and EU levels.

The main goal of an EPC is to make a building's energy performance clear and comparable for any future buyer or tenant. To achieve this, the certificates feature a summary of buildings' estimated annual energy requirements of primary energy use expressed in kWh per sqm, and a comparison with the reference values of similar buildings, following a rating scale.

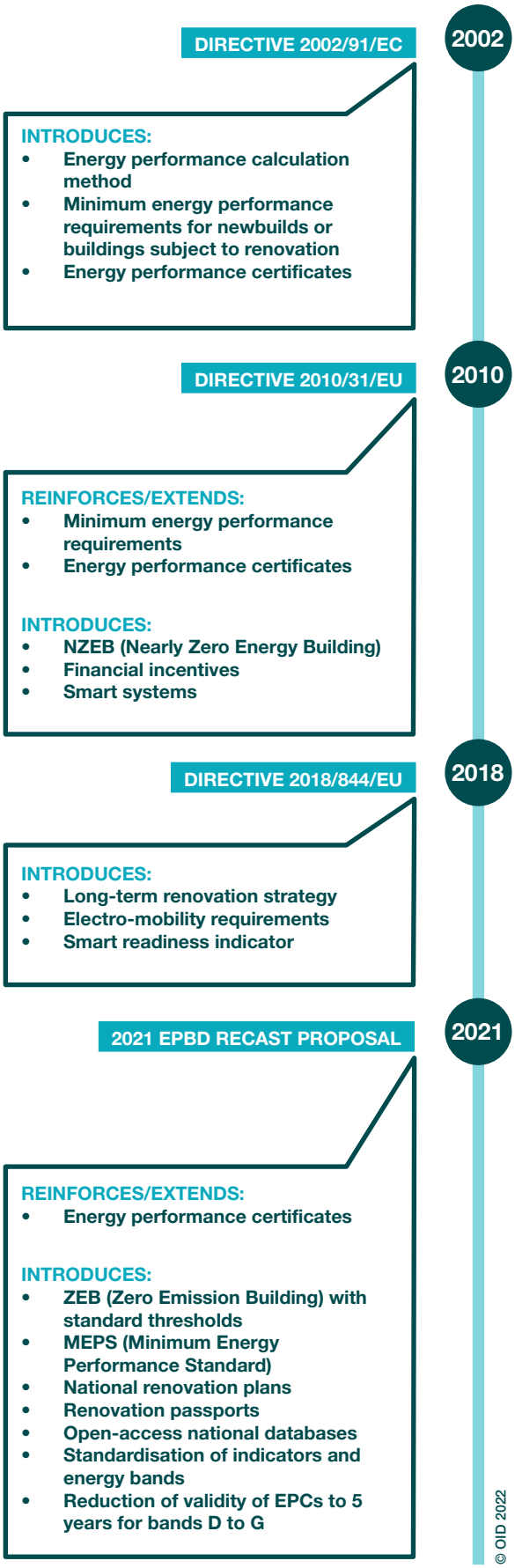
They also contain a description of the characteristics of the building and its equipment, and a list of recommended cost-efficient work to improve the energy performance. **EPCs have a maximum validity of ten years and must be established independently by an expert.**

The widespread use of EPCs in recent years has turned them into a public policy instrument: EPCs are used to measure the building stock's energy efficiency, to steer renovation action (such as phasing out energy bands G and F from the French rental market), and to (re)direct property investments toward the most energy-efficient products.

Although this increased use of EPCs within the EU has revealed some difficulties in the methods employed, it has also demonstrated the reliability of results, motivating the European Commission to work on a standardisation of the measure in its proposed recast of the EPBD published on 15 December 2021 and currently in the process of approval.

UPCOMING EPBD REVISION: WHAT WILL BE THE IMPACTS ON EPCs?

Faced with the limited European standardisation of EPCs, and in line with the "Renovation Wave" strategy dating from 2020 (announcing a doubling of the renovation rate by 2030) and the "Fit for 55" legislative package, **the proposed recast of the EPBD aims to clarify the measurement of energy performance and clearly establish the performance targets for 2050.**



The main changes include the requirement t**o express energy consumption as primary energy in the form of kWh per sqm per year and to stipulate whether or not it is of renewable origin.** As illustrated in the tables in the part giving an overview of EPCs in Europe, some Member States already apply these criteria, which means that they are already at least partially in compliance with European Taxonomy requirements. These requirements will also be further detailed in the part dedicated to the EU Taxonomy.

In addition, the recast proposal introduces the obligation to establish **minimum energy performance thresholds for the entire EU building stock**, aligned on the E rating for public and non-residential buildings by 2030 and residential buildings by 2033. The duration of D- and G-rated certificates will also be reduced from ten to five years.

The different consumption thresholds recommended in the EPBD recast (minimum performance level, NZEBs and ZEBs) will also need to be indicated in future EPCs to make them easier to compare. **One on the main purposes of the EPBD recast proposal published 2021 is to harmonise EPCs and their content between all Member States.**

Another new feature of the EPC will be a renovation passport providing step-by-step details of the renovation stages to reach the status of NZEB, with the related cost and cost-efficiency.

The EPC energy bands will also be standardised from 2026, with band A corresponding to zero emission buildings (ZEB), in line with EU Taxonomy criteria, and band G representing the 15% least energy efficient buildings in the national stock.

In addition, Member States will be required to establish extensive renovation strategies to bring their entire building stock to ZEB status by 2050. This will entail establishing a timetable for phasing out the most inefficient energy ratings in the national property market, in addition to the recommended efficient renovation measures that featured in the 2010 and 2018 revisions of the EPBD.

Member States will also have to create open-access national databases on energy performance that will then feature in the EU Building Stock Observatory.

EPCs should also become more transparent and reliable and play a key information-providing role in the renovation of EU building stock.

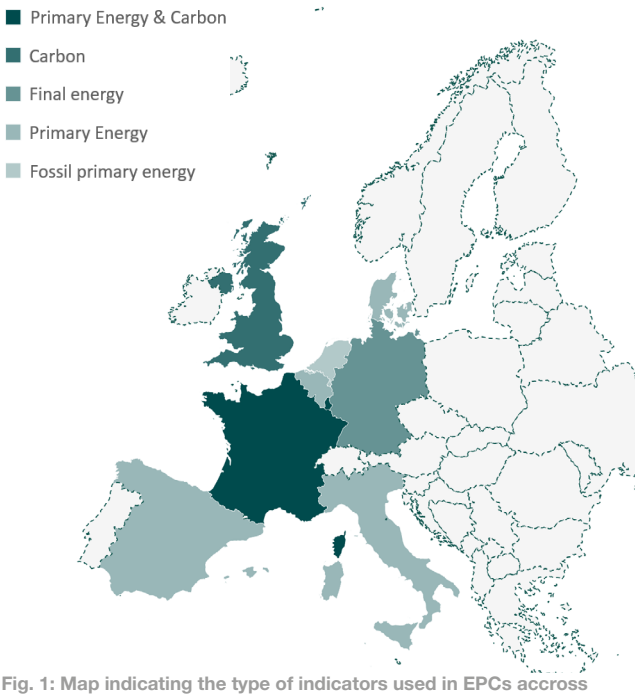


Fig. 1: Map indicating the type of indicators used in EPCs accross Europe.

FIT FOR 55: FIRST STEP IN 2030

To attain carbon neutrality by 2050 as set out in the European Green Deal, the European Commission established in July 2021 a package of 12 proposals focused on climate. The aim is to adapt climate policies to achieve a 55% reduction in GHG emissions by 2030 compared to 1990 levels.

The building sector needs to implement a 60% reduction in emissions by 2030 compared to 2005 levels. To achieve this reduction, the EU has suggested measures that include improving buildings' energy performance, ecodesign requirements for products related to energy, and energy labelling systems to inform consumers.

Among the Commission's proposals, two relate to the transport and building sectors. Firstly, a reform of the Energy Taxation Directive (ETD), introducing new minimum tax rates indexed to inflation for the different types of energy starting from 2023. Secondly, the extension of the EU Emissions Trading System to the transport and building sectors from 2026.

The European Parliament faced a vote on the issue in June 2022. In the context of inflation and energy crisis, the extension of the carbon market will be done first for commercial buildings in the construction sector, and for trucks and planes in the transport sector. These sectors will be covered from 2025. A review clause is planned in 2026 to analyse whether the inclusion of private transport and residential buildings is relevant, and will then propose an entry into force in 2029.

EPC, THE HINGE POINT OF REGULATIONS IN TRANSITION IN EUROPE

The shift of EPCs at European level, moving from an indicative estimation of energy consumption to a public policy tool for steering the decarbonisation of buildings, has gone hand in hand with a much greater use of this document in national policies.

At market level, the EPC now acts as an energy indicator for property, and a guide for good practices in building use and renovation. While Member States were already aware of the decarbonisation targets facing the sector, the progressive rise of EPCs and their level of detail make them a convenient tool for piloting decarbonisation policies on newbuilds and renovations of older buildings.

Regulations have therefore begun to centre around EPCs, both in some countries and at EU level.

EPC: STEERING TOOL FOR NATIONAL DECARBONISATION POLICIES

At the level of Member States, national regulations and financial incentives employ EPCs to establish their criteria and requirements. This is the case for several European countries, including France, the United Kingdom, the Netherlands and Italy.

FRANCE: EPCs ESTABLISH THE FRAMEWORK FOR DECENT HOUSING

In France, the 2019 Energy-Climate Act has prohibited rental increases in housing with inefficient energy performances since 2021. The energy performance certificate can be used to define this type of housing because residential buildings that consume excessive energy correspond to bands F or G in the new French EPC ratings.

The law also obliges the owners of energy-inefficient housing to carry out an energy audit when they decide to sell or buy starting from September 2022, and from 2023 this type of property will be qualified as "*indecent housing*". Properties that consume excessive energy, often called "*leaky buildings*" in fact raise the notion of what constitutes decent housing. Moreover, this issue overlaps social problems resulting from households living in fuel poverty.

The 2021 Climate and Resilience Act also helps to establish a new minimum energy performance for housing, since from 2025 it will be prohibited to let property in band G. This prohibition will be extended to F-band housing from 2028. In addition, from that year all owners of housing qualified as leaky according to its EPC band, will be obliged to carry out renovation work to bring the property's energy label up to at least band E. The year 2034 marks the deadline of carrying out renovations to upgrade to band D or above, since from 2034 landlords will no longer be able to let properties with an E rating.

UNITED KINGDOM: THE ENERGY WHITE PAPER, A NET ZERO STRATEGY BASED ON EPCs

To meet the requirements of the Climate Change Act, which establishes the United Kingdom's targets for reducing greenhouse gas emissions, in December 2020 the British government produced a ten-year plan called the Energy White Paper. The paper establishes that all housing will have to attain band C by 2035, with financial assistance and incentives to help individuals renovate their homes. **The objective for the tertiary sector is that by 2030 all non-residential buildings will reach at least band B** in the energy performance certificate ratings.

From 1 April 2023, the scope of the Minimum Energy Efficiency Standard (MEES), which came into force in England and Wales on 1 April 2018, will extend to existing tenancies of most commercial property and will restrict a landlord's ability to continue to let property with an F or G rating.

Other intermediate stages of defining a minimum energy performance standard are anticipated in order to reach the Energy White Paper's objective:

- "*1 April 2027: all non-domestic rented buildings must have improved the building to EPC ≥ C, or registered a valid exemption.*
- *1 April 2030: all non-domestic rented buildings must have improved the building to EPC ≥ B, or registered a valid exemption.*"

ITALY: A FINANCIAL INCENTIVE FOR PRIVATE INDIVIDUALS WHO IMPROVE THEIR EPC RATING

Renovations that improve the energy efficiency of a building can qualify for an Ecobonus and benefit from a 50-85% tax reduction. The Italian "Relaunch Decree" also increased the rate for the deduction of expenses for energy measures such as building insulation, earthquake protection or the installation of photovoltaic systems. These measures are also known as "Superbonus 110%" and apply to work that has been carried out since 1 July 2020 or that was completed by 31 December 2021.

In this way, the Superbonus is available for individuals that improved the EPC of a building by at least two classes, or reached the highest class of energy efficiency. Alternatively, the company that carried out the work can apply for a discount of up to 100% of the invoice and receive a tax credit equal to 110% of the amount of the discount applied. **The EPC thus acts as proof and is indispensable to obtain the Superbonus.**

THE NETHERLANDS: ESTABLISHING THE PERFORMANCE OF OFFICES USING EPCs

The Climate Law aims to reduce the emission of greenhouse gases in all sectors by 49% in 2030 and by 95% in 2050 (related to 1990). To meet this goal in the building sector, the Dutch government has set a minimum energy performance for office buildings. **As of 1 January 2023, all (existing) office buildings in the Netherlands should have an energy label C or above.** If an office building does not meet this requirement, as of this date, it may no longer be let. The goal for 2030 is that all office buildings should have an energy label A or above. This requirement is part of the 2012 Building Decree.

In addition, based on the same principle as Italy, a tax deduction is offered to companies that undertake work to improve energy performance, either at the construction stage or during the building's usage. This deduction may be contingent on a higher EPC rating, among other things.

EU TAXONOMY, A STEP FORWARD

A COMMON LANGUAGE FOR ALL ECONOMIC AND FINANCIAL PLAYERS

In March 2018, the EU Action Plan for Financing Sustainable Growth was published. The financial requirements of the European Union's ecological transition are estimated in the plan as 500 billion euros a year. To meet these needs, ten actions are promoted, including the need to create a European reference list of so-called "sustainable" activities. This list, called the EU Taxonomy, categorises economic activities according to their environmental externalities to make financial markets clearer and guide investments towards companies or environmentally virtuous projects.

The EU Taxonomy was formalised in EU regulation 2020/852 which establishes the regulatory framework of the measure and determines the key operating principles of sustainable activity. It also includes a list of the six main environmental objectives that should be pursued by this regulation.

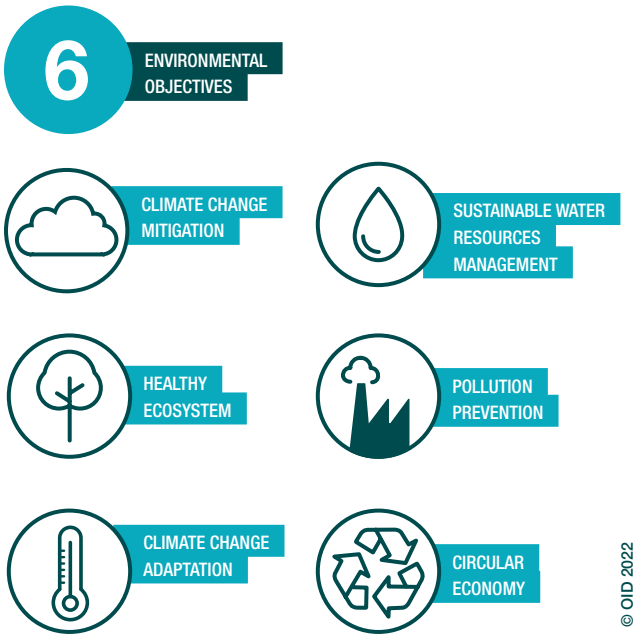


Fig. 2: Environmental objectives of the EU Taxonomy.

Each economic activity is the object of a definition and technical criteria to determine whether it can be qualified as sustainable. To guarantee a relatively standardised application in the various European countries, most of these technical

criteria are themselves based on other European directives.

The taxonomy-eligible activities listed have a high impact on each of the environmental objectives, but still have significant room for improvement.

To date, the taxonomy has stipulated criteria for two of the six environmental objectives, i.e. mitigation and adaptation.

Given its considerable impact on the environment, the building sector is closely concerned, in particular for the construction and renovation of new buildings, the installation of energy-efficient equipment, technologies related to renewable energy, and the acquisition and management of property. The actors involved will therefore need to analyse all of their activities in line with the taxonomy criteria to determine whether they are in compliance.

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.

MITIGATION DEFINED THROUGH EPC RATINGS

Mitigation is one of the major EU challenges, and the group of European experts has published the criteria applicable for the building sector. **In the real estate sector, several criteria refer to EPBD requirements.**

Concerning the construction of new buildings, one of the substantial contribution criteria for mitigating climate change relates to the primary energy demand of buildings, which must be under 10% of the NZEB threshold in force in the country concerned. Buildings' energy performance must be certified by an EPC.

In addition, the alignment of property acquisition and management activities with Substantial contribution criteria (SCC) and Do No Significant Harm (DNSH) criteria is dependent on EPC ratings.

For example, for SCC and DNSH, a building's thresholds are established based either on its EPC ratings, or the fact of that it comes within a percentage of energy-efficient buildings in its market.

CHALLENGE OF STANDARDISING EPC INDICATORS AT EUROPEAN LEVEL

For the energy performance of buildings, the taxonomy is closely based on EPCs. However, any attempt to standardise the definition of sustainable buildings in Europe comes up against the differences and similarities between EPCs in the various countries. For example, what does EPC A or EPC C mean in the different European countries? Are they really comparable in terms of actual energy consumption? Property players working across Europe regularly come up against these questions as they reflect on how to roll out a consistent decarbonisation strategy for their property on the European continent.

	Mitigation criterion *SCC*	Mitigation criterion *DNSH*
Energy band	EPC A minimum	EPC C minimum
Ranking	Top 15% of regional building stock	Top 30% of regional building stock

Fig. 3: Mitigation criteria for buildings in the EU Taxonomy.

SUSTAINABLE FINANCE DISCOLURE REGULATION (SFDR) AND EPCs : DEFINING EFFICIENT BUILDINGS

Regulation 2019/2088, known as Sustainable Financial Disclosure Reporting, imposes transparency obligations on financial market players in terms of environmental, social and corporate governance issues in their annual reports and pre-contractual documentation.

Among these obligations, in 2023, management companies will have to publish annual reports on their main negative impacts (potential damage to the environment).

The European Commission has defined precise indicators for this, with specific reporting for real estate players.

There are 2 mandatory indicators, one of which is the percentage of energy inefficient assets. An efficient real estate asset in the sense of the SFDR Regulation is an asset that has an ECD A or B. However, in the Taxonomy, a building with an ECD class C is included in the DNSH. This shows a lack of harmonisation between the two major EU regulations.

EUROPE: OVERVIEW OF EPCs

DIFFERENCES AND COMMON FEATURES IN DEFINING EPCs

The EPBD and its revisions give Member States a great deal of flexibility to develop EPC methods adapted to their national, and even regional, situations, which has resulted in a wide variety of measures. Below we look at the common features and differences in the energy performance certification systems currently in place in Europe.

COMMON FEATURES OF EPCs

SCOPE OF CONSUMPTION

In theory, a key feature of the EPBD is the measurement of the quantity of primary energy necessary to satisfy normal requirements for a building's heating, ventilation, hot water, cooling and heating in line with the construction characteristics of a building (orientation, envelope). These minimum requirements must be expressed in kWh per sqm per year, the basic unit that is theoretically common to all EPCs.

SCALE

EPCs must also "*include the energy performance of a building and reference values such as minimum energy performance requirements*", which suggests that they should be based on a scale. The directive does not however recommend any particular rating system for the scale, leaving individual countries free to determine their own measurements.

DURATION

The directive also establishes a common period of validity for EPCs of ten years maximum. In addition, it establishes the obligation to carry out EPC quality checks based on verifying a random sample of EPCs, although it does not recommend any particular way of carrying it out. Lastly, all energy performance certificates recommend adopting efficient energy practices in order to sustainably reduce consumption. They also suggest carrying out cost-efficient works.

SOURCES OF DIFFERENCES IN THE DIRECTIVE

The text authorises two types of energy performance evaluation: a calculated method using software (simulation of construction characteristics and building equipment to estimate its consumption), and a method based on actual consumption (as shown on bills).

The directive authorises Member States to adopt their own methods for buildings in line with their purpose (residential, non-residential or public), construction period (existing or new), and climate zone.

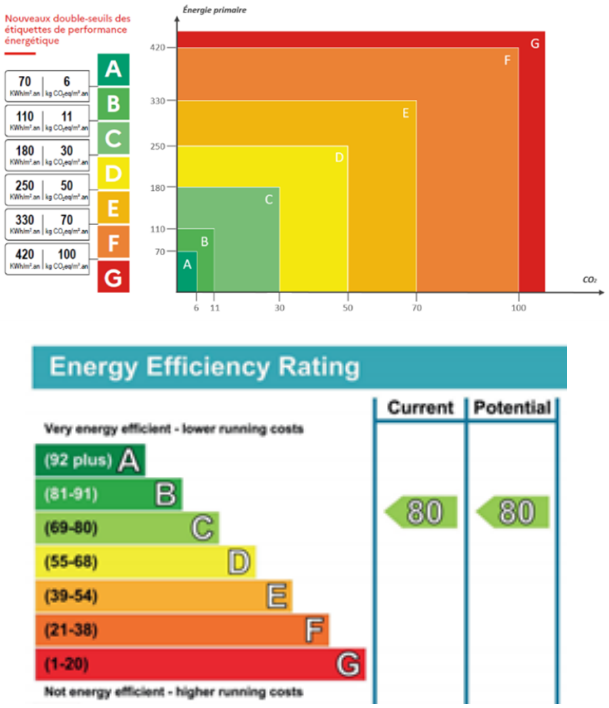


Fig. 4. Sources : ecologie.gouv.fr and which.co.uk.
Energy labels of housing in France (up) and England & Wales (down). The former expresses energy consumption based on a quantified scale, whereas the latter presents the energy performance in relation to a standard building (whose value is arbitrarily fixed at 50 on a scale from 0 to 100).

CLEAR DIFFERENCES

In the absence of a clear definition of energy scales and ratings, the most obvious differences are in the way that the energy ratings are presented. Some countries express energy consumption based on a scale measured in kWh per sqm per year, while others present energy consumption in relative terms, generally by comparing the energy consumption of the building studied with a standard building type. Similarly, the differences between energy bands (A, B, C, etc.) are not the same from one country to the next, nor from one type of property (housing, offices, schools) to another.

Moreover, sometimes other energy and environment criteria are added, or even preferred, to primary energy, like greenhouse gas (GHG) emissions, fossil fuel consumption, and final energy (like on the German label for tertiary buildings shown in fig.5), which can make comparisons difficult.

Lastly, some countries have chosen to promote the most efficient buildings by creating sub-categories of energy band A, which can make that rating difficult to interpret. One example is the Netherlands, which rates almost 50% of housing as A, A+, A++, A+++ and A++++. Every time energy performance requirements for newbuilds are made stricter, a new A sub-category is added, which makes it harder to compare A ratings as a whole.

More than simple differences in presentation, these variations reflect essential differences in methodology that need to be identified and evaluated.

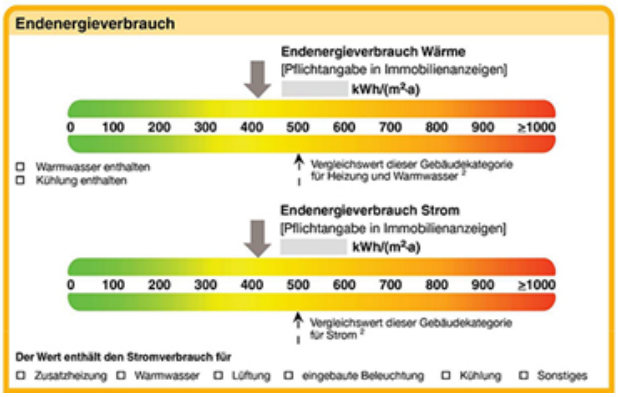


Fig. 5. Source : Bundesanzeiger.de.
Energy labels applicable to office buildings in Germany. The upper scale indicates the final energy consumption for heating, and the lower scale indicates final energy consumption for electricity.

METHODOLOGICAL DIFFERENCES

Fluctuating scope of consumption

Firstly, the scope of energy consumption, although explicitly targeted by the directive (heating, hot water, ventilation, lighting, cooling) tends to fluctuate depending on the country and building type. Residential EPCs are the most consistent in terms of consumption measured, with only a few minor differences, such as the humidification and dehumidification requirements included in the primary energy needs of the Dutch residential EPC.

However, **the consumption items included in the EPCs of non-residential buildings (shops, offices, warehouses and activities) and public buildings vary widely.** One of the main factors is whether or not specific energy needs are included (e.g. the electricity needed for office equipment) depending on the country and climate zone.

Different calculation methods

More fundamentally, this difference in scope is secondly due to the existence of two methods employed for counting the energy requirements authorised by the EPBD:

- "**CALCULATED REQUIREMENTS**" (simulation of the consumption of energy on the basis of insulation and technical equipment in a building);
- "**ACTUAL CONSUMPTION**" (generally based on energy bills, which makes performance highly subject to user behaviour or the duration of use of the building).

Member States generally use both of these methods according to the nature of the building (type, construction period), which corresponds to the distinctions between newbuilds and existing buildings and between residential, non-residential and public. New housing is therefore subject to an energy simulation, while the oldest residences (usually dating from before the introduction of energy performance standards) are subject to the "actual consumption" method.

Even more importantly, each country, and even each regional entity, takes into account specific data concerning its conversion factor of primary energy into final energy, and climate zone if relevant. Moreover, the successive changes to calculation methods, in particular following revisions of the EPBD, make it harder to compare EPCs over time.

COMPARING EPCs IN EUROPE: A CRUCIAL CHALLENGE

Given these differences and similarities in the theoretical components of EPCs in Europe, it is worth comparing the methods employed, in the interest of property players who want to make international analyses at European level.

Another standardisation issue regarding energy performance certificates in Europe is the comparability of energy bands. Each energy band is defined by a letter and is in principle limited by a lower threshold and an upper threshold. **Yet not all countries define these thresholds in the same way.** For example, the unit employed to display the energy performance of a building on the certificate is not the same in every country. An additional obstacle is the absence of a unit in some countries, which compare a building's energy performance to that of a standard reference building, making it impossible to compare ratings with each other or with those of other countries.

The following analysis relates more specifically to nine European countries (France, United Kingdom, Germany, Belgium, Netherlands, Italy, Spain, Luxembourg and Denmark) based on the following main criteria: the scale of energy ratings, the calculation methods used for new constructions, those applying to existing buildings, and the unit employed for the energy scale and the carbon scale when it exists.

RESIDENTIAL EPCs IN EUROPE: RELATIVELY FAITHFUL TO THE EPBD

THE THEORETICAL CRITERIA OF RESIDENTIAL EPCS

In the entire sample used, only one country does not express energy ratings by a unit. That country is the United Kingdom, which employs a standardised method based on a reference building. The nations that make up the United Kingdom do not use a scale measuring primary energy, but rather a rating ranging from 0 (very inefficient) to 100 (very efficient) depending on the energy performance of the building. The energy performance rating is therefore not expressed in units.

For the other countries presented here, two types of unit are most common:

- kWh_{PE} per sqm per year, independently from the source of energy.
- kWh_{PE} per sqm per year, stipulating non-renewable energy resources (Italy and Spain) or fossil energy sources (the Netherlands)

In addition, Germany expresses energy performance in final energy first, and then converts it into primary energy in order to display it on the EPC in the format recommended by the EPBD.

	Band scale	Calculation method newbuilds *(name)*	Calculation method existing *(name)*	Unit(s)
FR *Diagnostic de Performance Energétique*	**A to G** (7 bands)	**Calculated requirements** *(method 3 CL)*	**Calculated requirements** *(method 3 CL)*	. kWhPE/(sqm.year) . kgCO2/(sqm.year)
UK *Domestic Energy Performance Certificate*	Standard 0 to 100 **A to G** (7 bands)	**Calculated requirements** *(Standard Assessement Procedure)*	**Calculated requirements** *(Reduced Data SAP)*	No unit
DE *Energieausweiss*	**A+ to H** (9 bands)	**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*	**A++++ to G** (11 bands)	**Calculated requirements** *(Méthode BENG)*	**Calculated requirements**	kWhPE/(sqm.year) in fossil energy
BE. - Wallonie *Certificat de Performance Energétique du Bâtiment*	**A++ to G** (9 bands)	**Calculated requirements**	**Calculated requirements**	kWhPE/(sqm.year)
BE. - Bruxelles *Certificat de Performance Energétique du Bâtiment*	**A++ to G** (18 bands)	**Calculated requirements**	**Calculated requirements** *(UNI/TS 11300 with possible simplifications)*	kWhPE/(sqm.year)
BE. - Flandres *EPC Construction/EPC Residentiel*	**A+ to F** (7 bands)	**Calculated requirements**	**Calculated requirements**	kWhPE/(sqm.year)
IT *Attestato di Prestazione Energetica*	**A4 to G** (10 bands)	**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*	**A to G** (7 bands)	**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*	**A+ to I** (10 bands)	**Calculated requirements**	**Calculated requirements**	.kWhPE/(sqm.year) for annual energy consumption and heating requirements .GHG emissions in CO2 eq.
DK *Energimærket*	**A2020 to G** (9 bands)	**Calculated requirements** *(BE 2018)*	**Calculated requirements**	kWhPE/(sqm.year) for annual energy consumption

Fig. 6: Main criteria of the EPCs for housing in different European countries. This table indicates the upper and lower thresholds of the band scale, the number of bands in the scale, the calculation methods for newbuilds and for existing buildings, and unit(s) used in the EPCs.

Concerning the calculation method, all countries produce evaluations of the future energy performance of newbuilds according to a calculated requirement, which is estimated in view of the energy performance of the different equipment and materials in the building. The principle is therefore similar from one country to the next, given that newbuilds and buildings under construction do not have a consumption history that can be used to estimate their energy performance. However, the principle is not standardised, because **each country uses its own method, and its own software to calculate the energy performance**, which is also subject to diverse variations in the criteria considered (e.g. taking into account the climate zone, or the coefficient for converting final to primary energy).

The same issue concerns the calculation methods employed to produce EPCs for existing buildings. All countries employ a method based on "calculated requirements", except for Germany, where there is a choice between "calculated requirements" and "measured consumption" depending on the period of construction and the existence of renovation work.

The number of energy bands in an EPC varies depending on the country, ranging from 7 to 18 different bands (as shown in fig.7). In addition, the upper and lower thresholds of the bands are not based on the same indicators in all countries, since some use a threshold expressed in kWh_{PE} per sqm per year, while others employ percentages of consumption compared to a reference building.

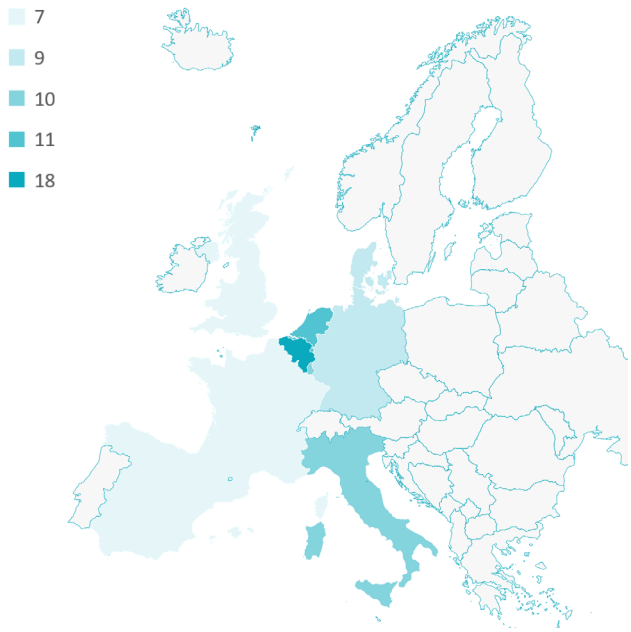


Fig. 7: Number of energy labels in residential EPCs accross Europe.

ENERGY LABELS FOR RESIDENTIAL BUILDINGS

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 and office buildings.

For bands used to identify the energy label for residential buildings, the comparison made for energy labels' thresholds concerns six of the countries studied in fig. 6 (France, Germany, Belgium, Netherlands, Luxembourg and Denmark).

This is because a comparison of the energy labels used in the United Kingdom, Italy and Spain is not possible. These countries are not comparable with the others (or with each other) because they do not use a unit expressed in kWh per sqm per year equivalent to that used in the other countries. The energy ratings featuring on EPCs in these countries relate to a reference building, and therefore not a unit.

Concerning the actual energy bands and their thresholds, the European countries studied have a different number of bands. This is the case for example in 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. The numerous bands in this country make comparison difficult. 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.

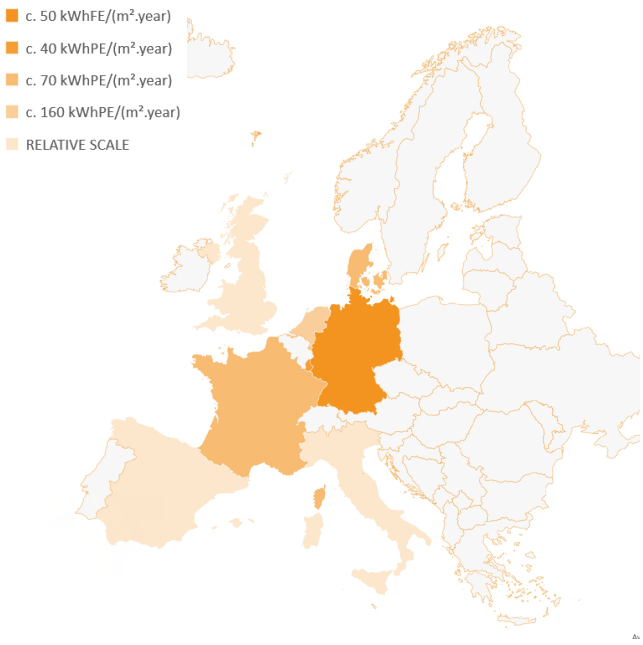


Fig. 8 : Lower threshold of label A for residential buildings EPCs in Europe.

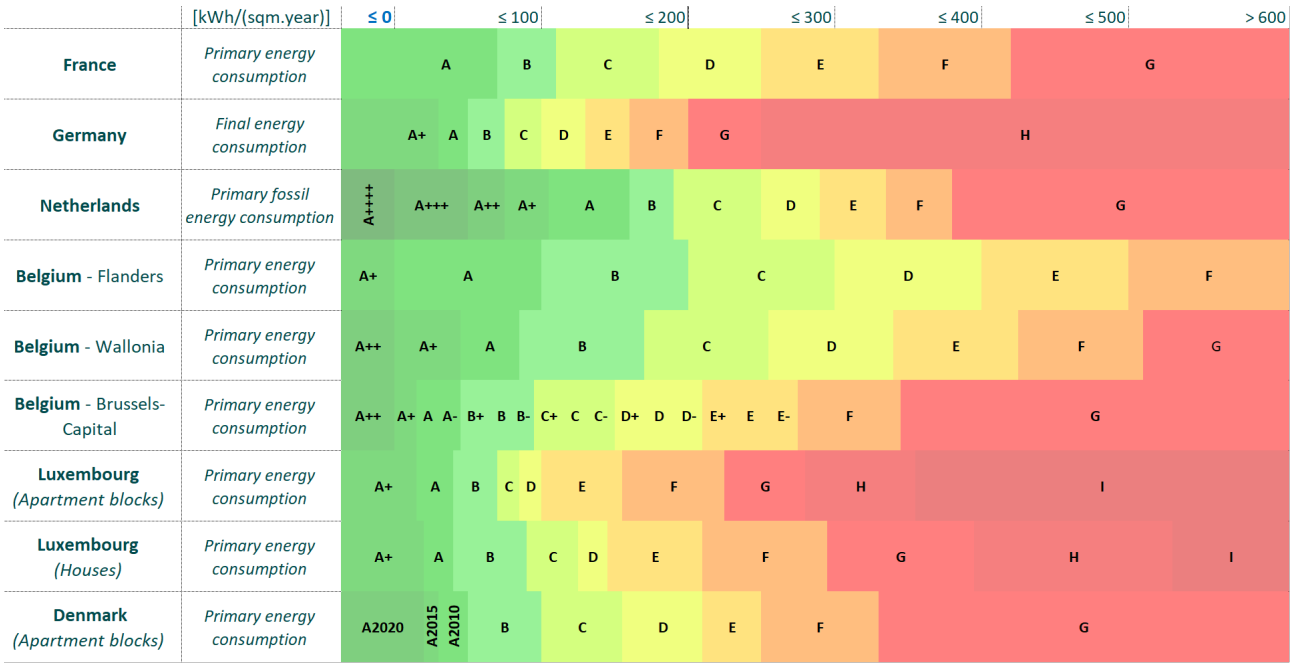


Fig. 9: Energy bands and their thresholds in several Member States that employ measurement scales in kWh/(sqm.year) for residential buildings.

As well as the varying number of bands depending on the country studied, the thresholds in kWh per sqm per year 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 band D, E or F in Germany, 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. There is therefore no standardisation here, 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.

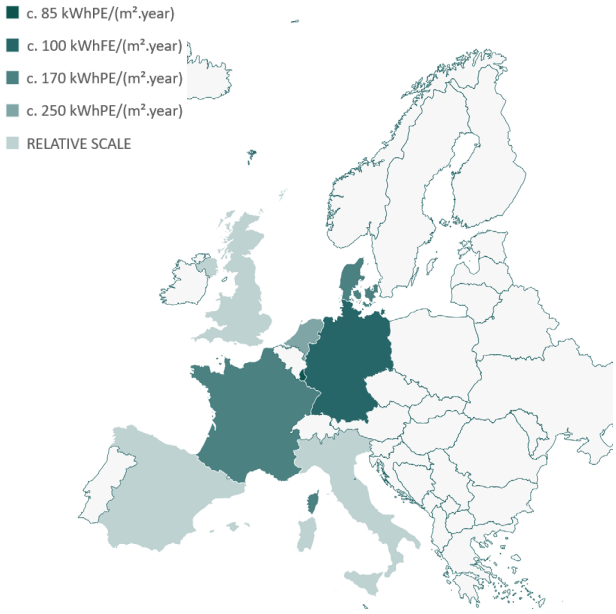


Fig. 10 : Lower threshold of band C on the scale of residential buildings EPCs in Europe.

EPCs FOR OFFICE BUILDINGS: STILL DIFFICULT TO COMPARE

OVERVIEW OF EPC CRITERIA FOR OFFICE BUILDINGS

Concerning energy performance certificates for non-residential buildings, countries in Europe do not all apply the same rating system for building types. As a result, a comparison of the theoretical criteria of EPCs for the non-residential sector as a whole is inconsistent. Below, we provide a concise overview of the situation for office buildings.

The main country that stands apart on these criteria is Germany, which does not use letters in its EPCs for office buildings, but rather applies a proportional scale that indicates the building's energy performance in comparison to a reference building.

Once again, the units employed to express energy performance are relatively similar, with most countries opting for the unit kWh_{PE} per sqm per year. However, some countries employ energy indicators other than primary energy, such as Germany (final energy), the Netherlands (fossil energy), Italy and Spain (non-renewable primary energy) and the United Kingdom and France (GHG emissions).

When it comes to the calculation method used to produce an EPC, all countries employ the "calculated requirements" method for new buildings, but three countries partially employ the "measured consumption" method for existing buildings (France, Germany and Luxembourg).

	Band scale	Calculation method newbuids	Calculation method existing	Unit(s)
FR *Diagnostic de Performance Energétique*	**A to G** (7 bands)	**Calculated requirements**	**Measured consumption**	. kWhPE/(sqm.year) . kg CO2/(sqm.year)
UK *Energy Performance Certificate*	**A+ to G** (8 bands)	**Calculated requirements**	**Calculated requirements**	GHG emissions
DE *Energieausweiss*	Relative to a reference building	**Calculated requirements**	Choice between **calculated requirements** and **measured consumption**	kWhPE/(sqm.year) converted into kWhPE/(sqm.year)
NL *Energielabels*	**A+++++ to G** (12 bands)	**Calculated requirements**	**Calculated requirements**	. kWhPE/(sqm.year) . kWhPE fossil energy/(sqm.year) . Share of renewable energy
BE. - Wallonie				
BE. - Bruxelles *Certificat de Performance Energétique du Bâtiment*	**A to G** (7 bands)	**Calculated requirements**	**Calculated requirements**	kWhPE/(sqm.year)
BE. - Flandres *EPC Construction/EPC Residentiel*	**A+to F** (7 bands)	**Calculated requirements**	**Calculated requirements**	kWhPE/(sqm.year)
IT *Attestato di Prestazione Energetica*	**A4 to G** (10 bands)	**Calculated requirements**		kWhPEnren/(sqm.year) (non-renewable primary energy per sqm per year, relative to a reference building)
SP *Certificado de Eificiencia Energetica*	**A to G** (7 bands)	**Calculated requirements**		. kWhPEnren/(sqm.an) (non-renewable primary energy per sqm per year, relative to a reference building) . kgCO2eq/(sqm.year)
LU *Passeport énergétique*	**A+ to I** (10 bands)	**Calculated requirements**	Choice between **calculated requirements** and **measured consumption**	No unit
DK *Energimærket*	**A2020 to G** (9 bands)	**Calculated requirements**	Calculated requirements	kWhPE/(sqm.year) for annual energy consumption

Fig. 11: Main criteria of the EPCs for offices buildings in different European countries. This table indicates the upper and lower thresholds of the band scale, the number of bands in the scale, the calculation methods for newbuilds and for existing buildings, and unit(s) used in the EPCs.

Like for residential EPCs, the number of energy bands in an EPC varies for office buildings. Depending on the country, it goes from 7 to 18 different bands for the EPC scale.

Moreover, the units used to define the different bands are not the same in all countries. Indeed, some use kWh_{PE} per sqm per year to define the thresholds (upper or lower) of the different bands, while others base their energy bands on percentages of consumption compared to a reference building.

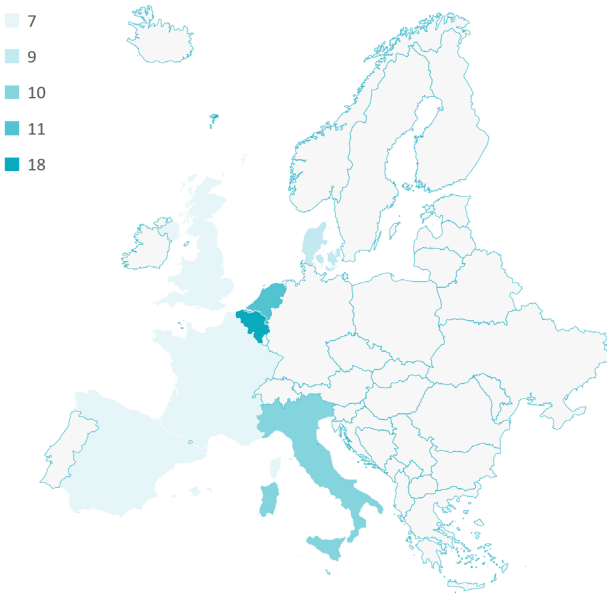


Fig. 12: Number of energy labels in offices buildings EPCs accross Europe.

OVERVIEW OF ENERGY LABELS FOR OFFICE BUILDINGS

Concerning office buildings, below we compare the energy bands featuring in EPCs in four of the nine European countries studied (France, Belgium, Netherlands and Denmark).

Once again, not all of the countries can be compared here. The United Kingdom, Luxembourg, Italy and Spain are not comparable with the others (or with each other) because they do not express consumption in kWh. Their energy rating systems for office buildings compare energy efficiency with that of a reference building, and therefore not a unit. In addition, Germany is not presented because for office buildings no band thresholds are identified. The scale is continuous rather than graduated, making it difficult to position the bands on a scale in kWh per sqm per year. Lastly, the Wallonia region of Belgium does not appear here because no EPC specific to office buildings has been identified.

Like for residential buildings, the four countries studied employ different numbers of bands for office building EPCs. The Brussels-Capital region in Belgium once again features a high number of bands. The same is true for the Netherlands, which has multiple bands corresponding to the most efficient buildings, with five bands designating performance higher than EPC A. These detailed ratings make it harder to compare EPCs between the different countries. In fact, in terms of primary energy consumption indicated on the EPC, the Netherlands A band is equivalent to a C band on the French EPC, a B band for Belgium-Flanders, a D+ band for the Brussels-Capital region, and a D band for Denmark.

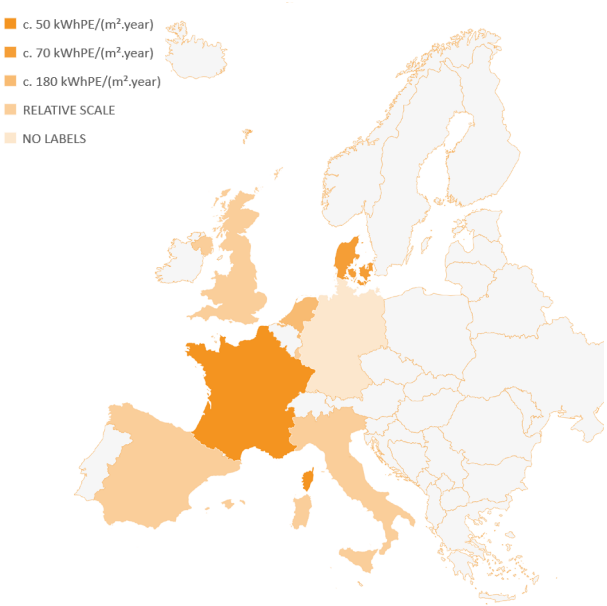


Fig. 13: Lower threshold of label A for offices buildings EPCs in Europe.

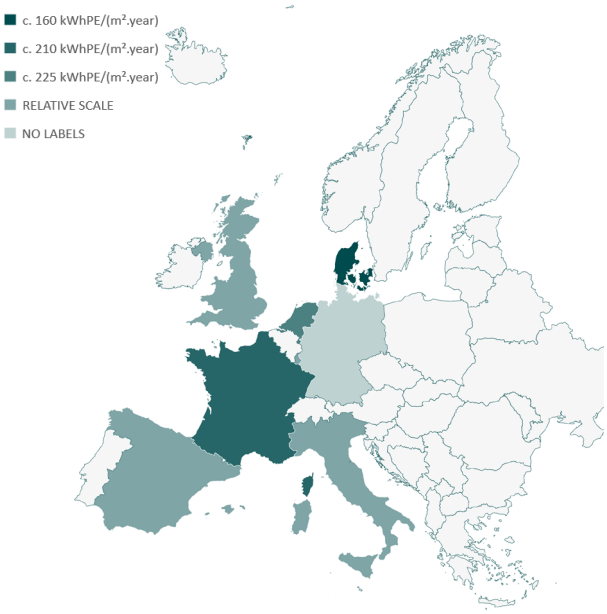


Fig. 14: Lower threshold of band C on the scale for offices buildings EPCs in Europe.

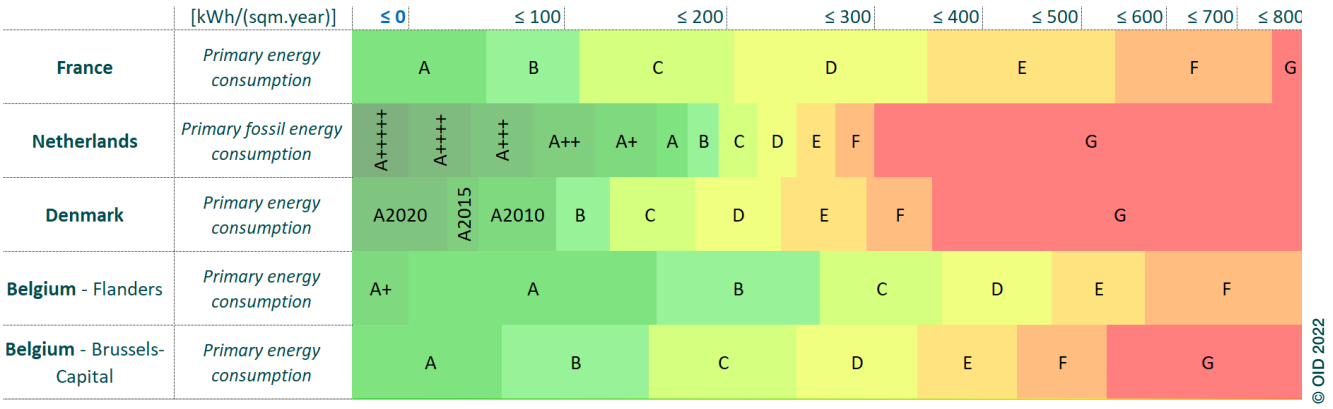


Fig. 15: Energy bands and their thresholds in several Member States that employ measurement scales in kWh/(sqm.year) for offices buildings.

UNDERSTANDING THE CRITERIA FOR TAXONOMY ALIGNMENT: THE ROLE OF EPCs

What does this mean for the EPC A (and EPC C) put forward in the EU Taxonomy as substantial contribution (or DNSH) criteria concerning the different environmental objectives? As mentioned above, the EPC A threshold is not standardised from one country to the next, with a wide variation in corresponding energy consumption levels. For example, the lower threshold of the A band ranges from 40 to 160 kWh per sqm per year depending on the country, for both residential and office buildings, which constitutes a huge difference in value. The comparison between EPC A bands in office buildings in the Netherlands with those of other countries clearly illustrates these different thresholds, both upper and lower.

This can be put down to different calculation methods, the criteria that they take into account, and perhaps also the diversity of building stock in Europe. Each country has its own specific features, such as the different energy needs of Mediterranean countries and Nordic countries, the old age of the building stock, or progress made in renovation works. These differences therefore have a direct impact on the definition of energy bands in the countries considered.

This major difficulty in interpreting taxonomy criteria in line with the energy performance of buildings requires collaboration between experts in the sector. There is a clear need for cooperation, both in terms of the choice and definition of taxonomy alignment criteria and on the standardisation and improved reliability of EPCs, both within European countries and at European level. The criteria for establishing EPCs are not always consistent from one country to the next. While the revision proposal of the EPBD of December 2021 goes in the right direction, work remains to be done before real estate actors can easily compare their activities throughout Europe.

CONCLUSION

While it sets down common principles, since its establishment in 2002 the EPBD has left European countries considerable leeway to define their certification systems. As a result, energy performance certification varies widely in Europe and **making a clear comparison of the energy performance of building stock in different European countries 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 objectives, both at European level and within the different countries. These objectives, which feature in the Renovation Wave for the building sector, are indeed crucial for the European Union.

In particular, the EU Taxonomy defines alignment criteria based on EPCs, although their concrete translation in terms of requirements is different 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. **Since their introduction in 2002, EPCs have evolved and become a transition tool for the real estate sector.**
2. **The mitigation criteria under the EU Taxonomy is based on the EPC band.**
3. **Differences persist between countries, both on theoretical criteria (bands and calculation method) and on EPC thresholds.**
4. **To date, residential EPCs are more in agreement with the EPBD recommendations.**
5. **The EPBD will be revised in the coming months, in order to move towards harmonisation leading to a common model.**

RESOURCES

EU Targets & Building sector:

EU climate strategies & targets

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

Energy Performance of Buildings Directive :

EPBD – Directive 2002 **– Text of the European Parliament and of the Council of the European Union**

EPBD – 2010 Revision **– Text of the European Parliament and of the Council of the European Union**

EPBD – 2018 Revision **– Text of the European Parliament and of the Council of the European Union**

EPBD – 2021 Revision **– Text of the European Parliament and of the Council of the European Union**

Concerted Action Energy Performance of Buildings

BPIE, About EPDB 2021 Recast

Europe:

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

Energy performance certificates across Europe

OID, ESREI Resources Centre

France:

Law No. 2005-781 establishing the guidelines for energy policy

Decree No. 2006-1147 on energy performance certificates

Law on Energy and Climate

Germany:

Implementation of the EPBD in Germany

Energieausweis – EPC in Germany

Italy:

Implementation of the EPBD in Italy

About the energy performance of buildings in Italy

Ecobonus 110% in Italy

Interministerial decree of 26 June 2015 on energy certification for buildings

Spain:

CAEPBD, Implementation of the EPBD in Spain, 2018

Energy certification for existing buildings in Spain

Royal Decree 390/2021 on the energy performance certification of buildings

Netherlands:

Implementation of the EPBD in the Netherlands

Energy performance regulations in the Netherlands

Regulations on energy performance of buildings in the Netherlands

United Kingdom:

About the Committee on Climate Change

The Energy White Paper

Implementation of the EPBD in the United-Kingdom: England, Wales, Scotland, Northern Ireland

Belgium:

Implementation of the EPBD in Belgium : Brussels-Capital Region, Wallonia, Flanders

Flanders – Energy performance certification for existing buildings

Wallonia – Energy performance certification

Brussels-Capital – Energy performance certification

Denmark:

Implementation of the EPBD in Denmark

Energy requirements of the Danish Building Regulations 2018

Energy labelling in Denmark

Energy performance certificate database in Denmark

Luxembourg:

CAEPBD, Implementation of the EPBD in Luxembourg, 2018

Grand Ducal regulation of 9 June 2021 concerning the energy performance of buildings

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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 ninety 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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