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1. Introduction

All MSs are required to set up certification and disclosure schemes for buildings. They must also set up inspection schemes for heating and air-conditioning systems, or implement alternative measures. Most of the requirements related to certification and inspection derive from the EPBD Directive 2002/91/EC, which was to be fully implemented by 2009, and were followed-up in Article 11 of the EPBD recast Directive 2010/31/EU. Therefore, countries have systems in place that address these requirements, though a few are still working on the transposition of specific parts of that directive. Most countries have developed systems for, and now have significant experience in, the certification of buildings, the inspection of heating systems and, to some extent, the inspection of air-conditioning systems. Furthermore, over the years, countries have developed and collected significant experience with independent control systems.

According to the Evaluation¹ of the EPBD, *"even if Energy Performance Certificates (EPCs) have positively influenced property valuation, EPC recommendations could have had a higher impact on informing and stimulating higher renovation rates. For certification to go beyond its main objective of giving a market signal for efficient buildings and equally stimulate more building renovation, EPCs should be better integrated within a framework of supporting measures including EPC databases, and stronger links to financing schemes and to compliance checking. For instance, EPCs can be a valuable tool for assessing the level of compliance with building codes and enable efficient compliance checks by providing information to central bodies. The public consultation indicated that, in their current form, inspection reports could be*

poorly suited to the needs of non-expert building owners, with a high risk for the recommendation therein of being ignored".

Currently, the major challenges lie in the quality and effective implementation of certification and inspection systems, to ensure that the **full impact** of these systems is achieved. The focus of the work in the CA EPBD is oriented towards possible improvements to existing schemes and the exchange of best practices, rather than on developing systems from scratch.

This report focuses on the quality of both certification and inspection systems, as well as on the full implementation of the certification system. For consistency, issues linked to the actual implementation of inspection systems are covered in the CT2 report on existing buildings.

2. Objectives

For the general public, the EPC provision of the EPBD is one of the most visible elements of the directive. EPC systems use significant national resources and can thus be expected to deliver significant savings. However, some elements in the systems that have been developed reduce their impact. This central team's objectives are, therefore, to identify the elements that limit the certificates' outcomes and to investigate how these could be improved upon, using the substantial experience gained from the MSs. The differences and challenges are often found in the system's details that require improvement: for example, the quality of the reports and certificates, the monitoring and development of databases and capacity building on multiple levels.

A major challenge is the quality and use of certification and inspection systems in order to maximise impact whilst maintaining reasonable costs. Many lessons have been learned on a national level, and a key objective of the CA EPBD is to foster the sharing of experience and the development of guidance documents to gradually improve certification, inspection reports and control systems, as well as to help understand why some systems work better than others.

The work focuses on learning from European experiences and developing lessons learned and recommendations. It focuses especially on the quality and usefulness of the certification system and on specific technical elements linked to certification, which countries have found to be of interest.

3. Analysis of Insights and Main Outcomes

3.1 Steps in the Energy Performance Certification process

The scheme that delivers EPCs or inspection reports can be divided into several steps (Figure 1). Based on this structure, those aspects that significantly influence the quality and the public's perception of the schemes have been identified and have been central for the discussions.

Figure 1 presents the elements for the implementation of functional EPC schemes and the regular inspection of heating and air-conditioning systems. This image presents six (6) steps necessary to develop a functional EPC or inspection scheme, to deliver the reports and to guarantee the overall quality of the system. The process begins with the legal framework (step 1), requires a methodology (step 2), training of experts (step 3), the delivery of an EPC (step 4) and its availability for third parties (step 5). It concludes

with feedback from the market (step 6) covering various aspects, such as the stakeholders' perception of the system or the feedback on the EPC layout and content resulting in the improvement of the attractiveness of EPCs. The independent control system and the communication strategy are two relevant overarching elements for the whole process. Depending on the country, some of the steps in Figure 1 can be arranged in a different order. Each step covers different elements that may not necessarily be fully developed in every country. For instance, a few countries have not begun working with a central EPC database and some do not have a single official EPC software.

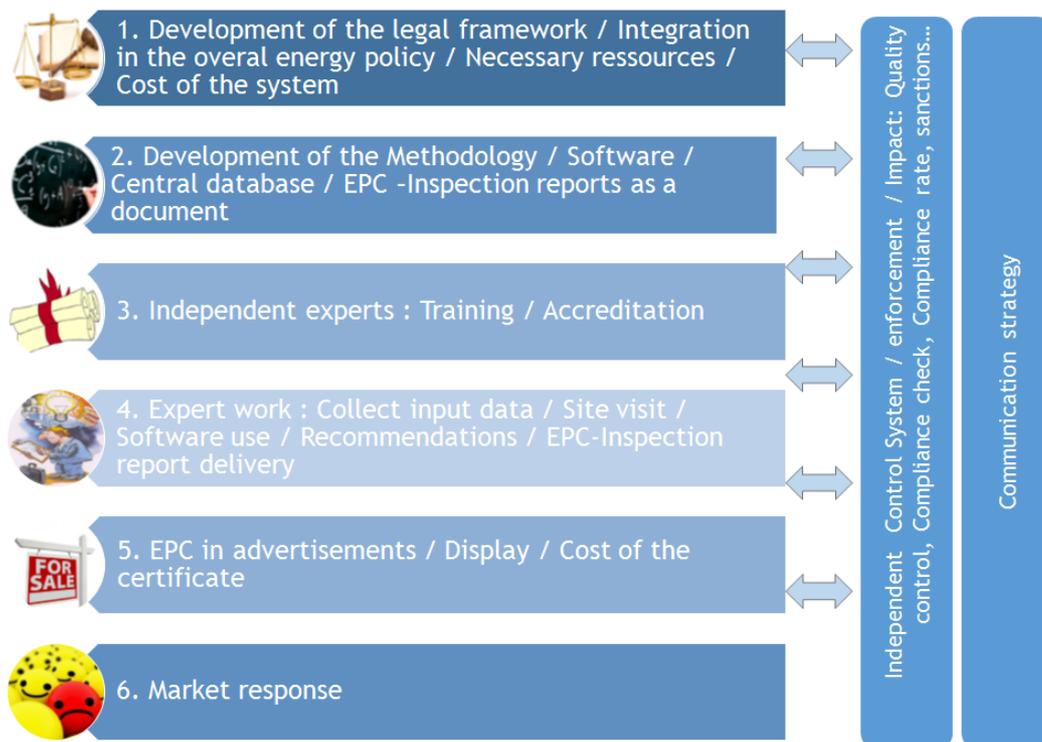


Figure 1. Steps in the Energy Performance Certification and regular inspection scheme process.

The different EPBD articles can be linked to these steps and overarching items. In practice however, there is a number of additional attention points beyond those explicitly specified in the EPBD articles that have to be taken into account. This structure has been used to organise the discussions between countries and is also used in the context of this report.

3.2 Understanding and improving the perception of the EPC system

Good quality data and information forms the backbone of confidence in an EPC system. Criticism has been expressed in the past regarding the efficiency of EPC systems as they are currently implemented². To achieve the goals of the EPC system, stakeholders' perceptions of and trust in the system is critical. Therefore, understanding stakeholders' opinions in order to make improvements in response to their feedback can be an important part of maintaining an EPC system. In practice, numerous individuals are involved in the EPC system and even more are in contact with the documents (certificates), including: experts in charge of the delivery of the EPC, real-estate agencies, the owners of the certified buildings, and future tenants or buyers.

3.2.1 Assessment of the perception of the EPC systems

The reputation of the EPC system varies significantly among countries. A self-evaluation of EPC systems by EPBD CA experts shows that no MSS' systems were rated either very-poor (0-value) or excellent (4-value). The evaluation scores are in the range of 1 to 3, with an average of 2.1. EPCs are delivered in very different situations (new buildings vs. existing buildings, residential vs. non-residential buildings, at building permit stage vs. at commissioning stage, etc.), with the consequence that there can be different perceptions of the various EPC systems among different stakeholders/types of certificates in one particular country. These multiple (positive or negative) perceptions are not the same in every country. For instance, in Croatia it is the scheme for existing residential buildings that is best perceived.

More than half of the countries participating in the EPBD CA consider it essential or very important to be able to objectively assess the perceptions of their EPC system. As of the end of 2016, 12 countries have realised programmes or studies to evaluate the quality of the EPC system. These programmes were conducted by the organisation in charge of the EPC or by third parties, such as consumer organisations (Figure 2). This feedback from the market has been used in several countries to enhance the EPCs by improving their content and layout and, hence, their attractiveness, as described in §3.4.



Figure 2. Examples of EPC quality assessment undertaken by consumer organisations in Europe.

Twenty countries intend to develop, begin or continue actions to evaluate and improve the perception of their EPC schemes. To date, no country has an exact set of criteria regarding the elements that should be taken into consideration to objectively evaluate the perception of their EPC system.

3.2.2 Elements identified as significantly impacting the perception of the EPC system

Based on countries' experience, the following main elements have been identified as most significantly impacting the credibility of EPC schemes:

1. communication relating to the EPC;
2. implementation and management of the independent control system;
3. effective and proportionate sanctions in case of poor quality or non-compliance with the EPC-related requirements;
4. resources necessary to operate the EPC system;
5. initial expert training and expert profile requirements.

The top five issues identified as problematic for the perception of the EPC system are:

1. differences between calculated/estimated (asset rating) and measured energy consumption;
2. means to monitor and improve the perception of the system;
3. resources required to operate the EPC system;
4. inputs and data required from the building owner;
5. communication and marketing campaigns related to the EPC.

Identification of these elements makes it possible for countries to initiate specific actions to improve EPC schemes by addressing these points.

Highlights of 3.2

Currently, no country has an exact set of criteria regarding the elements that should be taken into consideration to objectively evaluate the perception of their EPC system. This needs to be further investigated in the future.

More than half of the countries consider the ability to objectively assess perceptions of their EPC system important.

Main Outcomes of 3.2

Confidence in the EPC system shapes its credibility and the general public's perception. Twenty (20) countries intend to develop, begin or continue actions to evaluate and improve how their EPC schemes are perceived. Actions to objectively assess perceptions were effectively undertaken in 12 countries. This feedback from the market has been used in several countries, for instance, to improve the EPCs by modifying their content and layout and, hence, enhance their attractiveness. In practice, the EPC perception varies from country to country and multiple perceptions of the EPC, according to the type of building considered, may be found at the national level. A ranking of the elements that impact perceptions of the EPC allows for specific actions to be developed to improve these perceptions.

3.3 Costs for the development and operation of the EPC scheme

To be operational, an EPC scheme requires a set of tools and services (see Figure 1). It should cover, among others, the EPC software, the EPC registry (if applicable), a website for the qualified experts and the public, helpdesks and the operation of an independent control system. The EPC registry or database, for instance, can take several forms, ranging from very simple ones, containing only the EPC reference, to databases containing all the EPC data, intermediate calculation and final results. Associated software tools for data mining or quality control checks are also implemented in some countries. Among all costs, the business and IT investments for the development of the EPC registry and associated software may be considerable, depending on the range and scale of EPC registry functions. There are also recurring operational costs to maintain these registries and the associated software tools. In practice, the financing mechanisms and the costs for the development and operation of the EPC system can vary significantly, depending on the country considered. Several countries are interested in the existing options to limit these recurrent costs; the knowledge of the existing underlying business models in the countries, presented below, could provide an answer.

3.3.1 Different business models for the financing of the EPC system

The situation regarding the financing of the EPC scheme varies among countries, based on models where the initial development costs and the running costs are totally, partly or not at all financed by public funds. Table 1 presents a summary of the different approaches for each of the elements of an EPC.

Element of the EPC system	Situation
Costs	Only comparable if the national context is taken into account.
Financing and business model	<ul style="list-style-type: none"> • Totally, partially or not financed by public funds. • Fee required or not required from the qualified experts. • Fee paid can be annual and/or per EPC issued.
EPC software	<ul style="list-style-type: none"> • Single mandatory software or multiple software tools available. • Software development by public authorities or private companies. • Financed by public authorities or by third parties. • Mixed situation, e.g., both government and private company software can be available.
Registries / databases	<ul style="list-style-type: none"> • The content of these registries varies from country to country. Some store EPC rating only and others store all input data and evidence records as well.
Independent control system	<ul style="list-style-type: none"> • The three options described in Annex II of the EPBD are used and also equivalent measures.

Element of the EPC system	Situation
	<ul style="list-style-type: none"> • Administered by public authority or delegated to third party. • Number of conducted checks varies.
Other services	<ul style="list-style-type: none"> • Additional services not always present. • Additional services can be helpdesks, websites, advertising, statistics and legal services.

Table 1. Overview of different approaches for the EPC system across EPBD CA countries.

According to the option selected at the MS level, the amount of public funds used to finance the system can be very different, ranging from several million € on a yearly basis to almost no public funds. Performing a fair cost comparison between countries would require that the national context is systematically taken into account. In some MSs, qualified experts have to pay fees. Annual registration fees and fees to be paid for each EPC delivery also exist. Based on these fees, several MSs have (fully or partly) self-financing EPC schemes; for example, Denmark, Ireland and Portugal.

3.3.2 Example of the EPC software

The different options chosen by the countries regarding their EPC software, as presented in Table 1, illustrate very effectively the ways initial and running EPC costs are financed. The EPC calculation procedure is implemented in software tools in every case. In some countries, such as Belgium, Croatia and Lithuania, the development of mandatory EPC software is totally financed by public funds. The opposite situation is that no public funds are used to develop the software; for example, in Denmark and Portugal. Several software tools are available in the market, and the initial development and running costs of these tools are supported by third parties, such as private companies or universities. An official approval of these software tools can be required by the governments. This software approval can be free of charge for the software provider if the considered software fulfills the standard, as it is the case in Italy.

Main outcomes of 3.3

The financing of the EPC scheme varies among models where the initial development costs and the running costs are totally, partly or not at all financed by public funds, ranging from several million € on a yearly basis to almost no public funds.

The use of the system by the qualified expert can be free of charge or can be based on fees. In some MSs, qualified experts have to pay fees, either in the form of an annual registration fee, or as a fee to be paid for each EPC delivery. In several countries, these fees finance (fully or partly) the implemented EPC scheme.

Main outcomes of 3.3

The knowledge of these existing underlying business models shows possible solutions for the countries that intend to limit the recurrent costs financed with public funds associated with the running of the EPC schemes.

3.4 Modifying the EPC content and layout

EPBD CA countries identified communication relevant to the EPC as the most significant element impacting EPC perceptions (see §3.2). Improving the attractiveness of EPCs is therefore an important lever to maximising benefits. Since the introduction of the first version of national EPCs, many countries have in some way modified the EPC delivered to the final clients. Alterations to the EPC may include adding classes, changing limits (e.g., Figure 3), changing colours and modifying the layout (e.g., Figure 4).

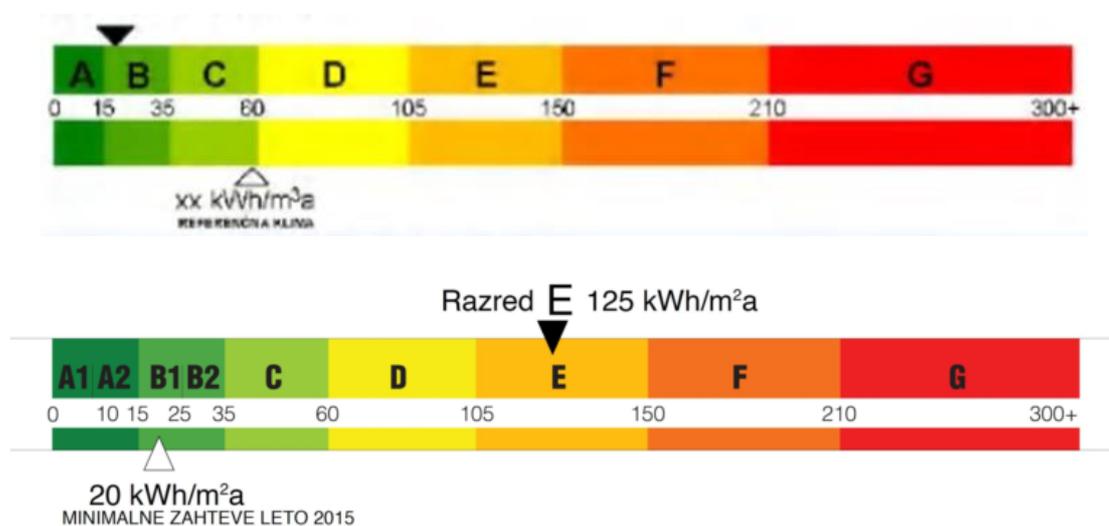


Figure 3. Example of rescaling the EPC – 2008 and 2014 EPC in Slovenia.

There can be different motivations for modifying the EPC content and layout. In 2010, the main driver for countries to modify the EPC was the introduction of new, stricter requirements: for example, alterations to the stepped certification scale (classes) to better reflect both ends of the scale, for both existing buildings and new buildings complying with new requirements. With increasing national experience, other motivations may lead to updates of the EPC content, such as taking consumer feedback into account, integrating better knowledge of the building stock or solving specific national problems³. The coexistence of old and new EPCs also needs to be taken into account.

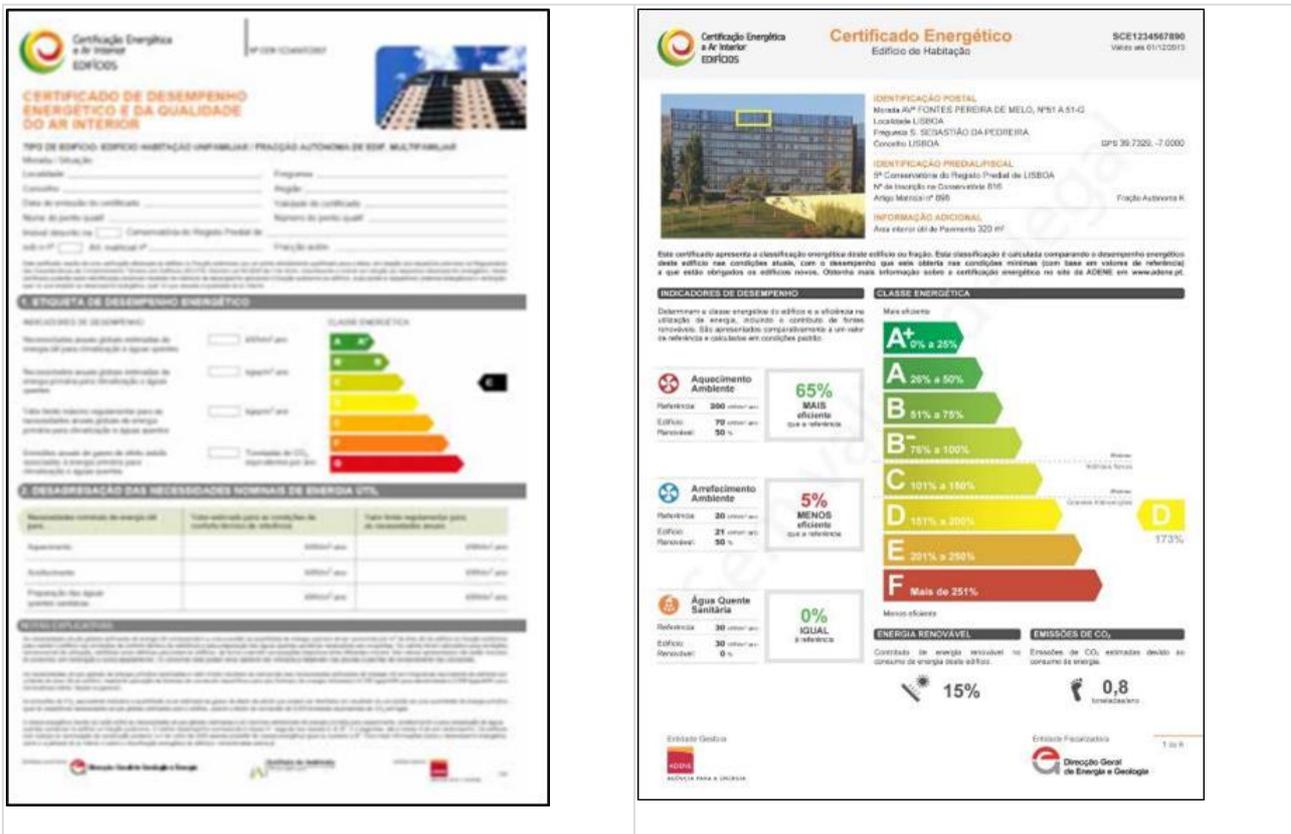


Figure 4. Example of modifications to the EPC layout – 2008 and 2014 EPC in Portugal.

3.4.1 A wealth of existing experience

Comparison between EPCs issued in 2008 and 2014 shows that half the countries have modified the layout of their EPCs. A second type of modification results from a change in the definition of the label, the consequence of which is a rescaling of the new EPC. Such a rescaling has taken place in 15 countries. This rescaling can take different forms: a full change of the EPC concept, dividing some of the A to G classes, changing or merging the classes’ limits (Figure 5). After several years of experience, many countries have a better knowledge of their national building stock. This information from past EPCs and those included in the database, if any, may be used to define the new scale and band boundaries.

3.4.2 Managing the coexistence of several EPC versions at the same time

Most EPCs have a maximum validity of ten (10) years. Modifying the EPC content means that EPCs with different content could coexist for several years. When a new version of the EPC is launched, no new EPCs based on former versions will be issued but EPCs already issued under the previous version could still remain valid for several years. In 2010, this was deemed a risk that could create confusion for the public. This coexistence is, in general, taken into account when modifying EPC content, e.g., to make a comparison possible, and countries that have experience with overlapping versions of EPCs do not consider it to be a major issue any longer.

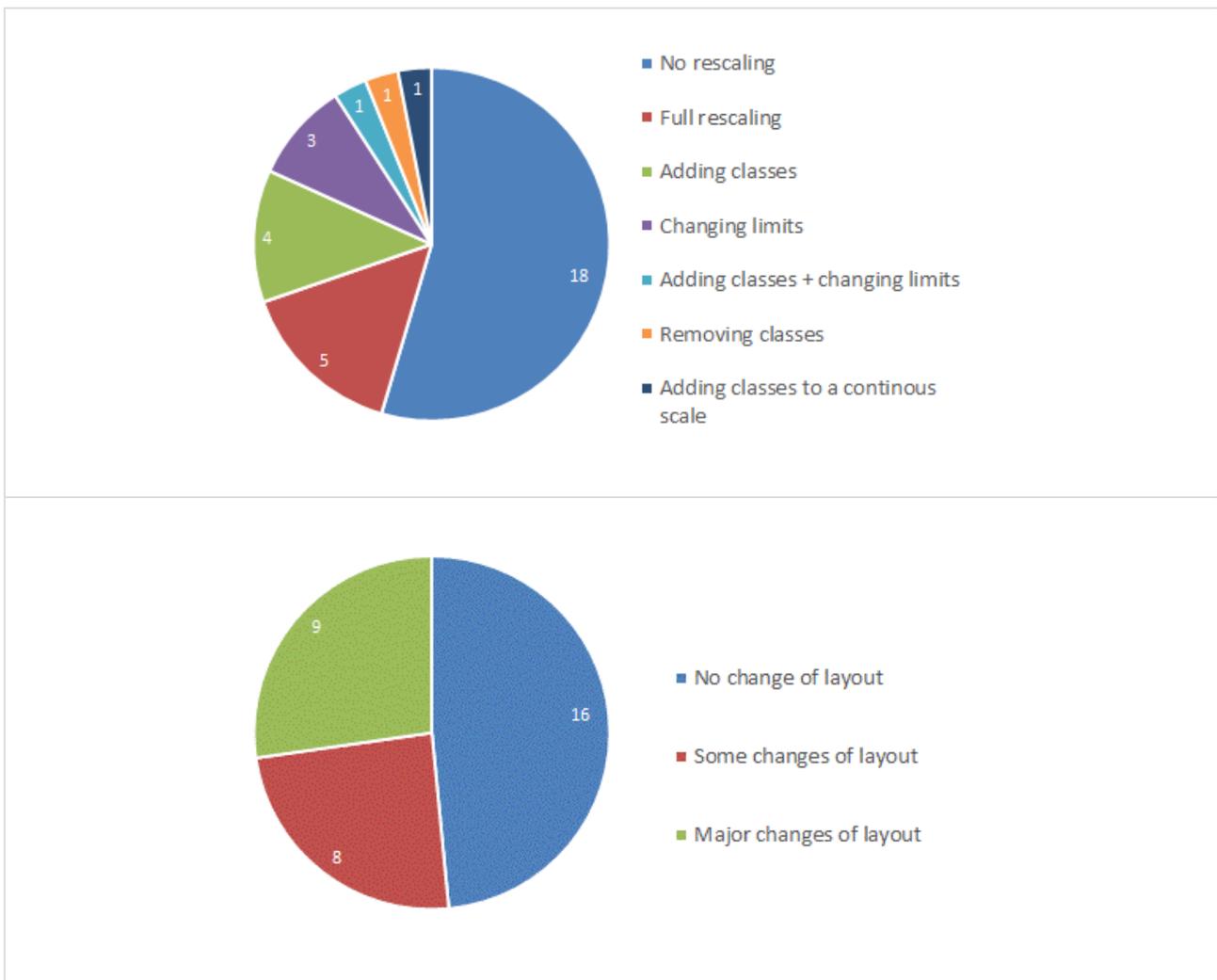


Figure 5. Types of rescaling (top) and layout changes (bottom) made to EPCs between the 2008 and 2014 versions⁴.

Highlights of 3.4 When comparing the 2008 and 2014 versions of the EPC, 17 countries had modified the layout over time. Major changes to the layout had been made in nine (9) countries. During the same period, fifteen (15) countries rescaled EPCs, ranging from light changes to a full rescaling.

Main Outcomes of 3.4

EPBD CA identified communication related to EPCs as the element with the greatest impact on the perception of the EPC. There is significant experience in Europe around modification of the EPC content in order to improve the certificates’ attractiveness. Changes may be motivated by customers’ feedback on previous versions of EPCs, by the integration of improved knowledge of the building stock and/or by the need to acknowledge the improved energy performance of new buildings complying with stricter energy performance requirements. Given the long validity of the EPC, it is a common situation in countries to have new EPCs based on the last version coexisting with still valid EPCs based on former versions. The country experience has shown that this situation is not experienced as a real issue for the end-users any longer.

3.5 Integrating step-by-step renovation in the EPC

The renovation of the existing building stock and the increase of deep renovations are essential to meet the EU 2020 targets and the commitment undertaken in Paris in 2015. The EPC is an important tool in this context. It provides information regarding the building's energy performance and contains recommendations to improve it. The renovation of buildings may occur in one step, where all energy efficiency measures are simultaneously applied. However, in practice, only part of the work might be done in one step. Staged (or "step-by-step") renovation works could then be the answer. Only a few national authorities have statistics regarding the number of step-by-step renovations in their country.

Although not formally required by the EPBD, taking these step-by-step renovation scenarios into account in the EPC could be, in some cases, an interesting way to promote deep renovations, and a way to increase energy renovation over time.

3.5.1 Integration of step-by-step renovation in the EPC or in complementary voluntary tools

The way EPCs were implemented at the national level influences the possibility or not to support step-by-step renovations. There are significant variations in the methods used to generate recommendations. EPC schemes containing tailor-made recommendations could integrate step-by-step renovation scenarios, while EPC schemes containing only standard recommendations appear to be less appropriate for this. A survey among 20 EPBD CA countries showed that only a few of them, 4 out of 20, are taking step-by-step renovations into account in their EPC. Portugal and Ireland, for instance, have made changes to the display and content provided for EPC recommendations that make them compatible with step-by-step renovations. Within the existing EPC schemes, the recommendations included in the EPC are required to be made in a specific order, based on criteria such as relevance or economy, in about half of the countries (10 out of 20) – see Figure 6.



Figure 6. Example of the Portuguese EPC defining priorities for the recommendations.

Several countries have decided not to use the EPC to address step-by-step renovations, but to develop other voluntary tools possibly linked with national incentive schemes for renovation works. This is the case

for some energy audits or tools such as the “*building renovation roadmap*” in Germany or the “*Energy Advice Procedure*” (EAP2.0) in Belgium (Walloon Region). This option was justified by particular considerations, such as the need for an extensive dialogue between the building owner and the expert, and the level of detail required to explain a deep renovation scenario or to limit the cost of an EPC.

Main Outcomes of 3.5

Taking step-by-step renovation scenarios into account in the EPC could be a way for countries to promote deep renovations. The integration of step-by-step renovation in the EPC exists in a few countries, while others have developed complementary tools, such as energy audits, to promote deep step-by-step renovation.

A single approach to addressing step-by-step renovation is not suitable for all countries, due to the different EPC systems currently in place and, in particular, the level of recommendations. Solutions taking the national context into account are needed.

3.6 Linking EPC and regular inspection schemes

Directive 2010/31/EU mandates energy performance certification of buildings (Articles 11-13) and regular inspection of heating and air-conditioning systems (Articles 14-15). Not all MSs have put in place operational inspection schemes, since the EPBD allows for the possibility to adopt alternative measures. EPCs and inspection systems in place in MSs are generally kept completely separate. However, several countries have experience in linking these two requirements, at, for example, the level of data storage or tools used to deliver the reports.

3.6.1 Interactions between the EPC and the inspection reports

In 2016, fifteen (15) countries implemented inspection schemes for both heating and air-conditioning systems, seven (7) implemented alternative measures for heating systems but inspection schemes for cooling systems, and six (6) implemented alternative measures for both heating and cooling systems⁵.

In most countries, the EPC and operational inspection systems are totally separate, with few to no links (in five (5) countries) made between them. Six (6) countries do make use of valuable interaction between these two tools, while four (4) have developed strong interaction. It should be mentioned that due to the exchange of best practices between countries, 15 now intend to create or further develop links between the EPC and the regular inspection scheme. The following connections are the most common between the two schemes:

1. EPCs and inspection reports are stored in the same database system;
2. data for both EPCs and inspections can be collected during a single building visit;
3. the applied control systems are similar for both instruments;
4. EPCs and inspection reports are both used to assist energy efficiency programmes;
5. EPCs and inspection reports are stored in different databases but a link can be made between the two.

In five (5) countries, data from EPCs can be useful and may be used to produce inspection reports. On the other hand, ten (10) countries allow information from inspection reports to be used to establish EPCs. In both cases, these links are optional and not mandatory.

There are several potential levels of interaction between the two systems. Simple levels of interaction were the most beneficial, e.g., building owners having access to all certificates and reports for an individual building through a single register.

3.6.2 Identifying sequence of EPCs or of inspection reports

In the lifecycle of a building, several EPCs or inspection reports may be issued. Most countries (11) do not identify sequences of EPCs or inspection reports applicable to a particular building. In cases where they do, the relevant EPCs are identified based on the address of the building -ten (10) cases- or based on a unique property reference number - five (5) cases)..

Main Outcomes of 3.6

While EPC schemes are implemented in all EPBD CA countries, not all have regular inspection schemes for heating and air-conditioning systems. Within the 22 operational inspection schemes, very few have interactions with the EPC system. Six (6) countries recognise the potential for valuable interactions between these two schemes, and only four (4) of these countries currently have strong links between the two. There are several potential levels of interaction between the systems, and simple levels were considered most beneficial, e.g., building owners having access to all certificates and reports for an individual building through a single register.

4. Lessons Learned and Recommendations

EPBD CA countries are investigating strategies for more effective EPC schemes. Creating synergies with the regular inspection of the heating and air-conditioning system is one of the methods used to improve national systems. Although not formally required as such by the EPBD, in some countries, the EPC can also be an appropriate tool to promote deep renovation works by taking step-by-step renovation into account. This option is adopted in a few countries, while others have developed alternative tools, such as energy audits.

Countries are also developing a vision based on the most important factors influencing EPC quality and how the market perceives this tool. Actions or studies to evaluate the quality of the EPC scheme were realised in 12 countries. It should be noted that no country has an exact set of criteria that should be taken into consideration to objectively evaluate the EPC perception by stakeholders. Such criteria will certainly have to be developed in the future to enable a common understanding at the EU level.

Communication related to EPCs is recognised as the factor with the greatest impact on how this tool is perceived. Communication has been and still is carefully taken into account in most countries. In 2014, half of the countries changed the layout of their EPCs in comparison to the 2008 versions. A modification of the definition of the label, causing a rescaling of EPC levels, was also made in almost half of the EPC schemes. In several cases, these modifications were designed based on possible improvements identified during

national studies, for instance from consumer organisations, or on the findings from the quality control systems.

Financing of the EPC scheme varies among models, where the initial development costs and the running costs are totally, partly or not at all financed by public funds. Some countries have reduced the public funding invested to develop and operate the EPC scheme. The qualified experts' use of the system can be free of charge, but can also be based on fees. In some countries, these fees may (fully or partially) finance the system.

Endnotes

1. The Evaluation of the EPBD was a direct follow-up to the Communication on an Energy Union, which asked for a review and possible revision of the Directive by the end of 2016.
2. 2016 – Implementing the Energy Performance of Buildings Directive (EPBD) – Featuring Country Reports - ISBN 978-972-8646-32-5 – Editor's message - p7)
3. An example is the case of apartments, where inefficient buildings appeared “too good” in the former version of the EPC.
4. More information related to this topic is available in the factsheet "Heijmans, Loncour - Changes in EPCs scales and layouts - Experiences and best practices"
5. 2016 – Implementing the Energy Performance of Buildings Directive (EPBD) – Featuring Country Reports - ISBN 978-972-8646-32-5



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