A comparative analysis of the energy performance certificates schemes within the European Union: Implementing options and policy recommendations

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Abstract

Energy certification of buildings is an important element of Europe's energy and climate policy. The Energy Performance Certificates (EPCs) were introduced in 2002 by the Energy Performance of Buildings Directive (EPBD, Directive 2001/91/EC) as a mandatory requirement for the EU Member States. The recast of the Energy Performance of Buildings Directive in 2010 (Directive 2010/31/EU) reinforced the EPC obligation for the Member States and introduced additional requirements. The EPCs can become a powerful tool to create a demand-driven market for energy efficient buildings, as they allow estimating the costs in relation to energy consumption and efficiency of a building. In December 2010, the Building Performance Institute Europe released a report which investigates the success factors and barriers along the design and implementation process of the ongoing EPCs schemes in twelve selected Member States.

This paper builds on the report's main findings and provides an extensive analysis of the EPCs implementation status including the drawbacks, best practice and key indicators of the EPC schemes. The paper reveals the differences between the EPC schemes based on the specific needs, structure of building stock and various climatic conditions throughout selected Member States. The evaluation methodology is based on a cross-country comparison between the energy performance indicators and allowed the identification of relevant approaches for a successful design and implementation of EPCs schemes. Moreover, the paper emphasises the importance of the exchange of experience and best practice between Member States as an important factor in fostering the effective adoption of the EPC schemes. Finally, the paper identifies and provides recommendations on several key factors to be considered in the creation of a EPCs scheme such as administration of the scheme, quality control, non-compliance provisions, enforcement, dissemination and main barriers to be overcome.

Introduction

Energy certification of buildings is an important element of Europe's energy and climate policy. The Energy Performance Certificates (EPCs) were introduced in 2002 by the Energy Performance of Buildings Directive (EPBD, Directive 2001/91/EC[1]) as a mandatory requirement for the EU Member States. The recast of the Energy Performance of Buildings Directive in 2010 (recast EPBD, Directive 2010/31/EU[2]) reinforced the EPCs obligation for the Member States and introduced additional requirements. The EPCs can become a powerful tool to create a demand-driven market for energy efficient buildings, as they allow estimating the costs in relation to energy consumption and efficiency of a building. In December 2010, the Building Performance Institute Europe (BPIE) released a report[3] which investigates the success factors and barriers along

1. Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.

2. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, recast of the Directive 2002/91/EC.

3. BPIE. Energy Performance Certificates across Europe: From design to im-

the design and implementation process of the ongoing EPCs schemes in twelve selected EU Member States.

The main aim of the paper is to provide an overview of EPCs design and implementation in the selected Member States, trying to identify the market failures and success factors as a support to the Member States for improving the ongoing processes or for designing new EPC schemes. The paper builds on the report's main findings and provides an extensive analysis of the EPC implementation status including the drawbacks, best practice and key indicators of the EPC schemes. The paper reveals the differences between the EPC schemes based on the specific needs, structure of building stock and various climatic conditions throughout selected Member States. The evaluation methodology is based on a cross-country comparison between the energy performance indicators and allowed the identification of relevant approaches for a successful design and implementation of EPC schemes. Moreover, the paper emphasises the importance of exchange experience and best practice between Member States as an important factor in fostering the effective adoption of the EPC schemes. Finally, the paper identifies and provides recommendations on several key factors to be considered in the creation of a EPC scheme such as administration of the scheme, quality control, non-compliance provisions, enforcement, dissemination and main barriers to be overcome.

Methodological approach

The paper is based on an extensive survey developed between March and September 2010 within twelve selected Member States, complemented by available information on web and exsiting studies as well by additional phone and email interviews with contact persons and key stakeholders involved in the EPC process. Therefore, the overview of current EPC schemes in the Member States was strived for "as complete and correct as possible". The research was set up to present the available information as objectively as possible. Nevertheless, for a better understanding of EPC practicalities, the report also considered the opinions of experts involved in the design and implementation processes.

The report analysed the implementation of the EPCs in twelve EU Member States: Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, the Netherlands, Poland, Portugal and Spain.

The research had been concentrated on the analysis of the success factors and challenges of the design and implementation processes, being focused on the following issues:

- The basic implementation approach;
- The use of certificates;
- Public acceptance by consumers and professional stakeholders;
- The cost of certificates;
- Administration/registration;
- Quality control;
- Promotion;
- Compliance and enforcement;
- Market barriers; and
- Future anticipated changes.

Energy performance certificates and the energy performance of buildings directive

The 2002 EPBD defines the energy performance certificate as to be 'a certificate recognised by a Member State or by a legal person designated by it, which indicates the energy performance of a building or building unit', calculated according to a methodology specified in the Directive. According to EPBD, the Member States are obliged to establish an energy certification system, including the overall energy performance of the building and reference values such as the minimum energy performance requirements that allows the owners or tenants to compare and assess its energy performance. The energy performance certificate may include additional information such as the annual energy consumption for non - residential buildings and the percentage of energy from renewable sources in the total energy consumption. As stipulated by the EPBD, the Member States should ensure that an EPC is issued for buildings or building units which are constructed, sold or rented out to a new tenant and for buildings with a total useful floor area over 1,000 m^2 occupied by a public authority and frequently visited by the public. The recast EPBD from 2010 extends the obligation to the public buildings with a total useful floor area over 500 m^2 and over 250 m^2 from July 2015 onwards.

In addition, the recast EPBD introduced the obligation to include in the EPCs 'recommendations for the cost-optimal or cost-effective improvement of the energy performance of a building or building unit, unless there is no reasonable potential for such improvement compared to the energy performance requirements in force'. All these recommendations should be technically feasible for the specific building and should indicate where the owner or tenant can receive more detailed information. Moreover, the EPC should also provide information about the actual impact of heating and cooling on the energy needs of the building, on its primary energy consumption and on its carbon dioxide emissions. In addition, the EPCs may provide an estimate for the range of payback periods or cost-benefits over its economic lifecycle. Furthermore, the methodology for evaluating the energy performance of the buildings should be in accordance with the European standards[4] and all the recommendations and minimum energy efficiency requirements have to consider, where appropriate, harmonised instruments as introduced by the Ecodesign[5] and Energy Labelling[6] Direc-

plementation. Report prepared together with BuildDesk Benelux BV. ISBN 9789491143007, 2010.

4. According to the Directive 2010/31/EU, the European standards are defined as standards adopted by the European Committee for Standardisation, the European Committee for Electrotechnical Standardisation or the European Telecommunications Standards Institute and made available for public use. The standardisation process is going in parallel to the EPBD and it is expected a further development of appropiate standards for helping a better implementation of EPBD.

5. Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

6. Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products.

tives. In order to ensure the quality of EPCs throughout the EU, the Member States should establish an independent control mechanism. The validity period of an EPC is established by the EPBD at no more than 10 years.

The EPBD sets several major requirements for the EPCs schemes, giving at the same time enough flexibility to the Member States to adjust these requirements to their national context. Indeed, there are great differences between Member States in terms of culture, policy and climate conditions, influencing significantly the regulatory and legislative approach, the building traditions, the fiscal planning, the energy infrastructure development and the regional energy standards for buildings. As a consequence, the general implementation of the EPBD and of EPC schemes in particular differ widely among the selected Member States and may be qualified as "context-related" processes and the successful introduction of EPCs requires the design of inter-dependent instruments as well as to consider the specificities of the building stock.

The legal implementation of the first EPBD, including the article 7 on the EPCs, required the directive to be legally implemented by January 2006, with a possible extension period of three years (until January 2009). By 2009, 22 Member States declared the full EPBD transposition into national legislation (still under the EU evaluation process) and Denmark is the only Member State that has implemented the entire EPBD in time[7]. The Member States are now facing second, more advanced, stage of the implementation. First substantial experiences of the EPBD implementation are now available, giving unfortunately fragmented and non-exhaustive information on its status.

The EPCs have a potential to become a reliable source of information about the energy performance of the building stock in the Member States. There is a legitimate need to disseminate and analyse the EPCs implementation process at EU level by revealing the lesson learned, the best practice and the implementation challenges. Therefore, the comparisons between methods, requirements and indicators may offer a substantial support to the policy-makers for the assessment of the implemented schemes and for the consideration of potential improvements. For example, it would be useful to see whether the energy performance indicator is reported in primary or final energy and if is about the energy needs or energy consumption. Moreover, it would be helpful to have a common understanding about methodology as well as about the key indicators displayed on the EPC. In this paper, focus is given to experiences drawn from a number of aspects of the implemented EPC schemes. In the following analysis the main findings are briefly presented for each topic.

Design considerations for an EPC scheme

In order to design an effective assessment approach of the energy performance of buildings it is important to consider the issues of reproducibility, accuracy, level of expertise and costs. These elements are explained below.

Reproducibility is defined as the ability of the results of a building energy performance assessment to be accurately reproduced by more than one individual building expert. **Acceptable reproducibility** refers to the level of reproducibility for which the deviation between assessments of a particular building made by two or more experts using the same methodology is relatively small. For instance, in the context of label classes, a deviation of one label class is generally acceptable while a deviation of two or more label classes may undermine the credibility of the certificate and hence may be regarded as unacceptable. If the scale is divided into many classes and the acceptable deviation is assumed to be one class at most, a high reproducibility should be obtained for the label to be credible and acceptable.

The **accuracy of the methodology**, which refers to the deviation between the calculated and the actual building's performance, is mainly associated with the accuracy level of all the three parts of the assessment procedure. The first part is the calculation method, with inaccuracy levels typically corresponding to a ±10 % variation with respect to the actual building's performance, assuming that a reliable calculation method has been considered. Secondly, inaccuracies may arise from the use of default input values to represent reality. Input parameters such as the level of the efficiency of a boiler, the solar gain factor of transparent building parts or the surface area-to-volume ratio of the building, are required in order to proceed with the calculation method. These parameters can be either measured or predetermined (default values). Typically, a small number of well-defined default values used in the calculation will lead to a deviation of about ±5 % in the resulting calculated values compared to the actual building's performance[8]. Lastly, the deviation may originate from inaccuracies that are related to the data acquisition made by the expert (i.e. inaccuracies associated with human error). In the case of a calculated rating with a full range of input data to establish by measurement/assessment (surface areas, U-values, system characteristics, etc.) the derived data may differ by ±30 % from the actual building's performance, due to the errors introduced by the expert. The expert error is the main source of inaccuracies which may lead to a total of ±45 % deviation in the calculated outcome of the energy performance of a building compared to the actual building's performance. In reality, there will be a compensation of the errors which will yield an overall inaccuracy level of about ±20 % (Figure 1, a). Typically, the deviation in data acquisition process is one of the main determining factors responsible for a 'poor'reproducibility, which can be in conflict with the chosen label class scale and may affect the overall acceptability of the energy label class. Therefore, it is possible to say that the reproducibility is mainly determined by inaccuracy of assessor's calculation and is inverse proportional to the number of label classes.

A possible way to improve the accuracy and to reduce the costs and the timeframe of the assessment procedure is to simplify the data acquisition procedure and to subsequent increase the number of enough accurate default values. On one hand, this would result in an increased inaccuracy of the assessment by the extensive use of the default values (from ±5 to ±15 %),

7. SEC(2008) 2865. Commission Staff Working Document Accompanying Document to the Proposal for a Recast of the Energy Performance of Buildings Directive (2002/91/EC). Summary of the Impact Assessment. Brussels, November 2008.

8. Vlaams Energieagentschap (VEA), 2010. Energy Performance Certificate Information. Available at: www.energiesparen.be/epc

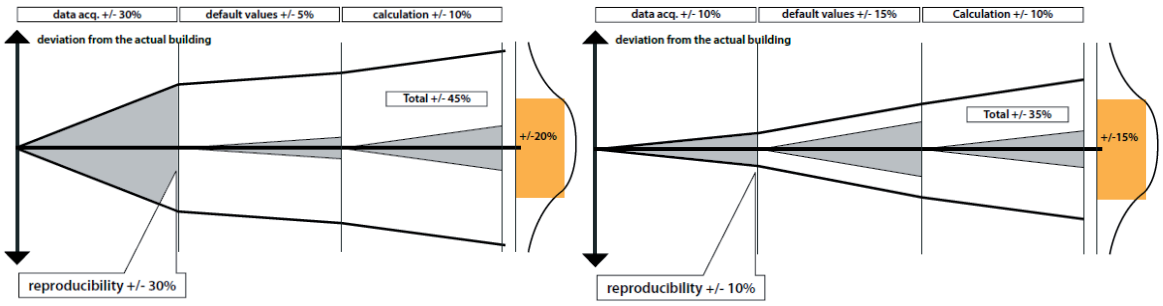


Figure 1: Reproducibility and standard deviation in the theoretical (a) and in operational optimised approach (b).

but on the other hand may generate consistent accuracy improvements at the levels of the data acquisition (from ±30 % to ±10 %) and calculation (from ±45 % to ±35 %). Consequently, an appropriate selection of the default values may increase the reproducibility of EPCs and may reduce the total inaccuracy of the assessment procedure to around ±15 % (Figure 1, b).

This trade-off mechanism emphasises the complexity of decisions that have to be made during the implementation process of an EPC scheme. At the same time, it shows the importance of a multidisciplinary approach and highlights the importance of an early consideration of all the key stakeholders at the design stage of the scheme.

So far, most of the EU Member States under survey opt for assessment methodologies based exclusively on default values. Only a few of them choose a combination between measured and default values (Table 1 from the following chapter). However, the paper does not have the aim to deeply analyse the assessment methodology, but to highlight the importance of it in the further development and credibility of the EPC scheme.

Design and implementation of the EPC schemes within the European Union

The national context imposes boundaries to the EPC implementation process and the approach varies largely among the Member States according to the knowledge level, to the experiences and to the particularities of the administrative and political structures (i.e. the national or regional levels of responsibility). Moreover, there are differences in terms of ambitions for developing EPC schemes. On one hand, some Member States tried to fit the EPC obligation into the existing national legislation, by adapting the EPBD requirement to the existing structures and instruments. On the other hand, other Member States are struggling to develop a new methodology for the assessment of energy performance of buildings.

The design of EPC schemes varies largely within the twelve analysed Member States and there are some important particularities at almost all stages of the process:

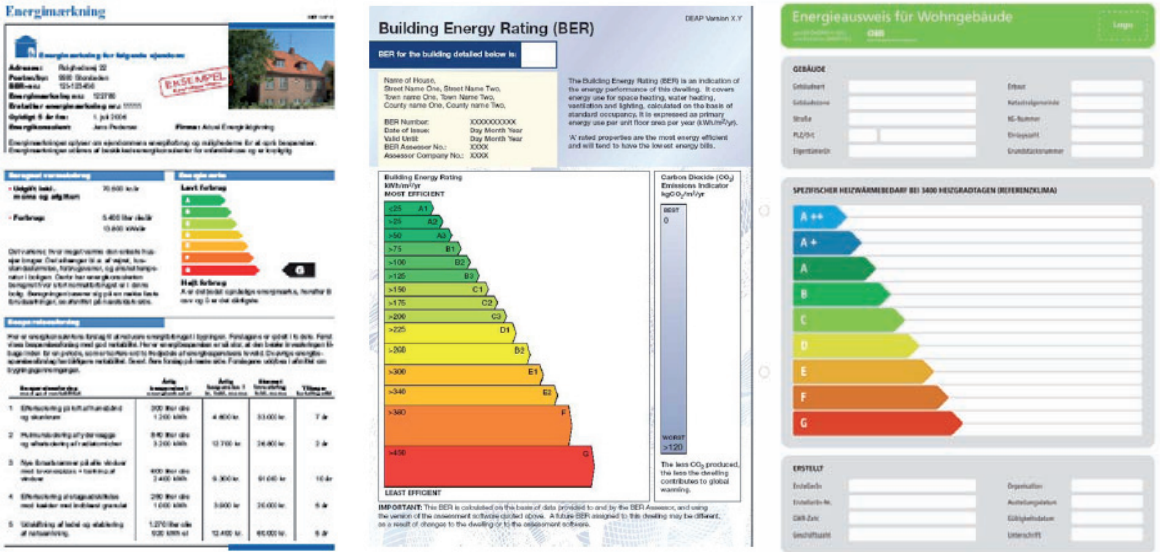
- **Responsibility for implementation and the assessment method.** In most of the analysed Member States the national authorities are responsible for the implementation of the EPBD and EPCs. However, in some Member States such as Austria, Belgium and Spain, the regions are (partly) responsible.
- **Building certification.** All Member States have introduced a legislative Act or Decree for implementation of the EPBD. However, in some Member States parts of implementation law has not yet come into force. Most Member States started implementing the EPC scheme for new residential buildings, leaving the existing housing stock and the non-residential buildings for a later stage. Moreover, in several Member States the Act relating to the implementation of EPCs according to the EPBD does not cover all the situations described by the directive. For instance, in the Czech Republic certification is only mandatory for new and existing renovated buildings larger than 1,000 m2 and public buildings. An EPC is not required for existing buildings when sold or rented. In the Netherlands, an exception was made for housing associations: they were given a one year delay to issue EPCs (until January 2009) if they would certify their entire building stock in one procedure. This resulted in the situation that almost the entire building stock of the Dutch Housing Associations has now been surveyed for energy performance; approximately 40 % is formally certified.
- **Further development of past experiences.** In several Member States such as Belgium, the Czech Republic, Germany, Denmark and the Netherlands, the energy certification already existed in some form before the introduction of the EPBD, usually on a voluntary basis and/or related to a subsidy scheme. Those Member States could build on previous experiences during the EPC implementation process. However, except for Denmark, these experiences did not result in a quick and smooth implementation of EPCs. For instance, in the Netherlands the implementation process was delayed for political reasons: the administrative costs of certification were to be as limited as possible. This requirement put an extra pressure on all aspects of the implementation process, ranging from the development of the method, to the quality control and the training of the assessors.

An overview of basic information regarding the design of the EPC schemes in the twelve analysed Members States is presented in Table 1.

In the twelve analysed Member States the EPCs visual presentation is similar, showing the general characteristics of the building and the assessed label class on the first page. Some examples of the EPCs first pages in Denmark, Ireland, Austria and Hungary are shown in Figure 2.

Table 1: Design options for the EPC schemes within selected Member States.

	Implementation	Assessment method	EPCs issued since
AT	National and regional responsibilities	Calculated rating	January 2008, January 2009 (public buildings)
BE	Regional	Combination of calculated and measured rating (public buildings)	Flanders Region: November 2008 (sale), January 2009 (rent), January 2009 (public buildings). Non-residential expected in 2011
CZ	National	Calculated rating	January 2009 (new buildings and existing renovated buildings)
DK	National	Calculated rating	2006
FR	National	Combination of calculated and measured rating	November 2006 (sale res and non-res), July 2007 (rent), July 2007 (new buildings), January 2008 (public buildings)
DE	National	Combination of calculated and measured rating	2002 (new buildings), July 2008 (existing buildings)
HU	National	Combination of calculated and measured rating	January 2009 (new and public buildings), January 2012 (existing buildings)
IE	National	Calculated rating	January 2007 (new res buildings), July 2008 (new non-res and public buildings), January 2009 (existing buildings)
NL	National	Calculated rating	January 2008 (sale and rent), January 2009 (public buildings, and social housing)
PL	National	Calculated rating	January 2009 (new buildings, renovations, existing buildings for sale/rent and public buildings)
PT	National	Calculated rating	July 2001 (new res and non-res buildings >1000 m2), July 2008 (new buildings), January 2009 (existing and public buildings)
ES	National and regional responsibilities	Calculated rating	2007 (new buildings), after 2010 (existing buildings)



a) Denmark *b) Ireland* *c) Austria*

Figure 2: EPC certificates in Denmark, Ireland and Austria.

However, there are significant differences in terms of information provided by an EPC in different Member States and the length vary from one page in Hungary and Ireland to eight pages in Czech Republic and Denmark. Most EPCs provide recommendations to improve the energy efficiency of the building. In some countries the EPC also presents the label class after implementation of the recommended energy saving measures (i.e. in the Czech Republic, Denmark and Portugal). A detailed analysis of the information provided by the EPCs in the twelve Member States is shown in Table 2.

Main results of EPCs implementation in selected Member States

The number of EPCs issued is a useful indicator of the actual use of energy certification in Member States, but the data availability differs from country to country. In countries having a central or regional database system for EPCs the information is easily available, but the degree of details varied largely from one country to another. On contrary, in countries without a sound registration system only estimation is possible. Most of the EPCs databases provide satisfactory information regard-

Table 2: Main characteristics of the EPCs in selected countries.

	AT	BE	CZ	DK	FR		DE	HU	IE	NL	PL	PT	ES
					Res	Non-res							
Label classes	A++ A+ A B C D E F G	No sliding scale	A B C D E F G	A B C D E F G	A B C D E F G	A B C D E F G H I	No sliding scale	A+ A B C D E F G	A1A2A3 B1B2B3 C1C2C3 D1D2 E1E2 F G	A++ A+ A B C D E F G	No sliding scale	A+ A B, B- C D E F G	A B C D E F G
Performance indicator	kWh/m2a	kWh/m2a	GJ/year	No specific info	No specific info		kWh/m2a	No specific info	kWh/m2a and CO2-emission	Energy index	No specific info	kWh/m2a	No specific info
Label present situation of the building	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Label after implementing the recommended measures	No	No	Yes	Yes	No specific info		No	No specific info	No specific info	No	No specific info	Yes	No specific info
Recommendations for improvement the energy performance	No	Yes	Yes	Yes	No specific info		Yes	No specific info	No	Yes	Yes	Yes	No specific info

ing the certificates issued for residential buildings, but the data availability is much lower in the case of non-residential buildings. Table 3 provides an overview of the actual status of the EPCs implementation and key usage indicators in the residential sector.

In several Member States such as Denmark, France, Germany, Ireland, the Netherlands, Poland and Portugal, there is available additional information on the average energy performance of the certified buildings. There is no available information on the actual or potential energy savings and on the effectiveness of the EPCs and such data is not specifically monitored in Member States. Moreover, despite the fact that most EPCs contain details about the main characteristics of the certified buildings, this information is not monitored in the databases. At the moment there is limited data availability concerning the structure of the existing building stock and EPCs may be an important tool in improving the knowledge level on this issue. The existence of an EPC database is essential in monitoring the implementation of the EPCs schemes and in providing useful information on the building stock, on the energy performance level of the buildings and on effective measures to improve it. In addition, without a centralised tracking and registration system for the issued certificates, the credibility and the effectiveness of the EPC schemes will be questioned.

Public acceptance and usability of the EPCs

The public acceptance of the EPCs is influenced by several factors such as the actual use of the certificates when a building goes up for sale or rent and the perceived EPC utility the general public. The public acceptance and the usability of the EPCs are important aspects in the EPCs' implementation process and it is closely related to their quality and to the cost of the assessment process. Some Member States are explicitly searching for ways to enhance public acceptance and usability of the EPCs and this is mostly done throughout promotional campaigns. However, the public acceptance and the usability of the EPCs are often related to the decisions made during the first phase of the implementation process. The main influencing factors of the EPCs' public acceptance are the followings:

- **The contents and the visual presentation of the EPCs.** The usability and therefore the credibility of the certificate is highly influenced by the level of information shown on it as well as by the way this information is accessible to a wide range of users, from professionals to building owners.
- **The assessment method.** The EPC quality depends strongly on the assessment methodology of the EPC scheme. For instance the preference for a rating system and the corresponding energy classes as well as the amount and the accuracy of the default values influence significantly the quality of the EPC.
- **The public awareness on EPCs.** The level of public awareness and the quality of the promotional campaigns are important factors in increasing the usability of the EPCs. The market campaigns for promoting the EPCs are especially influential for the building owners and users, but should properly address all the users' categories in order to be effective.
- **The level of enforcement.** The non-compliance and the poor quality of the certifiers' assessment may create serious doubts on the real value of the EPC. Therefore, the level of enforcement and the related penalties for non-compliance and bad execution are determinant for the usability of the EPC scheme.

Table 3: Key indicators of the EPCs issued for residential buildings.

	Nr. of issued EPCs (*1000)	Existing buildings with EPC [%, estimation]	Average energy performance rating
BE (Flanders)	141.3	4.10%	No specific information available
CZ	25-30 each year (= number of new buildings constructed each year, EPCs since January 2009 obligated)	1.50%	No specific information available
DK	45-50 each year	50%	Label class D (detached houses)
FR	No specific information available	90 % of social housing, 14 % of private houses	Label class C: 18% Label class D: 31% Label class E: 22%
DE	No specific information available	No specific information available	Single family home: 235 kWh/m2a Multi family home: 211 kWh/m2a
IE	75	No specific information available	New buildings: label class B2-B3 Existing buildings: label class D1-D2
NL	1287 (of which 83% rental homes)	18%	Label class ABC: 35% Label class CD: 50% Label class EFG: 39%
PL	80-100	0.75%	New buildings: 140 kWh/m2a
PT	100	No specific information available	Label class A+ A: 4% Label class B- B: 36% Label class C: 33% Label class D: 14% Label class EFG: 13%

Table 4 shows the identified public acceptance levels and the perceived utility of the EPCs as resulted from the BPIE market survey[9].

In Spain and Hungary, the introduction of EPCs for existing building under transaction (sold or rent) is still under development. In Czech Republic, the EPC is not required for existing buildings at the moment of transaction. In practice EPCs are often issued when specifically required in the transaction process and it is not a compulsory requirement. The enforcement level of EPC schemes is low in Spain, Hungary, Czech Republic, Poland, Netherlands, Austria, and Germany. On the other hand the EPCs are a common practice during real estate transactions in Member States with a strict practical enforcement system and non-compliance penalties such as Belgium (Flanders only), Ireland and Portugal. In most of the Member States the EPCs are issued at the time of transaction and not at the advertising stage and therefore it is unlikely that the EPC can be used as a selection tool. At the time when the BPIE report on EPC was finalised, in France was under assessment the possibility of moving towards a compulsory presentation of the energy certificate from the advertising stage (to enter in force at the beginning of 2011).

The transparency of the whole EPC scheme and the existence of an assessment process are crucial for the broader public acceptance. Once these two criteria are fulfilled, the EPCs should become a reliable tool containing useful and clear information on energy performance of a building or a building unit. Only by satisfying these three criteria it is possible to realise an effective EPC scheme, well perceived by the public.

In addition to the above mentioned utility, the EPCs can have a significant impact on the real estate value of a building. A recent study commissioned by Royal Institution for Chartered Surveyors (RICS) shows that the existence of an energy performance certificate can impact the value up to 2,5 %[10].

COSTS OF THE CERTIFICATES

The quality and usability of the EPCs are often directly related to the chosen assessment method. On the one hand, simplified method leads usually to substantial price reduction for EPCs, on the other one, lower price can be related to a lower quality and have a negative effect on building users. Prices among selected Member States range from 50 Euro in Poland, Hungary, France and Germany until about 800 EUR in Czech Republic, Spain and Denmark. Moreover, in some countries under survey there are several price quotations for an EPC, according to the level of the provided information.

QUALITY CONTROL

The quality control of the issued EPCs is very important for the effectiveness of the scheme and for improving the public acceptance. There are three factors influencing the quality control process. Firstly, the quality check process is much easier and credible when a national or regional database is settled in place. Secondly, it is necessary to impose quality requirements also to the energy performance certifiers in order to ensure the quality of the building assessment. Finally, it is necessary to improve permanently the skills of the energy certifiers by organising permanent training activities and periodical examination. Among the twelve investigated EPCs schemes, the quality control process is implemented in varied ways:

9. BPIE. Energy Performance Certificates across Europe. From design to implementation. Report prepared with the support of BuildDesk Benelux BV. ISBN 9789491143007, 2010.

10. D. Brounen, N. Kok. On the Economics of EU Energy Labels in the Housing Market. Study commissioned by RICS. 2010

Table 4: Public acceptance and perceived utility of the EPCs within the twelve analysed Member States.

	Use of certificates at sale/rent	Perceived usefulness by the public	Observations
AT			The scheme is transparent, but the certificate doesn't show the total energy performance and recommendations are not always presented (clearly).
BE (Flanders)			Functional and very well developed for the residential sector. The non-residential still under development.
CZ			Perceived as a new expression of bureaucracy. Information on EPC is not very useful. Only EPC for new buildings and major renovations. The existing building stock is not addressed.
DK			For new buildings EPCs are issued more than for transaction moments for existing buildings.
FR			High usage of EPCs on social renting market, but low on the private rental market. EPC is mainly perceived as an 'informative instrument'.
DE			The quality of the cheaper version based on measured rating. Registration and practical enforcement.
HU			The costs and the necessity of such certificate are the main public concerns. EPCs are not yet mandatory for the existing buildings.
IE			Recommendations for energy saving measures are not in the EPC but in the advisory report.
NL			High usage of EPCs on social renting market, but low on the private rental market. Th main public concerns are on the transparency, reliability and reproducibility of the certificates and these lead to further improvements of the scheme.
PL			The EPC provides only limited useful information for the building owner on the possible improvements. In practice, the EPCs are issued for market transactions only when both parties are asking for it.
PT			The EPCs are mainly used on the sale market and less on the rental market.
ES			In practice, the EPCs are used only for new buildings. The public awareness is low.

 Improvement is desirable	 Room for improvement	 Good	 Very good

- a centralised quality control based on national or regional databases (in Austria, Belgium, Ireland, the Netherlands and Portugal)
- direct responsibility of the energy assessors, with a sample checking system administrated by an authority (in Denmark, France)
- single responsibility of the energy assessors (in Germany)
- no quality control (in Poland and Spain)

ADMINISTRATION, PROMOTION AND COMPLIANCE OF THE EPC SCHEMES

Compliance with the Energy Performance Certification regulations by the general public can be stimulated and by an operational system of administration and enforcement and by dedicated promotional campaigns addressing all stakeholders involved in the process. Table 5 summarises the information relating to administration, promotion and compliance within the twelve surveyed Member States.

BARRIERS FOR THE IMPLEMENTATION OF THE EPC SCHEMES

The introduction of the EPCs within the analysed Member States had to overcome various barriers, many of these being related to country-specific circumstances such as slow administrative procedures, interferences between stakeholders on specific technical issues (i.e. on values to be used for reporting the final to primary energy as happened in the Czech Republic) and the lack of awareness among main target groups. These barriers should not necessarily be considered as failures or weaknesses and may represent inherent frictions in a complex implementation process. However, these barriers have to be overcome and therefore must be taken as lesson learned for further adaptation and refinement of the implementation approach.

Policy recommendations and conclusions

The extensive survey on twelve EU Member States reveals that the design and the implementation of the EPCs within their national legal frameworks encounter several challenges and barriers that lead to delays and suboptimal solutions. For implementing an effective EPC scheme it is necessary a strong commitment and to develop appropriate measures in accordance to the national specificities. Significant attention must be paid in choosing the calculation methodology, in developing clear quality control and enforcement mechanism, in establishing consistent promotional and dissemination campaigns and in ensuring a functional monitoring system based on centralised databases for the issued certificates.

The analysis of the twelve implemented EPC schemes has shown that improvements are possible especially regarding exchange of experience between Member States and in imposing reliable registration systems for EPCs. The results further

Table 5: Promotion, administration and enforcement of the EPC schemes.

	Promotion	Administration or registration system	Compliance/enforcement
AT	Regional promotion	Regional databases	No practical/functional system
BE (Flanders)	Regional promotion	Regional database	Strict enforcement system with penalties
CZ	Low promotion	No database	No practical/functional system
DK	Promotion for professionals	Central database	No practical/functional system
FR	Low promotion, but the professionals are well informed	No database	No practical/functional system
DE	National promotion campaign	No database	No practical/functional system
HU	National promotion campaign	No database	No practical/functional system
IE	National promotion campaign	Central database	Strict enforcement system with penalties
NL	National promotion campaign	Central database	No practical/functional system
PL	Low promotion	No database	No practical/functional system
PT	Promotion among stakeholders	Central database	Strict enforcement system with penalties
ES	Low promotion	No database	No practical/functional system

Improvement desirable | Room for improvement | Good

indicate that without involvement of all stakeholders, successful implementation may face some drawbacks. The choices that have to be made at the beginning of the implementation process represent the classic dilemma between the high impact of the initial decisions and the little knowledge on the subject. It is therefore important to create a strategy that lowers a risk of poor decisions and mobilises all available knowledge which can support decision-making process. This is the typical situation that occurs in the first phase of the implementation process. Therefore, at the beginning of the implementation process the Member States should impose decisions which provide maximum flexibility and trigger additional knowledge.

Based on the lesson learned from the analysis of the implemented EPC schemes in twelve Member States, the BPIE report elaborated a set of policy recommendations. A summary of these recommendations is presented below.

1. **Reproducibility and accuracy of the EPC's assessment methodology.** The assessment methodology is vital for the credibility, success and effectiveness of the energy performance certificates. Therefore, it is important to consider from the early design stages issues such as reproducibility, accuracy, level of expertise and costs of the certificates and to elaborate the most appropriate methodology for the given market. Moreover, a successful scheme has to be evaluated regularly and, according to the findings, to be continuously adapted and improved for preserving a high market value and utility.

2. **Exchange of experience, knowledge development and continuous consultation with stakeholders.** At the national level, it is beneficial to organise extensive consultation on regular basis with all the categories of multidisciplinary expertise relevant for the EPC. This practice can contribute with timely solutions for improving the EPC scheme by offering a necessary and comprehensive feedback. In the Netherlands for instance, many aspects concerning the implementation of the EPCs are regularly discussed in working groups. In Portugal, the energy agency ADENE plays a key role in the successful implementation of the EPC scheme. At the international level, exchange of experiences between Member States is crucial for acquiring necessary level of knowledge on the subject. Moreover, must be exploited the experience among the existing clusters such as policy and

technology networks, international institutes and centres of excellence dealing with energy efficiency in buildings. In addition, the further elaboration of relevant European standards will provide a substantial technical support for the EPCs implementation process.

3. **A clear legislative and administrative framework.** The implementation of the EPC schemes is faster and easier if the responsibilities are clearly distinguished between national and regional authorities. Member States with a strong regional structure should design implementation of the EPC accordingly, taking the advantage of the local experience and of the most effective communication channels in order to maximise the effectiveness of the scheme. Austria provides a good example of implementing the EPC scheme by providing national guidelines and leaving enough flexibility of adapting the system according to the regional specificities.

4. **An effective registration and quality control system.** Member States should set up reliable system of registration and quality control of EPCs which should also include advisory measures. This would enable a continuous and real-time monitoring and evaluation of the implementation process. A centralised registration database for the EPCs and a regular process for training and verification of the energy assessors have a key role in ensuring a high quality level of the energy certification and in raising the credibility and usability of the scheme. Among the twelve analysed Member States, the scheme is more effective where sound systems are settled.

   In addition, the development of a good registration system suitable for monitoring and evaluation is crucial for gaining knowledge about characteristics of the building stock and contribute to an adequate improvement of the existing EPC scheme. It is not a coincidence that the EPC schemes are operating better in countries with a well developed registration systems such as Denmark, Belgium (Flanders), Ireland, Portugal and the Netherlands.

5. **An appropriate level of consideration given by the implementing authorities.** Member States should continuously raise the awareness of all the relevant stakeholders on practicalities and results of the EPC scheme, by organising a promotion plan through all available communications channels. The public confidence and interest in the EPCs will be continuously improved if the responsible authorities show a constant high interest at all the stages of the implementation process. In all countries with a good level of implementation the EPC, the governments highly valued the scheme and develop consistent communication campaigns. This is the case in Belgium (Flanders), Denmark and Austria.

6. **Clear and appropriate enforcement.** In order to reach a high level of compliance, the EPC schemes should foreseen an appropriate set of enforcement measures, with penalties tailored in accordance to the market conditions and national/regional specificities. From the evaluation of the twelve EPC schemes it resulted that the energy certificates have high level of public acceptance and perceived usability exactly in the countries where enforcement regulation is implemented, i.e. Belgium (Flanders), Ireland and Portugal (see Table 4 and 5).

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