Implementation of the EPBD in Denmark

Status in November 2010

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CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementing the Energy Performance of Buildings Directive (EPBD)

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MINISTRY
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Buildings are at the core of the European Union's prosperity. They are important to achieve the EU's energy savings targets and to combat climate change whilst contributing to energy security. An enormous unrealised energy-saving potential lies dormant in buildings. In untapping that potential, not only more energy efficient buildings, but also better living conditions, financial benefits and sustainable jobs can be provided for Europe's citizens.

The EU's Energy Performance of Buildings Directive (EPBD), introduced in 2002 and recast in 2010, is the main legislative instrument for improving the energy performance of our building stock. Its impact becomes more and more obvious: tighter energy performance regulations for construction and renovations, building certification schemes, inspections and campaigns for heating and air-conditioning systems are being rolled out across Europe. As this report demonstrates, in face of the complexities of the building sector, a significant amount of ground has been covered. But evidently there is still a long way to go. By 2020, all new buildings constructed in Europe, not to mention an increased number of existing buildings, must be nearly-zero energy buildings. Continued efforts are needed across the board to reap the full benefits of the EPBD. Its full and proper adoption and effective implementation through nationally tailored adjustments are urgently needed.

I welcome this report, which reflects the major efforts taken by countries throughout Europe to date. It is an excellent example of how the European Commission and Member States working together can achieve faster and more effective progress towards development and implementation of EU policy objectives, in a climate of sound collaboration that allows a mutual better understanding of different perspectives.

Yet, there is still a need for more concerted efforts in order for the EPBD - and its recently adopted recast - to be equally effective throughout the whole EU. The fruits of direct collaboration and sharing of experiences, through activities such as this Concerted Action, speak for themselves. National administrations are encouraged to continue learning from one another in order to ensure the most cost-effective implementation of the legislation, in a climate of frank and mutual cooperation with the EC services. It is equally necessary for the European Commission, through its services and the Intelligent Energy Europe Programme, as in previous years, to monitor and support Member States in their effective implementation of this legislation across Europe, so that the buildings of the future can become a reality very soon.

I look forward to the next report in two years' time, which will show an even greater advancement along the path towards 2020.

Dr. Péter Szaló

Deputy Secretary of State

of Spatial Planning and Construction

Hungarian Presidency of the EU, 8 March 2011

Editor’s message

Back in 2001, the Energy Performance of Buildings Directive was about to become a reality, the result of enlightened European Union policy that established challenging goals for its Member States to implement and left them the freedom, but also the responsibility, of dealing with the tough details. Then, those of us in charge of preparing the needed legal instruments in several countries decided to meet and unofficially discuss ideas about the difficulties we faced. The challenges were many, and nobody really knew the best way forward. So, we agreed to help one another, meeting and discussing the alternatives put forward by the various country representatives, discussing freely the pros and cons of each solution. A small half a dozen at first, it rapidly grew to a group that required large meeting rooms, as more and more countries joined the group after they learned by word of mouth about how useful those meetings were. And the idea of a Concerted Action was born...

After our initial proposal, it took just a short period for the European Commission officials in charge of the Directive to welcome the idea of formalising a ‘Concerted Action EPBD’. Thus started the first Concerted Action EPBD, in 2005, after a long two years of legal preparations to make it official, hurdle after hurdle surpassed. Initially with just 22 Member States participating, plus Norway, every other Member State gradually joined, informally at first during the period 2005-2007, at their own expense, and then becoming formal participants for the continuation, ‘CA EPBD 2’, that ran from 2007 to 2010 with the full 27 EU Member States, plus Norway and Croatia.

The Concerted Action EPBD lived up to its initial objectives: it is a forum where Member States’ experts in charge of transposition, implementation and, now, the practical day-to-day running of building certification, training of experts, equipment inspections, information campaigns, preparing building regulations and calculation tools, and many other tasks related to energy efficiency in buildings, can gather, meet one another, and discuss common problems from a variety of points of view. These discussions take place in full confidence about confidentiality, with no obligations attached, knowing that their deliberations and ideas for the future are not going to become public knowledge the next day. Its success motivated the European Commission to replicate this policy support instrument for supporting the implementation of other Directives, namely Energy Services and Renewables.

We do not claim that without the Concerted Action the Directive would not have been implemented by all EU Member States, but we are 100% sure that EPBD implementation, in many countries, would have been much different or, at least, reached more slowly, at much higher expense and probably with less effectiveness. And, of course, the range of solutions would have been much more diverse than what is now in place. Many countries learned new ideas, others gained confidence that their ideas would work, and many others avoided making costly mistakes that could have undermined the whole national implementation of certification or inspection schemes.

In its second phase, the Concerted Action also brought about a new cooperation mechanism: Study Tours. Those countries who wished to implement central registers and did not yet have one in operation were able to send operational staff to other countries that already had one in place, seeing with their own eyes the details of the day-to-day operation, learning how to best implement their own system back home. As one participant well stated, *“we had often heard how to do it, but now we really understand how to do it”*. This is really the great advantage of the Concerted Action: we learn about problems that sometimes we did not even imagine existed, and we are then in a much stronger position to find solid solutions that will work well in our own countries, where our knowledge of local constraints and boundaries can frame the essence of the problem into the most adequate envelope.

In this process, awareness was also raised at the European Commission about best practices and practical difficulties faced by the Member States when implementing this very complex and challenging legislation. The Commission's officers were then able to work out policy solutions to improve the EPBD implementation and, then, to more effectively formulate the recently approved recast. They also had their opportunity to explain their ideas and concerns in a relaxed atmosphere, away from the formality of the official committee meetings in Brussels. It is only fair to acknowledge here the excellent steering that our main contact Martin Elsberger always managed to accomplish. He always used the Concerted Action to explore ideas and was always open to learn from the Member States' practical experiences, thus helping frame policy instruments to the best common interest. Cooperation always gets better results than confrontation and lack of dialogue. We, all the Concerted Action participants, sorely missed Martin following his return to national duties after the EPBD recast was completed, but we also welcome the most positive approach and enthusiasm from Michaela Holl, Martin's successor as EPBD lead officer, whom the participants already consider part of the Concerted Action 'family' even after only little more than one year of working together. A great thank you to both Martin and Michaela.

This positive and productive environment could only have become a reality, since 2007, with the full support of the EACI (the European Commission's Executive Agency for Competitiveness and Innovation), in charge of the EU's Intelligent Energy Europe programme that provided the formal contractual framework for the Concerted Action EPBD 2. We were very lucky to be assigned a most diligent, enthusiastic and knowledgeable project officer, Gordon Sutherland who, rather than simply waiting for the contractual outcomes, takes an active part in the operational discussions, contributing in the technical discussions by providing bottom-up input from projects supported under the Intelligent Energy Europe Programme, and is thus also regarded as a most valuable CA team member. Anytime there is some barrier for a new initiative or a difficulty that comes up, Gordon always finds a pragmatic solution that allows the Concerted Action to work effectively and advance towards the overall goals. His detailed review of all the results-oriented outputs of the Concerted Action, and his excellent contributions to their content, always brought a much welcome added value for the benefit of all. Gordon is the perfect model for the cooperative and useful EACI officer who, without forgetting to impose the obligations required by the contract and ensuring that all outputs are produced on time and with high quality, does so in a climate of total cooperation and in a most helpful manner.

The widely recognised success of this action must, however, be credited to each and every participant. Everybody who participated has his or her real share of the credits. As coordinator of the Concerted Action, I must thank each and every one of them for their work and collaboration in all the common tasks. Although there have been, of course, some changes over its 10 year life to date, from its conception as an informal grouping to an established policy support instrument , there is actually a core of key persons that have been there from day one. They are the real heart of the Concerted Action that ensures continuity and improves effectiveness. The list would be too long to name here, and so I leave it just as a general reference. It is a privilege to be able to share these tasks together with them. I must make a special reference to the five Core Theme Leaders and their assistants, authors of the reports in the first part of this book, as well as all the other members of the Management Team. They were the real engines behind all the technical work, steering discussions and producing the summaries of conclusions that are now published in this book. They form a great team, and the real success of the Concerted Action rests with them.

This book is the final and most visible reported outcome of the Concerted Action EPBD 2. It contains an extended summary of conclusions for each of the five Core Themes that were organised during the period 2007-2010 (Certification, Inspections, Training, Procedures and Information Campaigns) together with a collection of reports from each country describing the status of the EPBD-related issues at the end of 2010. These reports are an update of the information in the Book of Country Reports 2008 produced by the CA EPBD in 2009. This 2011 book, like its predecessor, has been an extensive work involving a significant number of Concerted Action participants. It has been a great pleasure to be able to edit this book and I hope that you will see it as the result of the work of hundreds of people all over Europe since 2001. It is that result, the contribution to the Directive in action and the energy savings which result from it, which is the most significant outcome of this Concerted Action.

Looking back to 2001 and the initial years of the EPBD, when there was widespread scepticism about the likelihood that it could be effectively implemented in most countries, and comparing with the present, when we have Energy Performance Certification Schemes already in place in almost every EU country, with thousands of Qualified Experts having issued millions of Energy Performance Certificates, we have really come a long way, and all those negative voices now have to recognise that they were wrong and that it was indeed possible to take bold steps and reach the policy goals. Surely, improvements are possible, but just having gotten this far is so significant an achievement that it cannot be overlooked. And the Concerted Action EPBD has contributed, in its not insignificant way, to this success.

This 2001 scenario is now comparable to the present widespread scepticism that we will not reach nearly-zero energy buildings by 2020, whether new or renovated, as required by the recast EPBD. Yet, for reducing the unnecessarily excessive energy consumption of their building stocks, whilst reaping the economic and social benefits of doing so, implementation of this recast is the major task EU Member States face for the next couple of years. And it can be done. The Concerted Action will be there to assist the process. I hope that, in 2013, with the EU Member States having put the recast EPBD into national law, and when publication of a new book with Country Status reports is planned, we will be back to prove, once again, the doubters wrong.

We hope you will find this book even more interesting, informative and inspiring than the first book with the country reports of 2008, and invite you to reflect on its content so that you too can act, in whichever way possible, to contribute to the next steps for advancement of EU implementation of the EPBD and its recast.

Eduardo Maldonado

Concerted Action EPBD Coordinator

31 January 2011

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For sharing their deliberations on the multitude of topics relating to energy efficiency in buildings, a special thank you is extended to all the invited experts who contributed so much to our work in the Concerted Action, namely:

- The coordinators and representatives of each of the IEE projects that shared their conclusions with the Concerted Action participants during technical sessions, as well as the consortia backing them up with technical substance from the field. The contribution from each project is outlined in the individual Core Theme reports of this book, each providing its own valuable insight, often from different perspectives, for EPBD implementation. Very special thanks must be given to Ian Knight and Dick van Dijk for their extensive contributions over several meetings.
- The CEN TC 371 team, coordinated by Jaap Hogeling, who personally attended every CA EPBD 2 meeting and actively promoted and engaged in fruitful dialogue between the Member States representatives and the European Standardisation Committee, CEN.
- The US Residential Energy Services Network, RESNET, and in particular Steve Baden and Philip Fairey, who twice crossed the Atlantic Ocean to inspire Concerted Action participants with a residential certification scheme that could very well fit into the group of best-practice examples in a EPBD environment.

For warmly welcoming us, even sometimes in the depths of winter, a very special acknowledgment is due to the cities of Warsaw, Lyon, Prague, Berlin, Amsterdam and Ljubljana and, more so, to the local hosts for their excellent arrangements, and in many cases additional funding, that made all our meetings so pleasant and productive. Thank you to Aleksander Panek, Gérard Guarracino, Jan Pejter, Sonja Leidner, Marjolein Heinemans and Marjana Šijanec-Zavrl, and of course their colleagues, for all your efforts.

For keeping us well informed, up-to-date and savvy on the topic of information sharing from one side of Europe to the other, many thanks to the dedicated Communications team under the leadership of Peter Wouters, for their internal webzines and project centre facility, and for the diligent upkeep of the Concerted Action website www.epbd-ca.eu. Thank you to Erika, Sabrina, Dominique and Stéphane.

Finally, last but not the least, a special acknowledgment to ADENE, and its Director, Dr. Alexandre Fernandes, who - in his vision of the strategic importance of the Concerted Action for the whole EU - never hesitated to commit the Agency's important financial and human resources, including the precious collaboration of Pedro Mateus as technical assistant to the coordinator.

FURTHER DOCUMENTATION

The Concerted Action CA EPBD 2, like its predecessor which ran from 2005-2007, released other public reports that are available through its website www.epbd-ca.eu, namely:

- The Book of Country Reports 2008
- Executive summary report of the Concerted Action EPBD (2005-2007), released in 2008.
- Detailed technical reports from the Core Themes – Certification, Inspections, Training and Procedures - of the Concerted Action EPBD (2005-2007), released in 2008.
- Executive summary report of the Concerted Action EPBD (2007-2010), released 2011.
- Several reports on specific technical issues, e.g., costs of certificates, high-performance buildings, inspection methodologies, effective ways to reach consumers, summer requirements in EU regulations, etc.

These reports are available from the website of the Concerted Action EPBD www.epbd-ca.eu and the European Commission's portal BUILD UP, energy solutions for better buildings, www.buildup.eu.

CONTENTS

Core Theme Reports

Introduction to the Core Theme Reports

Reducing energy consumption and eliminating wastage are among the main goals of the European Union (EU). They are embedded in Europe 2020 – the EU's strategy for smart, sustainable and inclusive growth. EU support for improving energy efficiency will prove decisive for competitiveness, security of supply and for meeting the commitments on climate change made under the Kyoto Protocol. There is significant potential for reducing consumption. With 40% of energy consumed in buildings, the EU has introduced legislation to ensure that they consume less energy.

A key part of this legislation is the **Energy Performance of Buildings Directive** (EPBD), which requires all EU Member States (MS) to tighten their building energy regulations and to introduce energy certification schemes for buildings. All MS are also required to have inspections of boilers and air conditioners.

The introduction of national laws that meet EU requirements is challenging, as the legislation has many advanced aspects. It is a great opportunity to further energy efficiency in EU buildings, but also a formidable and continuing challenge for many EU Member States.

To support them in this task, in 2005 the Concerted Action (CA) EPBD was launched by the European Commission to promote dialogue and exchange of best practice between them. An intensely active forum of national authorities from 29 countries, it focuses on finding common approaches to the most effective implementation of this EU legislation.

The multi-faceted format of the forum, with specialist workshops combined with high level discussions, allied to networking opportunities and web resources, has centred on sharing -and inspiring- smart solutions not only for the national legislation and regulations needed for implementation, but also for the professional tools, skills and systems in all fields addressed by it. These solutions are now being applied across the majority of EU Member States.

- **The Concerted Action EPBD** is carried out under the coordination of ADENE, the Portuguese National Energy Agency
- The consortium is composed of organisations appointed by all 27 EU Member States, plus Norway and Croatia
- The activities revolve around meetings, each with over 100 participants, held approximately twice a year
- Working groups and networking take place between meetings
- **Only national authorities implementing the Directive are involved, or those bodies appointed and entrusted by the national authorities to do so**
- Invited experts attend to give additional specialist viewpoints

The 100+ Members of the CA EPBD represent Europe's authoritative, collective knowledge on practical implementation and operational experience of energy performance certification of buildings and inspection and testing of boilers and air-conditioning systems.

When initiated in 2005, most MS were still at the planning stage, but are now well advanced. After stimulating advancement and convergence across the EU, the CA approach was further elaborated in 2007. The MS now share real operating experience and the Concerted Action provides ever increasing practical value and deeper learning to all participating authorities, playing its role in ensuring the success of this Directive as a vital instrument of EU energy-efficiency policy.

The CA EPBD 2 (2007 – 2010), the outcomes of which are presented in this book, is organised around 5 Core Themes (CTs):

- **Certification of Buildings**
- **Inspections of Boilers and Air-Conditioning systems**
- **Training of Experts**
- **Procedures for Characterisation of Energy Performance**
- **Information Campaigns**

Since its second phase was launched in December 2007, it has organised six major meetings between MS representatives, with intensive preparatory work in between. In addition to plenary sessions devoted to issues of general interest, it organised a total of 63 detailed technical sessions for discussing specific issues relating to one or more of the 5 CTs. Some sessions were organised in collaboration by two or more CTs, in topics that had impacts on various issues. The discussions built on the knowledge from the eight previous meetings, held during the period 2005-2007.

The initial plan for the CA EPBD 2 included a long list of topics related to the various Core Themes and additional topics have been identified by the participants since its launch. A brainstorming session at the first meeting in December 2007 was very useful in defining the topics of interest for the MS to discuss in the coming years. Furthermore, the recast of the EPBD was launched and adopted during this period, the CA being instrumental to that process.

The second part of this book contains extended summaries of the main outcomes of each of the 5 Core Themes, including conclusions and recommendations. The objective of the reports on the Core Theme activities is to present a snapshot of the concerns and deliberations of the teams dealing with practical implementation of legislation at national level. The synoptic information presented in these thematic reports is taken from dialogue during the period 2007 - 2010. Some topics may not have been revisited since the earlier part of that period and, as such, the results may be representative of that point in time. Nevertheless, the pros and cons of different approaches to implementation of the Directive remain relevant. For details on the present situation in all countries, i.e. in the final quarter of 2010, please see the Country Reports, part three of this book.

The CA EPBD is supported by **Intelligent Energy-Europe** under the **European Union's Competitiveness and Innovation Programme**.

CONCERTED ACTION
ENERGY PERFORMANCE OF BUILDINGS

Certification

Core Theme 1

Authors:

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November 2010

1 General Information

Since its launching in December 2007, the CA EPBD 2 (2007 – 2010) organised six major meetings among Member States representatives, with intensive preparatory work in between. In addition to plenary sessions devoted to issues of general interest to the 120+ participants at each meeting, it organised a total of **63 detailed technical sessions for discussing specific issues relating to one or more of its 5 Core Themes (CTs), 28 of which were devoted to topics covered by the Certification theme**. Some Certification sessions were organised in collaboration with some of the other Core Themes. Some Certification sessions were organised in collaboration with some of the other CTs. Certification of buildings has drawn a lot of interest from the beginning of the CA2 and a large number of participants joined the sessions.

Building on the experience from the CA EPBD (2005-2007), the initial plan included a long list of topics related to Certification of buildings; additional topics have been identified since then by the participants. A brainstorming session at the first meeting in December 2007 was very useful in defining the topics of interest for the Member States representatives to discuss.

This report summarises the main outcomes of these Certification sessions, including conclusions and recommendations.

2 Programme of Work

2.1 Description of the action "Certification Procedures" in CA EPBD 2

Member States (MS) *shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant*. Additionally, MS *shall take measures to ensure that buildings with a total useful floor area over 1000 m^2 occupied by public authorities and by institutions providing public services to a large number of persons … have an energy certificate ….placed in a prominent place clearly visible to the public.* Almost all MS now have experience in this kind of activity. Those with experience can describe their approaches, and MS can discuss the advantages and disadvantages of various possible alternatives, solutions to overcome difficulties, etc. In doing so, many MS may decide to converge on similar solutions, whenever possible, thus allowing a more harmonious implementation across the EU.

Since January 2006, energy performance certification is gradually being introduced in the MS for different types of buildings, and specific experience can now be exchanged, so that MS can see successes or problems in other MS and take corrective measures that will lead to further convergence on implementation of methods, including administration systems, so as to give a robust effect to the Directive. A further topic for discussion should be the identification of the best ways to use EPC data to monitor the energy performance of the building stock and estimate improvements, aiming at harmonising monitoring and evaluation methods.

Major advancements were made in the period 2005-2007, but at the end of that period some of the main issues remaining to be discussed could be summarised as follows:

- Certification of public buildings
- Certification of flats (with different ownership)
- Complex and mixed-use buildings
- Data collection, which data should be collected and how to do it
- Energy advisory reports (recommendations for energy savings) for all types of buildings
- Experience of MS relating, e.g., to organisation, scale, calculation procedure, software tools, prices etc.
- How to evaluate the certification process.

2.2 Certification Procedures in CA EPBD 2

This report summarises all discussions in the period 2007-2010 related to “Certification”, including the topics mentioned in 2.1.

During this period, all MS have implemented the EPBD and, therefore, also certification schemes and, thus, they have gained a lot of experience that has been shared for the benefit of all.

3 Actual Work in the Certification Theme

Nineteen topics with relation to energy performance certification of buildings have been dealt with. The topics are collected under three headings, and executive summaries are presented in this report:

- Building certification in general:
  - Measured or calculated energy performance rating
  - Certification of flats and blocks of flats
  - Certification of complex and mixed-use buildings
  - Energy Certificates for Display in Public Buildings
  - Processes for making recommendations
  - National standards for benchmarking using measured energy rating
  - Interaction between certification and inspections
  - Voluntary certification in the USA
- Administrative aspects of building certification:
  - Cost of certification
  - Layout of certificates
  - Quality assessment of certification
  - Practical experiences on Quality Assurance of Experts
  - Database management

- Extraction of additional value from EPC databases
    - Re-certification / re-scaling of EP scales
    - Design, operation and financing of central registers.
- Implementation of energy performance certificates in MS:
    - Impact of certification
    - Compliance with and control of EP requirements and certification systems
    - Influence of EP certificates on the market value of buildings
    - Study tours

Some topics were arranged in cooperation with the other Core Themes and are, therefore, also described in their relevant chapters and from their point of view. The work in the Certification Core Theme has included the topics listed above in Chapter 2, but other aspects of certification have been covered as well.

3.1 Building certification in general

3.1.1 Measured or calculated energy performance rating

The comparison of the calculated (asset) rating for energy certification with the measured (operational) rating is a matter of weighing advantages and disadvantages for each of the methods and selecting the most appropriate method for the actual situation in the Member States (MS).

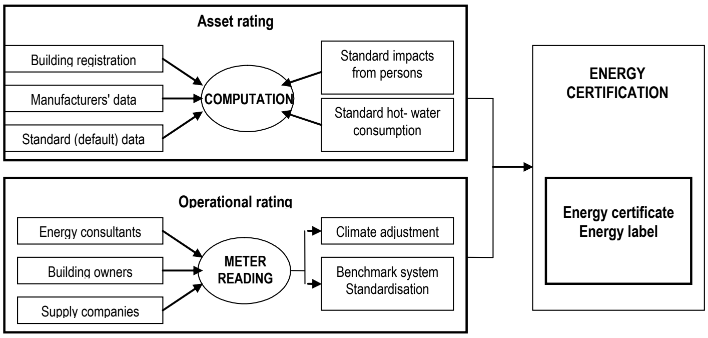

Figure 1. Data flows in calculated and measured building energy certification rating.

The figure (Jensen et. al, 2007[1]) shows the data flows and conceptual understanding of measured (operational) and calculated (asset) rating.

The measured rating is greatly influenced by the behaviour of the occupants and, consequently, adjustments to a standardised energy use can be a huge problem. The aim of building energy certification is to certify the buildings and not the users of the buildings. For larger non-residential buildings, a change in individual user behaviour will normally not have an important influence on the overall energy performance of the building. Information on the thermal performance of the thermal envelope and installations will often be rather scarce, as the information gathered very much depends on the expert. Recommendations based on measured rating can be difficult to identify and give an accurate estimate of the potential energy savings. Measured rating will normally be cheaper than using calculated energy performance, due to the short time needed to collect information about the building, in order to be able to identify the energy performance. Measuring the energy performance is not a straightforward matter, as there is often a need to sub-divide the energy use for different parts of the building, and this does not always take place. Estimation of the effect of energy saving measures in one part of the building can, therefore, be impossible, unless additional meters are installed.

> It is recommended to install additional sub-meters, where needed, to be able to identify potential energy savings in sections of a large building. Often, installation of additional meters is cost-effective in terms of energy saving.

[1] Jensen, O.M., Hansen, M.T., Thomsen, K.E. & Wittchen, K.B. Development of a 2nd generation energy certificate scheme - Danish experience. ECEE summer study 2007, Nice, France.

In contrast to measured energy performance, the calculated energy rating offers the possibility of getting detailed information about the thermal envelope and the installations. Another advantage is that energy performance is based on a standardised calculation method and the use of standard loads and climate. As a consequence, it is immediately feasible to compare the energy performance of two buildings, without any kind of adjustment or standardisation. However, the time needed to collect enough information to be able to carry out an energy performance calculation is not negligible. It can also be complicated to obtain the necessary information to establish an appropriate building model, especially when dealing with old buildings that have been renovated several times since their construction. Normally, the cost of issuing an energy performance (EP) certificate using calculated energy performance will be higher than that of an EP certificate based on measured data for the same building, because the former is more time-consuming to issue.

The reason for choosing measured or calculated energy performance certificates in a MS is often a political decision. Some MS have chosen measured EP rating for some types of buildings and calculated rating for other types, due to considerations of cost.

3.1.1.1 Conclusion of topic

The optimal solution would be to have both calculated and measured EP rating, but this approach is very costly and not without problems, e.g., comparison of the measured and the calculated energy performance in the same certificate.

Table 1. Advantages and disadvantages for metered and calculated energy performance certification.

	Advantages	**Disadvantages**
Metered energy performance	• The building survey is quick and energy savings are directly related to the real energy consumption. • Often cheaper than calculated EPC, due to the short time needed to establish the energy performance.	• It is difficult to identify savings, as energy break-down is often unknown. Very dependent on the skills of the expert. • Requires a special method for adjustment of measured consumptions to standard consumptions. • The time saved on certification can be lost on adjustments and recommendations.
Calculated energy performance	• In-depth knowledge about thermal envelope and installations is obtained. • Possible to identify (calculate) energy savings for each individual measure. • Standard calculation makes it possible to compare (benchmark) different buildings.	• Requires detailed information about the building and installations to set up an appropriate model (more time-consuming).

In some MS both calculated and measured ratings are used, depending on building typology and age:

- Calculated: AT, BE(F), BE(W), CZ, DK, HU, IE, IT, NL, NO, PT, RO, SL, SK, UK
- Measured: SE
- Combination: FI, DE, LU

3.1.2 Certification of flats and blocks of flats

Many different approaches have been implemented for energy performance certification of flats and blocks of flats[2] in the MS. In terms of complexity and level of detail, certification of flats and blocks of flats varies significantly. At one end of the scale, there is simple cloning of certificates for similar flats without the need to visit all blocks of the same type. At the other end of the scale, there are elaborate and detailed methods that necessitate certification and building survey of each individual flat. Moreover, detailed calculation of the building energy performance is undertaken, resulting in certificates for the whole building and for the individual flats. Naturally, there are advantages and disadvantages related to these approaches. Thus, proposing recommendations and drawing conclusions are not straightforward matters and, therefore, some pros and cons are listed in relation to each of the described methods.

3.1.2.1 Implementation of certification of flats and blocks of flats in MS

To summarise the actual status regarding certification of flats and blocks of flats, a short questionnaire was distributed in December 2007, with the possibility of answering "yes" or "no". 24 MS answered the questionnaire, but not necessarily all questions in the questionnaire, therefore some answers do not add up to 24. One of the results of this questionnaire was an overview of when certification of flats was introduced in the MS (see figure below).

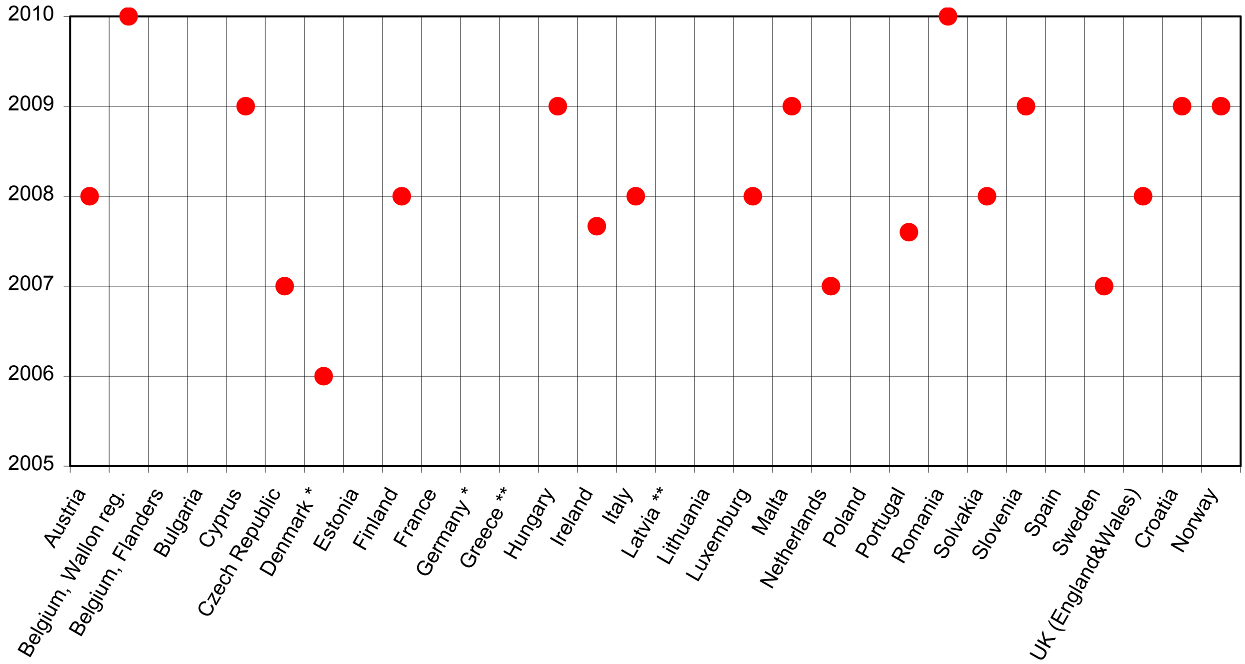

*Figure 2. Year during which a certification scheme for flats or blocks of flats was/is planned to be introduced in the MS present at the session on 'Certification of flats' in December 2007. *Denmark has had a certification scheme for owner-occupied flats since 1997; in 2006 a certification scheme was introduced for rented flats as well. Germany has had a certification scheme since 2002. **No certification scheme in force in December 2007.*

The answers also revealed that 20 MS had a planned or on-going certification scheme for flats and blocks of flats, and, in 9 of these MS, the certification scheme was already implemented in the legislation. In most MS (17), the certification schemes cover both new and existing buildings.

3.1.2.2 Certificate approach

Issuing the certificate either for each flat or for the whole block of flats is another important subject. In some MS, the energy performance label of the certificates can vary from flat to flat, while in other MS the

[2] Apartments and blocks of apartments

same label that has been assigned to the whole block of flats is assigned to each flat. In 9 MS, the certificate is issued for the whole block of flats, while 8 of the MS issue certificates for the individual flats. The remaining 2 MS issue a certificate for both the individual flat and the whole block of flats.

The reason for the "whole block" and the "block plus flat" approach is that many of the recommended energy saving measures are only applicable in the context of improving the whole block of flats, e.g., adding insulation to the roof. The "whole block" approach is almost a necessity, when the block of flats has a common heating system serving all flats. The "whole block" approach is generally cheaper for each flat, as costs are evened out, but in some cases it will be difficult to convince users who do not need a certificate for their flat that they must pay their share of a whole block certificate.

Some MS have many examples of individual heating in buildings, and here the "individual flat" approach can be more appealing, when looking at the installations. However, energy savings related to the entire thermal envelope show complications. One special complication is when different flats have been certified by different experts. Different energy saving recommendations could be given by different experts for the overall thermal envelope or for common installations. A common decision for the whole block of flats can, thus, be difficult to obtain, without consulting another independent expert.

Some MS have chosen to let either the measured or the calculated EPC be dependent on the age of the building. This combination makes it possible to customise the method and use the best approach for each building in terms of economy.

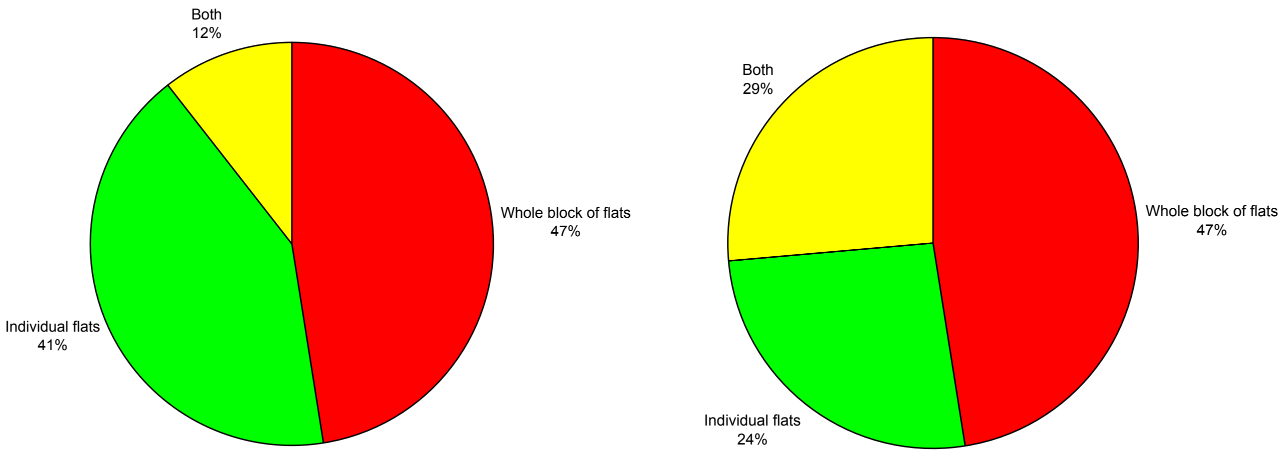

Figure 3. Left: Certificates are issued for either the individual flat or for the entire block of flats. Right: In about 50% of the MS, recommendations are made for the whole block of flats, while in 24% recommendations are made for the individual flat. In the remaining MS recommendations are made as a combination of recommendations for the individual flat and for the whole building.

Building surveys are dealt with in different ways in the MS. In 10 MS, a building survey is mandatory when certifying a flat or a block of flats, while 7 MS do not require a building survey. In the remaining 2 MS, the requirement for building surveys depends on the actual situation.

The choice of the building survey method has been an economic and, thus, a political decision in the MS. However, there is no doubt that a building survey will result in a more reliable and detailed EPC, if it is carried out properly and according to the guidelines.

The existence of **individual and even different heating systems** in the individual flats is one factor that makes certification of flats in a block of flats a special issue that is not straightforward to deal with. In 11 of the MS that answered the short questionnaire in December 2007, individual heating systems were widespread in blocks of flats, while in 7 MS individual heating was rare.

Generally, a common heating system can be considered in the same way as the common thermal envelope of a block of flats. Energy saving measures related to a common heating system are, therefore, of general interest for all flats.

Recommendations for energy saving measures in a block of flats can cover two levels of re-commendations, namely recommendations that can be implemented by the occupant of the individual flat and recommendations that require a communal decision, so as to be implemented in the whole block of flats. To be able to give the most complete set of recommendations, the "whole block" approach will normally be seen as the optimal approach.

3.1.2.3 Owner versus renter - conflict of interests

Owners of a block of flats generally have different interests than the renters of individual flats, in terms of investments and energy bills. Often, the owner has to deal with the costs of investing in energy saving measures, while the renter gets a lower energy bill.

In general, there are four different types of ownership in blocks of flats:

- **Non-profit housing associations** are regarded to be groups with a very positive attitude towards implementing energy improvements. The residents exercise influence via residents' participation in decision-making processes concerning the property, resources are systematically set aside for continuous maintenance and improvements, and investments benefit the residents through subsequent energy savings.
- **Private cooperative flats:** Housing cooperatives are regarded to have a relatively positive attitude towards implementing energy improvements. Cooperative housing is often in a better energy condition than owner-occupied flats or private rented flats. Residents benefit from investments through subsequent energy savings. It varies from housing cooperative to housing cooperative whether resources are continuously set aside for maintenance and improvements. But it is possible to raise a loan collectively in the housing cooperative.
- **Owner-occupied flats:** Energy saving initiatives will benefit the individual owners of flats. But owners are believed to have a stronger focus on individual improvements of their own flat than on common improvements of the property. It plays an important role that loans are raised for each flat individually and that the return will not be released until a subsequent sale.
- **Private rental flats:** Extensive legislation exists to regulate housing conditions in private rented housing. The owner decides and must be able to see the benefit of investing in improvements. Investments in energy improvements can lead to increased rent, in accordance with the rules about 'added value of the rented property'. The residents enjoy the subsequent energy savings.

In buildings with mixed ownership, the decision-making process is rather complicated. Owners of flats have the right to vote at the general assembly of the owners' association, while members of a housing cooperative only have the right to vote through the board of the housing cooperative. The board of the local section of a non-profit housing association has the right to vote, but must continue to follow the rules for non-profit housing governing residents' participation. Independent budgets are prepared and administrators are elected for the different housing cooperatives and associations.

Across the MS that responded to the short questionnaire, **payment of the certificate** is shared almost equally among the whole block of flats (owner or owner association) and the individual flats. In 8 MS, the cost was shared by the whole block of flats, while in 7 MS it was given directly to the individual flat user/owner. In 3 MS, the cost could be paid either by the occupant of the individual flat or shared by the whole block of flats.

The topic "Cost of Certification" is investigated further in Section 3.2.1.

3.1.2.4 Conclusion of topic

The topic 'Certification of flats and blocks of flats' was treated at three plenary meetings that demonstrated different ways of certifying flats and blocks of flats in the MS. The approaches and progress of the certification process vary significantly.

It is difficult to have a simple certification method and, at the same time, provide individual certificates for each flat in a block of flats. There are both advantages and disadvantages for certifying each flat individually or certifying the entire block of flats as a whole. Certification of the individual flat is time consuming and consequently costly. It also gives information on the specific flat, and it will be difficult to address energy saving measures that require interaction with the other flats or the whole block. On the other hand, certification of the individual flat is directly linked to the flat and the individual owner can easily identify his/her flat and relate to the suggested energy savings. Certification of a whole block of flats has the opposite advantages and disadvantages than certification of individual flats. The optimal solution for certification of flats and blocks of flats may, therefore, lie between the two approaches with certification of both flats and blocks and showing both certificates to the occupant of each flat. This method would ensure that suggested energy saving measures that require intervention in the whole building in order to be effective or to be implemented can more easily be accepted by the renters.

Table 2. Advantages and disadvantages for different aspects of certification of flats and blocks of flats.

	**Advantages**	**Disadvantages**
Certification of individual flats	• Easy to get access to survey the flat and tailor the advice to the actual situation. • Cost of certification is covered by the owner of the flat. • Easy to estimate energy performance in case of individual heating systems.	• Difficult to give advice that influences the whole building, e.g., insulation of roof, replacement of common boiler, etc. • Different experts may give different recommendations for the whole building. • Difficult to get agreement on common improvements to the building.
Certification of whole blocks of flats	• Cheap for each flat as cost for the certificate is evened out across all flats. • Easy to give common recommendations for the whole block of flats.	• Difficult to estimate energy performance in case of individual heating systems. • Difficult to gain access to all relevant flats for survey.

3.1.2.5 Recommendations for the future

It is recommended that this topic continues to be discussed and information is collected on lessons learned, when MS have gained further experience on the topic and measures have been subjected to potential revisions in the MS.

3.1.3 Complex and mixed-use buildings

The results of a questionnaire on certification of complex and mixed-use buildings were presented and combined with a presentation by 8 MS covering their current situation regarding the topic.

From a technical point of view, certification of residential buildings is a relatively simple matter, as the use of these buildings is clearly defined and most MS have experience with building structure and technical systems for heating and hot water preparation.

In the course of building certification, problems emerge in connection with complex and mixed-use buildings. The identified problems depend on the rating method (calculated or measured). For **calculated rating,** it is crucial to obtain all relevant information like blue-prints, plant diagrams, etc. Furthermore, identification of the technical systems may cause a problem, especially if the expert has limited knowledge of these systems. Finally, the calculation procedure and its limitations may present a challenge for representing the complex reality in a simplified tool. In the case of **measured rating**, availability and assignment of meters is one of the most crucial issues. Without proper sub-division of meter readings, it will be difficult to identify potential energy savings. Furthermore, valid quality reference values are needed for the actual building and its technical systems to enable proper assignment of the energy benchmarks.

The objective was to collect information on the procedures and problems that occur, when certifying complex or mixed-use buildings. Experience gained from the survey provided a basis for the development of databases, guidelines or recommendations that may be helpful in the certification process of these buildings.

To gain knowledge about the situation with respect to certification of complex and mixed-use buildings, a questionnaire survey was conducted, which 22 MS answered (not necessarily all questions). Most MS (13) use calculated rating for the certification of all types of buildings, while 4 MS use measured rating, and 4 MS allow both types of ratings. Two thirds of participating MS base certification of non-residential buildings on the assessment of the whole building (not on a particular unit). Almost half of the MS (8 of 19 answering this question) provide multi-zone calculated rating of non-residential buildings, only 4 of 19 use single zone, while 5 of 19 allow both options. Almost all MS (95%) stated that no sub-division (e.g., hotels by quality (stars), trade service buildings by size, sports facilities by type) of benchmarks were available for buildings certified using measured rating.

3.1.3.1 Complex buildings

In the context of this topic, a **complex building** is a building for which energy certification creates problems with the calculation of the energy consumption (due to difficult geometry, a lot of different – in existing buildings, not easily identified – technical installations, poor documentation of building components, and so on). A complex building could, for example, be a hospital building (because of the complex technical installations) or a shopping centre with various facilities (e.g., fitness, restaurants, shops, parking areas, etc.) or a historical building (because of unknown building materials and non-typical heating systems, e.g., fire places).

Most MS use monthly calculation procedures for certification that are based on the monthly or hourly method of ISO 13790.

While analysing the MS presentations and the answers given in questionnaires, some problems and experiences were revealed:

- There seems to be a lack of knowledge concerning the boundary conditions for common HVAC systems
- Categorisation of multi-functional buildings depends on the use of the individual sub-areas and it is important for the rating
- Complex buildings need more detailed calculation – especially for the calculation of cooling systems
- High costs for calculation of complex buildings, but the job is subject to market competition in a balance between price and quality
- Measured rating creates a dilemma regarding separating electricity for operating the building, lighting and appliances; procedure is not clear
- In most calculation methods, the cooling calculation procedures for renewable energy systems (solar cooling, night-time cooling) seem to be insufficient for coping with all types of systems
- Different tools give different results, and the variation due to the expert is too large
- Correct benchmark data are lacking
- In some MS there is a lack of applicable guidelines for data acquisition in existing buildings, interpretation of installation concepts is often not clear and simplifications are needed

The most important problems are: the lack of calculation procedures (for new/advanced systems); typical occupancy profiles not available or not adequate to describe reality; data acquisition is demanding and time consuming. Generally speaking, there is not enough experience in the certification of complex buildings.

3.1.3.2 Mixed-use buildings

A **mixed-use building** is, for example, a commercial/residential building with shops on the ground floor, office spaces on the first floor and flats on the upper floors. The calculation of the energy use of such a building can sometimes be simple, if the MS have chosen to neglect the presence of minor sections (e.g., less than 20% of the area) in the calculations. In other cases, individual certification for the different uses (with different tenants or owners) can create problems – especially when the certification is based on the measured rating procedure. Separation of energy consumptions and potential energy savings can be difficult to identify for the individual sub-areas.

From the questionnaire it was found that the majority of MS have no rules for certification of mixed-use buildings. Only 42% (8 of the 19 answers) have special rules for certification of mixed-use buildings. Benchmarks for rating mixed-use buildings are also a problem. Benchmarks weighted by floor area of a certain use (e.g., 10% restaurant in a block of flats) are, thus, not comparable with benchmarks for another building with a different distribution of areas.

Problems and lessons learned: Sometimes, mixed-use buildings can be calculated as two individual buildings, e.g., in Norway if the minor use area exceeds 20% of the total floor area. In Germany, if the residential use is below 10%, one single certificate can be issued. This procedure may, however, cause problems, as Germany allows both calculated and measured ratings.

3.1.3.3 Conclusion of topic

No special rules are available for the certification of complex and mixed-use buildings. Some MS have introduced simplifications, such as that the largest area determines which type of certificate to issue. Also, the possibility of separate certification of individual facilities (if individual heating systems or individual metering of consumption exist) can be found in MS. Some MS use measured rating and this causes problems with definition/assignment of energy consumptions for the different uses or sections of the building.

A number of possible solutions and recommendations were given:

Calculations:

- Zoning or a reduced zone model could be considered to model these kinds of buildings.
- Simplifications may be possible, since many mixed-use buildings are not so complicated and minor sections with a different use may be neglected.

Measurements:

- Guide for installation of meters and sub-meters is needed.
- Guide for in situ measurements is needed.

Benchmarks:

- Benchmarks for a variety of uses are urgently necessary.
- Rules for creating benchmarks for buildings with mixed use are necessary.

3.1.3.4 Recommendations for the future

Based on the experience gained, a new topic related to certification of complex and mixed-use buildings was suggested for future analysis:

- Studies on the simplification of zoning for complex and mixed-use buildings

This topic should be updated with new information in 2011/2012.

3.1.4 Energy Certificates for Display in Public Buildings

According to the EPBD, energy performance (EP) certificates for public buildings must be on public display. The requirement is stated as: *Member States shall take measures to ensure that for buildings with a total useful floor area over 1,000 m² occupied by public authorities and by institutions providing public services to a large number of persons and, therefore, frequently visited by these persons an energy certificate, not older than 10 years, is placed in a prominent place clearly visible to the public.*

This rule has been dealt with in many different ways in different Member States (MS) and so has received varying reactions from the public. The report in this section summarises the key findings from a survey on this topic conducted at the end of 2009 under the headings:

- Requirements for public buildings
- Differing ways in which this requirement has been implemented across the EU

Key conclusions drawn from the questionnaire responses and the discussions were:

- In the majority of cases across MS, the certificate and accompanying recommendations are valid for 10 years.
- Almost 70% of certificates were found to be based on the calculated energy performance rating. Only 21% were based on the measured rating.
- The requirement for where a certificate should be displayed was found to vary considerably across MS. This finding was confirmed by discussions, which also confirmed that only a limited amount of information on the EP certificate (rather than the whole EP certificate) tends to be made publicly available.
- Only 1 respondent said that a research had been carried out to establish whether displaying certificates in public buildings had resulted in action on the part of the building occupiers to reduce energy consumption. However, 2 respondents stated that they would be undertaking research in this area in 2010 (results not yet reported at end of 2010).
- The number of certificates for public buildings produced by each of the respondents ranged from 0 to over 20,000. 22% of respondents stated that no certificates for public buildings had been produced; 44% stated that it was not known; 13% stated that it ranged between 1,000 and 10,000; 13% stated that it ranged between 10,000 and 20,000; and 4% stated that more than 20,000 EP certificates had been produced for public buildings.
- In terms of the influence of the EP certificate, 48% of respondents stated that they felt there was no additional pressure on building owners to reduce energy consumption, as a result of the extra publicity created from displaying certificates. 48% stated that they were either unaware of this issue or that its impact was unknown.

3.1.4.1 Implementation across the European Union

The following key findings from the questionnaire were obtained:

- The requirement for where the certificate should be displayed varies considerably, as set out in the following chart:

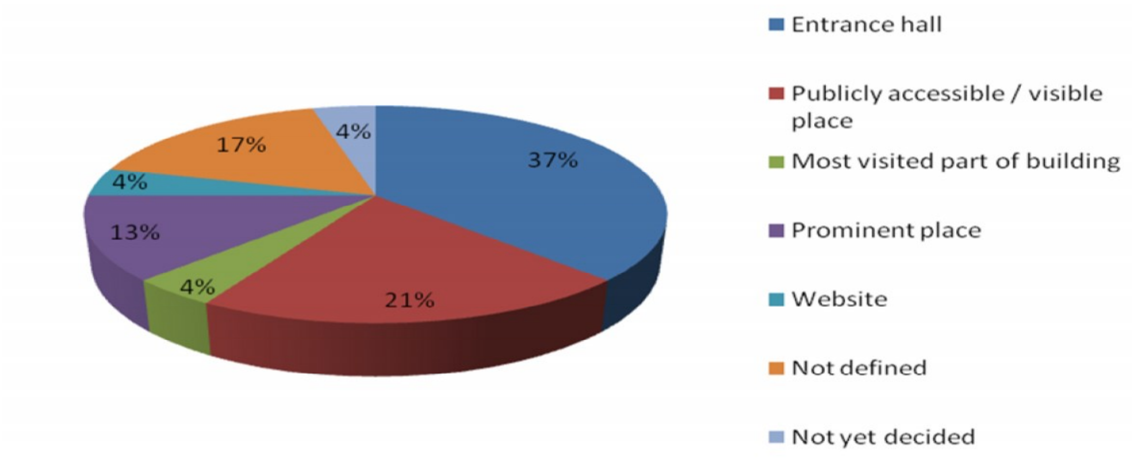

Figure 4. Possible locations for displaying the EP certificate in public buildings (results from 22 MS that responded).

Two main questions were discussed: (1) Where should the EP certificate be displayed? (2) What is the display size for the entrance hall? Some highlights are listed:

- In Germany, the EP certificate cannot be displayed on the Internet.
- In Portugal, part of the EP certificate can be shown on the Internet. Only the label and some general information are displayed, this does not include the recommendations and the energy consumption. It was noted that the full certificate will probably be shown in the future, and this option is currently being reviewed by lawyers.
- In Bulgaria, only the first page of the EP certificate is displayed.

For the size issue, the following national recommendations are listed:

- Germany uses A4, but it can be scaled to A2
- Portugal uses A4, but it depends on the size of the entrance hall
- Belgium (Flemish Region) uses A4
- Norway will be providing space for the logo and the name of the owner in the EP certificate
- Netherlands stated that the EP certificate must be visible for visitors to the building
- Cyprus is working on displaying a colour for the buildings in a Google Earth layer.

3.1.4.2 Approach adopted in England & Wales

As an example, the situation in England and Wales is described next in more detail. The key points from the public building certification approach adopted in England & Wales are provided below:

- Article 7(3) of the EPBD has been interpreted as applying to all buildings occupied by public authorities that are frequently visited by the public.
- Approximately 42,000 buildings fall within this definition in England & Wales.
- Certificates show the measured energy performance of the building.
- A measured rating approach was chosen, because it reflects both the energy efficiency potential of the building and the way it is being operated.
- The certificate shows the energy efficiency of the building on an A – G scale.
- The approach adopted in England & Wales goes significantly beyond the minimum requirements set out in the Directive in the following ways:
    - A new certificate must be produced every year.
    - The certificate must show the results from the previous two years.
    - The recommendations report must be updated every 7 years

The national impact assessment, taking account of the certification scheme adopted (measured energy performance) and prevailing local factors, showed that for public buildings in England and Wales the impact would be greater, if the certificate was updated every year.

> It is recommended that Member States fix location and size for display of the Energy Performance Certificate in public buildings. In this way, awareness of the certificate will rise and confusion will be avoided.

3.1.4.3 Conclusion of topic

It was noted that this was an important issue of interest to all MS and agreed that the topic should be further explored in future CA sessions.

3.1.5 Processes for making recommendations

The processes for making recommendations on energy savings are central to both certification and "Procedures for Characterisation of Energy Performance" and have thus been dealt with as a joint effort.

A questionnaire was distributed during the spring of 2009 to create a solid base for the discussions. The results from the questionnaire were presented together with presentations by 8 MS, showing the current situation with respect to the topic. The energy certification method differs, both from MS to MS, but also internally within the MS. Both calculated and measured rating is thus being used, depending on the building type and the age (new or existing) of the building (see figure below).

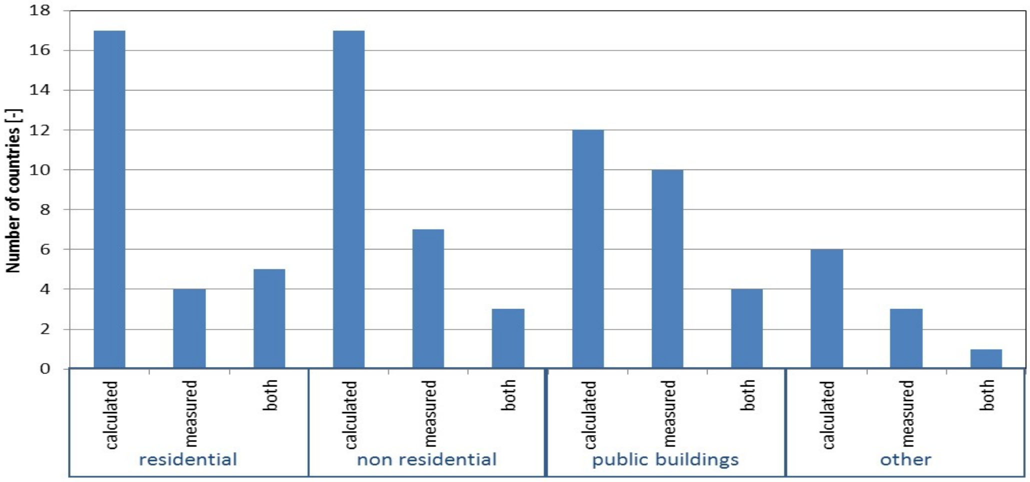

Figure 5. EPC method used for different building types in MS.

Many MS base their recommendations on standard lists, which in some cases are filtered automatically by the national software tool, while in other cases the recommendations are selected individually by the Qualified Expert. In other MS, recommendations are made individually by the expert, based on the survey of the actual building (see figures below).

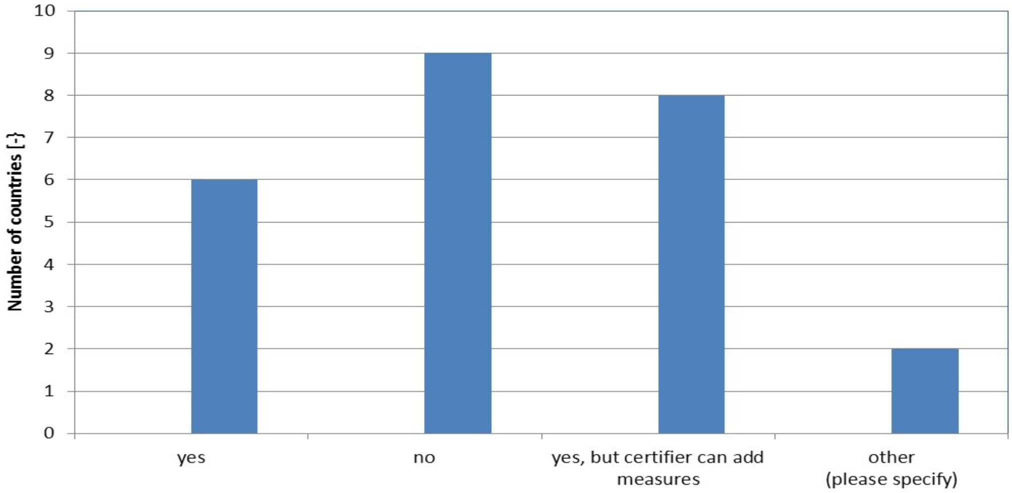

Figure 6. Number of MS using standard (default) lists for selecting energy saving recommendations for the certificate.

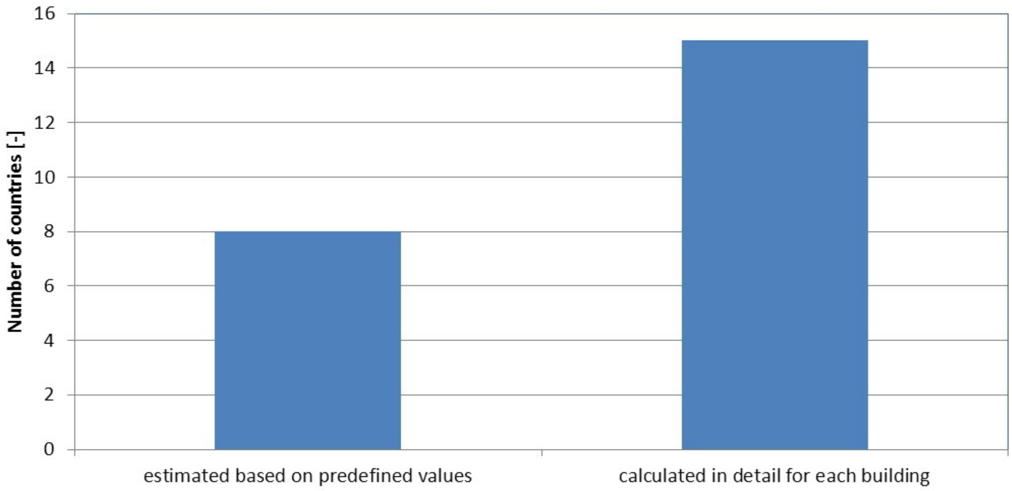

Figure 7. Number of MS using estimated or calculated energy savings for recommendations.

The energy savings connected with the recommendations are likewise differently handled. Some MS base the energy savings on standardised calculations connected to the standard recommendations, while others make customised calculations for each individual measure or group of measures. The number of recommendations that has to be given is unlimited in most cases.

An example of an automatic selection procedure for energy saving measures could be that the insulation of un-insulated pipes outside the heated volume is given as a standard recommendation, if the boiler is older than 15 years. For the thermal envelope, the selection will normally depend on the U-value of the construction.

All recommendations are listed according to generally accepted payback time. The lists of standard measures are based on studies of payback and policy of the energy renovation programme and are, thus, not calculated for the specific building. After recommendations related to insulation, the measures related to installations are listed. Recommendations on boilers come before measures on heating distribution system and control systems. The latter recommendations are related to domestic hot water and cooling. In some MS the order of the recommendations is chosen according to considerations on the overall energy performance of the improved building.

Indication of the potential energy savings is handled very differently in the different MS. Most MS show savings in energy units, while others add cost savings. A few MS add the CO_2 emission related to the energy savings.

In the case of energy units, there is a large variety among MS, ranging from the final energy consumption to the primary energy need. The conversion factors, which transform energy consumption into primary energy, differ from MS to MS, as well as within MS, e.g., in Poland they use conversion factors ranging from 0 to 3, depending on the energy source.

In addition, the economic presentation of the energy savings is given very differently, as some MS show energy savings as currency/saved kWh, as investment costs and payback period, or as reduction of energy costs after renovation.

The number of recommendations given in the certificate depends, of course, a great deal on the expert and/or the software tool used, but national recommendations or rules may apply. Figure 8 shows an overview of the limitations in terms of number of recommendations in the different certificates.

Issuing the recommendations normally does take some time for the expert. Different MS have different approaches and different tools to help the expert and, thus, the time needed to give recommendations varies, as shown in Figure 9.

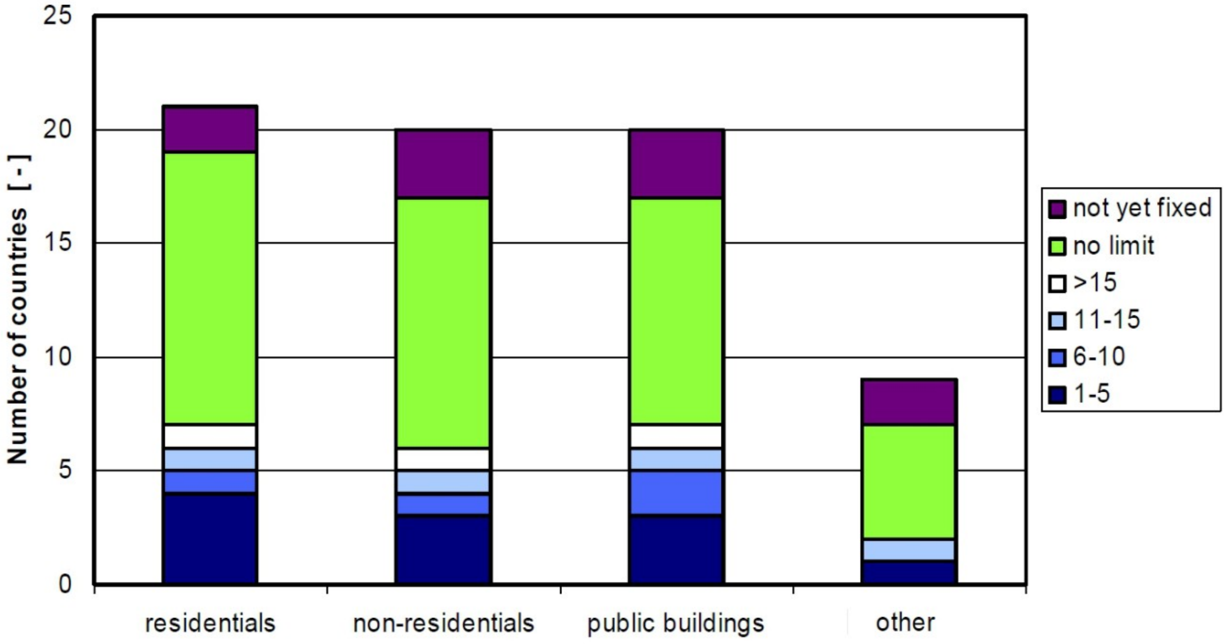

Figure 8. Number of recommendations that must be given in the certificate.

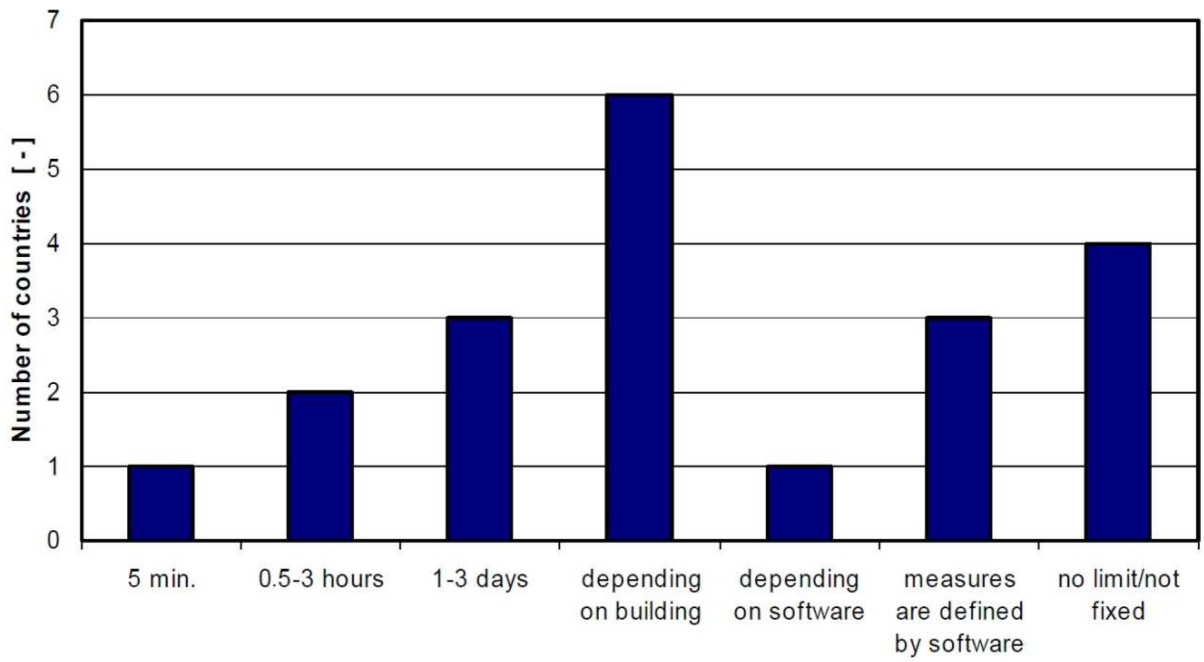

Figure 9. Time needed to give recommendations in the certificate, incl. time needed for building survey and calculations.

3.1.5.1 Conclusion of topic

There are different levels of issuing energy saving recommendations in the EP certificate, ranging from a simple approach, with automatic generation of energy performance and measures, to detailed building surveys and calculation of profitable measures.

Selecting or even automatic generation of recommendations from a standard list offers both advantages and disadvantages. The advantages are that recommendations do not depend on the quality and skills of the expert. Moreover, information can be stored in a standardised way for later processing. Among the disadvantages is that it becomes more difficult to tailor the recommendations to the specific building.

Table 3. Advantages and disadvantages of different ways to make recommendations in EP certificate.

	Advantages	**Disadvantages**
Metered energy performance	• The building survey is quick and energy savings are directly related to the real energy consumption.	• It is difficult to identify savings due to improvements to parts of the building, as sub-division of energy consumption is unknown. • Very dependent on the skills of the expert and requires a special method for the adjustment of measured consumption to standard consumption.
Calculated energy performance	• Possible to identify (calculate) energy savings for each individual measure.	• Requires detailed information about the building and installations to set up an appropriate model.
Automatic selection of recommendations	• Recommendations do not depend on the skills and preferences of the expert. • It is easy to categorise the recommendations for later processing of collected data. • Generally a cheap method.	• The system is more rigid and new measures must be approved before they can be part of the general list. • Difficult to tailor recommendations to the actual building and there is a risk that irrelevant recommendations are presented to the owner.
Selection of recommendations from standard (default) lists	• Recommendations do not depend on the expert's ability to remember all possibilities. • It is easy to categorise the recommendations for later processing of collected data. • Cheap, but more costly than automatic selection of recommendations.	• The system is rigid and new measures must be approved before they can become part of the general list.
Recommendations made individually by the expert	• Recommendations are tailored directly to the actual building and will thus have a higher degree of reliability and potentially lead to a higher implementation rate.	• Depend strongly on the skills and preferences of the expert. • Costly, as it requires more time for analysis and calculations.

The main focus of the EPC scheme is on saving energy, but focus should also be placed on encouraging a good indoor environment. Thus, a good and healthy indoor climate should not be neglected at the expense of energy savings. When making recommendations the expert must focus on potential risks which could be detrimental to the indoor climate.

> Recommendations given in the certificate should be directly targeted at the actual building being certified. This will increase public acceptance of the certificate and help persuade building owners to carry out the suggested energy saving measures.

3.1.6 National standards for benchmarking using measured energy rating

In December 2008 possibilities and problems related to measured energy rating methods for energy performance of buildings were discussed[3]. It was decided to investigate the topic further. During the investigation, existing calculation procedures for measured energy rating, especially for complex buildings and buildings with specific use, and the status and possible improvement of national benchmarking systems for measured energy rating were explored. A questionnaire covering both scopes was circulated and the findings were presented in June 2009, together with presentations of the current situation in selected MS.

The common aspect resulting from the questionnaire, presentations and explanations of how MS deal with measured energy rating is the need for simplification of the procedures for certification, at least for some purposes, under some conditions and for some building types, in order to save effort and money.

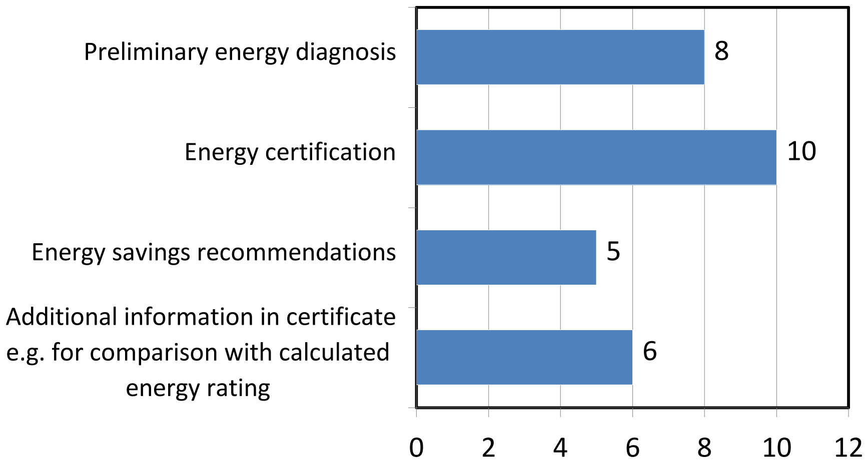

Figure 10. Answers from 22 MS on what purpose a measured energy rating is used or intends to be used for.

Some MS (7 of 22 answers) have experience with measured energy used for national/regional energy performance evaluation. Different aspects are taken into account to normalise the measured energy (climate, hours of operation, pattern of use, internal heat gains), to neutralise (for conditioned area, volume, notional building or others), and different possibilities for data collection are accepted.

As Bill Bordass[4] expressed in a paper in 2005, one can think of four different levels of benchmarking systems, maybe even five, starting with level 0 (called entry level) – which is not really a benchmarking system, but nevertheless the basis for getting started. In order to get started, one collects data on a specific building and states the energy intensity.

Level 1 (called fixed benchmarks) allows a simple comparison of energy intensity with a fixed benchmark for the building type. At this point, the benchmarking system can include benchmarks for heating and electricity (cooling, if used, is included in either the heating or the electricity, depending on the cooling system) on the one hand, and benchmarks for different types of buildings (office buildings, schools etc.) on the other hand.

At level 2 (called corrected benchmarks), one can assess a building's energy performance by using a system of corrected benchmarks. This can be necessary in cases, in which "level-1-benchmarks" do not fit a specific building, due to the different uses present in a building. The system of corrected benchmarks can include different technical standards or allow an interpolation of (two or more) fixed benchmarks.

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[3] Please also see this topic under Core Theme 'Procedures'

[4] The USABLE BUILDINGS TRUST, Feedback and strategy for better buildings *www.usablebuildings.co.uk* June 2005. Onto the Radar: How energy performance certification and benchmarking might work for nondomestic buildings in operation, using actual energy consumption

The assessment of a building's energy performance with "customised benchmarks" is one step beyond level 2. Benchmarks at level 3 (called "customised benchmarks") contain a more detailed description of the breakdown of the energy use of a building (such as for heating, ventilation, lighting or cooling) and are normally computed using software. They can take account of individual areas or energy end-uses, the breakdown of energy use into its components, the intensity of occupation and the hours of use. Such procedures can be very powerful, but are rare at present. However, once principles are defined and numerical values agreed upon, the concept can be developed and applied more widely.

Benchmarking at level 4 (called modelled benchmarks) assesses a building's energy performance using modelled benchmarks. At this level, benchmarks can be modelled mathematically. In theory, building energy performance can be modelled precisely; any differences between the estimated and actual performance can be turned into a list of actions; and the effects of technical and management changes can also be modelled. In practice, the results can be subject to error, owing to limitations in the power of description and modelling. Considerably more effort is required to produce an operational rating on level 4 than compared with lower benchmark levels. However, where an asset rating is already available, a comparison can bring further insights. In the long term, a detailed modelling approach could become possible, where building designs will have been developed using "a whole project" model software, control systems simulated before being uploaded into building management system software, and where facilities management will keep the database up to date.

Pros of benchmarking systems:

- In order to build up a benchmarking system at levels 1 or 2, it is not necessary to have detailed information on the energy consumption of the building stock. It is sufficient to have partial knowledge about the energy consumption of the building stock based on statistical data.
- Some MS already had information about the building stock energy consumption based on statistical data before developing a benchmarking system.
- Some MS adopted the use or partial use of an already existing system.

Cons of benchmarking systems:

- All benchmarking systems have in common that they need some kind of statistical basis for the energy consumption of the building stock. This data must be collected and analysed.
- Analysing the energy consumption of the building stock statistically, in order to gain a benchmark, usually leads to a typical/average energy efficiency level of the benchmarks. Best practice/very good energy efficiency level of the benchmarks is only used in two MS.
- Many benchmarking systems of MS have the common characteristic that they need some kind of improvement after a certain period of time or while experience is being accumulated.

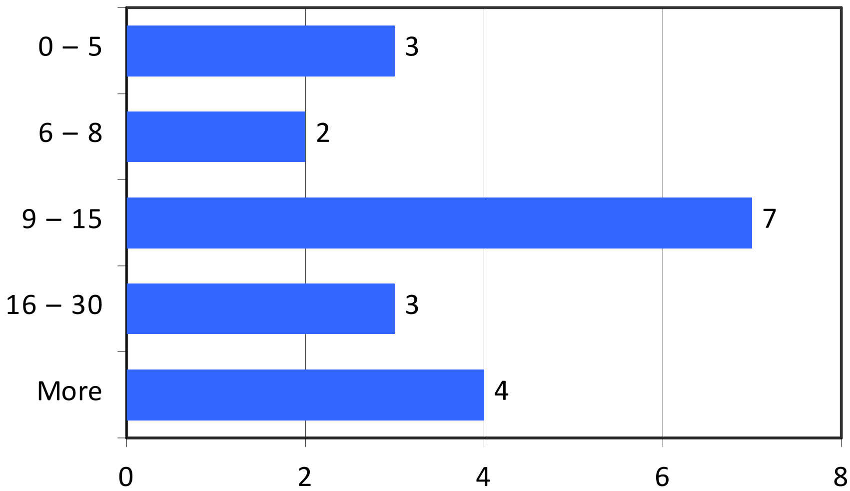


Figure 11. Individual categories (including subcategories) of benchmarks (labels) in MS.

In dealing with EPC benchmarking, an interesting issue, among others, is the number of grades (if any) in the benchmarking. MS have chosen many different approaches for sub-division of the EPC benchmarking scale, ranging from 0-5 grades to more than 30 in 4 MS. A high number of grades offers the easy possibility of moving up one or more grades, when implementing energy saving measures, and thus obtaining a better label on the certificate. A low number of grades will, on the other hand, ensure a more stable certification between different experts.

Many buildings have mixed uses, such as an office building with a restaurant, and are not covered by the benchmarks. One possible way to get a benchmark is to analyse the consumption of the building stock statistically.

> There is a need to investigate the energy consumption in the existing building stock statistically, in order to enable a valid set of benchmark criteria, in particular, but not solely, for mixed-use buildings.

3.1.6.1 Conclusion of topic

Some MS use or intend to use measured energy rating. MS are mostly aware of the advantages of measured energy rating, but common methods for normalisation of measured energy, for checking the data quality and ways for dividing the measured energy into different uses are missing, and future work in this area is needed. Time can therefore be saved on the collection of data, but may be lost on normalisation and checking the quality of data. On the other hand, the quality of the recommendations is strongly dependant on the skills of the expert as energy flows are not clearly identified.

Many benchmarking systems take final energy into account and cover the overall result of the energy used for heating, hot water, cooling, ventilation and lighting. Often, the energy consumption for heating and electricity (incl. electricity consumption for cooling systems) is addressed using at least two numeric indicators, in some cases one combined numeric indicator.

A typical difference in benchmarking systems of MS is the number of different benchmarks that are taken into account. The number of benchmarks ranges from less than 5 to more than 30. Often, the building categories are identical or almost identical to the typologies given in the annex of the EPBD.

3.1.6.2 Recommendations for the future

Based on the analysis of the questionnaires and the national presentations, it was clear that the two topics, measured energy rating (MER) and benchmarking systems, need additional work. Several leading subjects for further studies were concluded from the questionnaire analysis and some were briefly discussed. The subjects addressed were:

1. MER for specific building categories are needed, and special attention should be given to:
    - Requirements for quality of data used in MER and benchmarking
    - Normalisation (correction) procedures, aspects to consider, and how to take them into account for normalisation (climate, hours of operation, pattern of use, internal heat gains)
    - Neutralisation (by conditioned area, volume or comparison with notional building)
    - Dividing measured energy for different uses (excluding those not relevant according to the EPBD)
    - The use of MER when recommending improvements.
2. Requirements for an energy monitoring scheme
    - Guidelines for suitability of MER for a) preliminary energy diagnosis and b) energy performance certification.
3. Survey on why EN 15603 (overall energy use and definition of energy ratings) is not used in several MS
4. Combination of calculated and measured energy rating

5. The necessity of reducing or increasing the number of benchmarks
6. How to analyse the building stock and metered energy, in order to get reliable benchmarking systems, including best practice benchmarks.

3.1.7 Interaction between certification and inspections

The Energy Performance of Buildings Directive (EPBD) establishes requirements for both energy certification of buildings and regular inspections of heating and air conditioning systems, in order to promote the improvement of energy performance of buildings within the EU.

Besides these requirements, it also indicates that regular maintenance of heating and air conditioning systems by specialised personnel contributes to preserving their correct adjustment, in accordance with the product specification and ensuring optimal performance, from an energy point of view.

On the one hand, inspections tend to be seen not only as a check of proper maintenance, but also as an assessment of the energy efficiency of the systems.

On the other hand, the system performance is assessed as part of the overall building performance, using available information on system characteristics or checking the conditions of the system components and their assembly on-site.

There are several interactions that might occur between maintenance, inspections and certification procedures. For example, the recording of energy consumption is useful to evaluate system efficiency, as compared with suitable benchmarks, but is also useful for certification methods, based on measured performance. Regarding the present stage of EPBD implementation, it is important to clarify points of contact between these procedures, in order to avoid double work and increase the effectiveness of the maintenance, inspection and certification processes.

For these reasons, it might be interesting to evaluate the possibility to combine maintenance, inspection and certification of existing buildings, even knowing that there are some barriers, which can make the process difficult, especially due to the high level of skills required for professionals involved in these tasks.

3.1.7.1 Potential benefits from coupling system inspection schemes to EPC schemes

Several types of possible interactions may occur between maintenance operations and inspections, as well as with building surveys. Figure 13 and figure 14 show examples of possible combined procedures for maintenance, inspections and energy certification of buildings.

> It is clear that there are several points where regular maintenance procedures and inspections could provide useful information to the expert in the intermediate time between two building surveys.

Naturally, there will be some tasks that should be the responsibility of inspectors, such as checking the system sizing, a task that may not be the responsibility of people who perform maintenance tasks. Thus, it would be possible to have a regular recording and to create a history of the system regarding energy efficiency and system performance. This could also be very useful for national benchmarking, if data are collected in a register.

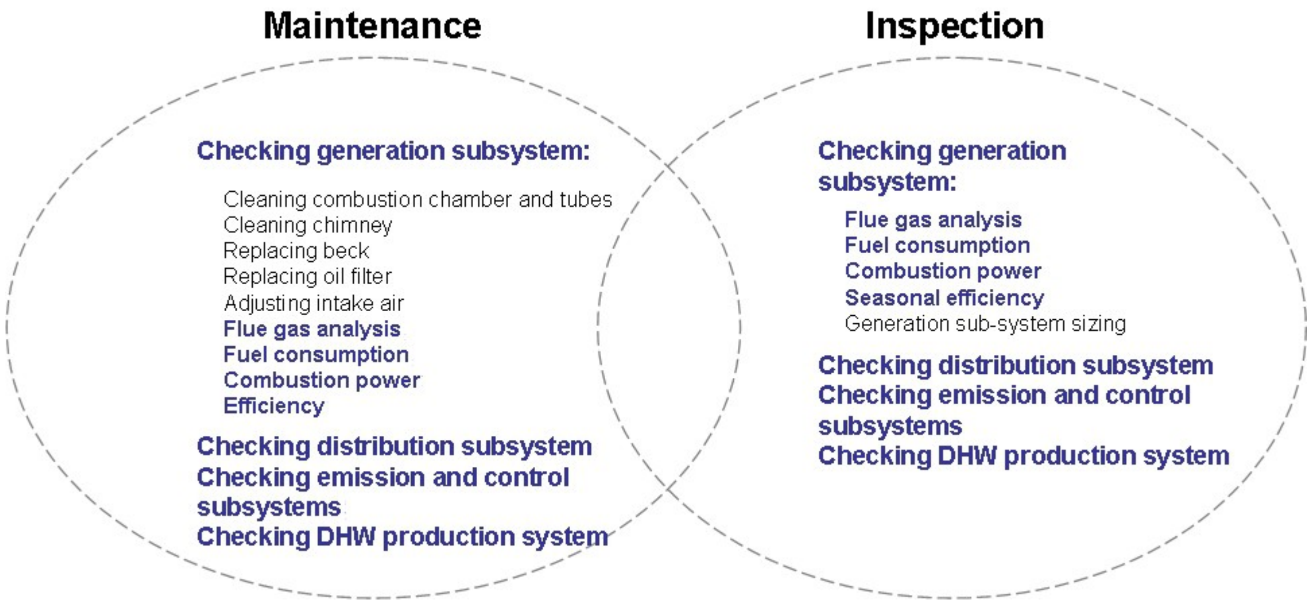


Figure 12. Examples of possible procedures for boilers and heating systems, regarding maintenance (left) and inspection (right).

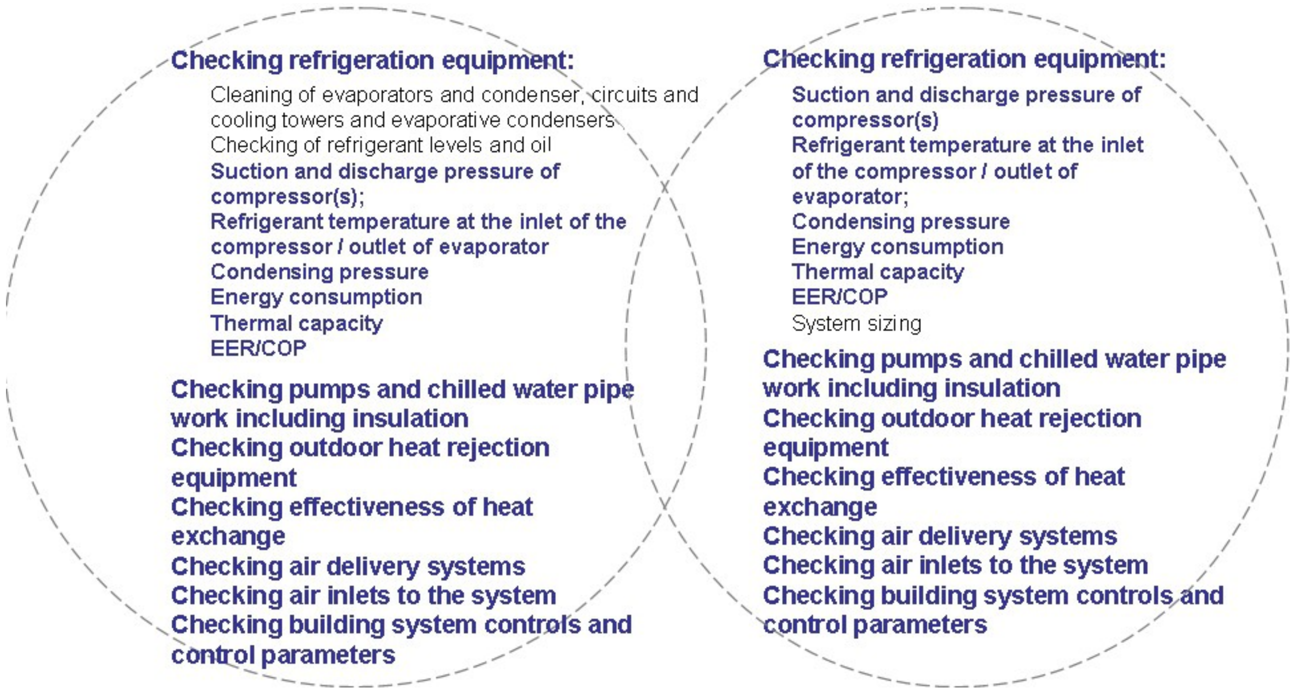


Figure 13. Examples of possible procedures for air conditioning systems, regarding maintenance (left) and inspection (right).

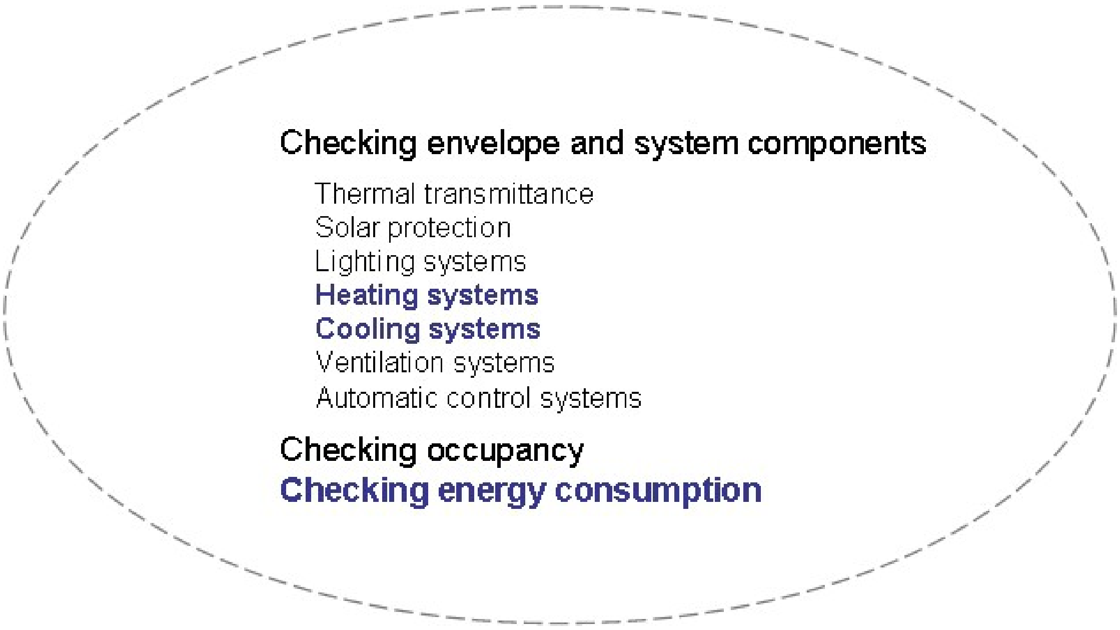


Figure 14. Examples of possible procedures for energy certification of existing buildings.

3.1.7.2 Conclusion of topic

It was confirmed that most MS had not established an integrated approach for maintenance, inspection and certification of existing building processes and that for most of these MS it is quite difficult to integrate the schemes, especially due to the high level of skills needed for professionals involved in the tasks.

3.1.7.3 Recommendations for the future

Knowing that some MS are still developing inspection and certification procedures, it might be interesting to evaluate the possibility of combining maintenance, inspection and certification of existing building schemes.

3.1.8 Voluntary certification in the USA

The RESNET[5] certification scheme has been established on the basis of a non-governmental organisation (NGO) and, as such, it is not a mandatory scheme for energy rating of buildings (presented in December 2007). However, the scheme could potentially become more official, as 3 States already require that homes that are sold must have a RESNET label. The mortgage and insurance industries are also interested, as they see an advantage in cutting the energy costs of operating a home.

RESNET has its own set of standards for calculation and labelling of a home, as wells as its own set of standards for training and minimum skills for experts.

In 2006, approximately 10% of the new housing stock in California was rated and 12% was expected to be rated in 2007.

The energy yardstick (graphic on the right) is a USA energy-consumption index that measures energy performance for the entire home on a relative HERS[6] scale. The energy consumption of the "American Standard Home" equals 100. If it equals 0, it means that the home has no purchases of energy and consequently no net energy, i.e., it is the "Zero

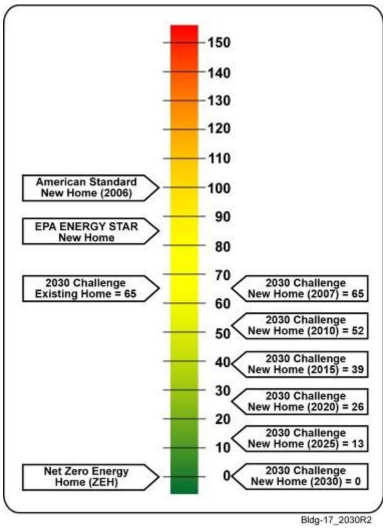


Figure 15. RESNET building energy certification rating label.

[5] Residential Energy Services Network *www.resnet.us*

[6] HERS – Home Energy Rating System

Energy Home". An Energy Star home has a HERS index of 85 or lower. There are about 100,000 Energy Star rated homes in the USA today. A home can have a negative rating, if annually it produces more energy than it consumes.

In the USA, there are two codes, one for residential buildings and one for non-residential buildings. Residential buildings with more than 3 storeys are treated as commercial or non-residential buildings. Three storeys or less are dealt with under the residential buildings code.

3.1.8.1 Conclusion of topic

RESNET is a voluntary scheme based on calculated rating of the buildings' energy performance, including consumption for heating, cooling, hot water, standard lighting, appliance and miscellaneous loads. The calculation method is not based on ISO 13790, but on a similar method. The scheme has many similarities with the EBPD building certification schemes, but is not directly comparable.

3.2 Administrative aspects of building certification

3.2.1 Cost of certification

The cost of certification is one of the key issues for achieving widespread acceptance of the energy certification schemes. Like any other service, cost is an inevitable issue when putting the certification scheme into real practice on a mass-scale level. People will look for value for money in the fee paid to the expert. Particularly in those MS where no previous experience exists with voluntary or other type of building certification schemes, some kind of market reaction should be expected. Depending on circumstances, such reaction can be of political relevance and may influence the actual level of implementation of the EPBD.

The objective was to collect information from MS, particularly from those with practical experience or relevant studies on the cost of certification. Such information may provide reference values useful to the different MS, and reveal common approaches and smart ideas or options, in order to deal with the cost issue.

A questionnaire survey was conducted on the impact of certification and was circulated to all MS. In most MS (that responded to this survey), costs for issuing a certificate are determined by the market. Thus, 20 MS answered that price definition is completely determined by the market, while most of the remaining MS have a combination of free and fixed prices. MS with a controlled market use the following approaches:

- Spain, Portugal and Malta, where part of the cost is (or will be, in the case of Malta) fixed and part is determined by the market. In Spain, the regional governments have fixed certification taxes for each certificate and/or for being a registered expert. In Portugal, a fixed mandatory tax of 45 € for single flats or single family houses and 250 € for non-residential buildings is charged for each certificate issued in the system. The expert can charge the building owner any price, depending on the free market forces.

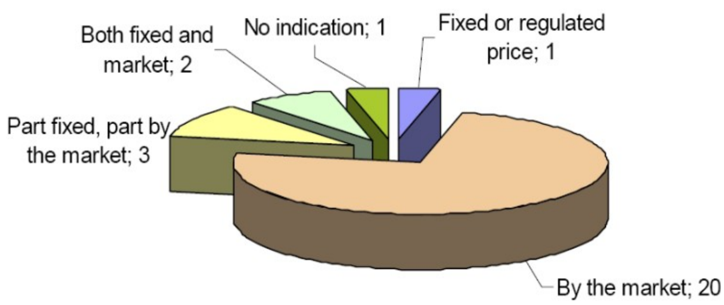


Figure 16. Cost model for issuing an EPC is decided differently in MS.

- In another survey, it was found that the cost of the quality assurance scheme in Ireland is paid for partly by a fee for every issued certificate and partly by a fee for accreditation paid by the expert.
- Denmark and Greece, where both cost models are considered. For Danish residential buildings up to 299 m^2, there is a fixed price determined by legislation, while for other building types it depends on the market. In Greece, prices will be regulated by a board or association of professionals, or determined by the market, depending on building type and size.

- Slovenia, where the price will be fixed by legislation.

Differences between costs in MS are more evident in the case of non-residential buildings, ranging from a few hundred euro up to 20,000 € per certificate. Cost is often higher (both per area and per building) for existing, non-residential buildings than for new ones.

In the specific case of single family houses, prices range from 100 € to 1,250 €. Despite this generally wide range, a narrower range from 200 € to 600 € per certificate is used in 50% of the MS in this survey. This may be taken as a useful reference for other MS.

Regarding multi-family buildings, costs depend on the strategy adopted by the MS for certification (a certificate for each flat or a certificate for the whole building), and it is more difficult to determine a trend or definitive range. Certification by flat in new buildings provides a clear economy of scale in the individual cost per flat, although it is more expensive for the whole building, when compared with a single family house. Certification of existing buildings also tends to cost the same or more than certification of new ones.

Costs are normally related to the amount of work necessary for performing and completing all the expert's tasks in the certification process. Although the costs depend heavily on the specific methodologies used in each MS, the influence level of some experts' activities on the price of certification for new and existing buildings may be verified from the average values presented in the following figures.

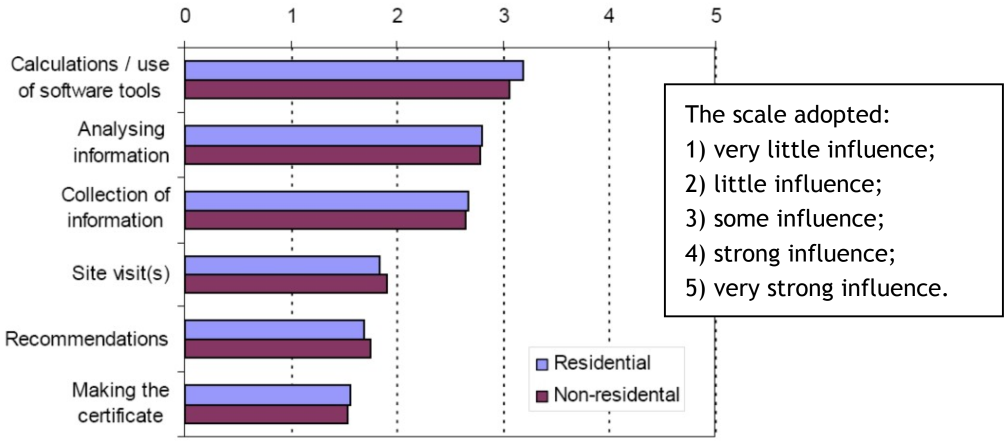


Figure 17. Most time consuming tasks in experts' work for certification of new buildings

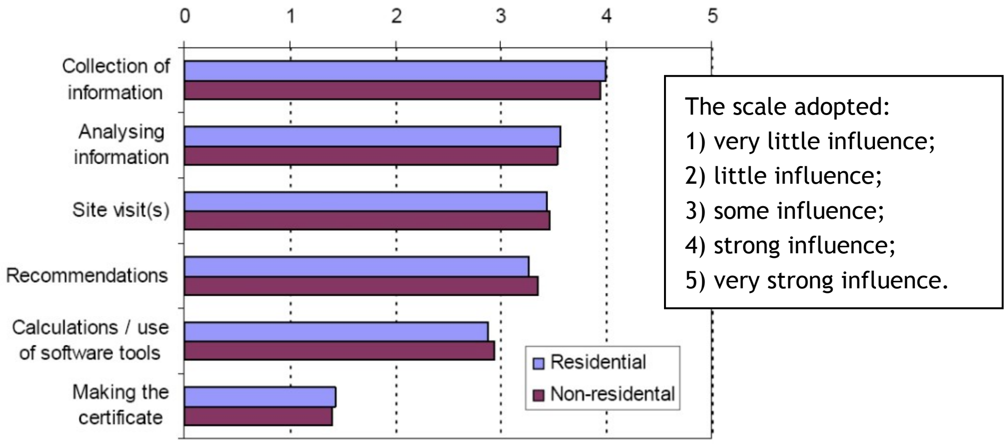


Figure 18. Most time-consuming tasks in experts' work on certification of existing buildings.

In the case of new buildings, "performing calculations / use of software tools" and "analysing and collecting information" are the most time-consuming activities of the experts' work. As expected, building surveys (site visits) and "preparation of recommendations" have little or very little influence on the work performed by the experts. The survey of a new building is often a control of the information given, when asking for a building permit.

In existing buildings, “site visit(s)” and “preparation of recommendations” are naturally grouped with “collection and analysis of information”, at the top of the scale of influence on the experts’ work. “Calculations and use of software tools” are lower on the scale. These changes may be explained by the fact that simplified methodologies are often used in existing buildings and their results depend a great deal on the quality of the information collected and used. In addition to this, proposal of recommendations is one of the main objectives of certification in existing buildings, thus being one of the aspects where experts invest more time.

3.2.1.1 Conclusion of topic

Identification of the factors that most influence the cost can help in the practical implementation of certification schemes. Aspects, such as the number of experts available compared with the building stock, if the cost refers to an existing or a new building, and the complexity of the method for determining ratings, influence the final cost of the certificate.

> It is recommended for MS to establish a structure for the cost system and to ensure that users of the certificate get a document with a content that matches the cost of the certificate.

3.2.2 Layout of certificates

The CA EPBD 2 conducted a study to obtain information about the layout and content of building energy certificates in different MS and to discuss the potential for energy certificates in the future.

Generally, there are two types of certificates in the MS, stepped labels or continuous coloured band strips. The pros and cons of these two main forms of certificates seem to be balanced, so it is not likely that any MS will use another option than that already selected. It is likely that tightened requirements for future buildings will have consequences for the certificates. No decision has been made yet with regard to the implementation of these new benchmarks or categories and their appearance on the front page.

The physical unit used in different MS to identify energy performance differs a lot. The physical unit kWh/m² per year, and only this specific value, is used in 5 MS for new buildings and for existing buildings in one more MS. In Germany, e.g., both primary energy and delivered energy are shown in the certificate.

In many MS specific energy consumption is accompanied by additional data expressed in physical units. The most typical additional data is CO_2 emission in kg/m² per year. A relative scale is used in some MS.

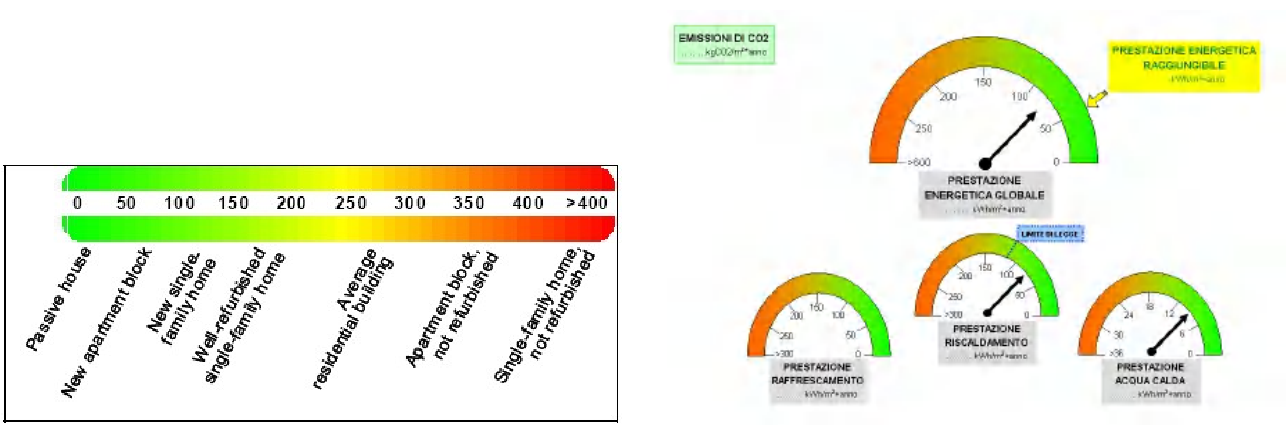


Figure 19. Examples of labels, Germany (left) and Italy (right), representing a continuous energy performance scale.

Figure 20. Examples of labels, Ireland (left), Denmark (centre) and Sweden (right), all three representing the stepwise energy performance scales.

In the top categories, it is reasonable to have narrow categories in the case of stepwise labels. Although 30, 15 or 0 kWh/m^2 per year do not represent a great difference, as far as the absolute figures are concerned, it is clear that the difference is astonishing from the point of view of the building and the mechanical systems. And, today, the “energy plus” building is already a reality.

Each type of certificate has pros and cons worthy of discussion. The substantive question is whether relative value or physical units are applied on the scale. Disregarding the schemes that include additional data, three main types are to be mentioned:

- Relative value (each building type is measured on its own scale);
- Specific energy need (physical unit, absolute value is applied);
- Specific energy need and emission (physical units, absolute values are applied and the environmental impact of the energy consumption is expressed).

3.2.2.1 Conclusion of topic

The front page (or a main one) should be eye-catching, clearly displaying the energy performance for everyone to see, possibly also using an expressive graphic presentation. As additional information, what will be achieved when the recommended actions are carried out should be clearly shown.

The date stating when the certificate was issued must be shown, as the classification scale may be updated every 5 years, to reflect future tightening of the energy requirements for new buildings. A certificate should “survive” maybe two changes to the requirements.

Stepped labels are used as a graphic presentation in the majority of MS. In most cases their scale is linear, and the length of the arrows is more or less proportional with the specific value. Typically, the arrows are coloured, so that poor energy performance is emphasised with darker red, whilst the low-energy consumption and environmentally friendly quality are expressed by using lighter colours, green at the top (to be associated with the “green building” concept).

Finally, it should not be forgotten that the compulsory review of the requirements necessitates the introduction of new categories in the future.

3.2.3 Quality assessment of certification

Energy performance certificates are official instruments and sources of information for sale and rental activities. A lack of quality can destroy the credibility of the instrument, lead to problems with legislations, and give false information about compliance with the national legal requirements. In order to implement certificates as a meaningful and reliable source of information, numerous MS decided to implement a quality assurance (QA) system for energy performance certificates. National approaches regarding QA schemes for energy performance certificates were investigated and discussed.

The objectives can be summarised as follows:

- To give an overview of the existing approaches in different MS regarding QA schemes and structures;
- To outline similarities and differences regarding the frameworks and the resulting structure of the QA scheme;
- To gain experience about typical quality leaks in the measured schemes in the MS and typical mistakes made by experts.

The following topics were therefore not dealt with as part of this investigation:

- QA of training providers
- Effective utilisation of existing consumer protection/code of practice
- Understandability of the certificate and the recommendations by the building owner
- QA of inspections of boilers and air conditioning systems
- Measures to ensure a high quality of the certification system (upstream).

In order to receive feedback on the different approaches, a survey was conducted and answers from 19 MS were received. Additionally, representatives from 3 MS (Denmark, Ireland, and Portugal) that already have a quality assurance (QA) system in place were interviewed, in order to gain first-hand experience.

The majority of the participating MS (15) already have a QA scheme in place or are planning to have one. The QA scheme is mainly (60% or 11 MS) the result of a government initiative and, therefore, a mandatory scheme. Only 3 MS (15%) are going to implement a voluntary QA scheme. Even though most MS are going to have a QA scheme, very few MS have first-hand experience already. In most MS, a scheme will be introduced for new buildings. By the end of 2008, 8 MS (42%) were expected to have a QA scheme in place for new residential buildings and 6 MS (32%) for new non-residential buildings.

As the scheme mainly depends on the national frameworks, the approaches and infrastructure vary greatly regarding infrastructure/structure, funding, involved parties and building survey systems. Two main overall approaches have been identified, regarding the structure of the QA system: most MS decided to set up one customised national QA system that applies to all experts. The most experienced MS (Denmark) has switched from such an overall national QA approach to a scheme where accredited companies (with ISO 9001 standards) have to run their own QA system. Accredited companies have to follow certain overall QA rules, when running their own QA scheme, and get checked on a regular basis as well.

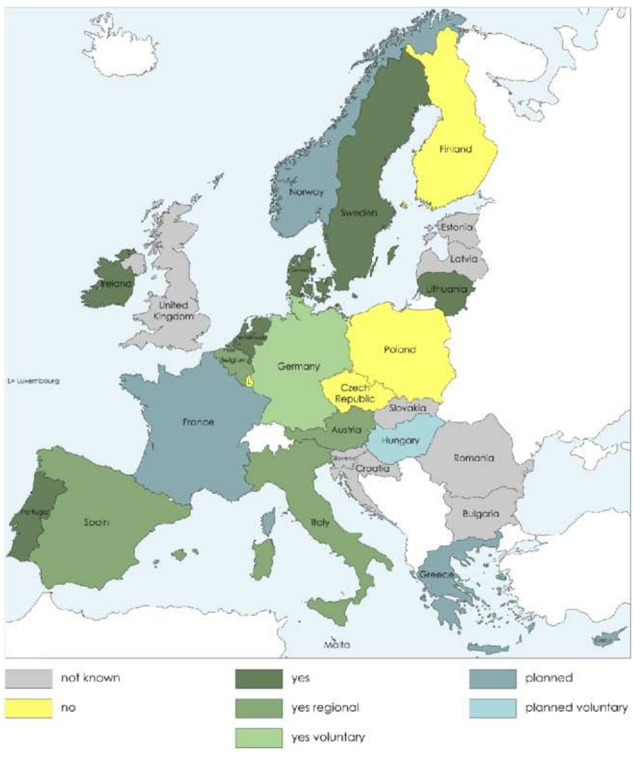


Figure 21. QA schemes in MS as of December 2008.

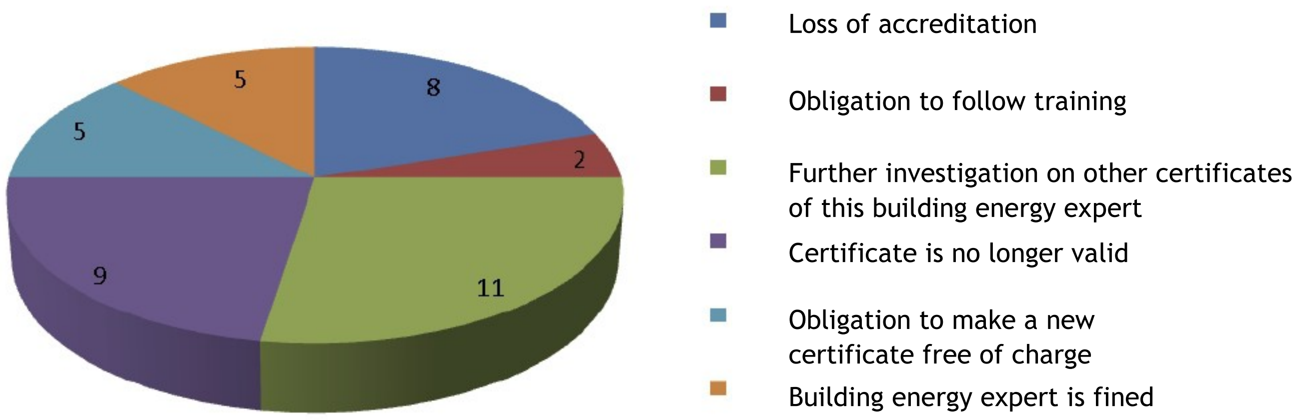


Figure 22. Possible sanctions if QA check shows that the quality of the certificate is too low.

When the government is involved in QA systems, the costs are mainly paid for by the expert, building owner or seller. In 5 MS (26%) the costs are covered by the government and are therefore general costs for running the system. MS, where the QA scheme is paid by fees, are listed in the section "Cost of certification".

> When running a Quality Assessment scheme, the follow-up mechanism regarding the quality of the certificates is the core of the whole scheme.

QA audits can be made automatically (i.e., via an automatic electronic check on plausibility of data) or manually by a specially appointed, independent auditor. Most MS have incorporated both mechanisms in their audit system. The audits can be performed in the form of targeted checks (i.e., triggered by complaints or out-of-range values), as well as checks on random samples (i.e., a certain percentage of all certificates or each expert gets audited once within a certain time-frame), to follow up on the quality criteria.

If lack of quality is discovered, a range of sanctions can be imposed on the expert: these penalties range from further investigation to the loss of accreditation for the expert or the whole accredited company. Most MS decided to gradually implement these penalties, in order to implement the QA system in cooperation with the experts and accredited companies.

An acceptable cost of less than 5 €/certificate has been indicated by 4 of 19 MS, and costs of more than 5 €/certificate are acceptable for 3 of 19 MS. In 10 MS, the cost of the QA scheme was not calculated. The figure shows the personal opinion of the respondent of the MS. It does not necessarily reflect the actual cost of the QA scheme.

Denmark is the MS with the most experience in EPC (building energy certification has been mandatory since 1997) and, accordingly, also in quality assessment of EPC schemes. QA in Denmark is performed at many different levels: 1) automated checks, when the expert sends the certificate to the database; 2) desk audits, where an auditor looks at all mistakes in certificates that do not require on-site audits of the building surveys; 3) on-site re-certification by an auditor using the same techniques as the expert. Each year, 2,500 certificates (approx. 5%) get a desk audit and 250 certificates (approx. 0.5%) get an on-site audit of the building survey. Too many errors by an expert result in warnings and withdrawal of accreditation.

The most frequent mistakes are wrong judgement of materials and insulation levels of constructions; mistaking heating systems for boilers and vice versa; lack of registration of distribution pipes; faulty use of computer tools, and missing check of input data. The most frequent mistakes are being used to produce lists of frequently asked questions and answers, as information to be included in newsletters and to upgrade training material.

A shift to company accreditation, where each company must run their own QA scheme, has advantages and disadvantages. The major advantages are that the company is responsible for their own QA and recruitment of experts. Additionally, there is greater flexibility in the use of different domain (building envelope and installations) experts for the same building. Among the possible disadvantages are that the accreditation body may have conflicting interests, as it may have the company to be accredited as customer in other cases; several certification companies might result in uneven quality of EPC; and the energy agency has no possibility of interfering directly in company affairs.

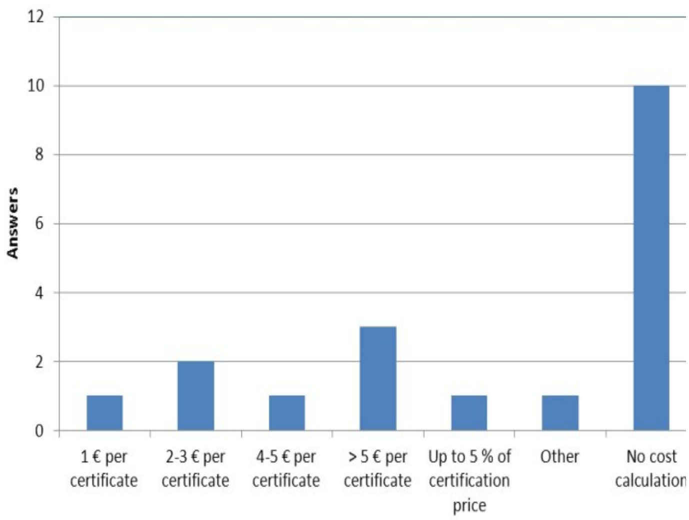


Figure 23. Acceptable costs for the QA scheme in number of MS.

3.2.3.1 Conclusion of topic

A QA scheme is needed to ensure a good quality of certificates and it complements the upstream system (like accreditation and training of experts). Several MS have a running QA scheme that can be interesting for other MS, when starting up a scheme. Based on the experience gained so far, some key elements have been identified that might be worth considering, when starting up a QA scheme:

- Define the QA scheme with processes and actors
- Consider the use of a central database. A central database is a powerful tool that allows fast access to the information that has to be checked. Search functionalities trigger which certificates to check
- Define the cost structure of the QA scheme
- Built-in automated checks in local software or the central database can lower the amount of mistakes and can decrease the costs of a QA scheme
- Develop a sanction system and use it. Although, it can be good to have a learning period, during which the sanctions are not yet applied.

At this moment (autumn 2008) it is too early to know if one kind of QA scheme is more successful than another, or to know what the practical results of the QA schemes are.

3.2.3.2 Recommendations for the future

QA schemes are starting up in many MS. Experience will accumulate over the next years. When the schemes have been running for a longer period of time and more experience has been gained, it would be interesting to work further on this topic. It would be interesting to find out whether some decisions lead to more successful QA schemes than others.

3.2.4 Practical experience of Quality Assessment of experts

This topic is a follow-up and expansion of the work summarised in section 3.2.3 “Quality assessment of certification” carried out in the autumn of 2008. The aim of this work was to compile new and additional information about the status, organisation and experience related to quality assurance (QA) of experts and – in parallel – energy certificates, as implemented in individual member states (MS).

This work (autumn 2009) focused on practical experience, with the aim to possibly identify most suitable approaches, common difficulties and obstacles, and recommendations for planning, implementation and further development of QA systems. Updated facts and figures from the former topic were collected, with special focus on tracking QA system developments in the last year.

A parallel brainstorming session focused on:

- Common problems with certificates, as observed through practice
- Feedback and corrective actions for the scheme in general
- Necessary basis and components of an effective QA system.

Certification schemes are demanding from financial and organisational points of view. The legitimacy of the individual national EPBD framework depends on their quality and reliability. Certificates serve not only as an evidence of actual state and conditions: if correct, they provide an explicit basis for planning of improvement measures, influence real-estate market value, offer indirect information about expected operational costs, and help build up comprehensive benchmarking databases, which are fundamental for shaping strategies on a national level. Without instruments for evaluation of the quality of certificates, it is questionable whether and to what extent the above tasks are fulfilled. Also, trust on the clients' side can be compromised, if no safety mechanism exists that offers a "value-for-money" guarantee.

It was clear that the majority of MS recognise the role of QA as a vital component of the certification scheme. Many MS have a QA system already in operation; several others are planning to introduce it in the near future.

Differentiated approaches to QA reflect divergent starting points, past national practice, and also varying structures of EPBD-related national legislation. However, the choice of a mandatory QA system by far outnumbers the voluntary option.

A QA system serves as a safety mechanism ensuring integrity and legitimacy of the certification scheme. It provides oversight of the work of assessors, as well as a consistency and accuracy check of certificates. Furthermore, it detects poor quality, identifies reasons for bad practice, feeds information back to preceding stages, helps improve training and examination steps, motivates assessors for keeping up quality levels, and helps in maintaining trust on the side of the clients.

There are several basic rules for any QA system to satisfy and fulfil expectations. It must be independent, transparent, highly professional, and have clearly documented and communicated rules. It must be effective, financially secured, publicly supported by authorities, and have adequate human resources available with no conflicts of interest.

Even a QA system itself must have appropriate QA instruments established, in order to continuously self-evaluate its operation and delivered results.

The role of QA systems is at least twofold:

- Penalisation of poor practice, elimination of incompetence
- Constructive and educational feedback, input for continuous improvement of the scheme.

Present experience and reasoning evolving from observation of QA systems in other frameworks indicate the importance of having an intense QA in the early stages of operation of certification schemes. This is crucial for establishing the reputation of the overall scheme and gaining the trust of the public. During this phase, many weak points can be identified and corrected, including editing of training content or adjustment of examination level.

Quality assurance systems are vital components of certification schemes. Their introduction must be well timed, be transparent and with clear rules, and perform not only penalisation tasks, but also educational and motivational ones, with the aim to constantly improve the scheme in general.

3.2.5 Database management

Many MS recognise the necessity or the advantages of establishing a database with data from the energy performance certification (EPC) schemes. Data have begun to enter into the databases and difficulties have been identified, as well as solutions in order to overcome them have been found. Most MS have, however, been very busy with the implementation of the EPC schemes and, therefore, have not had the time or the resources to investigate the possibilities of exploiting the information in the database for purposes other than meeting the requirements in the EPBD. However, research groups and other organisations have shown an interest in the content of the database, and it is evident that MS with central registers for EPC data will be able to gain increased knowledge about the energy performance of the building stock.

A short questionnaire was circulated to MS in May 2009 to investigate the current status of EPC databases and database management in the MS. The questionnaire comprised only 10 questions that could be answered using both calculated and/or measured EPC.

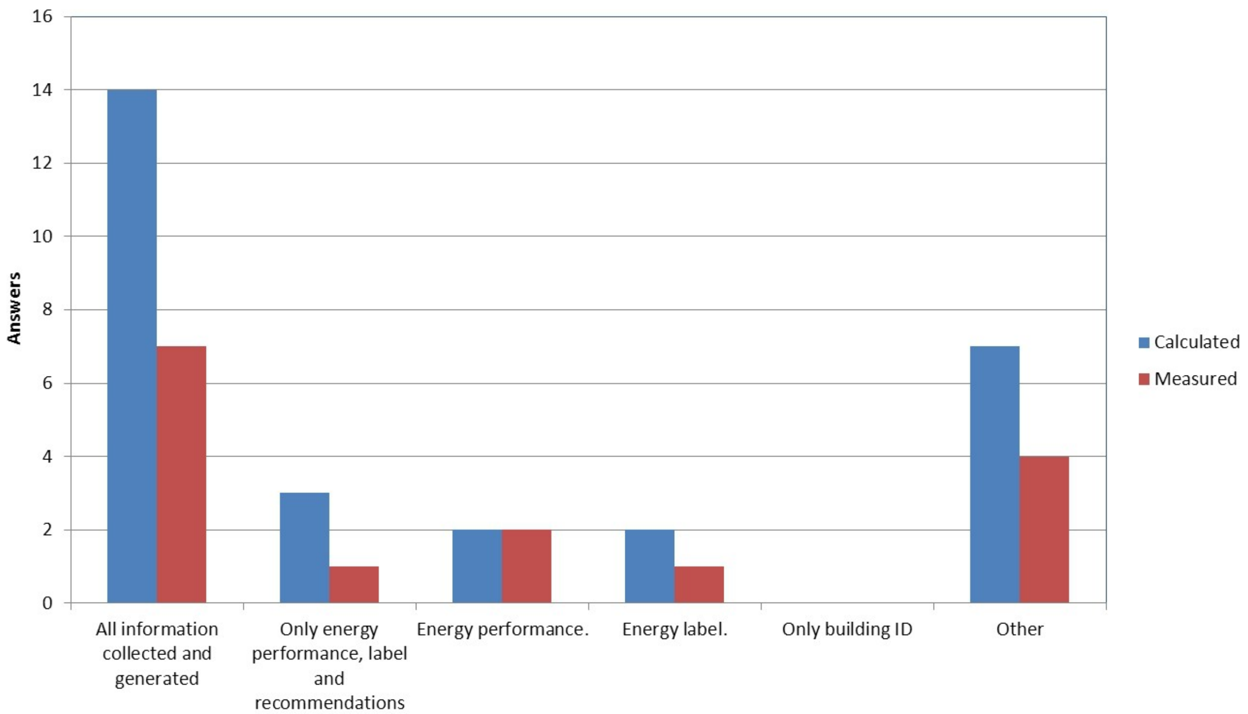


Figure 24. Different amounts of data are being stored in building energy certification databases in MS.

The majority of MS (18) compile EPC data in a central register managed by an official authority. There are, however, MS who do not have a central register and some MS employ a private company to manage the register. Almost all MS that compile EPC data in a register have arranged it so that data flow directly from the expert into the database; in most cases, by using an accredited EPC tool. The data being collected are, in most cases, all gathered while carrying out an energy performance certification. There are however a few MS that only collect information about the label value (energy performance ID). Most MS perform some kind of quality checks on data. In some cases, the check is made before data enter the database, but in most cases the check is a retrospective exercise with selected (randomly or after complaints) certificates being investigated. Most MS have not extracted data from the database to recreate a full EPC and only 8 MS have used EPC data for purposes other than those strictly related to the EPBD.

3.2.5.1 Conclusion of topic

It is recommended that Member States establish a central database that facilitates quality checks of data and the accumulation of knowledge about the energy performance of the building stock.

Data from the EPC can provide information, not only about the number and quality of issued EP certificates, but can also be used to estimate the potential energy savings in MS, regions or counties, for the benefit of the authorities. Information from the EPC schemes can, thus, provide the building blocks for creating added value, with respect to knowledge about the potential energy savings in the total building stock and the costs needed for harvesting them.

> The existence of central databases with information gathered while issuing energy performance certificates opens a world of new opportunities for numerous analyses on all kinds of energy-related topics.

A more widespread dissemination of statistical information from the EPC schemes will probably lead to a higher degree of acceptance by the public.

There is still one issue that MS need to address, when discussing the publication of information derived from EPC schemes: data confidentiality. It is not a straightforward matter to publish all information derived from EPC. The MS must identify any sensitive data and find ways to make them anonymous before publication.

3.2.5.2 Recommendations for the future

It was suggested that this topic should be further analysed, but with a slight twist towards other possible uses of EPC data.

To be able to exploit the data in the most effective ways and, thus, increase the value of the EPC schemes, it is crucial that all relevant data are collected and codified in compatible formats to enable merging of regional or different other sources. Identification, evaluation and discussion of the possibilities for utilisation of EPC data for purposes other than issuing the certificate –and which, in this way, add value to the EPC scheme– will be continued. One of the key challenges is the accessibility to data and this will be explored further.

3.2.6 Extraction of added value from EPC databases

The topic of extracting added value from the Energy Performance Certification (EPC) schemes covers many different issues, depending on the circumstances in the individual Member States (MS). Some MS do not have a mandatory database to collect information from the EPC schemes, while others have nationwide databases that gather all information collected during the building energy audit and certification process.

The following issues of extracting added value were discussed:

- Public subsidies (how can the information collected be used for identifying specific target groups and evaluating the effectiveness of a subsidy scheme, and what data are needed for this purpose)
- Potential energy saving (extracting average figures from database)
- Benchmarking (comparing different buildings/dwellings)
- Quality control and assurance (extracting random checks),
- Targeting new and old policies (evaluation of effect of policy actions),
- Energy consumption in different sectors (extracting average energy consumption per sector).

3.2.6.1 Examples of extraction of added value from EPC databases

This section summarises the answers of the 8 MS that received the questionnaire in advance of the meeting.

In Austria there are different databases in each of its provinces, though with the same structure in 3 of the 9 provinces. Any analysis of the content of the databases is the job of the individual provinces. The database gathers all information collected for issuing an EP certificate, but only for new buildings and buildings under a public subsidy scheme. Data have been used for analysing whether the energy characteristics of buildings under public subsidy schemes have evolved over time. This database has also been used to analyse the heating reduction potential of social housing. It is recommended to store a unique ID for each building, in order to facilitate cross-linking to other data sources. Furthermore, it is recommended to collect as many data as possible, preferably gathered in one nationwide database.

In Bulgaria, nationwide analyses of the energy saving potential have been performed for different selected building types (by usage and by ownership). Furthermore, the investments needed for harvesting energy savings have been extracted. Until now, the database has been running in an Excel environment, but there is an urgent need to move to an information-based system capable of handling the large quantities of data that are being collected. Additionally, there is a need to collect further information about already-carried-out energy savings and data to support the calculation of energy saving targets. Information about the connection between investments and potential energy savings has attracted much public attention in Bulgaria.

In Denmark, all information collected to enable the calculation of an EP certificate is stored in a central database, together with information about building type and ownership. From this information, scenarios for potential energy savings in different building types and ages have been calculated, in combination with investments necessary for reaching these goals. This information has been used as input to the government's energy saving strategy, which was implemented in 2010. The amount of information gathered in the database seems to be sufficient, but there is a strong need for threshold values that prevent illegal data from entering the database. According to the Danish experience, it is important to collect as much information as possible and to avoid aggregated data in the database. Furthermore, it is recommended to give research institutions ready access to the database, as this will certainly foster many interesting analyses and raise the public's awareness of energy saving in the built environment.

In Italy, all information needed for calculating an EP certificate is collected in regional registers. Furthermore, general information about the building, the building owner and the experts are collected with each EP certificate. No general extraction of added value information has been carried out yet, but for selected sectors it can easily be done. It is recommended to collect the measured energy consumption of the certified buildings in the database, even though the EP certificate is based on calculated consumption.

Ireland has gained experience in the field of extracting added value since 2009. The amount of collected data depends on the building type. For public and residential buildings all input plus the certificate data are stored, while only part of the input data are stored for other non-residential buildings. Data in Ireland have been used for quality assurance in the EPC scheme and estimates of the public sector energy consumption. The analyses demonstrated that the year of construction is a central piece of information to collect with the other data of the building. Default values in the EPC tools cause obstacles for accurate analyses of the content in the database – it is recommended to define functionalities instead, and the data that should be collected will follow from that.

The Netherlands collects (central register) the information needed to perform an EPC and in addition to that, information about the building's address, building type, usage and the expert's ID. It is planned to use the data for calculating the potential energy savings of buildings with commercial companies; also, as a registration tool for building owners, who invest in energy savings and receive subsidies accordingly. Finally, a survey of the connection between EP certificates and the market value of the building has been conducted. All data are being collected, but wrong data have entered the database and there is an urgent need for improved filtering of data, before they enter the database. Distribution of EP certificates in Dutch provinces has attracted a lot of attention in the media. Giving access to a limited set of variables of the database will provide the basis for research and all kinds of different activities of the market.

In Portugal, information needed for calculating the EP certificate and the suggested energy saving measures is stored in a central register. In addition to this, general information about the building and the expert is also stored. Examples of extracted added value from EPC data are: average building stock label; benchmarking for revision of building regulations; dissemination of renewable DHW systems; and most recommended energy-efficiency measures. It has been necessary to change the database structure, in order to include a full ID of each certified building. Use of a standardised database analysing tool is highly recommended, as it makes it possible to follow the development of central data in the EPC database in the form of tables and graphics.

In Sweden, all information necessary to calculate an EP certificate is stored in a central register, including the climatic zones. Furthermore, information about data from possible radon measurements, ventilation checks, air conditioning system inspections (> 12 kW), or any other environmental work carried out in the building, and the ID of the expert. Information in the database can help municipalities obtain an overview of the buildings that have not had the compulsory ventilation check and of what the radon level is in the buildings. The content of the Swedish database is defined in regulations, which makes it less debatable whether data should be there or not.

Additionally, the IEE DATAMINE project outlined issues relating to storage, handling and processing of data from EPCs which are of relevance in developing databases of energy performance certificates and in analysing their content for the development of policies targeted at different sectors of the building stock[7].

3.2.6.2 *Conclusion of topic*

The topic of extracting added value form the EPC schemes covers many different issues, depending on the circumstances in the individual MS. Some MS do not have a mandatory database to collect information from the EPC schemes, while others have nationwide databases gathering all information collected during the building energy audit and certification process.

MS wish to continue discussing the topic, with focus on how to set up an appropriate scheme for handling central registers, for which additional data are needed, to be able to extract additional information from the EPC databases. At the same time, other MS have a need to discuss how to combine information in the EPC database with information residing in other national databases, and in this way create added value from the combined information from more databases. Last, but not least, some MS need to discuss how to prevent the database from being polluted by faulty data, e.g., by defining threshold values and procedures on how to clean up a database if it has been polluted.

> It is recommended for MS to establish central registers for collection of EPC data and grant access to data for different kinds of analyses and, thus, extraction of added value.

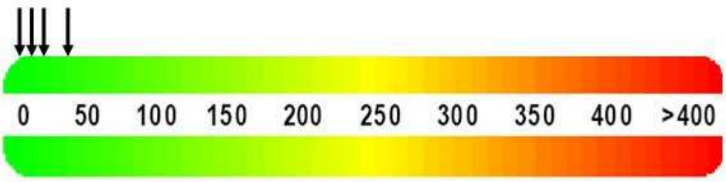
3.2.7 Re-certification / re-scaling of EP scales

According to the EPBD, every five years the energy performance requirements for new buildings should be reviewed to investigate if it is possible to tighten the requirements. The first deadline for this activity is 2011. Having made a decision about tightening the energy performance requirements, the natural question is then whether the certificates should be revised and whether the Energy Performance (EP) scale should be modified.

Two main types of scales are used, i.e., the continuous scale type and the stepped scale type. In the cases in which the continuous scale is used, fewer problems are foreseen, when introducing the new tightened requirements in the certification scale. If the stepped certification scale is used, introduction of new categories is more difficult.

3.2.7.1 *Continuous scale*

The continuous scale is just a coloured band strip with an indication of where the actual building is located on the scale. There are thus no separate categories. The only question with respect to future tightening of the requirements for new buildings is the clear graphic interpretation and representation.



[7] DATAMINE Intelligent Energy Europe - Project number EIE/05/097 *Collecting Data from Energy Certification to Monitor Performance Indicators for New and Existing Buildings* www.meteo.noa.gr/datamine

In the case of the coloured band strip, the linear scale does not provide a clear indication of the difference, e.g., between 50, 30 and 0 kWh/m².a, although the difference in effort and cost is considerable. Introduction of a logarithmic scale would be a solution, but it is difficult to explain it to lay people.

3.2.7.2 Stepped scale

For the stepped scale there are three main options for addressing the future tightened requirements for new buildings at the top of the scale.

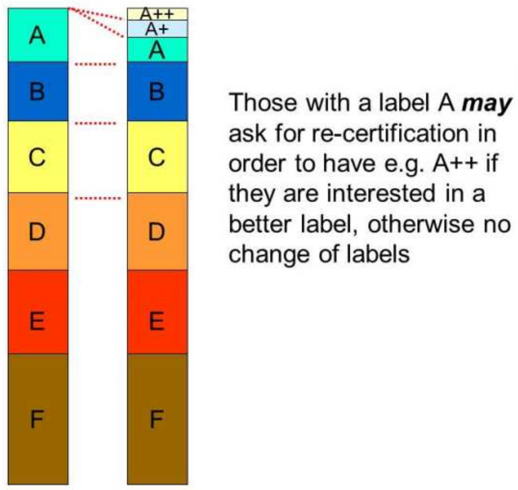
Option 1:

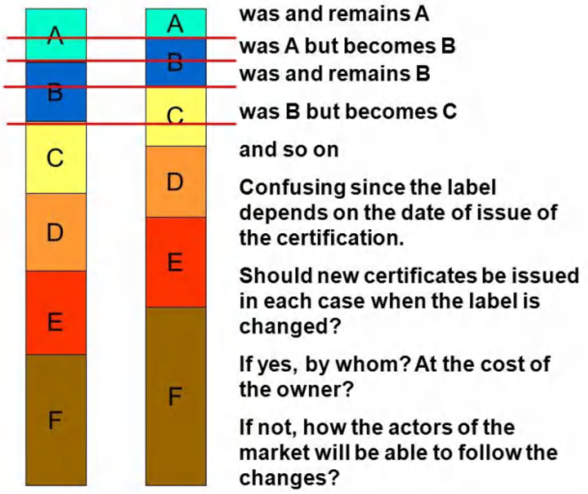
No change of the existing labelling scale is made, buildings constructed according to new tightened energy requirements are placed at the top category. This approach is simple, but gives no motivation for house owners to improve the energy performance of their home. A better energy performance value is not reflected in the certificates at the top of the scale.

Option 2

The already issued certificates remain unchanged and new narrow top-categories are implemented to reflect the new energy requirements. This option gives no problem with former certificates. Providing correct, and inspiring, new top categories will be implemented, and the energy performance will be expressed precisely, according to variations in energy performance at the top of the scale.

One of the drawbacks of this option is that the number of categories increases and there are some practicalities that need to be addressed, e.g., the question of colours, letters, or terms. For this option there are also a number of difficulties that need to be addressed, e.g., the small pragmatic problem of graphic interpretation, namely that the „best colours" are already taken and what colours should then be used for the new categories. Furthermore, the terms should also be suggestive, inspiring. However, the term „passive house" is disputable, even though it is becoming increasingly popular in some MS.





Option 3

The number and name of categories remain unchanged, while the limits will be changed. The advantage is that the number of categories remains unchanged. On the other hand, the old certificates must be changed or the issuing date becomes very important, in order to be able to understand the full meaning of the label value shown in the certificate.

3.2.7.3 Nearly zero-energy buildings

Approaching zero energy buildings in the future, the issue of life-cycle energy consumption is worth considering. Furthermore, the new certification system is to be open to the idea of nearly zero-energy buildings.

3.2.7.4 Conclusion of topic

Re-scaling of EPC labelling scales is certainly an important topic and there was general consensus that scales should be valid for as long a period of time as possible, e.g., 2-3 tightenings of the requirements for new buildings. On the other hand, if (when) the energy performance requirements for new buildings are being tightened in MS, the certification scales must be able to reflect the differences at the top of the scale. There is definitely a need for thorough considerations in MS though, before changing a well-established building energy performance scale.

Some MS that are currently using a stepped scale are considering shifting to some kind of continuous scale to avoid the need for future changes in their scaling system.

> It is recommended to prepare the next generation of Energy Performance Certification scales for future tightening of the requirements for new buildings and in this way make the scale more durable and avoid the need for frequent changes of the scale.

3.2.8 Design, operation and financing of central registers

Effective database set-up and management is an issue coming to the fore. There are several distinct operational areas – training, examination, registration, software, quality assurance, finance, administration, etc. – that are brought together in a single integrated administration system. Therefore, it is important to focus on the Member States (MS) that have the most developed and mature administration systems, with the goal of highlighting key successes in the form of best-practice guidelines.

Central registers are more than common IT databases, where data from EP certificates are stored.

They are secure fully integrated systems, linked with many elements, that facilitate the day-to-day management of the EPC scheme (e.g., registration and database of assessors, link with calculation tools, online validation of EP certificates, look up tools, e.g., boiler efficiency database, etc.), online/self-service options for assessors and public, the generation of EP certificates and advisory reports, quality control and auditing, billing, statistics, research and analysis, etc.

Building up such a register is challenging and represents a huge investment in terms of money and human resources. However, MS that chose to invest in an automatic register, to help them carry the administrative burden of managing millions of documents, achieved a high-quality scheme for certification with a relatively small administrative backup.

3.2.8.1 Conclusion of topic

The nature of this topic is such that the discussion is not actually concluded; as certification and inspection programmes continue to develop, the multi-functional central register becomes a key factor to successful implementation.

> It is recommended to set up central registers to support the daily operation (quality assurance, statistics, impact assessment, etc.) of Energy Performance Certification schemes in Member States.

There are several aspects to be considered in the design, operation and financing of a central register for EPC schemes. A full and comprehensive specification of processes and database requirements is a great challenge, which requires a considerable investment and available resources, but the outcome is very high.

3.3 Implementation of energy performance certificates in Member States

3.3.1 Impact of certification

The CA conducted a study in December 2007 to collect and share information about the expected impact of energy certification of buildings in Member States (MS). There are several levels of impact at building level and at national level. There are reactions from the involved parties and expectations from governments, energy authorities, and citizens in general.

A survey was conducted to investigate the different situations in MS in relation to this topic. The survey elicited 19 answers from the MS. The answers proved that the survey may have been premature.

MS estimated the impact on the energy consumption in new buildings to be a decrease between 15 and 50%. On a national level, the expected impact on energy consumption in the existing building stock is estimated to range from no influence at all to energy savings of up to 25% of the total heating consumption. In conclusion, the questionnaire shows that most of the MS need to make an effort to improve methods that could clarify these figures.

The answers to the questions about building quality almost unanimously accept that there is an impact of the certification on the thermal quality of the buildings and, consequently, on the indoor climate quality. Improved insulation and better glazing in the building envelope is assumed everywhere, and so is the use of more efficient systems. Regarding the use of renewable energy, the answers are not clear and need to be explored in further studies.

Regarding the reactions to the EPC process, there is a general feeling of mixed reactions (negative and positive) of building owners and quite positive reactions from the final users and tenants to the certification process. In the answers, 8 MS do not express any reactions at all. There are some MS (4), where the process has had a "positive" reaction in general, while the others express mixed feelings.

Finally, on mechanisms for directly facilitating the take-up of Energy Performance Certification there are no MS that use incentives. Some MS (3) refer to this possibility as a "might be possible", and some (1) as "should be possible", and the others refer to the possibility of loans. Basically, all the MS admit that as the process is "mandatory" by law, it will be accomplished anyway. Nevertheless, many point to the necessity of having public awareness campaigns, during the process of implementation.

3.3.1.1 Conclusion of topic

Introduction of EPC schemes in MS have undoubtedly increased public awareness of energy consumption in the existing building stock. MS have introduced rules for improvement of the energy performance in buildings that are being renovated. However, it is difficult to quantify the impact on the energy consumption in this segment of the building stock, as there is no statistical information that can identify which energy saving measures that have been implemented were due to EPC, and which would have been implemented anyway.

In spite of the limited experience of MS, it was possible to gather initial information about the impact of building certification at a national level (in terms of energy). The same MS that present some figures related to impacts on building energy consumption also present figures at a national level for the building sector. However, it is evident that impact assessments do not relate to the same share of the national energy consumption. Some examples:

- Cyprus: A reduction of the energy consumption for new buildings is estimated at 20% for residential and 30% for non-residential buildings. For existing buildings, energy savings in the individual building are expected to be 15% in residential and 20% in non-residential buildings. With very rough estimations, it is expected that during the first year (2009) at a national level there will be a reduction of 40 ktoe that will reach 70 ktoe until 2020.
- Denmark: A 2 to 3% annual reduction of total heating and electricity consumption would be expected at national level for all buildings involved, if the suggested energy saving measures were carried out. Buildings in general tend to be better in terms of indoor climate. Another

impact is controlling new buildings' compliance with energy requirements, which can be considered as a quality check.

- Germany: A better energy quality is expected for all types of buildings, in relation to a better price for rent or sale. At the building level, the use of renewable energy sources in new buildings is expected and for existing buildings replacements to achieve more efficient systems are also expected.
- Slovakia: In terms of impact, at the building level a reduction of around 20% is expected on energy consumption in new buildings, and 45% in existing residential buildings and 50% in non-residential buildings. These figures can have a national impact of 0.4 to 1% on the total annual energy consumption.

To be able to measure the impact of the Energy Performance certificate in all Member States, it is essential to agree on one unique, common approach.

3.3.1.2 Recommendations for the future

It is advisable to repeat the study when MS have gained more experience with their certification schemes.

3.3.2 Compliance with and control of EP requirements and certification systems

There are still many questions about the impact, compliance and control of EP requirements and certification.

Discussions on this topic focused on:

- A review of the impact of EPC on the energy standard of the building stock: New and existing buildings. What is the impact? How is the impact quantified? Who is interested in assessing the impact?
- Compliance with and control of EP requirements and certification. What does compliance mean? Who reports compliance with requirements? What to control? How to organise the control? Who should do the control? When should the EP certificate be available? Who is responsible for requesting the EP certificate?

This topic was prepared in cooperation with IEE ASIEPI project activities on "Impact, compliance and control of legislation".

3.3.2.1 Main discussion and outcomes

The discussion underlined that although all MS claim that they implemented the EPBD, there are big differences in the level of implementation. Practically, in all countries implementation of the EPBD was connected with issuing a new energy performance regulation (in some MS it has already been reviewed recently or there are plans to do this in the near future). However, as most of the countries started certification in 2009, it is too early to quantitatively evaluate the impact of the EPBD on the building stock. But preliminary data and/or qualitative observations are promising. One should remember that data from 2009 are strongly affected by the world crisis.

The level of implementation (number of issued certificates, quality of certificates, changes in the building stock) seems to be correlated with the enforcement procedures. It can be concluded that regulation without enforcement leads to lack of compliance. The existence of sanctions (for building owners, energy experts and others) increases compliance with the regulations and, subsequently, it also increases the quality of the issued certificates.

Although it can be very time consuming in the case of complex buildings, random checks of certificates, allow the authorities to sustain the high quality of both certificates and independent experts. It seems interesting to develop automatically working control mechanisms (e.g., in a calculation interface or a database of certificates).

Some MS supplement enforcement with systems of incentives and grants. This financial support towards energy conservation investments and/or application of new technologies also increases the impact of the EPBD and, additionally, it is worth pointing out the high public acceptance.

The concept of raising public awareness of energy savings via public access to the database of certificates is interesting.

Main conclusions:

- There are big differences at the level of EPBD implementation among MS.
- As most MS began certification in 2009, it is generally too early to quantitatively evaluate the impact of the EPBD on the building stock, but preliminary data and/or qualitative observations look promising.
- Regulation without enforcement leads to lack of compliance.
- Existence of sanctions increases compliance with the regulation.
- Random checks of certificates increase quality of both certificates and independent experts.
- Automatically working control mechanisms could save time and cost of checking.
- Systems of incentives and grants (widely accepted by the public) increase the impact of the EPBD.
- Public access to the database of certificates is recommendable.

3.3.2.2 Recommendations for the future

It proved that the issue of interrelations between impact, compliance and control of energy performance requirements and the certification process create the field for an interesting discussion between MS. This topic should be revisited in a couple of years after MS have gained more experience.

3.3.3 Influence of EP certificates on the market value of buildings

The goal of a discussion on the "Influence of Energy Performance (EP) certificates on the market value of buildings" was to identify, characterise and present possible tools and strategies that can be adopted by the MS, for determining a correlation between EP certificates and the market value of buildings. Examples of on-going and finished studies were presented in January 2010. The background was a recent Dutch study, which showed how energy labels had been adopted in the housing market during 2008 and 2009, and what effects these labels have had on the sales process ever since. MS learned about the key elements that need to be organised, in order to perform similar studies about the influence of EP certificates on the market value of buildings in their countries. Two additional case studies were presented from Poland and Austria. These showed different approaches to the subject and gave useful information on implementation strategies in MS.

The main outcomes of the case studies can be summarised as follows:

- Dutch case study: Empirical analysis based on 180,000 sold houses, 40,000 of which with an energy label. No effect on the speed of sale, but a green premium of 2.7% for the top category of energy labels.
- Polish case study: Opinion survey of major companies, before EPBD implementation. About 60% said labels would have a positive effect on the market value, but after implementation it is not yet possible to assess the actual effect.

The Austrian study only covered 10 non-residential buildings and no reliable conclusion could be reached.

The evidence base for a higher transaction price of more energy efficient buildings is still weak. Whilst a study on the Netherlands' residential sector, performed in 2010, found a positive correlation of 2.7%, this seems not yet universally applicable or it is too early to be shown, due to late/incomplete implementation of certification schemes. In other countries, this positive market signal is not yet observed. One reason could be misbelief/lack of knowledge among house buyers regarding the operation, maintenance, comfort level, etc., of a highly energy efficient house.

Based on the information gathered and taking into account the experience presented, some conclusions can be pointed out:

- There is still very limited and recent experience in assessing the impact of EP certificates on property market value.
- Available or on-going studies vary in methodology, players, targets, etc., which makes results quite country specific at this stage.
- No clear EU trend can be pointed out conclusively, in terms of how much influence EP certificates have. In the short term, other MS case studies can be used as a reference.
- There is a growing demand for knowledge about how EP certificates influence the market value of properties. This can be a key driver for reaching the objectives of the EPBD and EU targets on energy efficiency.

It is recommended that Member States start (or continue) paying close attention to the Energy Performance certificates' influence on the real estate market and pass on the available information to the market.

3.3.4 Study tours

Study tours were arranged as a pilot project to investigate if such an activity could become an efficient tool for transfer of experience on selected topics among MS, especially from experienced to less experienced MS.

Study tours are designed to tackle the day-to-day details of implementation – enabling delegates to 'learn by doing', working alongside EPBD teams, clarifying procedures, identifying and replicating best-practice systems. On study tours, delegates focus on the 'mechanics' in the design and operation of day-to-day programmes to enable national and EU-wide certification and inspection regimes.

The pilot study tours were organised as a common activity between Core Theme 1 (Certification) and Core Theme 3 (Specifications and training requirements for Qualified Experts and inspectors), and a more detailed summary of this activity is reported by Core Theme 3.

Since 2009, the discussion on effective database set-up and management has been a key issue across the majority of core themes. Underpinned by the need to monitor compliance, to build an evidence base for continued policy initiatives, to implement QA systems and to prepare for the more stringent requirements of the recast EPBD, data management and the wider functionality of a centrally integrated administrative system has been central to at least four different technical sessions in the period 2007-2010. It was thus decided to test the study tour concept, as a means to harvest the value to be gained from 'hands-on' work shadowing – i.e., actually witnessing and working with the systems that different MS have developed in the course of EPBD implementation. During the meeting sessions, it is often challenging to present a topic that is broad enough to interest a wider audience, but sufficiently detailed to provide value to those working closely with designing and operating administrative and technical systems supporting EPBD implementation.

The initial set of study tours on the topic of central registries took place during May – June 2010. Host countries were Sweden, Ireland, Belgium and Portugal. Visitor MS were Austria, Croatia, Germany, Greece, Ireland, Portugal, Malta, Italy, Luxembourg, the Netherlands, Belgium, and Slovenia. The areas of highest priority for investigation were (broadly categorised) as: database structure; quality assurance; and finance models. Overall, there was a high degree of satisfaction regarding the quality and suitability of the information provided by the host MS during the study tours.

Study tours provide valuable hands on experience to those Member States unfamiliar with selected, advanced topics of the EBPD implementation. In this way it is possible to provide practical answers to questions posed by designers and operators of certification schemes in their own countries.

3.4 Some questions to be considered in the future

Member States suggestions for topics and issues that should be addressed in future work with respect to Certification. The list is based on attendees' responses in September 2010.

- Re-certification
- Organisation and administration of the EPC scheme
- Specifying, developing, managing and testing software tools, plus tools in general
- Level of detail and quality of recommendations
- Voluntary certification schemes for non-residential buildings
- Use of EPC data for evaluation of policies (funding schemes)
- How to organise the control of certificates to ensure a good quality of certificates
- How to organise a good support to help assessors in their job
- What kind of information do we find in certificates that push people to make improvements in their countries?
- Interaction between energy audit and certification
- Study tours to investigate "Public EPC register"
- Tools and strategies for evaluation of impact (additional savings, broader than just market value)
- How to present an EP certificate, so that the cost is acceptable for the end-user, while ensuring that the EP certificate provides enough detailed information, so that recommendations will be carried out?
- Connecting EP certificates with energy consultation
- Information included in EP certificates – how can people understand the information?
- Providing guidance for CEN
- Additional functions of the EP certificate 1) major renovation requirements 2) subsidies 3) real estate value (rent)
- Use of EPC data or connection of EPC to incentive mechanisms
- How to monitor actual implementation of recommendations in the certificates
- How to monitor the quality of recommendations made by experts in the EP certificate
- Risks regarding recommendations
- Reliability of the EPC: experts not adequately qualified (thus, 1) results are sometimes very far from reality, 2) calculation method not very accurate)
- Specific recommendations to be carried out, when renovation needs to be carried out for other reasons
- Need to share experience of carrying out market surveys on market impact of EP certificates – how to do such studies?
- Need to find the optimal position on: 1) Costs of certification, 2) Level of detail of recommendations, and 3) Impact – encouraging action
- Use of EP certificates to link grants and taxes, e.g., higher property tax for low-rated buildings etc.
- Smart ways to ensure compliance

4 Main outcomes from the Certification sessions

Topic	Main discussions and outcomes	Conclusion of topic	Future recommendations
Certification of flats and blocks of flats	It is difficult to have a simple certification method and, at the same time, provide individual certificates for each flat in a block of flats. The optimal solution for certification of flats and blocks of flats may be to **show both certificates to the occupant of each flat**.	MS have selected their solutions among a variety of options, adapted to their specific conditions and possibilities.	Lessons learned need to be discussed when MS have gained approx. 3 years' experience in the topic.
Complex and mixed-use buildings	Solutions for mixed-use have been found, though **benchmarking of these buildings offers some challenges**. The same goes for complex buildings that require special calculation procedures, carefully developed simplifications or use of measured EP data.	It has **not** been **possible to recommend one universal method.**	Great need for further discussions and analyses to search for better solutions.
Energy Certificates for Display in Public Buildings	Different possibilities for displaying EP certificates in public buildings were discussed. It is recommended for **MS to fix location and size for display of EP certificates** in public buildings.	No common approach was agreed. Pros and cons need to be investigated.	The issue is important and of interest to all MS and should be explored in the future.
Processes to produce recommendations	Depending on the level of ambition, **MS use different solutions**, ranging from standard recommendations generated automatically to detailed calculations of the measures. Some MS use different solutions, depending on building type and EPC method.	MS have selected their solutions among a set of options adapted to their specific conditions and possibilities.	Lessons learned need to be discussed in the future, when more experience has been gained.
National standards for benchmarking using measured energy rating	Measured energy rating (MER) and benchmarking systems need further work. There is a **need to investigate the energy consumption in the existing building stock statistically**, to enable a valid set of benchmark criteria for the stock as a whole, but in particular for mixed-use and complex buildings.	Even though EN 15603 deals with a method for measured benchmarking, there are still many complications that need to be clarified.	Urgent need for further discussions to search for possibilities for use of measured certification and benchmarking.
Interaction between certification and inspections	MS have not established an **integrated approach** for maintenance, inspection and certification of existing buildings, and for most countries it is quite difficult to integrate these schemes, especially due to the high level of skills needed for professionals involved in the different tasks.	There is a clear need for interaction between inspection and maintenance of systems and inspection and energy certification of buildings.	MS should try to **combine maintenance, inspection and certification of existing buildings** schemes.
Cost of certification	The factors that influence the cost of certification have been identified and cost models discussed. **Complexity of the method for determining the energy rating and market mechanisms can influence the cost significantly**.	MS have selected their solutions for settling costs from a set of options based on local conditions.	There is a need for continuous sharing of experience of costs and on the value-for-money issue.
Layout of certificates	**There are two main approaches to layout of certificates**, the stepped scale and the continuous scale. Within the stepped scale there are differences in the layout and the number of steps among MS. **They are both equally effective**.	**The front page should be eye-catching**, clearly expressing the energy performance and recommendations.	Although improvements in content are possible, **there is no need for further discussions about layout.**
Quality assessment of certification	**Key elements for a QA scheme were identified: central database, checks and penalties**. It is too early to see which QA schemes are more successful than others.	**A sanction system is a valuable tool to ensure high quality** work by the experts.	More experience needs to be gained to be able to find optimum solutions for QA.

Topic	Main discussions and outcomes	Conclusion of topic	Future recommendations
Practical experiences on Quality Assessment of experts	It was clear that the majority of the MS recognise the role of QA as the vital component of the certification scheme. Many MS have a QA system already in operation; several others plan to introduce it in the near future.	**Introduction of QA must be well timed, be transparent and with clear rules**, and perform not only penalisation tasks, but also educational and motivational ones.	QA schemes need further sharing of knowledge, when MS have gained more experience in this field.
Extraction of added value from EPC databases	Extraction of added value from the EPC schemes covers many different issues, depending on the circumstances in the individual MS, e.g., subsidy impact analyses; energy-saving potentials; benchmarking; quality control and assurance; evaluation of effect of policy actions; energy consumption in different sectors, etc.	**MS with mandatory, comprehensive databases have experienced the possibility of using data for many purposes**.	Many different issues related to use of EPC databases need to be discussed in the future.
Re-certification / rescaling of EPC	According to the EPBD, every five years the energy performance requirements for new buildings should be reviewed, to investigate whether it is possible to tighten the requirements. This must be reflected at the top of the EPC scale.	**Rescaling is** certainly **an important topic and scales should be valid for as long a period of time as possible**, e.g., 2-3 tightenings of the requirements for new buildings.	When more MS have gained experience with the topic, further discussions might be needed.
Database management	Collection of EPC data in a database is not required, but most MS do it anyway, though on very different levels of detail. Only a few MS have experience with the use of databases for purposes other than EPC registry.	**It is recommended that all MS should collect EPC data in central (or regional) registers**.	Possibilities for use of data need to be explored, but **confidentiality issues need to be addressed**.
Design, operation and financing of central registers	Effective database set-up and management is an issue coming to the fore. There are several distinct operational areas – training, examination, registration, software, quality assurance, finance, administration, etc. – that are brought together in a single integrated administration system.	**It is recommended to set up central registers to support the daily operation** (quality assurance, statistics, impact assessment, etc.) **of EPC schemes** in MS.	This topic is not actually concluded; as certification and inspection programmes continue to develop. **Multi-functional central register becomes a key factor for successful implementation**.
Impact of certification	In most MS, implementation of the EPBD was connected with issuing a new energy performance regulation. As most MS only started certification in 2009, it is too early to quantitatively evaluate the impact of certification on the building stock, but preliminary data and/or qualitative observations are promising.	To be able to measure the impact of the EP certificate in all MS, **it is essential to agree on one unique common approach** for all the MS.	Experiences gained from EPCs are still very limited and, to acquire knowledge about the impact of certification, more work is needed.
Compliance with and control of EP requirements and certification systems	The level of implementation (number of issued certificates, quality of certificates, changes in the building stock) seems to be correlated with the enforcement procedures. **Financial support to energy conservation investments and/or application of new technologies** also **increases the impact of the EPBD**.	**Regulation without enforcement leads to lack of compliance**. Random checks allow high quality certificates and independent experts.	There is a need for continuous sharing of experience.

Topic	Main discussions and outcomes	Conclusion of topic	Future recommendations
Influence of EP certificates on the market value of buildings	**EP certificates will presumably influence the market value of buildings** in the future. Some interesting market analyses were presented and a green premium of about 2.7% for better energy labels was found. It is too early to draw conclusions.	MS are recommended to monitor the influence of EP certificates on the real estate market.	There is a need for continued sharing of experience of the EP certificates' influence on the building market in general.

5 Lessons learned and recommendations

Certification of buildings includes many, often interdependent, topics and covers all building types that require energy performance certification. Buildings are different and certification of different building types (uses) and ages calls for different certification methods. It has been inspiring to learn how Member States have implemented an Energy Performance Scheme and that certificates are being issued in many different ways.

In the period 2007-2010, the Concerted Action addressed and discussed general aspects of certification of **flats and blocks of flats**, as well as **complex and mixed-use** buildings. The CA EPBD 2 also addressed and discussed certification of new and small buildings in all phases and topics. An important part of the certification process is the **recommendations** for energy saving measures. Recommendations can be divided into two groups, one on recommendations that are cost-effective immediately, and the other one on recommendations that should be implemented in combination with a planned renovation of the whole building. For blocks of flats and mixed-use buildings, it is important that the same expert issues all needed certificates – preferably for the whole building - to ensure coherence in the recommendations for the building. In large and complex buildings (e.g., hospitals), it seems appropriate to use measured energy performance values, as it is very time consuming and therefore costly to set up a calculation model representing the building in all details. All problems, although not solved as measurements, need to be standardised and adjusted to the actual use and climate in the measuring period. Recommendations will also be more difficult to make, because sub-use of energy is often not available, and savings can thus only be quantified with difficulty. An accurate certification of a building can only be made after a physical building survey of the actual building. Building surveys are also a necessity, to be able to tailor the recommendations to the actual building. The optimal solution would be to have both measured and calculated EPC, even though this is a very costly approach and not without problems. In **public buildings**, the EP certificate must be on display. MS have taken many different approaches to accomplish this, but in some MS it is not clearly defined. It is recommended that MS clearly define where the EP certificate can be placed. Issuing an EP certificate may benefit from information collected in other **inspection and maintenance schemes**, e.g., for boilers, ventilation, and air conditioning. Most MS have not implemented such a connection in a formal way. It is strongly recommended to establish an interaction between certification of buildings and inspection of boilers, ventilation and air conditioning systems.

The CA EPBD 2 also addressed and discussed administrative issues related to the EPC schemes, such as cost of certification, layout of certificates, re-scaling EPC scales, database management, extracting added value from EPC databases, design and operation of central registers, quality assurance (QA) schemes and the practical experiences with QA. The cost of obtaining an EP certificate is greatly dependent on the EPC method, the building type and the complexity of the building, but also on the market conditions. The factors influencing the cost in a market-price setting have been identified. In existing buildings, collection of information has the most influence on the experts' work, while for new buildings it is the use of the software tool that is most time consuming. The costs of the quality assessment schemes for EPC must be covered, as it is important that the quality of the schemes is high, in order to gain the confidence of the public. Quality assessment can be performed on many different levels: education of experts; screening of collected data; re-certification of buildings; random check of certificates, etc. A sanction system is also a valuable tool to ensure high-quality work by the experts. Practical experience of QA of experts demonstrated that the role of QA systems is at least twofold: - penalisation of poor practice, elimination of incompetence; - constructive and educational feedback, input for continuous improvement of the scheme. In most MS, experts feed data into central databases, which can be a powerful tool for quality check of the data. Databases can also provide information in a structured form, to enable analyses for many purposes, like national energy saving potentials; market penetration of EPC; geo-coding of EP certificates information, etc. Information in databases can also be used to raise public awareness of the EPC schemes, even though this is not without complications, in terms of confidentiality of data. It is recommended to make collection of EPC data mandatory in all MS. It is not sufficient to demand a central register in all MS; in addition, there is a clear need to design and set up an operations and financing scheme for it. A central register should, thus, be a fully integrated system, linked with many elements, that facilitates the day-to-day management of the EPC scheme (e.g., registration and database of assessors, link with calculation tools, online validation of EP certificates, look up tools, e.g., boiler efficiency database, etc.), online/self-service options for assessors and public, generation of EP certificates and advisory reports, quality control and auditing, billing, statistics, research and analysis, etc. Data are part of the certificate and should be presented in an attractive and eye-catching way. So, the layout of the certificate is an important issue that should be addressed. MS have introduced labelling scales in two different ways, the stepwise scale and the continuous scale. It is important that the selected scale is capable of reflecting possible improvements to the building, such as an improved certificate, and in this way encourage the building owner to implement the improvements. The encouragement could be made by placing the most cost-effective recommendations at the very first page of the certificate. In the future, the requirements for new buildings will be tightened in all MS and a re-scaling of the EP labelling scale must be foreseen. Rescaling of EP labelling scales is certainly an important topic and there was general consensus that scales should be valid for as long a period of time as possible, e.g., 2-3 tightenings of the requirements for new buildings.

There are administrative costs associated with implementing EPC schemes and, therefore, it is of vital importance to gain information about their actual **impact in practice**. Indeed, the weight of administrative costs varies from country to country, but this can be expected to be minimised over time through sharing of best practices, such as use of centralised databases, better software tools, etc. The experiences gained from the EPC schemes are still limited, even though some MS have tried to estimate the potential for saved energy. It is therefore crucial to conduct a more in-depth survey on the impact of EPC, when MS have gained further experience and have exploited the possibility of analysing information in detail. To be able to do this, it is recommended to identify and establish a commonly agreed approach to evaluate the impact of EPC in MS. One impact from implementing EPC has been investigated, the market value of green premium labelled buildings. Some surveys showed a green premium of 2.7% for better energy labels. There are big differences between MS at the level of EPBD implementation with respect to **impact, compliance and control of energy performance requirements and certification system**. As most MS began certification in 2009, it is still too early to quantitatively evaluate the impact of the EPBD on the building stock, but preliminary data and/or qualitative observations look promising. It has been demonstrated that there is a need for regulation, and lack of enforcing it will lead to lack of compliance. Compliance with the regulation will be furthered by the existence of sanctions.

Study tours were arranged as a pilot project to investigate if such an activity could become an efficient tool for transfer of experience from experienced to less experienced MS, especially on selected topics.

Recommendations related to energy performance certification of buildings can be summarised as:

- For certification of blocks of flats and mixed-use buildings, it is important that the same expert issues all needed certificates for the building – preferably for the whole building - to ensure coherence in the recommendations.
- In large and complex buildings (e.g., hospitals) it seems appropriate to use measured energy performance values, as it is very time consuming and, therefore, costly to set up a calculation model representing the building in all details.
- The optimal solution would be to have both measured and calculated performance for the certification of complex and mixed-use buildings, even though this is a very costly approach and not without problems.
- It is recommended to install additional sub-meters where needed to be able to identify potential energy savings in sections of a large building. Often, installation of additional meters is cost-effective from an energy-saving point of view.
- For complex and mixed-use buildings, the following set of recommendations apply:
    - Zoning or a reduced zone model could be considered, when calculating these kinds of buildings.
    - Simplifications in calculations may be possible, since many mixed-use buildings are not so complicated and minor sections with a different use may be neglected.

- Guidelines for installation of meters and sub-meters are needed.
- Guidance for in-situ measurements is needed.
- Providing benchmarks for a variety of uses is necessary.
- Common rules for creating benchmarks for buildings with mixed use are necessary.

- It is recommended for Member States to fix the location and size for the display of the EP certificate in public buildings.
- There is a need to statistically investigate the energy consumption in the existing building stock, to enable a valid set of benchmark criteria to be established for the stock as a whole, but in particular for mixed-use buildings.
- Recommendations given in the certificate should be directly targeted at the actual building being certified. This will increase the public's acceptance of the certificate and help persuade building owners to carry out the suggested energy saving measures.
- Issuing a certificate may benefit from information collected in other inspection and maintenance schemes, e.g., for boilers, ventilation, and air conditioning. Most Member States have not implemented such a connection in a formal way. It is recommended to establish a formal interaction between certification and inspections.
- It is recommended that Member States establish a cost-settlement system ensuring that users of the certificate get a document with a content that matches the cost of getting the certificate.
- The front page of the Certificate should be eye-catching, clearly expressing the energy quality for everyone to see, possibly using an expressive graphic presentation. As additional information, what will be achieved, if the recommended actions are to be carried out, should be clearly shown.
- It is recommended to prepare the next generation of energy performance scales for future tightening of the requirements for new buildings and in this way make the scale more durable; it would prevent the need for frequent changes to the scale.
- When running a quality assessment scheme, the follow-up mechanism regarding the quality of the certificates is the core of the whole scheme.
- A sanction system is a valuable tool to ensure high-quality work by the experts.
- Quality assurance systems are a vital component of certification schemes. Their introduction must be well timed, be transparent and with clear rules, and perform not only penalisation tasks, but also educational and motivational ones, with the aim to constantly improve the scheme in general.
- It is recommended that Member States establish a central database, making it possible to perform quality checks of data and to gain increased knowledge about the energy performance of the building stock.
- The existence of central databases, with information gathered while issuing the certificate, opens a world of new possibilities for numerous analyses of all kinds of energy-related topics.
- It is recommended to set up central registers to support the daily operation (quality assurance, statistics, impact assessment, etc.) of Energy Performance Certification schemes in Member States.
- Encouragement to implement the energy saving recommendations from the certificate could be ensured by placing the most cost-effective recommendations on the very first page of the certificate.
- To be able to evaluate the impact of the certification schemes, it is recommended to identify and establish a commonly agreed approach to measure the impact of certificates in the Member States.
- It is recommended that close attention is paid to the influence of certificates on the real estate market and Member States should pass on the available information to the market.
- There is a need for regulation and without enforcement it will lead to lack of compliance. Compliance with the regulation will be furthered by the existence of sanctions.

CONCERTED ACTION
ENERGY PERFORMANCE OF BUILDINGS

Inspections

Core Theme 2

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1. General Information

Since its launching in December 2007, the CA EPBD 2 (2007 – 2010) organised six major meetings among Member States representatives, with intensive preparatory work in between. In addition to plenary sessions devoted to issues of general interest to the 120+ participants at each meeting, it organised a total of **63 detailed technical sessions for discussing specific issues relating to one or more of its 5 Core Themes (CTs), 23 of which were devoted to topics covered by the Inspections theme**. Some Inspection sessions were organised in collaboration with some of the other Core Themes. Inspections have been a topic of novel interest for most Member States during this period, due to the low level of implementation till 2007 in most MS, allowing participants to learn a lot from each other during the sessions.

Building on the experience from the CA EPBD (2005-2007), the initial plan included a long list of topics related to inspections of boilers, heating and air-conditioning systems; additional topics have been identified since then by the participants. A brainstorming session at the first meeting in December 2007 was very useful in defining the topics of interest for the Member States representatives to discuss.

This report summarises the main outcomes of these Inspection sessions, including conclusions and recommendations.

2. Programme of Work

2.1 Description of the action “Inspections” in CA EPBD 2

According to the EPBD (Art. 8), Member States must implement mandatory inspections of boilers and air-conditioning (A/C) systems, above certain threshold power levels, depending on type of equipment or fuel, as well as of heating systems when older than 15 years, and produce recommendations for upgrade or substitution in certain cases. With millions of such units everywhere in Europe, this is a task that might prove even more challenging than implementing certification of new, existing and public buildings, by the simple force of the very large numbers involved. For boilers, an option is offered: to implement, instead of inspections, information and advice campaigns having at least the same impact as inspections.

2.2 Identifying the activities

Within the CA EPBD 2, MS took the opportunity to discuss the logistics and the methodologies involved in these inspections, especially the organisational and financial solutions, the relative merits of inspections versus information campaigns and how to assess their relative success, as well as the costs that consumers will have to pay for this service.

Normally, a number of between 20 and 30 participants have taken part in the sessions. The participants represented many countries, or even all countries in a fair percentage of the sessions, and often countries sent more than just one delegate to certain sessions, in particular when the workshops were organised in collaboration with other Core Themes. The selection of topics was based on an initial list proposed at the first meeting in December 2007, but then other topics of interest were proposed by some participants and the Core Theme leader, according to new needs that were identified as the discussions progressed.

The range of topics for the "Inspections" Core Theme has spanned a wide area: discussion and analysis of EN standards, updating on experiences with boiler inspections and on advice campaigns (Option B according to Art. 8b), methodologies for A/C inspections with the support of the IEE HARMONAC project, updating with actual data and evaluation, combining EPBD inspections with safety and CFC regulations, ways to further motivate users to improve their old heating systems, training of boiler and A/C inspectors, impact of regular inspections of boilers, improvement of inspection schemes, EU harmonised profile for boiler inspectors, interaction between certification and inspections. In detail, the topics raised in the first CA EPBD 2 meeting are the following:

- Specific content of training courses for boiler inspectors.
- Evaluation of energy impact of inspections.
- Equivalence between inspections (Option A), and information and advice (Option B).
- Connecting the two schemes: Inspection of Heating and Air-Conditioning systems, and Energy Certification of buildings.
- Interactions between the Energy Services Directive and EPBD.
- State-of-the-art for air conditioning components, to allow inspectors to recommend the best alternative solutions using updated databases of available technology (e.g. the EUROVENT database, extended in 2006 by the IEE project AUDITAC).
- Comparative presentation of national legislations implementing EPBD's Articles 8 and 9 throughout MS, in connection with core theme training, to include Art. 10.
- Connection between EPBD inspections and fluorinated gas checks, and between EPBD and gas safety inspections.
- Generation of advice from inspection, including cost-effectiveness issues, production of software and experiences from MS.
- Information to end users – connection with information campaigns.

3. Activities under the Inspections Theme

The work in the "Inspections" Core Theme included most of the topics listed in the previous section. In all the sessions, there have been a total of 65 presentations, ranging from presentations of the state-of-the-art to discussion of specific problems, from almost all the MS taking part in the Concerted Action.

The many different types of inspection schemes and the adoption of Option A or B of Article 8 of the EPBD led to the fact that some approaches might be suitable for some kinds of situations or some types of buildings, while impossible for others. As an example, so-called pre-inspections on air-conditioning systems could be sufficient in most cases, but for complex A/C systems (such as in hotels), a full inspection procedure (including pre-inspection) would be necessary.

The main issues addressed by the Core Theme were grouped in two areas:

A. Development of methodologies for inspections

– *Boilers and heating systems: inspections, information campaigns, or both?*

Both approaches are acceptable under the EPBD. Participants representing MS that have already decided to opt for one or the other, presented their approaches and, when available, their previous and current experiences.

The consequent issue was the comparative evaluation of effectiveness and costs of inspections and information campaigns. The analysis of the two approaches led to the presentation of possible methods to assess their impacts on energy efficiency, even if a common conclusion is far from being determined, and the discussion remains still open.

– *Regular inspection of air-conditioners – too expensive with respect to the achievable result?*

The new CEN standard "EN 15240 Inspection of air-conditioners in buildings" includes many checks and requires significant time, even if it is not able to quantify the energy performance of the system. Are there alternative solutions?

B. Implementation of inspection schemes

The organisation of an inspection scheme involves several complicated issues, such as selection of inspectors, costs of inspections, registration of results, identification of boilers or A/C systems to inspect, the authority for quality assurance and control, and so on. Which are the most cost-effective solutions, allowing the use of existing skills, traditional schemes, service personnel contribution, and minimising the use of public structures, bureaucracy, direct or indirect burden to end users?

In the following sections, the details of the issues for each of these topics are described.

3.1 Development of methodologies for inspections

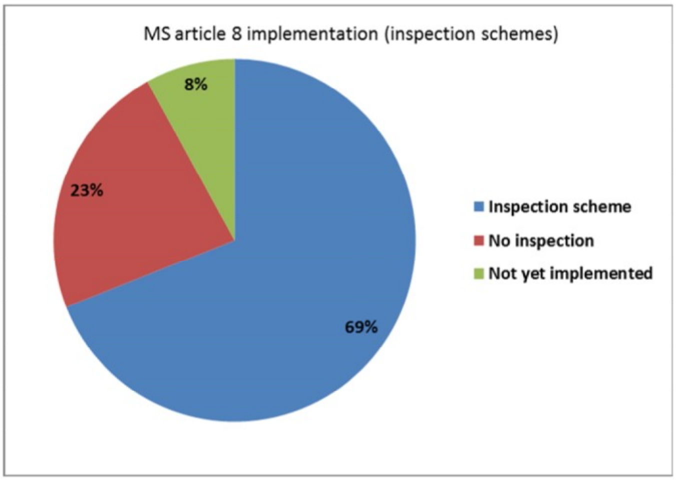
3.1. Article 8: Option A (Inspections) or Option B (Campaigns)?

Evaluation methods are necessary in order to clearly define if advice/information campaigns (Option B in EPBD Art. 8) are as effective as inspections (Option A).

On the basis of a questionnaire answered by Concerted Action participants in December 2008, the quota of MS having selected option B is 20%, whilst 30% have selected to some extent both options A and B. Out of 26 responding MS, 18 have decided to implement an inspection scheme, 6 have decided to use option B, and 2 are still uncertain.

An unexpected trend was identified during discussions: several MS have decided to implement combined solutions, mixing somehow information campaigns and inspections. Examples were reported of inspections or pre-inspections accompanied by a user-targeted information campaign, or an information/advice campaign supplemented by voluntary inspection schemes.

Many MS have therefore decided to move from a rigid definition of the two approaches to a more flexible, combined approach, using the most effective elements of both, with the objective of improving the energy efficiency of the systems in mind. A possible way to improve the impact of inspections, combining it with other measures, would be to include some relevant mandatory requirements, which should be implemented in case, for example, of old boilers, or un-insulated pipe works, or lack of central climatic controls and thermostatic valves. Another proposed option is to provide the user with a calculation of the seasonal energy efficiency of the whole system, and offer a benchmark in respect to the most advanced technologies. This could provide a powerful motivation for renovation of the system and improvement of energy efficiency.



Results from the inquiry on 26 MS on Art.8 implementation (2008)

In most of the countries, cost plays an important role. Other effects, like emission reduction, reduction of energy demand or avoided CO_2 emissions have different weight in MS approaches. Some MS demonstrated that their choice was the most cost-effective, even if their opinion has changed from a previous approach. In general, the cost-effectiveness of an approach has to be substantiated by an evaluation of the impact in energy efficiency improvement, as the simple verification of a correct maintenance of boilers or air-conditioners does not justify the effort of setting up an inspection scheme. There is a widespread agreement among MS that, while inspections of larger installations are clearly cost-effective, inspections of smaller units, option A, especially in moderate climates (low heating or low air-conditioning loads), are clearly not cost-effective.

Another experience stresses that inspection and provision of advice should be provided not just for boilers using non-renewable liquid or solid fuel, but to all kind of boilers, including those burning biomass. One MS suggested the estimation of the benefits of using renewable energy sources for heating, according to the suggestions of the Directive 2009/28/EC on the promotion of the use of energy from renewable sources. The discussion continued on how this will affect the current implementation and what the benefits are of including all kind of boilers. 11 MS declared to have considered the influence from other EU Directives for the implementation or for developments further than those required by the EPBD. Of those, 5 have considered Directive 2005/32/EC for establishing a framework for the setting of ecodesign requirements for energy-using products. Most of them mentioned definitions and standards, others considered Directive 2006/32/EC on energy end uses and energy services, as Article 8 of the EPBD mentions the reduction of energy consumption as the main objective.

MS that have chosen option B must submit **reports on the equivalence of the Option B approach**. Therefore, they were particularly interested in defining a method for assessing the impacts of the two approaches.

Ten countries have considered measuring the performance impact of inspections/information campaign, as well as the estimated expected impact. As there was no exact answer on how to measure this impact, some possible survey-based methods were suggested, together with suggestions on how this impact could be defined in official statistics. Even though the MS which have chosen option A do not have to submit such reports, information on cost-effectiveness and anticipated energy savings will be very important in order to define the policy implementation features. A synergy may therefore exist between those two kinds of reports.

A study performed in an Italian region (Florence) after some years of implementation of an inspection scheme, gave interesting results: based on a sample of roughly 134,000 inspected boilers, the frequency of detected anomalies/defects in the systems was calculated (un-insulated pipe work, absence of thermostatic valves, low generator efficiency, etc.). Then the potential improvement of the seasonal system efficiency for each defect type was estimated, for two different scenarios: A = standard solutions according to legislation in force, B = applying the best available technologies, obtaining a potential energy saving from 45.9% to 68.4% respectively in case of scenario A, and up to 81.3% in case of scenario B (correcting the worst case, where all the most common defects show up). Applying the potential improvement related to each defect type to the frequency of occurrence of the same defect, the authors obtained a potential improvement of the overall energy efficiency for the whole sample of between 4.5 to

6.5%. This study implies that the inspection is able to analyse the whole system and not just the boiler, and that the inspector is able to provide reasonable advice, so that the owner is convinced to invest in energy efficiency or to modify his/her behaviour regarding the use of energy.

One tool developed in a MS in the framework of Option B was considered really promising and interesting: it concerns a voluntary one-off inspection of old boilers. The system is based on a computer tool (excel sheet) consisting of a checklist which automatically generates advice. It can be adopted as a kind of a voluntary inspection-based advice scheme on heating and air-conditioning systems. A recent survey has been carried out on this scheme, showing, for example, that the most known energy efficiency tool in the country was the energy labelling of buildings (87% of the sample), while the awareness on this voluntary inspection was only 32%. This demonstrates that people are less informed about inspections than about building energy certification. This is a further example of how MS efforts in this direction are still at an initial stage.

National authorities have had a large influence upon the introduction of Option A or B. Other organisations such as inspectors, advisors, building owners associations, politicians, as well as installers and maintenance service associations have had any influence only in five countries. For a successful implementation of the EPBD, and especially for the introduction of inspection or the provision of adequate information, it is very important that building owners understand the measures and the possibilities of achieving cost-effectiveness and energy savings.

It is recommended that MS consider the adoption of a combined approach, using the most effective elements of both inspections and measures for provision of advice, having in mind the objective of improving the energy efficiency of the systems.

3.1.2 Drivers motivating voluntary inspections

One of the most important questions connected to inspections is “What are the reasons and the most successful tools, schemes, projects and policies within Member States -both local and national- motivating users to improve or replace their old heating systems (boilers and the main components of the system)?”.

The following main policy tools were considered:

- Tax Credits & Incentives
- Info Campaigns
- Obligation to substitute components + Support for low-income users
- Information/training for installers

Other successful experiences on implemented measures were pointed out:

- Contracting more efficient systems for social houses (rented multifamily buildings).
- Allowing higher rental fees after renovation.
- Supply contracts related to quality.

Successful experiences have shown that some specific drivers have fostered the improvement-replacement-retrofitting of old heating systems, such as:

- Information and advice (campaign on oil boiler substitution).
- Overcoming institutional and regulatory constraints.
- Banks-ESCO agreements that facilitate the overcoming of the financial barriers.
- “All inclusive” energy services.
- Refitting evaluation (is the proposed intervention actually cost-effective?).

- Inspections providing also advice.
- Incentive programmes (an example from one MS shows that new boilers covered 31% of all energy tax-credits, which produced globally an impact on energy consumption of -0.3% in one year).

The key elements of success in order to persuade users to retrofit their heating systems can be summarised as follows:

- Information provision (energy education of owners, tenants, staff and management).
- Targeted programme marketing.
- Thorough energy and cost analysis.
- Technical assistance in retrofit planning, including supervision of bidding and contractor work.
- Awareness on performance standards and other regulatory tools.
- Timely information on financial incentives.
- Effective procedures (internet-based) for monitoring, evaluation and follow-up.

Valuable experience regarding effective approaches to improve energy efficiency in buildings has been gained through the efforts of local, state, utility, and regional programmes.

An example of information campaigns connected to boiler inspection was described by one MS, where the campaign promoted actions requiring just a small investment, such as:

- Heating pumps with electronic volume flow control.
- Proper pipe insulation.
- Hydraulic adjustment of heating systems.
- Proper settings of central control units.
- Advantages of modern boilers.

Furthermore, the National Heating Association stipulated an agreement with all its members, convincing them to participate in a PR-campaign, where advice was provided by heating installers. This campaign also promoted the heating system inspection by advertisement and by direct contacts between members and customers.

> Marketing of the inspection scheme, provision of information, technical assistance, training, performance standards and ratings (mandatory or voluntary), as well as financial incentives, must all work together in order to significantly improve energy efficiency.

3.1.3 The CEN Standard for A/C inspections (EN 15240)

Member States need to understand how to best use the EN 15240 standard in the national transposition of air-conditioner inspection (as required in art. 9 of EPBD). As reported by the head of the technical committee that produced EN 15240, Jorma Railio, this standard has been expressly designed to leave a fair margin for national differentiation, just as the EPBD leaves freedom for national adaptation in inspection frequency and extent. In fact, various interpretations of the standard have been identified, and even some basic terms seem to have been interpreted differently from country to country. For this reason, some points of the standard need to be revised, some of its basic terminology subject to misinterpretation needs to be clarified, and some classification may be introduced:

- Definition of an "air-conditioning system": what does it include exactly? Art. 2 of the EPBD defines an air-conditioning system as *a combination of all components required to provide a form of air treatment in which temperature is controlled or can be lowered, possibly in combination with the control of ventilation, humidity and air cleanliness*. The adverb “possibly” introduces ambiguity. This has been redefined in the recast Directive.

- Definition and applicability of the 12 kW threshold: should there be a unique definition of the limit or, instead, should there be an adaptation of the limit to the specific building, zone or unit? (One MS has taken the decision to sum up all installed devices within a building.) The recast Directive has specified that the limit applies to system size.
- Definition of the background of a "qualified expert”.
- Clarification of the meaning of "self-inspection", mentioned in Annex C of EN 15240, as part of the recorded material to be checked by the inspector.
- Many arguments came out in favour of extending the inspection to always include ventilation, when part of the A/C system. Due to the constant improvement of building insulation (towards very high performance levels), and the shading of glazed areas, ventilation will soon represent the main source of overall energy consumption.
- Classes are also included in EN 15239. There is a possibility to combine the inspection with an energy audit and/or an indoor air quality (IAQ) audit. MS do need more guidance, as the legislation is new for most of them.
- Does the methodology apply to existing buildings as well as to new ones? Existing buildings may not have maintenance records available, and documentation may be incomplete, outdated or even lacking. The first inspection will be important in order to put the system improvement on the right track!

It is necessary to gather feedback from in-field experiences. Some actions (e.g. the IEE project HARMONAC), have strongly contributed towards that goal.

There is at present no method defined in the standard for the assessment of the efficiency of the whole A/C system (from outer air inlet to air supply to the room). **A revised standard is strongly needed**.

EN 15240 leaves a large margin to MS implementation, and it needs to become more precise and targeted, with better definitions and A/C inspection methodologies.

3.1.4 Cost-effectiveness of air-conditioner (A/C) inspections

Following the successful completion of the project “Field Benchmarking and Market Development for Audit Methods in Air Conditioning – AUDITAC”[1], on the inspection and auditing of air-conditioning systems, analysed during a meeting in 2007, MS discussed in detail the results and proposals of the IEE project “HARMONAC[2]: "Harmonising Air Conditioning Inspection and Audit Procedures in the Tertiary Building Sector”, presented by its coordinator, Prof. Ian Knight.

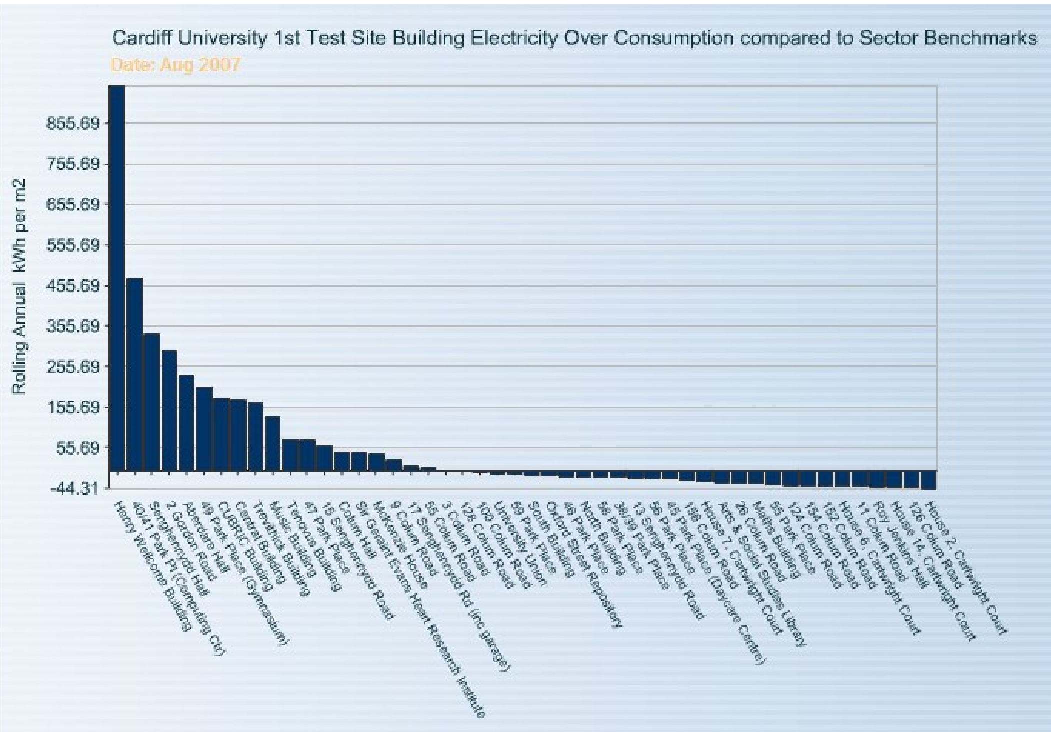
There are strong needs for making A/C inspections more cost-effective, as the required time for an inspection performed in full accordance with EN 15239 can be from several hours to some days. Previous discussions in the period 2005-2007 indicated that “while inspections of larger installations are clearly cost-effective, inspections of smaller units, especially in moderate climates (low heating or low air-conditioning loads), are clearly not cost-effective”.

However, HARMONAC concluded that there is significant scope for energy savings in A/C inspections, but it may be not necessary to have detailed inspections and tests for all systems. It is thus necessary for an effective A/C inspection scheme to allow identification of the systems which are consuming too much energy. There is a range of options which allow A/C inspections to be simple and not expensive, without losing the majority of the energy efficiency benefits. One of these options includes introducing a “graded or step-by-step” inspection scheme on air-conditioning systems (pre-audit, inspection, audit, advice):

[1] AUDITAC Intelligent Energy Europe - IEE project number EIE/04/104 *http://www.cardiff.ac.uk/archi/research/auditac/*
[2] HARMONAC, Intelligent Energy Europe - IEE project number EIE/07/132 *www.harmonac.info*

- **Pre-inspection**: checking building type and use, A/C system type, consumption, maintenance records, etc. It can be undertaken by personnel without specific A/C skills. The aim is to establish whether there is a potential problem before visiting the system, and to focus the visit on those areas that need attention during the inspection.
- **Inspection**: includes the work already undertaken during the pre-inspection, and should establish, through a visit to the system and some quick and simple measurements, an overall energy performance evaluation and an indoor air quality status for the system.
- **Audit**: involves the detailed analysis of an A/C system when its inspection has indicated unacceptable performance in one or more areas. This may involve more specialist checks that are normally outside the competencies of an inspector to undertake.

The main point of interest is the adoption of a pre-inspection, where analysis can be based on the data provided by the owner through the service personnel, which could be upgraded with appropriate analysis tools, mainly software tools. A combined condition is to have a dedicated electricity meter, measuring the energy absorbed by the A/C unit alone, and benchmarking values, coming from a wide and multinational sample of monitored systems. The main advantage of this approach is that the following step, the on-site inspection, could be limited to only those systems having a performance far lower than the benchmark and, therefore, having a high energy saving potential. It is however controversial whether this simple analysis could lead to reliable advice and solutions. A good compromise could be represented by the adoption of pre-inspection schemes for simple buildings on one hand, and detailed audits for complex ones on the other.



Ranking of the electric consumption of University buildings by decreasing energy performance indicator relative to the sector benchmark (Source: HARMONAC)

The full set of HARMONAC outputs is now available. For those MS which are still in the implementation phase of the appropriate regulations, it would be worth analysing the different approaches and experiences from the project. It would also be worth comparing benchmarking values from different studies and methods in comparison with actual building consumption data.

> There is a significant scope for energy savings in A/C inspections, but it may be not necessary to have detailed (expensive) inspections and tests for all systems. It is necessary for an effective A/C inspection scheme to allow the identification of the systems which are consuming too much energy, where inspections may be cost-effective.

3.2 Implementation of inspection schemes

3.2.1 Status of implementation

An inquiry to MS shows that many MS are still working on the development of an updated inspection procedure (January 2010). The implementation of a working methodology is a time-consuming process. Thus, not all MS have developed a procedure yet, and fewer have entered the implementation phase. The obtained results, out of a sample of 20 participants, can be summarised as follows:

- 40% of the countries do not have new inspection regulations, but continue to rely on the previous legislation still in force,
- 40% have new inspection regulations published or in preparation, and
- 20% do not have any inspection regulation in force.

There are barriers which need to be identified and possibly removed. A revised CEN Standard 15240 may help to overcome difficulties with implementation: a set of elements should be recommended to the CEN as priority items in a cost-effective inspection. Cost-optimality is a crucial aspect to be considered: in this context; pre-inspections could be the cost-optimum solution.

Most MS still need to improve their methodologies, train experts and start with regular inspections; MS are encouraged to complete these tasks soon and start regular inspections shortly, as required by the EPBD.

3.2.2 Boiler and A/C inspector training, and a possible harmonised profile for boiler inspectors.

From information collected in 2009 from MS where inspector accreditation is running, the following main conclusions were obtained regarding the contents of boiler and A/C inspector training courses:

- Four MS started training A/C inspectors.
- Seven MS have set but not started specific training or are envisaging specific training of boiler inspectors only.
- In one case, a common training is supplied for certification and inspection experts.

The bodies providing training within various MS may be far different:

- professional associations
- public institutes
- energy agencies
- universities
- training companies

Usually, the MS involved in training are those that have established an accreditation system for inspectors. Typical training courses take from 5 to 10 days and require a final examination. The main topics delivered are common to every country: i) safety of gas boilers, ii) inspection procedures, iii) energy efficiency improvement opportunities, iv) drafting of recommendations.

Subject	Nr. of hours
Legislation and basic theory	16
Fuels and combustion	8
Heating systems for buildings (efficiency + safety)	4 + 12
Measuring instruments	4
Technical standards for inspection	4
Practical experience on inspections	16

Example of structuring a training course for boiler inspectors

On the contrary, the background level of qualification of inspectors is far different, spanning from skilled workers (for example chimney sweepers) to thermal engineers, reflecting a diversified approach to the quality and level of the depth of inspections, having a clear connection with the expected costs for the end users.

It is common understanding in the MS that it is not necessary to have a separate training and qualification scheme for the inspection of boilers and the inspection of the whole heating system, neither for commercial nor for residential buildings, as the basic skills are the same. It is not known to what extent the training for basic skills is already harmonised, though doing so should not be difficult. In practice, it is more likely that installers and maintainers (who may become inspectors) specialise in particular products, even in the products of a particular manufacturer only (especially in the case of boilers).

The structure of the markets for installers and maintainers of heating services has evolved over a long period and would be difficult to change. Unification may be easier for newer types of heating systems, such as pellet boilers, heat pumps, or micro-CHP. There is already some recognition of cross-border skills and methods. European standards such as EN 15378 were thought to be unhelpful in this respect, as they do not deal with the national differences (although the structure of the standard allows for national annexes).

A harmonised profile for boiler inspectors will probably be feasible over a certain period of time, but it is certainly premature at this stage of development. This may be because of entrenched national practices that are difficult to harmonise, or because it is believed that few advantages may be gained from doing so. Even if inspection is a new requirement in several countries, pairs of neighbouring countries with broadly similar systems and installation practices would benefit from collaboration, and skill shortages in some countries could actually be filled in by others. However, at present, there is no sign that such a move will occur spontaneously.

Similarly, harmonised training on the basic skills of inspectors is hindered by language differences, different practices, and different background qualification levels.

> A harmonised profile for boiler inspectors will probably be feasible over a certain period of time, but it is certainly premature at this stage of development.

3.2.3 Advice/recommendation in inspection reports, and interaction with energy certificates

Recommendations can play a positive role, even in relation to heating and air-conditioning systems. The more detailed and tailored they are, the higher the probability that those suggestions will be implemented. Nevertheless, most MS have not yet established an integrated approach for maintenance, inspection and certification processes for existing buildings, and for most of these countries it is quite difficult to integrate these schemes, especially due to the high level of skills needed for professionals involved in these tasks.

The inspection report could include a comparison of the energy performance of the system inspected with the best feasible one available, or with a system of similar type, for which all relevant components achieve the level of energy performance required by the applicable legislation. However, in order to reach this level of recommendation, a suitable method for calculating the seasonal system efficiency starting from data taken during the inspection should be defined.

Furthermore, recommendations for the cost-effective improvement of the energy performance of the system of the building or parts thereof shall be specific to the system, and shall provide clear information as to their cost-effectiveness. The evaluation of cost-effectiveness shall be based on a set of standard conditions, such as the assessment of energy savings and underlying energy prices, as well as interest rates for investments.

Member States shall provide, in particular, information to the owners or tenants of buildings on both energy performance certificates and inspection reports, their purpose and objectives, cost-effective ways to improve the energy performance of the building, as well as mid- and long-term financial consequences if no action is taken to improve the energy performance of the building.

It was agreed that an inspection report should:

- Be understandable for non-technicians (owners and tenants).
- Provide customised advice, suggesting cost-effective measures focused mainly on low-cost investments.
- Compare the actual performance with more energy efficient heating systems, and the existing system type with better technologies (renewable energies, co-generation).

A requirement for an independent control system for the reports on the inspection of heating and air-conditioning systems, i.e. via random sampling checks of the quality, is considered very important. The competent authorities, or bodies to whom responsibilities for implementing the independent control system have been delegated by the competent authorities, should make a random selection of at least a statistically significant percentage of all the inspection reports issued annually, and subject these to verification. The verification shall be carried out at one of the three alternative levels indicated below; each verification level shall be carried out at least for a statistically significant proportion of the inspection reports selected:

(a) Validity check of input data of the technical building system inspected, which were used for the issuing of the inspection report and the results stated in the inspection report.

(b) Check of the input data and verification of the results of the inspection report, including the recommendations given.

(c) Full check of input data of the technical building system inspected, which were used for the issuing of the inspection report, full verification of the results stated in the inspection report, including the recommendations given, as well as an on-site visit of the system, in order to check correspondence between specifications given in the inspection report and the technical building system inspected.

To make this check, it is necessary to create a database on inspected boiler performance in each MS or region. The results of a survey indicated, however, that only 21% of the MS have established a database for boilers, and only 1 MS has established a database for A/Cs.

A natural link between the energy audit and the inspection has been also identified. Guidelines for linking certification and inspection could be summarised as follows:

- Encourage voluntary inspections (as an extension of mandatory inspection).
- Explore the possibility to go, on a voluntary basis, beyond the EPBD in extent and depth.
- Control on inspections: penalty in the case of failure may be a possible way to impose an effective implementation.

Recommendations are an essential part of the inspection, and the inspection report should have the same quality check as certificates, including random quality checks.

3.2.4 Organisational aspects of boiler inspection: combining EPBD requirements with safety and CFC environmental regulations

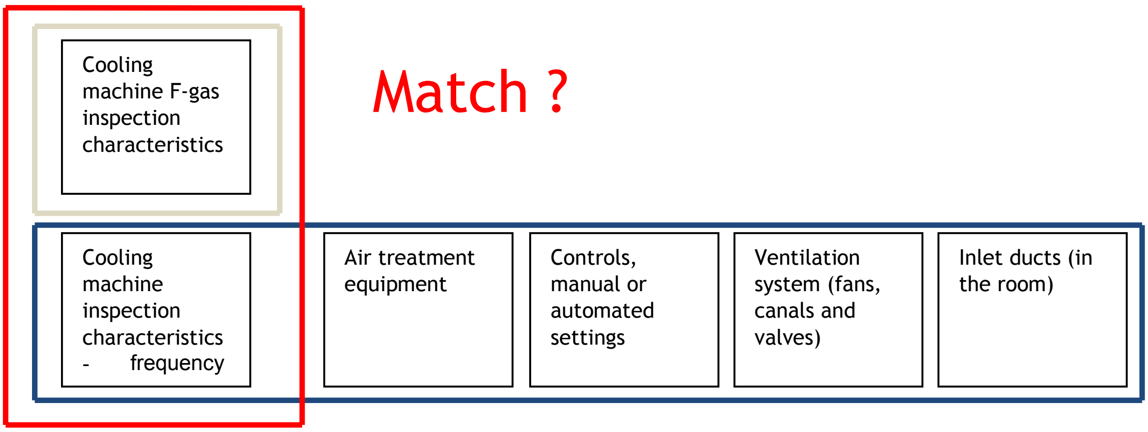
The possible interaction of energy efficiency, environmental and safety aspects in a single operation could limit costs and avoid duplication of checks. The coordination of energy efficiency inspections with other types of inspections is an interesting avenue for keeping the costs as low as possible – even if the objectives of the inspections differ.

In Regulation (EC) 842/2006 on fluorinated greenhouse gases, a number of requirements are put forward to reduce their emissions. There are even more inspections "regulated" by EU, national bodies or even trade associations that may be subject to such coordination. Based on national and European guidelines and regulations, there may be inspection schemes under development for:

- Prevention of uncontrolled bacteriological contamination, including legionella pneumophila.
- Avoidance of radon gas contamination of buildings (for further literature: http://www.bre.co.uk/radon/).
- Other possible checks of A/C systems.

The EPBD calls for inspection of A/C systems with effective output above 12 kW, whereas 842/2006 requires that installations containing more than 3 kg of fluorinated greenhouse gases be checked. Both regulations at the European level are presently under more detailed development nationally, but 842/2006 gives less freedom for national legislation than the EPBD. The fact that the two regulations have a different focus and define the target systems differently could be an obstacle if one would strive to have a uniform system. The recommendation for national implementation is to have both regulations in mind when the national rules are defined.

In the formal documents for the two European "regulations", surprisingly few cross-references exist. An analysis of benefits of coordination should be developed by MS, in order to identify possible coordination benefits, as suggested by the following Figure.



Schematic view of interaction between two different types of in situ checks on A/C systems.

Considerable benefits are available to Governments, experts and system owners, just by coordinating the two schemes. When the combination of the two inspections is enabled through information, enabling individual experts and companies to offer both types of inspections, as well as the proper use and reuse of reported data, the most important is the benefit for the owners, and the possible understanding of the rationale of the public regulation.

Even when the inspection phase cannot be unified, other elements can be commonly operated, such as data collection, expert training and accreditation, definition of inspection frequency, supply of information, and management of the data base. A general recommendation is to make sure that the most frequent inspection collects data which can be also used for other types of inspections, thus avoiding duplication.

Early experiences in some MS show, for example, an attempt of coordination of the non-technical parts of the two regulations (organisation, frequencies, etc.); in another case, there is an attempt of combining EPBD 2002/91/EC article 9 with existing parts of the legislation on air-conditioning. Experiences of accreditation of gas inspectors are also available, and in a few countries a common regulation is already in place. In some countries, an integration of ventilation control and EPBD inspections is applied, while gas safety and energy efficiency are already quite frequently evaluated together during boiler inspections, as well as energy efficiency and polluting emission measurements. It was also acknowledged that differences occur in the required skill level of technicians, making common training more difficult.

The coordination of energy efficiency inspections with other types of inspections is an interesting avenue for keeping the costs as low as possible, even if the objectives of the inspections differ.

3.2.5 Deriving all-season heating efficiency from inspection data

To obtain more useful data concerning the performance of the whole heating system, not just the boiler, it is necessary to also go beyond the instantaneous efficiency usually measured by the flue-gas analysis, towards the determination of the seasonal efficiency, which is more related to the actual impact on energy costs. It is thus necessary to establish a methodology to derive the seasonal heating system efficiency with a simplified calculation, based on data collected during an inspection, e.g., using the calculation method supplied by EN 15316-4-1, knowing seasonal efficiency would help to estimate the seasonal fuel consumption and cost with much greater accuracy. Comparing this with real (billed) seasonal fuel consumption and cost would help to estimate the net energy need and the energy losses.

No single assessment method provides a correct solution for all cases: a simplistic method may not be able to show the effect of improvements, whilst a detailed method may be unnecessarily time-consuming for common situations. The boiler typology method defined in Clause 5.2 of EN 15316-4-1 has proven to be a reliable and easily applied method, suitable for use by people with minimal modeling skills in common situations. The other two methods illustrated in EN 15316-4-1 may be used to determine the values for the typology method; they may be also used for situations beyond the scope of the typology method.

The boiler cycling method, in particular, is meant to deal with existing boilers/buildings (it keeps a connection with directly measurable parameters and allows for the calculation of operating performance of condensing boilers), while the boiler typology method requires the development of a national annex. Case-specific and boiler cycling methods come with annexes (Annexes B and C to EN 15316-4-1), where default values are given to cover a much broader set of cases; adjustments may be required in order to develop a national annex using them as a template.

If no national annex is defined, Annex A provides a limited but complete inspection class set of tables. Nonetheless, it is advisable to use it as an example and/or template for the development of a custom national annex. This inspection procedure is not meant to be a full energy audit or the basis for a complete renovation design. The expected result of the inspection process is an indication of whether there is a reasonable possibility that energy conservation measures could be adopted. Then each improvement measure should be designed and implemented according to local regulations. Many parts of the inspection process are not well covered yet. The intention is to collect experiences and suggestions, and to include them in the next revision of the standard.

A paper was presented, where the all-season efficiency was calculated on a large sample of inspection data[3]. The assumptions made regarding the influence of the different improvements (pipe insulation, thermal regulation system, chimney status, boiler tuning, etc.) on the average global seasonal efficiency values will probably need a more scientific or a regulation reference basis, but this study represents a gallant attempt to find an application of the boiler inspections in the local energy planning strategy.

> Calculation of the seasonal efficiency of boilers and A/C equipment will provide a much more accurate prediction of energy savings, as well as better recommendations.

3.2.6 *National minimum EP requirements for technical systems*

The EPBD only demands minimum requirements for the building envelope. However, many MS also set requirements for technical systems. A survey (September 2010) showed the following existing requirements, expressing the opinion of a sample of 15 MS participants (% of participants indicated):

- Heating systems: 70%
  - boilers: 70%
  - renewable sources: 50%
- Domestic hot water systems: 80%
  - water storage: 56%,
  - supply temperature: 50%
- Air-conditioning and large ventilating systems: 80%
  - fan: 62%,
  - AHU: 50%,
  - overall system efficiency: 36%
- Lighting systems: 20%
- Metering and monitoring systems: 50%

The minimum requirements of the components of technical building systems and lighting elements are covered by the 2005/32/EC, 2010/30/EU Ecodesign and Ecolabel Directives.

The EPBD recast, Directive 2010/31/EU, also asks MS to set requirements for the technical building systems. The requirements of the elements (boiler, pump, fan) cannot replace the requirements of the technical building system. It is still unclear how exactly overall system requirements could or should look like and how they shall be defined, as the system performance depends on the interaction of various components of the building.

> Requirements on technical building systems and their parts are essential for the energy efficiency in buildings.

[3] D. Parente. Energy saving due to boilers inspections in compliance with the Italian Decree 412/93 and its related further modifications. (In Italian). Magazine “La Termotecnica”, 2004.

3.2.7 Interaction of inspectors with other market actors

Advantages are expected from the possible wider involvement of the market actors in the HVAC inspections, in terms of participation in local/regional Advisory Committees, in training programme development, and in exchanging information for a better service to the end users.

In most MS, interest is increasing on simplified methods for transforming the role of the inspector from a crude assessor of the present efficiency to a motivator of efficiency improvement. The inspector should be capable of providing useful suggestions on quantitative aspects like possible efficiency improvements and correct/appropriate system sizing. This change of attitude is the key for possible interactions with the other market actors.

The category of maintenance staff can provide good skills, willingness to be trained on technical aspects, strong motivation for possible presentation of offers to the clients. There is in fact a general issue concerning the character of independence in providing recommendations. A careful control of the compliance with the independent recommendation requirement should be committed to a public body by the national/regional implementing body.

The role and qualifications of the ideal inspector is yet open to debate.

4. Main outcomes from the Inspections sessions

From the most recent summaries presented by the participants, it appears that many MS are still at an early stage in the implementation of their inspection approach, especially in relation to A/C systems.

The situation (decision) related to boiler inspection in 26 Member States is (December 2008):

- 70% implement inspections, or are ready with legislation and going to implement soon;
- 20% do not implement inspection schemes, but have selected the “Option B” approach, i. e. the launching of information and advice campaigns.
- 10% are still uncertain on final decision.

The situation for A/C inspections, obtained from 15 participants, updated in October 2010, is as follows:

- 40% do not have new inspection regulations, but can rely on the previous legislation still in force;
- 40% have new inspection regulations published or in preparation;
- 20% do not have any inspection regulation in force.

Differences among MS on inspection schemes, methodologies, type of systems (Heating and Air Conditioning), and training for inspectors are still relevant. Nevertheless, a significant progress has been achieved with respect to the situation at the beginning of the Concerted Action in 2005. The newly designed schemes have adopted several lessons learned from the more experienced countries; the initial scepticism on inspections has been partially removed, whilst there has been a convergence towards a reduced set of models of application, compared to the initial dispersion of approaches.

Some good practices are coming out already from the early on-field experience of MS having implemented inspection schemes. The countries having a tradition of chimney sweepers' organisations have encouraged these people, already accustomed to visit homes for boiler checks, to verify the boiler energy efficiency, obtaining a quite cheap cost for the end users, as the additional check is quoted at marginal cost. Difficulties have arisen in the attempt to use the inspections for advising the end users on possible system improvements, as the chimney sweepers are often not qualified for delivering this type of recommendations, therefore requiring the appointment of additional or alternative, more qualified personnel for this task. Another problem connected with chimney sweepers is that they have traditionally a monopoly in their district, but free market rules require an opening to competition. Therefore, the role of chimney sweepers and energy inspectors has to be committed by periodical open tenders.

Where inspectors are accredited as independent experts, the final impact is generally positive, even if in some cases complaints were received by the public authorities that the attitude of the inspector was too severe for minor infringements of the safety or efficiency rules, producing official letters reporting defaults and fines. The role of the inspector encompasses therefore the risk to be more a "policeman" than an advisor, reducing the potential of inspections for obtaining an actual energy efficiency improvement. It is recommended to train the inspectors so that they act as advisors and provide the most useful energy information to the users.

On the other hand, when the inspections are delegated to the service staff in charge of maintenance, the qualification and the capacity of providing recommendations is good, but the independence of inspections is questionable. Some MS have indicated the need for more objective methods for providing inspections, avoiding, for example, any bias in providing recommendations on efficiency improvements by service staff involved in installation services. To avoid or limit a non-independent issue of recommendations, some MS developed tools for an automatic generation of advice, based on the findings registered during inspection.

A specific situation regards A/C inspections. Every year, millions of new small air-conditioners are installed all over Europe, and units larger than 12 kW will have to undergo mandatory periodic inspections. Their inspection should provide the answer about its proper installation, as well as some guidelines for the end users about their management. However, most MS have no public registers of A/C systems, no obligation of regular maintenance, no checks made by public authorities on their efficient performance, except for the risk of leaks of polluting fluorinated gases. Therefore, the task imposed by Art. 9 of EPBD is particularly new and challenging; in most MS, little progress has been observed in this respect.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Boilers: Option A (Inspections) or Option B (Campaigns)?	Advice/information campaigns (Option B) have to be compared with proper inspections (Option A) on cost-effectiveness.	**Combined solutions have been developed in more flexible approaches.**	These combined solutions should be further studied in the near future. Examples of cost-effectiveness as-sessments have to be provided and discussed.
Drivers motivating voluntary inspections	MS have a multiple set of policies and programmes to improve substitution of old systems.	The elements of success have been identified and prioritised.	The quantification of the relevance of each driver requires data on impact evaluation. **Impact assessment surveys should be implemented**.
Training for inspectors	Possible development of a harmonised profile for boiler inspectors and common training features.	Not yet feasible.	**When the inspection approaches become more similar, the circulation of experts could be a reasonable option**.
The EN 15240 Standard for A/C inspections	Usability of the standard, role of national implementation in defining inspection classes, methods for determining efficiency have been discussed in detail.	**The standard is useful, but several questions remain open**, in terms of ambiguities, missing parts, points of questionable interpretation.	**A quick revision of EN 15240 would be very useful**.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Recommendations and interaction with energy certificates	The issuers and recipients are not always aware of the role and added value of certifi-cation and inspection.	**Recommendations for heating/ cooling system efficiency improvements should be always included in the reports**.	**More effective information campaigns should be initiated by Member States**.
Combining EPBD requirements with safety and CFC environmental regulations	The potential to make the coordination easier is large.	Several elements for coordination have been tested and referenced.	**MS are invited to create connections in secondary legislation between actions related to EPBD inspections and CFC environmental control**.
Improvement of inspection schemes in MS	Most MS are convinced that there is room for the improvement of their inspections scheme.	**Areas of improvement** have been detected: **frequency** of inspections, info to building owners, **control system analysis**, and **cost-effective improvement**.	Further work is required and concrete experiences are needed.
Boiler and Air Conditioning Databases	A database for boiler and A/C inspection reports has been established in a few MS.	Databases can: help compliance and control checks; assess boiler situation to draw new policies; allow users to compare their boiler “passport” with catalogues of more efficient boilers.	A better targeting of **boiler and A/C databases** is **necessary**, to justify the large effort required for creating them at regional or national level.
All season heating efficiency from inspection data	Several methods for the calculation of all-season system efficiency are available; a few of them can profit from data collected during inspection.	Include seasonal efficiency estimates in the formats for inspection reporting.	The new mandate to **CEN should prepare a methodology tailored for a calculation method to be used by inspectors**.
National approaches to fixing minimum EP requirements	Single product requirements fall under the Energy-related Product Directive, while whole buildings, and whole heating/cooling systems are covered by the EPBD.	Only a few MS have expressed minimum requirements on heating and cooling systems, and cost effectiveness analysis is often missing.	**Heating and cooling system efficiency should be considered in MS minimum requirements**; cost-effectiveness in fixing values must be taken into account.
Cost-effectiveness of A/C inspections	**A stepped approach could provide a more cost-effective approach to A/C inspections.**	The way explored by the IEE HARMONAC project was found to be an interesting option to implement.	Further analysis is needed in order to clarify the terms of actual implementation. The final results of the project HARMONAC should be explored.
Developments in A/C inspections in MS	The most advanced regulations on **A/C inspections provide** a **pre-inspection** phase, and **recommendations on operation, improvement and replacement.**	Considering the limited number of MS having produced suitable regulations, the topic is far from concluded.	When other MS issue regulations on A/C inspection, pre-inspection and recom-mendation topics will receive wider consideration.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Long-term automatic monitoring of heating & A/C systems	The **benefits of monitoring energy consumption have been clearly demonstrated**, using smart meters, data loggers connected to energy measuring sensors and B.E.M.S.	Early examples of smart meters capable of supplying energy data to end users and obligation to monitor energy consumption are already available. Further discussion is needed.	MS should ensure that utilities installing **smart meters** are obliged to **supply energy data to the users**. Forms of obligation to install energy meters on A/C systems should be experimented.
Interaction of inspectors with other market actors	Discussing the benefits of an interaction between inspections and other market actors, interest was raised in simplified tools for installers, based on inspection data.	Simplified tools for assessing efficiency of existing equipment and **estimating benefits by substitution should be part of the inspection process**.	The raised interest indicates that the topic needs further discussion, also in light of the EPBD Recast Directive.

5. Lessons learned and recommendations

Many Member States are still at an early stage in the implementation of their inspection approach, especially in relation to A/C systems.

Most chose mandatory inspections for heating and A/C systems. Nevertheless, there are still not sufficient data and studies to clearly define if advice/information campaigns (Option B) compared to proper inspections (Option A) are equally effective.

Combined solutions have also been developing, meaning that inspections or pre-inspections are accompanied by information campaign targeting users. An interesting shift has indeed been detected: from a rigid definition of the two approaches to a more flexible and combined approach, from an inspection aimed at controlling the systems to a combination of on-site visits, generation of advice, and informative supporting campaigns.

The situation could still evolve and change, as many countries are comparing their ideas with the new information obtained from experiences of other countries. A gradual convergence has been achieved since 2005, considering that, at the beginning of the CA EPBD, each country had different ideas about how to implement this requirement of the Directive.

To improve inspection schemes, a SWOT analysis was carried out. Current Inspection schemes present common strengths, weak points, as well as opportunities and threats:

STRENGTHS	WEAKNESSES
• verification of actual status • concrete observation • creating awareness • provide figures from measurements	• possible high cost • measuring equipment is required • skills are missing, even for advice
OPPORTUNITIES	**THREATS**
• the inspection should include advice to improve the system • a benchmarking with respect to best systems will be very effective • the inspection may create business	• the application of the advice may not match the expectations • mistakes can occur with measurement and advice • inspections could be perceived as useless, or as a "fiscal" check • possible commercial exploitation

The lessons learned during the CA EPBD 2 can be summarised as follows:

- Inspections are a tool in a cluster of actions for reducing energy consumption and CO_2 emissions.
- The inspections must suggest energy efficiency improvements in the system being inspected; they should be combined with information and advice campaigns.
- Many Member States have opted for a combination of inspection and information to users, where the main difference is between mandatory and voluntary approach. Communication campaigns are no longer implemented in a conventional way, but combined with the promotion of voluntary inspections, check-up lists aimed at giving advice to end users, offer of small incentives, etc.
- It is not known to what extent training for basic skills for inspectors can be harmonised. Language differences are seen as a significant barrier to the circulation of experts. A harmonised profile for boiler inspectors is probably feasible over a long period, but not in the short term.

Important recommendations are already identified:

- On-site inspections should represent (at least for A/C systems) the last step in the framework of the so-called "graded inspection" scheme (pre-audit, audit, on-site inspection), expected to reach a higher level of cost-effectiveness.
- Maintenance data obtained from service personnel are useful and probably reliable enough for a pre-inspection phase. Energy consumption data could be used for benchmarking, both for heating and A/C systems.
- The on-site visit should sum up different checks: ventilation efficiency, fire risk and gas exhaust safety, CFC, EPC data collection, etc.
- As inspections are a good opportunity to give specific advice while visiting the end-user premises, the inspection report should address the non-technical final recipient:
  - It should be understandable for non-technicians (owners and tenants).
  - It should provide customised advice, suggesting cost-effective measures, mainly focused on low cost investments.
  - It should compare the actual performance with more energy efficient heating systems, and the existing system type with better technologies (renewable energies, co-generation).
- Member States should ensure that utilities, when installing smart meters, should be obliged to supply energy data to the users. Forms of legislative obligation to install energy meters on heating and A/C systems should be experimented.

Possible topics to be further investigated in the future include the following:

- Interaction between inspection and certification (producing an inspection report in combination with certification, using certification information at inspection and vice versa).
- Interaction with Eco-design of end products Directive (component characteristics and limits) and with Energy Services Directive, including cost-effective methods for identified optimum requirements for heating and cooling systems.
- In-depth analysis of the HARMONAC suggestion of a pre-audit methodology, connecting it with EN 15239, collecting A/C benchmarking values from different studies and methods, and comparing them with the actual building consumption data, as well as analysing the MS new Regulation texts for A/C inspections (some of them already adopting parts of the HARMONAC scheme);
- Analysing further simplified tools to assess actual and future (after substitution) all-season system efficiency.

CONCERTED ACTION
ENERGY PERFORMANCE OF BUILDINGS

Training

Core Theme 3

Authors:

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November 2010

1 General Information

Since its launching in December 2007, the Concerted Action (CA EPBD 2, 2007 – 2010) organised six major meetings among Member States representatives, with intensive preparatory work in between. In addition to plenary sessions devoted to issues of general interest to the 120+ participants in each meeting, it organised a total of **63 detailed technical sessions for discussing specific issues relating to one or more of the 5 Core Themes (CTs), 18 of which were devoted to topics related to "Training"**. Some Training sessions were organised in collaboration with other CTs.

The overall progression of this work has been towards ensuring the reputation of the EPBD as an effective policy instrument in the building construction marketplace through encouraging the establishment of suitable systems for regulating the **competence** and **conduct** of 'experts', comprising either assessors or inspectors[1]. It thus has a perspective beyond the technical confines of training alone, and in particular it seeks to advance the potential for harmonisation and mutual recognition of experts, and to highlight key operational procedures relevant to MS as training programmes mature.

Core Theme 3 Leader Kevin O'Rourke (Ireland) together with Paulo Santos (Portugal) were instrumental in the development of the Study Tours initiative, a new information exchange mechanism not only between CA delegates but also inclusive of a wider group of government and national agency personnel working on EPBD implementation.

Building on the experiences of the CA participants in the period 2005-2007, the initial plan of work included a long list of topics related to Training; additional topics have been identified since then by the participants. A brainstorming session at the first CA EPBD 2 meeting in December 2007 was very useful in defining the topics of interest for the MS to discuss, and their prioritisation. A high proportion of the in-depth work in delivering on these topics was carried out through a series of small working groups established over the course of the project.

This report summarises the main outcomes of these Training sessions, including conclusions and recommendations.

[1] NOTE: Unless otherwise indicated, throughout this report the term 'expert' refers equally to a person qualified to carry out a building energy certification assessment ('assessor') or to a person qualified to carry out an inspection of a boiler/ heating system or air conditioning system ('inspector') under the terms of the EPBD.

2 Programme of Work

2.1 Description of the action "Training" in CA EPBD 2

According to the EPBD (Art. 10), *certification of buildings, the drafting of the accompanying recommendations and the inspections of boilers and air-conditioning systems are carried out in an independent manner by qualified and/or accredited experts, whether operating as sole traders or employed by public or private enterprise bodies*.

How to accredit and recognise such experts is left to MS to decide. While approaches may therefore be highly variable between MS due to the specifics of the local labour markets, training and education of professionals is an issue of common interest.

In the course of the original EPBD Concerted Action, up to 2007, problem issues were identified and possible common solutions were explored but not yet finalised and implemented due to the prior need to focus on the methods and procedural aspects for energy performance characterisation. MS were able to present the systems and procedures that they are adopting or intending to adopt, and to exchange views to help them come to some degree of convergence on methods and qualifications. This would be highly desirable in itself as a visible reflection of a consistent strategic approach. In particular such convergence could lead to individual assessors or inspectors being allowed to work beyond national borders with little additional specific training (e.g., to know local regulations better) and ease local difficulties with shortages of such trained persons or improve the economic aspects of this type of activity.

It has also been appropriate and beneficial to explore and assess the approaches and experiences across MS, not only in terms of technical competences of assessors and inspectors, but also in terms of codes of conduct and behaviour. The latter is considered to be most important in the field to ensure the independence, reputation and ultimate effectiveness of the services provided to building owners by assessors and inspectors.

2.2 Activities on "Specification and Training requirements"

The approach to this body of work has been to build on the Volume/Quality/Quality Assurance paradigm developed in the first years of the CA work, 2005-2007. Energy certification of homes, non-residential buildings and public buildings, inspection of boilers and inspection of air conditioners have been addressed on a differentiated basis. In the period 2008-2010, the specifications and training issues have included assessment of operating experiences and development of guidelines in relation to:

- Specifications of fundamental and specific learning outcomes to be demonstrated by persons intending to be assessors or inspectors
- Specifications of inputs to be demonstrated by training providers by way of entry requirements, tutor qualifications, duration/ mode, materials and facilities, examination content/ process and external validation
- The content and transmission of practical advice material to building and system owners on energy efficiency opportunities
- Approaches and mechanisms for registration of assessors and inspectors, and associated registration and monitoring of service delivery
- Approaches and mechanisms for quality assurance in the field, plus continuing professional development (CPD) to maintain or improve service quality
- Approaches to codes of conduct governing matters such as service competence, diligence and ethical behaviour of assessors and inspectors
- Achieving synergies across the above differentiated tasks.

3 Actual work in the Training Core Theme

3.1 Overview of work plan

After the brainstorming session in December 2007, in order to identify the topics of most importance and relevance for participants, an initial 'shopping list' of potential topics for discussion was drawn up:

- Training specifications
- Quality assurance – interface with Core Theme 1: Certification
- Conduct
- Training delivery
- Boiler/ A/C inspections – interface with Core Theme 2: Inspections
- ISO 9001 as analytical framework
- Mutuality & recognition of assessors across MS

Quality assurance and harmonisation have been on-going issues. Several sessions have taken place around these and related topics and it is anticipated that further exploration will be pursued in the coming years.

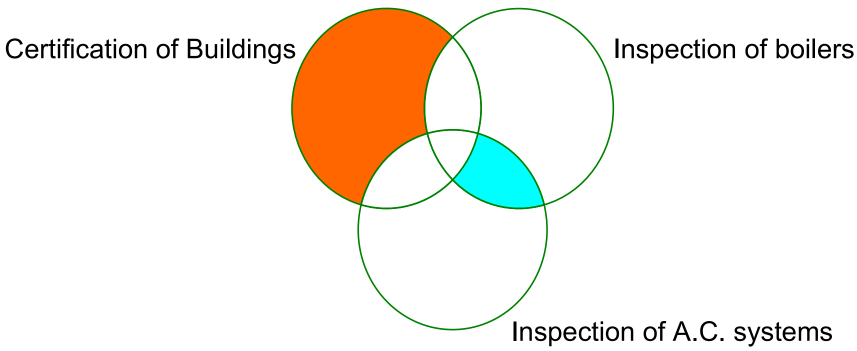
From mid-2008 to the end of 2010, effective data management and the practical establishment, operation and benefits of central registries for certificates and experts emerged as topics of increasing importance across several Core Themes, particularly CT 1 (i.e. not including inspectors as Core Theme 2 has led the examination of that topic). This was reflected in the two joint sessions between the 'Training' and 'Certification' Core Themes dedicated to these subjects, as well as the Study Tours initiative. The emphasis is not solely on data management; rather, the scope has extended to looking at the different models of central registries as enablers to the management and regulation of a quality service by experts, and of ancillary policy and planning benefits in relation to improving the energy performance of national or regional building stocks.

3.2 How many categories of experts?

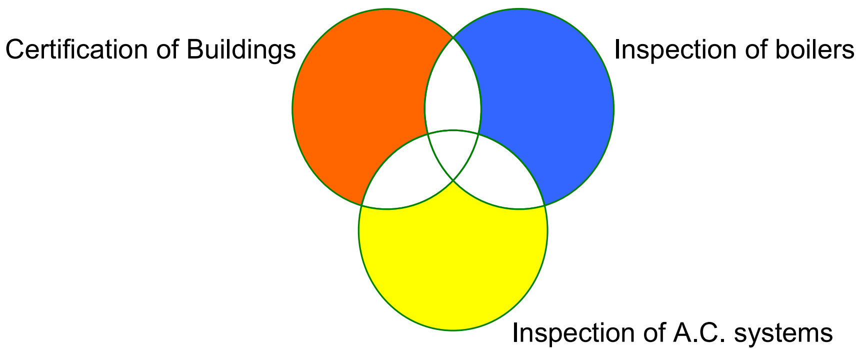
A questionnaire answered by representatives of 17 MS confirmed that the average differentiation across MS is four categories of experts, and the single most popular combination is three - building certification, boiler inspection and air conditioning inspection. One MS with seven defined categories of experts acknowledged that the distinction between mid-range and complex commercial buildings was a somewhat artificial divide which adds some further complexity in administration, as well as a possible lack of flexibility in responding to changing market conditions. At the other extreme, in a MS with just one defined category of expert, legislation is underway to create further distinctions, as a single category of expert accredited to certify all types of buildings (new/residential/commercial) was found to be negatively affecting the quality of certificates.

In general, if the approach to accreditation of experts is to automatically qualify existing professionals (engineers, architects, etc.), then it is likely that fewer categories will be defined. However, if a fully open market based approach is taken, then it is likely that more categories will be defined. The most common approach (10 out of 17 MS surveyed) was based on the following 3 generic categories: **Certification of buildings / Inspection of boilers / Inspection of air conditioning systems.** Two examples are illustrated below:

2 categories of expert: Certification / Inspection of boilers + A.C.



3 categories of expert: Certification / Inspection of boilers / Inspection of A.C.



The nature of skills required tends to relate closely to the methodology. However, even using a similar or identical calculation procedure, an obvious distinction may still be made between certification skills for new buildings (e.g. possibly desk based and not requiring a survey under national rules) and existing buildings (which will generally require a survey on site, in the likely absence of full drawings and specifications).

Another point to note is that most MS have not yet specified Continuous Professional Development (CPD) or on-going requirements for experts, probably due to the relatively early state of implementation. This is likely to become a challenging issue as feedback and practical experience emerges from the operation of building energy certification schemes.

> Numbers of categories of experts varies between 1 and 7, with on average 4 different categories defined. The most common distinction is between building certification, boiler inspections and air conditioning inspections.

3.3 Training specifications and delivery

Training specifications and delivery can be considered respectively as being ‘the rules of the game’ and ‘who plays it’. **Training Specifications** and **Training Delivery** sessions explored the diversities and commonalities of approaches in the design and implementation of training programmes to qualify experts in certification and energy assessment. (While the approaches and principles have generic validity, the focus of this work has been on skills for building energy certification rather than for boiler or air conditioning inspections.) The rules and players in the systems of acknowledging experts are defined by government, and thus training delivery and specification is to some degree defined by national legislation. The legislative approach to training delivery is a key issue when considering mutual recognition of experts and the scope and interaction of the Recognitions (2005/36/EC) and Services (2006/123/EC) Directives (see section 3.10, Codes of Conduct).

Routes to qualification as an expert/assessor vary between self-declaration of eligibility according to defined criteria, to training and/or examination. Some MS are reporting successful experiences with optional training, and in fewer cases the examination is waived if the candidate is deemed to be qualified via prior experience. An aspect of best practice must be to retain sufficient controls over the standard, quality and numbers undertaking training/examination. Too much dependency on commercial training providers has in some cases resulted in an oversupply of assessors, with mixed qualitative results. An increasing number of MS are directly administering a single national examination in order to ensure a controlled gateway to entry as a service provider and in some cases as a means of on-going maintenance of standards, usually in combination with a market based training approach. In other MS, the requirements of experts are defined legislatively and training providers are limited – usually to a small number of third level educational bodies. In some cases this has created somewhat of an initial bottleneck, where the experts are highly qualified but there are not enough in the short term to adequately service the market.

When considering the optimum approach to qualifying experts, it is interesting to note the experience of a MS with experience of energy certification of buildings prior to the implementation of the EPBD. In this instance, the approach has changed from acknowledging individual experts to acknowledging expert companies. This change in approach took place as a more efficient and more flexible scheme was sought, and it was found that there was no clear correlation between previous experience and ability to deliver a high quality certificate. There are tasks within the certification and inspection processes which are routine and can be delegated to a less-qualified individual than a building services professional with 5+ years of experience and a degree, and it was envisaged that a company accreditation approach would allow flexibility in this regard. At the end of 2010, it was too early to assess the relative merits of the new scheme in terms of certificate cost and quality. However, future developments will be tracked.

Generally, the majority of MS are delivering training through a combination of government and market actors. There is a high degree of reliance on existing professional bodies, and academic institutions to a lesser extent.

Government or nominated agency preparation of training materials has the effect of improving quality and consistency of training while simultaneously decreasing the costs of training. However it is more commonplace for a government agency to issue a training specification rather than actually prepare a detailed curriculum.

Normally training duration for assessors is between 3 and 10 days. For success, the following factors must be balanced: number of experts, quality of experts (competence and behaviour), effective system of quality assurance, and adequately specified training requirements.

Training delivery for building energy certification is through a combination of government and market actors, with a high degree of reliance on existing professional bodies and academic institutions. Training providers prepare curricula according to government-issued specification. Training duration is generally between 3 and 10 days.

3.4 Training the trainers

At the opening meeting of December 2007, there was an invited presentation by Philip Fairey from the US voluntary/ NGO residential energy rating accreditation body RESNET[2] in relation to the features, conditions and experiences of its scheme. This applies solely to experts/ assessors for building energy certification. As implementation has progressed over the two year interim period, it was timely to re-examine the RESNET strategies for ensuring high standard training is delivered through a market-based accredited training provider model.

Although, according to the principle of subsidiarity, each MS may decide its own approach to implementation, the general recognition across Europe that the quality of experts must be improved indicates that there is an issue to be tackled. Directly administered, government/national agency training programmes tend to be costly without necessarily producing the required quality of expert (cf Danish experience and recent rethinking). Accreditation schemes tend towards bureaucracy (UK), market based training can result in a variable standard (Ireland, France), and the path of self-

[2] Residential Energy Services Network www.resnet.us

certification/automatically recognising experts (Germany, Poland, Norway) is perhaps even more challenged by lack of standardisation.

The scheme administered by RESNET is a market-based accredited training provider model. In order to be able to use the RESNET scheme, commercial training providers must submit curriculum and training materials to RESNET to demonstrate that training will ensure that candidates have the knowledge base needed to become a home energy rater, and also must employ RESNET-certified trainers that pass a stringent online national rater trainer examination. RESNET delivers and administrates the national examination for trainers. In addition, continuing professional development (CPD) for trainers is specified by RESNET, along with formal training on effective vocational education for adults. Key to this 'federal' model is harmonised methodology and language, which is far from the reality across the EU. This notwithstanding, the RESNET scheme provides an example of a relatively flexible model with light administrative cost overheads which may be of value in considering a pan-European qualification scheme or even a MS scheme within its own borders. In European countries which have set mandatory training as a pre-condition for experts, similar operational models with pre-qualifications for trainers, but with less intensive oversight of trainer quality assurance, are to be found – for example in Portugal and Ireland.

> Mandatory trainer qualifications contribute towards standardised training. RESNET 'federal' scheme is dependent on harmonized methodology and language but provides a useful flexible lightweight model when considering a pan-European qualification scheme.

3.5 Guidance on high quality training materials

CA participants examined the applicability of different modes of training delivery according to the subject type. The primary mode across MS was found to be classroom based training. E-learning, as demonstrated through the RESNET model (see Training the Trainers, section 3.4) is considered to have significant potential as a medium of training delivery, both at national/regional level and in particular when considering the potential for pan-European harmonised materials and approaches.

Examples of the process of standardising training materials were examined:

- The Croatian UNDP (United Nations Development Programme) handbook;
- The Spanish approach, by defining learning outcomes and oversight of commercial/ market based training providers;
- The Irish experience of auditing commercial training providers.

Key issues identified were:

- Lack of national political will for harmonisation.
- A pan-European unitary database could at least enable the exchange of information and experience and help sharing the knowledge between MS. Access to the database should be free to all professionals that have interest in the field.
- A survey guide should be based on what to look for and where to look. The aim would be to offer a common tool describing basic needs and relevant stages of surveying work and to provide supporting materials for practice.

It was concluded that the development of such material may be worthwhile but is beyond the scope of the CA. However, the CA could provide for instance necessary and common boundary conditions and requirements, which could then be elaborated within a project from one of the EU programmes.

> E-learning is currently under-utilised in training delivery, and has potential at both national and trans-European level. A survey guide has the potential to develop as a harmonised module within a suite of training materials.

3.6 Creating opportunities for shared learning

The need for on-going training or continuous learning coupled with the acknowledgement of experts either as individuals or as companies stimulated the discussion on shared learning. This focussed primarily on building energy certification, i.e. inspections are not included. The ENFORCE[3] project (European Network for the Energy Performance Certification of Buildings) has undertaken a comparative study on replicable best practice in the training of experts. ENFORCE includes seven partners from Italy, Portugal, Spain, Slovenia and Greece working closely with the relevant stakeholders at national and European level. The training approach in Austria is also addressed by the project. A workshop with the project representatives focused participants on identifying opportunities to create shared learning across the chain of actors responsible for service quality and quality assurance in training provision and qualification of experts.

The menu of topics and potential opportunities examined in this process included the following:

Shared learning between software developers:

- Provision of standardised software modules/ templates
- Cooperation in development of software modules
- Quality assessment/ rules
- E-learning courses
- Limiting the number of companies allowed to develop approved software.

Shared learning between training developers or providers:

- Stricter enforcement of EPBD stimulates better training provision
- Develop mutually recognised (across MS/ regionally) training provision or agreements between training bodies
- Single national examination promoting minimum training standards.

Shared learning between experts:

- Develop the online community – bulletin boards / discussion forums / networking
- Support initiatives by assessors and inspectors - professional associations, competitions / recognition of expertise / best practice
- Accreditation of minimum size (10+) companies of experts
- CPD seminars

Shared learning between different groups in the quality chain:

- Avoid one-way communication only
- Cooperation between home owners (residences associations) and municipalities / local authorities
- Enforcement on minimum quality standards
- Fixing price levels (not always legislatively possible)
- Expand the range of projects similar to ENFORCE.

Within the above menu, the topics identified as offering the most promising opportunities were software training through e-learning, feedback of areas of candidate weakness in national examinations, and active on-going interaction with professional associations. Collectively such initiatives can contribute to a progressive upskilling of persons offering and delivering building energy certification and inspection services.

[3] ENFORCE, Intelligent Energy Europe - IEE project number IEE/08/599 www.enforce-een.eu/eng/

As the core theme of training of experts is taken forward, it is anticipated that this discussion will continue and broaden to include a wider range of building industry workers. Future directions include the expansion of the quality chain to include building installers and construction industry professionals, the inclusion of more MS in projects similar to the ENFORCE project, and possible extension of support by government/national agency actors to enable the shared learning of building energy certification assessors and inspectors, training providers and agencies and software developers.

> The 'quality chain' of actors should include building installers and construction industry professionals. Government and national agencies should enable shared learning of building energy certification assessors, training providers and software developers.

3.7 Requirements of experts and qualifying examinations

This topic probed more deeply into the specifications or requirements for experts set by the national authority in each MS. The diversity of requirements remains a barrier to harmonisation. In general, high entry requirements are a necessary but not sufficient condition to ensure high quality (although this is contradicted by the experience of one MS). High entry requirements do not lessen the dependency on a robust and effective quality assurance scheme. The recourse to market based training providers has resulted in a variance in the quality and standard of training in the marketplace, and therefore providing national examinations is a strategy for standardising the qualification. Acknowledging experts individually (as opposed to companies or accreditation schemes) may be a barrier to peer learning.

Some trends identified were:

- In most countries, a prior level of educational qualification is mandatory. For experts in energy certification of buildings, this is usually a university degree; for boiler and air conditioning inspectors a diploma is usually required.

- The dominant background of an assessor is engineering and architecture and as expected the background of inspectors of boilers/ air-conditioners is engineering or heating/ air-conditioning technician respectively. In the majority of cases experience is a prerequisite for experts.

- National examination and training are the most popular tools for qualifying experts.

Qualifying examinations are one of the least harmonised topics of the EPBD implementation in MS. Differentiated approaches reflect divergent starting points, past national practice, and variant structure of national legislation. Nevertheless, the majority have introduced a qualifying examination (or are planning to do so in the near future), with varying degrees of rigour. In the case of assessors, examination durations vary between 45 minutes and 4 hours with an additional practical/ case-study element.

Not all MS intend to keep the same system in the future, as some plans were undoubtedly 'last-minute'. Qualifying examinations represent a significant aspect of the quality assurance process, and as such are key to the reputation of certification and inspection programmes. The only two clear commonalities in qualifying examinations across MS are surveying and general EPBD information modules.

> Many MS have introduced, or are planning, qualifying examinations to ensure quality of building energy certification assessors across varying standards of training provision. Examination durations vary between 45 minutes and 4 hours with an additional practical/case-study element.

3.8 Harmonised profile for boiler inspections

Although EU harmonisation will be difficult to achieve for the analysis and certification of buildings, there would seem to be a better prospect for such an approach in relation to plant inspection. Boilers, air-conditioning units, and other components of heating and cooling systems are often made by large manufacturers for international markets, so greater similarities between the installations in different countries might be expected.

In the Concerted Action, efforts have been made to identify similarities between the inspection schemes being set up by MS that have chosen option A of Article 8, and identified what moves towards harmonisation were feasible and desirable. Key issues to be considered in any movement towards harmonisation were discussed and are as follows:

- what advantages may be expected from harmonisation;
- are they worthwhile in relation to the effort;
- how should existing schemes be analysed to determine common characteristics;
- what are the critical features that should underlie a harmonised scheme;
- what plans, at national and European level, should be made for effective adoption.

It was concluded that, although there were no insuperable barriers, moves to harmonisation were unlikely to occur spontaneously except, perhaps, between pairs of neighbouring countries with similar systems and traditions. Language is a major barrier. MS would need to envisage powerful advantages to induce a commitment towards harmonisation. These might emerge in time, when more experience from inspection schemes had been gained and there was a greater consciousness of their costs and benefits. Otherwise, it appears unlikely that EU-wide harmonisation would evolve in the foreseeable future, unless a Directive were to require it.

A harmonised profile for boiler inspectors will probably be feasible over a certain period of time, but it is certainly premature at this stage of development.

3.9 Towards harmonisation for mutual recognition of experts

Mutual recognition of professional qualifications is a fundamental principle of the EU and this is clearly established in Directive 2005/36/EC on the recognition of professional qualifications with regard to mutual recognition of professional experts. Although the EPBD clearly allowed countries to define an independent technical methodology for the implementation of the Directive, a certain amount of convergence of principle can be identified. However, the procedure for the training and registration of an expert within a MS is not limited solely to the knowledge of the technical methodology, but generally includes prior technical education, skills in surveying, knowledge of the local building regulations, administrative procedures, and a code of ethics.

MS have developed their own systems for the training and registration of experts. The scope of work on this topic has been to identify possible approaches to harmonisation of the systems and procedures for the recognition of experts, specifically for MS to be in compliance with the Directive for the mutual recognition of professional qualifications. At the same time, in spite of the considerable diversity in types and levels of qualifications for experts across MS, and even across regions within the same MS, there are a number of MS with similar methodologies and/ or building practices. The identification of these commonalities could facilitate the mutual recognition of experts.

The topic was not one upon which a specific conclusion could be reached. However the main points arising from the discussion were:

- There is a strong tendency to focus on the differences between the MS rather than the similarities;
- The concept of mutual recognition of experts is one which is met by resistance from MS;
- It is not clear how mutual recognition would benefit the client or end user, although obviously it could be to the advantage of the expert;
- An additional point raised during the discussion was that this did not necessarily further the aims of the EPBD, i.e. introducing mutual recognition of experts would have no direct material effect upon energy savings in buildings. Whilst there might be an economic benefit arising from a wider market of experts, there was no discernible energy benefit;

- Although it might not be practical to harmonise the technical knowledge of the expert, the route to qualification, e.g. examination, etc., could be harmonised and an EU examination could be devised, with different content for the various MS.

Many participants did not feel that this was a topic which could be carried forward with a reasonable possibility of success. A number expressed the opinion that, to date, there had not been many issues with requests for mutual recognition. At the same time, it was noted that the EPBD recast is highlighting this issue: Member States should take account of **Directive 2005/36/EC on the recognition of professional qualifications with regard to mutual recognition of professional experts** which are addressed by this Directive, and the Commission should continue its activities under the Intelligent Energy Europe Programme on guidelines and recommendations for standards for the training of professional experts addressed by this Directive. Furthermore it is to be expected that as the number of experts increases in all MS, the potential for transfer of experts between MS will also increase.

Harmonisation remains a problematic issue; but remains on the agenda as emphasised in the EPBD Recast. It is anticipated that as the number of experts increases, the potential for transfer of experts between MS will also increase.

3.10 Codes of Conduct

This topic was identified during the discussion on Training Delivery, as it was observed that the way in which MS accredit/qualify experts has consequences for the implementation of the Services Directive (2006/123/EC) and the Recognitions Directive (2005/36/EC). These and other issues of independence and conduct need careful consideration in order to ensure effectiveness in implementing the EPBD.

The figures below give a ‘snapshot’ of what proportion of MS (out of 22 MS surveyed) have Codes of Conduct for experts, and whether experts qualified in other MS are recognised.

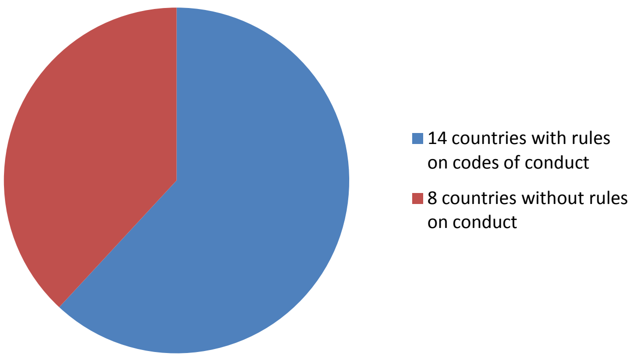


Figure 1: MS with defined rules on conduct

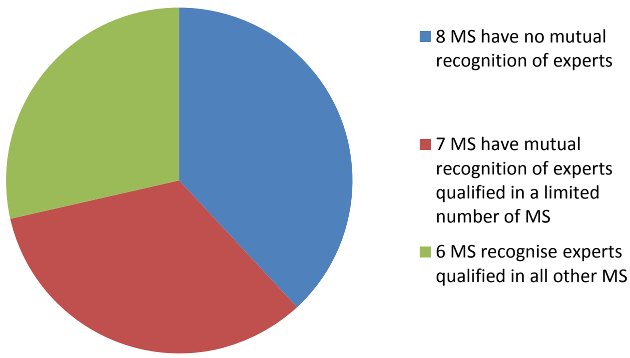


Figure 2: MS with mutual recognition of experts

In addition, the preparatory questionnaire asked participants to identify the most important issues covered by codes of conduct. The top priority issues were legal obligations and framework, insurance and professional liability, independence of conduct (conflict of interest), the relationship and obligations between experts and their clients and issues concerning costs/ fees, and guide pricing.

The following issues in defining codes of conduct for experts were considered:

Independence

Key questions addressed here are: What do rules on independence mean for the possibilities for recommending and carrying out energy savings? What barriers lie within rules on independence when it comes to promoting energy savings in buildings? How can rules on independence be set up to promote energy savings in buildings? And finally how can independence be combined with for instance ESCO activities?

Independence of experts is a major issue of the EPBD, especially in order to ensure the quality of certificates and the suitability and accuracy of the recommendations on accompanying advisory reports. Codes of conduct can address this issue by requiring that the expert makes a declaration of conflicts of interest. In addition, more stringent rules are in force in some MS, whereby estate agents are explicitly prohibited from certifying properties in which they have a financial interest, regardless of disclosure or a self-declaration on conflict of interest. It is also necessary to make clear that experts must not stand to gain financially as a consequence of the client implementing recommendations made in the advisory report. During the discussion it was concluded that enforcement of the independence rule was problematic, and that automatic acknowledgement of experts qualified in other MS may increase this challenge.

Intensity of rules on codes of conduct

There are three main ways of recognising experts. These are via government approval, accreditation/ certification, and no approval necessary. A national setup for recognising experts has consequences for which EU rules apply to codes of conduct, and therefore consequences on how intensely codes of conduct are regulated. What does intense or not very intense regulation mean for promoting energy savings in buildings? (Further discussion on Complaints and Disciplinary procedures are detailed in chapter 3.11).

Large or small companies

The national setup on recognition of experts also has consequences on whether the setup promotes small or large expert and inspector companies. Does this have an effect on the possibilities for promoting energy savings in buildings?

Complaint procedures

What level of quality may the building or system owner expect when receiving a certification for his/ her building or inspection of boiler or air-conditioning system? This is partly influenced by the national setup for recognising experts. What do differences in complaints procedures mean for the possibility of promoting energy savings in buildings?

Data security

Confidentiality vs. publicity of energy data is a theme with which every MS must engage. Obviously the more public certification and inspection data may be, then the easier they will be to use in promoting energy savings in buildings. But differing institutional arrangements across MS will lead to variable conclusions as to who should regulate data security and how does a country balance need for publicity vs. the consumer's need for privacy.

Key conclusions were:

- There should be rules ensuring that experts are independent (as required by the EPBD).
- Establish if and how the Directive on the recognition of professional qualifications (2005/36/EC) ('Recognitions Directive') applies to the scheme in question. This in turn decides the applicability of the Directive on services on the internal market (2006/123/EC) ('Services Directive') to the scheme.
- Ensure there is not a conflict between the national codes of conduct and the three Directives (services, recognitions, EPBD recast).
- Focus on rules on liability insurance, independence of conduct and prices on services. These are frequent topics within national regulations.
- MS will need to address any threat to quality that might arise if mutual recognition of qualifications were to be proposed on the basis of 'lowest common denominator' standards of competence – for example by requiring localisation training as a supplement.

> The Recognitions and Services Directives should be taken into account when setting up rules of codes of conduct for EPBD experts. Ensuring independence of experts is a high priority across MS, although there are significant challenges in enforcing this rule.

3.11 Complaints & disciplinary procedures

This is analogous to the discussion on the Quality Assurance (QA) of certificates, in that the majority of MS have not yet adopted a definitive approach, and there is a lack of practical operational experience. Therefore, the focus was on providing MS with reference points and key issues for consideration in defining, designing and implementing procedures and processes for handling complaints and disciplinary cases. Two main types of complaints were defined:

- Complaints arising as a result of the QA process – issues with conduct/professional behaviour or technical error of experts;
- Complaints originating outside the QA process - complaints about the scheme from householders, building owners, experts, members of the public.

Complaints arising as a result of the QA process account for the majority of the complaints processed. Best practice identified to date is to assign a penalty points system to different categories of mistakes with de-registration or withdrawal of an expert's licence to practice as the ultimate penalty. This results in a transparent and fair system for dealing with errors. Another key finding is that the majority of errors picked up by the quality assurance seem to be 'minor' errors – typographical/clerical rather than deliberate falsification. Not many complaints are received from the public; perhaps at this early stage the consumer is not well informed enough to know what to expect from the assessor, and hence is not in a position to complain. In one country, the majority of complaints (arising from outside the QA process) was from assessors/ inspectors registered as complaining about the amount of paperwork required!

The MS participants, faced with given complaint scenarios, agreed with the idealised process by which the complaint should be dealt with. As can be seen from the table below, there was strong agreement on how the complaints & disciplinary procedures should be developed by MS.

Who receives complaint	What is the process	What are the outcomes	Possible sanctions	Consequences / communication
The organisation that manages the scheme - NGO/certification institute	If it is easily resolved the certification body deals with it, more complex than a consumer body	New certificate issued, warning to assessor, re-examination, additional training, check assessor's other certificates, no fines but assessor should bear cost of re-issuing certificate		Communicated to all parties involved
Acknowledgement body/ consumer organisation. Provider of advice on model contract between assessor and client.	Investigation, following a defined procedure	1. No action 2. Some action necessary 3. Serious action required	Accumulated points system, remains on assessor's record for some time	For severe complaints, suspension and lower tolerance of mistakes on re-registration
Agency/ acknowledgement body	Does the assessor admit the mistake? If not, agency appoints a competent, neutral expert	1. Assessor is wrong 2. Client is wrong 3. System is wrong/ bad guidelines	If assessor not satisfied with outcome then case must be resolved legislatively	1. New certificate issued 2. Certificate remains as valid 3. Procedure is corrected
Qualifying agency/ administration body	1. Check accuracy 2. Interview assessor 3. Identify source of error	Negligence, poor quality training, misinformation from building owner	Suspension/ re-issue of certificate, retraining, owner pays for new certificate	Client/owner notified if certificate incorrect
Issuing authority	Complaint is noted, complainant is interviewed, claims investigated, report	Complaint dismissed or upheld	No consequences, temporary or permanent suspension	Communicated to all parties involved

Sanctions are in place in most MS although in general these are used infrequently. There is clear convergence on the approach to resolving complaints and applying disciplinary procedures. An appeals process is necessary but can be time-consuming and costly.

3.12 Quality assurance of experts

Participants in this work topic tried to identify the most suitable approaches, common difficulties and obstacles, and directions for planning, implementation and further development of QA systems. A questionnaire was circulated to MS in order to update some facts and figures. The general conclusions about the role of QA systems in certification schemes were:

- Certification schemes are challenging to implement and must be well planned and managged from the financial and organisational point of view. The legitimacy of each national EPBD framework depends on their quality and reliability. Certificates serve not only as an evidence of actual state and conditions: if correct, they and their accompanying recommendations provide an explicit basis for planning of improvement measures, influence real-estate market value, offer indirect information about expected operational costs, and help build up comprehensive benchmarking databases, which are fundamental for shaping of strategies on the national level.

- Without instruments for evaluation of quality of certificates it is questionable if and to what extent the above tasks are fulfilled. Also, trust on the clients' side can be compromised if no safety mechanism exists, which would offer a 'value-for-money' guarantee.

- Quality assurance systems are thus a vital component of certification schemes. They must be introduced in a timely manner, be transparent and with clear rules, and perform not only penalisation tasks but also educational and motivational ones, with the aim to constantly improve the scheme in general.

Quality assurance is a vital component for ensuring the reputation of the certification schemes. The next stage focus is providing feedback to trainers, coupled with readiness to impose penalties/ sanctions on experts who fail to deliver a consistent quality of service.

3.13 Experiences in managing central registries

Nearly all MS are running 'live' building energy certification schemes at this stage, and therefore registration and associated quality assurance systems for experts/ assessors, plus lodgement and management systems for the data on the performance of buildings and/ or heating/ cooling systems, is becoming a more central issue. An emerging issue is that minimum QA requirements specified by the EPBD recast also highlight the need for effective database management. This finding was echoed across other Core Themes (especially Certification and Inspections), and this topic will be further explored in the CA in the future.

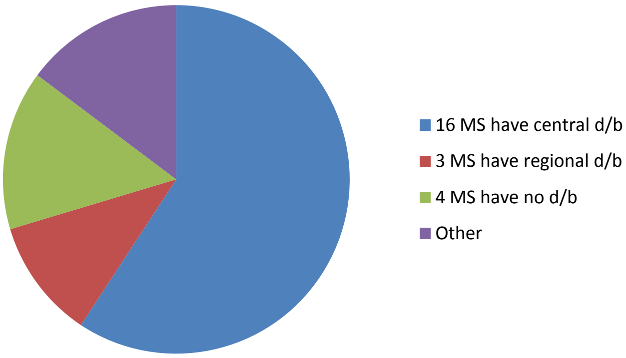


Fig 3: How many MS are opting for a central registry

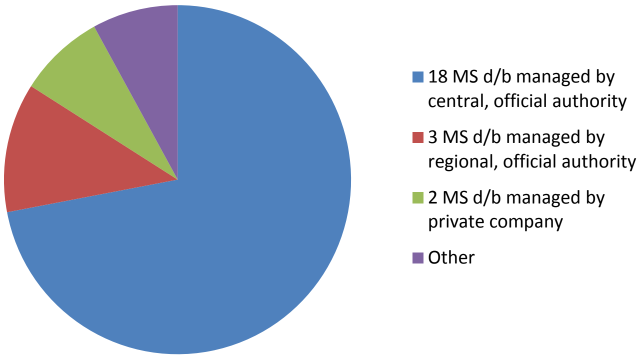


Fig 4: Responsibility for central registries

Although the majority of MS are convergent on the issue of a single central database (d/b) with oversight by the national authority, in many cases the functionality of the registry and the extent of the information gathered is very limited, which in turns limits the potential usefulness of the data arising from certification and inspection schemes.

Outcomes from this discussion included MS concerns about the set-up cost of a comprehensive IT system. Very few MS are operating a single integrated system with a range of functionalities (including billing, credit control, experts' forum and help desks/ communications centre) including direct interaction with the experts/ assessors. Although there is considerable design and financial overhead in the investment and set-up phase of such a system, there is more potential for the system to be self-financing as well as easing the administrative burden of implementation, verification of compliance, and achieving active follow-through and impact in conjunction with other national or regional policies, e.g. incentives. Identifying such self-financing or 'revenue neutral' models is likely to be a high priority topic in the coming discussions, and it is intended to explore this further, and provide MS with best practice models.

> Very few MS are operating a single integrated system with a range of functionalities (including billing, credit control, experts' forum and help desks/ communications centre) including direct interaction with the experts/ assessors. Identifying a range of financing options for set-up and operation of single integrated systems is key to progressing this issue.

3.14 Design, operation & financing of central registries

Effective database set-up and management is an issue coming to the fore across all the Core Themes of the Concerted Action. There are several distinct operational areas – training, examination, registration, software, quality assurance, finance, administration etc. – that can be brought together in a single integrated administration system.

The focus for this topic has been on the MS which have the most developed and mature administration systems, with the goal of highlighting key successes in the form of best practice guidelines. Among the summary recommendations emerging from this work are as follows:

Design of central registers

- Specify/describe all business processes in detail
- Define all information relevant to the system, including technical aspects
- Plan the project according to available resources
- Define the requirement for software developer skills
- A key interface is the interaction of the certification methodology/ software and the central registry (databases)
- Validation of data
- Definition of data relevant for others topics relating to energy efficiency (e.g. EU Energy Services Directive)

Operation of central registers

- Management of the central register should be maintained within the energy agency but day to day operation should be outsourced. Energy agency should focus on development of energy policy.
- Deciding who has access to information and the level of information available in the central register is important. Take care of privacy issues.
- It is desirable to include all inputs as well as energy performance certificate results in the database (such that a certificate could be reproduced from the data).
- Quality assurance data is particularly important for meaningful analysis and recording of findings.
- Look to possibilities for synergies with other databases/ tools on the building stock in order to maximise use of data gathered for informing reporting/ policy requirements.

- Customer support can be resource intensive. Some countries do not offer phone support but only by email.
- Volume of data storage can be an issue as file sizes may be large e.g. photos of the building.
- Use register to gather information for other requirements e.g. reporting on the Energy Services Directive (Directive 2006/32/EC on energy end-use efficiency and energy services)

Financing of central registries

- The business model and budget for the central register should be defined beforehand, taking into account the business model of the scheme.
- Self–financing model vs. non-revenue model or somewhere in between.
- For which financial issues should the central register be used?
- Fee management + invoicing management
- Think beforehand about the costs related to consulting other non-free databases (fee/consulting). These costs have to be included in the global costs of the central register.
- Think beforehand about the costs of improvement of the central registers. These costs have to be included in the global costs of the central register.
- Some MS could retrieve money from selling information from the central register to third parties.

The nature of this topic is complex and extensive, so that the discussion is not actually concluded. As certification and inspection programmes continue to develop, the multi-functional central register will become key to EPBD implementation in a manner that maximises compliance and benefits. In this regard, the pilot Study Tours initiative, described next in more detail, focused on central registers/ national administration systems.

Strategic mapping and scoping of the design of central registries is vital from the outset. Demonstrations of functionality options, and discussion of detailed finance functions and budgetary items should continue to be shared e.g. during Study Tours.

3.15 Study tours

The study tours on the topic of central registries took place in May – June 2010. Host countries were Sweden, Ireland, Belgium and Portugal. Visitor MS were Austria, Croatia, Germany, Greece, Ireland, Portugal, Malta, Italy, Luxembourg, The Netherlands, Belgium and Slovenia. The areas of highest priority for investigation were (broadly categorised) database structure, quality assurance and finance models.

The concept of the study tours was born in 2009, as a group of Concerted Action members were informally discussing work practices. During the discussion, the group agreed that there was much value to be gained from ‘hands-on' work shadowing – i.e. actually witnessing and working with the systems that different MS have developed in the course of EPBD implementation. During the CA meeting working sessions, it is often challenging to present a topic that is broad enough to interest a wider audience but also sufficiently detailed to provide value to those working closely with designing and operating administrative and technical systems supporting EPBD implementation.

In public administrations, it is a major challenge for civil servants to design fair, transparent, workable, efficient systems that are supported by legislation, accepted by and useful to the general public, and which can effect (in this case) energy savings and attitudinal shift towards a more energy-efficient built environment.

Key learning goals were declared in advance by participants, namely database structure and set-up, quality assurance procedures and financial models. Other topics of interest were certification software, data protection, sanctions, statistics, training, procedures, certification of public buildings and inspections.

The participants rated a high level of satisfaction average (4.2/5) indicative of how well these key learning goals were met by the host countries. Participants also scored each learning with respect to feasibility of implementation, that is, how realistic it would be to incorporate the measure into one's own national EPBD implementation programme. The average rating for such feasibility of implementation was 3.5/5. A specific example of a measure implemented as a consequence of the study tours information exchange was an innovative customer service technique, which resulted in a 30% time saving on the previous approach.

Participants also committed to a range of follow-through actions, the most popular of which were: meeting with decision-makers and/ or key players and reporting findings and suggestions; evaluating in more detail the feasibility of introducing opportunities identified; and reporting findings and suggestions to other authorities or entities involved in EPBD implementation in the participant's home country.

There is a saying '**The devil is in the details**' meaning that **the most difficult part of a task is in the many small details**. Study tours are designed to tackle the day-to-day details of implementation - enabling delegates to 'learn by doing', working alongside EPBD teams, clarifying procedures, identifying and replicating best-practice systems. On study tours, delegates focus on the 'mechanics' in the design and operation of day-to-day programmes to enable national and EU-wide certification and inspection regimes.

Overall, there was a very high degree of satisfaction among participants regarding the quality, suitability and practical value of the direct 'hands-on' information, experiences and insights gained through the study tours.

4 Main outcomes from the Training sessions

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Categories of experts	Convergence of majority of MS on 4 categories. Less differentiation of building categories than previously anticipated.	**Too large a variety of experts/ assessors is a barrier to harmonisation.**	Informing mutual recognition schemes across MS
Training specifications	Wide variety of specifications, in many cases legislatively defined. Convergence on **single national examination** (per category of expert) **to ensure training standards**. Continued reliance on professional associations and academic bodies.	Forms starting point for discussion of related topics and advancing harmonisation.	Codifying the modules and detailed content of a model training specification. Mapping regional potential for recognition of experts.
Training delivery	Structural approach to implementing training / accreditation programs. Mix of public and private sector providers with accreditation oversight systems. Decreasing cost of training without deteriorating quality of training is a key issue of concern.	No, but most MS have selected their solutions among a limited set of options. Role of government in oversight and examinations.	Consideration of interaction with other Directives on **recognition of professional qualifications and provision of services is important** to design of training scheme.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Training the trainers	Majority of MS recognise the need for improving the quality of experts. Goal is to identify lightweight flexible administration model for qualification of experts. Presentation and discussion of the U.S. based RESNET approach - market-based accredited training provider model.	Pros and cons of different MS approaches to qualification of experts have been identified. Improving trainer quality is an effective strategy.	RESNET may be a useful model regarding **pan-European qualification of experts. Similar models exist in some MS.**
Guidance on high quality training materials	Training delivery mode was considered in relation to type of learning material. **Classroom training is the dominant mode of delivery in MS**. Proposal for pan-European online building survey guide/ process for identification of building typology.	Actual materials development was beyond scope of CA; harmonisation/ standardisation on-going development issue.	Cooperate with other projects aimed at elaboration of a common and open EU building surveying procedure. Potential for e-learning should be pursued.
Requirements of experts	Requirements vary from building-related degree plus 3-5 years' experience to attendance at 2 week training with no prior experience. Some MS use company accreditation following ISO 9001 model. Very few MS have CPD requirements at this stage.	**National examination is a strategy for standardising the qualification of experts**.	**Boiler inspection is the most likely category of experts for harmonisation.**
Qualifying examinations for experts	Primarily a tool for standardisation and QA. Common modules among MS are surveying techniques and general EPBD information. Majority of MS convergent on solution of national qualifying examination.	Divergent starting points, past national practice, and variant structure of national legislation.	**There is very limited scope for harmonisation unless and until common certification and/ or inspection methodologies are established.**
Harmonised profile for boiler inspections	This category of persons shows the most potential for harmonisation, as recommended by HARMONAC[4]. Similarities identified. Lack of political will among MS to advance on this issue.	**Pre-inspection scheme should be linked to certification** and be adaptable to local conditions.	**Harmonisation possible but unlikely** unless required by legislation.
Towards harmonisation for mutual recognition	**Mutual recognition is a low priority for MS**; the potential benefits for increased energy savings must be identified.	CA participants are doubtful about prospects and feasibility of mutual recognitions for experts.	Future solutions to be found through common methodology and/or increased interaction between national qualification schemes.
Codes of conduct for experts	Key issues: independence, intensity of rules on codes of conduct, business configuration, data security and complaints procedures. Structural approach to training delivery defines scope of interaction between services, recognitions and EPBD recast Directives.	**Only a few MS have formal codes of conduct for inspectors/ assessors.**	Experiences in practice with procedures for disciplining, sanctions, managing complaints, appeals etc. merit detailed consideration.

[4] HARMONAC, Intelligent Energy Europe - IEE project number EIE/07/132 www.harmonac.info

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Complaints & disciplinary procedures	Not yet underway in most MS. Participants confirmed clear consensus in how an idealised procedure should be defined. Most complaints/ mistakes arise as a consequence of the quality assurance process and can be classified as 'minor' in nature (but not necessarily minor in impact).	**Disciplinary procedures are an essential part of certification** that remains to be developed in most MS. However, legislative basis for sanctions is often in place.	Developed systems not in place in most MS. **Likely procedures to follow national consumer legislation & professional association codes**.
Quality assurance (experts)	**Cost of effective QA is an issue for many MS**; examples of intensive phases (at start-up/ early stage) and lighter but effective strategies identified.	QA is an on-going issue on which exchange of MS experiences will be important.	Next stage focus is providing **feedback to trainers and experts**.
Quality assurance (certification)	Most MS at early stages of certification and therefore a lack of mature robust QA schemes in operation. Comprehensive documentation of developing QA schemes across MS	Scope to pursue further. **QA is a vital reputational/ public confidence issue**.	To be revisited when more developed systems in place
Design, operation & finance of central registers	Benefits, scope, functionality and financing of central administration system/ database set-up. Sufficient IT resources; different approaches to financing dependent on whether start-up capital is available. Possibilities for synergies with other databases/ tools and maximising use of data gathered for informing reporting/ policy requirements.	Functionality of central register becoming more challenged by QA requirements and monitoring compliance etc.	**Focus on strengthening the functionality of central registries** to enable effective interrogation of data to inform building energy upgrading actions.
Experiences in managing central registries	There is a large need for database management to improve certificate quality, enable cost-effective QA, enable compliance monitoring and provide input for national intervention programmes. Up-front cost outlay a leading issue for many MS.	Need to give MS clarity and confidence on value for money and policy benefit of strong central registry systems.	Need to continue sharing experiences and ideas, with a **focus on financial models and planning**.
Creating opportunities for shared learning	Discussion on on-going training/ continuous learning coupled with the acknowledgement of experts either as individuals or as companies. ENFORCE project informing overview of training; workshop focused on improving information exchange in quality chain of EPBD professionals.	Topic concluded for the time being; CA provided models and ideas for supporting peer learning opportunities	Expanding the quality chain of **EPBD professionals to include building installers and construction industry professionals**

5 Conclusions and recommendations

Two key objectives continue to inform the work of Core Theme Training. Firstly, to ensure the quality, reputation and effectiveness of EPBD implementation (building energy certification and inspection) in the construction and property marketplace, it is vital that Member States adopt robust arrangements whereby the service providers (experts in the form of assessors and inspectors) operate to high standards of competence and conduct. Secondly, while recognising the principle of subsidiarity, it is highly desirable that all possible opportunities are identified and appropriately pursued by Member States in respect of harmonisation of approaches and scope for mutual recognition of qualifications of experts.

Significant progress in identifying, mapping, analysing and reporting on a number of detailed priority constituent issues has been made during the course of the Concerted Action to date. The following are summary conclusions and recommendations:

- The role of experts under the EPBD should be seen as a “top up” to the qualifications of existing professionals rather than the creation of a new profession.
- Specifications and training requirements for experts are highly diverse across MS, even regionally within some MS. Requirements range from stringent (e.g. engineering degree + 5 years' experience) to self-assessment. The task of harmonisation is challenged by the variety of delivery mechanisms and qualification routes.
- Nonetheless, there is clear potential for groups of MS (linked regionally/ linguistically/ common methodology) to engage in mutual recognition of experts, and it is strongly recommended that work towards formalising the mutual recognition process is commenced.
- In particular, examination as an entry condition is an effective mechanism towards enabling harmonisation, and can offer significant opportunity to advance the harmonisation agenda.
- A solely market-based solution to training has in some instances resulted in a wide variance in the quality of the training offered by commercial training providers. In principle, while a market based approach is appropriate, it is then essential that effective methods of carrying out quality assurance of training providers are established.
- The structural approach in MS to training delivery and qualifying of experts defines the scope of interaction between the Services Directive (2006/123/EC), the Recognitions Directive (2005/36/EC) and the EPBD recast. MS need to be aware of the requirements of these Directives as this has direct impact on the legislative basis for mutual recognition of experts from other MS.
- However, irrespective of progress on such mutual recognition, there is clear benefit to EPBD implementation and reputation from the comprehensive codification of codes of practice/ conduct. An important subset of this agenda is the codification of complaints, disciplinary and appeals procedures.
- Independence of experts is especially important towards ensuring the quality of certificates and the suitability and accuracy of the accompanying recommendations. Conflicts of interest can be addressed through a combination of mandatory prohibitions and transparent declarations within codes of conduct. Experts must not stand to gain financially as a consequence of the certificate or accompanying recommendations.
- Effective acquisition and management of the data generated by implementation (registers of assessors, certificates, training providers) is a particular current challenge facing many MS. Cost-effective/ self-financing models for central registries must be presented to MS, in order to encourage development of administrative/ ICT infrastructure sufficient to facilitate the quality assurance and other requirements of the recast EPBD.

Future directions are indicated in the EPBD recast, including ensuring that ‘an adequate number of installers and builders should, through training and other measures, have the appropriate level of competence for the installation and integration of the energy efficient and renewable energy technology required’, cognisant of the ‘Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications with regard to the mutual recognition of professional experts’. Future directions for harmonisation of methodologies and experts include:

- Towards EU harmonisation – modularised training tools, examination
- Surveying skills
- Training assessors in extended fields of competence – and codification of qualifications in these fields
- Differential top up training for different foundational disciplines – architects, building engineers, HVAC engineers, building surveyors, renewable energy system installers
- Training the building workforce – installers, testers, technical HVAC systems, renewable energy systems, etc.
- Follow through/ CPD skills for assessors, inspectors, and building and equipment contractors
- Experiences in on-going management of QA
- Insurance/ legal liability risks – preventing, managing, costs
- Reconciliation with EU recognitions and professional services Directives.

CONCERTED ACTION
ENERGY PERFORMANCE OF BUILDINGS

Procedures

Core Theme 4

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November 2010

1 General Information

Since its launching in December 2007, the Concerted Action (CA EPBD 2, 2007 – 2010) organised six major meetings among Member States' representatives, with intensive preparatory work in between. In addition to plenary sessions devoted to issues of general interest to the 120+ participants in each meeting, it organised a total of **63 detailed technical sessions for discussing specific issues relating to one or more of the 5 Core Themes (CTs), 29 of which were devoted to topics related to "Methods and Procedural Aspects for Energy Performance Characterisation"**. Some of these sessions were organised in collaboration with the other CTs. As methods and procedural aspects are the basis for energy performance assessment and certification of buildings, they have been of great interest from the beginning of the Concerted Action in 2005; an average of more than 40 participants joined these sessions.

The initial plan of work included a long list of topics related to Procedures; additional topics have been identified since then by the participants. A brainstorming session at the first meeting in December 2007 was very useful in defining the topics of interest for the Member States' representatives to discuss. A final review session was organised in September 2010 and resulted in feedback that is also incorporated into this report.

This report summarises the main outcomes of these Procedures sessions, including conclusions and recommendations.

2 Programme of Work

The Core Theme Procedures works on topics related to the Articles 3 to 6 of the EPBD (2002/91/EC). According to the EPBD, *Member States shall apply a methodology, at national or regional level, of calculation of the energy performance of buildings. Based on this methodology, Member States shall take the necessary measures to ensure that minimum energy performance requirements for new and existing buildings that undergo major renovation are set.*

The European Commission has given to CEN[1] the mandate to develop a set of standards for assessing the energy performance of buildings. Due to the short time between the issuance of the mandate and the

[1] European Committee for Standardization www.cen.eu

implementation deadline, most Member States further developed their own national standards, as the CEN standards were still in the developing phase. Therefore, the methodologies used in the Member States are differing greatly, including the use of calculated and measured energy performance assessment. Thus, national minimum requirements dependent on the methodologies cannot easily be compared among the Member States.

3 Activities under the Procedures Theme

The activities included many aspects of the development of procedures, their practical application and verification, as well as the European activities on harmonisation. The most important topics discussed during the CA EPBD 2 are listed below:

- High performance buildings
    - Definitions
    - Occurrence
    - National roadmaps
    - Low-energy buildings in Southern European climates
- Comparison of national requirements
- Setting minimum energy performance requirements
    - Cost-benefit assessment methods
    - Cost-optimal framework of the EPBD recast
    - Minimum requirements for technical systems
- National procedures
    - State of the art
    - CEN compatibility
    - Advances
    - Software applications
    - Changes in national procedures after the implementation of the EPBD (status 2010)
- Measured energy performance rating
    - Procedures
    - Benchmarks
    - Parallel use of calculated and measured energy rating
- Feasibility analysis of alternative systems
- Procedures for specific certification challenges
    - Recommendations
    - Complex buildings
- Special issues
    - Thermal bridges
    - Infrared thermography
    - Climatic correction factor with focus on cooling

Some of the topics were arranged in cooperation with the other Core Themes and are therefore also described in their relevant chapters. These topics are described from the point of view of the respective Core Theme.

3.1 High performance buildings

High performance buildings constitute a growing part of the European building stock; 2/3 of the European Member States include them in national roadmaps as the goal for future new buildings. Various terms for high performance buildings are used in the countries. By comparing the definitions or the calculation procedures of the building types, it became clear that for many terms no real definition exists, and for most others the definitions differ among countries.

- Bioclimatic House	- Passive house
- BREEAM Building	- Plus Energy House
- Carbon Free House	- TBQ: Total Quality Planning and rating
- Climate: Active House	- Triple Zero House
- CSH: Code for Sustainable Homes	- Ultra Low energy House
- Eco-Building	- Very Low Energy House
- Emission Free House	- Zero Carbon house
- Energy Saving House	- Zero Emission House
- Energy Self-Sufficient House / Energy Autark House	- Zero Energy House
- Green building	- Zero Heating Energy House
- Lider A	- 3 - Liter House
- Low Energy House	

Figure 1. List of identified terms for high performance buildings used in the EU Member States.

Additionally, special attention has been devoted to low-energy solutions for Southern European climates, where cooling becomes much more important.

3.1.1 Main conclusions

- At the time of the enquiry, in spring 2008, 23 different terms for high performance buildings were identified across Europe.
- There is a strong need for the harmonisation of terms and definitions, and also for the assessment of existing definitions in comparison with the official calculation methods. Market confusion needs to be avoided through, e.g., parallel certification.
- The definitions of high performance buildings should not limit the technological options which can be used to meet performance requirements.
- The existing definitions are often not based on national calculation procedures, and the buildings can therefore not easily be compared with the EPBD rating. All countries stated that examples of one or more high performance building types have been realised in practice within the country. Two thirds of the countries have a national roadmap that includes one or more types of high performance buildings as the goal for future new buildings.
- Seven of eight countries of Southern Europe that responded to a questionnaire reported that there exists no national definition for a low-energy building. The minimum requirements used focus only on the envelope and shading; overall requirements or requirements for technical systems are missing. However, a minimum fraction of solar energy for domestic hot water is prescribed in the building regulations of many countries of Southern Europe.

3.1.2 Future directions

The next steps on the way towards harmonising the terms and definitions can be:

1. A comparison of the definitions of high performance buildings with the national EPBD calculation and the resulting certification labels. Are all high performance buildings really class A buildings?
2. A clarification of the terms and definitions, as well as a dissemination of the knowledge to the building professionals, the public (building owners) and, last but not least, to national and international policy makers.
3. A review of national funding policies for high performance buildings.

4. A review of the national roadmaps, concerning the realisation of the planned goals for buildings. What are the necessary steps in order to secure a smooth transfer of national requirements until the high goals are reached, what costs will result from it, and is the industry able to provide the necessary technologies and strategies?
5. Focused efforts to help the smoother implementation of low-energy buildings (nearly zero-energy buildings) in Southern Europe.

There is a strong need for the harmonisation of terms and definitions of high performance buildings. These definitions, however, should not limit the technical options and innovations. Parallel certification schemes for high performance buildings (in comparison with national energy performance certification) result in market confusion; this needs to be absolutely avoided.

The market penetration of high performance buildings in Southern European countries is significantly lower than that in Middle and Northern European countries. In order to meet the EPBD recast target of nearly zero-energy buildings by 2020, most Southern European Member States will have to bridge a larger gap.

3.2 Comparison of national requirements

During the period 2008-2009, the CA participants discussed five different studies on the intercomparison of national energy performance requirements, mostly between neighbouring countries. All studies have been used as a preparation for a tightening of national requirements. Additionally, the IEE project ASIEPI[2] presented the developed concept for comparing national requirements.

The discussions were rather lively, and focused on the methodologies that were chosen for the comparison of the different requirements; they also focused on the influence parameters which have been analysed in different depths within the studies. Also, the way in which the results were presented was disputed. The main discussion points can be summarised as follows:

- An intercomparison study includes so many different influence parameters, that it may never be a fair and robust comparison of national energy performance requirements.
- Influence parameters include climate data, national calculation procedures, national default values and choices that have to be made during calculation, building tradition, used and allowed building system configuration in the countries, detailed assessed energy parts in the calculation method (energy needs, energy use, primary energy), national primary energy factors or CO_2-factors, values for building system performances used in national calculation procedures, airtightness values and thermal bridges values, solar shading factors, internal gains and usage times, set room temperatures, different calculation methods for floor and building component areas and volumes (internal or external dimensions, etc.), etc.
- It is not appropriate to present the results of an intercomparison study by reducing it to required U-values, as it takes away the influence of the building systems. Europe has already made the step from U-value requirements to primary energy performance or CO_2 emission requirements within a holistic, integrated approach.
- It is necessary to use more than one basic building for a complete overview. Different building types and different building systems will probably make the overview more complex, but also more correct.
- The methodology of some of the studies was partly influenced by the expected results.
- The offered national incentives might round-up the overview of national requirements
- If intercomparison studies also include cost influences, the experts having performed or initiated these studies so far are afraid that this will become even more complicated.

It is unclear whether it will ever be possible to find a fair scientific comparison. A global comparison may be possible, but fair and robust? A further problem is that national requirement levels and calculation

[2] ASIEPI Intelligent Energy Europe - Project number EIE/07/169 Assessment and improvement of the EPBD impact (for new buildings and building renovation) www.asiepi.eu

procedures are changed so often. Thus, any intercomparison study can only be a 'snapshot', an overview of the actual situation, which might be out-dated even before the comparison has been finalised.

Most of the intercomparison studies, however, did have an influence on the national energy performance requirements of the country that initiated the study. The results gave arguments for a tightening of the requirements, as other countries seemed to have more severe requirements.

The work in the IEE ASIEPI project did not only show how difficult an intercomparison study is. It also pointed out how many influence parameters have to be taken into account, and gave a first impression of how big the influence of different parameters is.

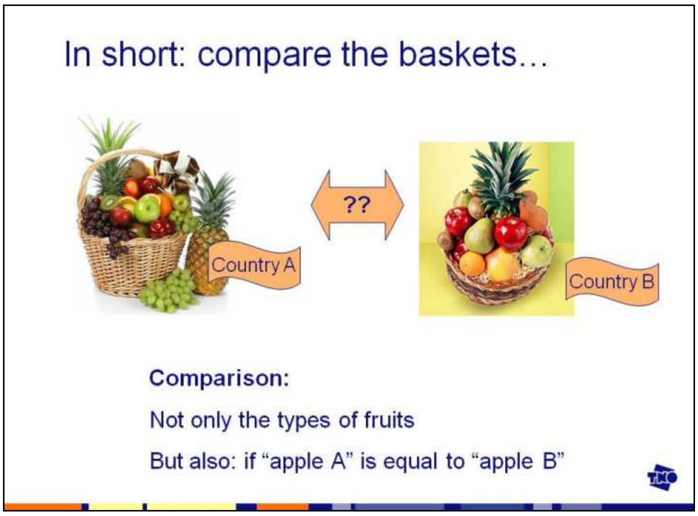

Figure 2. Presentation slide illustrating the challenges for the comparison of energy performance requirements in different Member States by using a comparison between two fruit baskets.

3.2.1 Main conclusions

Experiences from the studies showed that intercomparisons are influenced by many different parameters, including national calculation procedures, boundary conditions like user behaviour, the climate, the used base case technologies, building types and building geometry, and even simple issues like the definition of the reference floor area. There is currently no robust, simple and fair method available for the comparison of different national requirements. The participants pointed out that the situation might get even more complicated if cost assessment is added to the comparison. The studies should include the potential impact of the various influence parameters.

3.2.2 Future directions

The IEE ASIEPI project has completed its work regarding the comparison of national requirements, and has developed and tested a conceptual methodology for such comparison studies. All project results are presented on www.asiepi.eu and www.buildup.eu.

Some topics still need further discussion, such as:

- Weather correction for calculated and measured energy performance, with special regard to cooling.
- National studies for cost-optimal minimum energy performance requirements.

> There is currently no robust, simple and fair method available for the comparison of national requirements. The situation might get even more complicated if cost assessment is added to the comparison.

3.3 Setting minimum energy performance requirements

In order to improve the understanding of how Member States choose the levels of minimum energy performance requirements, discussions focused on three different issues:

- Types and basic principles of cost-benefit assessments.
- Methodology for the cost-optimum calculation of national requirements as defined in the EPBD recast.
- Minimum requirements for building service systems.

The instruments of energy policy may be assessed from a variety of perspectives. For minimum energy performance requirements for buildings (for brevity often referred to as 'building energy codes' – or 'building energy regulations'), the most relevant are:

- Economic: to assess costs and benefits to society. These may include costs and benefits that are not adequately reflected in the market prices. The most obviously relevant of these is the expected cost to society of the climate change resulting from greenhouse gas emissions. The focus for this type of assessment is cost-effectiveness seen from the perspective of society as a whole.
- Financial: to assess costs and benefits from the perspective of an "economically rational" purchaser. The measures that seem to be financially worthwhile on the basis of "rational" financial assessment, but are not actually taken up, are an established feature of building energy efficiency. Here, the issue is the cost-effectiveness from the perspective of building owners and their agents or proxies.
- Accelerated technical development: to assess the value and cost of an increased rate of development and implementation of relevant novel technologies. This could be justified from either an economic or a financial perspective but, in either case, there are likely to be considerable uncertainties of costs and benefits.

Two common errors in cost-effectiveness assessments of energy saving measures need to be guarded against: the "bundling" of different measures into single packages, and the choice of inappropriate baselines.

Most Member States already carry out either financial or economic cost-effectiveness calculations in support of the requirements. Many do both. A significant minority reported that they do not use such methods.

According to Article 5 of the EPBD recast, the European Commission shall establish a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements. The Commission presented as a first draft the possible key steps of this framework methodology to be:

- Selection of reference buildings.
- Definition of energy efficiency packages (i.e. sets of measures).
- Calculation of the energy use of a building or building element.
- Cost calculation according to the net present value, which includes the global cost calculation, the definition of the calculation period, the definition of input parameters for the cost calculation, and a sensitivity analysis.

Many Member States already apply processes similar in nature and purpose to those presented. Others are at an early stage of applying cost-effectiveness calculations to the building energy performance standards. Therefore, the ideal outcome would be a process that is simple yet robust, while also being as consistent as possible with the existing established procedures. Ideally, it should have sufficient flexibility to accommodate the established procedures and to be considered by the Member States as an acceptable compromise between complexity and rigor.

In addition to minimum energy performance requirements on the building level and possibly on the building envelope, most Member States have set requirements for building service systems. Those requirements vary in detail (whole system or component level) and rate of use in the countries. The minimum requirements of the technical building systems and lighting elements are covered by the

2005/32/EC, 2010/30/EU Ecodesign and Ecolabel Directives. Also, the 2010/31/EU EPBD recast requires Member States to set requirements for the system. It remains to be seen exactly how overall system requirements will be defined, as they are dependent on the interaction of various components of the building.

3.3.1 Main conclusions

Cost-benefit assessments for setting requirements can be performed from different perspectives. Most Member States are already fixing their requirements based on either financial or economic cost-effectiveness calculations. Many follow a procedure similar to the planned methodology for the cost-optimum assessment of the EPBD recast. The ideal outcome would therefore be a process that is simple yet robust, while also being as consistent as possible with the existing established procedures.

3.3.2 Future directions

Concerning the overall building service system requirements, the interface between product performance information and system performance calculation seems worthy of further investigation, concerning, in particular, product information, such as part load efficiency, to be used in EPBD calculations.

> The cost-optimum methodology should be simple yet robust, while also being as consistent as possible with the established procedures in the Member States.

3.4 National procedures

Currently applied national procedures, as well as the timing and content of further developments, have been described and compared. This included a reflection in 2010 on changes in national procedures after the implementation of the EPBD in several Member States. In-depth discussions have also been held on the set of standards prepared under the European Commission's mandate to CEN to support the EPBD. These standards were mostly published in the years 2007-2008. There was a detailed discussion on whether the CEN standards are taken into account by the national procedures -and on how this is done-, and a dialogue was also maintained with the participants of the IEE project CENSE[3]. The result was that there is no country that uses a one-to-one transfer of all CEN standards into their procedures, but many countries use a CEN compatible approach. Many reasons were given for not using the CEN standards more extensively:

- Difficulty of converting into practical procedures: CEN standards include alternative paths. National procedures mostly fix one path.
- Inconvenient structure: CEN requests to include the national boundary conditions as an annex. Countries prefer to have the boundary conditions integrated in the standard. Therefore, a national standard is written, which takes the CEN elements into account, but is no longer a CEN standard.
- Timing: Implementation decisions had to be made before standards were available.
- Copyright of CEN standards: Some countries insist that national procedures should be available for free.
- Some CEN standards do not cover the whole challenge of the EPBD. An example for this is the lighting standard EN 15193, which is applicable for existing buildings, but not for the building design phase. The countries needed to develop their own method for this.
- The CEN procedures may form a barrier for swift national responses to movements or opportunities in the market.
- In some Member States, the building code writers are not involved in CEN standards writing.

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[3] CENSE Intelligent Energy Europe - Project number EIE/07/069 Leading the CEN standards on energy performance of buildings to practice – Towards effective support of the EPBD implementation and acceleration in the EU Member States www.iee-cense.eu

Other conclusions from the discussions are:

- There is a need for a simplification of the standards, though that applies more to the data requirements than to the calculation methods.
- Some standards are unsuitable for existing buildings, where the need for simple, practical and cost-effective methods is paramount.
- The Energy using Products Directive, the Environmental Liability Directive, and possibly other directives, introduce requirements for performance testing of energy-using products. Where such products are installed within buildings the results are relevant to the EPBD calculations and should be allowed for in the standard methods.

The following remarks and suggestions to CEN have been worked out:

- A technical review of each standard is needed, in terms of scope and relevance, identifying any gaps or overlaps, as well as inconsistencies.
- In order to avoid ambiguities, and for a more efficient use of the standards, it is recommended that CEN leaves no loose ends in the procedures: for each variable, it should be made clear whether the input is expected from another equation, from another standard or to be provided nationally.
- Calculation results should be confirmed in terms of producing realistic results.
- It would also improve the transparency of the calculation procedures if all standards had a similar structure, distinguishing general procedures, specific detailed procedures (e.g. allowing for national options), as well as (e.g. partly national) input and boundary conditions.
- The Member States are most interested in a harmonised framework (methodology) that allows national differentiation.
- Standards should be distinguished from complementary guidebooks.
- The planning of the future steps of CEN and ISO should be transparently communicated.
- Revised standards should be tested against acceptance criteria set by a Liaison Committee, representing the EPBD implementing bodies, before proceeding to the voting stage.
- In the future, the standards will be mainly applied by computer software. Standards writers should have this in mind.

The above recommendations were presented in brief to the European Commission and CEN in a meeting hosted in May 2010 by the Directorate General for Energy. They were communicated in detail to both parties, and were instrumental in shaping the Commission's mandate for the 2nd generation of CEN EPBD standards.

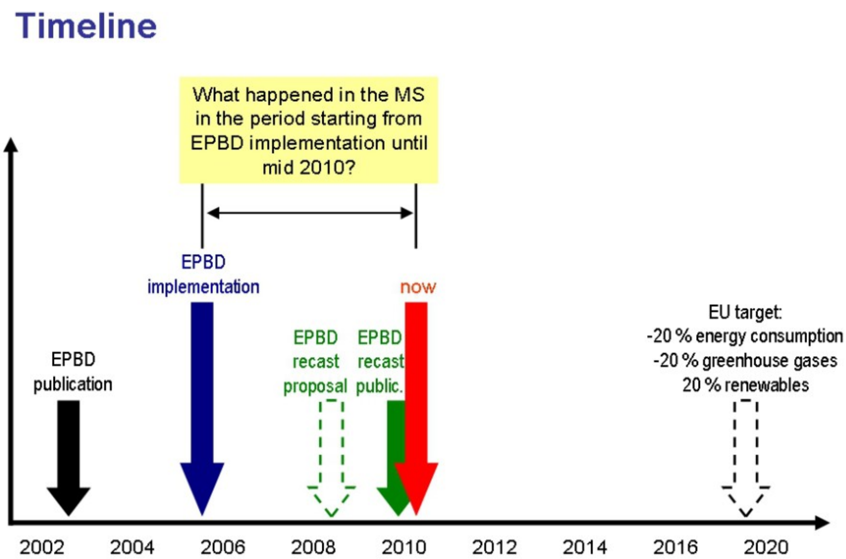

Figure 3. Diagram presenting the analysed period of changes in national EPB procedures.

In 12 of the 24 countries responding to a survey carried out in 2010, changes in the EP procedures have been already realised since the first national implementation of the EPBD. Nearly all of those countries which made changes have tightened their EP requirements (10 out of 12 countries). Furthermore, 7 countries reported that, due to the changes, the new procedure is CEN conform.

Different approaches to the summer comfort estimation and the cooling demand calculations are used in the EU Member States. A working group has analysed the requirements for, e.g., the calculation time step and the zoning of buildings in the Member States calculation procedure, based on a form filled by the Member States. It was clear from the discussion at the meeting that no Member States believed or claimed that they have already found the right or best balance in the optimisation of time-cost-accuracy related to their cooling demand calculation procedure.

Calculations can be done using the standard EN ISO 13790:

- monthly calculation
- simplified hourly approach

Different approaches on minimum requirements for summer thermal conditions are used in the countries (temperatures not higher than X °C in Y % of occupancy time; temperatures lower than X °C in Y % of time). The countries are concerned about time consumption, complexity and feedback from practice if they require too much of the calculation procedure regarding zoning for the calculation of summer conditions and cooling demand.

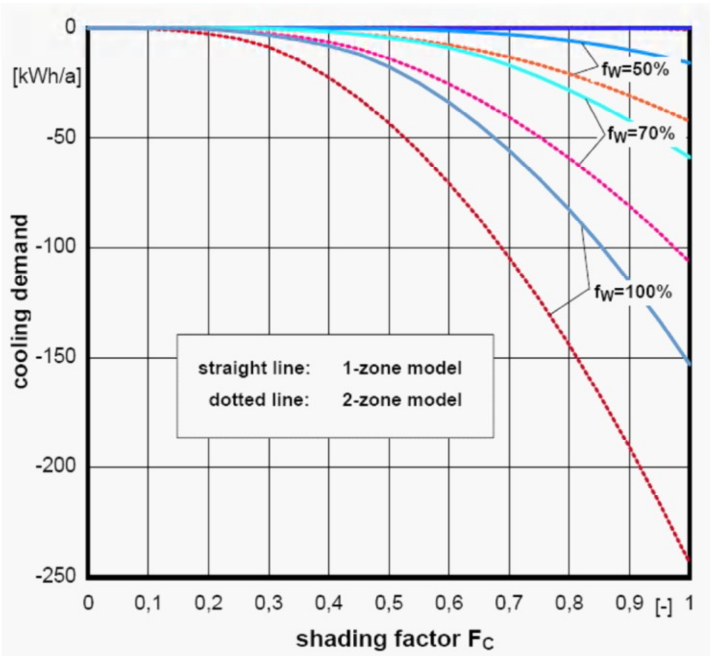

Figure 4. Comparison between the cooling demands of a 1-zone model and a 2-zone model calculation for a sample office with heavy constructions situated in Würzburg, Germany. The orientation of the facades was north-south. Windows: Uw = 1.4 W/(m²K), g = 0.6, f_F = 20 %. Active sun protection. Internal loads 0 W/m². Cooling if Ti > 24 °C. The window fraction (f_W) was varied.

Most national procedures are applied as software programmes. The discussions on the available software concentrated on quality control and accreditation, as well as on the necessary level of input data for assessing the summer performance, especially whether multiple zones are necessary. One-zone models can be problematic for summer comfort and cooling, as they underestimate the cooling demand and the overheating period. Figure 4 shows that there is a considerable difference between the cooling demand in a 1-zone model and a 2-zone model. Also, it is evident that the 1-zone model is not on the safe side, as it produces a lower cooling demand instead of a higher cooling demand. Multi-zone models solve these problems, but require increased efforts and may need simplifications. Many countries, but by no means all, are using the EN 13790 monthly calculation procedure. However, it does not cover HVAC or lighting systems. The EN 15265 testing procedure is not intended for monthly calculation methods (although the EN 13790 monthly method is understood to meet the consumption requirements – at the lowest level of acceptance).

Four of the nine countries responding to a questionnaire indicated that accreditation measures for software tools were in use or planned. Of these, most included the use of sample buildings. Possible further actions concerning the quality control of software applications are:

- Agreement on principles for a suite of sample buildings.
- Filling of gaps in accreditation tests.
- Recommendations for the reporting of intermediate calculation values.
- Sharing experience from beta-testing and live application of software.
- Define a scope for EU-wide standards test procedures or certification routes.

There is no country that uses a one-to-one transfer of all CEN standards into their procedures, but many countries use a CEN-compatible approach. Most national procedures are applied as software programmes. However, software accreditation seems to be conducted in only about half of the Member States. There is no best solution so far for the optimisation of time – cost – accuracy related to the cooling demand calculation.

In 50 % of the countries responding to a questionnaire, changes in the EP procedures have been already realised after the implementation of the EPBD. The implemented changes are rather diverse, having, however, some general directions:

- tightening of requirements
- conformity to or direct use of the CEN standards
- correction of weaknesses/gaps in the earlier EPBD implementation procedures
- inclusion of additional technologies

3.5 Measured energy performance rating

Several Member States allow measured energy performance rating for existing buildings. There is a need for a simplification of the certification procedures and measured energy performance is perceived as a way to save efforts and money. The countries are mostly aware of the advantages of measured energy rating, but are often not aware of all the risks arising from it. There is no common method, neither for the normalisation of measured energy and for the check of the data quality nor for ways for dividing the measured energy into different uses. Additional information on the use of measured energy performance rating can be found in the Core Theme 1 Certification report.

Different systems for the benchmarking of measured energy rating exist in the Member States. In order to further develop these systems, some countries need to find more benchmarks and/or more subcategories, whereas other countries plan to reduce the number of subcategories in order to facilitate the rating.

Most countries answering the questionnaire on measured energy performance use or intend to use the measured energy rating at least for some types of building and at least for some purposes. Its use is not only for certification, but also for preliminary diagnosis, energy saving recommendation or additional information in the certification process. The building categories covered or intended to be covered by measured rating are mostly public buildings, but also apartment blocks. In some countries, family houses are also involved in measured energy rating, but the way of handling the influence of the inhabitants' behaviour in small buildings with one user was not explained.

The countries mostly have no experience with measured energy performance rating, and the existing national methods are rather simplified. In 7 countries, a national standard or guideline on measured energy rating other than the EN 15603 is used. Only in few countries the national method for measured energy rating complies with the EN 15603, and no country has created a national annex to the EN 15603. There is a need for an amendment of the EN 15603, to better support measured energy rating. Some countries prefer to improve their national method for measured energy rating.

In terms of normalisation, only few countries take into consideration internal heat gains, internal temperature and ventilation rate. In some countries (4), measured energy rating is a part of the energy performance certification scheme or of the preliminary energy diagnosis, but no normalisation of measured energy is identified and used. Some countries have special requirements for data quality (7), but these are mostly based on recommendation, not set at legal basis.

The problem of how to divide the measured energy into different uses is solved in a very simplistic way. In some countries, all energy is included (7), or separate measurement per use is required for the measured energy rating.

The CA worked to identify procedures and best practice on benchmarking systems, and to give a basis for the improvement of (existing) systems. Many Member States have initiated a benchmarking system to analyse the energy consumption of the building stock. Some Member States have initiated a benchmarking system with good information on the energy consumption of the building stock, and some others with limited information. However, benchmarks were created on the basis of -or partly on the basis of- statistical data; the benchmarks were found by calculating an average value. In some cases, a system was not developed, but an already existing system was adopted.

Many benchmarking systems are based on the final energy consumption, and cover the overall result of the energy used for heating, hot water, cooling, ventilation and built-in lightning. The energy consumption for heating and electricity is often treated by at least two numeric indicators, and in some cases by one combined numeric indicator. A typical difference in the benchmarking systems of the Member States is the number of different categories of benchmarks that are taken into account. The numbers of benchmarks range from less than five to even more than 30. Often, the categories are identical or almost identical to those in the annex of the EPBD. In one case, the benchmarking system was developed on the basis of customised benchmarks. The approach for the generation of the reference values takes into account the actual use of the building (the building is divided into zones), the use of mechanical ventilation and cooling, as well as special uses like IT, elevators or kitchens.

Pros on benchmarking systems are:

- In order to build up a benchmarking system, it is not necessary to have detailed information on the energy consumption of the building stock. It is good enough to have a partial knowledge about the building stock energy consumption, based on statistical data.
- Some Member States already had information on the building stock energy consumption, based on statistical data, before developing a benchmarking system.
- Some Member States used or partly used an already existing system.

Cons on benchmarking systems are:

- The need for a kind of statistical basis of the building stock energy consumption is common in all benchmarking systems. This data must be collected and analysed.
- The statistical analysis of the energy consumption of the building stock in order to get a benchmark usually leads to a typical/average energy efficiency level of benchmarks. Best practice/very good energy efficiency levels of benchmarks are only used in two Member States.
- The need for some kind of improvement after a certain time period or while experiences are gathered is common in many benchmarking systems of the Member States.

In order to improve the existing benchmarking systems, it is necessary to:

- either find more benchmarks or to reduce the number of benchmarks (depending on the country's approach)
- either find more subcategories or to reduce the number of subcategories (depending on the country's approach)

Some of the experiences of the Member States related to creating and improving a benchmarking system have a general character and can be transferred to other systems. In order to have a functional benchmarking system, it is necessary to have benchmarks that cover:

- Typical building categories of a Member State. To achieve this, the building stock must be analysed and described in a building-typology.
- Typical sizes of buildings. The benchmark of a specific building category sometimes varies depending on the buildings' size. For this reason, in some building categories there can be a differentiation between smaller and bigger buildings.
- Typical subcategories in terms of use. Depending on the building stock, it may be necessary to take into account typical subcategories such as:

- Schools: elementary schools, secondary schools etc.
- Administrative buildings: ministries, public office buildings, general office buildings, bank buildings etc.
- Typical technical standards. Depending on the building stock, it may be necessary to take into account typical technical standards, such as natural ventilated or air-conditioned.

Many buildings have mixed uses, such as an office building with a restaurant, and are not covered by the benchmarks themselves. In this case, a mixture of two benchmarks (one benchmark for office buildings and one for restaurants) can be calculated for these buildings from the benchmarks for the different uses, weighted by the floor area of each use.

A typical approach for improving a system in the Member States is to gather experience with a certain system and to update the benchmarks when more statistics and experiences are available. The typical problems are:

- Finding a reliable data source.
- Finding a representative number of consumption data for each building type.
- The quality of consumption data is often poor.

The parallel use of calculated and measured energy rating was also discussed. Only very few countries use both rating systems in parallel, and they reported on their experiences. Differences in the ratings result mostly from different user behaviour in practice, compared with the standard user profiles in the calculations.

3.5.1 Main conclusions:

The most important aspects actually considered and taken into account for the normalisation of measured energy performance identified from the questionnaires are:

- Climate
- Building size
- Building type, closely connected with hours of operation and pattern of use.

3.5.2 Future directions:

To handle the problems concerning the benchmarks for measured energy performance, a high quality database-management is needed. Special attention should be given to:

- Requirements for the quality of the data used for measured energy rating and benchmarking.
- Normalisation procedures, including weather correction procedures.
- Division of measured energy into different usages, and exclusion of those energy uses that are not part of the EPBD procedure.
- Ways to derive recommendations for improvements, based on measured energy rating.

The countries are mostly aware of the advantage of measured energy rating, but are often not aware of all the risks arising from it. A common method for the normalisation of measured energy is missing as well as data quality checking procedures and ways for dividing the measured energy into different uses.

Some countries plan to add more benchmarks and/or more subcategories, whereas other countries plan to reduce them, in order to facilitate the rating procedures.

3.6 Feasibility analysis of alternative energy systems

The feasibility study requirement is transposed into the national legislation of the 27 EU Member States in various ways. It is not clear in every case neither how the quality of the feasibility study is guaranteed nor who is responsible for the control. Thus, it will not be easy to have a European-wide standardisation of the procedure and the compliance of the requirement. The IEE project SENTRO[4] has developed a handbook, as well as supporting tools, like checklists, etc., that shall help to standardise the process. Without a proper compliance system in place, the feasibility study requirement poses the risk that the calculations/reports are made indeed, but there will not be much impact in practice. The key factor in the whole process is the timing of the feasibility study: it has to be carried out in the pre-design phase, when the strategic decisions are being made.

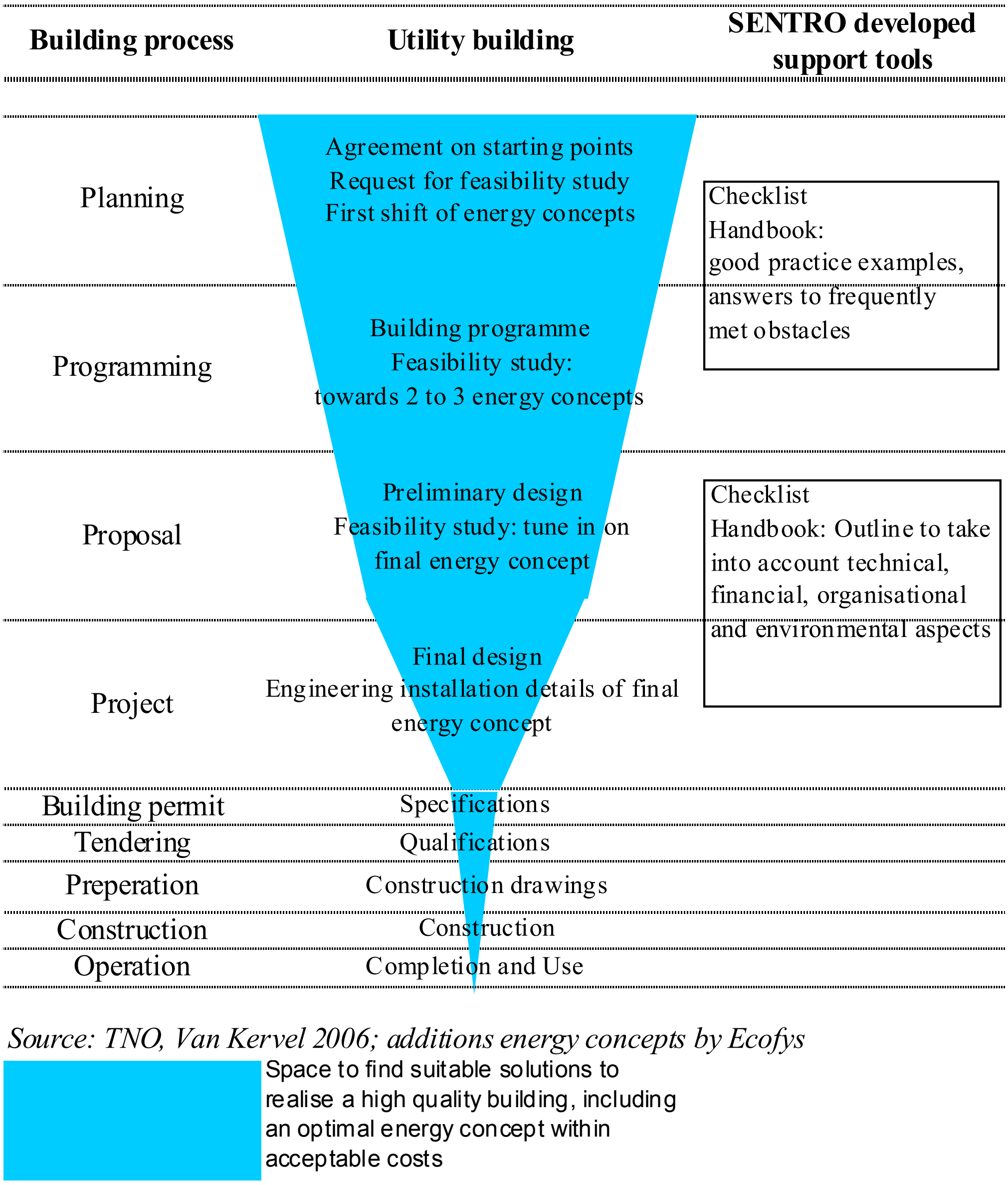

Figure 5. Space for suitable solutions for the realisation of a high quality building, including the optimal energy concept and the developed support tools, taking into consideration alternative energy systems.

[4] SENTRO Intelligent Energy Europe - Project number EIE/06/102 Sustainable energy systems in new buildings - Market introduction of feasibility studies under the Directive on Energy Performance of Buildings www.sentro.eu

3.6.1 Main outcomes:

- The feasibility study requirement (Article 5 of the EPBD) is transposed into the national legislation of 27 EU Member States in various ways. This implies that it will not be easy to have a European-wide standardisation of the procedure and compliance with the requirement.
- The approach developed within SENTRO, including its supporting tools, is an initiative towards standardisation. In particular, the handbook is a protocol: it specifies how to perform a high-quality feasibility study of alternative energy systems in buildings.

3.6.2 Future directions:

More attention is needed to be paid to the assurance of the quality of performed feasibility studies of alternative energy systems, as well as to the assurance of compliance.

> The key factor in the whole process is the timing of the feasibility study, which has to be carried out in the pre-design phase, when the strategic decisions are being made.

3.7 Procedures for specific certification challenges

Recommendations for energy improvements of existing buildings are derived in different ways in the Member States, inter alia:

- The use of either calculated or measured energy rating.
- Standard recommendations to choose from, or individual recommendations made by the issuer.
- Inclusion of energy and/or cost data.
- National software that proposes recommendations automatically.

National presentations offered the chance for exchanging practical ideas on how to develop suitable recommendations. A special challenge seems to be the quantification of recommendations when using measured energy rating.

Indication of the potential energy savings are handled very differently in the Member States. In some countries, energy savings are being recalculated to cost savings, while most countries display energy savings. The energy savings, however, are not given identically in all countries, but variously, in differing combinations:

- Total and/or specific primary energy need.
- Total carbon or equivalent CO_2 emissions.
- Total and/or specific final energy consumption.
- Total saved delivered energy, primary energy and CO_2-emission, also % of those.
- List of measures only according to payback, without values.
- Actual consumption and consumption estimated after refurbishment,

Also, the economic presentation of the energy savings is given very differently:

- Currency/saved kWh of final or primary energy.
- Energy cost for housing, with some software for other buildings.
- Investment costs and payback period.
- Reduction of energy costs after refurbishment.

The number and quality of the recommendations given in the certificate is strongly dependent on the certifier and/or the software tool being used. National recommendations or rules may apply. Figure 6 shows an overview of the restrictions, in terms of the number of recommendations in the different certificates.

For complex buildings, the energy certification is not an easy task, because of a difficult geometry, a lot of technical installations, often poor documentation of building components, etc. Also, the mixed use of a building (e.g., a commercial/residential building with shops in the ground floor and flats in the upper floors) can complicate the certification process. The following problems emerge with complex buildings:

- In case of calculated rating: availability of data sources, identification of technical systems, calculation procedures and zoning rules.
- In case of measured rating: availability and assignment of metres, quality of reference values, different users or change of user.

After the discussions, the Member States participants agreed to some recommendations:

- For calculations, a reduced zone model should be considered.
- Measurements should be supported by guidelines for the installation of metres and for in situ measurements.
- Benchmark procedures should include a variety of uses and rules for creating benchmarks for buildings with mixed use.

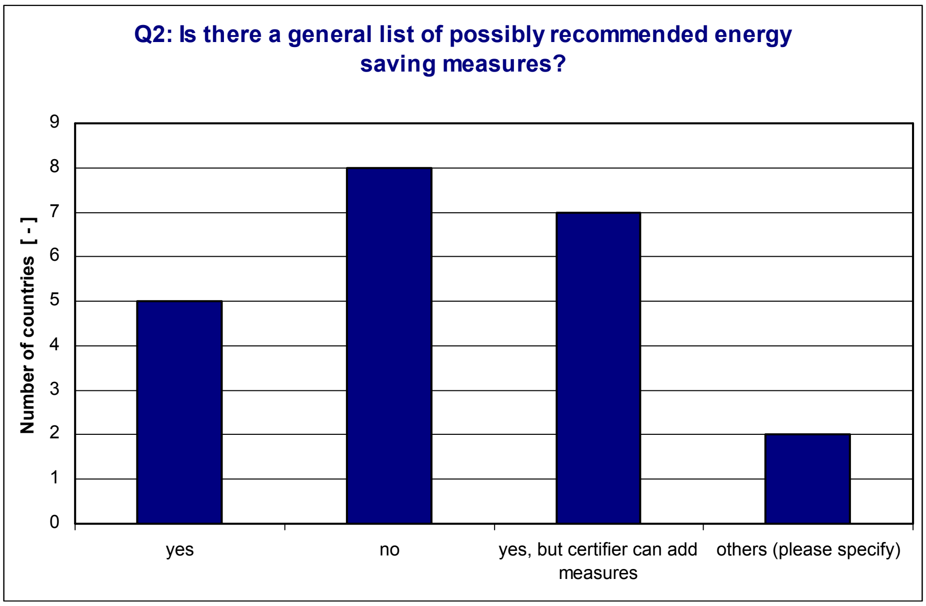

Figure 6. Overview of the answers to the question on how recommendations are derived in different Member States. The survey was made at the end of 2008.

> Recommendations provided in the certificate should be directly targeted to the actual building being certified. This will increase public acceptance of the certificate and help persuade building owners to implement the suggested energy saving measures.

> For large and complex buildings, it seems appropriate to use measured energy performance values. Then, guidelines for installations of metres and sub-metres are needed, as well as guidelines for in situ measurements.

3.8 Special issues

According to an analysis in IEE ASIEPI, countries cover thermal bridges in different ways in their national EPBD implementation, regarding energy impact, limits, good practice guidance, as well as compliance checks at the design and realisation phase of a building. This analysis was mirrored, extended and discussed in the CA. Thermal bridges become even more important for high performance buildings, as the relative impact of poorly designed component joints on the heating energy consumption can be significant.

The main discussion points and conclusions on thermal bridges can be summarised as follows:

- Most countries stated that they include thermal bridges in the energy performance calculation for new buildings, or, as it happens in two southern countries, they are in the process of including thermal bridge influences in their calculations.
- Some countries do not include thermal bridges in the energy performance calculations for the renovation of buildings.
- Compliance and control: about half of the countries conduct a control during or after the design phase. A few countries conduct a control during the realisation phase.
- Thermal bridges are checked differently during design and realisation:
    - One country requires that all details with a possibility of condensation have to be sent to the authorities for a check.
    - A second country reported that the detailed design has to be submitted for the building permit and that the U-values for components and the corner joints, etc. are checked by the authority.
    - Another country performs a general check in connection with the building permit.
- The responsibility lies generally with the building owner, but in a few countries they can hand it over to the designers.
- Are the checks in the countries performed as a standard routine, or is this just a general possibility which is rarely realised? This seems to be quite different in the various countries. It was reported that the execution check is not exercised on a regular basis in most of the countries that stated that this procedure does exist.
- Is there really a significant impact of thermal bridges on the cooling load of buildings? While there was consensus that thermal bridges have no influence on the cooling energy, the currently available results regarding the impact of thermal bridges on the cooling load are inconclusive and further research is needed. Some of the Southern European experts were surprised that there seems to be an impact on the cooling load. Two countries have conducted studies on the impact of the opaque building components on cooling issues, and have found that only the roof has some impact. However, they have not analysed the thermal bridges in detail.

Figure 7. Interactive workshop during the session on the handling of thermal bridges in the EPBD context.

3.8.1 Main conclusions:

The collection of information on national approaches for including thermal bridges in the energy performance regulations, on useful and validated software, on thermal bridge atlases, as well as on good practice guidance and innovative developments in this field, combined with the presentation in information papers and other dissemination activities was considered as very valuable work. All information gathered is available at www.asiepi.eu and www.buildup.eu.

Most countries take thermal bridges into account for the energy performance calculation of new buildings, and less for the renovation of existing buildings. The compliance and control checks during the design and realisation phases seem to be handled on diverse levels – varying not only among the countries, but also within a country, among different regions.

It was agreed that the issue of thermal bridges is even more important for high performance buildings, as the relative impact of poorly developed and executed joints can become significant and reach the same level of significance as, for example, the addition of a solar thermal system for domestic hot water.

3.8.2 Future directions

The assessment of thermal bridges needs to be further discussed, towards finding more common solutions for all Member States. Information on thermal bridges is available at the BUILD UP community "Thermal Bridges Forum", http://www.buildup.eu/communities/thermalbridges. The community also offers a discussion platform for specific items.

> Thermal bridges become even more important for high performance buildings. Countries cover the issue of thermal bridges in different ways.

> The impact of thermal bridges on the energy performance is even more important for high performance buildings: energy wastage from thermal bridges can be the same as the energy saved from the use of a solar thermal system for domestic hot water.

The role of thermography for the identification of thermal conductivities of materials during building inspection was analysed. Points made during discussion were as follows:

- For assessing thermal conductivities, infrared thermography is a qualitative process only.
- It is viewed as an expensive process for field measurements.
- It has some use for training purposes.
- Other methods of on-site measurements, such as glazing system identification and other methods which support energy performance identification, may be useful, but need further discussion.

Three different methods for climatic normalisation of energy uses with focus on cooling energy have been discussed:

- The heating and cooling degree day method (DDM)
- The modified utilisation factor method (MUFM)
- The Climate Severity Index (CSI)

Most countries only normalise according to heating degree days and do not take into account the cooling issue in terms of normalisation. Weather normalisation is a crucial task for measured data and for comparing calculated data. The error made by simply correcting the heating and cooling energy needs by degree days increases in high performance buildings.

Within the IEE project ASIEPI, the climate severity index method was used for analysing the issue of the different local climates on the comparison of EP requirement levels among different countries. The project recommended further developing of a climate severity index within CEN/ISO, as the need for European/global comparisons of energy uses and requirements will expand.

> A correct and European-wide harmonised approach for the climate normalisation for both heating and cooling would simplify the intercomparison of national requirements, as well as the use of measured energy rating.

4 Main outcomes from the Procedures sessions

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
High performance buildings	Various terms and definitions exist. Individual definitions are descriptive only or are used differently in the countries. Often, the existing definitions do not comply with the national energy performance calculation methods. The market penetration of high performance buildings in Southern European countries is significantly lower than that in Middle and Northern European countries.	Most countries have national roadmaps that include high performance buildings as a goal for future buildings.	There is a **need for harmonised terms and definitions**, taking into account national calculation methods, neither limiting the technological options nor hindering innovation.
Comparison of national requirements	The comparisons are influenced by various parameters. The studies should include the potential impact of these influence parameters. There is currently no robust, simple and fair comparison method available. The situation might get even more complicated if cost assessment is added to the comparison.	Intercomparison studies cannot be simply reduced to U-value comparisons or to comparisons of the energy consumption in different countries.	**Intercomparisons are extremely complicated** and will remain a topic for in-depth discussion in the future.
Setting minimum energy performance requirements	Cost-benefit assessments for setting requirements can be performed from different perspectives. Most Member States already fix their requirements based on either financial or economic cost-effectiveness calculations. Many Member States follow a procedure similar to the planned methodology for the cost-optimum assessment of the EPBD recast. In addition to minimum energy performance requirements on a building level and possibly on the building envelope, most Member States have set requirements for technical building systems, which vary in detail (at whole system or component level) and rate of use in the various countries.	**Member States would welcome a simple yet robust framework for the cost-optimum methodology**, which should also be as consistent as possible with the established procedures.	Member States have to develop the national content and use the comparative methodology. The definition of national content and national use of the framework methodology can benefit from exchange between Member States. The interface between product performance information and system performance calculation, including part load efficiency, needs to be improved.
National procedures	No country uses a one-to-one transfer of the CEN standards. The CEN standards offer alternative paths, but the countries prefer to fix one path. Some CEN standards do not cover the whole challenge of the EPBD. Quality control and accreditation of software needs to be further addressed. The problem concerning how to correctly model the summer performance is not completely solved: one-zone models can be insufficient for summer comfort and cooling, but multi-zone models need increased efforts and require simplifications. In a significant number of countries, changes in the energy performance procedures have been already realised after the implementation of the EPBD.	**Many countries use CEN compatible approaches**. Multiple paths and requirements for annexes complicate the direct use by the countries. **The changes in energy performance procedures realised after the EPBD implementation show a general direction towards the tightening of the requirements and the conformity with the CEN standards**.	**Some CEN standards should be extended** to cover the whole field of application. **Barriers for the use of the CEN standards** have to be communicated to CEN. There is a necessity for further discussion on how to control the quality of software programmes and user-induced errors.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Measured energy performance rating	The measured energy rating is perceived as a way to save efforts and money. Countries are often not aware of the risks arising from it. The existing systems for benchmarking of the measured energy rating either need more benchmark data and/or subcategories or fewer subcategories, in order to facilitate the rating.	**There is no common method neither for the normalisation of measured energy nor for the check of the data quality**. Ways for dividing the measured energy into different uses are also missing.	Information exchange on how to produce reliable benchmarks. Is a combination of calculated and measured energy rating useful and, if yes, for which situations?
Feasibility analysis of alternative systems	The feasibility study requirement is transposed differently into the Member States. **The key factor is the timing of the feasibility study**, which has to be carried out when the strategic decisions are being made.	Quality control procedures are unclear.	Further experience is needed.
Procedures for specific certification challenges	The recommendations for energy improvements of existing buildings are derived in different ways in the Member States. A special challenge seems to be the quantification of recommendations when using measured energy rating. Complex and/or mixed use buildings are difficult to be certified, due to data availability, zoning, identification of building systems, assignment of metres and quality of reference values.	Practical ideas on how to develop suitable recommendations are existing in the Member States. Reduced zone models, guides for the installation of metres and for in situ measurements, as well as rules for benchmarks are needed.	Topics including **summer modelling, procedures and benchmarks for measured energy rating**, as well as ways to form recommendations **need to be addressed in depth**.
Thermal bridges	The countries cover thermal bridges in different ways in their national EPBD implementation regarding energy impact, limits, good practice guidance and compliance checks at the design and realisation phase of a building.	**Thermal bridges become even more important in the case of high performance buildings**.	A follow-up of the impact of thermal bridges on the cooling load is needed.
Infrared thermography	Thermography can support the building inspection by the identification of thermal conductivities of materials. Results are mostly qualitative only and require a lot of experience.	The application possibilities are limited.	**Thermography needs no further consideration**.
Climate correction methods	Weather normalisation is a crucial task for measured data and for comparing calculated data.	In high performance buildings, the error made by simply correcting heating and cooling needs by degree days increases.	A **European-wide harmonised approach for the climate normalisation within CEN/ ISO is recommended**.

5 Lessons learned and recommendations

CA participants unanimously welcomed the support and hints received from other Member States, as they all have comparable issues to solve. Everybody profited from the experience gained in the other Member States.

As it turned out, high performance buildings are named and/or defined differently in the Member States. Most of the available definitions do not take the national calculation procedures into account. Common understanding on the use of terminology and the definition of nearly zero-energy buildings are needed, accompanied by a comparison with national ratings.

The market penetration of high performance buildings in Southern European countries is significantly lower than in the rest of Europe. In order to meet the EPBD recast target of nearly zero energy buildings by 2020, most Southern European Member States will have to bridge a larger gap.

Experiences gained from the intercomparisons of national requirement levels showed that this is a very sensitive topic and will become even more complicated if cost aspects are added.

Cost-benefit assessments of the minimum energy performance requirements are being performed in most EU Member States, from either the financial or the economic perspective. Many Member States use both assessment methods. The future EPBD recast framework methodology on this issue should try to accommodate, both, countries applying such assessments for the first time and the assessment methodologies in place in other countries.

In a significant number of countries, changes in the EP procedures have been already realised after the implementation of the EPBD. Nearly all the countries in which changes have been realised, have tightened their EP requirements.

Weather normalisation is a crucial task when using measured data, but is also important when doing calculations. Cooling energy is only partly influenced by simple temperature differences that can be corrected by degree days or similar. The mistake made by simply correcting the heating energy need (instead of the thermal and ventilation losses) by degree days, becomes bigger in the case of high performance buildings. A European-wide harmonised approach for the climate normalisation within CEN/ISO is recommended.

Assignment of meters, division into different uses, suitable benchmarks, normalisation and derivation of recommendations, are some of the problems of measured energy rating. Guidelines and minimum requirements for a correct procedure for measured energy rating are missing.

Calculated energy rating discussions are about the necessary complexity in zoning and the accreditation of software. Simplifications for the handling of some calculation methods have to be found, whereas other methods need to be made more detailed, in order to give reliable results with acceptable accuracy in specific situations.

Due to practicability reasons and desired independency, the CEN standards are not transferred one-to-one into the national procedures. Instead, the content is incorporated into the national documents. Thus, the CEN standards should be further developed into general framework documents that fix general principles only and allow maximum flexibility for the implementation in each country.

The information exchange with European projects that can offer solutions for the challenges existing in the national procedures proved to be a useful supplement to the Concerted Action work.

CONCERTED ACTION
ENERGY PERFORMANCE OF BUILDINGS

Campaigns

Core Theme 5

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1 General Information

Since its launching in December 2007, the Concerted Action (CA EPBD 2, 2007 – 2010) organised six major meetings among Member States' (MS) representatives, with intensive preparatory work in between. In addition to plenary sessions devoted to issues of general interest to the 120+ participants at each meeting, it organised a total of **63 detailed technical sessions for discussing specific issues relating to one or more of its 5 Core Themes (CTs), 16 of which were devoted to topics related to "Information Campaigns".** Some of these sessions were organised in collaboration with other CTs. **After joining all the meetings for this CT, the MS know what the possibilities are to maximise the impact of the EPBD and strengthen the EPBD policy in their countries, as well as what flanking measures are possible.**

Building on the experience from the CA EPBD (2005-2007), the initial plan for CA EPBD 2 included a long list of topics related to Information Campaigns; additional topics have been identified since then by the participants. A brainstorming session at the first CA EPBD 2 meeting in December 2007 was very useful in defining the topics of interest for the MS to discuss. A final review session was organised in September 2010, and resulted in feedback that was also incorporated into this report.

This report summarises the main outcomes of these Information Campaigns sessions, including conclusions and recommendations.

2 Programme of Work

The Core Theme "Information Campaigns" works on topics related to the article 12 of the EPBD.

According to the EPBD, *Member States may take the necessary measures to inform the users of buildings as to the different methods and practices that serve to enhance energy performance. Upon Member States' request, the Commission shall assist Member States in staging the information campaigns concerned, which may be dealt with in Community programmes.*

In order to be effective, such information campaigns will be directed at many actors, from construction and property professionals to the general public. They also need to use multiple communication channels and be phased appropriately over time.

At individual Member States (MS) level, MS are likely to require alliances between national or regional authorities, and professional and other market actors. Discussions on the most appropriate approaches and comparison of the experience of individual MS contributed significantly in speeding up take-off, as well as in increasing the degree of convergence and the impact leverage of the Directive. The essence of the Core Theme "Information Campaigns" was to explore the comparative approaches across MS, seeking to maximise the impact of the EPBD in all countries.

3 Activities of the Information Campaigns Theme

At the end of 2007, drawing on over 30 months of sharing practical experiences on the implementation of the Energy Performance of Buildings Directive, the participants in the Concerted Action EPBD set out their strategic lines of discussion for the next three years. The strategic lines for the Information Campaigns were:

- The public is informed
- Professionals: capable and competent for issuing the energy performance certificate
- Financial instruments/services available
- Supporting legislation in place
- Organisation and procedures should be in place and operational

Some of the strategic lines were arranged in cooperation with the other Core Themes, and are therefore also described in their relevant chapters. The topics are described here from the perspective of this Core Theme.

Building on the positive experiences from earlier years, a "Market Place" was organised for all delegates, in order to inform each other about the different information campaigns on the EPBD, the Energy Performance Certificate, inspections, etc. that were going on in each country. In the Market Place, all participants had the opportunity to present the state of affairs in their country regarding the various topics, and show their national communication and information materials. The Market Places were very well received by all delegates, and helped them to see and learn what kind of knowledge and information products are developed in other countries.

3.1 “The Public is informed”

3.1.1 Analysis of National Information Campaigns

By the end of 2010, most MS had already implemented an EPBD related campaign. Sharing information about these campaigns showed that 50% of the MS monitor them, and that this helps with their improvement. The most important parties involved in a national information campaign are: relevant authorities, energy agencies and communication/marketing companies, whether at national, regional or local level. The main success factors for the information campaigns are to:

- start with a strategic plan
- use one simple positive message
- define your target groups and be prepared for reactions (positive or negative) to the campaign
- make use of a helpdesk to answer the public’s questions
- deliver a tailored message to professionals
- collaborate with professionals/organisations in the building sector
- make use of free publicity through professionals
- make use of cross media

The main recommendations and conclusions were:

- **Know your target audience.** This enables you to more effectively tailor the campaigns. The identification of your audience is critical, because this will shape the angle of your message, as well as the media to be used for communicating your message.

- **Ensure the commitment** of decision-makers to support the campaign. In order to be successful, campaigns require a firm commitment.
- **Word of mouth is irreplaceable.** Often overlooked by community organisations, word of mouth is essential for the success of any campaign. It builds credibility and is typically very compelling and convincing.
- **Free publicity could become your best tool.** Posting information through community calendars, community bulletin boards, websites, by sending letters to the editor, participating in town forums, creating a word of mouth buzz, and using public service announcements could be instrumental in the success of your campaign.
- **Use existing resources.** Network with other agencies in order to share strategies, ideas, and lessons learned. Look for opportunities to partner with other departments, community groups, and government agencies in order to spread your message.

Since the demand for energy saving services will be stimulated by a campaign, it is also important to make sure that a sufficient amount of qualified assessors and professionals in the building sector is available to respond to the public demand stemming from the campaign.

The individual campaigns implemented across Europe can be seen in some detail in the "Country Report 2010" of each specific Member State.

3.1.2 How to deal with public reactions

For a successful implementation of the EPBD across Europe, it is important that building owners understand the meaning and the goals of the legislation. It is important that the energy performance of buildings is improved, and that building owners can see the advantages that improving energy efficiency has for them, such as higher comfort levels, less energy costs, higher value of their building, etc.

As MS approach full implementation of the legislation, it is possible that there could be a degree of negative reaction and comments. Cases of negative publicity have arisen in some countries. For example, in individual cases, separate evaluations of the same building have led to the issuing of different EPCs; software tools, such as calculation tools for professionals, have been too time-consuming to be used efficiently; the cost of certification has been set too high for the perceived level of service provided, etc. These are examples of teething problems in certification and inspection markets which are not yet fully functional. These problems can be avoided through effective planning, or remedied through prompt corrective action.

Of course, negative publicity should be avoided in the first instance through implementation of robust national schemes. However, if weaknesses in the scheme come to the forefront in everyday working practice, solutions for managing negative publicity lie in responding quickly and positively, listening to the criticisms given by market actors, accepting responsibility, and promptly taking appropriate corrective action to improve the system.

> Collaborating with all parties involved in the implementation process gives the opportunity to unite in purpose and goal. Robustness and transparency of procedures provide market actors with confidence in the EPBD related services.

3.1.3 First reactions to the Energy Performance Certificate from the General Public

In early 2009 –with many of the national schemes still in their early stages– a study of the national approaches to assessing public response to the EPBD was carried out. A total of 19 countries provided information. From these, at that time, 6 countries indicated that they had carried out investigations into public reactions, half of them using qualitative research and half of them using both quantitative and qualitative research. The general conclusion from the studies in those countries is that most of the consumers understand the purpose and the message of the certificate. The cost of the certificate is also an issue which is often raised. All 6 countries indicated that they would use the outcome of the research to improve their EPBD schemes.

For example: in January 2008, the energy performance certificate was implemented in The Netherlands. After one year, the government decided to change the certificate, in order to improve its usability and to make it easier for people to understand. The study on public reactions had influenced the certification scheme.

The representatives of the 19 countries also described perceived strengths and weaknesses of their own certification scheme. Successes and failures of their schemes were presented for comparison, in terms of: information campaigns; communication from the government; communication from the market; clarity of the certificate; usability of the certificate; costs of the certificate; and complementary measures (such as subsidies).

As part of the enquiry, the national representatives were asked, "How would you improve the response of consumers to your certification scheme?" The responses are indicated below:

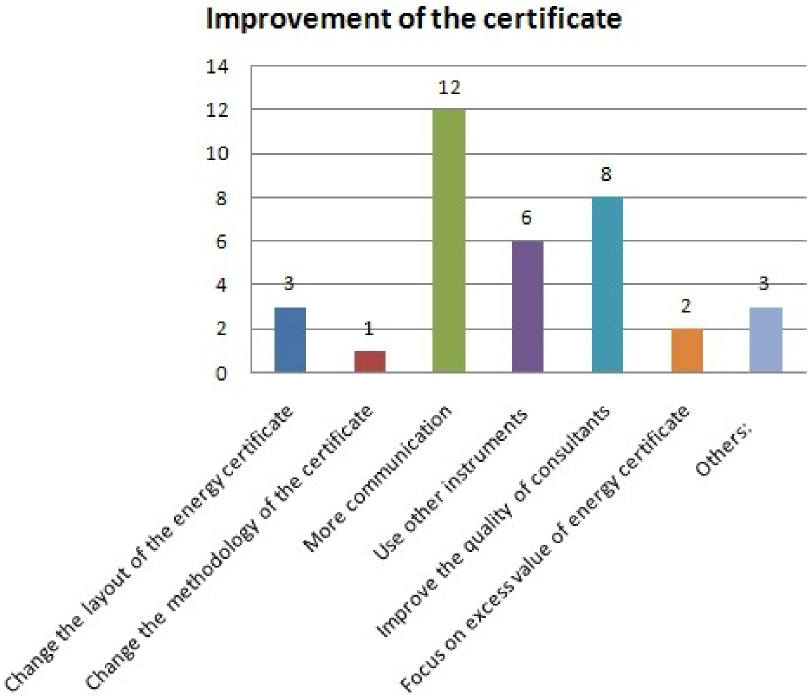


Figure 1. Methods for improving response to the certification scheme

> Member States should carry out evaluations of the information campaigns they implement in support of the Directive, and act on their findings.

National representatives active in this field participated in a workshop in order to exchange information, and to learn from each other about early consumer responses to certificates. Following on presentations of experiences in Norway, The Netherlands and Germany, the workshop participants brainstormed on a step-by-step approach to good practice communication about the certificate. The suggestions resulting from this brainstorming were the following:

- Consumers are more likely to invest in the recommendations on the Energy Performance Certificate (EPC) if the reactions of other consumers/building owners are positive.
- Building owners are likely to react positively to the EPBD and the EPC when countries emphasise the added value.

The quality of the EPC plays an important role in this respect.

The brainstorming amongst participants suggested that the first public reaction can be more positive if the following items are taken into account:

- **Plan and pre-test:** It is important to test the certificate before it is implemented, to increase the social basis. In order to make plans for a new policy, the public can be involved, e.g., by consumer panels.
- **Involve different parties:** Make direct contact and communicate with key market actors, such as real estate agents, banks, notaries, etc. Work with professional companies to provide the media with robust information.
- **Good quality:** The consumers will only take measures when they are confident of the quality of the consultant delivering the certificate and of the energy saving recommendations, as well as when the certificate has a good price/quality ratio.
- **Recommendations in the certificate:** The information in the certificate needs to be suitable for the public: it should provide the right level of technical detail, as well as links to other information. The certificate should include sufficient information about how to improve the rating and how to save energy.
- **More communication:** It is important to develop communication plans for the better information of the consumers. MS should use effective information campaigns and communicate the advantages of the certificate, such as higher market value of buildings with a higher certificate.
- **Make certificates more fun:** Communicate about the positive results and the advantages of the certificate and the energy saving measures. Show that the certificate is beneficial. Make the certificate more fun.
- **Connect to additional instruments:** Communicate the whole policy package, including the certificate, legislation, financial instruments and other campaigns on behavioural change. Do not let the EPC "stand alone".
- **Changes to the scheme:** Change the certificate only if it is really necessary. If changes are made, the communication process needs to be tailored to the different parties involved.

3.2 The role of professionals in maximising the impact of the EPBD

An important group of actors with a decisive influence on improving the energy performance of buildings, and therefore on the impact of the EPBD, are the professional parties in direct contact with building owners. These parties are: designers of buildings/architects, building assessors and inspectors of heating/cooling systems, real estate agents, housing organisations, energy suppliers, financial parties, legal parties (lawyers and notaries), suppliers of new products and materials, the building sector in general, the media, consumer organisations, NGOs and accreditation bodies. Professional parties can give advice to building owners on the possibilities of improving the energy performance of buildings, translating this into a market opportunity.

To launch free thinking on the roles of the different professionals, a workshop approach was adopted for brainstorming on success factors relating to different market actors. The national representatives, inspired by the presentation of the Dutch "More with Less” Market Initiative, formed small groups in order to focus on the role of different market actors. A few of the suggested success factors, as well as ways to maximise the impact of the EPBD are, inter alia:

- **Spreading the knowledge** should make the purpose and the benefits of the EPBD clearer, allowing consumer organisations to communicate details about the EPBD in an informed way.
- Setting up of **Quality Assurance** about the EPBD by the building sector could create better communication about the improvement of the energy performance of buildings.
- Better **training of parties in the building sector** would allow the building sector to communicate about the EPBD in an informed and convincing way.
- **Good examples of financial advantages of the EPBD**, e.g. better rating, translating into higher building value, could be an incentive for building owners to improve the energy performance of new and existing buildings.
- **The EPBD means added value for the energy company**. Energy companies can play their role in the communication about the EPBD.
- **Education for real estate agents**. Knowledge of the advantages of the EPBD will encourage the real estate agents to communicate positively about the energy certificate. For example, they should be aware about the higher value of the building or about higher comfort levels.

- Introduction of **financial instruments, such as revolving funds,** e.g. based on structural funds. These kinds of funds will encourage investments in energy saving measurements by building owners.

At the end of this brainstorming process, national representatives had gained insight and heightened awareness of the possible roles and impacts that market actors could have –depending on the national situation– in their countries.

> Increased awareness of the roles of market actors at national level can help Member States to implement effective, nationally tailored schemes: there could be further benefit from studying and comparing the roles of the key actors in a representative sample of countries.

3.3 Financial instruments - maximising the impact of the EPBD

Financial instruments can have a positive influence on improving the energy performance of buildings and, therefore, on the impact of the EPBD. They can play a major role in helping building owners to decide on energy saving measures for their buildings. There are many types of financial instruments, all of which may be implemented differently. The most widely available instruments are subsidies, soft loans, structural funds and tax reductions.

During the 1st semester of 2009, the Concerted Action members analysed the availability of financial instruments across Europe. A total of 22 national representatives responded to questions on the topic:

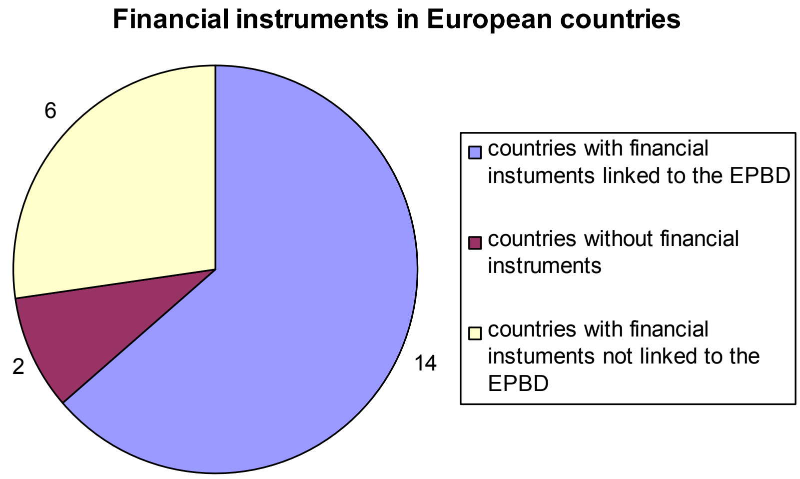


Figure 2. Financial instruments in European countries

An overview of the financial and support instruments available in each Member State is given in the individual "Country Report 2010" of each country.

In order to have high effectiveness, the ideal situation for financial instruments is:

- They are visible to the public and readily accessible; i.e. building owners and investors have insight into financing possibilities to improve buildings by taking energy saving measures.
- Their accessibility is linked to the improvement of the EPC class.
- Their effectiveness is monitored and evaluated by the improvements of the EPC class of the buildings, and they are further tailored, if necessary.
- The administrative burden and costs for all parties are low.

> Access to financing instruments should be linked to the Energy Performance Certificate. The effectiveness of the financial instruments should be evaluated through improvements in the energy performance class of the buildings.

3.4 Supporting legislation in place

3.4.1 EPBD and penalties

To realise the goals of the EPBD, it is important that the legislative/regulatory requirements are followed in practice and carried out in an orderly manner. Penalties can be used as a way to ensure proper implementation. Various penalties are in place in the MS. The penalties can be divided into two main categories (in brackets, the number of countries using these penalty mechanisms):

- Penalties for building owners for not making an EPC available:
    - Financial penalties (14)
    - Legal penalties (6)
- Penalties for assessors (for issuing an incorrect EPC):
    - Cancellation and correction of the EPC (7)
    - Warning and complaint procedure (7)
    - Further training/examination of assessors (2)
    - Financial penalties (7)
    - Revocation of license (7)

The application of penalties in the MS varies significantly. A few countries have an active control and sanctioning system. Some have a sanctioning system in theory, but have not used it very much in practice yet. Other MS are investigating the possibilities for sanctioning, and others start actively with sanctioning when they implement the EPBD recast.

The penalties on assessors for issuing an incorrect EPC range from fines of e.g. 500 € - 5,000 €, to liability for damages and revocation of licence. Additionally, the penalties for owners who fail to present a certificate range from no penalty, to prison sentences, to fines for tens of thousands of € for large non-residential buildings.

The Concerted Action participants investigated the approaches to penalties from different perspectives. A group discussion has taken place, using the method of "Six thinking hats of Edward de Bono" in order to look at the topic from the following perspectives:

- Objective figures and facts: one uses neutral information
- Feelings and intuition: one observes and acts emotionally
- Negative and pessimistic view: one acts as the devil's advocate and asks critical questions
- Positive and optimistic view: one looks on the bright side, and seeks opportunities and disadvantages
- Creative thinking: freewheeling is allowed, with free association of thought
- Reflective and controlling: one keeps a close eye on the process and planning

Some interesting questions raised from different perspectives are, inter alia:

- Are penalties really necessary?
- Do we know how big the compliance problem is, in order to apply the correct penalty?
- Is there room for human error?
- What is the effectiveness of applying penalties?
- Could further training help to overcome quality issues?
- What do we actually want to achieve with the penalty system?

It is the answer to such questions that allows the establishment of appropriate penalty systems in the individual countries.

The experience in the use of penalties by front-runner countries is very important for other countries: Member States should learn from each other's successes and failures, and evaluate these in the light of local market conditions.

3.5 Set up and operation of organisational structures and procedures

3.5.1 More effective ways to reach consumers

To reach the goals of the EPBD, dwelling and non-residential building owners must be motivated to obtain an Energy Performance Certificate, as well as to act upon the advice therein and undertake energy saving measures. The decision to undertake energy saving measures is difficult for the consumers. They have to be motivated in many different ways in order to take this step. In order to make it easier for them, there are a lot of barriers to remove.

With the project IDEAL-EPBD[1], there is an attempt to understand the response of dwelling owners, and the reason why some of them do not follow the recommendations given in the EPC. The study focuses on possible influential factors for individual households' behaviour regarding residential energy performance, such as investments in renovations of the building shell or the technical systems. Based on the literature that has been reviewed, important influential factors for individual households regarding the implementation of energy saving measures can be described as:

- Financial issues, e.g., long payback time, can hinder consumers to take energy efficiency investments.
- Social context; e.g., residents are most likely to implement energy saving measures if these are both visible and contribute positively to a "statement" towards peers (e.g., family, friends or neighbours).
- Information issues, e.g., knowledge about choices and costs, are strong determinants of behaviour.
- Decision-making context; e.g., there is an important barrier for energy efficiency investments when the owner who needs to decide about the investment does not necessarily benefit from it in the operational phase.
- Perceptions of renovation, e.g., the possible negative effect of the amount of work and the mess that energy efficiency improvement measures might cause.
- Perceptions of "green" issues; e.g., an individual's attitude to "green" issues will have an impact on whether they adopt energy efficiency measures.
- Life events and routines; e.g., there are sensible time-frames in the life of persons, during which they have greater sensitivity towards making changes in daily routines.

The best way to remove the barriers in order to motivate consumers to implement energy saving measures is a total approach which takes all the above influential factors into account. This removes barriers and effectively motivates consumers in making investments in energy saving and, by so doing to reach the goals of the EPBD.

Solutions lie in:

- Lowering investment costs, e.g. by subsidies: the high investment cost of an energy saving measure is a high barrier to taking action.
- Focusing on lowering the energy bill when energy saving measures are implemented.
- Pre-financing the investment costs: more consumers can implement energy saving measures, including consumers with a lower income.
- Communication and information in the right time and context: when consumers purchase their

[1] IDEAL-EPBD Intelligent Energy Europe - Project number IEE/07/600 *"Improving dwellings by enhancing actions on labelling for the EPBD"* www.ideal-epbd.eu

(first) home, they must get information from the municipalities. It is an important task for the central government to communicate and give information to the regional government and the municipalities for promoting energy saving measures to this target group. Timing is also important: when consumers ask for a building permit, the municipalities could inform them about implementing energy saving measures (with info on available subsidies/financial help).

3.5.2 Influence of the EPC on the market value of buildings

There is a significant interest in identifying the influence of the Energy Performance Certificate on the market value of buildings. Investigations on the approaches in each country were carried out in the 2nd semester of 2009. The objective was to identify, characterise and present possible tools and strategies that can be adopted by Member States for determining the correlation between Energy Performance Certificates and market value.

An enquiry regarding the actual large scale deployment of certification and the existence –or not– of databases for housing transactions in the different Member States showed that:

- Of the 25 Member States responding, 13 had –at that point in time– not yet witnessed a large scale introduction of certification.
- Approximately 1/3 of the countries had detailed data resources for the housing market.
- Completed studies were available in 2 countries, 4 countries had on-going studies, 3 countries had plans for studies, whilst the remainder had as yet no explicit plans to perform such a study.

Whilst the experience in assessing the influence of EPCs in the market value of properties remains limited since most schemes have only recently been introduced, empirical studies show that a "green premium" of 2.7% for better Energy Performance Certificates was detected in The Netherlands (sample of 40,000 houses with an energy certificate). Although there was no effect on the speed of sale, based on the average value of a home in the country, this premium means an added value of about 6,000 €[2].

About 60% of the building owners in Poland report that an EPC has a positive effect on the market value of buildings (based on a Polish case-study: opinion survey with major companies), but it is not yet possible to actually quantify this effect.

The main conclusions on the EPC's effect on the market value of buildings are:

- There is still very limited experience in assessing the impact of EPCs in property market value.
- Available or on-going studies vary in methodology, actors, targets, etc. That makes results quite country-specific at this stage.
- In the short term, other MS case-studies should be used as reference.

The need for consumers and market actors to have knowledge on the EPC's influence on the market value of buildings is growing. This can be a key driver for reaching the objectives of the EPBD and EU targets on energy efficiency. Therefore, it is recommended that MS start (or continue) to pay close attention to this topic, and pass on the available information to the market.

3.5.3 How does the EPBD work in practice?

To maximise the effect of the EPBD, it is important that all buildings covered by the Directive obtain an Energy Performance Certificate. An excellent way to promote the EPBD and the EPC is via market initiatives. When professionals use the EPBD and the EPC in their day-to-day work practice, building owners can appreciate the overall added value.

Examination of the market initiatives across Europe shows that they can be grouped into five different categories. From a snapshot of initiatives based on an enquiry in 2010, it was found that from the 19 countries that responded, 15 of them have specific initiatives (in brackets, the number of countries implementing this type of market initiative):

[2] Brounen, D., Kok, N. and Quigley, J. (2009) The diffusion of green labels in the housing market, RSM, Rotterdam. See *http://www.rics.org/site/scripts/download_info.aspx?fileID=7754* or *http://www.erim.eur.nl/ERIM/Research/Centres/Erasmus_Real_Estate_Centre_EREC#axzz1GCOzE9CI*

- Financial initiatives, e.g. tax reductions & lower credit interest for high performance buildings, etc. (7)
- Initiatives from suppliers of energy efficient goods and services; e.g. installers offer packages of solutions, suppliers advertise the thermal properties of the construction materials and their contribution to the improvement of the EPC's rating, etc. (4)
- Initiatives of real estate agents or building companies, e.g. public announcement of the EPC when a dwelling is put on sale, use of EPCs results in selling advertisements –as is now required by the recast Directive– etc. (7)
- Information initiatives that improve the knowledge on the EPC, e.g. websites to promote the EPC, certification of buildings, provision of information on regulations, addition of further information and value to the EPC, such as standardised recommendations or other related information (3).
- Governmental initiatives (4).

An example from Luxembourg: a real estate agency has placed the EPC in a prominent position on its homepage, i.e. visitors of the website can use the energy label classification (A to I) as a prime criterion when searching for houses/buildings. The agency also reports that selling a house/building with a label D or lower is more difficult than selling a house/building with an energy rating of A, B or C.

This is an example of how important it is that the EPBD and the EPC are part of the day-to-day work practice of professionals, so that consumers are exposed to the Directive and the opportunities it creates. Market initiatives help to integrate the EPBD and the EPC in the daily work practice of professionals and in the mind of building owners. In general, market initiatives try to:

- Improve the understanding of how energy is used of buildings.
- Increase the public awareness on energy efficiency and energy saving.
- Create an added value to the building stock.

4 Main outcomes from the Information Campaigns sessions

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
National Information Campaigns	**Success factors** of a national information campaign: - Know your target audience - Make a commitment - Word of mouth is irreplaceable - Make use of free publicity - Use existing resources	For the MS: if you cannot do everything, do just one thing! But do it successfully, and **success will build upon itself**.	**Campaigns must continue** in MS.
How to deal with negative public reactions, concerning implementation of the EPBD in MS	The 3 key factors in **managing negative publicity** scenarios are: - Timely and robust response - The good reputation of the organisation/service implementing the scheme - A responsible and proactive approach	Solutions lie in listening to the criticisms, giving a **quick and positive response**, and accept responsibility, if necessary.	All MS benefit from discussing possible scenarios and ways of dealing with negative publicity.
First reactions from the general public	The reactions of consumers are likely to be positive when MS emphasise the added value of the EPBD and the Energy Performance Certificate. When the certificate is pre-tested, the quality of the certificate and the assessors is good; the costs of the certificate are low and it is connected to additional (financial) instruments, public reactions to the certificate are likely to improve.	These results will lead to an ideal situation of how to **involve the public in the implementation of the EPBD**.	MS must **take into account the behaviour of the consumers**.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
Role of professionals in maximising the impact of the EPBD	The **professional parties** that are in direct contact with the building owners (such as designers of buildings, building assessors, financial parties, legal parties, suppliers of products and materials, media, consumer organisations etc.) are an important group that has a **decisive influence on improving the energy performance of building**s. and therefore on the impact of the EPBD.	**Increased awareness of the role of market actors** can help MS to implement the EPBD effectively.	MS must continue to **improve dialogue with all the relevant professionals**.
Financial instruments	By linking financial instruments to the Energy Performance Certificate, the impact of the EPBD can be heightened. **When consumers, building owners and investors have an insight into the different kinds of financial opportunities on offer, there is a higher possibility that they will implement energy saving measures**.	The financial instruments have to be efficient and effective and have a **low administrative burden.**	Governments could give a positive signal to the certificate by **connecting** it **to financial instruments**.
EPBD and penalties	In order to realise the goals of the EPBD the Directive should be carried out in an orderly manner. **Penalty systems** already in place in some MS show that they **could play an important role in ensuring the aims of the EPBD**. Penalty systems in MS are. e.g.: financial and legal penalties for building owners, penalties involving fines, warnings and even loss of the license of Qualified Experts.	Diverse **penalty systems** exist in MS, which **work as control mechanisms**	MS must strike a **balance between penalties and an informative approach**.
More effective ways to reach consumers	Important influential factors for consumers in order to take energy saving measures in their homes are: financial issues, social context, information, decision-making context, perceptions of renovations, perceptions of "green" issues, as well as life events and routines. The decision to undertake energy saving measures is difficult for the **consumers**. They **have to be motivated** in order to take this step. A lot of **barriers have to be removed** to make it easier for them.	The best way to remove barriers is a total approach which takes all factors of influence into account.	**Consumers must be convinced of the added value of** the EPBD and **the EPC** in a way they understand, and by which they can see the added value of them in their own lives.
Influence of the EPC on the market value of buildings	**The effect of the EPC on the market value of buildings cannot yet be conclusively deducted**: the experience in assessing the impact of EPCs in property market value is still very limited.	**Indications are positive**, but not conclusive.	The need for consumers and market actors to have knowledge on the EPC's influence on the market value of buildings is growing. MS should pay close attention to this topic and pass on the available information to the market.

Topic	Main discussions and outcomes	Conclusion of topic	Future directions
How does the EPBD work in practice	**Market initiatives help to integrate** the EPBD and **the EPC in the daily work practice of professionals and in the mind of building owners**. These include financial initiatives, initiatives of suppliers of energy efficient goods and services, etc.	Market initiatives help to increase the public awareness on energy efficiency, to **improve the understanding of how energy is used in buildings** and to create an added value to the building stock.	Continue the sharing of information on the EPBD and the EPC in the daily work practice of professionals and with consumers.

5 Lessons learned and recommendations

From the sharing of experiences over the last three years, the participants in the Concerted Action are now well aware of the possibilities available to maximise the impact of the EPBD and to strengthen the relevant policy in their own country through appropriate flanking measures. All the topics addressed in this report remain relevant in the future, especially when Member States are faced with the implementation of the EPBD Recast.

The main ideas to be retained are:

- Effective information campaigns are critical for the success of the Directive. Almost all countries have experience in promoting the national schemes for its implementation. Success factors of a national information campaign are: know your target audience; make a commitment; word of mouth is irreplaceable; make use of free publicity; and use existing resources.
- As Member States approach full implementation of the Directive, teething problems accompanying the introduction of the schemes could result in a degree of negative reaction. Solutions lie in listening to justified criticisms given by market actors, giving a quick and positive response, accepting responsibility and implementing the necessary improvements to the scheme.
- The Involvement of professional parties and the general public during the whole process of implementation is very important to improve the social basis and the impact of the Directive.
- In order to achieve the full potential offered by the legislation, Member States should connect financial instruments to the Energy Performance Certificate.
- Member States should closely monitor the effect of the Energy Performance Certificate.
- The acceptance of the Energy Performance Certificate by the public will be high when it is of a high quality and good value for money.

Country Reports

Introduction to the Country Reports

This collection of Country Reports presents the status of implementation of the Energy Performance of Buildings Directive (2002/91/EC) from the perspective of each Member State (MS). They are written by experts who are at the heart of the processes for its legislative, regulatory and practical implementation at national or regional level and provide a global view of the whole process, past, present and future.

As such, these Country Reports provide a bird's eye view of the ways in which the Directive has been put into place through national laws and regulations, together with its practical implementation, in each country, describing the following items:

- Legal documents for transposition and implementation;
- Ministries, Departments or Agencies in charge of the implementation;
- Reference documents, sources of information and links;
- Certification of buildings:
  - new buildings and major renovations of existing buildings;
  - buildings for sale and rent;
  - which public buildings are included and how display is handled;
  - the cover pages and contents of the certificates for all cases above;
  - the criteria for defining labels (typically A through to G), when MS adopt that type of format;
  - whether measured (operational) or calculated (asset) ratings are used;
  - calculation methods used;
  - type of recommendations provided;
  - typical costs of certificates;
  - validity of certificates;
  - availability of a central database for registering certificates;
  - quality control mechanisms, checks and penalties;
  - statistics of issued certificates;
- Inspection systems for boilers, heating and air-conditioning systems:
  - inspections of boilers or information campaigns;
  - methodology for inspections;
  - how often are inspections required;
  - inspection reports;
  - availability of a central database for registering reports;
  - qualifications and number of available inspectors;
  - typical costs;
  - quality control mechanisms, checks and penalties;

- Qualified Experts:
  - qualifications;
  - training requirements, exams;
  - checks on the quality of the work, penalties;
  - number of experts available;
  - continuing education, if required;
- Information campaigns to promote energy performance certificates, inspections schemes, or energy efficiency of buildings;
- Incentives and subsidy schemes available at a national or regional level related to certificates, or to improved energy efficiency in buildings;
- Impact of the EPBD:
  - tightening of the minimum requirements as a result of the Directive;
  - actual savings and improvements achieved in the buildings sector so far, and expectations for the future;
  - reactions from the market;
- Plans for the future:
  - improvements of the certification/inspections scheme;
  - transposition and implementation of the recast EPBD (2010/31/EU).

Not every report addresses every item in this comprehensive list, but most of them include information about the majority of these issues, as well as other pertinent information for the particular Member State or region. This will certainly allow the reader to get a good overview of how the Directive is being implemented in practice all over Europe, including the many points in common amongst the MS, as well as specific differences between them. There are, obviously, no two MS in which the implementation is precisely alike, but there are many similarities, including on essential points.

These reports must not be seen as formal reports for any legal purpose. In the spirit of transparency and in an effort to provide a true portrait of reality, they are straightforward and frank, even when reporting on details of implementation that might not be as successful as desirable. This is the true value of these reports: they convey the reality of the implementation of this challenging Directive in each country as of the end of 2010.

Most importantly, these reports show how much progress has already been achieved all over Europe in the promotion of energy efficiency in buildings as a result of this Directive. Readers are invited to pay special attention to the best practices presented by the experts in many of the reports, as they were the inspiration and building blocks for the new upgraded requirements that were adopted in the recast of the Directive in 2010. This recast Directive will present new opportunities and challenges for all EU Member States in the coming years.

Implementation of the EPBD in Austria

Status in November 2010

Wolfgang Jilek
Energy Commissioner
of Styria (Austria)

Austria

National websites:

- *www.oib.or.at*
- *www.as-institute.at*
- *www.statistik.at*

1 > Introduction

In Austria, the implementation of the EPBD (2002/91/EC) was completed in 2008, after a difficult process of harmonisation within the country – previously the nine "*Länder*" (provinces) had nine different building codes, including quite different regulations concerning energy. It has to be mentioned that (various) energy certificates had been in use beforehand in some of the federal *Länder*, referring only to the heat demand of buildings caused by the envelope, not including Heating and Ventilation/ A/C systems, etc., like the current certificate does (this being the reason why the heat demand is still the energy rating of the current certificate). The implementation is based on building codes and other relevant regulations of the federal *Länder* and the "*Energieausweis-Vorlage-Gesetz (EAV-G)*" of the Republic of Austria, represented by the Ministry of Economy, Family and Youth, the latter concerning only civil rights, i.e. selling or renting a flat or building. The revision process of the current legislation has already started in order to accommodate the requirements of the recast of the EPBD in 2010.

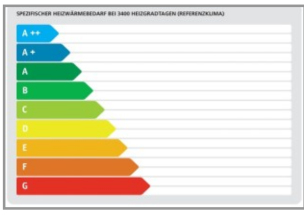
This report presents an overview of the current status of the implementation and of the planned development of the implementation of the EPBD in Austria, as far as it is already harmonised or agreed by the federal *Länder*. It concerns mainly the certification and inspection systems and gives some information on the influence on energy efficiency and instruments used, like financial support.

2 > Certification

Certification of buildings

In Austria, the implementation of the EPBD lies mainly in the responsibility of the federal *Länder*, and the Ministry of Economy, Family and Youth has fixed the same procedures (certification methodology, labels etc.) as the *Länder* agreed. Starting from very different building codes, the *Länder* agreed on the development of a harmonised implementation of the EPBD in 2006, thus developing a common calculation procedure, followed by diverse (harmonised) procedures concerning labelling, certificates, inspection of heating and VAC systems, etc. Meanwhile, the harmonised energy-relevant regulations have become a good example for other parts of the building regulations such as fire protection, safety, buildings for handicapped people and others.

The process of harmonisation and implementation is managed by the OIB (Austrian Institute of Construction Engineering; (*http://www.oib.or.at*) and an official working group of representatives of the nine *Länder*, headed by the energy commissioners of Styria and Upper Austria. While OIB experts designed and developed the energy certificate including calculation methodologies, mainly based on an important input of the Austrian Standards Institute (ON; *http://www.as-institute.at/*), the working group was concerned with the implementation of most of the other elements of the EPBD as such and the implementation in the building codes and other relevant regulations of the nine *Länder*.



Energy Label

Most of the above mentioned regulations came into force between January 1st, 2008 and May 2008. The inspection of heating systems had been in use long before, but the inspection of VAC had to be newly developed and introduced. Some of the *Länder* included those new regulation parts in their building codes, some published new laws, but always on a harmonised basis. The regulations included all types of buildings, i.e., new buildings, major renovations, large non-residential buildings and all buildings when sold or rented. Each building or building unit, e.g., an apartment, is assigned an energy rating according to the table on the left (in final energy). Certificates can only be issued by qualified experts (more information in chapter 4).

A++	≤ 10 kWh/(m²a)
A+	≤ 15 kWh/(m²a)
A	≤ 25 kWh/(m²a)
B	≤ 50 kWh/(m²a)
C	≤ 100 kWh/(m²a)
D	≤ 150 kWh/(m²a)
E	≤ 200 kWh/(m²a)
F	≤ 250 kWh/(m²a)
G	> 250 kWh/(m²a)

Energy Label criteria

The energy performance certificate

The energy certificate is based on calculated values only and assigns an energy performance label to residential and non-residential buildings or building units. The energy label classifies the buildings on an efficiency scale ranging from A++ (high energy efficiency) to G (poor efficiency). Page one shows the general data of the building, of the qualified expert and the heat energy demand in kWh/m²year as key factor for the labelling. To implement the recast of the EPBD, in the future, the first page will also show the primary energy demand and the CO_2 emissions.

Page 2 shows detailed data concerning (final) energy demand of the envelope as well as of the HVAC systems, based on specific climate data of the site.

The validity of energy certificates is 10 years.

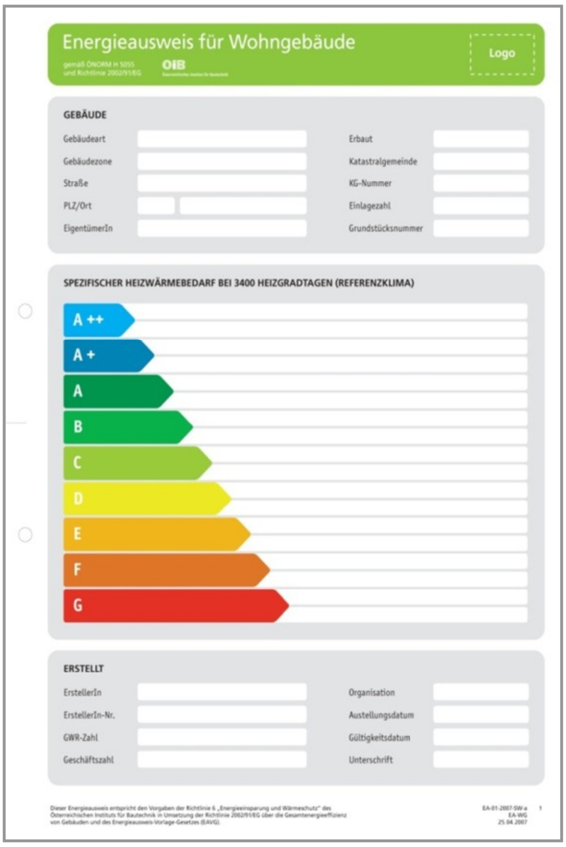


Fig. 1 - Cover page of the EPC

The following 30 to 40 pages contain the description of the building geometry and of every single part of the building, including relevant features not only for the energy demand, but also concerning ecological aspects of the materials used, depending on the kind of building and of the software used for calculation (some give additional information, e.g., an energy flow chart).

When preparing an energy certificate for a major renovation, recommendations have to be given to the building owner. These are listed on additional pages added to the energy certificate. Up to now, the quality of recommendations mainly depends on the expertise of the qualified experts, but a comprehensive catalogue of measures will be prepared and it will become a basic document for the experts within the next two years. Recommendations always have to be worked out for the specific building and usually include a detailed description, estimates of costs, savings and paybacks, as well as the impact on the energy rating if all measures are implemented.

For subsidized residential buildings, special rules apply (see chapter 3).

The calculation methodology

www.oib.or.at

This methodology was developed before 2008 including the existing CEN-standards at that time. The main procedure is listed in the "OIB-guideline 6", linked to diverse Austrian standards (mostly based on CEN-standards). It describes the whole building envelope as well as heating, cooling, ventilation and air conditioning, etc., needs in detail, expressed in terms of useful and final energy. For non-residential buildings, lighting is also included. All kinds of renewable energy systems are included (most new buildings use solar energy for supplying part of their domestic hot water preparation and some also for part of their space heating).

http://www.statistik.at/web_en/

Results and details of the calculation of the energy rating have to be uploaded to the central register of Statistics Austria, a web based central registration system. Some *Länder* offer important support to the experts and maintain an additional web based registration system, a helpline and consulting by specialists, as well as comprehensive possibilities of formation and training.

Fig. 2 shows the main elements of the calculation methodology: starting from useful energy demand, including gains and losses, the efficiency of every technical device is defined and taken into account for the calculation of the final energy demand of heating, cooling etc.

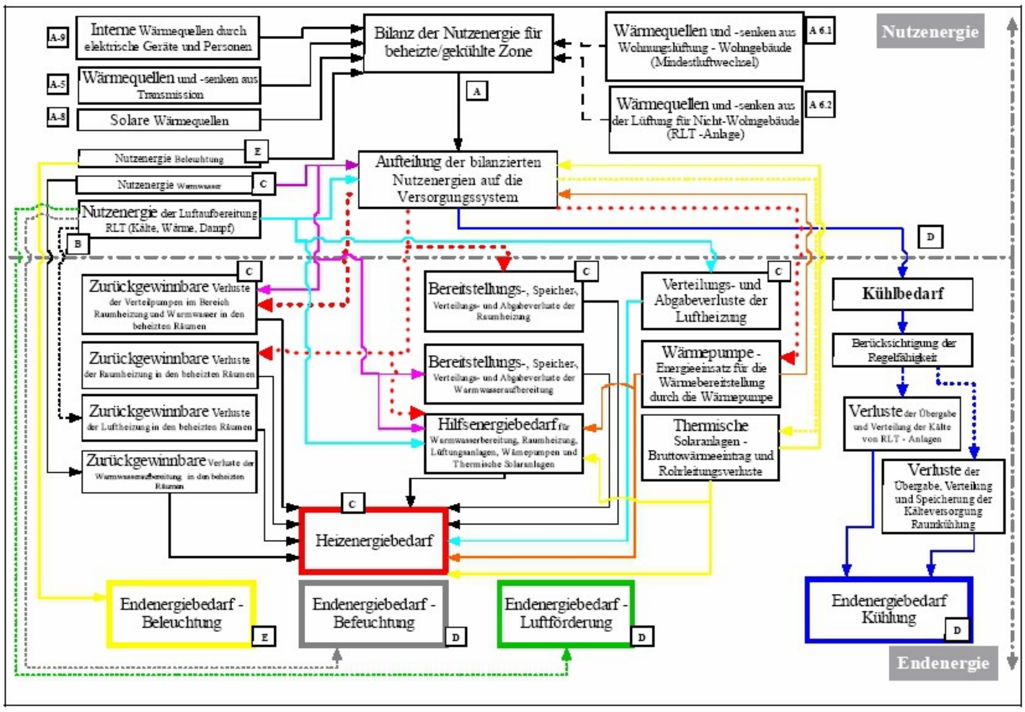


Fig. 2 – scheme of calculation methodology (in German)

<u>New buildings and major renovations</u> (or building units in new buildings or major renovations) must achieve at least the lowest C rating (the exact requirement depends on the building code of the province) to be approved at the planning stage before construction begins. This requirement will be changed to B in 2012 and to A+ sometime on or before 2020, corresponding to the road map of the agreement between the Federal Republic and the *Länder* (Article 15a of the Constitutional Law) which had been fixed in 2009 already. Subsidized residential buildings have to fulfil much stronger requirements (see chapter 6).

At first, a temporary certificate has to be prepared for the building permit, based on the construction plans, HVAC-systems, etc. When no details are changed, this certificate is finally uploaded to the central database of the province or to the central database of Statistics Austria. In case of any change, the certificate has to be adapted and edited when the building has been finished. Fig. 3 shows a simplified illustration of the process for certification of new buildings, from design to first occupation, sale or rental.

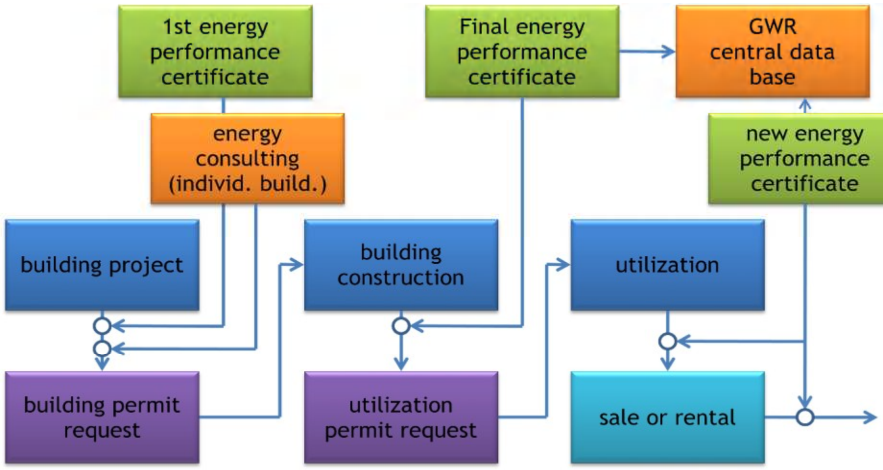


Fig. 3 – Edition of energy certificate

Existing buildings - As of May 2008, all existing residential and non-residential buildings need to be certified when they either undergo a renovation for which they need a building permit or when they are sold or rented. The owner must present a valid certificate to the building authority or to the buyer when the selling or renting contract is established. Usually, the certification is based on the building plans, or, if these do not exist, a qualified expert has to closely examine the property in order to define the building in terms of the construction type (walls, windows, insulation, thermal bridges, ventilation and air-tightness, etc.) and the type and quality of HVAC and hot water systems as well as possible. Finally the thermal efficiency of the building has to be calculated and the certificate has to be issued. There is no minimum requirement for an existing building, i.e., they can be labelled from A to G, but most existing buildings range above B or C.

The building owner must bear the responsibility of having a certificate. The costs of a certificate range from approximately 450 € for an individual new small building (single-family house) to 15,000 € or even more for an existing complex hospital. For subsidized residential buildings, support is granted by the regional governments. Some of the regional governments authorize regional energy agencies to issue certificates or to control the certificates issued by qualified experts. If so, the agencies do not charge a fee for the issued certificate.

Until 2010 there is no possibility of sanctions if a certificate was wrong or simply not issued, except referring to civil rights: an incorrect (or non-existent) building energy certificate may cause a damage which can be claimed at court – a difficult way to get compensation and thus not often used. The obligation of introducing sanctions fixed in the recast of the EPBD will result in a new law where sanctions have to be defined.

Public buildings: In Austria, every public building (owned by private or government bodies) larger than 1000 m^2 is required to display an energy certificate at the main entrance. Currently, only some 100 public buildings are certified but many more are in the process of being certified. The public authorities on the *Länder* level will certify most of their buildings within a few years: some of the *Länder* developed ambitious programmes to realize the certification for their own (governmental) building stock independently from the official time schedule of certifying existing buildings, but many municipalities seem to be less ambitious.

Quality assurance (QA)

In Austria, there is no national (mandatory) QA scheme. Qualified experts (see also chapter 4) usually have had a certain amount of information and training during their specific formation, although widely differing and – with some exceptions – not covering all fields of knowledge necessary to issue an EPC. Therefore, most of them undergo additional training which was set up and is offered by the responsible

Länder institutions and governments, especially since the responsibility for the EPC results is given by civil rights and incorrect EPCs can be brought to court, either leading to compensation payments or to the annulment of a contract.

QA websites:

- *www.lev.at*
- *www.esv.or.at*
- *www.energieinstitut.at*
- *www.energieberatung-noe.at*

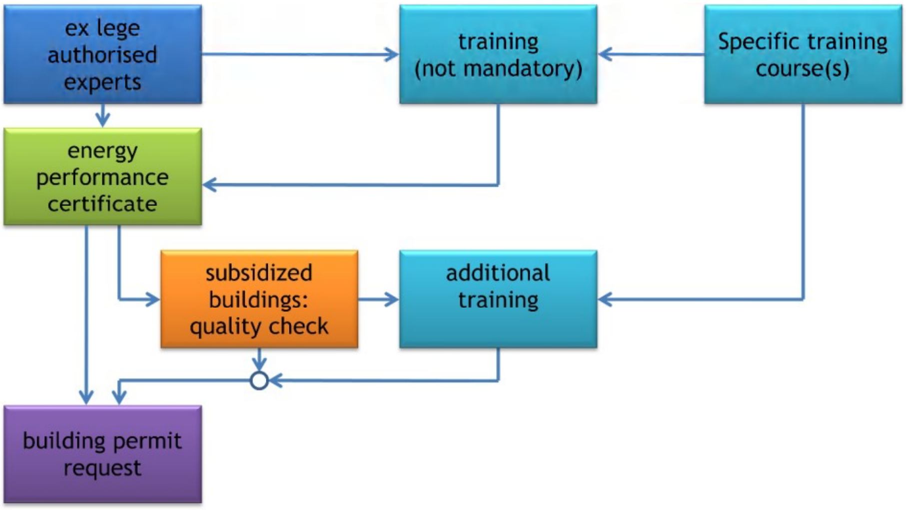


Fig. 4 - Quality assurance scheme

The training of experts, managed mainly by the *Länder* authorities, universities, the Chambers of Commerce and Civil Engineers as well as some private organisations, evaluates the knowledge of the experts about the technical requirements of the buildings, diverse regulations and the details of the certification system itself.

Depending from the different regulations of the *Länder*, either all EPCs or most of them are checked if combined with the support scheme for residential buildings or other subsidies (see chapter 6). A random check is carried out if the EPC is uploaded to one of the *Länder* data bases like "ZEUS" (used in three of the 9 *Länder* in 2010). Checks always include a full data review of calculations in order to check accordance with the correct methodologies. Further checks may include input data if they do not seem plausible. Furthermore, the actual requirements have to be fulfilled. Other EPCs are not regularly checked, but they will in the future, as soon as the independent control institutions will be installed by the *Länder*.

Until now, more than 40,000 detailed QA processes have been made, many experts have had to revise the EPCs (if needed, several times, to eliminate all the mistakes) at their own expense and, in some few cases, legal actions have been taken due to incorrect application of thermal regulations or certification methodologies (which have finally led to compensation payments or to the annulment of the contract), since the process intends to be more educational than punitive.

3 > Inspections - Status of implementation

In Austria, inspection obligations for boilers exist for more than 15 years. Therefore, Austria has adopted option a) of Article 8 of the EPBD. The frequency of inspections depends on the energy source and the size (power) of the heating system (from up to four times a year for solid fuels to once a year for gaseous fuels). In 2011, the present regulation will be replaced by a new agreement between the federal *Länder* and the Republic of Austria.

Up to now, the mandatory inspection report only includes little information, but local and regional authorities have to be informed if requirements are not entirely fulfilled. These are mainly based on emissions and performance as well as safety requirements. Comprehensive inspection reports will be introduced when implementing the recast of EPBD in 2012. Up to now, there is only a short report for heating systems usually including:

- date of inspection;
- year of installation or age of equipment;
- source of recorded data;
- measurements and calculations;
- efficiency rate;
- emission values.

Heating system inspection reports are gathered in different databases of the inspectors and will be collected in a central database in at least some of the *Länder*. Database structures are defined and the system is supposed to start operations in 2012.

The inspection of air-conditioning (A/C) systems is still at an early stage, since these have so far not been regularly inspected. It was necessary to develop requirements and a calculation methodology as well as training for experts. A/C systems from a 12 kW rated output (refrigerating capacity; within one building, A/C systems are added together to establish the 12 kW limit) are to be inspected. Three inspection intervals (annually, every 3 years, every 12 years), with different levels of detail, are to be carried out. The inspection is to be carried out according to the engineering rules. EN 15240 and EN 15239 respectively apply. While the yearly inspection can be carried out by service personal, 3 years inspections and 12 years inspections have to be made by independent experts. The inspection obligations commenced as of January 1, 2009. Inspection reports for A/C systems were introduced together with the obligation of the inspection itself. Inspections for all HVAC systems have to be paid by the end user or by the owner of the building.

It is still not common for many experts to give individual and precise recommendations. Training of those experts is still necessary and is organized by the *Länder* governments and/or energy agencies together with the Chambers of Commerce and of Civil Engineers.

In Austria, there is no relation between experts responsible for issuing EPCs and those making the inspections (see also chapter 4).

4 > Qualified Experts

In Austria, qualified experts are defined “by law” (“*ex lege*”), experts accredited by the rules and regulations relevant to their occupation. These include (legally authorised parties):

- Chartered engineering consultants with relevant authorisation
- Engineering agencies of expertise within their trading licence, master builders and master carpenters (timber construction)
- General legally accredited experts of relevant areas of expertise
- Accredited inspection authorities
- Technical departments of public enterprise bodies

The EPC is therefore to be issued by a person authorised according to the relevant rules and regulations of the trade, an accredited inspection authority or a person who has been certified on the basis of co-operation in the building trade.

In addition, the provinces’ certification bodies for building products (at present situated in Salzburg, Linz, Graz and Vienna) may, within their accreditation, certify people for the purpose of issuing energy performance certificates. The certification is completed by an examination.

Qualified experts are not obliged to attend recognized courses, but these are offered (see also chapter 2 “quality assurance” for experts issuing EPCs) and also used to a large extent: at least 1,500 experts already profit from the knowledge and the experience of others.

Experts responsible for carrying out inspections of boilers and air conditioning systems are not (yet) offered recognized courses concerning the inspection of HVAC systems in the context of the EPBD. In Austria, there are about 4,000 ex lege qualified experts, ranging from chimney sweeps (who have a 3 years training, responsible for most heating systems except in industry) to civil engineers (at least a 5 years education). These experts are usually properly trained to carry them out. Nevertheless, courses especially for A/C systems experts are planned.

5 > National Information and Communication Campaigns

Austria started the implementation of EPBD-certificates in 2008, but energy certificates ("*Energieausweise*") had existed long before in some *Länder*, based on the heat demand of residential[1] and non-residential buildings, using the labelling without the presently available classes A+ and A++. Therefore, EPCs were not a completely new instrument for showing the efficiency and thermal quality of buildings.

Nevertheless, the *Länder* governments started many actions to promote EPCs on a regional level, mainly using brochures, folders and information campaigns linked to the training of experts. No extensive advertising campaign was developed to launch the EPCs, like in some other Member States, but information was well distributed by numerous energy agencies as well as by the experts and by the *Länder* governments and independent energy consultants. In this context, it has to be mentioned that energy consulting is mandatory in some *Länder* if subsidies are involved (see also chapter 6). The calculation methodologies had been partly developed by Austrian universities (Graz, Innsbruck, Vienna) which were also engaged in promoting the EPCs. The universities in Austria were strongly involved in the dissemination of building energy certification, also lecturing in training actions for recognition of professionals as qualified experts.

In the run-up to the introduction of the EPBD energy performance certificates for buildings, comprehensive measures to inform the population and affected professional groups (such as planners, real estate agents, residential constructors, etc.) were taken in all federal provinces also with the help of several joint projects co-financed by the European Commission. Moreover, the conceptual design of a comprehensive training structure for planners was implemented so that training could commence on time and on such a broad basis so as to compensate for lack of qualified personnel.

During 2008-2010, representatives and experts of the *Länder* governments, of the indicated universities, of energy agencies and of the Chambers of Commerce and of Civil Engineers have been present in far more than 3,000 events, fairs, seminars and workshops disseminating the certification process and the EPCs, promoting awareness among citizens regarding information on the thermal quality performance of buildings. Different websites (see chapter 6) provide detailed information about the building energy performance certificates.

Information and training activities were addressed to different groups with very different interests: while qualified experts (legally authorised parties issuing EPCs) and many private people were really interested and engaged, mainly key players involved in home buying and selling, including notaries, real estate agencies, banks, etc., although well informed, showed no special interest in the dissemination of building energy certification. It has to be mentioned that the national legal basis, responsible for the "civil rights part" of the implementation of the EPBD did not impose any sanction and thus the obligation of obtaining Certificates is still not respected by the public to an acceptable extent.

In conclusion, however, people are now used to the fact that the energy performance certification rating is an additional factor when making an investment decision concerning the construction of a new building or the renovation of an existing building.

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[1] Residential buildings represented about 95% of the issued certificates.

6 > National incentives and subsidies

Austria and its *Länder* have a comprehensive system of subsidies, including research and development, matters of efficiency and the use of renewable energies.

Subsidies on national level mainly work as investment subsidies: The "*Klima- und Energiefonds*" (National Climate and Energy Fund; *http://www.klimafonds.gv.at*) provides 100 M€ per year until 2014 for the thermal retrofitting of residential and non-residential buildings. It gives a grant of up to 30% and it has been oversubscribed twice already. Many private people, as well as small and medium enterprises, profit from this programme and will also continue to profit in the future. One of the main preconditions to be given the grant is the issue of an EPC before and after the process of retrofitting and thus giving exact data about the reduction of energy consumption.

On the provincial level, various subsidies exist, some being linked to the support for housing (*Wohnbauförderung*), especially concerning thermal insulation, use of biomass for heating and solar energy for heating and domestic hot water preparation, but also energy consulting and the issue of EPCs. In some *Länder*, the support for housing provides mandatory energy consulting which includes the EPC and a comprehensive explanation of the role and function of EPCs, so people are aware of the expectation and the possible effects an EPC can offer. Since far more than 50% of residential buildings profit from subsidies, that has a very positive effect on the knowledge of the public.

Subsidies for the retrofitting of buildings are put into effect either as investment grants (usually between 10 and 25%) or loans (with 1% to 4% interest for a period of 10 to 20 years, depending on the regional system and the quality of supported measures). Some examples are:

- Vienna: Passive buildings (one family houses) receive 16,000 €;
- Vorarlberg: 1% loan for 20 years for energy efficient retrofitting of buildings;
- Lower Austria: Renovation bonus of 12,000 €;
- Upper Austria: various incentives and a monthly "housing benefit" depending on household income and household expenses.

Each subsidy is combined to numerous, sometimes complex conditions to be granted a subsidy, but it includes normally the issuing of an energy certificate, before and after construction, if it concerns renovation or retrofitting of a building.

The EPBD requires a mandatory check of alternative energy systems. Austria has additionally introduced the mandatory use of renewable energies to a certain extent, e. g., making use of some of the subsidizing instruments (like support for housing). Exact minimum values for the use of Renewable Energy sources in buildings have not yet been determined. The mandatory use of solar installations for water heating in residential and commercial buildings has been partly implemented in some provinces and is considered to be valid for whole Austria. The introduction of mandatory part-solar space heating for residential buildings is also being discussed. On the other hand, there are many possibilities to get subsidies for renewable energies, mainly for thermal solar energy and photovoltaic and for individual heating and district heating with biomass or other biogenic raw materials (district heating from biogas plants).

Feed-in tariffs are handled by the federal Austrian government (with some additional regional incentives). Supports for, e.g., a solar thermal installation ranges from 1,500 € to 3,000 € for an installation of 15 m^2 (average size). Biomass district heating systems receive a 30% non-refundable support on investment. Solar thermal installations have a long tradition in Austria.

Share of renewable energies (%)	2005	2010	2015	2020
Residential buildings	24	25	26	26
Commercial buildings	8	9	10	10
Industrial buildings	1	2	2	2
Public buildings	1	1	2	2
All buildings	33	35	38	38

www.solarwaerme.at

Fig. 6 - Estimated share of renewable energy in the building sector (Source: NREAP)

The Austrian National Action Plan for Energy Efficiency (under the Directive 2006/32/EC) was developed by the Federal Government and the nine *Länder*, showing the variety of financial subsidies and other incentives which should lead to successfully fulfil the given goals for 2020. Building certification is part of it and will play a considerable role, combined with strong limitation of final energy demand provided in the OIB-guideline 6 and legislative measures based on it.

Subsidies:

www.energyagency.at

www.burgenland.at

www.ktn.gv.at

www.noe.gv.at

www.land-oberoesterreich.gv.at

www.salzburg.gv.at

www.stmk.gv.at

www.tirol.gv.at

www.vorarlberg.gv.at

www.wien.gv.at

Subsidies for residential buildings

The development of thermal requirements in residential buildings in Austria cannot be understood without having a look at the subsidizing system, a support for housing (*Wohnbauförderung*):

The federal government created a large fund in order to accelerate the reconstruction of damaged buildings and new buildings as well after World War 2. In 1968, this fund was replaced by a system of subsidies for residential buildings which is still in operation, at first concentrating on opening the possibility of financing a flat to people with a low income, but successively introducing elements of energy efficiency and use of renewable energies. Today, in all *Länder* except one, the granting of housing support is still tied to certain income limits. Support is granted for an adequate living area, any oversized living area is excluded from the support. The compliance with certain minimum requirements for heating a building is a precondition to receive subsidies: until 2008, when the EPBD was put in force, some *Länder* used an ensemble of U-values to specify the necessary features of a building and some already based their subsidies on requirements for the whole building (kWh/m^{2}a) on the basis of heat demand. Then, all the *Länder* switched to total heat demand and, from 2012 onwards, they will additionally introduce primary energy demand and CO_2-emissions, as declared in the energy performance certificates.

www.ec.europa.eu/energy/demand/legislation/doc/neeap/austria_en.pdf

The conditions to get subsidies have always been much stricter than the building codes. So, low energy buildings and passive buildings have been supported well by the subsidizing system for years in Austria. By 2006, there were already 1,000 "passive" buildings and, in 2010, there are more than 8,500, compared to 25,000 in the whole EU. Most of the new buildings today have a heat demand of less than 50 kWh/m^2.a. As an example, fig.5 shows the evolution of the requirements for individual one family houses in Styria.

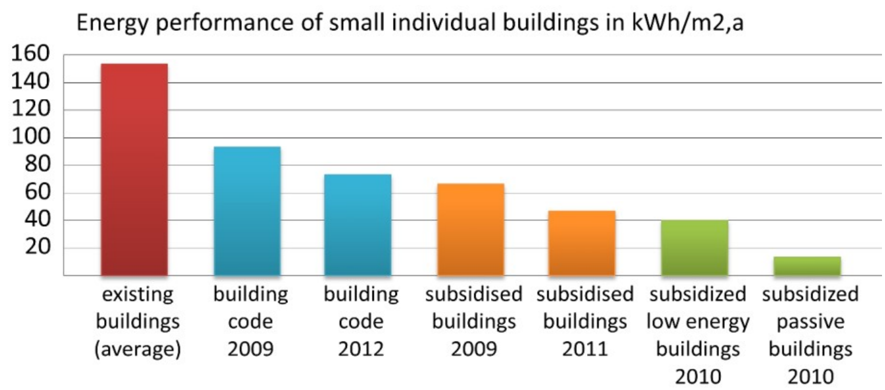

Fig. 5 - Energy performance of small individual buildings in Styria/Austria

Evolution of minimum quality requirements in building regulations

In 2001, Austria had 9 building codes in the 9 *Länder*, each defining the energetic quality of buildings by U-values mainly. For a usual single family house, using just the limits of the ensemble of valid U-values led to an average energy rating of approximately 90 kWh/m^2.a for the heat demand, which was the leading indicator of energy performance certificates at the time. This level was kept until the agreement of 2008. The process of implementation of the EPBD, which had already started in 2006, led to a broad discussion about this agreement and a further process of strengthening the legislative framework, finally issuing a road map as follows:

Thermal heating demand of new residential buildings (kWh/m^{2}a)

Surface/Volume	1.0	0.5	0.33	0.25	0.2
lc[2]	≤ 1.0 m	2.0 m	3.0 m	4.0 m	≥ 5.0 m
as of 1.1.2008	78.0	52.0	43.3	39.0	36.4
WBF-15a B-VG special agreement for subsidised buildings	75	50	41.7	37.5	35
as of 1.1.2010	66.5	42.8	34.8	30.9	28.5
Subsidised buildings	54	36	30	27	25.2

Thermal heating demand of new non-residential buildings (kWh/m^{2}a)

S/V	1.0	0.5	0.33	0.25	0.2
lc	≤ 1.0 m	2.0 m	3.0 m	4.0 m	≥ 5.0 m
as of 1.1.2008	27.0	18.0	14.9	13.5	12.6
as of 1.1.2010	22.8	14.6	11.9	10.6	9.8

In addition, the following requirements apply to the **cooling demand for new non-residential buildings** without ventilation and without air-conditioning technology:

- From the 1st of January of 2006: 3.0 kWh/m^{2}a
- From the 1st of January of 2010: 2.0 kWh/m^{2}a

For other buildings, e.g., residential, only the requirements for the U-values according to Directive 6 of the OIB apply for summer cooling.

For any renovation which is subject to notice or authorisation, the principle of improvement exists. This means that the heat insulation quality of building components or component connectors must have lower U values or thermal bridging correction coefficients respectively than before the renovation and that the density of the building shell must at least be maintained. In principle, the U-values according to Directive 6 are to be met, in so far as is technically, functionally and economically feasible. In addition, the following limits apply:

[2] lc = characteristic length - a measure for the geometry of a building: gross volume/heat exchanging (enveloping) surface (the inverse of Surface/Volume)

Thermal heating demand of residential major renovation (kWh/m^{2}a)

S/V	0.8	0.5	0.33	0.25	0.2
lc	≤ 1.25 m	2.0 m	3.0 m	4.0 m	≥ 5.0 m
as of 1.1.2006	90	65	51.1	44.2	40
as of 1.1.2010	75	55	43.9	38.3	35

Thermal heating demand of non-residential major renovation (kWh/m^{2}a)

S/V	1.0	0.5	0.33	0.25	0.2
lc	≤ 1.0 m	2.0 m	3.0 m	4.0 m	≥ 5.0 m
as of 1.1.2006	30	21.7	17.0	14.7	13.3
as of 1.1.2010	25.0	18.3	14.6	12.8	11.7

In addition, the following requirements apply to the **cooling demand for non-residential major renovation** without ventilation and without air-conditioning technology:

- From the 1st of January of 2006: 6.0 kWh/m^{2}a;
- From the 1st of January of 2010: 4.0 kWh/m^{2}a;

For other buildings, including residential, only the requirements for the U-values according to Directive 6 of the OIB apply for summer cooling.

In principle the requirement for residential buildings is proof of avoidance of summer overheating. This proof is also to be fulfilled for all other buildings, whereby within the proof for non-residential buildings the inner loads may be neglected (they are accounted in the calculation of cooling needs, though). In addition, the requirements for the proof of avoidance of summer overheating are also fulfilled for non-residential buildings if ventilation and air-conditioning technology solutions (without cooling) are used exclusively to meet the requirements. All other factors (e.g. final energy demand) are compared against Reference HVAC systems according to the energy sources used.

Other impacts

Austria already had a quite good performance level and energy performance certificates before the implementation of the EPBD, especially because of the existence of the above mentioned housing subsidy system and its positive influence on all other non-residential buildings. The EPBD achieved a welcomed harmonisation of the nine building codes in Austria and the integration of elements like ventilation, cooling and lighting in the certificate as well as the central registration system GWR (*Gebäude- und Wohnungsregister*) which will probably start being used in 2011.

As of November 2010, more than 135,000 certificates have been issued since the scheme was launched in 2008. The classes of the certificates are shown in Fig. 6. About 90% of the new buildings have got an EPC, while only 20% of existing buildings upon sale or rent are supposed to have gotten an EPC – due to the fact that there are still no sanctions if an EPC is not issued at all, except based on civil rights.

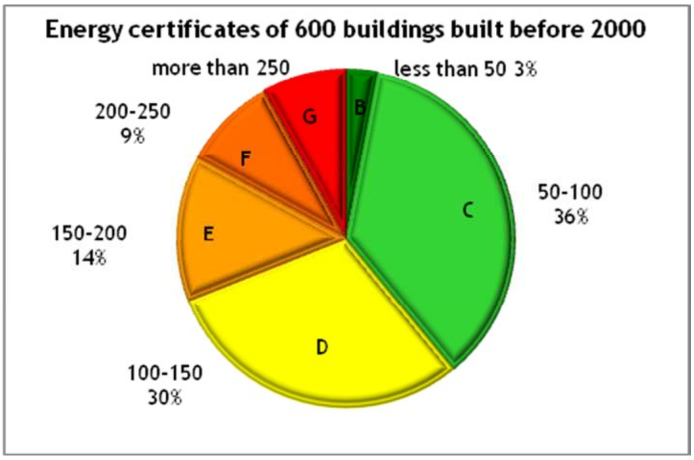

Fig. 6 – Classes of issued certificates in Austria by the end of 2010

8 > Conclusions and future planning

The EPBD requirements have certainly brought some additional aspects to the certification of buildings. It also influenced the building code and it will influence it again in the future, finally leading to “nearly zero-energy” buildings – the road map for such a development is being fixed in running negotiations which should be finished by autumn 2011.

Since “Austria is already built” – the additional building stock is about 1% yearly – an essential effort has to be taken for the existing buildings, raising the actual rate of major renovations from 2% to 4% or 5% yearly. Incentives to the improvement of existing buildings exist, but they have to be supported by special regulations concerning energy efficiency and the use of renewable energy sources too. Existing legislative barriers are far more important than financial concerns about the investment cost in using energy efficient technologies and renewable energies.

Furthermore, the training of more qualified experts and labourers, and training the public to be aware of their energy use are inevitable. Responsible people, politicians as well as their administrative bodies, are well aware of all those necessities and will hopefully help reach the ambitious goals.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Belgium
Brussels Capital Region
Status in November 2010

Pierre Sibille

Bruxelles Environnement - IBGE

Belgium

Brussels Capital Region

1 > Introduction

The implementation of the EPBD in Belgium is a regional responsibility. Therefore, three specific reports have to be prepared for Belgium, one for each Region – the Brussels Capital Region, the Flemish Region, and the Walloon Region. This is the report for the Brussels Capital Region.

Legal context

The implementation of the EPBD in the Brussels Capital Region is the responsibility of the regional Ministry of Energy and the regional Ministry of Environment. They both have the same administration and the same Minister at the end of 2010.

On the 7th of June 2007, the Government of the Brussels Capital Region adopted an ordinance transposing the EPBD into regional law. Some minor changes were introduced on the 14th of May 2009.

Moreover, several execution orders were adopted by the Government of the Brussels Capital Region or by the Minister of Energy, since the last country report produced in 2008. These concern:

- The contents of the technical and economical feasibility study (entered into force in 2008);
- The energy assumptions for the technical and economical feasibility studies (entered into force in 2008);
- The contents of the Energy Performance of Buildings (EPB) declaration (entered into force in 2008);
- The contents of the EPB technical file to be completed before and during the construction of new buildings and major renovations (entered into force in 2009);
- The rules for the calculation of transmission losses (entered into force in 2008);
- The innovative technologies procedure that allows for the consideration of technologies and products that are not currently taken into consideration in the calculation procedure (entered into force in 2009);
- The accreditation of “EPB advisors” (entered into force in 2008);
- The energy performance certificate for new buildings, assigned to individual dwellings, offices and educational buildings (entered into force in 2008);
- The energy performance certificate for public buildings (will enter into force in 2011);
- The EPB requirements regarding the heating systems of buildings during installation and operation. They include acceptance of new heating

website:
www.bruxellesenvironnement.be

systems, periodic inspection of boilers and one-off inspections of heating systems (will enter into force in 2011).

Other execution orders are in preparation, regarding the certification of existing buildings and the inspection of air-conditioning systems, and should be adopted in 2011.

2 > Certification

New buildings and major / light renovations

An energy performance certificate will be issued by *Bruxelles Environnement* - IBGE at the end of the EPB process for new buildings, including individual dwelling, offices and services or education, based on the EPB declaration. EPB advisors are in charge of this EPB declaration.

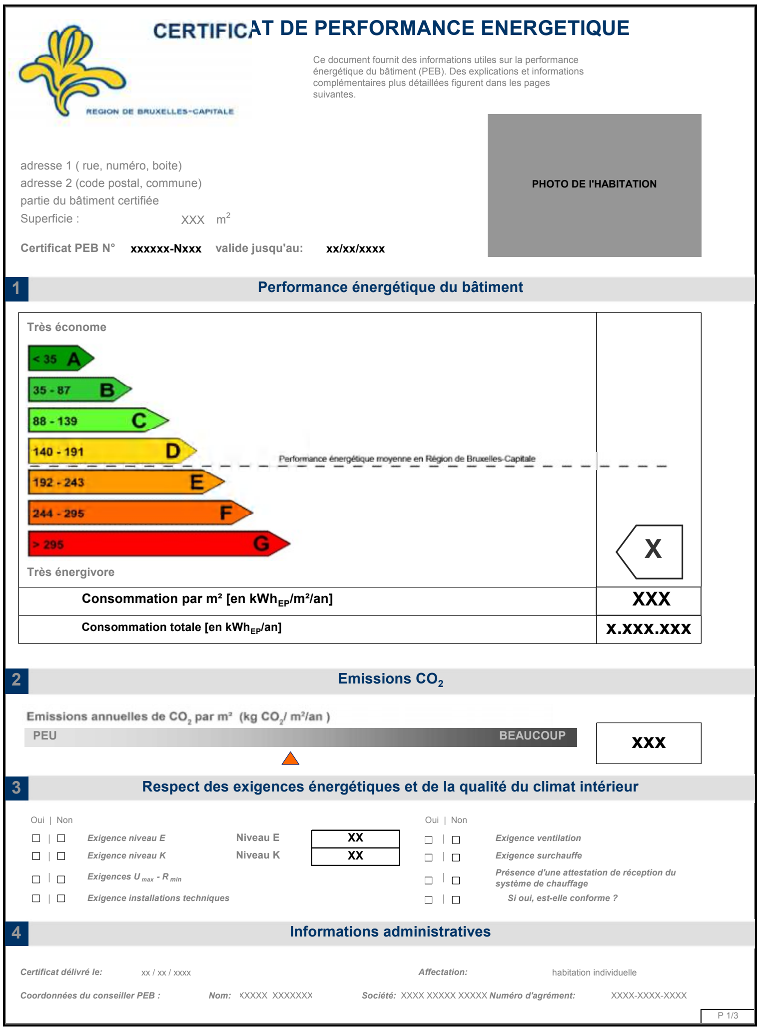

Fig. 1: First page of the energy performance certificate for a new individual dwelling

This certificate contains:

- The address of the building, possibly the "name " of the building;
- A picture of the building;
- The expiry date of the certificate;
- The floors (or parts of the building) certified, if the EPC does not cover the entire building;
- The identifying number of the certificate;
- The label (A to G) granted to the building (ranking based on consumption

compared with buildings of the same type);
- The values of consumption per m² and the total annual consumption of primary energy in kWh, calculated using the EPB software;
- The amount of CO_2 emitted annually per m², calculated using the EPB software;
- Levels E[1] and K[2] calculated using the software PEB;
- A statement of compliance with energy and climate quality inside the building, checked for each requirement;
- The date of issuance;
- Assignment (individual dwelling, office, school,…);
- Contact of the EPB advisor (name, address, phone, e-mail, number of registration).

The certificate is also accompanied by an explanatory form and standard recommendations, for the purchaser or tenant. Standard recommendations relate heating, domestic hot water, ventilation, summer comfort, lighting and domestic appliances and depend only on the type of building.

First certificates for new buildings will be issued in the beginning of 2011.

Calculation procedure

The calculation procedure is defined in the execution order of the 21st of December 2007. The method is identical to the one established in the Flemish Region and very close to the one in the Walloon Region. See the Flemish report for more details.

A study to revise and extend the calculation procedure for cooling and overheating is about to be completed. The results of this study should be incorporated into the calculation procedure during 2011.

The software tool, developed in collaboration with VEA (Flemish Region) and BBRI, that enables the calculation of the energy performance of buildings and the verification of whether the main requirements are met, is operational and has been available since March 2007. See the Flemish report for more details.

An integrated calculation tool with 3D construction graphical views, product databases and administrative forms has been developed, in collaboration with the Walloon Region, and will replace the current software tool in July 2011.

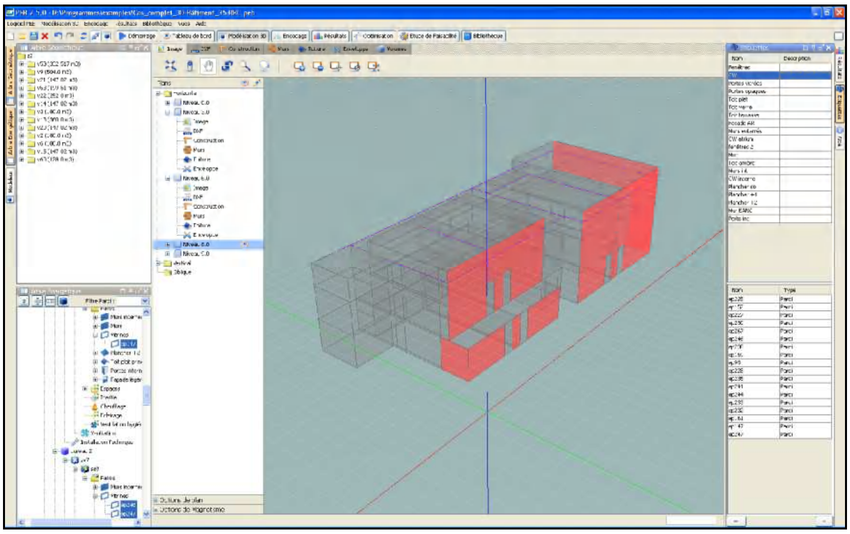

Fig. 2: 3D construction graphical view in the new software tool

[1] The K level is the level of overall thermal insulation of a building. It depends on:
- characteristics of thermal insulation exterior walls
- the compactness of the building, i.e., the ratio between the volume and surface of thermal losses.

[2] The energy performance level E is an overall index of primary energy consumption of a PEB unit. It is a dimensionless number, expressed as follows:
E level = Characteristic primary energy consumption / Primary energy consumption of reference

Requirements for new buildings and major / light renovations

Since July 2008, the EPB requirements are mandatory for buildings for which a building or environmental permit has been requested. The applicable EPB requirements are on primary energy consumption, insulation level, ventilation rate, overheating, technical installation, etc., and depend on the type of building. Requirements should be revised and tightened in 2011.

Enforcement

Minor renovations are directly handled by municipalities. Major renovations and new buildings are handled by *Bruxelles Environnement* – IBGE.

Public buildings

Public bodies that occupy more than 1,000 m² in a building, are obliged to display an energy performance certificate on the front door or in the main lobby of the building.

The rules relating to this certificate are subject to an execution order adopted by the Government of the Brussels Capital Region on the 27th of May 2010.

The execution order comes into force in two phases, according to the category of the building being certified.

<table>
<tr><td rowspan="2">Entry into force:
- 1st of July 2010
Display of the certificate:
- 30th of June 2011</td><td>Offices: Administrative and technical services, town halls and communal houses</td></tr>
<tr><td>Sport: swimming pools and sports centres</td></tr>
<tr><td rowspan="4">Entry into force:
- 1st of July 2011
Display of the certificate:
- 30th of June 2012</td><td>Offices: Buildings of parliament, judicial courts and administrative courts</td></tr>
<tr><td>Schools: Nurseries, schools, colleges, universities etc.</td></tr>
<tr><td>Culture and entertainment: Museums, theatres, cultural centres, libraries, media centres and similar services</td></tr>
<tr><td>Health and other: Hospitals, health centres, nursing homes, revalidation and care and similar services</td></tr>
</table>

Table 1: Entry into force of energy performance certificate for public buildings by category

The certificate is to be issued by a qualified expert using the software and applying the protocol provided by *Bruxelles Environnement* - IBGE. The execution order determining the rules for the accreditation of qualified experts and the recognition of training courses should be voted in the beginning of 2011. Therefore, no certificates can yet be issued, even for the buildings included in the first group in Table 1 (entry into force on the 1st of July 2010).

The certificate is based on consumption data for electricity and fossil fuels used for all purposes, collected on counters or invoices and, where appropriate, data on electricity production on site. The time at which the record of such types of consumption is taken can not be earlier than 24 months before the date of the certificate and has to cover a continuous period of 11-13 months. Energy performance is calculated on the basis of the occupied floor area.

The certificate reflects the level of energy performance of the public building and places it on a scale of labels appropriate to its category. The mean level of energy performance for the building's category in the Brussels Capital Region is also shown as a dotted line in the scale. In addition, the certificate displays the index of CO_2 emission and various other information, such as financial data, information on production systems on-site, recommendations from a list of typical issues, and a histogram of consumption over the last three years.

If the occupier is the owner of the public building, he/she has to install a counter by energy vector and by building within twenty-four months from when the execution order enters into force. In rented buildings, this requirement does not apply.

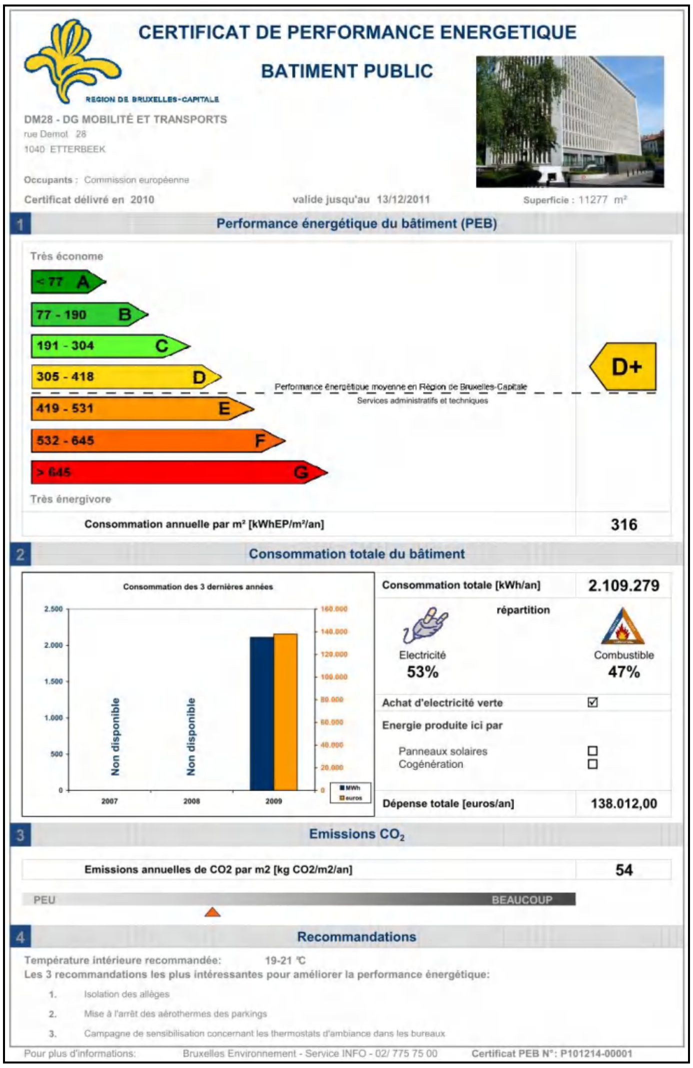

Fig. 3: First page of the energy performance certificate for display in a public building

Existing buildings for real estate transactions

Execution orders determining the rules for certification, the asset calculation procedure, the accreditation of qualified experts and the recognition of training courses, should be adopted in the beginning of 2011. The entering into force is foreseen for the 1st of May 2011.

An energy performance certificate must be issued before any real estate transaction of an existing building: sale, rental, real estate lease, etc. It aims to inform the potential buyer or tenant of the level of building energy performance. The reference values included in the certificate allow them to evaluate the performance of the building and also to compare it to other buildings.

The energy performance of a building must be described in a clear way and must contain an indicator of CO_2 emissions. The calculation procedure depends on the use of the building, residential or non-residential. It is based on the same calculation procedure for new buildings, with some simplifications and the introduction of default values. As of the end of 2010, two software tools are being developed.

The energy performance certificate also includes recommendations obtained from a list of typical issues for improving building energy performance, but imposes no obligation for carrying out work to meet specific energy requirements.


CERTIFICAT DE PERFORMANCE ENERGETIQUE

REGION DE BRUXELLES-CAPITALE

Ce document fournit des informations utiles sur la performance énergétique du bâtiment (PEB). Des explications et informations complémentaires plus détaillées figurent dans les pages suivantes.

Rue Jean Dupont, 50
1000 Bruxelles
appartement E4J4
Superficie : 180 m^2

Certificat PEB valide jusqu'au : 13/12/2020

1 Performance énergétique du bâtiment

Très économe

< 35 A
35 - 87 B
88 - 139 C
140 - 191 D
192 - 243 E
244 - 295 F
> 295 G

C+

Performance énergétique moyenne en Région de Bruxelles-Capitale

Très énergivore

Consommation par m² [en $kWh_{EP}/m^2/an$]	94
Consommation totale [en kWh_{EP}/an]	16.920

2 Emissions CO_2

Emissions annuelles de CO_2 par m² [kg $CO_2/m^2/an$]

PEU — BEAUCOUP 26

3 Recommandations

Les 3 premières recommandations pour améliorer la performance énergétique sont :

1. Isoler la toiture en pente ou le plancher du grenier.
2. Prévoir un thermostat d'ambiance programmable.
3. Installer un système de ventilation permettant la ventilation contrôlée du logement.

Retrouvez plus de détails et d'autres recommandations dans les pages suivantes.

4 Informations administratives

Certificat délivré le : 12/12/2010 Affectation: Habitation individuelle
Certificat PEB n° : 20101212-0025452546-01-7
Oui | Non
Présence d'une attestation de réception du système de chauffage :
Si oui, est-elle conforme ?
Présence d'un rapport de diagnostic :
Coordonnées du certificateur PEB : Nom: Pierre Dupont Numéro d'agrément: 5454-43587-244
Société: Certificat 2000

P 1/3

Fig. 4: First page of the energy performance certificate for existing residential building

The certificate must be issued by a qualified expert with specific training for residential or non-residential buildings.

3 > Inspections of Boilers and Air-Conditioning Systems

Boiler inspections

Heating systems must meet a series of requirements that aim at a minimum energy efficiency and a reduction of their environmental impact. To ensure compliance with these requirements, the regulations require that, from the 1st of January 2011, various inspections are carried out by qualified experts. These requirements and actions are determined in the execution order of the Government of Brussels Capital Region of the 3rd of June 2010, concerning the requirements regarding the heating systems of a building during installation and operation.

The execution order applies to all heating systems in the territory of the Brussels-Capital Region comprising one or more boilers:

- with a nominal power above 20 kW,
- operating on a liquid or gaseous fuel, and
- with hot water as the heat transfer fluid.

The heating system is the set of components necessary to heat the air in a building and/or Domestic Hot Water (DHW), including one or more heat generators, distribution lines, storage tanks and the elements for the emission (radiators, convectors, etc.), as well as control systems. A heating system is of type 1, if the heat is produced by a boiler with a nominal output below 100 kW, and of type 2, if the heat is produced by a boiler with a nominal output greater than or equal to 100 kW or by more than one boilers.

The execution order contains 16 requirements concerning the following points:

1. the holes for measuring combustion efficiency
2. the combustion efficiency and emissions of boilers in operation
3. the sizing of the boilers
4. the modulation of power of boiler burners
5. the chimney draft
6. the ventilation of boiler room
7. the tightness of exhaust gas and combustion air supply ducts
8. the insulation of pipes and accessories
9. the partitioning of heating and air distribution
10. the control of the heating system
11. the logbook
12. the energy metering on boilers
13. the energy metering on the electric fans
14. the heat recovery on exhaust air
15. the variation of the flow of fresh air by actual occupation
16. the energy accounting

Acceptance tests of heating systems with new boiler(s)

The system owner must hire a qualified expert to perform an inspection of the entire heating system during its commissioning, in anyone of the following cases:

- After installation of a boiler;
- After replacing the boiler body;
- After replacing the burner;
- After moving a boiler.

The purpose of the approval is to verify the compliance of systems with different heating requirements, including the points previously listed. This type of inspection is named "*reception*" of heating systems.

Periodic inspection of boilers

Each year for oil boilers, and every 3 years for gas boilers, the owner of the heating system has to hire a qualified technician to maintain and check the boiler. This type of inspection is named "periodic inspection of boilers" and it follows a formal methodology, unrelated top CEN standards. It shall include verification of the following items from the previous list of 16:

- Cleaning of the boiler;
- Cleaning the exhaust system of combustion gases;
- Adjustment of the burner of the boiler;
- Verification of the following requirements:
  - Presence of holes for measuring combustion efficiency;
  - combustion efficiency and emissions of boiler in operation;
  - modulation of power of boiler burners;
  - draft of the chimney;
  - ventilation of boiler room;
  - tightness of the exhaust gas and combustion air supply.

One-off inspections of heating systems

The one-off inspection of a heating system is an assessment of the whole system by a qualified expert. It must be made not earlier than one year before and not later than one year after the oldest boiler, with a power greater than 20kW that is connected to the heating system, has reached the age of 15. A periodic inspection shall be conducted within 12 months prior to this one-off inspection. The one-off inspection includes:

› assessment of the energy performance of the boilers and the heating system;
› information regarding compliance with applicable requirements, depending on the type of heating system;
› assessment of the oversizing of the boilers;
› advice on:
  › boiler replacement;
  › on other possible changes to the heating system;
  › on the use of the heating system;
  › on alternative solutions.

The method and tools for the one-off inspection are developed in collaboration with the Flemish and Walloon region. Different tools are used depending on the type of the heating system (type 1 or type 2). For type 1 systems, a calculation device is used (Figure 3). For type 2 systems, a specific software programme was developed.

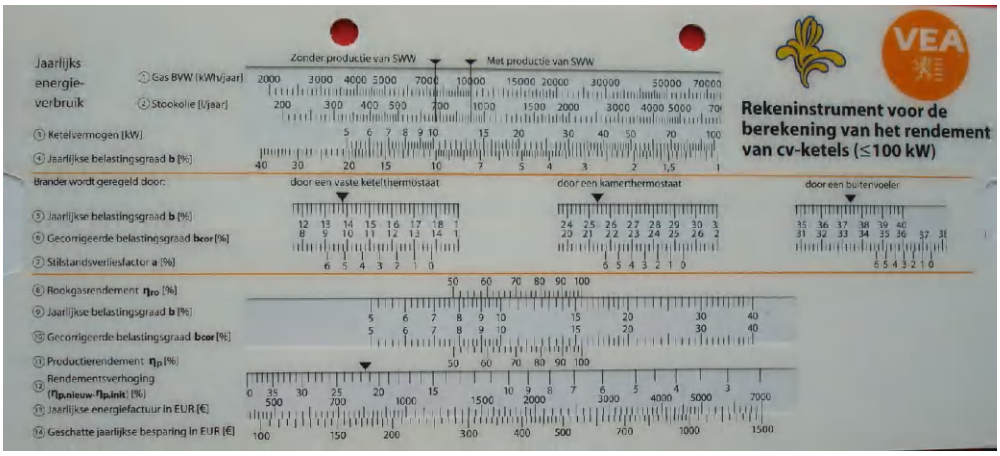

Fig. 5: Calculation device for one-off inspection of type 1 heating systems

Air-conditioning systems inspection

The execution order should be adopted in 2011. The principle will be similar to the one followed in the regulation for the heating systems.

4 > Qualified experts

QEs for issuing EPCs

There are 4 types of qualified experts, one per type of certificate:

› New buildings (EPB-advisors);
› Public building;
› Existing residential building for real estate transaction;
› Existing non-residential building for real estate transaction.

They all have to follow a specific training program, obtain a certificate of competency and ask an accreditation by *Bruxelles Environnement* – IBGE. The training is organised by independent training centres.

At the end of 2010, there are about 600 EPB-advisors accredited.

QEs for carrying out Boiler Inspections

There are 5 types of qualified experts, depending on the type of inspection and on the type of boiler:

› the certified boiler technician L (boiler fuel oil);
› the certified boiler technician G1 (atmospheric gas boiler or burner premix);
› the certified boiler technician G2 (gas boiler with forced air burner);
› the certified heating engineer;
› the EPB heating advisor.

Type of inspection	Type of heating system	Type of qualified expert
Reception	Type 1	certified heating engineer
	Type 2	EPB heating advisor
Periodic inspection	Type 1 & 2	certified boiler technician L, G1, G2
One-off inspection	Type 1	certified heating engineer
	Type 2	EPB heating advisor

Table 2: Types of qualified experts, depending on the type of heating system and type of inspection for which they are authorised.

Accreditation by IBGE is subject to certain conditions, including obtaining a certificate of competency depending on the type of accreditation, compliance with certain obligations and follow-up refresher training. The accreditation is valid for 5 years and may be extended for periods of 5 years.

IBGE has provided specific syllabus with the content of the training (including exam). They are available free of charge on the website or on demand. The trainings are organised by independent training centres.

IBGE expects to accredit about 3,000 qualified experts, especially technicians but also engineers for *reception* and diagnostic of large installations.

Quality control

Quality control will focus on the obligations of the qualified experts and especially on the accuracy of their reports (EPB declaration, report of periodic inspection, certificate,…) by administrative and on-site controls. It will be ensured by an accredited institution, designated by IBGE. The methodology will be slightly different depending on the type of qualified expert (EPB advisor, certified boiler technician,…).

The tender for the quality control for the certified boiler technician, the certified heating engineer and the EPB heating advisor was launched in late 2010. It is foreseen to control 2 or 3 reports and compliance with administrative obligations for each qualified expert every year or two years.

The quality control for the other qualified experts will be developed during 2011.

5 > National Information and Communication Campaigns

Advertising campaigns on the radio, in the press, etc. are foreseen in 2011, in order to encourage certification and boiler inspections. Professionals will be informed through newsletters and specific seminars, in collaboration with professional associations.

A lot of information is already available on the website of *Bruxelles Environnement* - IBGE: *www.bruxellesenvironnement.be*

6 > Incentives and Subsidies

There are several federal or regional incentives and subsidies (condensing boiler, insulation, heat pump, passive or low energy building…) for new building or retrofit available under certain conditions, but they are unrelated to EPCs.

See the IBGE website for more information: *www.bruxellesenvironnement.be*

7 > Impact of the EPBD

Before the EPBD, the only requirement for a new building was to get a K level (function of insulation and building form) of 55 and to have the liquid fuel boilers maintained by an accredited professional each year.

Since July 2008, the requirement concerning the K level was strengthened, and other requirements were added (E level, insulation performances of wall and roof, minimum ventilation ratio, requirement on technical installations). Those requirement are different for new building, major or simple retrofit or existing building.

	K level		E level		
	Before July 2008	From July 2008	Before July 2008	Before July 2011	From July 2011
Individual dwellings	55	40	-	90	70
Offices	55	45	-	90	75
Schools	55	45	-	90	75

Table 3: K level and E level required for new building.

8 > Conclusions and future planning

The following steps are under way:

- Finalisation of the last execution orders required for the certification of existing buildings and air-conditioning system inspections,
- Training and accreditation of the qualified experts to perform heating system inspections and certifications,
- Revision of the calculation procedure for new buildings,
- Launch of the new software tool for the energy performance calculation for new buildings,
- Preparation of the transposition of the recast.

Implementation of the EPBD in Belgium
Flemish Region
Status in November 2010

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1 > Introduction

Since the last report published in the spring of 2008, major new steps were taken for the implementation of the EPBD in the Flemish Region. As certification of existing buildings started in 2008, a lot of experience on both new and existing buildings is now available.

The EPBD was implemented in the following phases:

- Requirements and certification for new buildings since January 2006.
- Certification of existing residential buildings for sale since November 2008.
- Certification of existing residential buildings for rent since January 2009
- Certification of public buildings since January 2009.
- Regular inspection of natural gas boilers and one-off inspection of the heating system since June 2010. Regular inspection of other types of boilers was already mandatory before the EPBD implementation.
- Regular inspection of A/C installations since February 2007. In February 2011, specific legislation will be introduced in order to specify the inspection intervals, as well as the method of inspection.

In 2009, there were minor changes in the decree that constitutes the base for the implementation of the requirements and certification scheme. The requirements for new and renovated buildings were tightened on the 1st of January 2010. At this moment, the revision process of the current legislation is launched for the implementation of the recast of the EPBD in 2010, in order to improve the processes based on the experience from the last 5 years, and to set two further steps in the tightening of the requirements.

This report presents an overview of the current status of the implementation and of the plans for the evolution of the implementation of the EPBD in the Flemish Region. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

In Belgium, the implementation of the EPBD is a regional responsibility. The Flemish Energy Agency (VEA) and the Ministry of Environment, Nature and Energy are responsible for the implementation in the Flemish Region. VEA is also the managing body for the requirements and certification schemes. VEA designed, developed and supports the requirements and certification system for the Flemish region.

2 > Certification

The certification system was implemented in different phases, based on the variety of buildings. The certificate for new buildings is part of the energy performance requirements procedure, which is in force since January 2006. The certificate for existing residential buildings for sale is mandatory since November 2008. In January 2009, the certificate became mandatory for existing residential buildings when rented, as well as for public buildings. The legislation concerning the certification of existing non-residential buildings is already in place, but the software tools are still under construction. The implementation is expected in 2013. The development of the certification system for existing non-residential buildings happens in collaboration with the Brussels and Walloon region.

The methodology, software and qualifications of the qualified experts are different for new buildings, residential buildings and public buildings.

	Existing residential buildings	Public buildings	New buildings	Existing non-residential buildings
Implementation	Since 1/11/2008 (sale) or 1/1/2009 (rent)	Since 1/1/2009	Since 1/1/2006	Legislation is approved but not yet implemented. Expected in 2013.
Qualified Expert	Type A: training course + examination	Type C: training course (attendance mandatory)	'reporter': degree in architecture or engineering needed	Type D: Not defined yet
Calculation	Calculated energy* use in kWh/m²	Measured energy* use in kWh/m²	Calculated energy* use E-level	Calculated energy* use in kWh/m²
Methodology	Mandatory inspection protocol	/	/	Not defined yet
Responsibility for obtaining a certificate	Owner of the building	User of the building - public organisations	Person who asks for the building permit	Not defined yet

** Primary energy*

Table 1: Overview of the different certification systems

Existing residential buildings

A certificate must be available from the moment the building is put for sale or for rent. The owner must give a valid certificate to the buyer when the deed is established. In case of rent, the renter must get a copy.

A qualified expert (type A) visits the property and assesses the building in terms of the type of construction (walls, windows, insulation, ventilation, etc.), as well as the type and quality of HVAC and hot water systems. The expert has to use the mandatory certification software offered by VEA. This software calculates the energy score. There is no minimum requirement for an existing building. The energy score which expresses the calculated primary energy use is placed on a colour bar between 0 kWh/m² and 700 kWh/m². The impact of the behaviour of the inhabitants is not taken into account. Old buildings with wasteful use of energy can have a calculated energy score that is much higher than the marked 700 kWh/m² on the scale. In order to be legal, the certificate has to be signed by the qualified expert.

The front page of the Energy Performance Certificate contains:

the address of the building;
the type of the building (single-family home or multiple, detached, semi-detached and terraced buildings);
the software version;
the energy score: the calculated primary energy use in kWh/m² per year.
the energy score on the colour bar shows the energy impact of the building: from green (energy friendly) over orange to the red zone (not energy friendly);
the data of the qualified expert;
the validity period (10 years).

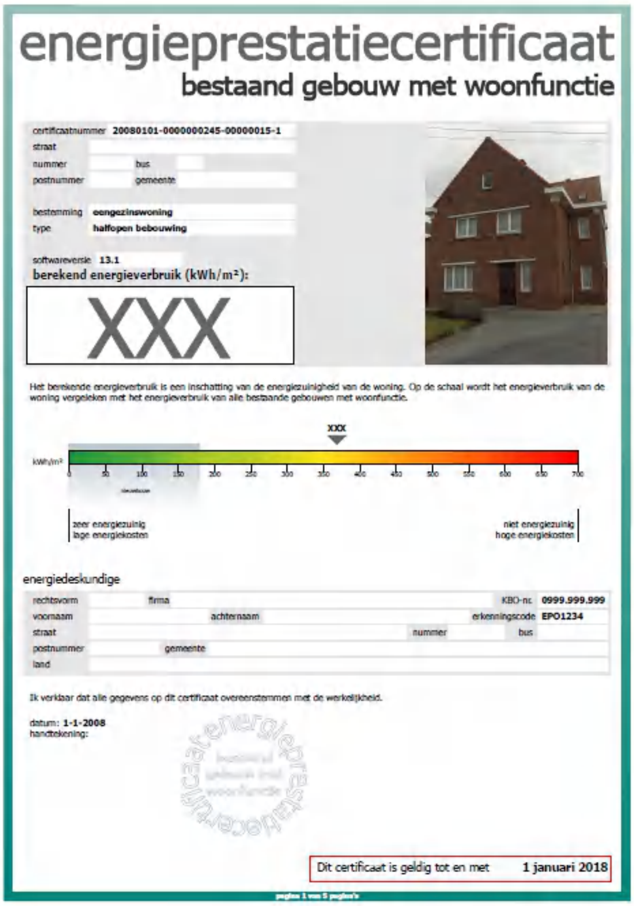


Figure 1: Cover page of the EPC for existing residential buildings

Cover page of the EPC for new buildings

Second page of the EPC for existing residential buildings

The second page contains the energy performance of the building envelope, the energy performance of the heating system, an estimation of the CO_2-emissions, and the recommendations, generated automatically based on the data filled in by the qualified expert. There is a blank field where the energy expert can fill in additional information or additional advice based on the specific condition of the building. There is currently no obligation to implement these recommendations.

VEA charges no fee to the owner or to the qualified expert. The owner has to pay the qualified expert. The cost usually varies between 100 € (apartments) and 300 € (houses). There is no fixed price.

Calculation methodology

The calculation methodology for existing buildings is developed for the Flemish region on the basis of the methodology used for new buildings, as well as the methodology used in the Netherlands for energy performance certificates. A lot of default values are used to increase the reproducibility. It includes heating, cooling, DHW and electricity use for fans and pumps. The result is expressed in terms of primary energy in kWh/m².year. The qualified expert has to follow a mandatory inspection protocol. He/she fills in all the necessary data in the software, which is an online system based on a central server.

Enforcement

VEA carries out random checks for the availability of the certificate for existing buildings, by inspecting websites, real estate agents and advertisements. If no certificate is available in the central database for that address, the owner will receive an invitation for a hearing. The owner risks a fine between 500 € and 5000 €. Besides this, the notary has to report to the VEA the absence of an EPC. Renters or buyers can also make a complaint to the VEA if no EPC is available.

Front page of the certificate for public buildings

The energy performance certificate for public buildings contains:

- the name, address, of the public organisation;
- the energy score, based on the measured energy use of exactly 1 year;
- the energy score on a colour bar in order to make a comparison with similar buildings;
- the recommendations;
- the data of the qualified expert.

Training centres for energy experts on existing residential buildings are listed on:

http://www.energiesparen.be/epcparticulier/opleiding+energiedeskundigetypeA

The list of qualified experts is updated weekly at VEA's website:

Public buildings: *www2.vlaanderen.be/economie/energiesparen/doc/externe_energiedeskundigen.pdf*
Residential: *www2.vlaanderen.be/economie/energiesparen/doc/energiedeskundigen_type_A.pdf*

In 2009, VEA executed 2,017 checks on availability. In 47% of the investigated cases, the seller or renter did own a valid certificate at the moment the building was put for rent or for sale. In the first half of 2010, 2,019 checks on availability were executed, and almost 65% of the renters and sellers owned a valid certificate.

Public buildings

A "public building" is a building with a total useful floor area over 1,000 m², occupied by public authorities or by institutions providing public services to a large number of persons, and therefore frequently visited by these persons. The certificate must be placed in a prominent location, so that it is clearly visible to the public.

The public organisation using the public building is responsible for having a public certificate. If no certificate is available, the organisation using the building can get a fine between 500 € and 5,000 €, and it must obtain a certificate. The certificate has to be issued by a type C qualified expert or an internal expert, an employee of the public organisation. The qualified expert or the internal expert has to use the web tool provided by VEA. VEA charges no registration fee for the use of the software or for the publication of the certificate.

In order to be valid, the EPC has to be signed. The validity period of an EPC is 10 years.

VEA carries out random checks for the availability of the certificate for public buildings. 10% of the local authorities were checked in 2009. In 2010, the checks were extended to other target groups (provinces, schools and universities). In 2011, the focus will be on the health and welfare organisations.

In July 2010, more than 5,728 public buildings were certified, and many more are in the process of being certified.

Quality assurance (QA)

The first level of quality assurance regarding energy certificates for existing residential buildings is the accreditation of the experts. Only a type A qualified expert can carry out certifications. He/she has to follow a specific training course and pass an exam. No further degrees are required.

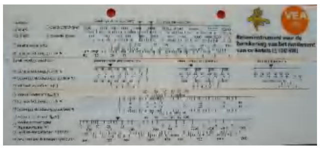
The energy expert has to follow a strict audit protocol when issuing a certificate for an existing residential building. He/she has to fill in the data in the certification software that is provided by VEA. The use of the specific certification software and the audit protocol are mandatory, in order to guarantee a more uniform and correct approach.

There are some automatic software checks on the data. Mistakes have to be corrected. Strange input generates a message to warn the expert.

VEA has started carrying out quality controls on the issued certificates for existing residential buildings. VEA checks a list of standard issues. The qualified expert receives a letter from the VEA, containing his/her mistakes, and can be asked to send evidence. If mistakes or errors occur in the certificates, the qualified experts will get a warning. If a second check shows again errors or mistakes, the qualified expert will get a penalty, a suspension or a fine, based on the impact of the errors. Besides these controls, VEA also investigates complaints. In case of complaints, a detailed inspection on the location is carried out.

VEA noticed that some mistakes are frequently made by the qualified experts. Therefore, VEA is investigating how a higher quality guarantee can be introduced to the training course and the exam.

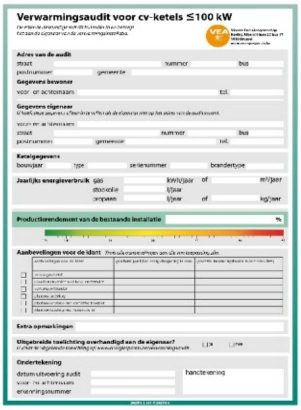
One of the options is a central examination beside the current training courses. Such an examination has the advantage that every candidate will be evaluated in the same way. Also, extra training courses will be obligatory, in order to enhance the knowledge of the qualified experts. Furthermore, specific courses will be given for the trainers.



Calculation device for one-off inspection of small heating systems

Around 200 QA investigations of certificates for existing residential buildings started in October 2010. By the end of 2010, 89 of the most active qualified experts were checked. Fines are not yet imposed. The target is to audit at least 600 of all the issued certificates every year after 2010.

Currently, there are no quality checks on the certification of public buildings. There are only checks concerning the availability of the certificate for public buildings. Quality checks on the certificates for public buildings will start in 2011.



Inspection report of a one-off inspection of the heating system

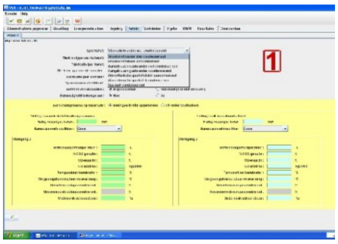
3 > Inspections - Status of implementation

Boiler inspections

Since 1978, boilers using solid fuels must be inspected every year. Since the 1st of June 2010, natural gas boilers must be inspected every two years.

The regulation related to the one-off inspection of boilers more than 15 years old came into force on the 1st of January 2009 for central heating boilers using liquid fuel. For boilers using natural gas, this became active from the 1st of June 2010. The owner of the installation must order a heating audit when the installation is more than 15 years old. This inspection audit to the heating system, carried out by a qualified technician, will contain an advice to the user concerning a possible replacement or ameliorations of the system.

The method and tools for the one-off inspection are developed in cooperation with the Brussels and Walloon region. The method is not based on CEN standards. Different tools are used for systems between 20 and 100 kW and for systems higher than 100 kW. For smaller systems, a calculation device is used.



Software for the inspection of large heating systems

For large installations, specific software was developed.

The experts for the one-off inspection are the same experts carrying out regular boiler inspection. For small heating systems, they have to follow one extra one-day of training and pass a test.

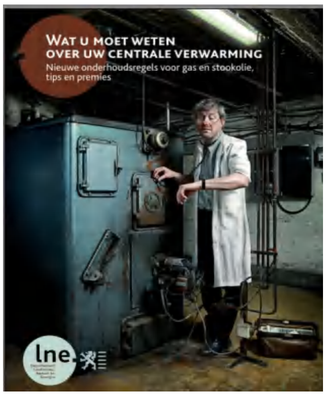
Once a year, the expert has to give the government a list of the inspected installations.

Air conditioning inspection

The Flemish region incorporated the inspection requirements for air conditioning installations in the Order of the Flemish Government, issued on the **1st** of June 1995, concerning general and sectoral provisions relating to environmental safety. Air conditioning systems with a nominal cooling capacity of over 12 kW need regular inspection by a competent expert. The inspection consists of an assessment of the efficiency of the air conditioning and its dimensions, taking into account the cooling requirement of the building. The Minister can determine the content and the frequency of the inspection.

Advertisement for the launching of the certification for existing buildings

In 2008 and 2009, the Flemish government organised an informal consultation with experts from the sector, in order to determine the elements and the frequency of inspections. Following this consultation, it was concluded that an inspection tool prepared by the Flemish government, which could be freely used by inspectors, is necessary. This will promote the effective implementation of the inspection obligation; the inspections will be carried out in an uniform way, will allow for the identification of many occurring shortcomings or points which are subject to significant improvement, and will prevent inspections which will not meet the desired minimum requirements. The study for the development of the software started in February 2010. At this moment, a test of the first version of the software is performed on different types of air conditioning installations (real cases, in the field). The software will be optimised on the basis of these tests. The study was completed in November 2010, and the results are under consideration.



Advertisement for the launching of regular inspections of boilers

Based on the complexity of the methodology and the duration of the inspection, the Minister will determine an appropriate inspection interval. The study will also include a proposition for the inspection frequency, (based on inspection regimes in surrounding countries and on the constructed methodology/software itself).

Industry representatives are involved in the follow-up of the study and the construction of the inspection requirements. The early involvement of industry representatives will enhance the acceptance of the inspection tool that is now under development. The definite approval for the necessary legislative framework is expected in February 2011.

The system does not include a registration system for the competent experts or an independent control system. This will be studied in view of the implementation of the recast. At the same time, the opportunity to collect all the reports of the inspections (for instance, in some sort of central database) will be also investigated.

4 > Qualified Experts

Brochure for public buildings' EPC

Certification of new buildings

A degree in architecture or engineering is required. There is no mandatory training and no exam. There are more than 5,000 experts for new buildings, from which more than 3,000 are actively working.

Certification of existing buildings

Qualified experts are the only persons recognised to issue certificates. Qualified experts for existing residential buildings (type A) do not need a specific degree, but they have to follow a training course and pass an exam. For public buildings (type C), there is a mandatory training but no exam.

More than 4,100 type A qualified experts are registered. 928 type C qualified experts are registered. Both types can act on an individual basis or be integrated in legal organisations.

For public buildings, there is also the possibility for the certificate to be issued by an internal qualified expert who is an employee of the public organisation, with at least two years of experience on energy in his/her current job. An internal qualified expert can only issue certificates for the buildings of his/her own organisation.

The list of qualified experts is updated weekly, and is available online for the public at VEA's website, on the following pages respectively:

- public buildings: *www2.vlaanderen.be/economie/energiesparen/doc/externe_energiedeskundigen.pdf*
- residential: *www2.vlaanderen.be/economie/energiesparen/doc/energiedeskundigen_type_A.pdf*

Air conditioning inspection

A competent expert for air conditioning inspection needs a degree in electromechanics, to be specialist in climate control, in cooling and heating technology, industrial cooling technology or cooling installations, or to have a certificate on climate control, or to be an air conditioning or cooling technician recognised by the Flemish government. It is also possible for someone to become an expert if they have at least a three years proven experience in servicing and setting air conditioning systems with a nominal cooling power above 12 kW, or if they are recognized as experts for air conditioning inspecting in another EU Member State.

In 2010-2011, the necessary qualifications of the competent experts will be evaluated. This will be based on the profile needed for using the software. A tightening of the qualification demands is therefore an option.

5 > National Information and Communication Campaigns

Information regarding the information campaigns is available on:

- existing residential buildings *www.energiesparen.be/epcparticulier/documenten*
- public buildings *http://www.energiesparen.be/epcpubliek/communicatie*
- boiler inspections: *http://www.lne.be/campagnes/centrale-verwarming/brch-jrlijketelcontr-21x26-lagres.pdf*

In 2005, an advertising campaign was developed for the launching of the requirements.

In September 2008, a campaign for the launching of the certification of residential buildings was promoted on television channels, in the press and on the Internet. The concept is that buildings have to be inspected, just like cars. The idea is that a certificate for residential buildings gives us information on the status of the house, just like there are labels for products, food, cars, etc.

VEA's website *www.energiesparen.be* provides detailed information about:

- energy performance requirements for building permits, for builders, for experts, and for building companies;
- the certification system, for professionals of the sector, property owners, and also for the general public. It includes information on training courses, a list of qualified experts, legislation, etc.

Detailed brochures, as well as official texts, are available at the website. An adapted brochure on certification was sent to professionals such as notaries, real estate agents, etc.

A specific information brochure was developed and sent directly to public organisations such as schools, city halls, etc.

The new obligation for the regular inspection of boilers on gas, as well as the one-off inspection of the heating system, was also launched with a campaign.

6 > National incentives and subsidies

Search engine for subsidies

VEA developed a search engine for subsidies: *www.energiesparen.be/subsidies*

There are incentives on different levels. There is a tax reduction on national level for:

New buildings:

- For 10 years, if the net energy demand for heating and cooling is lower than 30 kWh/m². Low-energy house: tax reduction of 420 € per year.
- For 10 years, if the net energy demand for heating and cooling is lower than 15 kWh/m². Passive house (incl. airtightness): tax reduction of 850 € per year.
- For 10 years, if the net energy demand for heating and cooling is lower than 15 kWh/m² and the rest of the energy is compensated by locally generated energy. Zero-energy house (incl. airtightness): tax reduction of 1,700 € per year.
- Heat pump, solar panels and PV.

Existing buildings:

- Roof insulation, wall insulation, floor insulation, windows, heat pumps, solar panels and PV: 40% of the investment with a maximum of 2,770 € (3,600 € if PV solar panels are included). If 40% of the investment is higher than 2,770 (3,600 € if PV solar panels are included), the balance may be used over the following three years.

The government pays 1.5% of the interest on green loans used for investments in roof insulation, wall insulation, floor insulation, windows, heat pumps, solar panels and PV. The maximum amount of the loan is 15,000 € per person and per year, and started to be granted in 2009.

On regional level, there is a property tax reduction for low energy new buildings:

- residential buildings E60 or lower: -20% for 10 years;
- residential buildings E40 or lower: -40% for 10 years;
- non-residential buildings E70 or lower: -20% for 10 years.

The distribution network managers have the obligation to give subsidies to consumers investing in energy savings. There is a global subsidy for new residential buildings having an E-level of E60 or lower. Investments in existing buildings are subsidised according to the separate investments. The Flemish government grants an additional subsidy of 500 € for roof insulation if at least an area of 40 m² is insulated. Some communities and provinces have additional subsidy schemes.

7 > Impact of the EPBD at national level

New buildings

An analysis of the final declarations shows that new residential buildings become more energy-efficient over the years. The amount of buildings with an E-level higher than E80 drops from 70% for building permits asked for in 2006, to 49% for building permits asked for in 2009. Low-energy buildings (E< 60) are slowly introduced into the market. The average E-level decreases, both for residential and non-residential buildings.

	2006	2007	2008	2009
New flats	90	83	81	81
New single-family houses	86	81	78	76
New offices and schools	100	87	83	79

Table 2: Overview of the average E-level (on 31/12/2010)

Even when the new buildings become more efficient on average, there is still a huge potential for improvement. The potential of very good insulation is not yet used enough. The airtightness is only measured in 3.5% of the new residential buildings. Renewable technologies (PV, solar DHW heating and heat pumps) are used in 10% of the new residential buildings.

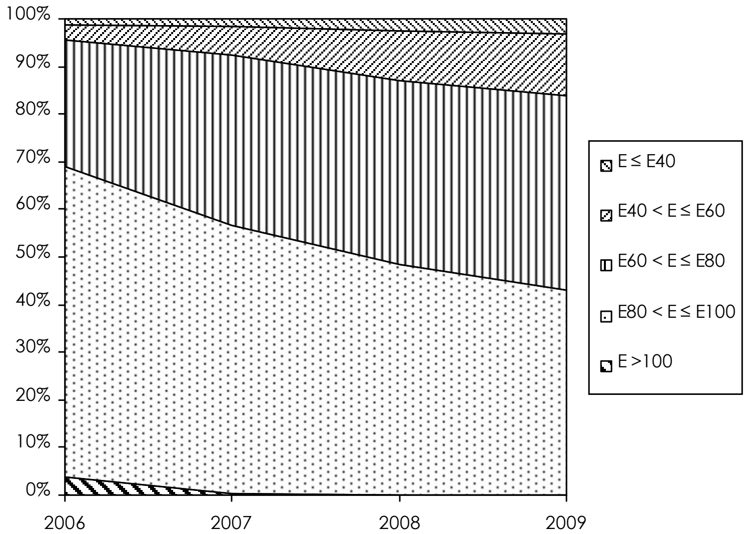


Figure 2: Accumulated percentage of different energy performance levels met by new single-family houses (from final declarations submitted), e.g., the amount of houses between E80 and E100 (E100 required since 2007) diminishes; only a few houses have an E-level lower then E40 (very low energy buildings).

Existing residential buildings

There are almost 350,000 certificates already issued. About 13,000 new EPCs are monthly issued for existing residential buildings.

	2007	2008	2009	2010
Existing residential buildings	0	8,596	154,961	142,913
New buildings	567	5,658	15,899	22,471
Existing public buildings	0	1,868	3,341	780

Table 3: Number of issued EPCs (on 31/12/2010)

The average energy score (primary energy) for apartments is 254 kWh/m^2 per year. For a single-family dwelling, the average primary energy score is 359 kWh/m^2 per year. This corresponds to the middle of the colour bar. An analysis of all the scores as a function of the date of the construction of the building shows that younger buildings have a better energy score.

Date of construction	Apartment	Single family	Single family terraced	Single family semi-detached	Single family detached
<=1970	373	565	472	592	666
1971-1985	287	447	361	426	479
1986-1995	252	345	293	328	362
1996-2005	199	245	207	236	269
>2005	160	192	174	189	230
Average energy score (kWh/m^2)	254	359			

Table 4: Average energy score for apartments and single-family dwellings, depending on the age and the building type

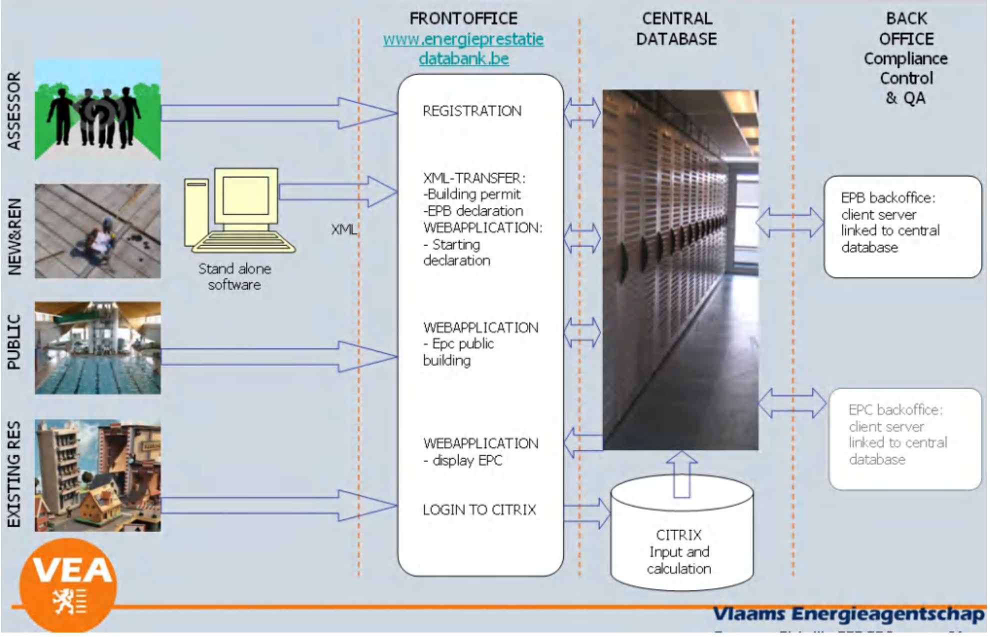
The legislation can be consulted on the following websites:

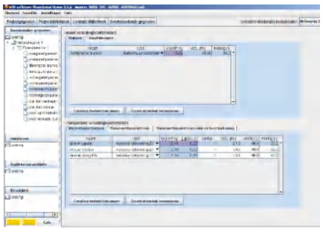
for residential buildings: *http://www.energiesparen.be/epcparticulier/documenten*
for public buildings: *http://www.energiesparen.be/epcpubliek/documenten*
for new buildings: *http://www.energiesparen.be/epb/energieprestatieregelgeving*
for non-residential buildings: *http://www.energiesparen.be/epcnietresidentieel*

8 > Energy Performance Requirements for new buildings and renovations

Each new and renovated building with a building permit since the 1st of January 2006 has to fulfill the requirements both on energy performance and on indoor climate (EPB-requirements). The most important requirement concerns energy performance. New buildings should have an energy performance level lower than E100. The E-level is the annual primary energy consumption divided by a reference consumption.

All procedures are electronic, with a central regional energy performance database. This database is also the core of the enforcement system.



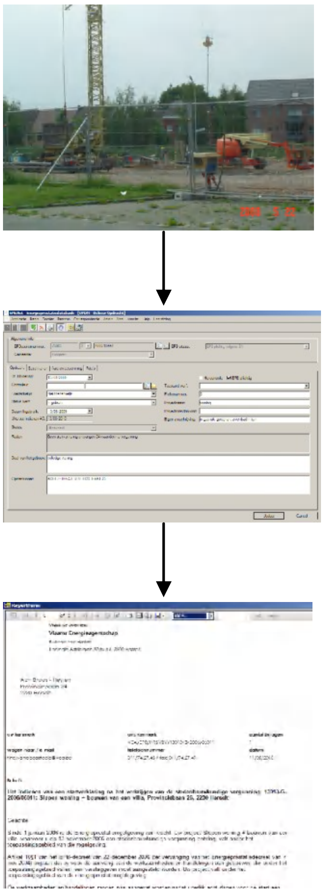


EPB-software

All communities send the new building permits monthly. All documents regarding the procedures on the energy performance requirements and the energy certificates are gathered in the same database.

	2006	2007	2008	2009	2010
Declaration of start of work	4,540	20,726	24,462	24,631	26,737
Final declaration	-	981	8,102	21,408	30,662

Table 5: Overview of the amount of declarations for building permits in the energy performance database



On-site visit leads to input in the system, and to a letter in order to urge the implementation of the solution

Calculation methodology

The calculation method for new buildings is the same for the three Belgian regions. In Flanders, it is described in the building regulations and includes heating, cooling, DHW for residential buildings, lighting for non-residential buildings, electricity use for pumps and fans and on-site production of electricity from PV or CHP. The result is expressed in terms of primary energy. The methodology is based on the CEN standards, as they were before 2006, when the calculation method was established.

The three regions have an agreement to work together for further development of the methodology. As a result, a study project started in 2009, in order to revise the cooling and overheating calculations, and to include some innovative technologies. Major changes due to this project are expected during 2011.

Tightening of the requirements

The requirements were tightened for all buildings permits asked for since the 1st of January 2010. The maximum U-value for wall and roofs changed for all building types, new and renovated. New residential buildings have to meet an energy performance level of E80.

	Wall	Roof	Floor	Glazing	Windows
2006-2009	0.60	0.40	0.40	1.60	2.50
2010-2011	0.40	0.30	0.40	1.60	2.50
2012-2013	0.35	0.27	0.35	1.30	2.20
2014-…	0.30	0.24	0.30	1.10	1.80

Table 6: Overview of maximum U-values (values for 2012 and 2014 are based on a regulation that is in principle approved, but not yet officially adopted)

A change in the legislation for the tightening of the requirements in 2012 and 2014 is on the way. A project was started up in spring 2010, for studying the amount of renewables which will be mandatory from 2015 onwards.

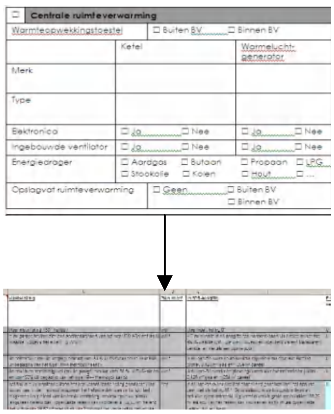
Enforcement

A specific software, the 'EPB back office', was developed on the energy performance database, so that VEA can check the compliance with the procedures and the requirements, and to perform QA checks for new buildings. On the basis of the building permit, VEA checks the availability of the declaration of the start of work for every building. If documents are missing in the database, VEA sends a letter to remind (no on-site visit) or to fix a short deadline in order for the obligations to be fulfilled (based on on-site visit).

94% of all building declarations fulfill the requirements, while 6% of all buildings do not fulfill one or more of the requirements. The amount of building declarations not fulfilling the requirements was higher for building permits in 2006 (9%) than in the more recent years (5% in 2008).

At this moment, 3,300 declarations are made with an administrative fine larger than 250 €. VEA calls the building owner for a hearing before imposing the administrative fine. 227 building declarations with a fine larger than 250 € were analysed in 2008. In 2009, VEA treated 500 cases. The same amount of cases will be treated in 2010. The average fine is approximately 2,000 €. The largest fine till now was +/- 15,000 €. More than 2,000 cases are still waiting for a hearing.

In 90% of all cases, the ventilation requirements are not met (fully or in some rooms). It only rarely occurs that a building does not fulfill the energy performance level. The building owner has to pay an administrative fine in case of non-compliance. Repairs to the building are then not needed.



Controller compares his on-site gathered data with the input in software made by the expert

Quality assurance

The quality of the final declaration, which includes the energy performance certificate for new buildings, is checked by the VEA. Quality checks for new buildings and renovations with a building permit started in 2008. The priorities are the most active experts, large building companies, complaints, and buildings that get financial rewards. There are two types of quality control:

- Desk control: check of the validity of the input data in the software file. In most cases, specific attention is given to a certain amount of input data;
- Control with on-site visit: desk control combined with a comparison of data in the software file, and materials and installations that VEA saw on an on-site visit.

2% of all final declarations got a desk control in the period 2008 - 2010. In 1 on 3 cases, a small or major problem was detected. When the desk control shows that there is a quality problem, VEA asks the expert for the building plan and the evidence for the input values. A more detailed assessment follows the initial check.

Year	Desk control not ok		Desk control ok		Total	
	Amount of files	Amount of experts	Amount of files	Amount of experts	Amount of files	Amount of experts
2009	87	46	108	65	195	111
2010	264	94	547	188	811	282
total	351	/	655	/	1006	335

Table 7: Overview of amount desk controls on new buildings

The 282 experts checked by VEA during 2010 have submitted 57% of all EPB-declarations in 2009. VEA also carries out inspections on the building site and visits buildings after they are completed. Until now, 550 new buildings were inspected. If the performance of the building is in reality worse than what the expert declared in the final declaration, an administrative fine is calculated for the expert. VEA invites the expert to a hearing before imposing the administrative fine. The QA processes for 69 files for which VEA calculated a fine for the expert are now completed. More than 100 files need further treatment.

9 > Conclusions and future planning

Experience on the running systems for energy performance requirements and certification indicates the need for improvements on:

- The calculation methodology. At midterm, the Flemish government wishes to have one single method that can be used for both new and existing buildings.
- The user-friendliness of software for new buildings. A change of software is planned to be made in two years.
- The quality of the experts for existing residential buildings, by a central examination.
- The reinforcement of the QA scheme, increasing the number of checks.
- An Improvement of the energy performance database, in order to reduce the administrative burden and to increase the efficiency of the enforcement process.

Other changes will be made to the system for the implementation of the recast of the EPBD. The consultations for the development of the action plan for nearly zero energy buildings and for the long term path for the requirements have already started. This process will become more intense during 2011.

Implementation of the EPBD in Belgium
Walloon Region
Status in November 2010

Benoit Fourez

Public service of Wallonia

DGO4 – Department of Energy and sustainable building

Belgium
Walloon Region

1 > Introduction

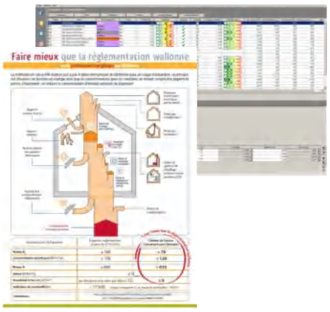
The Walloon Region of Belgium transposed the EPBD on the 19th of April 2007. The Walloon Region has for many years had a Thermal regulation for new and existing dwellings, schools and offices in place. For existing buildings, there are requirements for the building envelope (U-values) and ventilation, when a town planning permission ("*permis d'urbansime*") is required for renovation. For new buildings, requirements depend on its typology and may cover building envelope (U-values, global insulation level), global energy performance rating (E_w, E_{spec}), ventilation, and overheating rating.

Since January 2004, a voluntary action for new dwellings (called *Construire avec l'énergie* – *build with energy*) aims to provide the building sector with future statutory requirements - requirements on the building envelope (U-values, global insulation level), ventilation, primary energy consumption and summer requirements. At the end of the process, a certificate is issued, describing measures that have been taken to fulfil the requirements. This was a first step towards certifying new dwellings. A first specific software tool that makes a calculation of the primary energy consumption had been developed for this action, but has been replaced by the ones used for the new regulation.

Since September 2006, a voluntary action aims to prepare the building sector for the certification of existing dwellings (*Energy Advise Procedure*). The audit provides an evaluation of the energy performance of the building and recommendations to improve this performance. It takes an average of one day and a half to complete these audits. The training to be an accredited assessor takes five days. Admission to training courses is based on requirements, such as education (architecture and engineering degree) and/or professional experience in the field of energy in buildings. At the moment, more than 688 assessors are accredited. 352 others are awaiting training. Among them, more than 75 will be accredited by the end of this year. All audits are centralised on a database. At this time, over 15,600 audits have been listed on this database (representing more than 1% of the existing building stock in the Walloon region).

Other voluntary actions have been taken regarding tertiary buildings to prepare the building sector for the Directive transposition. At the moment, there are 129 accredited research departments.

Legal context



The implementation of the EPBD in the Walloon Region is the responsibility of the regional Ministry of Energy and sustainable building (articles 3, 4, 5, 6, 7 and partly 10 on certification aspects) and the regional Ministry of Environment (articles 8, 9 and partly 10 on inspection of boilers and air-conditioners).

On the 9th of March 2006, the Government of the Walloon Region approved a project of decree, regarding the transposition of the EPBD into regional law. The decree has been adapted following the comments received from the public consultation. As far as the mandatory procedure is concerned, the projects of the decree were approved by the Government on the 13th of July, the 21st of December 2006 and on the 15th of February 2007 respectively. On the 19th of April 2007, the Parliament approved the decree.

The *decree* has been integrated into the CWATUP (regulation on country planning and town planning) that became CWATUPE (E for "*Energie*"). The decree is a framework that translates the EPBD into a regional decree. Orders have to be taken to define the mode of enforcement of the law.

The decree establishes the minimum requirements that must be achieved for new buildings and for major renovations of existing buildings. Major renovations of existing buildings are defined in the enforcement order as the renovations of buildings of over 1,000 m^2 of total useful surface, where the total cost of the renovation related to the building shell or energy installations is higher than 25% of the value of the building, excluding the value of the land upon which the building is situated. Renovations in which more than 25% of the building shell undergoes renovation are also considered as major renovations.

Flyers for 'build with energy'

The person in charge of the conception, description of measures for fulfilling the EPB requirements and control of building works has been identified in the decree. He/she is called an "EPB responsible".

The procedure is linked to building permits and is divided in three stages:

1. Upon application for a building permit, "a declaration of honour" is to be attached to the permit application and co-signed by the EPB responsible and the applicant,
2. 15 days before the beginning of building work, the EPB initial declaration has to mention the main measures for fulfilling EPB requirements and is to be co-signed by the EPB responsible and the applicant,
3. 6 months, at the latest, after provisional acceptance of construction work, the EPB final declaration presents the energy performance calculation for the building. It is an "as-build declaration". It is to be co-signed by the EPB responsible and the applicant.

Certification is mandatory for new buildings, and for existing buildings when they are sold or rented. The certificate is valid for 10 years.

Enforcement orders on calculation methods, requirements, agreements and penalties were approved by the Government on the *17th of April 2008*.

The enforcement order on the procedure was approved by the Government on the 26th of June 2008 and reformed on the 18th of June 2009.

The enforcement order on certification was approved by the Government on the *3rd of December 2009* and modified by the Government on the *27th of May 2010*.

Attestation 'build with energy'

Practical EPB Guide

Governmental websites:

http://energie.wallonie.be

Calculation procedures

The calculation procedures (art. 3) are included in an execution order. The Walloon Region uses the same calculation method as the Flemish Region. The 3 Regions work in collaboration on adaptations to the calculation method. The aim is to regularly adapt the calculation method.

Requirements for new buildings

Minimum requirements for new buildings have been included in an execution order.

Two phases were foreseen for their entry into force. A first step began in September 2008 and a second in May 2010.

The first phase involved measures to strengthen requirements of previous regulation, as regards U_{max} values, K levels, but also ventilation for offices and schools. Other specific functions and industries have also been subject to this new execution order (cf. Table1).

A first software tool was made available for the calculation of U-values, K levels and ventilation.

In this first phase, the proof of compliance was verified at the time of town planning permission.

The second phase consisted of adding new requirements, depending on the function and type of the building. These may be requirements on overheating, maximum primary energy consumption per square metres and/or maximum E_W values (cf. Table2).

For new residential buildings, a third phase is planned for September 2011: the requirements on maximum primary energy demand will be increased from 170 kWh/m^2 to 130 kWh/m^2.

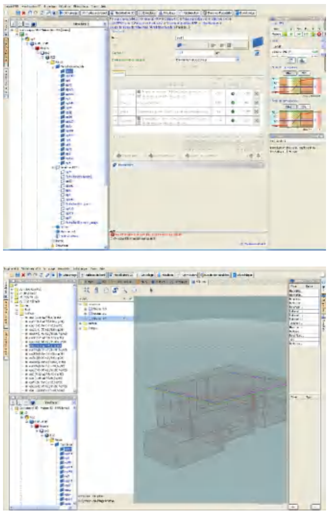
The type and level of requirements for new buildings are determined by the function and type of the building (residential/schools and offices/industry/other non-residential buildings) and may cover:

- maximum primary energy demand per square metre
- maximum E_w value, which expresses the primary energy consumption of the project, compared to primary energy demand of a reference building
- maximum K value, which depends on average U-value and compactness of the project
- maximum U-values for each element of the building shell
- compliance with requirements concerning ventilation
- maximum value for overheating rating

The proof of compliance must be made after completion of the building. For new or rebuilt buildings, the control of compliance is carried out by a registered "EPB responsible", appointed by the applicant. The "EPB responsible" must be an architect or an engineer that has followed a specific training course. He/she sends his final calculation - in the form of an "EPB final declaration" - to local administrations. Control of the regulation is the responsibility of regional (agents designated by the government) and local administrations, whose executives can fine the applicant, the EPB responsible or the building contractor, to the extent that they are concerned, if the requirements are not met.

“EPB responsible”

For the time being, there are 2,083 accredited “EPB responsible” legal entities. Among them, 538 are corporate bodies and 1,545 are private persons. Names and addresses of “EPB responsible” professionals are listed on the *web*.



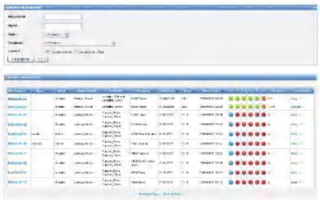
EPB Software tool

Software tool, practical guide, support

A specific *software tool* has been developed for the “EPB responsible” to be able to calculate primary energy consumption of the project, to check compliance with regard to requirements of the regulation, and to deliver proper forms to the administration. The software tool integrates a 3D builder interface to facilitate the project coding.

Local and regional administrations have access to a *web central database*, in order to control the regulation. At the moment, 2,579 projects have been registered on the database (new buildings and major renovations since May 2010).

A *practical guide*, designed for professionals, helps them understand the new regulation.



EPB web central database

A specific support system called “*Facilitateurs PEB*” is available for professionals, to offer them support in their projects. This support can be accessed by email or phone.

Requirements for existing buildings

Minimum requirements for existing buildings have been included in an execution order.

For small existing buildings (<1,000 m^2), the requirements of the previous regulation remain in force for ventilation, with tighter Umax values. The requirements are also extended to other uses (other specific functions, but also to industry, in some cases of extension or rebuilding) (cf. Table on requirements).

Minimum requirements for renovated buildings >1,000 m^2 have been included in an execution order. The type and level of requirements is a function of the type of building and the extent of the renovation.

A. U_{max} values (W/m²K)			
New and existing[1] houses, collective housing, hospitals, offices and schools			
Requirements	Before September 2008	September 2008-April 2010	Since May 2010
1. Walls delimiting protected volume except dividing walls with an adjacent protected volume			
1.1. Windows and others translucent walls except doors, garage doors, curtain walls and glass bricks	$U_{w,max}$ = 3.5	$U_{w,max}$ = 2.5 and $U_{g,max}$ = 1.6	$U_{w,max}$ = 2.5 and $U_{g,max}$ = 1.6
1.2. Opaque walls			
1.2.1. Ceilings and roofs	0.4	0.3	0.3
1.2.2. Walls without any contact with soil, except 1.2.4 and 1.2.5	0.6	0.5	0.4
1.2.3. Walls in contact with soil	0.9	0.9	R_{min} = 1.0
1.2.4. Vertical walls and sloping walls in contact with underfloor space	0.6	0.6	R_{min} = 1.0
1.2.5. Vertical walls and sloping walls in contact with cellar outside protected volume	0.9	0.9	R_{min} = 1.0
1.2.6. Floor in contact with outside environment or above an underfloor space	0.6	0.6	0.6
1.2.7. Floors above non heated premises sheltered from frost	0.9	0.9	U_{max} = 0.4 or R_{min} = 1.0
1.2.8. Floors above soil	1.2	0.9	
1.3. Doors and garage doors	$U_{D,max}$ = 3.5	$U_{D,max}$ = 2.9	$U_{D,max}$ = 2.9
1.4. Curtain walls	3.5	$U_{CW,max}$ = 2.9 and $U_{g,max}$ = 1.6	$U_{CW,max}$ = 2.9 and $U_{g,max}$ = 1.6
1.5. Glass brick walls	3.5	3.5	3.5
2. Walls between 2 protected volumes located on adjoining parcels	1.0	1.0	1.0
3. Opaque walls inside the same protected volume or adjacent to another protected volume on the same parcel except doors and garage doors :			
3.1. between distinct dwelling units	1.0	1.0	1.0
3.2. between dwelling units and common spaces (staircase, entrance hall, passage)	-	1.0	1.0
3.3. between dwelling units and non-residential occupancy spaces	1.0	1.0	1.0
3.4. between industrial occupancy spaces and non-industrial occupancy spaces	1.0	1.0	1.0

Table 1 (A1) Requirements - old/first phase/second phase

[1] Renovated buildings are those for which a building permit is mandatory, and buildings changing their occupancy that were previously non-heated.

New and existing shops, catering buildings, sports facilities, businesses, industries			
Requirements	Before September 2008	September 2008-April 2010	Since May 2010
1. Walls delimiting protected volume except dividing walls with an adjacent protected volume			
1.1. Windows and others translucent walls except doors, garage doors, curtain walls and glass bricks	-	$U_{w,max}$ = 2.5 and $U_{g,max}$ = 1.6	$U_{w,max}$ = 2.5 and $U_{g,max}$ = 1.6
1.2. Opaque walls			
1.2.1. Ceilings and roofs	-	0.3	0.3
1.2.2. Walls without any contact with soil, except 1.2.4 and 1.2.5	-	0.5	0.4
1.2.3. Walls in contact with soil	-	0.9	R_{min} = 1.0
1.2.4. Vertical walls and sloping walls in contact with underfloor space	-	0.6	R_{min} = 1.0
1.2.5. Vertical walls and sloping walls in contact with cellar outside protected volume	-	0.9	R_{min} = 1.0
1.2.6. Floors in contact with outside environment or above an underfloor space	-	0.6	0.6
1.2.7. Floors above non heated premises sheltered from frost	-	0.9	U_{max} = 0.4 or R_{min} = 1.0
1.2.8. Floors above soil	-	0.9	
1.3. Doors and garage doors	-	$U_{w,max}$ = 2.9	$U_{D,max}$ = 2.9
1.4. Curtain walls	-	$U_{CW,max}$ = 2.9 and $U_{g,max}$ = 1.6	$U_{CW,max}$ = 2.9 and $U_{g,max}$ = 1.6
1.5. Glass brick walls	-	3.5	3.5
2. Walls between 2 protected volumes located on adjoining parcels	-	1.0	1.0
3. Opaque walls inside the same protected volume or adjacent to an other protected volume on the same parcel except doors and garage doors :			
3.1. between distinct dwelling units	-	1.0	1.0
3.2. between dwelling units and common spaces (staircase, entrance hall, passage)	-	1.0	1.0
3.3. between dwelling units and non-residential occupancy spaces	-	1.0	1.0
3.4. between industrial occupancy spaces and non-industrial occupancy spaces	-	1.0	1.0

Table 1 (A2) Requirements - old/first phase/second phase

B. Level K (-) – Global insulation level (function of average U-value and compactness)			
Requirements	Before September 2008	September 2008-April 2010	Since May 2010
New houses	K55	K45	K45
New offices and schools	K65	K45	K45
New collective housing, hospitals, shops, catering buildings, sports facilities, businesses	-	K45	K45
New industries	-	K55	K55
Existing non heated buildings changing their occupancy to houses	K65	K65	K65
Existing heated buildings (except industries) changing their occupancy to houses	K65	-	-
Existing non heated buildings changing their occupancy to offices or schools	K70	K65	K65
Existing heated buildings (except industries) changing their occupancy to offices or schools	K70	-	-
Existing industries (heated or non-heated) changing their occupancy to houses	K65	K65	K65
Existing industries (heated or non-heated) changing their occupancy to offices or schools	K70	K65	K65
Others	-	-	-

Table 1 (B) Requirements - old/first phase/second phase

Requirement C. : E_w (-) – Global energy performance level (calculated primary energy consumption divided by calculated primary energy consumption of a reference building) **Requirement D.: E_{spec} (kWh/m^2.a) – specific energy consumption** (calculated primary energy consumption per square metre of heated floor area) **Requirement E. : Overheating rating (Kh)**			
Requirements	Before September 2008	September 2008-April 2010	Since May 2010
New houses	-	-	E_w100 E_{spec}170 $I_{overh,seci}$≤17,500
New offices and schools	-	-	E_w100
New collective housing, hospitals, shops, catering buildings, sports facilities, businesses	-	-	-
New industries	-	-	-
Existing non heated buildings changing their occupancy to houses	-	-	-
Existing heated buildings (except industries) changing their occupancy to houses	-	-	-
Existing non heated buildings changing their occupancy to offices or schools	-	-	-
Existing heated buildings (except industries) changing their occupancy to offices or schools	-	-	-
Existing industries (heated or non-heated) changing their occupancy to houses	-	-	-
Existing industries (heated or non-heated) changing their occupancy to offices or schools	-	-	-
Others	-	-	-

Table 1 (C/D/E) Requirements - old/first phase/second phase

F. Ventilation			
Requirements	Before September 2008	September 2008-April 2010	Since May 2010
New houses and buildings changing their occupancy to houses	Requirements are set in the annex V of the execution order of the 17th of April 2008 (based on NBN D50-001)	Requirements are set in the annex V of the execution order of the 17th of April 2008 (based on NBN D50-001)	Requirements are set in the annex V of the execution order of the 17th of April 2008 (based on NBN D50-001)
New offices and schools and buildings changing their occupancy to offices or schools	Requirements on air output are a function of premises use	Requirements are set in the annex VI of the execution order of the 17th of April 2008 (based on NBN EN 13779)	Requirements are set in the annex VI of the execution order of the 17th of April 2008 (based on NBN EN 13779)
New collective housing, hospitals, shops, catering buildings, sports facilities, businesses and buildings changing their occupancy to these functions	-	Requirements are set in the annex VI of the execution order of the 17th of April 2008 (based on NBN EN 13779)	Requirements are set in the annex VI of the execution order of the 17th of April 2008 (based on NBN EN 13779)
Renovated houses with mandatory building permit	Partial system (only for air entrance, if windows are replaced)	Partial system (only for air entrance, if windows are replaced)	Partial system (only for air entrance, if windows are replaced)
Renovated offices and schools with mandatory building permit	Partial system (only for air entrance, if windows are replaced)	Partial system (only for air entrance, if windows are replaced)	Partial system (only for air entrance, if windows are replaced)
Renovated collective housing, hospitals, shops, catering buildings, sports facilities, businesses with mandatory building permit	-	Partial system (only for air entrance, if windows are replaced)	Partial system (only for air entrance, if windows are replaced)
New and existing industries	-	-	-

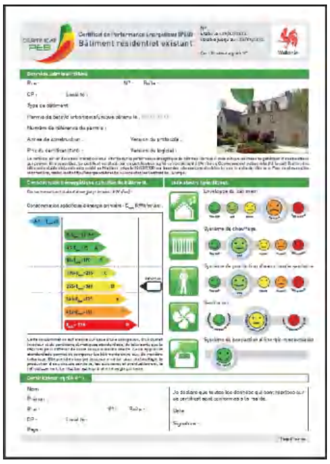
Table 1 (F) Requirements - old/first phase/second phase

Nature of works		Function			
		Residential: single family houses, flats	Offices and schools	Others specific function : Collective housing, Hospitals, catering buildings, sports facilities, business,…	Industry
1) New buildings + Extension or rebuilding • **If housing unit** • **If > 800 m³** • **75% shell replaced and systems partly replaced**	Energy Performance	**E_w 100** and E < **170kWh/m²**	**E_w 100**	(to determine – specific calculation method)	(to determine – specific calculation method)
	Thermal insulation	**K 45** **U_{max}** values or R_{min}	**K 45** **U_{max}** values or R_{min}	**K 45** **U_{max}** values or R_{min}	**K 55** **U_{max}** values or R_{min}
	Indoor climate	**Ventilation AND** limitation of **overheating** risk	**Ventilation**	**Ventilation**	**Ventilation**
	Thermic Solar	**Solar panels** or other equivalent system			
2) Buildings > 1000 m² : **Major renovations**	Energy Performance	**n.a.**			
	Thermal insulation	**U_{max}** values or R_{min} (for new components or rebuilt components)			-
	Indoor climate	**Ventilation**: partial system (only for air entrance if windows are replaced)			-
3) Simple renovations without allocation change	Energy Performance	**n.a.**			
	Thermal insulation	**U_{max}** values or R_{min}			-
	Indoor climate	**Ventilation**: partial system (only for air entrance if windows are replaced)			-
4) Allocation change with or without renovations	Energy Performance	**n.a.**			
	Thermal insulation	**K65** **U_{max}** values or R_{min} (for new components or rebuilt components)			-
	Indoor climate	**Ventilation**			-

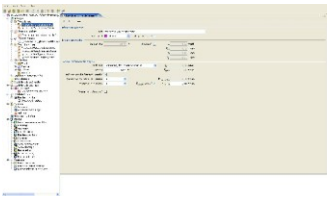
Table 2 Requirements - Second phase

3 > Certification of buildings

The requirements regarding the certification of buildings are included in execution orders.



EPC for residential buildings



EPC software tool for residential buildings

Certification is mandatory for new buildings, when the application for a building permit was made after the 1^{st} of May 2010. Regarding compliance to the requirements, a responsible has been identified during the whole phase of the construction of a new building. At the end of the process, the certificate is issued by the administration on the basis of information contained in the EPB final declaration.

Concerning the certification of existing residential buildings, an execution order was approved by the Government on the *3^{rd} of December 2009* and modified by the Government on the *27^{th} of May 2010*. Buildings, for which the application for a building permit was made before the 1^{st} of May 2010, are considered as existing buildings. In this execution order, three phases are foreseen to enter into force. A first step began in June 2010. Since June, a certificate is mandatory at the time of selling for single family houses, when the application for a building permit was made after the 1^{st} of December 1996. A second step will enter into force on the 31^{th} of December 2010 and will concern all sales of single family houses. A third step will enter into force on the 1^{st} of June 2011 and will concern sale and rental of all existing residential buildings.

For existing residential buildings, the calculation method (asset rating), the handbook for assessors, the content of the certificate, the development of the software tools and the training material have been finalised. Concerning certification of flats, the certificate is issued for each flat. In the case of a collective system (heating, hot water, ventilation, etc.), an audit of the collective system is completed at the time of rental or sale of the first apartment. This audit is collected with others on a database and used as input information for certification of the other flats of the building. The inspection process is quick (lasting about 4 hours), in order to lower its price. The EPC contains automatic improvements without detailed facts and figures. Improvements are automatically delivered by the software tool. However, they are related to the result of the calculation. For example, a recommendation concerning the improvement of wall insulation is given by the software, if the U-value calculated for this wall is above 0.4 $W/m^2.K$.

If a house has a bad EPC, it is proposed to the landlord to have an audit of the building (duration about 1.5 day): the outcome of this audit is linked to incentives to improve the Energy Performance of the house. These audits provide improvements with detailed facts and figures. Assessors who perform audits are also the assessors who issue certificates. Except for assessors for the completion of audits that follow a new training of 3.5 days to be certified, new assessors for issuing certificates follow a training of 5.5 days and an exam. Degrees and/or the professional experience of the persons to be accredited as experts for issuing certificates are set out in the order (architects, engineers, other university degrees concerning energy performance in buildings, or a professional experience of at least 2 years in the field of calculation of energy performance of buildings). The first training course for trainers began in May 2009, and the training of accredited experts in February 2010.

The administration has received 1,392 applications of professionals for becoming assessors responsible for issuing certificates. Among them, 1,277 applications fulfil the requirements set in the order, in terms of education or professional experience.

At this time, there are 502 assessors accredited to issue certificates. Names and addresses of assessors are listed on the *web*. It is expected that there will be 100 new assessors by the end of this year, and over 1,000 assessors by June 2011.

Information campaigns

All certificates are generated by a central database, on the base of output files coming from the software. An assessor needs a login and password to be able to upload a file onto the central database. The certificate generated is then sent by mail to the assessor. This database is managed by the administration, whose executives use it for communication purposes and quality checks.

At present, the database contains more than 1,500 certificates.

For existing non-residential buildings, a common procurement contract (Brussels capital Region, Flemish Region and Walloon Region) has been launched and allocated. The work consists of adapting an existing calculation method (asset rating) and software tools for non-residential buildings to the Belgian context, and organising training for trainers.

The certification of public buildings should enter into force in 2011, on the basis of an operational rating, as is the case in the Flemish Region.

The certificate is valid for 10 years.

4 > Inspection of boilers and air-conditioning

Inspection of boilers and air-conditioning systems has been included in an execution order and are mandatory.

Concerning the inspection of boilers, on the 29th of January 2009, the Government of the Walloon Region approved the execution order related to preventing atmospheric pollution produced by central heating systems for heating and DHW. This execution order is an extension of the royal order in force since 1978 for the inspection of liquid or solid fuel boilers. Inspections are mandatory at least every year for oil boilers and every three years for gas boilers. This execution order mandates the inspection of the whole installation, when it concerns installations older than 15 years.

For the inspection of air-conditioning systems, there are two execution orders, concerning refrigerated air production and air-conditioning equipment (controls, performance, requirements, refrigeration technicians' agreement, etc.). These two execution orders were approved by the Government on the 12th of July 2007 and entered into force in October 2007.

5 > Future planning

In September 2011, the requirement on maximum primary energy demand for residential buildings will be strengthened, rising to a level of 130 KWh/m^2.

Execution orders concerning certification of existing non-residential buildings and public buildings will be approved by the Government in early 2011.

A revision of the requirements is foreseen at least every five years.

Relevant information

Detailed brochures as well as official texts and tools are available on the Walloon Region website (*http://energie.wallonie.be)*.

Implementation of the EPBD in Bulgaria

Status in November 2010

Snezhana Todorova

Energy Efficiency Agency

Nikola Kaloyanov

Technical University - Sofia

Violeta Angelieva

Ministry for Regional Development and Spatial Planning

Bulgaria

National websites:

- *www.mee.government.bg*
- *www.mrrb.government.bg*
- *www.seea.government.bg*

1 > Introduction

This paper provides information on the EPBD implementation process in Bulgaria, as well as on future plans for the improvement of the implementation of the changes of energy efficiency in buildings.

It contains information on the building certification process, inspections of buildings' boilers and air-conditionings systems, process controls, information campaigns and financial instruments – incentives and subsidies.

For additional details, please visit the referenced websites, or contact the responsible institutions.

2 > Energy passports and certification of buildings

Legal context

The implementation of the Directive 2002/91/EC - EPBD in Bulgaria is the responsibility of the Minister of Energy, Economy and Tourism, the Executive Director of the Energy Efficiency Agency (Articles 7, 8, 9 and 10) and the Minister of Regional Development and Public Works (Articles 3, 4, 5 and 6).

Since the last report published in March 2008, many changes took place in the legal normative base. First of all, there is a new Energy Efficiency Act adopted by the National Assembly of Bulgaria and published in the State Gazette on November 2008, amendment January 2009. This Act improves the certification process, based on the experience from the last 5 years.

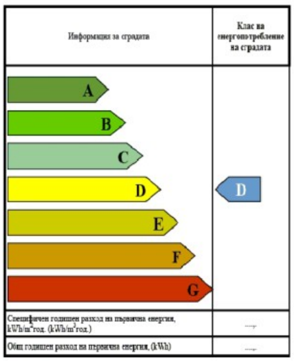
The new package of secondary legislation regulations consists of Ordinances on:

- Indicators for energy consumption and energy performance of buildings - in force since December 2009.
- Conditions and procedures for the energy efficiency assessment and certification of buildings, for the issuing of energy performance certificates, as well as the categories of the certificates - in force since December 2009.
- Energy efficiency, heat conservation and energy retention in buildings
- (recast) - in force since October 2009.

- Design of technical systems and installations (HVAC in buildings) since the 1st of March 2005. Changes will be made in 2011.
- Regulation for technical passports of buildings – in force since December 2006, amendment 2010.
- Conditions and orders for energy efficiency inspections on hot-water boilers and air-conditioning systems, as well as for the establishment, maintenance and usage of the database for these – in force since November 2009.
- Public register of persons executing certifications and audits on energy efficiency in buildings.

Most of the regulations have already passed the procedure of preliminary technical notification prior to their final acceptance by the appropriate Bulgarian authorities.

The energy efficiency scale



Energy passports of buildings

An energy consumption scale consisting of classes from A to G is established following the BDS EN 15217. The energy consumption classes' scale is composed on the basis of two values of the integrated energy performance characteristic: $EP_{max,r}$ and $EP_{max,s}$, determined as primary energy or as delivered energy, or CO_2 emissions saved, calculated with the method described in Annex No 3:

1. $EP_{max,r}$ - total specific energy consumption for heating, cooling, ventilation, hot water and lighting, corresponding to the current national norms.

2. $EP_{max,s}$ - total specific energy consumption for heating, cooling, ventilation, hot water and lighting, corresponding to the norms in operation when the building came into use.

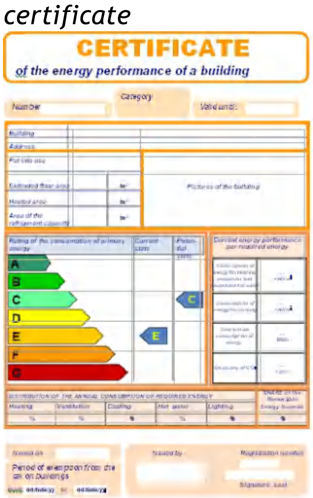
The energy passport of buildings

The values of the thermal and technical performance of the building envelope and elements, as well as the efficiency of the heating, cooling, ventilation and domestic hot water systems, are determined under the legal acts in operation when the building came into use.

The energy consumption classes.

Limits	Energy consumption class	Building energy demands
$EP < 0.5\ EP_{max,r}$	A	High energy efficiency
$0.5\ EP_{max,r} < EP \le EP_{max,r}$	B	
$EP_{max,r} < EP \le 0.5(EP_{max,r} + EP_{max,s})$	C	
$0.5\ (EP_{max,r} + EP_{max,s}) < EP \le EP_{max,s}$	D	
$EP_{max,s} < EP \le 1.25\ EP_{max,s}$	E	
$1.25\ EP_{max,s} < EP \le 1.5\ EP_{max,s}$	F	
$1.5\ EP_{max,s} < EP$	G	High energy consumption

The energy certificate



The energy passport is required for a new building after the completion of its construction. It is issued by qualified construction consultants. The passport contains the energy performance parameters, corresponding to the normative and project requirements for the energy efficiency of the completed construction.

The energy certificate is required for existing buildings.

The energy performance certificate of the building shall be updated after major renovation leading to the improvement of the overall energy performance.

The energy certificate for an existing building is issued by physical or legal entities registered in the EE Agency, after a detailed audit of the construction.

The energy certification can be only conducted in no less than 3 years and maximum 6 years after obtaining the building permit.

All buildings in operation with a floor area above 1,000 m^2 are subject to **obligatory certification.**

The validity of the certificate can be up to 10 years. This depends on the energy efficiency class of the building and on whether RES are used for the reduction of the energy demands for purchased energy.

The price of the certificate, including an energy audit, is determined by the market and the complexity of the building, and ranges from 1-2 €/m^2.

The energy performance certificate contains the following information:

Boiler inspection report

- The type of the building, its address, the year when it was put into use, total floor area, heated area, cooled area, pictures of the building.
- The values of the building's integrated energy performance according to the required energy: total annual energy consumption in MWh, annual quantity of generated CO_2 emissions in t/year, rating and class of the energy consumption according to the primary energy, category of the certificate.
- The distribution of the annual energy consumption for heating, ventilation, cooling, DHW and lighting, expressed as a share of the total consumption.
- The name of the person who carried out the certification, and the number of their public registration certificate.
- Number, date of issue, period of validity and period of exemption from the tax on properties, according to the Act on local taxes and fees.
- Recommended groups of energy efficiency measures leading to the achievement of minimum requirements.

Categories of certificate - "A" and "B"

The Bulgarian legislation has introduced two categories of certification - "A" and "B" - **for existing buildings constructed before 2005**. This should not be confused with the **energy class** of the building. The certificate defining a category is issued to **assist the building owner to get an exemption from property tax** for the period of validity (see also section 7). This is done to promote the process of the certification of existing buildings and to improve the buildings' energy performance:

Category A certificate -with validity from 7 to 10 years- is issued for buildings:
1. Constructed between 1990–2005 with energy consumption class "B".
2. Constructed before 1990, with energy consumption class C.

Category B certificate –with validity from 3 to 5 years- is issued for buildings:
1. Constructed between 1990 – 2005, with consumption energy class "C";
2. Constructed before 1990 and having an energy consumption class "D".

A certificate defining the building's category is issued after the building has been in use for one year from the date of the implementation of the energy saving measures.

3 > Inspection of boilers and air-conditioning

The Republic of Bulgaria has adopted option A of the Article 8 of the EPBD, establishing a regular inspection of boilers. Article 9 was also adopted for A/C systems. However, the inspection of boilers and air-conditioning systems is still at an early stage and was introduced as an obligatory procedure during 2009.

The procedure for the energy audit and certification of existing buildings also requires a total audit of the heating system, including boilers and air-conditioning systems. The qualified experts responsible for the inspections are HVAC engineers or technicians. They are trained to carry out their responsibilities after a specific training module, in the frame of the main training course for implementation of the Directive 2002/91/EC on energy characteristics of the building.

Inspections of boilers and air-conditioning systems are based on the assessment of efficiency under normal working conditions. Currently, inspections must simply follow the reference methodologies defined in the relevant CEN standards. Inspection of boilers is totally based on the CEN standard 15378, but for air-conditioning systems, the CEN standard 15240 is partially implemented, and some improvements are in progress.

There is a template report for the final document of the inspection, expressing the status and the recommendations for boilers and A/C systems. The Inspectors have to present the following data as a result of inspection:

For boilers:

- Identification
- Visual inspection
- Assessment of maintenance
- Assessment of the building's heating demand and boiler capacity
- Assessment of how the control system covers the building's annual heating demand
- Test procedure for proper energy efficiency adjustment of the boiler
- Recommendations for energy efficiency improvements

For A/C systems:

- Collection of data for the existing A/C system
- Inspection of cool/heat generator
- Inspection of the ventilation system
- Inspection of the control system
- Recommendations for energy efficiency improvements

The inspection of boilers takes place every 2, 3 and 4 years, depending on the fuel used and its power, while the inspection of air-conditioning systems takes place every 4 years (see table below). The cost of the inspection is paid by the end user or by the owner of the building.

Inspection time interval:

Boiler inspection

Boiler fuel	P – power [kW]	
	20>P<100	P>100
Liquid, solid	3 years	2 years
	-	4

The qualification certificate

4 > Independent experts and training procedure

The EEA maintains a public register for the companies carrying out audits for the energy efficiency and the certification of buildings. The Agency issues a certificate for the entities included in the register, against a 50€ fee. Eligible entities must meet the following minimum requirements:

- Minimum set of technical means for measuring
- Available qualified staff with at least three specialists with labour contracts:
  - one specialist on architecture and civil engineering
  - one specialist on thermotechnics
  - one electrical engineer

The rules regulating the requirements and procedures for registration of individual persons dealing with the energy efficiency auditing and the certification of buildings at the EEA register are as follows, for all the three types of the specialists listed above:

A. Lectures – 45 hours:

- Specific requirements of EE normative base.
- Building types and characteristics.
- Principles of heat transference.
- Measuring of hydraulic, heat and electrical values.
- Stages, subject and characteristics of the energy efficiency audit in buildings.
- The BDS EN 832 and EN ISO 13790 method for the determination of the energy consumption in buildings.
- Basis and characteristics of the software.
- Economic assessment of energy saving measures.
- Fundamental principals and norms for the EE in the basic sub-system groups of the building.
- Fuels, fuel processes and systems.
- Hot water and steam boilers. Combustion systems.
- Steam condensation systems.
- Subscription stations for centralised heat supply.
- Cogeneration aggregates
- Heating systems.
- Ventilation and air conditioners.
- Pumps and fans.
- Thermal pumps.
- Solar systems.
- Lighting systems.
- Energy supply aggregates.
- Thermal processes regulation.
- System for monitoring and energy costs management.
- Certificate for the EE of a building.

B) Exercise – 15 hours:

- Gathering information, energy analysis of a building, database, evaluation of the potential for decreasing energy consumption.
- Modelling of buildings and systems with a special software.
- Economic assessment of energy conservation measures with software.

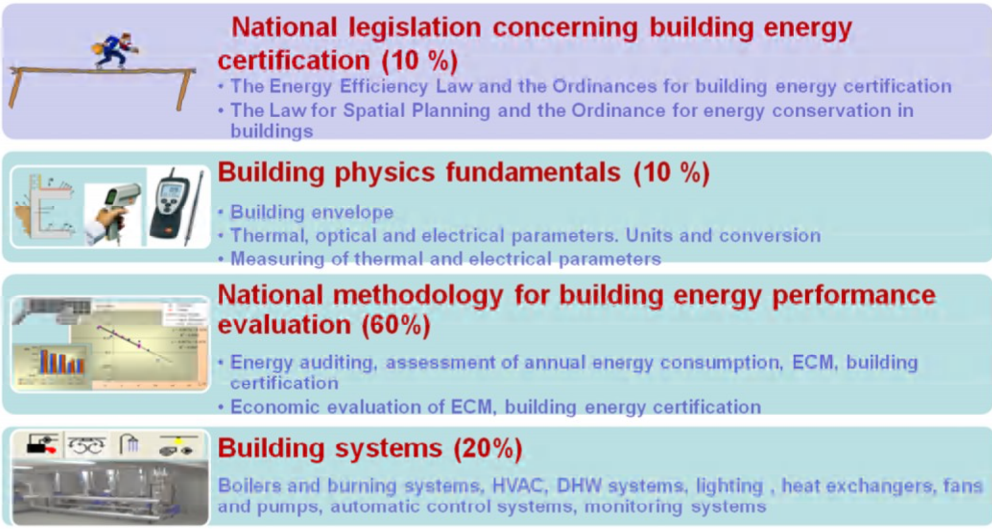
C. Individual Project of buildings' energy analysis and energy certificate- 30 hours.

- To have successfully passed the exam on audits and certification of buildings;
- To have an experience of service for 3-6 years in the field;
- To have a bachelors or masters degree depending on the qualification.

Training procedure

The scope of the examination material as well as the manner of evaluation are standard throughout the country. They are prepared by high technical schools, accredited and coordinated by the Executive Director of the EEA and approved by the Minister of Economy, Energy and Tourism.

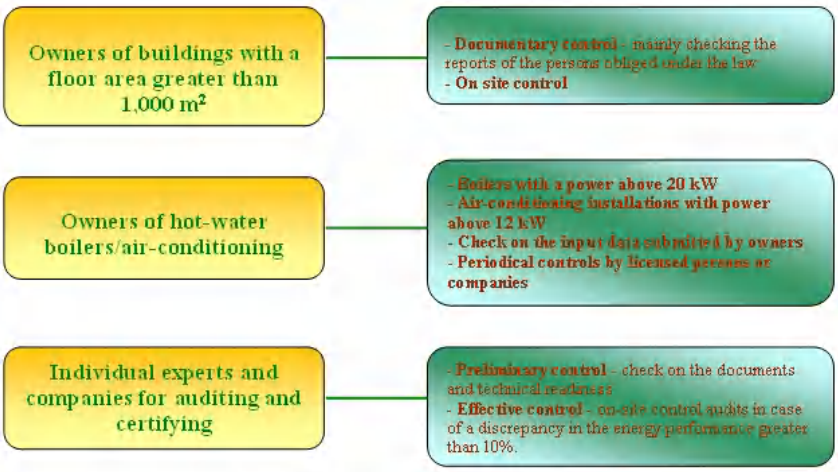
The minimum mandatory scope of the educational plan for qualification courses on buildings' energy efficiency audits and certification include the list of topics mentioned on the left of the page.



At the end of the training course, the qualified experts/inspectors have to pass a two-part final exam: an individual test and a presentation of a team project. The final exam is conducted by an examination board. The members of this board are professors from technical universities and representatives of the Ministry of Regional Development and Construction, the Ministry of Economy, Energy and Tourism, and the Energy Efficiency Agency.

Quality Control System

The energy efficiency control on buildings is carried out on the basis of the Energy Efficiency Law and is executed by the Energy Efficiency Agency at the Ministry of Economy, Energy and Tourism, with proper penalties provided by this Law.



The control includes:

1. Control on the owners of residential and non-residential buildings with a floor area above 1,000 m^2 (in just one or in multiple floors).

The building owners' duties concern the managing of the energy efficiency of their buildings, and include giving proof of:

- Detailed audit and certificate for the energy performance of the building.
- Implementation of the measures prescribed for the improvement of the energy efficiency in a period of not less than 3 years after the audit. Groups of energy efficiency measures leading to the achievement of minimum requirements are proposed to the building owners. The owners can choose the measures to be implemented.
- Achievement of the mandatory individual indicative objectives for energy savings.
- Elaboration of plans and programmes.
- Reports about the results and the effect of the measures, submitted to the Agency annually, by the 31st of March.

The inspections for the implementation of the energy saving measures are conducted on documents and on-site, by qualified experts registered in the EEA.

The inspection on documents mainly includes checking of the reports submitted by the persons obliged under the law. During the period 2008-2010, in the EEA, documentary checks of nearly 800 buildings were conducted. These checks represent nearly 14% of the total number of buildings subject to mandatory certification.

On-site inspections are conducted in order to find a discrepancy between the measures taken and the requirements of the Energy Efficiency Law. They usually end with the provision of a protocol containing recommendations and the period for correcting the discrepancies, or with a Penalty Act. Penalties for a building owner who fails to comply with the prescribed energy efficiency measures in a period of 3 years range from 15,000 € to 30,000 €.

2. Control on the owners of hot-water boilers with a power above 20 kW and of air-conditioning installations with a power above 12 kW

The inspections include checks on the input data submitted by the owners, periodical control on the installations to ensure a high efficient coefficient, and a control on the work of the inspectors.

The periodical control is conducted by licensed persons or companies included in the Public Register of the Agency, while the quality of their work is checked by the Agency.

Boiler owners which do not provide the EEA with this information shall be fined 800 € to 1000 €.

3. Control on the individual experts and companies, who have the authority to conduct energy audits and to issue certificates for buildings

These companies and persons are included in the Public Register of the Agency as prescribed by the Energy Efficiency Law and the Ordinance of the Register mentioned above. There are two types of controls: preliminary and effective.

- **The preliminary control** includes a check on the company's documents and technical readiness to conduct this activity. The requirements are defined in the EE Law.
- **The effective control** includes a check on the activities of the auditors by executing random on-site control audits. In case of a discrepancy in the energy performance greater than 10%, penalties are imposed on the auditor.

Interactive energy workshops for kids

Exhibition of handmade models

“Less energy, more light” flyer

The penalties for auditors range from 12,000 € to 50,000 €.

In 2010, the Agency has executed 6 control audits on auditors issuing certificates.

5 > National Information and Communication Campaigns

“Less energy, more light”

“Less energy, more light” is the name of the campaign organised in 2009 by a Bulgarian electricity supplying company - CEZ Bulgaria, in cooperation with the Energy Efficiency Agency and the Eco-Society. The main objective was to popularise the energy efficiency in the society’s daily round. The organisers’ idea was to present the energy efficiency in an accessible way for every consumer, in order to decrease their electricity bills and, at the same time, to promote a more economical use of the natural resources. The EEA supported this initiative, with the idea that the energy efficiency cause could succeed only with the joint efforts of the government, the market and the end consumers.

The EEA experts participated in the information campaign, which was a part of a road show in Western Bulgaria. The organisers performed interactive energy workshops for 5-12 year-old kids and teenagers, organised an exhibition of handmade jewels made by recycled materials, as well as various competitions. They also presented a new website providing useful advices for energy savings.

The same campaigns included two educational seminars explaining the new Energy Efficiency Law. The organisers of the seminars were the EEA Bulgaria, the Centre of Competence in Infrastructure and Energy, the Public Services and Utilities “*Uconomics*”, the Centre for Energy Efficiency *EnEffect*, and the Association of the Bulgarian Black Sea Municipalities.

6 > National incentives and subsidies

Exemption from property taxes for owners of buildings having Category A and Category B certificates, as per EE Law

The owners of buildings that were put into use prior to the 1st of January 2005 and with a Category A certificate (i.e. Classes A and B), are exempted from the property taxes for a period of 7 years following the issue of the certificate and for 10 years if they use RES for the building’ energy consumption.

The owners of buildings that were put into use prior to the 1st of January 2005 and with a Category B certificate (i.e. Classes C and D), are exempted from property taxes for a period of 3 or 5 years respectively (with or without RES).

Programmes for energy efficiency audits

The Bulgarian government authorised the EE Agency to manage the execution of 3 financing programmes in 2006, 2007 and 2008, for the conduct of audits on energy efficiency subsidies in 1,181 public and municipal buildings. The total subsidy was about 3.5 M€, and the audits were financed 100% by the budget. The analysis of the audits results showed that:

- The total useful floor area of the buildings audited (hospitals, schools, social housing, administrative buildings, etc.) was 5,133 million m^2.

- The total energy savings after the implementation of the recommended energy saving measures were 490,362 GWh/year.
- The total emission savings were 222.87 thousand CO_2e/year.

http://www.bgregio.eu

The EBRD Credit line for energy efficiency in households (2005-2010)

This financing programme was initiated by the EBRD (European Bank for Reconstruction and Development) with the aim to stimulate the implementation of energy saving measures in households by granting soft loans via 6 nominated Bulgarian banks, plus a 20% subsidy offered by the International Decommissioning *Kozloduy Fund*, equal to 7 M€. The final result at the end of 2009 was the implementation of 28,635 small EE projects in Bulgarian households. 45.2% from them were spent on installation of efficient window frames, and 27% on the installation of heat pumps. The implementation of these measures led to energy savings of 217,805 MGWh/year and an annual reduction of CO_2 emissions of 312,117t.

The total sum of the credit line, about 45 M€, was used by the 20th of January 2010.

Operational Programme "Regional Development" (2007-2013)

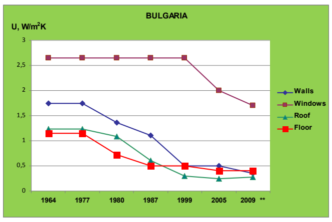
The EU Regional fund and the operational programme for regional development 2007-2013 may be used to encourage the implementation of energy saving measures in the building stock of Bulgaria. Activities that may be financed are indicated as audits for the energy consumption and implementation of energy saving measures in buildings of public and municipal property. The subsidies offered for these activities are sufficient incentive for the beneficiary -public or municipal owner or association of owners of big residential blocks- to start working on this area.

Since the beginning of 2011, this operational programme, elaborated by the European Regional Fund, is offering 80 M€ for the energy efficiency in the residential building stock, which is sufficient for the partial renovation of 600 residential panel blocks.

7 > Impact of the EPBD at national level

Evolution of minimum performance requirements in the building regulation

National requirements for the heat conduction coefficient – U, W/m^{2}K of buildings' envelope constructions and elements used in the design of new and existing buildings for the period 2002 - 2010

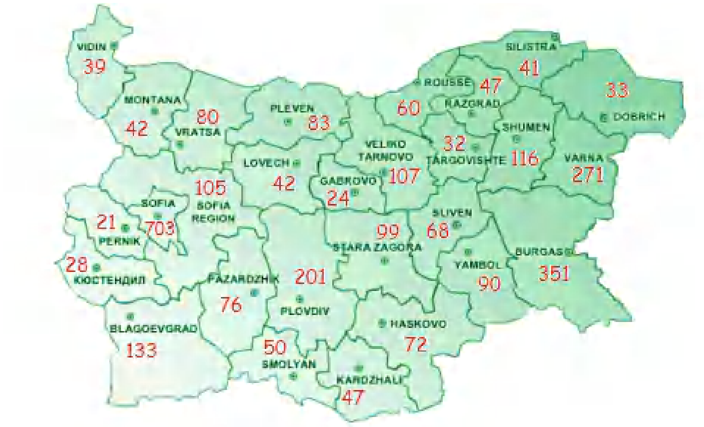


year	1964	1977	1980	1987	1999	2005	2009**
U walls W/m^{2}K	1.75	1.75	1.36	1.11	0.50	0.50	0.35
U windows W/m^{2}K	2.65	2.65	2.65	2.65	2.65	2.0	1.7
U roof* W/m^{2}K	1.23	1.23	1.087	0.603	0.30	0.25	0.28
U floor W/m^{2}K	1.15	1.15	0.725	0.503	0.50	0.40	0.40

Notes:
The values apply to buildings with an average internal temperature θi ≥ 15 °C; the values apply to θe = - 12 ºC for massive buildings with brick walls.
*The values apply to flat roofs.
**The values until 2005 are Maximum U values for heated buildings, until 2009 are reference values, and after 2009, for all buildings (new and existing). The main indicator for conforming with the national normative requirements for energy efficiency of buildings is the EP, kWh/m^2.year - the total annual energy use for heating, cooling, ventilation, hot water, lighting and appliances per m^2 of the total heated area of the building (Af) in m^2, defined in terms of energy demand and primary energy.

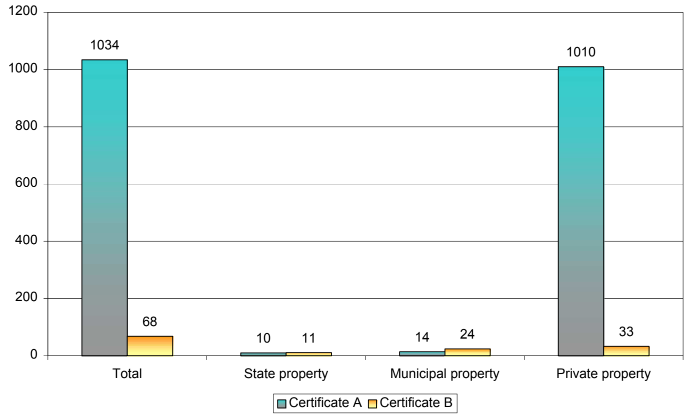
Other impacts

By the end of November 2010, the total number of the issued certificates was 1,102. These certificates were issued after an auditing process at the total amount of 12 million m^2 floor area (Note that energy performance certificates are only required for existing buildings over 1,000m^2, whereas for all new buildings, the "energy passport" is required).



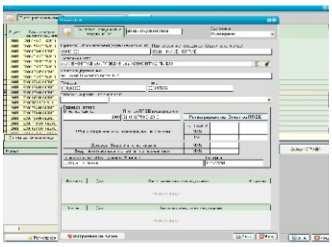
Numbers of the certified buildings per region in Bulgaria

Information system for the state of the energy efficiency in the country - initial screen

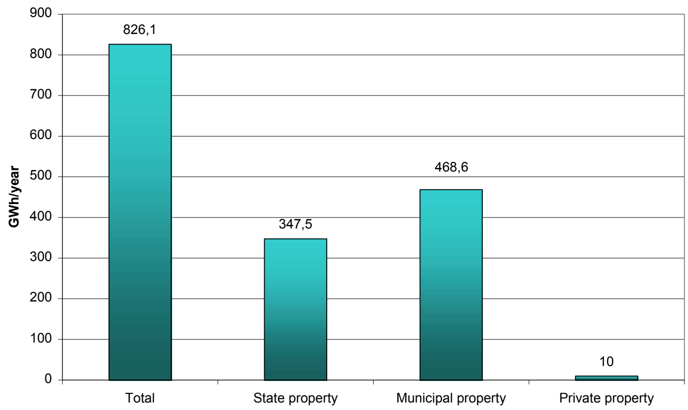


Numbers of the issued certificates distributed by the type of the building's property

Information system for the state of the energy efficiency in the country - registration of the legal entity

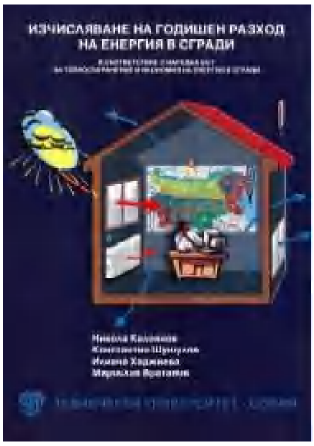


The estimated energy savings are expected to be more than 800 GWh/year. The total investments needed for the implementation of the recommended measures in the certified buildings that did not achieve an "A" rating are about 250 M€.



Saved energy in GWh/year, distributed by the type of the building's property

Handbook for the calculation of the annual energy consumption



National information system for energy efficiency

Bulgaria developed and introduced measures for the transparency and reputation improvement of the work of the EEA. The project was financed by the European Social Fund and the Bulgarian state budget, through the Operational Programme Administrative Capacity. The main project aim is to guarantee transparency and honesty in the EEA activities. Some of its specific aims are:

- Establishing publicity and access to the information for the citizens and the business representatives of the administrative activities and the services provided by the EEA.
- Improving protection against possible opportunities for corruption in the EEA.
- Increasing the public confidence in the EEA and encouraging active participation of the public in the decision processes and the control on the questions connected with the energy efficiency.

The project is still at the implementation process. One of the main results will be the creation of registers and databases providing information on the state of the energy efficiency in the country.

Existing building before refurbishment

After the fulfilment of the EE requirements

The calculation methodology

The calculation procedures have been adopted via the Regulation on Energy Efficiency, heat conservation and energy retention in buildings - in force since the 1st of March 2005 by the Minister of Regional Development and Public Works, recast in 2009. These are:

- Requirements for buildings and technical energy efficiency requirements: energy savings and heat conservation, minimum energy performance requirements for the designing of new buildings, as well as of reconstruction, and total and major renovation of existing buildings.
- Technical requirements for heat conservation and energy retention in buildings shall apply to the design and construction of residential and non-residential buildings with an average indoors air temperature above 15°C, relative air humidity of up to 70% and an average indoors air temperature between 12 and 15°C, depending on the design of buildings heated for at least three months per year.
- Technical rules and standards for the designing of thermal insulation, including the values of thermal transmittance and of the minimum requirements for thermal insulation.
- Rules for water vapour penetration, water tightness, air leakage and solar protection during the summer period.
- Minimum requirements for conforming to the energy efficiency of buildings.
- For new buildings at the design and construction stage, the specific energy consumption shall correspond to Class B of the energy consumption scale.
- For existing buildings built in the period 1991-2009, the specific energy consumption after renovation shall correspond at least to Class C.
- For existing buildings built before 1990, the specific energy consumption after renovation shall correspond at least to Class D of the energy consumption scale.

The calculation method is based on the BDS EN ISO 13790 and on efficient European practices in calculation of the annual energy consumption for heating, ventilation, cooling and hot water. This method provides a quantitative evaluation of the impact of:

- Heat losses and gains through the building envelope.
- Ventilation heat losses and gains as a result of the air exchange.
- Heat gains from solar radiation as a result both of direct radiation through transparent elements and the absorption of radiation from non-transparent elements.
- Heat losses from skyward radiation.
- Heat gains from internal sources, lighting and people.

Energy efficiency requirements and basic indicators are as follows:

- For new buildings with a district heating system serving all the apartments:
- the total annual energy consumption for heating, cooling, ventilation, hot water, lighting and appliances per m^2 of the total heated area of the building (A_f) defined in terms of final energy demand and primary energy.
- For new buildings with local heating, or where the constructions do not permit district heating: the total annual energy consumption for heating, cooling, ventilation, hot water, lighting and appliances per m^2 of the total heated area of the building (A_f) defined as net energy;
- For existing buildings: the total annual energy consumption for heating, cooling, ventilation, hot water, lighting and appliances per m^2 of the total heated area of the building (A_f), or per m^3 of gross heated volume (V_s) defined in terms of primary energy.

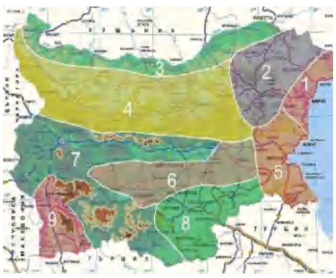
The reference values of the heat transfer coefficient – U of buildings' envelope constructions and elements used both in the design of new buildings and after reconstruction, total and major renovation, capital repair or conversion of existing buildings, are given in the next Table.

Type of envelope structures and elements	U, W/(m^2K)	
	Int. T° $\theta_i \geq 15$ °C	Int. T° $\theta_i < 15$ °C
External walls in contact with the external air	0.35	0.44
Walls adjacent to unheated spaces	0.50	0.63
Floor slab over an unheated basement	0.50	0.63
Floor of a heated basement	0.45	0.56
Floor of a heated space in contact with the external air	0.28	0.35
Wall, ceiling or floor in contact with the external air or the ground with inbuilt area heating	0.40	0.50
Flat or sloped roof with a heated under-roof space designed for habitation	0.28	0.35
Ceiling slab of an unheated flat roof with an air layer with thickness $\delta > 0.30$ m	0.30	0.38
External door, solid, adjacent to the external air	2.2	2.75
External door, solid, adjacent to an unheated space	3.5	4.38

Thermal transmittance reference values for glazed building enclosure elements (windows and doors) of residential and non-residential buildings: the type of assembled component: complete window system - U_w, (W/m^2K) are as follows:

- External windows, glazed doors and sheet glass windows opening horizontally and vertically with extruded PVC frames, having three or more hollow chambers; roof windows opening in any direction with PVC frames - **1.7**
- External windows, glazed doors and sheet glass windows opening horizontally and vertically with wooden frames; roof windows opening in any direction with wooden frames **- 1.8/1.9**
- External windows, glazed doors and sheet glass windows opening horizontally and vertically with aluminium frames and thermal break of the thermal bridges - **2.0**
- Curtain walls/Curtain walls with high specifications - **1.9/2.2**

External climatic factors



The energy consumption is determined considering the following climatic factors:

- Monthly average ambient temperatures
- Hourly average ambient temperatures during the cooling period
- Hourly average intensity of total solar radiation
- Average monthly relative ambient air humidity (for the cooling period); average hourly relative ambient air humidity (for the cooling period);

The climatic factors are determined for nine climatic zones of the country.

The method is described in Annex N° 3 of an Ordinance for energy efficiency, heat conservation and energy retention in buildings and is provided in *www.mrrb.government.bg*.

8 > Conclusion and future planning

The legal framework in Bulgaria on the energy performance of buildings has been elaborated in conformity with the European norms and standards. It facilitates the introduction of new financial and market mechanisms targeting the consumers, to stimulate the implementation of energy efficiency measures in the building stock.

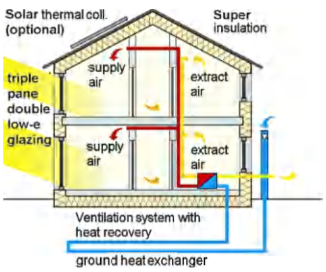
In 2010, the EEA staff elaborated a draft of the New Energy Efficiency Strategy, which is covering a period of 10 years – up to 2020. Its approval by the Council of Ministers and its adoption by the National Assembly is to be expected in the near future. Special attention will be paid on the legislation for the implementation of the following measures in the building stock:

- Improvement of buildings energy performance considering the local climate specifications.
- Provisions for payment of energy depending on the real consumption.
- Stimulation of the energy efficiency in the building market via local tax exemptions.
- Modification of the energy tariffs in order to stimulate lower consumption of energy and usage of RES.
- Clarity of information on the potential and the possibilities for energy savings for every consumer.

The key elements of the draft energy efficiency strategy are:

A. New buildings:

- Gradual implementation of norms for lower energy consumption after 2015.
- Stimulation of multifamily houses construction.
- Stimulation of usage of RES in the building stock.



Passive house in Varna, Bulgaria

B. Existing buildings:

- Establishment of low interest loans; securing funds for the renovation of buildings.
- Connection of the local taxation with the buildings' energy performance characteristics.
- Reduction of the number of inhabited non-efficient buildings.
- Combination of the energy efficiency audits and controls with other controls, like labour safety control, fire safety, etc.
- Elaboration of new financial models, which will surmount the difficulties for initial investments (ESCO).
- Improvement of the efficiency of existing systems for heating, cooling and lighting, by means of regulating, heat recovery, etc.
- Organisation of dissemination at national level and educational campaigns.

For Bulgaria, it will be reasonable to use the opportunity given to the Member States, by Regulation modifications 1080/2006 (adopted on the 6^{th} of May 2009 by the EP and the Council) to carry over 4% of the national operational programmes budget, financed by the European Fund for Regional Development, towards the execution of energy efficiency measures at the existing building stock. In this way, 128 M€ may be secured in order to facilitate the investments in energy efficiency measures by the end of 2013, which may accumulate total investments exceeding 600 M€. The concrete financial means may be defined in the national action plans for increasing the number of low-energy constructions conforming to the energy savings indicative targets, as well as the economic and financial opportunities of Bulgaria.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Cyprus

Status in November 2010

Constantinos Xichilos

Energy Service - Ministry of Commerce, Industry and Tourism

Nicos Hadjinicolaou

Energy Service - Ministry of Commerce, Industry and Tourism

Cyprus

National websites:

› *www.mcit.gov.cy*

1 > Introduction

Many developments took place in the implementation of EPBD in Cyprus since the last report was published in March 2008. The Law for the Regulation of the Energy Performance of Buildings 2006, L.142(I)/2006, is the legal document on which the transposition of EPBD in Cyprus is based on. The implementation of the EPBD started in 2007 with setting minimum requirements for the building envelope and has been fully implemented in 2009 with the launching of the Energy Performance Certificate and the inspection of air-conditioning systems.

This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in Cyprus. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

In Cyprus, the implementation of the EPBD is the overall responsibility of the Energy Service, which is a department of the Ministry of Commerce, Industry and Tourism. The Energy Service has designed and developed a certification scheme, which is based on a central registry and database.

The implementation of the Energy Performance Certificate (EPC) in Cyprus took place in two phases. The first phase was the certification of all residential buildings, new and existing, which started in the 1st of October 2009 as optional and it became mandatory by the 1st of January 2010 by publishing the Ministerial Order for the Minimum Energy Performance Requirements of 2009. The second phase was the certification of commercial buildings, education buildings, office buildings and all other buildings that are not considered residential, new and existing, which became mandatory on the 1st of September 2010 by the same Ministerial Order.

The Energy Performance Certificate and the recommendations report can be only issued by the Qualified Experts (QEs), and their qualifications and responsibilities are regulated by The Energy Certification Regulations of 2009 (see more details in chapter 4).

The energy performance certificate

The Energy Performance Certificate (EPC) was chosen to have a similar appearance to the energy labels used for domestic appliances, in order for the public to better relate and understand the information given on it.

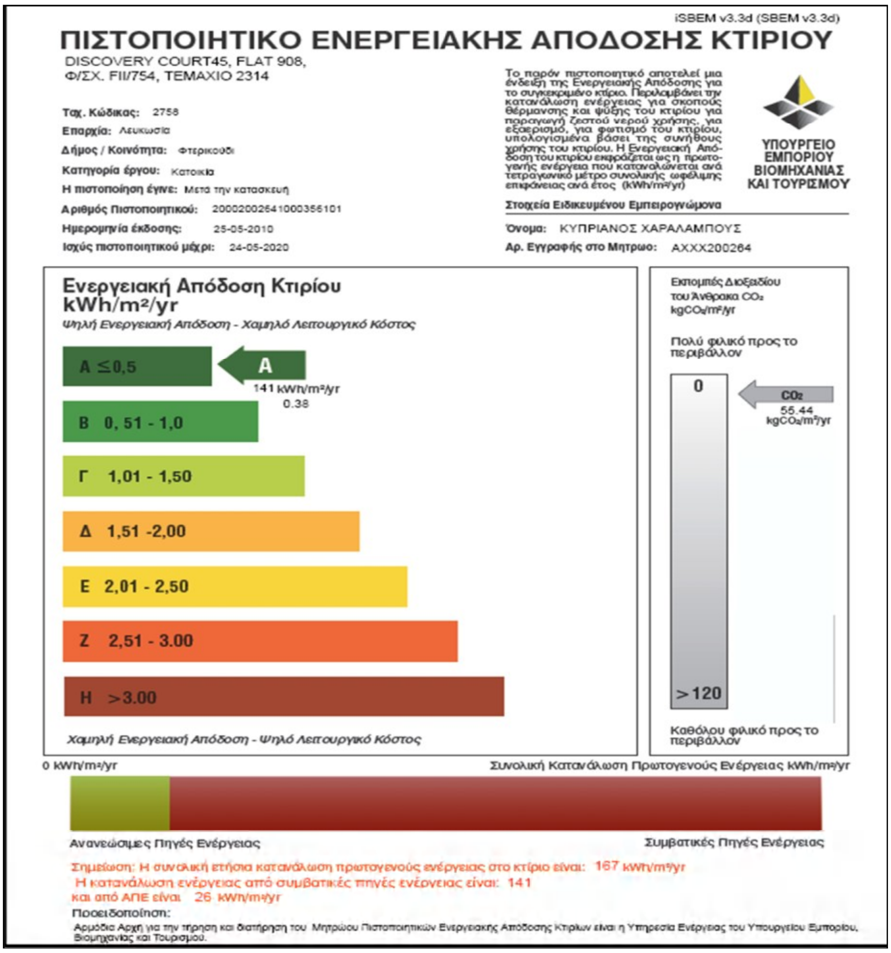


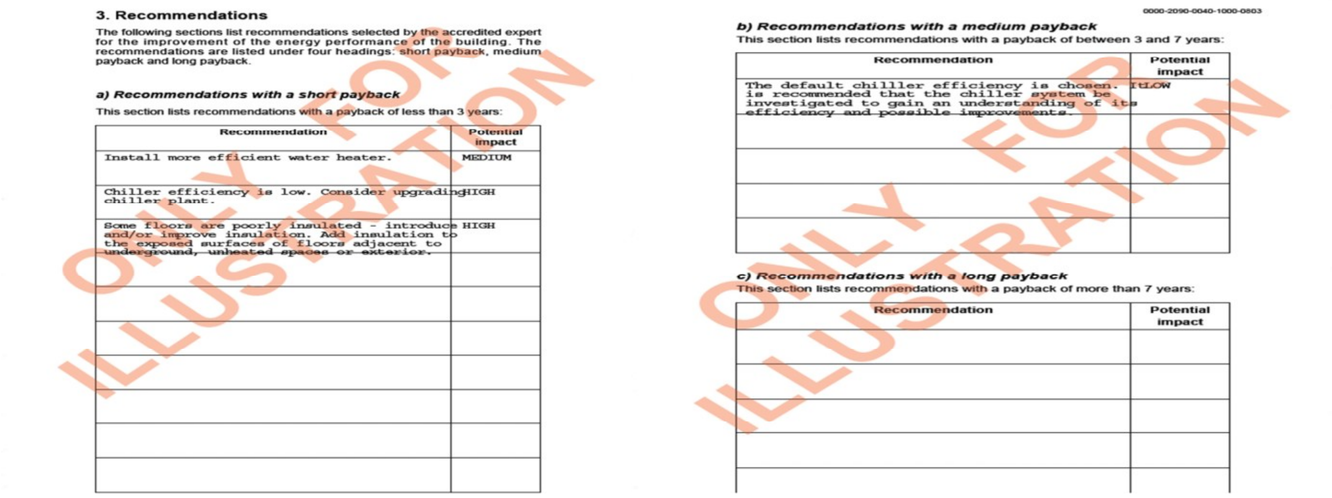
Fig. 1 – Energy Performance Certificate

The main purpose of the EPC is to give useful information considering the cumulative energy performance of the building. The buildings are rated based on calculated consumption (asset rating) of primary energy per year (kWh/m^2.year) for typical use of the building and according to the building type. The energy label classifies the buildings on an efficiency scale ranging from A (high energy efficiency) to G (poor efficiency).

The EPC also provides information about the estimated CO_2 emissions resulting from the calculated energy consumption, and the calculated energy that comes from renewable sources.

The EPC has to be accompanied by the recommendations report, consisting of a list of suggested measures and the related costs for their implementation. The report is divided in three tables. A table of short payback period recommendations (up to three years), a table of medium payback period recommendations (three to seven years), and a table of long payback period recommendations (more than seven years). Every suggested measure has to have a short description, and be classified in one of these tables. Further than that, the impact on energy saving has to be evaluated as Low, Medium or High. The recommendations are the sole responsibility of the Qualified Expert. The software that is used for calculating the energy performance of buildings generates a list of recommendations for the building for which the calculations are performed. The QE can then choose from this list and/or can create his/her own.

The validity of the EPC and the recommendations report is 10 years for all types of buildings.



3. Recommendations

The following sections list recommendations selected by the accredited expert for the improvement of the energy performance of the building. The recommendations are listed under four headings: short payback, medium payback and long payback.

a) Recommendations with a short payback

This section lists recommendations with a payback of less than 3 years:

Recommendation	Potential impact
Install more efficient water heater.	MEDIUM
Chiller efficiency is low. Consider upgrading chiller plant.	HIGH
Some floors are poorly insulated - introduce and/or improve insulation. Add insulation to the exposed surfaces of floors adjacent to underground, unheated spaces or exterior.	HIGH

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b) Recommendations with a medium payback

This section lists recommendations with a payback of between 3 and 7 years:

Recommendation	Potential impact
The default chilller efficiency is chosen. It is recommended that the chiller system be investigated to gain an understanding of its efficiency and possible improvements.	LOW

c) Recommendations with a long payback

This section lists recommendations with a payback of more than 7 years:

Recommendation	Potential impact

Figure 2 – Recommendations to improve the energy performance

As of the 1st of January 2010 for residential buildings, and as of the 1st of September 2010 for non-residential buildings, it became mandatory that every new building or building unit and every existing building above 1,000 m^2 that undergoes major renovation must have an EPC in order to get a building permit before construction starts. As part of the minimum requirements, the buildings that apply for a building permit have to be at least class B.

From the same dates, all existing residential and non-residential buildings need to be certified when they are sold or rented. The building owner has to present an EPC to everyone that is interested in renting or buying. In all cases, the EPC has to be accompanied by a recommendations report.

In order to issue an EPC and a recommendations report for an existing building, a QE has to visit the building and collect all the necessary data to perform energy performance calculations. This data must include the thermal characteristics of the building envelope, the type and efficiency of the HVAC systems, and the characteristics of the hot water and lighting system. The QE will then calculate the energy performance of the building and issue the EPC. There is no minimum requirement for an existing building, i.e., they can be labelled A through G. The Energy Service has issued the “Guide for Certifying Existing Dwellings” in order to assist QEs, as it lists the process that they must follow, as well as checklists and tables that they can fill on their visit. It also contains default values of thermal properties of constructions in case they cannot be practically assessed.

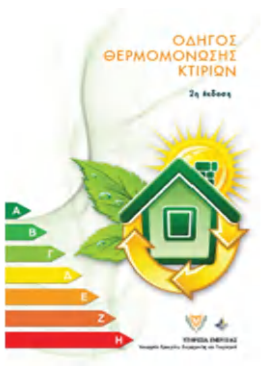
The calculation methodology is defined by the Ministerial Order for the Methodology for Calculating the Energy Performance of Buildings of 2009, and is described in two documents:

- Guide of Thermal Insulation of Buildings (2nd Edition)
- Methodology for Calculating the Energy Performance of Buildings

The “Guide of Thermal Insulation of Buildings” was first issued in 2007 in order to guide engineers and architects to calculate U-values and inform them on different insulation techniques. The 2nd Edition included more detailed calculation methods of U-values and calculations related to thermal mass. The “Methodology for Calculating the Energy Performance of Buildings” describes all the algorithms and assumptions used to calculate the energy consumption. It includes heating, cooling, domestic hot water and lighting needs, expressed in terms of primary energy. Both documents are based on CEN standards, and they are both mandatory to be used to calculate the energy performance of all buildings, existing and new. The “Methodology for Calculating the Energy Performance of Buildings” is simulated by the software SBEMcy, which is the only approved software by the Energy Service. The methodology and the software can be downloaded from the webpage of the Ministry of Commerce, Industry and Tourism (link at left).

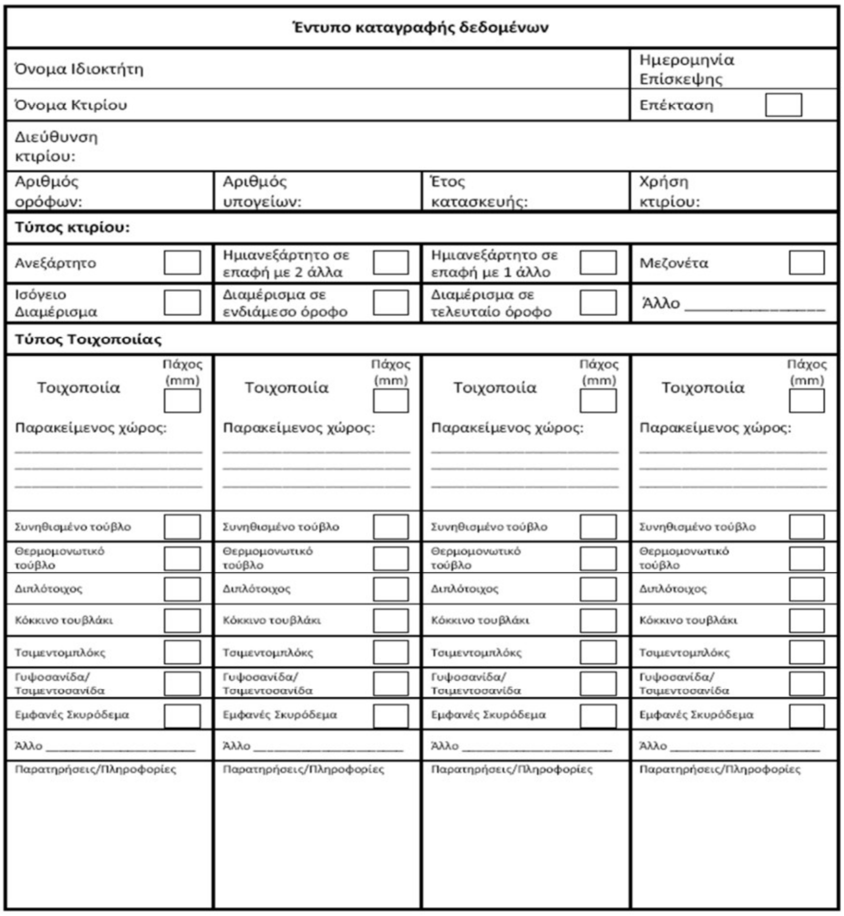
http://www.mcit.gov.cy/mcit/mcit.nsf/dmlperformance_gr/dmlperformance_gr?OpenDocument

The "Guide for Certifying Existing Dwellings"



The "Guide of Thermal Insulation of Buildings (2nd Edition)"

The "Methodology for Calculating the Energy Performance of Building"



Έντυπο καταγραφής δεδομένων			
Όνομα Ιδιοκτήτη			Ημερομηνία Επίσκεψης
Όνομα Κτιρίου			Επέκταση ☐
Διεύθυνση κτιρίου:			
Αριθμός ορόφων:	Αριθμός υπογείων:	Έτος κατασκευής:	Χρήση κτιρίου:
Τύπος κτιρίου:			
Ανεξάρτητο ☐	Ημιανεξάρτητο σε επαφή με 2 άλλα ☐	Ημιανεξάρτητο σε επαφή με 1 άλλο ☐	Μεζονέτα ☐
Ισόγειο Διαμέρισμα ☐	Διαμέρισμα σε ενδιάμεσο όροφο ☐	Διαμέρισμα σε τελευταίο όροφο ☐	Άλλο ________
Τύπος Τοιχοποιίας			
Τοιχοποιία Πάχος (mm) ☐	Τοιχοποιία Πάχος (mm) ☐	Τοιχοποιία Πάχος (mm) ☐	Τοιχοποιία Πάχος (mm) ☐
Παρακείμενος χώρος: ________	Παρακείμενος χώρος: ________	Παρακείμενος χώρος: ________	Παρακείμενος χώρος: ________
Συνηθισμένο τούβλο ☐	Συνηθισμένο τούβλο ☐	Συνηθισμένο τούβλο ☐	Συνηθισμένο τούβλο ☐
Θερμομονωτικό τούβλο ☐	Θερμομονωτικό τούβλο ☐	Θερμομονωτικό τούβλο ☐	Θερμομονωτικό τούβλο ☐
Διπλότοιχος ☐	Διπλότοιχος ☐	Διπλότοιχος ☐	Διπλότοιχος ☐
Κόκκινο τουβλάκι ☐	Κόκκινο τουβλάκι ☐	Κόκκινο τουβλάκι ☐	Κόκκινο τουβλάκι ☐
Τσιμεντομπλόκς ☐	Τσιμεντομπλόκς ☐	Τσιμεντομπλόκς ☐	Τσιμεντομπλόκς ☐
Γυψοσανίδα/Τσιμεντοσανίδα ☐	Γυψοσανίδα/Τσιμεντοσανίδα ☐	Γυψοσανίδα/Τσιμεντοσανίδα ☐	Γυψοσανίδα/Τσιμεντοσανίδα ☐
Εμφανές Σκυρόδεμα ☐	Εμφανές Σκυρόδεμα ☐	Εμφανές Σκυρόδεμα ☐	Εμφανές Σκυρόδεμα ☐
Άλλο ________	Άλλο ________	Άλλο ________	Άλλο ________
Παρατηρήσεις/Πληροφορίες	Παρατηρήσεις/Πληροφορίες	Παρατηρήσεις/Πληροφορίες	Παρατηρήσεις/Πληροφορίες

Figure 3 – Table that the qualified expert has to fill when visiting an existing dwelling

The QEs have to submit the EPC, the recommendations report, and the calculations file via email, to the central registry of the Energy Service. Upon submission, the EPC is registered under a unique number. The same registration number appears on the recommendations report.

As from the 1st of September 2010, all public buildings in Cyprus with more than 1,000 m^2 that are frequently visited are required to display an energy certificate at the main entrance. The definition of public building includes every building that is used by a government body or by an organisation or company that is funded or controlled by the government. Buildings are defined as frequently visited when a service is provided to the public constantly. This definition covers a large number of buildings in Cyprus and most of them are in the process of certification at the end of 2010.

The responsibility of having a certificate is always of the building owner. The Energy Service charges the QEs with a registration fee of 200 € for the first year and 100 € for every other year. An owner, who fails to deliver the Certificate to a buyer or renter, or to display it on a public building, will incur in a fine which must not exceed 8,550 €. Until the end of 2010, there are no statistics about the cost of preparing EPCs.

Fig. 4 shows a simplified illustration of the process for certification.

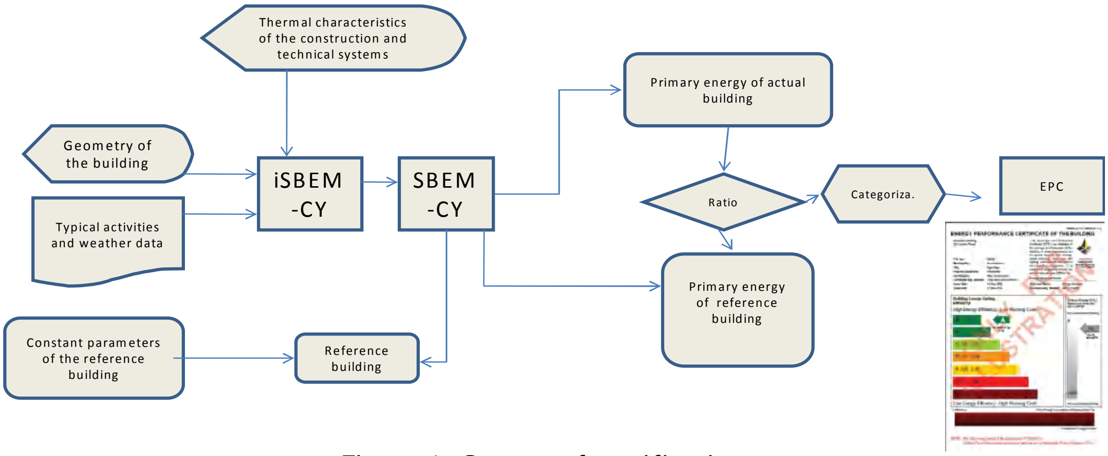


Figure 4 – Process of certification

Quality assurance (QA)

The Energy Service has set a quality assurance scheme in order to ensure as much as possible the high quality of EPCs and the recommendations report.

The first step includes setting the vigorous qualification requirements of the QEs. These requirements include certain academic background, work experience, training and high passing grade on the exam (see chapter 4).

The second step concerns checking the way that QEs are performing calculations. The checks are on a random basis, but there are also several criteria to flag a certificate for a check, of which the most important are: issuing certificate for the first time, recorded previous failure to perform calculations, and use of RES other than solar thermal. The target is to have enough EPCs checked in order to have a reliable indicator, and to check every QE at least once in order to fix problems from the source.

As soon as the EPC is submitted, a straightforward visual verification of its form takes place, by checking if the name and the number of QE are correct, and if all the required information is filled on the EPC, e.g., address, date and so on. All EPCs are checked in this first stage. In case of problem, the EPC is send back to the QE, otherwise the EPC is issued.

Then, parameters considering the building envelope, efficiency of HVAC systems and RES are checked. In case they exceed certain criteria, e.g., very low U-values, the EPC is flagged and further clarification is asked from the QE. If the clarification is not satisfactory, then the Energy Service proceeds to a thorough check of the energy performance calculations. If more questions arise from this stage, then the QE is audited to verify the source of the data used and the correctness of any other calculation that cannot be checked by the electronic files that are submitted.

Until the end of 2010, 332 EPCs have gone through a thorough check, which accounts for 16% of all the EPCs submitted, and 103 of them were cancelled. All QEs have been checked at least once on the way they are performing calculations. The implementation of a quality assurance system has led to 53 mandates with the aim of fixing individual QE problems, and 3 mandates to all QEs addressing general problems in calculations and data collection.

3 > Inspections - Status of implementation

The inspection of air-conditioning systems in Cyprus started on the 1st of October 2010. The Ministerial Order for the Inspection of Air-conditioning systems makes the inspection of air-conditioning systems larger than 12kW mandatory, and the inspection of air-conditioning systems that, adding together their nominal power in the same building, exceed 50kW.

The "Guide for the Inspection of Air-conditioning systems"

The inspections can only be performed by inspectors of building services, which have to be registered in the corresponding registry of the Energy Service. To be qualified, they must have a degree in Mechanical Engineering, be members of ETEK, and have three years of related experience. Until the end of 2010, there are 44 registered inspectors. In 2010, it is planned to reassess the qualifications of the inspectors by going through training and take an exam. These qualifications will apply for the new and the existing inspectors.

The methodology of inspecting air-conditioning systems is described in the "Guide for the Inspection of Air-Conditioning Systems", and is based on EN 15240:2007. The document describes the required data that has to be gathered, the checks that have to be performed and guidance on the recommendations.

Table 1: Frequency of inspections of air-conditioning systems

Nominal power of the system	Inspection frequency	Completion of first inspection
12kW – 250 kW	Every 5 years	31st of December 2011
≥250 kW	Every 3 years	31st of December 2011
>50 kW	Every 5 years	31st of December 2010

Cyprus has started an information campaign to the public for the benefits of regular inspection and maintenance of boilers. The Energy Service has issued the document "Simple ways to save energy in the central heating system" which is directed to the public and guides the home owners and users of the system to make a first assessment of it and, when it is needed, to call an inspector. The methodology for the inspection of boilers is described in the "Guide for the Inspection of Central Heating Systems with Boilers".

A registry for boiler and air-conditioning inspectors is planned to be set up.

"Simple ways to save energy in the central heating system"

4 > Qualified Experts

EPCs and recommendations reports can be only issued by QEs. The QEs are separated into two categories: QEs for residential buildings, and QEs for non-residential buildings. All QEs must have a degree in Architecture, Mechanical Engineering, Civil Engineering or Electrical Engineering and be members of ETEK (Cyprus Technical and Scientific Chamber).

- For residential buildings, they have to have three years of experience in their field and pass a national exam.
- For non-residential buildings, they have to have six years of experience and pass an exam, and it is a prerequisite that they already passed the exam for residential buildings.

In addition, Energy Service offers courses that the candidates may attend in order to pass the exam. The course offered for residential buildings covers the legal framework, basic heat transfer, calculation methodology, recommendations and software practice. The course offered for non-residential buildings covers case studies of big buildings with emphasis on complex technical systems and recommendations. Though the attendance to the courses by the candidates is not mandatory, the attendance is very high and for non-residential buildings is 100%.

Once the candidate has all qualifications, he/she applies to register on the qualified experts' registry, and a professional license is issued valid for one year. The license can be suspended or cancelled if it is concluded that they cannot perform energy performance calculations or that they are changing data to alter the energy rating.

Qualified experts can act only on an individual basis. At the end of 2010, there were 200 Qualified Experts that can certify residential buildings and 32 of them can also certify non-residential buildings. The qualified experts' registry is on the website of the Ministry of Commerce, Industry and Tourism, on which the public can view their names and contact information.

The need of informing citizens on certification

The Ministry of Commerce, Industry and Tourism has recognised that informing the professionals of the building industry and the public is crucial for exploiting the full potential of the EPBD. The Energy Service, as the competent authority for implementation of the EPBD, has intensified the information campaigns during 2009 and 2010, with more emphasis on the EPC and the inspections.

The first stage information was the training of the building permit authorities, the majority of which are the Municipalities, which took place through three training sessions. Furthermore, a guide was issued, in order to assist the building authorities to effectively check if the buildings are complying with the energy performance requirements when their building permit is examined.

Advertisement for the EPC

The second stage was the information of all the parties involved in the building industry. Energy Service organised or participated in tens of seminars and presentations to promote the EPC, minimum energy performance requirements and inspections, especially directed to professional associations, including the land development association, the property owners association, as well as the architects and civil engineers associations.

As from 2008, for every public building there is one public employee assigned as “energy saving attaché”. His duties include the promotion of energy saving culture, the implementation of national energy policies, and suggestions for reducing the overall energy consumption of the building. The “energy saving attachés” have to submit every year to the Energy Service a report that includes measured energy consumption and measures taken to improve energy efficiency. So far, there are 300 “energy saving attachés” in the corresponding public buildings who were trained by the Energy Service in related matters including the implementation of the EPBD in Cyprus and, especially, in the public buildings. Starting from 2011, this function is being expanded to public schools.

Advertisement for air-conditioning inspections

A three page leaflet informing the public about the EPC has been issued and made available in places where frequent services are offered to the public, like the Office of Servicing the Citizen, the Electricity Authority of Cyprus and banks. Additionally, three advertisement flyers have been published: one for the EPC when a building is for sale or for rent, one for the inspection of air-conditioning systems and one for the inspection of heating systems.

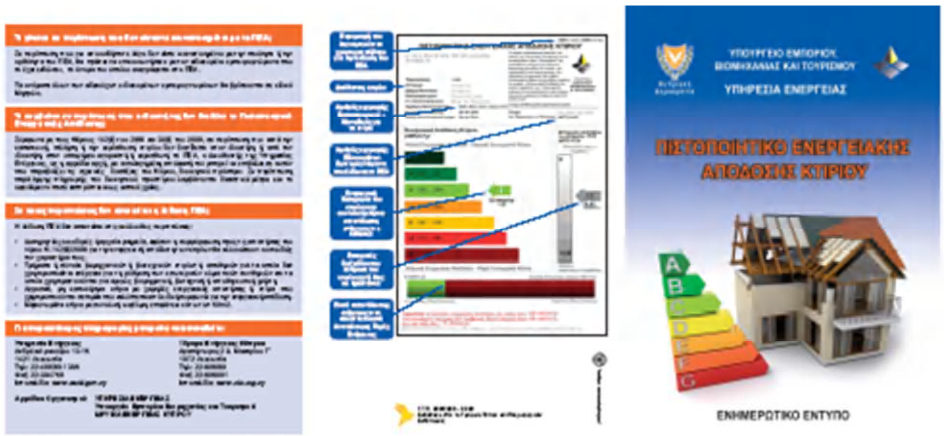


Figure 5 – Three page leaflet about the EPC for the public

Adds of these three issues were published in newspapers, and additionally officers of the Energy Service have participated in radio and television shows to promote EPBD issues.

6 > National Incentives and Subsidies

In 2004 the Government of Cyprus has launched the “Grant scheme for the promotion of renewable and energy conservation” This Scheme is intended to provide financial incentives in the form of government subsidies for investments to be made to generate electricity using wind and solar energy, biomass and landfill biogas and for investments made to improve energy efficiency in the sector of buildings, industry and services.

Considering the building sector the Scheme covers thermal insulation for existing buildings, and installation of ground source heat pumps, solar thermal systems, photovoltaic and small wind turbines for new and existing buildings. For the thermal insulation and the installation of ground source heat pumps and solar thermal systems the building owner receives a fund according to the size of the investment. Since the beginning of 2010 an EPC has to be issued and included in the application forms in the case of solar thermal systems for space heating and ground source heat pumps. In the case of photovoltaic and small wind turbine the building owner receives an operational aid with a subsidy per KWh generated. The subsidy (the difference between the overall sale price per KWh and the Electricity Authority of Cyprus purchase price) shall be paid by the Special Fund which has been set up, and which is financed by imposing a charge on electricity consumption of 0.0044 €/KWh.

7 > Impact of the EPBD at national level

Evolution of Minimum Energy Performance Requirements in building regulations

The implementation of the EPBD in Cyprus was the first attempt ever made to regulate the energy consumption in buildings. The 2007 regulations for the first time required thermal insulation of the building envelope in Cyprus.

Table 2: Minimum energy performance requirements for new building and all buildings above 1,000 m^2 that undergo a major renovation (2007 regulations)

Description	U-value (W/m^{2}K)	Comments
Horizontal structural elements of the shell	≤0.75	
Wall and structural elements of the shell	≤0.85	Not applied to passive systems
Windows and external doors	≤3.8	Not applied to shop windows
Floor in contact with unheated spaces	≤2.0	

In 2009, a new Ministerial Order for the Minimum Energy Performance Requirements was issued. It keeps the same maximum U-values for the building envelope, but it makes the requirements more stringent as it regulates the building as one entity. These new requirements are:

- The average U-value of the building envelope
- The EPC with a B category

The calculation of the average U-value (or U-mean) takes into account the U-value of each element of the building envelope and its corresponding surface area and averaged over the whole area of the building envelope. The roof and the floor are not included in this calculation. Compliance with this requirement results in lower U-values in case that extensive use of glazing is chosen. The maximum average U-value differentiates between residential and non-residential building.

The B energy category as a minimum requirement is achieved only if the building needs the same or less primary energy than the reference building. The reference building has predetermined values of the thermal characteristics of external walls, floors and windows which are slightly lower than those set as minimum requirement for every individual element. Additionally, it has predetermined values for the efficiency of heating, air-conditioning, hot water and lighting systems. For non-residential buildings, these parameters are stricter.

Table 3: Predetermined U-values for the reference building

U-values in the Reference building		
Exposed element	U-value (W/m^2K) **(residential)**	U-value (W/m^2K) **(non-Residential)**
Roofs[1] (irrespective of pitch)	0.6375	0.6375
Walls	0.7225	0.7225
Floors (except for ground floors, below)	0.6375	0.6375
Ground floors	1.6	1.6
Windows, roof windows, roof lights, and pedestrian doors	3.23	3.23
Vehicle access and similar large doors	Same as real building	Same as real building
[1] Any part of a roof having a pitch greater or equal to 70^o is considered as a wall		

The new Ministerial Order of 2009 introduced for the first time the integration of RES in new buildings. It made the installation of a solar thermal system for the production of hot water mandatory in all new residential buildings. The installation of these systems was already common practice in Cyprus for houses. However, for the first time, their technical parameters are regulated, including size and efficiency, since they now have to be designed and installed according to the "Technical Guide for the Installation of Solar Thermal Systems". Additionally, and for all new buildings, it is required to pre-install the necessary infrastructure in case the future owner decides to install RES to produce electricity.

Table 4: New Minimum energy performance requirements for new buildings and all buildings above 1,000 m^2 that undergo a major renovation (2009 regulations)

Description	U-value (W/m^2K)	Comments
Average U-value not including floors and roofs	≤1.3 residential ≤1.8 non-residential	
Energy class on the EPC B or better		
Installation of solar thermal systems in all new residential buildings according to the "Technical Guide for the Installation of Solar Thermal Systems"		It is subject to restrictions and requirements set by the Department of Spatial Planning and Housing
Installation of the needed infrastructure for the future installation of RES electricity production systems		

Other impacts

The implementation of the EPBD in Cyprus leaves complete freedom to building designers in the choice of technologies and, to a great extent, freedom in architectural design. This freedom enables the architects and engineers to meet the minimum requirements by using different construction materials and technologies.

The demand from the designers to find construction materials to meet the minimum requirements had an impact on the quality of information on the building products, and even on the competition between producers and vendors in supplying materials of improved thermal properties.

The requirement of a minimum B class on the certificate has integrated for the first time the importance of efficient technical systems in the energy performance of buildings. As a result, more designers have shown interest in heat pumps and condensing boilers. The calculation of the overall energy performance of the building has also underlined the importance of integrated solar strategies and external shading for the designers. Furthermore, the Qualified Expert, most of the times an established professional in the building sector, in many cases operates as a consultant that oversees all matters related to the energy performance of buildings, making the implementation of minimum requirements more effective and even leading to designs better than the minimum requirements.

8 > Conclusions and future planning

According to the National Action Plan, it is estimated that the targets of Cyprus in energy saving can be achieved to a great extent by applying the EPBD requirements for new buildings and major renovations. This is due to two major factors: the long absence of legislative measures regarding the thermal insulation of buildings, and the relatively large number of new constructions.

The real challenge in energy saving is the existing building stock. It consists of 380,000 homes, and it is estimated that less than 15% have thermal insulation in any elements of the building envelope. Since these buildings were not built under any regulation, they were insulated either under individual initiative, or under the "Grant scheme for the promotion of renewable and energy conservation" that started in 2004.

In 2010, this Grant scheme was revised and it started to include subsidies for the installation of ground source heat pumps, solar thermal for space heating, replacement of solar thermal systems for producing domestic hot water older than 10 years with new more efficient units, as well as installation of photovoltaic and small wind generators.

The Energy Service is preparing proposals to further revise the Grant scheme targeting improvements of the energy performance of the existing building stock. The certification and inspections schemes, already created by the implementation of EPBD, are significant tools to be used in any new financial incentive introduced in the future.

The adequate information of the public and key persons in business and corporations is another challenge that had to be faced in order to promote energy efficiency measures in the existing building stock. A more intensive information campaign is planned, with advertisements and pilot projects that will serve as show cases.

The experience from implementing the EPBD so far, as well as the new obligations from the recast of the EPBD, has set forward the planning of more actions. The most important of them are:

- Technical solutions for achieving nearly zero energy building in Cyprus;
- Redefinition of the reference building, and the minimum requirements, in order to better reflect the climatic variety of Cyprus and the resulting cost-benefit relationship;
- Provide additional training to building designers in energy efficiency and integration of RES;
- Provide additional training for installers of insulation materials and HVAC systems.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in the Czech Republic

Status in November 2010

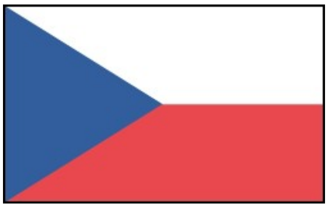
Jan Pejter

ENVIROS, s.r.o.

Pavel Gebauer

Ministry of Industry and Trade of the Czech Republic

Czech Republic



National websites:

- *www.mpo.cz*
- *www.phare-epbd.org*
- *www.ideal-epbd.eu*

1 > Introduction

This country status report aims to summarize how the implementation of the EPBD has been applied in the Czech Republic, what has been changed in the national energy performance requirements, how these influenced the building stock, and what is planned for the future.

Two years have passed since the last report, and the Energy Performance Certificate for buildings is used all over the country. The aim of the EPC is mainly to inform building users and residents about the energy performance of the building, and optionally to encourage them to take energy saving measures.

The EPC implementing regulation (published in 2007) of the Act (Energy Management Act incorporating the EPB Directive – published in 2006) sets the minimum requirements for the energy performance of new buildings, as well as for existing buildings under major renovation.

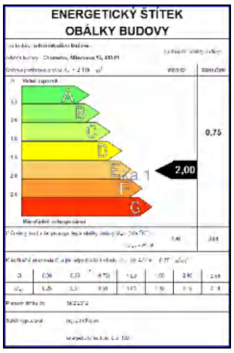
Recently, the revision process of the current EPBD, general (Energy Management Act) and secondary legislation (implementing decree) has been published in order to put the Czech requirements in line with the requirements of the “old” EPBD and to be prepared for the recast of the EPBD in the following years.

This report describes the way the Czech Republic handles the EPBD, and endeavours to present interesting approaches and achievements. It addresses certification and inspection systems, including quality control mechanisms, training of certified experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

The energy assessment of buildings is not new in the Czech Republic. Since 2001, there is a methodology for energy audits and certificates for the building envelope in place. The energy audit (EA) is mandatory for all types of buildings with total energy consumption higher than 1,500 GJ per year. Part of the energy audit was also the energy certificate with a graphical scale, representing the thermal characteristics of the building envelope (external walls, roof, windows and doors, ground floor).



Energy certificate of building envelope

Due to the energy auditing system, a set of national requirements in terms of energy efficiency and indoor climate was adopted.

In the Czech Republic, the implementation of the EPBD is the overall responsibility of the Ministry of Industry and Trade. The Ministry is the crucial body for amending the general EPBD law and for implementing the regulation. It is also the managing body for examination and accreditation of energy auditors and experts to conduct energy audits, EPCs and inspections. Authorised energy auditors are registered on a List of Energy Auditors kept by the Ministry (see *http://www.mpo-enex.cz/experti/ExpertListEng.aspx*).

In 2006, the Czech Parliament adopted the amendment of the Act on Energy Management, transposing the requirements of the Directive 2002/91/EC into the legislation of the Czech Republic. In the middle of 2007, the decree about the buildings certification was published.

The Energy Performance Certificate

Major renovation means alteration to a completed building, which involves more than 25% of the overall surface area of the building shell, or a change of the technical equipment of the building, that causes energy effects whose overall impact on initial energy consumption is higher than 25% of the overall energy consumption of the building.

The Energy Performance Certificate is the document demonstrating compliance with the requirements for the energy performance of the building; it is an integral part of the documentation prerequisite for the planning permission for constructing a new building or for a major renovation of an existing building - an obligation linked to the building permit.

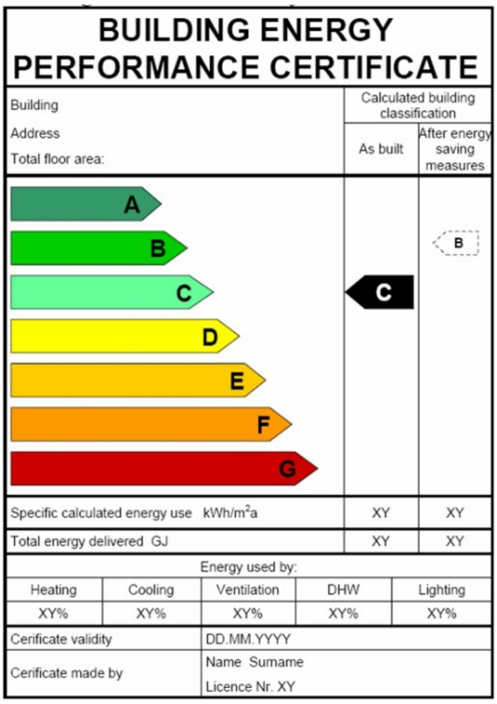
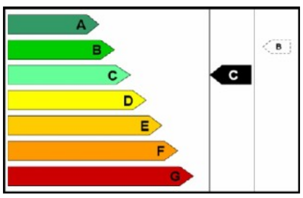


Figure 1 – Graphical display of the label (EPC)

Calculation procedures

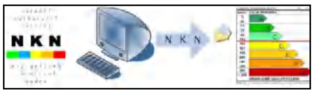


Energy Label Defined by "A-G" Classes

In the Czech Republic, the same methodology is used for all regions and all building types. The recommended calculation procedure is based on published CEN Standards and applicable Czech Technical Standards.

The energy performance is expressed by the total annual delivered energy consumption, including heating, cooling, DHW preparation, mechanical ventilation, lighting, and auxiliary energy needed for standardised building operation.

A simplified multizone calculation is used, based on a typical day for each month, in an one-hour time step. Climate data are specified for 4 climate zones, according to the national standards, which are used as input data for building physics calculation. Building energy systems such as heating, cooling, DHW preparation and ventilation are included as zone assigned systems, while energy sources (e.g. boilers, co-generation unit, solar collectors etc.) are assigned in the model for the energy delivery systems.



The National Calculation Tool (NKT) has been published in October 2007 and is available free of charge.

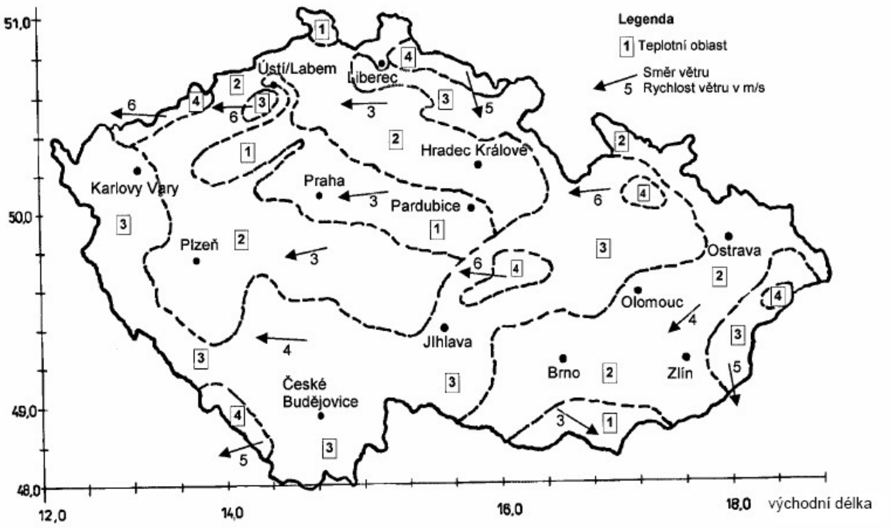


Figure 2 – 4 Climatic zones (with rated outdoor temperature -20°C, -18°C, -15°C, -12°C)

Energy Perfor-mance Category	Verbal description of Energy Performance of Buildings
A	Very efficient
B	Efficient
C	Fair
D	Unsatisfactory
E	Inefficient
F	Very inefficient
G	Extra inefficient

Verbal assessment on energy performance of buildings

The result of the energy performance calculation for the assessed building is the annual delivered energy consumption, counted over gross floor area (kWh/m^2 p.a.) and classified according to the levels of the energy classes.

Primary energy and CO_2 emission are not assessed in the energy building certification. The discussion about primary energy co-efficients was stopped at the beginning of the preparation of the EPBD implementation, due to various interests of stakeholders (district heating companies, gas and electricity suppliers).

The energy label classifies buildings on an efficiency scale ranging from A (high energy efficiency) to G (poor efficiency). In the table below, energy classes (in kWh/m^2 p.a.) for different building types are displayed. Class “C” is a minimum EP requirement level for new buildings and for existing buildings under major renovation.

Building Type	A	B	C	D	E	F	G
Single-family Houses	< 51	51 - 97	**98 - 142**	143 - 191	192 - 240	241 - 286	> 286
Apartment Blocks	< 43	43 - 82	**83 - 120**	121 - 162	163 - 205	206 - 245	> 245
Hotels & Restaurants	< 102	102 - 200	**201 - 294**	295 - 389	390 - 488	489 - 590	> 590
Offices	< 62	62 - 123	**124 - 179**	180 - 236	237 - 293	294 - 345	> 345
Hospitals	< 109	109 - 210	**211 - 310**	311 - 415	416 - 520	521 - 625	> 625
Education Buildings	< 47	47 - 89	**90 - 130**	131 - 174	175 - 220	221 - 265	> 265
Sports Facilities	< 53	53 - 102	**103 - 145**	146 - 194	195 - 245	246 - 297	> 297
Wholesale & Retail Trade Services Buildings	< 67	67 - 121	**122-183**	184 - 241	242 - 300	301 - 362	> 362

Figure 3 – Energy classes (in kWh/m^{2}a) for different building types

The aim of the EP certificate is to inform residents and building owners/users, and encourage them to take energy saving measures. These are summarised in the report attached to the certificate.

The EPC, in terms of recognised achievable energy savings, contains concrete measures leading to their utilisation. For each measure, the volume of energy savings is stipulated in technical units, along with financial assessment, amount of investment, simple payback period, and the impact on the energy rating if all measures are implemented. Recommendations for energy saving measures should be developed for the specific building by the energy expert; there are no general recommendations selected from a database, on the basis of the building type or the building structure and the typical situation.

The validity of the energy certificates is 10 years.

Measures	Energy Savings (GJ)	Investment costs (kCZK)	Simple Payback Period
Energy Management	89	0	-
Windows Replacement	1,086	4,900	15.3
Thermal Insulation of external walls	1,065	4,600	14.3
Total Saving (incl. synergy effects)	2,240	9,500	14.5

Figure 4 – Example of recommendations for the improvement of the energy performance in a building

Materials	Block of flats	Family houses	Total
Baked matter and profilated bricks	47%	58%	52%
Stones, baked matter bricks	13%	33%	23%
Concrete panels	37%	1%	19%
Other materials	2%	9%	5%
Total	100%	100%	100%

The structure of residential houses according to the material of outside walls

The EP certification is obligatory since the 1st of January 2009 for **new buildings** (above 50 m^2) and **existing renovated buildings** (above 1,000 m^2). When rented or sold, buildings are provided with the Energy Performance Certificate only if they are newly constructed or renovated, i.e., when renting or selling new buildings (above 50 m^2), as well as existing renovated buildings (above 1,000 m^2). Similarly, **public buildings** (above 1,000 m^2) must display the EP certificate in a prominent place visible to the public, only in case of a new construction or a major renovation.

In the Czech Republic, these national modifications strongly influence the scope of the EPBD. As mentioned above, it applies only to new buildings and to renovated buildings over 1,000 m^2 of total floor area. The inconsistent implementation of the Directive leaves energy classes "D" to "G" entirely unused. Those are the buildings which are assessed in terms of energy performance as poor, and therefore require the implementation of saving measures. This limitation means that, basically, only EPCs for classes A to C are currently issued in the Czech Republic. There is no record of the number of certificates issued so far.

The owner should present a valid certificate to the buyer or renter when the selling or renting contract is in preparation, but in practice this happens only in the cases described above (only if the property is newly constructed or renovated).

The calculation methodology is described in the EPC implementing regulation No. 148/2007 Coll. (published in 2007) of the Act (Energy Management Act incorporating EPB Directive – published in 2006). The EPC implementing regulation sets the minimum requirements for the energy performance of new buildings and existing buildings under major renovation.

In the Czech Republic, one methodology is used for all regions and all building types. The procedure is based on published CEN Standards and applicable Czech Technical Standards. The EPC regulation has adopted the majority of valid national standards (mostly in the form of EN ISO standards), as well as other requirements (regulations, decree of the government e.g. on thermal insulation of hot water pipes, boiler efficiency, indoor climate), by reference to these standards and regulations. Zone operation profiles include occupation, lighting, indoor environment requirements and auxiliary energy. These profiles are standardised for typical zones such as offices, schools, dwellings, etc.

In the Czech Republic, the definition of a **public building** follows the EPBD terms, and states that operators of buildings with a floor area larger than 1,000 m^2, used for education, health services, culture, retail, sport facilities, accommodation and restaurant services, customer centres of water/energy supply, transportation, telecommunication and public administration (i.e. almost all buildings except apartment buildings), are obliged to **display the EP certificate** in a publicly accessible area of the building.

At the end of 2010, only slightly more than 10 public buildings have been certified, but many more are in the process of being certified.

The responsibility of having a certificate lies with the builder, the owner or the association of the owners of the building in case of a new construction or a major renovation. Display of the EP certificate on public buildings (according to the definition) is mandatory for building operators.

The cost of the EP certificate is based on a market price and ranges from 200€ for single family buildings, to 1,500€ for multifamily buildings, kindergartens and schools, to 6,000€ for large administrative buildings with A/C system.

Quality assurance (QA)

The Ministry of Industry and Trade (MIT) is responsible for the certification scheme. The MIT authorises energy experts for certification schemes, keeps the list of authorised experts and annually collects experts' record (number of issued EPCs, energy saving potential and other monitoring indicators). There is no central register of EPCs in the Czech Republic.

The training of experts is the first stage to guarantee a high level of quality for the system. A specific training course with high passing grades in the exam is required. This topic is detailed on Chapter 4. The second stage to guarantee the EPC quality is random sample checks conducted by the State Energy Inspectorate (SEI). SEI has the right to impose penalties (warnings, fines, and removal from the list of energy experts) for failure to comply with the Act.

Act 458/2000 Coll. - Law on Business Conditions and Public Administration in the Energy Sectors is known colloquially as the Energy Act. Although this Act is largely concerned with regulations in the energy sector, it also defines the responsibilities and powers of the State Energy Inspectorate (SEI). This Act gives SEI the right of initiative to instigate inspection proceedings in order to ensure compliance with the Acts and Decrees related to energy generation, distribution and consumption. The State Energy Inspectorate has specific responsibilities for the Quality Control of EPC, as well as for inspections, according to the requirements of the Energy Management Act. The Quality Control of EPC is additionally co-financed by the state budget, through the State Programme (programme for energy efficiency).

If, during the construction, or after the completion of a building, SEI finds out that the building does not comply with the EP requirements, a fine is imposed on the builder or the owner. The law does not clearly define whether the building will have to be subsequently brought into conformity with the requirements of the Act.

Detailed information about the total number of Q&A checks of EPCs, as well as the results of the checks is not available.

3 > Inspections - Status of implementation

Boiler inspection

The Czech Republic has adopted the option A of the Article 8 of the EPBD, establishing a regular inspection of boilers.

This obligation does not apply to boilers and internal heat distribution systems in residential buildings (family houses, multifamily houses and apartments), which do not use heat for business purposes. These residential owners are provided with consultations and advice, free of charge, by the network of Energy Consultancy and Information Centres (EKIS).

Any other operating boilers (running on natural gas, liquid or solid fuels) with a rated output power from 20 kW up to 200 kW must be subjected to regular efficiency inspections, according to the EPBD (regulation No. 276/2007 Col.). Boilers with a rated heat output over 200 kW are inspected according to the Minimum Efficiency of Energy Use for Heat Energy and Electricity Production Act (Act No. 150/2001 Col.).

Thermal output of the boiler(s)	Coke	Hard Coal	Coal Pressed Fuel	Brown Coal - sorted	Brown Coal - unsorted	LFO	HFO	Natural Gas
up to 0.5 MW	69	68	67	66	62	80	-	85
0.51 - 3 MW	-	70	69	68	63	83	-	86
3.1 - 6 MW	-	75	-	72	65	84	81	87
6.1 - 20 MW	-	77	-	75	70	85	82	90
20.1 - 50 MW	-	80	-	-	77	87	85	92
above 50 MW	-	82	-	-	82	89	86	93

Figure 5 – Minimal boiler efficiency of new boilers, sorted by fuel and heat output according to the Act No. 150/2001 Col.

Heating appliances (boilers) with a rated heat output above 20 kW, which are more than 15 years old, must undergo an one-off inspection of the whole heating installation. Mainly, the space heating system dimensioning and function is checked. Such a review has to include an assessment of the boiler efficiency, as well as possible advice on its replacement.

Inspections of boilers in buildings started in November 2007.

The time interval between periodic boiler inspections depends only on the fuel used:

- Solid and liquid fuel boilers – every 2 years
- Natural gas boilers – every 4 years

A/C inspection

In the Czech Republic, A/C system inspections use the same methodology based on the use of CEN standard 15 240 for all sizes and types of A/C systems. The procedure includes reviewing the documentation for the air-conditioning system, initially to determine the extent and the location of the system components, as well as reviewing the quality and the likely effectiveness of maintenance. It is considered that some aspects of physical inspection can be omitted from the "standard" inspection procedure when it is clear that the systems have been well maintained. When it is not clear that maintenance has been carried out to a good standard, the system components are inspected, largely to identify and report instances of neglect or damage that could have reduced the efficiency.

Part of the inspection is the review of the suitability and settings of the system controls, as these may be improved or simply reset at low cost.

Inspections of A/C systems in buildings started in November 2007. The default inspection period is 4 years.

The A/C inspection report includes:

- refrigeration equipment
- outdoor heat rejection
- cooled air and independent ventilation air, delivery systems
- heat exchange to the refrigeration system
- building system controls and control parameters

Inspection reports

There is a standardised report template with a common set of required minimum information defined. Inspection reports are not collected at a central database. Boiler or A/C system owners keep these inspection reports to present them on demand.

Inspections of boilers and air-conditioning systems are based on the assessment of efficiency under normal working conditions. Currently, inspections must simply follow the reference methodologies defined in the relevant CEN standards.

Boiler and A/C inspections are paid by the end user or by the owner of the building.

4 > Qualified Experts

In the Czech Republic, experts in building certification, as well as inspectors of boilers and A/C systems, have to pass different examinations, but the same expert can be simultaneously authorised to perform more than one of these activities. Experts for building certification and inspections need to be registered with an Energy Auditor Registration Number, and authorised by the Ministry of Industry and Trade.

The application may be submitted only by a person who:
- has an Energy Auditor Registration Number, or
- is registered as an authorised architect or authorised engineer and technician by the Czech Chamber of Certified Engineers and Technicians.

Energy auditors (the qualification required is a university degree and 3 years of technical experience, or a “highschool” degree + 5 years of experience). Authorised engineers or architects undertaking a specific training course and passing an examination are authorised by the Ministry.

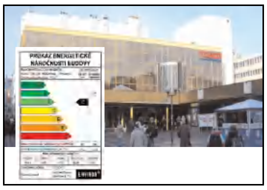
Experts should have a liability insurance because clients usually so demand (but not required by the law) and must play an independent role in the certification process.

The EP certificate/inspection may NOT be performed by a person who:
- holds a share in the company or the co-operative that ordered the EPC;
- is a stakeholder in or a member of the co-operative that ordered the EPC, or is a statutory body of or a member of the statutory body of the entity that ordered the EPC, or is employed by or has a similar relationship to the corporation that ordered the EPC;
- is someone close to those people, who might be, due to their position, a natural or legal person to influence the energy auditor.

If there are complaints on an expert's work or if an expert does not issue any audit or EPC for 5 years, than he/she is deleted from the list of experts.

At the end of 2010, there are about 788 authorised experts for EP certification, and 275 authorised experts for inspections in the Czech Republic.

National EPBD information leaflet (IEE Project IMPLEMENT)



Example of a promotional case study prepared for each building types

5 > National Information and Communication Campaigns

In the Czech Republic, there has been no official state campaign supporting the EPBD implementation. Some energy consultancy companies, technical equipment manufacturers (pumps, space heating and cooling control systems) and professional associations are running information campaigns, mostly in collaboration with local municipalities.

Local campaign in the frame of IMPLEMENT projects

The IMPLEMENT project started in January 2007 in the framework of the Intelligent Energy for Europe Programme (*www.epbdinaction.eu*). The aim of the campaign carried out was to set up, lead and evaluate an awareness campaign which should communicate direct information to building owners (private, municipal and government), building users, installing companies, designers and developers in the Czech Republic.

The focus of the campaign was to raise interest among all target groups regarding the EPBD, energy savings and using urban renewable energy sources with respect to the minimal energy performance requirements set in the EPBD for new buildings and major renovations.

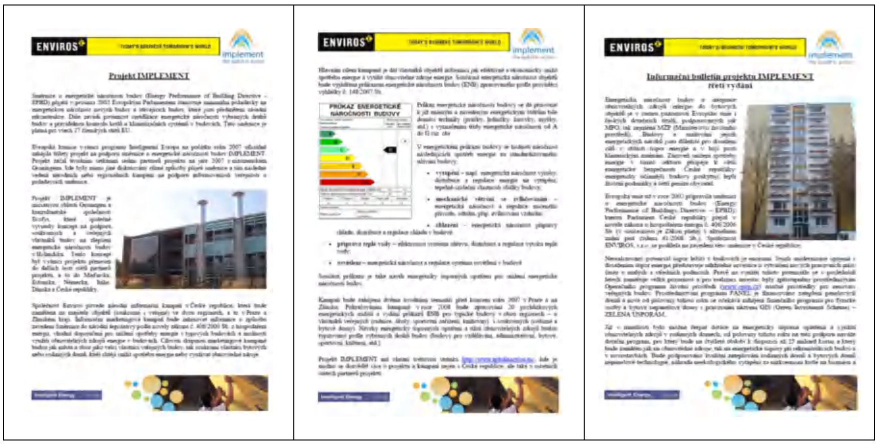


Figure 6 – IMPLEMENT newsletters distributed among relevant stakeholders

The Czech IMPLEMENT campaign should not be simply a remedy for problems associated with energy efficiency and the use of renewable energy sources in the building sector, but it is an important contribution to the increase of energy efficiency and the improvement of the quality of the existing building stock.

The campaign was not intended as a “universal cure” healing all energy related problems in buildings. The success rate lies in making people understand how they consume energy and the offer of technical and financial solutions.

Figure 7 – IMPLEMENT brochure

However, the high-quality preparation of the campaign, its attraction and its aiming to the right target groups are the core of the campaign's success. However, the obstacles have shown that, although a lot of work has been done, much more has still to be done in order to convince building owners to implement energy saving measures.

6 > National incentives and subsidies

The Green Savings programme focuses on support for heating installations utilising renewable energy sources, but also for investment in energy savings in reconstructions and new buildings. The programme will support quality insulation of family houses and non-panel multiple-dwelling houses, replacement of environment-unfriendly heating equipment by low-emission biomass-fired boilers and efficient heat pumps, installation of these sources in new low-energy buildings, as well as construction of new houses complying with the passive energy standard.

The Czech Republic has raised funds for this programme from the sale of emission credits under the Kyoto Protocol on greenhouse gas emissions. The overall anticipated programme allocation is up to 25 billion Czech crowns (about 1,000M€).

The Green Savings support has been set up so that the funds can be used throughout the period from the programme's launch in 2009 until the 31st of December 2012. Applications for subsidies will be admitted until the 30th of June 2012, or until the programme's funds are exhausted. A subsidy may be granted before or after the implementation of the measure, but support for measures completed before the programme's launch cannot be granted. The support is granted for equipment installed in residential houses, not for buildings intended for individual recreation or for industrial buildings, even if the applicant has their permanent residence there.

7 > Impact of the EPBD at national level

Evolution of minimum quality requirements in building regulations

The EPC implementing regulation (published in 2007) sets the minimum requirements for the energy performance of new buildings and existing buildings under major renovation. The EP requirements for new and existing buildings are the same. This means that there is no difference in energy performance aspects between newly constructed and refurbished buildings.

The main regulations are:

- Regulation No. 148/2007 Coll. of the Ministry of Industry and Trade, specifying the details of the energy performance of buildings.
- Level of heat energy demand, according to the Czech standard ČSN 73 05 040-2/Z1: 2005

Both specify details of energy efficiency in buildings. The required values are obligatory for almost all new buildings. In case of existing buildings, they are obligatory for larger refurbishments (e.g. if more than 25% of the surface of a building is insulated, then the insulation must comply with the standard).

The standard sets two levels of insulation: required and recommended. The required level is obligatory. The recommended level reflects the expected development in the future.

Following the development of the required U-values in the Czech Republic, no impact of the EPBD is evident regarding the strengthening of the thermal characteristics of the building envelope (the more recent update of U-values was prepared and published in 2005).

U-value (W/m^2K)	ČSN 73 0540 July 1964	ČSN 73 0540 January 1979	ČSN 73 0540-2 May 1994	ČSN 73 0540-2 November 2002	ČSN 73 0540-2 January 2006
Windows	-	3.700	2.900	1.800	1.700
Wall	1.467	0.894	0.461	0.380	0.380
Floor	1.369	1.091	1.034	0.600	0.450
Roof	0.900	0.508	0.316	0.300	0.240

Figure 8 – Development of the U-value of the key structure elements of the buildings (included in Czech Technical Standard ČSN 73 0540)

Other impacts

In the Czech Republic, the average age of the housing stock is relatively high. In 2001, the average age of the housing stock increased to 46.9 years. A serious problem is the neglect of maintenance of the housing stock, meaning a lack of maintenance over a protracted period of time, which has resulted in a decrease of the financial and utility value of residential structures. Specific problems exist in respect of prefabricated-panel buildings. Due to construction and design flaws, as well as to insufficient maintenance, these problems are exacerbated by the fact that buildings of this type account for close to the one third of the housing stock.

Since the beginning of the 1950s, new technologies for a new type of residential building construction were used: the panel houses, which were being built till the end of the 20th century. Heat transmission resistance of the outside walls was 1.2-1.5 m^2K/W (it represents an U-value of 0.83-0.67 W/m^2K).

Despite the fact that most of the blocks of flats built in the period 1970-1990 used concrete panels as the material for outside walls, the majority of the currently used housing was built using bricks.

There are some new requirements directly connected with the EPBD implementation. The following requirements are considered as new features:

- Global minimum requirements on consumption for all types of buildings, expressed in kWh/m^2 per year of delivered energy;
- RES and D-H feasibility studies for new buildings over 1,000 m^2;
- Energy Performance Certificate (incorporating heating, cooling, DHW preparation, mechanical ventilation, lighting, and auxiliary energy).

8 > Conclusions and future planning

Fundamental change in Czech legislation on energy efficiency in buildings will be completed in 2011 by implementing aspects of the EPBD recast. With these changes, new demands will come up regarding the reconstructed or newly constructed buildings in many areas, e.g.:

- Extension of the building stock under the EPBD.
- Tightening of thermal-insulation characteristics of the building envelope.
- Calculation of CO_2 emission produced by the building's use.
- Introduction of primary energy calculation.
- Addition of features missing in the previous transposition of the Directive (namely, certificates in cases of sale and renting of existing buildings, display of certificates in buildings for public services frequently visited by the public).

The incorporation of the key steps and the timetable for the implementation of obligations under the EPBD recast into the Czech legislation is expected to take place as follows:

- In 2011 - The new legislation will be prepared and publicised. The amendment of the Energy Management Act will be submitted to the Parliament for approval.
- In 2012 - The new legislation will become mandatory.

Implementation of the EPBD in Germany

Status in November 2010

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Germany

National websites:

- *www.bbsr-energieeinsparung.de*
- *www.dena.de*
- *www.kfw.de*

Standards:

www.enev-normen.de

1 > Introduction

Since the first Thermal Insulation Ordinance (*Wärmeschutzverordnung*) in 1977, there have been requirements concerning the energy performance of buildings in Germany. Over the last 33 years, the requirements have been continuously increasing (see Figure 19). The additional requirements of the EPBD were supplemented by the Energy Saving Ordinance 2007 (*Energieeinsparverordnung*). Among other things, this concerns the introduction of the holistic calculation method of DIN 18599, further improvement of the Energy Performance Certificate and a regular mandatory inspection of air conditioning units.

The last amendment of the Energy Saving Ordinance came into force in October 2009 and strengthened the level of requirements by 30% on average. Since the beginning of 2009, in addition to the requirements of the Energy Saving Ordinance, it has been compulsory nationwide to use renewable energies for heating in new buildings, according to the Renewable Energies Heat Act (*Erneuerbaren-Energien-Wärmegesetz*). This obligation has even been expanded to certain refurbishments of existing buildings in some federal states.

According to the Recast EPBD, the Energy Saving Ordinance will be amended again in 2012. Further steps for the introduction of standards for nearly zero energy buildings, for the implementation of an independent control system for Energy Performance Certificates, as well as for the compulsory energy performance indicator in commercial advertisements, are under consideration.

This gives an overview of the development and status of the current requirements of the German Energy Saving Ordinance. It also indicates the prospects for future implementation in Germany.

Responsibility for the implementation of the EPBD for Germany as a whole lies with the Federal Ministry of Transport, Building and Urban Development, together with the Federal Ministry of Economics and Technology. The inspection of boilers is the responsibility of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

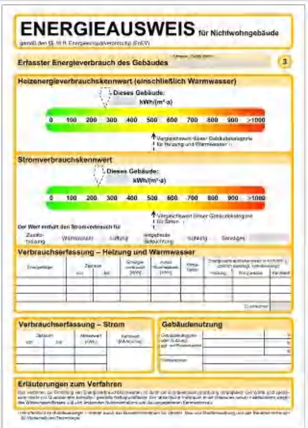
The EPBD has been implemented primarily on the basis of the Energy Saving Act (*Energieeinsparungsgesetz*), which originally came into force in 1976 and which has defined since then the legal basis for requirements concerning:

- Thermal insulation of buildings
- Heating, ventilation and hot water systems, as well as billing of heating and hot water costs on the basis of individual consumption

Figure 2 - Energy Performance Certificate for non-residential buildings

Cover page: Building data, basis of issue, issuer, signature

Page 2 Issue based on energy demand



Page 3 Issue based on energy consumption

Since 2002, detailed requirements concerning the energy performance of new and refurbished buildings have been provided by the Energy Saving Ordinance, based on the Energy Saving Act. These requirements already included almost all aspects of the EPBD annex which are relevant to Germany: since 2002, energy performance requirements were already based on the annual primary energy demand of a building, which is the result of a standardised calculation method.

2 > Certification

An Energy Performance Certificate has been compulsory for new buildings and major refurbishments since 2002. In subsequent years, the requirement for an Energy Performance Certificate was also gradually introduced for existing buildings, for sale, rent or public use. In Germany, the Energy Performance Certificates can be grouped into two categories, according to the type of the calculation method: certificates on the basis of calculated demand and certificates on the basis of metered consumption. Up to 2008, there was freedom of choice between the "demand" and "consumption" methods for all existing buildings. This now applies only for large residential buildings (at least 5 units), in which the individual influence on use is statistically balanced by the large number of users. It also applies for smaller residential buildings which conform at least to the first German Thermal Insulation Ordinance for thermal insulation, as well as for all non-residential buildings. For a certificate to be issued, owners of older, small residential buildings, which have not been refurbished, must have an Energy Performance Certificate based on calculated energy demand (Figure 1).

Standard forms are mandatory for Energy Performance Certificates; they consist of four pages plus an annex of at least one page, with “Recommendations for cost-effective modernisation”. The recommendations which are given depend on the individual and free opinion of the assessor. Figure 2 shows the first 3 pages of the form for non-residential buildings. A benchmark indicates the average value of the building stock, which defines the central point of the scale, according to the individual use. Page 4 explains the technical terms used in the form, in order to enable the reader to understand the data. Figure 3 shows the form for residential buildings, which has a similar layout, but contains a fixed scale of reference values.

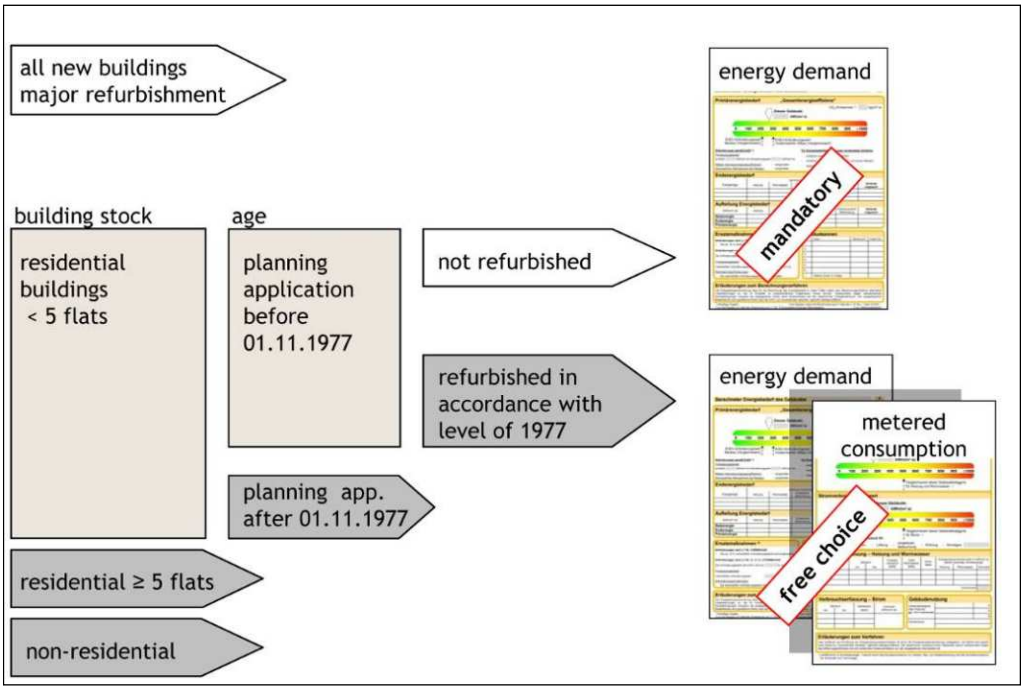
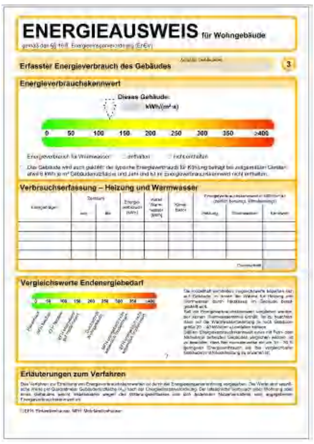


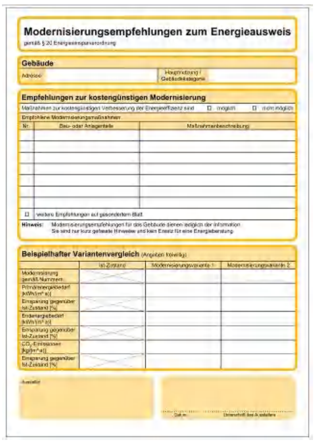
Figure 1 – Which Energy Performance Certificate is required, and when?

Figure 3 - Energy certificate for residential buildings

Cover sheet: Building's data, basis of certification, issuer, signature



Page 3: Certificate based on metered energy consumption



Annex: Refurbishment recommendations form

In the Energy Saving Ordinance 2007, new forms were introduced, in order to achieve a standard layout for the certificates for new and existing buildings. The forms were modified again in the Energy Saving Ordinance 2009, so that what was now a free choice of calculation method for residential buildings, as well as the optional use of simplifications, could be indicated. A part of the form concerning the use of renewable energies or corresponding alternative measures is also new. In addition, there was a rescaling of the reference scale for buildings, with the objective of clarifying the change in the level of requirements (Figure 4).

The display of certificates is adopted as taken directly from the directive. Mandatory forms are given in the annex of the ordinance.

Despite numerous changes to the forms, the certificates issued according to the old law, as well as the certificates from earlier programmes with different layouts (because of transitional regulations), retain their validity for 10 years -uniformly- from the date of issue.

There is a lack of knowledge about consumption for new buildings, which means that an Energy Performance Certificate can be issued exclusively on the basis of calculations (energy demand). For this reason, and in the interests of uniformity, the intention was initially to also make the specification of this basic principle mandatory for all cases of existing buildings prescribed in the EPBD. However, in Germany, there has been for many years a mandatory requirement for consumption-based billing of heating and hot water costs for all buildings with more than two units of use. Against this background, in order to limit the cost of Energy Performance Certificates for existing buildings, the use of consumption data obtained from billing information was allowed. To achieve comparability with data obtained by calculating demand, the influence of the weather during the data collection period must be corrected. Since in Germany, when measuring thermal insulation, a uniform, location-independent "reference climate" (the climate of Würzburg) has been assumed for a long time, the heating consumption data must also be standardised to this climate. This is done by forming the ratio of the relevant degree days.

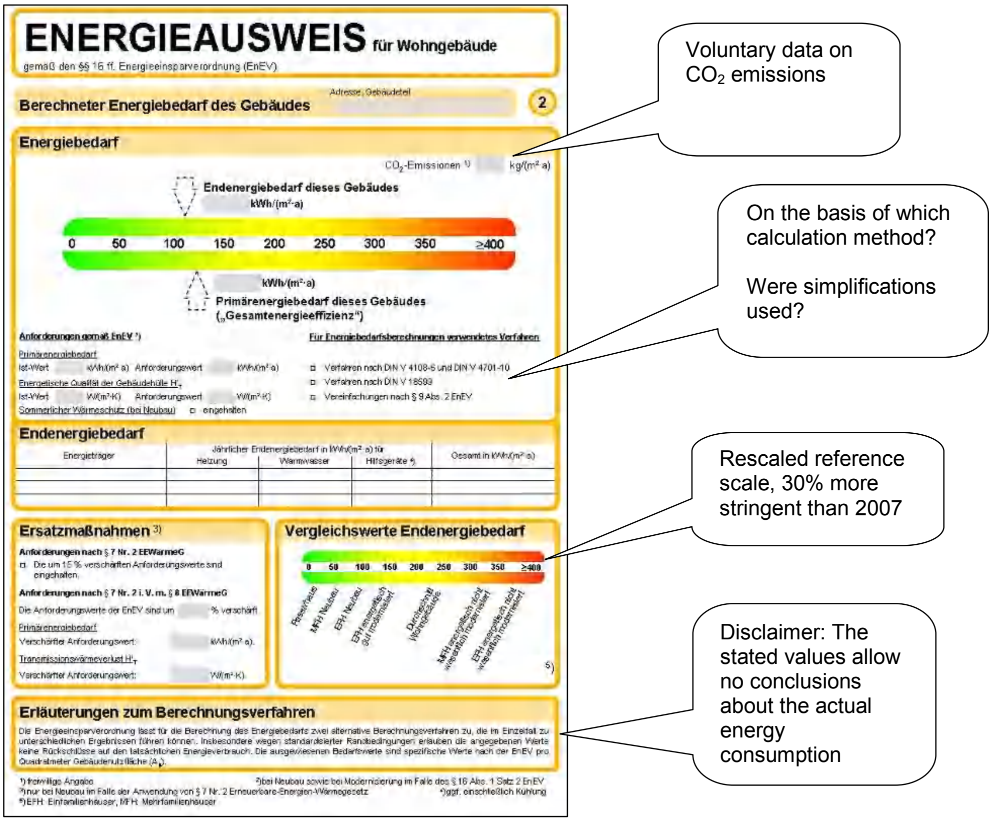


Figure 4 - Page 2 of the Energy Performance Certificate

Figure 6 - Ratio of issued Energy Performance Certificates according to a BBR study

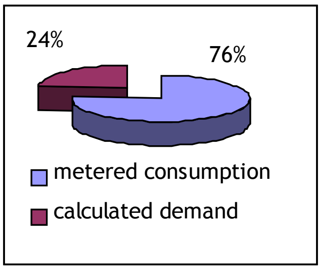
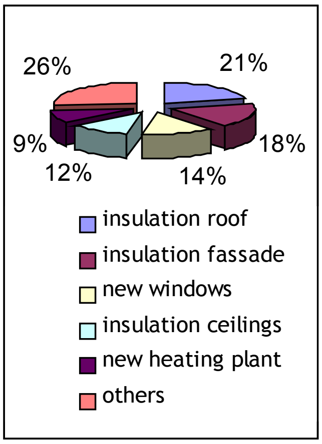


Figure 7 - Frequency of refurbishment after recommendations made



Note:

Figures 6, 7, 9 and 11 show the results of a study by the Weeber and Partner Institute, produced on behalf of the BBSR

Method of calculation

The holistic German method of calculation is described in the standard *DIN V 18599*, which does not contradict the CEN standards. It is used to prove that the Energy Saving Ordinance requirements have been met, and provides the energy performance values for Energy Performance Certificates based on energy demand. The German preliminary standard DIN V 18599 is a uniform assessment method for the building envelope, the built-in lighting and the systems for heating, ventilation, cooling and hot water. The standard consists of ten sections with interfaces with one another. Formula symbols, technical terms and indices are uniform in all sections of the standard, and are defined and used coherently for the different technical disciplines. Figure 5 shows the calculation scheme.

The basic conditions of climate and use to be applied in line with the calculations in the Energy Saving Ordinance are contained in Part 10 of DIN V 18599.

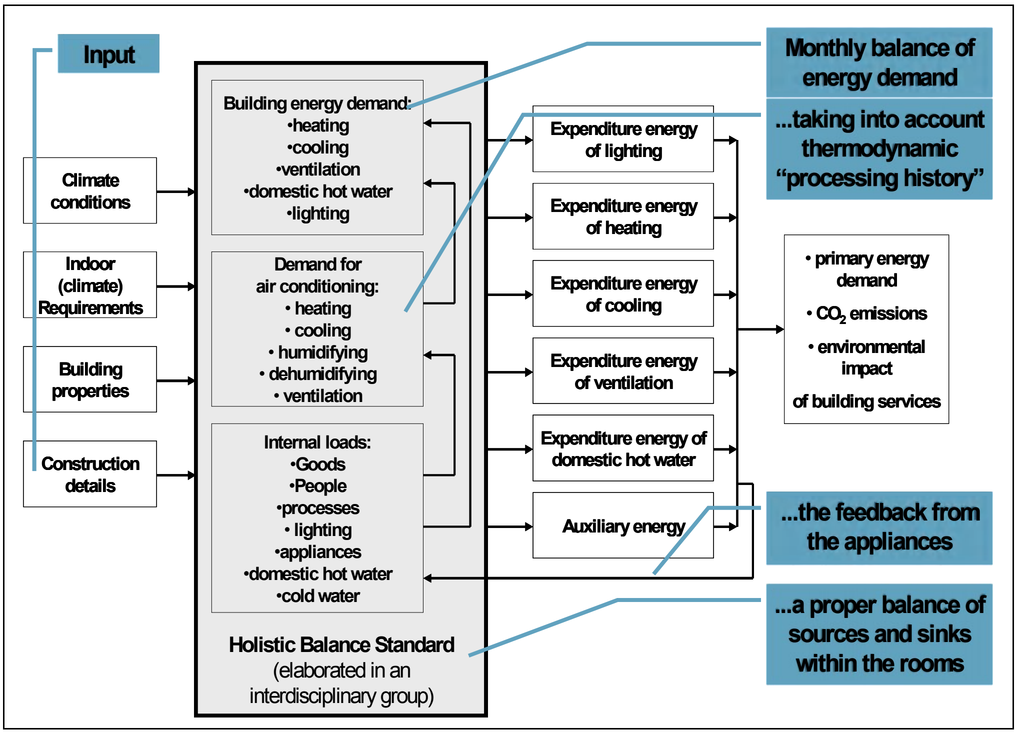


Figure 5 - Layout and action plan of the calculation standard DIN V 18599

Since the Energy Saving Ordinance 2009, DIN V 18599 is also applicable to residential buildings, in parallel with the previous and simpler calculating method of preliminary standards DIN V 4701 and DIN V 4108. With the objective of limiting the work, and therefore the cost of energy reporting for existing buildings, there is the possibility of "simplified data recording". Simplifications allow the assessor to calculate with default values (e.g. historical U-Values) and to approximate the geometrical shape of the building.

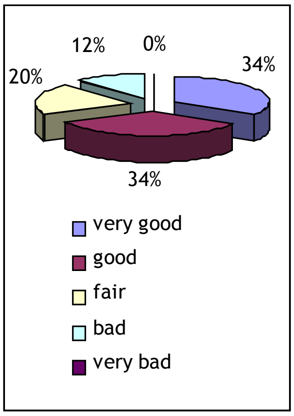
Energy consumption is determined on the basis of a record of heating costs, which must normally be made as part of consumption-based billing. A condition for the use of this data in Energy Performance Certificates is that a period of at least 36 continuous months is recorded. The proportion of heat energy is weather-adjusted using climate correction factors. So far, the weather-adjustment method is not used for cooling, though cooling is included in both methods (calculation or metered energy consumption).

Comparative values must be taken from an official notification and stated as values for energy consumption characteristics of non-residential buildings (Examples in Figure 8).

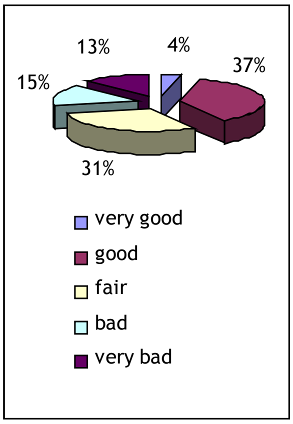
Figure 10 - Principle of the Dena quality seal

Figure 11 - Private customers' opinion of the information content of the certificates

Calculation-based certificates



Consumption-based certificates



More than 70% of the assessors have a university degree.

Use (examples)	Comparative value according to the ordinance of 2009	
	Heating and hot water	Electricity
	final energy demand [kWh/(m² a)]	
Hotels, mid-range	85	55
Restaurants	205	95
Cinema	55	80
Gyms	120	35
Multipurpose halls	240	40
Indoor swimming pools	385	105
Non-food trade, small	135	45
Food trade, small	125	75
Department stores, shopping centres	70	85
Hospitals, large	175	80
Office buildings, only heated	105	35
Office buildings, heated and ventilated	110	85

Figure 8 – Comparative values and central point of scale in EPC for non-residential building stock

Quality Assurance

The German Energy Performance Certificate system does not require issued certificates to be reported, and thus there is no central register, in order to keep the cost of issuing certificates low (Costs range between 50 € and 500 €). This unbureaucratic arrangement must also be viewed against the background that an independent control system has so far not been stipulated.

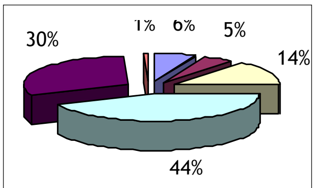
As for the enforcement of the regulation in general, the federal states are also responsible for controlling the issuing of Energy Performance Certificates. This task is generally delegated to the local building control authorities. This legal situation enables the responsible agencies to impose fines in the case of breaches of the regulations, such as incorrect issuing of certificates, refusal to issue or submit a certificate, or deliberately include incorrect information in energy certificates.

The voluntary quality seal of the German Energy Agency (dena) labels particularly quality-tested energy certificates. In a corresponding list, prospective landlords or building owners can find specially qualified and entitled assessors registered in the dena database. The contents of quality assurance are: particularly stringent approval requirements for assessors and mandatory standards for the issuing of certificates, such as an obligatory on-site appointment, personal explanations and additional information concerning refurbishment. Every certificate is electronically checked for plausibility before it can be issued. In a further stage, random sample checks are made by independent experts and, if there are major errors in individual cases, these are examined by subsequent on-site inspection (Figure 10).

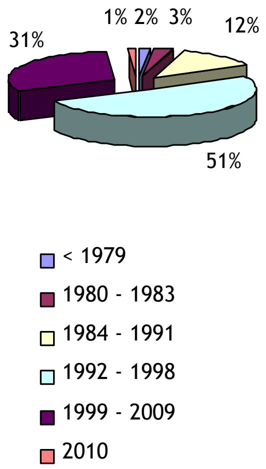
In contrast to other member states, in Germany there is no official software for energy certificates. Developers are acting free on the market. The quality of software, i.e. the right transfer of the technical rules into the software, is an important step regarding the quality of the results. Since there is also great interest by private sector software suppliers in guaranteeing the quality of their products, the great majority have joined together since April 2009. to form a "Quality community 18599". The quality community is organised as an association and contributes to further improvements in the products and greater clarity for the users.

Figure 13 - Age structure of boilers (year of installation) as at end of 2009

Gas-fired boilers



Oil-fired boilers



3 > Inspections

In Germany, regular inspection of boilers has been mandatory for many years, and in fact to a much greater extent and at shorter intervals than those provided for in the EPBD. The requirements are mainly included in the Emission-Act. Energy aspects of limiting flue-gas losses are also covered. If a boiler does not comply with the prescribed requirements, it must be replaced. The inspections are carried out by the local master chimney sweeper on behalf of the competent authorities. The chimney sweeper keeps a register of all the boilers in the region. The operator of the boiler has to pay a fee, which is officially fixed according to the amount of work (e.g.: gas boiler with a rated output of 24 kW, about 25 € per year).

Thus, thousands of boilers have to be modernised every year, which results in a reduction of the average age of the boiler stock in Germany (see Figure 13). Furthermore, boilers installed before 1978, which do not comply with the status of low temperature boilers, have generally to be shut down. In many cases, the deadline for this has already expired.

Against this background, Germany has chosen "Option b"“, because the additional introduction of a one-off inspection of heating systems was not considered reasonable by the Federal Government. Among other actions, the German Energy Agency conducts a campaign in order to inform citizens about possible improvements to heating systems. There are also promotional programmes, as well as information campaigns by third parties (Figure 12).

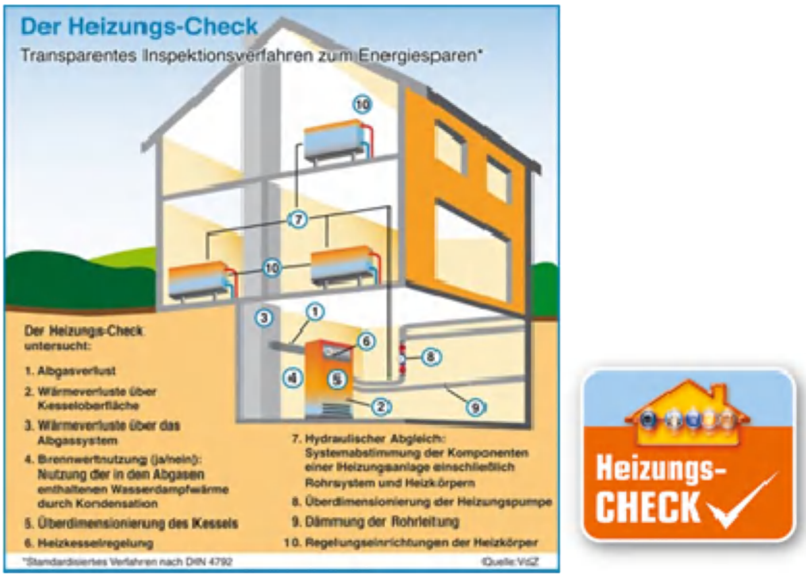
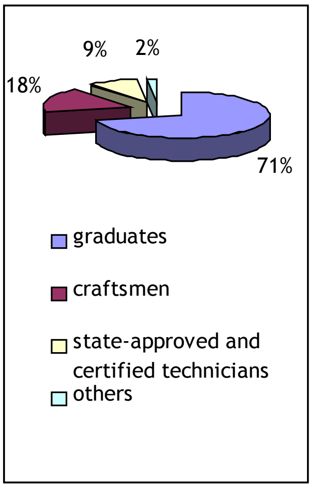


Figure 12 – The "heating check", a voluntary additional measure for the heating industry, source: VDZ

Maintenance became mandatory for air conditioners. In Germany, there is also the consideration to include in this maintenance the testing of the required properties of energy-related components by the maintenance-technician. Every air conditioning unit with a thermal output of more than 12 kW also has to undergo an inspection by a specialist engineer every 10 years. In particular, the engineer has to inspect the appliance to check whether it meets the individual demand and whether its technical condition requires modernisation. He has to provide recommendations according to the EPBD for the improval of efficiency.

Figure 9 - Qualification of assessors



More than 70% of the assessors have a university degree.

4 > Qualified experts

In Germany, a system for authorising the issuing of energy certificates, which does not require any additional bureaucracy, was introduced with the Energy Saving Ordinance 2007. Authorisation to issue certificates is based on the qualification of the persons concerned. For new buildings, the assessors' requirements are defined by regional law. Those intending to issue energy certificates for existing buildings must identify their personal qualifications and check whether they meet the conditions set in the Energy Saving Ordinance. There is no official approval certification. A person who issues an energy certificate and who is not entitled to do this, breaches the regulations and can be punished by a fine in theory. In Germany, due to the large number of certificates required, there is a need to make the circle of certificate assessors as wide as possible.

The qualifications required for certificate assessors are described comprehensively and conclusively in the Energy Saving Ordinance. Certificates may be issued by:

- for all buildings:
  architects and engineers of building-related disciplines and by other engineers and natural scientists with a building-related field of study, who have learned about energy efficient building either during their study or during a further vocational training, according to the Annex 11 of the Energy Saving Ordinance, or who have related professional experience of at least two years; by persons who are authorised to make energy calculations for new buildings, according to the building codes of the relevant federal state - in each case within the limits of their respective authority.

- only for residential buildings:
  master craftsmen or persons of equal qualification of crafts related to building and building appliances (including chimney sweepers), who have successfully attended further vocational training, according to the Annex 11 of the Energy Saving Ordinance.

The last category covers a few cases which are not included in the above-mentioned provisions, in which certain experts -mainly craftsmen- are entitled by the local building codes to independently construct simple buildings. The federal states wanted to use this amendment in order to avoid differences between certificates for new and existing buildings.

5 > National information and communication campaigns

Information campaigns and specialist handbooks play an essential role in the German implementation strategy. In this case, the offers are adapted to the different levels of knowledge and needs of the interested groups (tradesmen, building owners and tenants, as well as engineers and planners). The acceptance of and familiarity with the Energy Performance Certificates should be further encouraged, especially for building owners and tenants. Planners and tradesmen receive practical tips for how to include the Energy Saving Ordinance and the official announcement in their everyday routine. With regard to the Energy Saving Ordinance 2009, many guidelines have been revised and adapted to the current situation. Such information is published mostly free of charge for citizens.

A large advertising campaign for the CO_2 building refurbishment programme was initiated in 2007 (Figure 16).

Figure 16 – Advertising campaign for the CO_2 refurbishment programme

6 > National incentives and subsidies

The CO_2 building refurbishment programme of the *KfW Bankengruppe* [German Development Loan Bank] is part of the German climate protection programme and of the Federal Government's programme for growth and employment. It is intended to promote measures for saving energy and reducing CO_2 emissions in residential buildings by financing corresponding measures, both at low interest rates and in the long term. Particularly efficient new buildings and refurbishment measures in existing buildings are both eligible. In this case, the interest rate is reduced by means of the use of Federal Government funding in the first 10 years of the life of the loan. There can be additional support in the form of a repayment subsidy. Alternatively, an application can be submitted for an investment subsidy for refurbishments.

The support is graduated according to the level of energy refurbishment achieved in the KfW's "Energy efficient refurbishment" and "Energy efficient building" programmes. The energy performance standard is ranked in relation to the requirements for new buildings included in the current Energy Saving Ordinance (Figure 18). A refurbished building which requires, for instance, 115% of the primary energy of a comparable new building –therefore only 15% more– is assigned to the promotion standard "KfW efficient building 115". On proof of compliance with the programme requirements for the erection or refurbishment as a KfW efficient building, the following compensation credit subsidies (when a low-interest rate loan is taken up) or, alternatively, investment subsidies can be granted.

KfW BANKENGRUPPE

Figure 17 - KfW promotes as public body by order of the Federal Government CO_2 building refurbishment and especially efficient new buildings

A basic condition for granting these subsidies is that all measures are undertaken exclusively by specialised contractors. All costs caused directly by the energy saving measures are eligible investment costs. These also include consultancy and planning costs, as well as the necessary ancillary work related to the project's completion. Professional monitoring of the building work by experts during the refurbishment is also eligible, to the extent of 50% of the costs (up to 2,000 € per project).

KfW efficient building	Option 1: Credit and subsidy	Option 2: No credit, only subsidy	
	Compensation credit subsidy[1]	Investment subsidy[2]	Max. support per housing unit
Measures in existing buildings			
115	2.5%	7.50 %	5,625 €
100 (= new build)	5.0%	10.00 %	7,500 €
85	7.5%	12.50 %	9,375 €
70	10.0%	15.00 %	11,250 €
55	12.5%	17.50 %	13,125 €
New buildings			
77	Credit without subsidies	-	-
55	5.00 %	-	-
40	10.00 %	-	-

1 Related to the credit received of a maximum of 50,000 € per housing unit (new build) and 75,000 € per housing unit (refurbishment)
2 Related to refurbishment costs incurred

Figure 18 - Investment subsidies in existing and new buildings (as at 11/2010)

The applicant must submit a confirmation from an approved energy consultant or an approved expert that this refurbishment measure will serve the above named purposes, and after this has been done, this person must confirm that the measures have been carried out according to plan.

The funding volume of the CO2 programme amounted to a record value of 2,000 M€ in 2009. Because of strong demand and the high utilisation of funds available in the budget, it has not been possible to support individual measures in existing buildings since September 2010. The funding programme for efficient new buildings and comprehensive refurbishments to efficiency standards continues to operate. The promotional quota is set at 950 M€ for 2011.

7 > Impact of the EPBD at national level

The first version of the EPDB in 2002 had scarcely any effect in Germany, since the obligation for national requirements for the energy efficiency of buildings was already more than met in advance by independent national activities. From today’s perspective, the new version of the EBPD gives further impetus for the updating of the Energy Saving Ordinance, in addition to the national integrated energy and climate programme (IEKP), and the energy concept of the Federal Government. This means that the debate about further steps to make the Energy Saving Ordinance more stringent when it is updated will now be conducted in relation to the EPBD requirement of "Nearly zero energy building by 2020". With this clear target in view, national acceptance of more stringent requirements in future ordinances is rising, in preparation for the standard for nearly zero energy buildings.

Evolution of minimum standards in the Energy Saving Ordinance

Since the introduction of the EPBD, the requirements of the Energy Saving Ordinance have been tightened by 30% on average, and the expected obligation to introduce the standard for nearly zero energy buildings in 2020 further stimulates the discussion about the remaining scope for renewed and cost-effective tightening. Since the ordinance is basically subject to the need for cost effectiveness, a scientific study of cost effectiveness precedes every tightening in the law. in Germany, the basic idea of the "cost-optimal level" has therefore been anticipated.

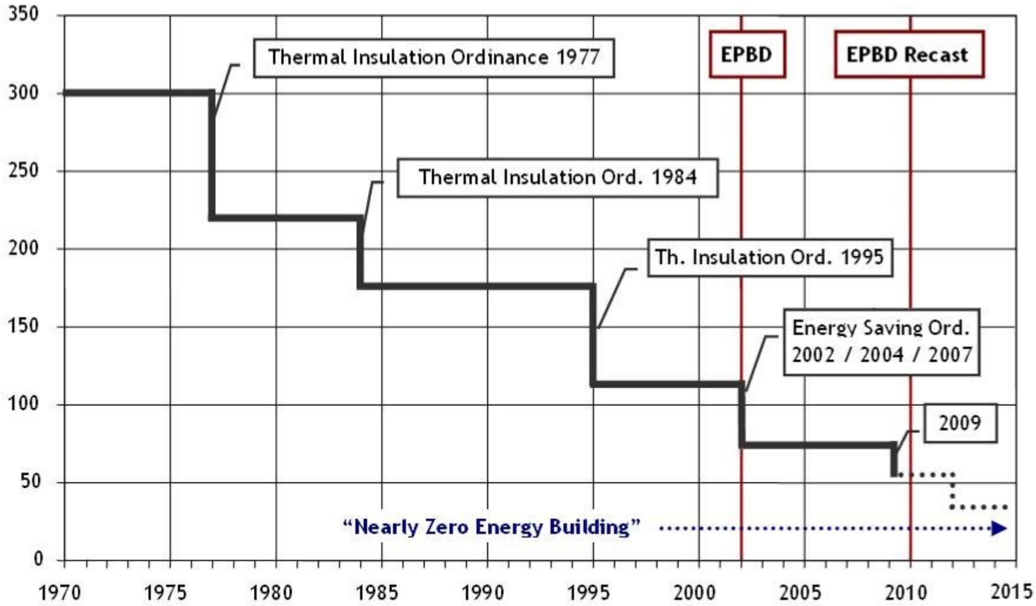


Figure 19 – Evolution of primary heating demand in kWh/m²a

8 > Requirements for new and existing buildings

Requirements methodology for new buildings

In the Energy Saving Ordinance 2009, the previous certification procedure for new residential buildings, which defined the required value depending on the surface area-to-volume ratio, was replaced by the new so-called reference building process. The reference building method had already been the requirements methodology for non-residential buildings. Requirements are specified by means of a reference building which coincides with the actual building in geometry, usable area of a building, orientation and basic conditions of use. In addition, a minimum requirement was also set for the energy efficiency of the building envelope. In cases of favourable heat supply, this ensures, from a primary energy viewpoint, a minimum of energy quality for the envelope. The heat transfer coefficients of the table in Figure 14 serve to calculate the threshold for primary energy demand for residential buildings, with the help of the reference building. The stated specific transmission heat loss (H'_T), on the other hand, must be understood as an obligatory minimum requirement, and thus it must be complied with in every case.

Conditional requirements for existing buildings

For existing buildings, conditional requirements must be complied with in defined cases either of first-time installation or of renovation of the relevant component or building compliance, whereby the requirement extends, in each case, exclusively to those parts of the building surfaces and parts of the installation that are the subject of the measure. The table in Figure 15 shows the threshold for renovated fabric elements. No requirements are imposed for external parts of the building if less than 10% of the relevant parts of the building are concerned.

<table>
<tr><th>Component</th><th>Reference design / value</th><th>2nd requirement</th></tr>
<tr><td>External walls, Floors</td><td>$U = 0.28\ W/(m^2 \cdot K)$</td><td rowspan="5">Small detached residential building
$H'_T = 0.40\ W/(m^2 \cdot K)$

Large detached residential building:
$H'_T = 0.50\ W/(m^2 \cdot K)$

Residential semi-detached building :
$H'_T = 0.45\ W/(m^2 \cdot K)$

All others:
$H'_T = 0.65\ W/(m^2 \cdot K)$</td></tr>
<tr><td>Floor, basement structural element</td><td>$U = 0.35\ W/(m^2 \cdot K)$</td></tr>
<tr><td>Roof, upper ceiling</td><td>$U = 0.20\ W/(m^2 \cdot K)$</td></tr>
<tr><td>Windows incl. French windows</td><td>$U = 1.3\ W/(m^2 \cdot K)$
(Skylight $U=1.4\ W/(m^2 \cdot K)$)</td></tr>
<tr><td>Entrance doors</td><td>$U = 1.8\ W/(m^2 \cdot K)$</td></tr>
<tr><td>Boilers</td><td>Condensing boilers</td><td rowspan="2">Requirements for pipe insulation and control systems</td></tr>
<tr><td>Hot water</td><td>Central, with solar system</td></tr>
<tr><td>Cooling</td><td>None</td><td>Thermal protection in summer</td></tr>
<tr><td>Ventilation</td><td>Central exhaust fan, demand-controlled</td><td>None</td></tr>
</table>

Figure 14 – Example of how requirements can be met for new residential buildings

External structural element (examples)	**Maximum heat transfer coefficient at normal indoor temperatures U [kWh/m²*K]**
	Energy Saving Ordinance 2009
External walls	0.24
Windows Windows with special glazing	1.30 2.00
Glazing	1.10
Curtain walls Curtain walls with special glazing	1.50 2.30
Top floor ceiling, pitched roofs	0.24
Flat roofs	0.20
Floor structures	0.50

Figure 15 – Requirements for structural elements in case of modification in existing buildings

As an alternative to complying with individual requirements for structural elements, a holistic assessment can also be made – analogous to the calculations for new buildings. The requirements are met if modified residential or non-residential buildings exceed the relevant requirements for similar new buildings by not more than 40%.

Retrofitting obligations

Apart from the conditional requirements which result from refurbishment or replacement of a structural element, the Energy Saving Ordinance also contains retrofitting obligations which must be fulfilled by the building owners in each case, before a specific time limit. All retrofitting obligations are also subject to the precondition for cost-effectiveness. According to legal requirements, these are measures with short payback periods, such as the insulation requirement which exists since 2004 for all previously non-insulated and accessible hot water distribution pipes and fittings in unheated rooms. In addition, there is a requirement for the insulation of non-insulated top floor ceilings of heated rooms, above which there is an accessible, but non-walkable space. The obligation also applies to top floor ceilings, above which there is an attic, as from the 31st of December 2011. As an alternative, the roof located above can be insulated instead of the top floor ceiling.

Retrofitting automatically operating control devices with separate reference values for the room humidity is mandatory for larger air conditioning and ventilation systems, insofar as these systems are intended to affect the humidity of the indoor air. Because of the high primary energy expenditure in electric power generation in Germany, the Energy Saving Ordinance requires that electrical heat storage systems must gradually be taken out of operation, if the room heat of the building is generated exclusively by electrical heat storage systems. This applies to larger residential and non-residential buildings whose thermal protection does not comply with the Energy Saving Ordinance '95.

Quality assurance and ensuring implementation of the Energy Saving Ordinance

Since the Energy Saving Ordinance 2009, in order to ensure the implementation of the ordinance and the quality of execution, there has been an obligation to provide proof in the form of a contractor's declaration. This is provided by the contractor in writing and certifies that the modified or installed parts of the building or installations meet the requirements of the Energy Saving Ordinance 2009. The contractor's declaration must be given to the owner promptly after the conclusion of the work, and must be kept for at least five years by the developer or owner. Paragraph 26b, which regulates the duties of the district master chimney sweeper with regard to compliance with the regulations of the Energy Saving Ordinance, has recently been included in the Energy Saving Ordinance 2009. In the future, district master chimney sweepers throughout Germany should check whether the retrofitting obligations (replacement of old boilers, insulation of heat distribution and hot water pipes), as well as the requirements for the installation of a new heating system (night-time temperature reduction, circulating pumps with automatic electric power consumption adjustment, insulation of heat distribution and hot water pipes) are complied with. A comparable ruling has already been previously applied in 2 federal states.

9 > Conclusion and future planning

Because of the long tradition of energy saving in Germany, notable successes have been achieved in actual energy saving in the building sector (see Figure 19). Comprehensive measures contributing to reducing energy consumption and to increasing the share of renewable energies have been implemented successfully.

The Energy Performance Certificate can provide initial information about the expected energy efficiency standard of a building for ambitious consumers, and can thus help to save energy in the long term. Measures are required to increase familiarity with the Energy Performance Certificate and confidence in its information. The introduction of an independent control system during the implementation of the recently issued recast of the EPBD must be viewed in this context.

Current considerations about the possible tightening of the requirements by up to 30% in the Energy Saving Ordinance 2012 had not been brought to a final conclusion. However, a step-by-step harmonisation with the future standard for nearly zero energy buildings, so that it can be established on the market by 2021, appears to be adopted in a short time. The steps by which this occurs and at which time depend directly upon the national definition of the standard for nearly zero energy buildings, and on the results of studies of the cost effectiveness of such requirement levels, which have not yet been concluded.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Denmark

Status in November 2010

Søren Aggerholm

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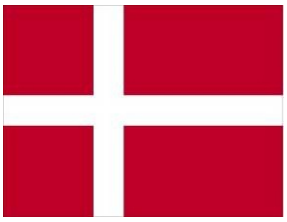
Denmark



National websites:

- *www.ens.dk*
- *www.ebst.dk*
- *www.sbi.dk*
- *www.seeb.dk*
- *www.ois.dk*

1 > Introduction

This report presents an overview of the current status of implementation and of the plans for the evolution of the implementation of the Directive on the Energy Performance of Buildings (EPBD) in Denmark. It addresses requirements, as well as certification and inspection systems, including quality control mechanisms, training of qualified experts, information campaigns, incentives and subsidies.

Since the last country report, published in November 2008, much development has taken place, e.g. revision of energy requirements in the Danish Building Regulations. Energy requirements for new and existing buildings have been tightened and incorporated in the new Danish Building Regulations, BR10 (see section 8). The new regulations came into force in July 2010, with a transition period of 6 months, meaning that all new building permits issued after the 1st of January 2011 must comply with the BR10. In Denmark, the implementation of the EPBD is the responsibility of the Danish Energy Agency (DEA) and of the Danish Enterprise and Construction Authority. The Danish building energy certification scheme has been thoroughly revised, and the revised scheme will be published in the spring of 2011.

2 > Certification

Certification of buildings

In Denmark, the implementation of the EPBD with respect to certification is the responsibility of the DEA. A new secretariat for the daily operation of the Energy Performance Certification (EPC) scheme started functioning in May 2010. The new secretariat (*Energieffektive Bygninger*, SEEB) also covers quality assurance and contributions to the future development of the scheme, and marketing.

The current EPC scheme replaced the mandatory certification schemes existing from 1997. The Danish schemes have been regularly revised over the years and are currently under revision for implementation in early 2011.

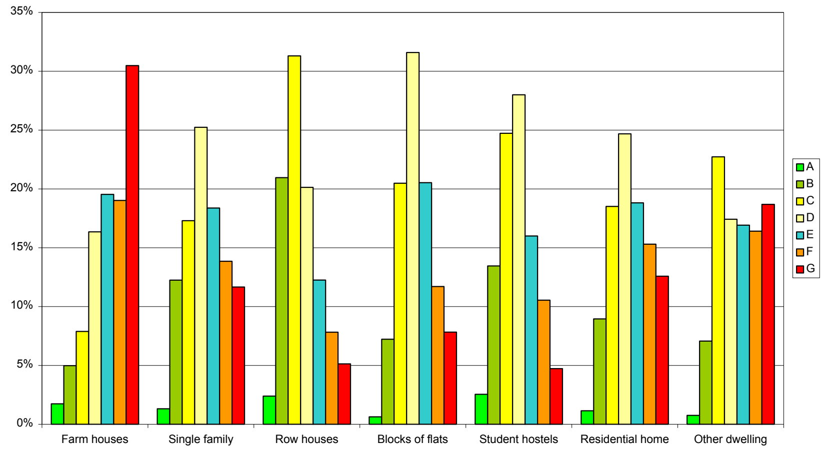
The energy performance certificate

The energy performance (EP) certificate assigns an energy performance label to nearly all types of buildings and lists cost-effective measures for improving their energy performance. The energy label classifies the buildings on an efficiency scale ranging from A (high energy efficiency) to G (poor efficiency). Class A is divided into two categories, A1 and A2, which identify the two low energy classes defined in the Danish Building Regulations from 2008. The validity of the energy certificates is 5 years.

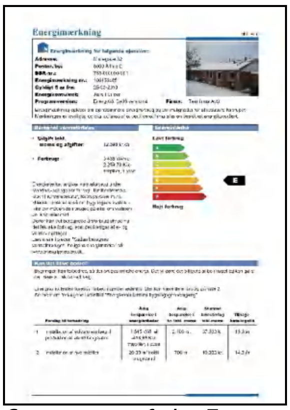
Energy label. Label "A" is sub-divided into A1 (best) and A2

Label	Residential	Non-residential
A1	< 35 + 1100/A	< 50 + 1100/A
A2	< 50 + 1600/A	< 70 + 1600/A
B	< 70 + 2200/A	< 95 + 2200/A
C	< 110 + 3200/A	< 135 + 3200/A
D	< 150 + 4200/A	< 175 + 4200/A
E	< 190 + 5200/A	< 215 + 5200/A
F	< 240 + 6500/A	< 265 + 6500/A
G	> 240 + 6500/A	> 265 + 6500/A

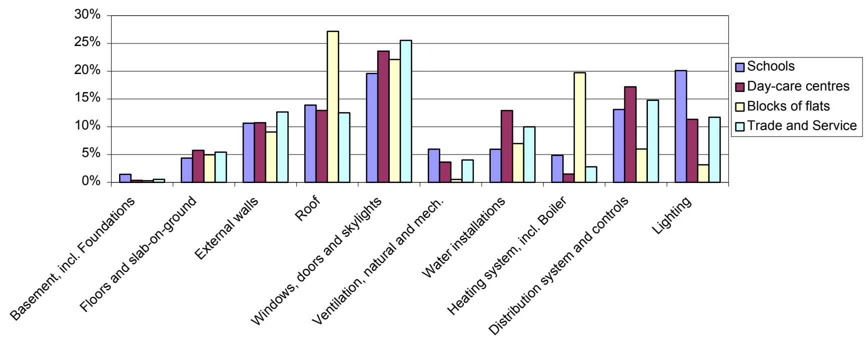
Primary energy label criteria valid until the end of 2010



Label distribution on Danish dwellings as registered in the current (since 2006) EPC scheme


Cover page of the Energy Performance Certificate for single family houses

The real benefit of the EP certificate is in the recommendations given to the building owner. These are summarised on page 2 and following pages of the certificate (see example on the left). Suggested improvements include a short description, estimates of costs, savings and paybacks, and the impact on the energy rating if all measures were implemented. Recommendations must be made for the specific building.



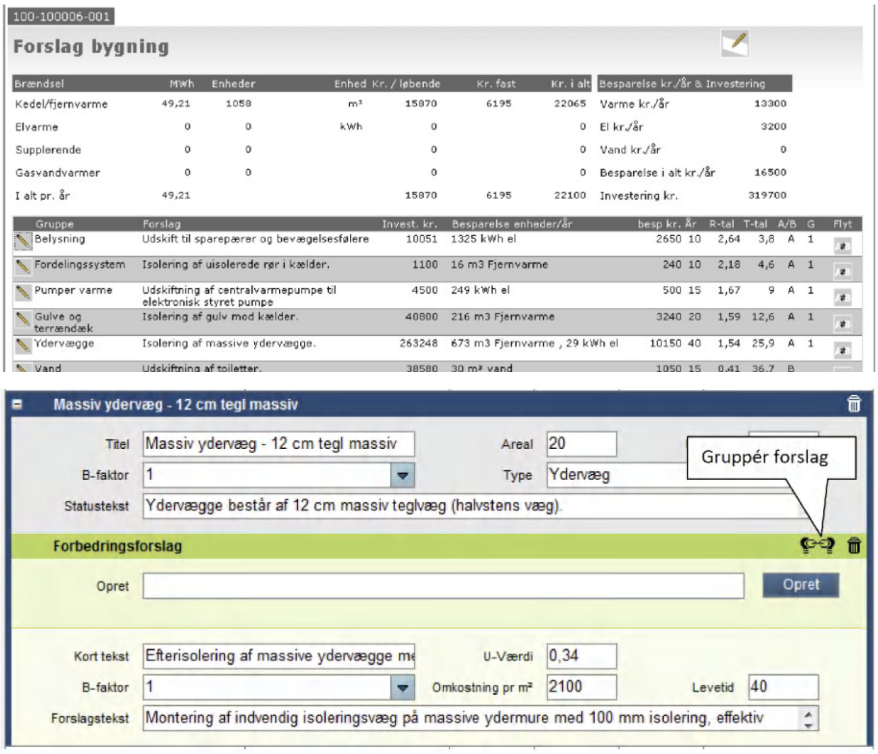
The 10 most used recommendations for improving the energy performance in large buildings (Schools, Day-care, Blocks of flats, and Trade and Service)


Recommendations for improving the energy performance are shown on page 2 and the following pages of the certificate

New buildings *or* ***buildings that change type of usage,*** i.e. from residential to non-residential or vice versa, must achieve at least a B rating in order to be granted a permit for use. This requirement was implemented on the 1st of January 2007.

As of the 1st of January 2007, all **existing** residential and non-residential **buildings** need to be certified when they are sold. As of the 1st of July 2009, the owner must present a valid certificate to the buyer/renter when the selling or renting contract is established. A qualified expert must visit the property and make an assessment of the building in terms of the type of construction (walls, windows, insulation, thermal bridges, ventilation and airtightness, etc.), as well as the type and quality of HVAC and hot water systems. The qualified expert must then calculate the thermal efficiency of the building and issue the certificate. There is no minimum requirement for an existing building (it can be labelled from A to G).

The calculation methodology is the same as that used as proof of compliance in the Danish Building Regulations for a new building. The methodology is defined in a calculation engine. Any company can create its own energy certification tool, but it must use the same calculation engine as in SBi-Direction 213. For the time being, there are two available tools for energy certification in Denmark: EK-Pro and Energy08. Both tools use the required calculation engine, but have different user interfaces. The tools are web-based and require internet access.

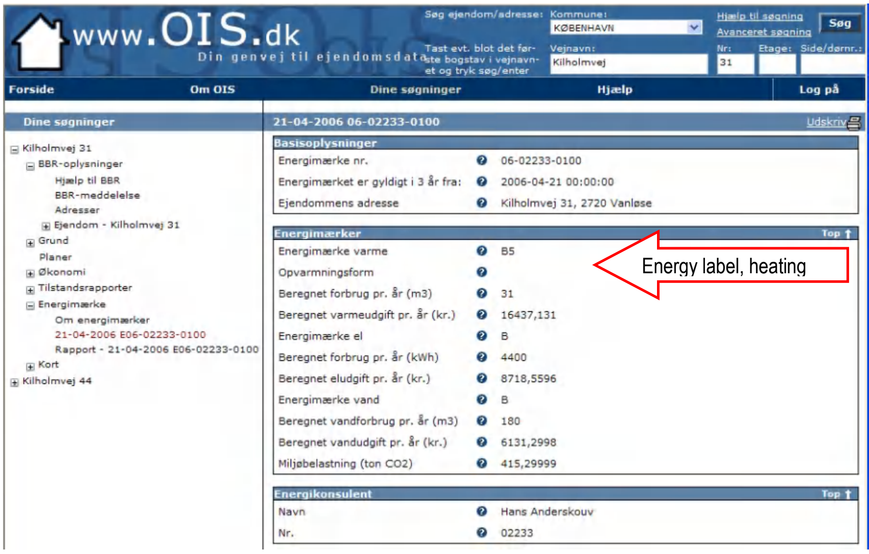


Suggestions for recommendations in the two Danish certification tools

After the building energy inspection and identification of energy upgrading measures, it is necessary to login into the online web-based central registration system in order to report the building description and issue the building energy certificate. It is possible to import and export all data through a XML file, and to access/consult/modify/copy the documents and print the EP certificates online, for delivery to the building owner.

In Denmark, the definition of **public building** includes 1) Buildings used for public administration. 2) Institutions, companies, associations etc., if e.g. the expenses are covered by public means. 3) Publicly-owned companies or companies where the public have the final influence on decisions. In 2009, it was decided that governmental energy consumption should be reduced by at least 10% by 2011, compared with the consumption in 2006. A new database will gather data for the energy consumption of public buildings, and the results of the energy savings initiative will be published on the Internet. Each ministry must now decide how to reduce energy consumption by 10%.

The certificate of public buildings must be put on physical display in the building itself. Furthermore, all central information from the certificates is shown on a central web-based information server (www.ois.dk). It is thus possible to see the energy label and the calculated consumption for heat, electricity and water, plus the name and ID-number of the building energy expert who issued the certificate.



Screen dump from www.ois.dk showing information about the energy performance certificate for any certified building. The entire information set is only available to the building owner (requires login)

From 1997 to 2006, a total of approx. 770,000 certificates were issued, including approx. 18,000 large buildings (+1,500 m²) that were certified each year. In the same period, approx. 55,000 single-family houses were certified each year.

In the current EPC scheme, the number of certificates issued is shown in the table below. Since September 2006, a total of approx. 258,000 certificates have been issued in the current EPC scheme. The total number of issued certificates in Denmark, since certification was initiated in 1997, is over 1 million.

Number and distribution of energy performance labels in five major building categories from the current Danish scheme (Dec. 2010)

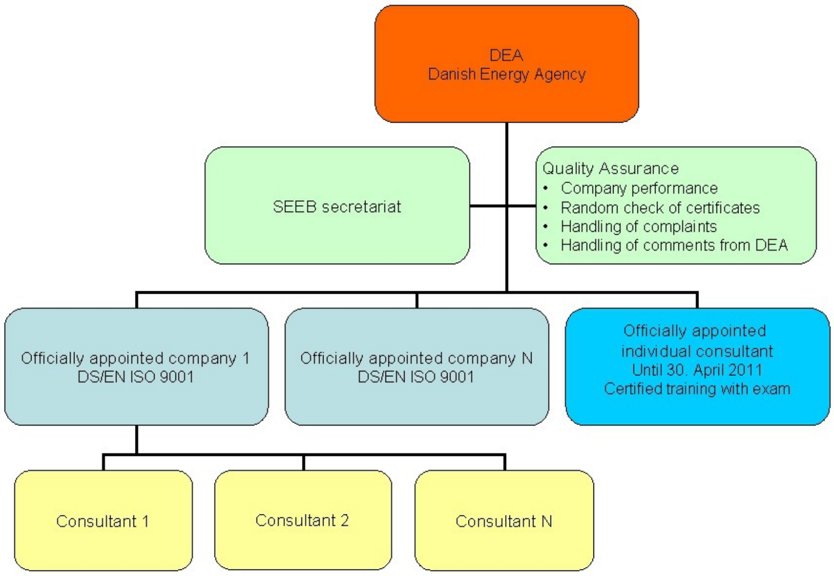
	Single family	Multi family	Office/trade	Education	Second homes	Other
A1	366	16	18	7	8	27
A2	2172	113	77	28	32	117
A	2959	143	110	39	40	151
B	26355	1595	856	265	100	1210
C	37913	4482	1262	687	90	2440
D	46058	6885	1716	1347	170	4028
E	33086	4469	1395	1237	133	3562
F	24659	2551	1015	796	6202	3033
G	21059	1700	973	618	7441	3127
Total	192089	21825	7327	4989	14176	17551

The responsibility of having a certificate always rests with the building owner. DEA fixed the maximum cost for issuing EP certificates for residential buildings up to 299 m^2: up to 100 m², 730 €; up to 200 m², 800 €; and up to 299 m², 875 €. For larger buildings and other building types, the cost is market-dependent, and the price usually ranges between 1.3 € and 3 € per m² per certificate.

The operation of the scheme is financed by fees paid by the EPC experts. Each expert pays an annual fee of 135 €, plus 17 € for issuing a certificate for a small residential building and 47 € per certificate for other buildings. Experts in accredited companies pay half the fee per issued certificate, due to the mandatory internal quality assurance of the company.

Quality assurance (QA)

DEA has set up a mandatory QA scheme, the structure of which is shown in the following illustration.



Quality assurance scheme

EP certificates are selected at random by the secretariat for quality checks. Of the issued certificates, 5% must undergo a manual desk audit, while 0.5% must undergo a technical revision that includes a re-certification by a specially appointed expert. For companies with internal Q&A system, the random check is at least 10% of the single-family certificates and 5% of the multifamily and commercial building certificates.

DEA has identified six topics to which energy experts must pay special attention in certificates. Too little attention to these topics may cause sanctions.

- Possibility of utilising renewable energy sources
- Ventilation
- Central heating plants
- Pumps for circulation and domestic hot water
- Oil burner scrapping scheme
- Energy savings in dwellings (*www.energisparebolig.dk*)

DEA has the competence to withdraw the registration of individual experts and accredited companies. Prior to this sanction a warning will be issued.

Handbook for experts

Quality assurance also includes an up-to-date handbook for the experts (see front page on the left). The handbook is updated and revised regularly, and describes the building energy audit process. It also offers check-lists for the audit and the calculation. The current version of the handbook dates from 2008, but a revision is in preparation.

3 > Inspections - Status of implementation

Inspection of boilers and heating systems

The requirements regarding inspection of boilers and heating systems are stated in Decree number 438 of the 3rd of June 2008, in the Inspection of Boilers and Heating Systems in Buildings issued by the DEA, and follows relevant CEN standards to a great extent. The inspections of boiler and heating systems are based on the same Act as the EPC scheme.

The inspection of boilers and heating systems were implemented on the 1st of September 2006, on the same date as the current EPC scheme. At that time, Denmark had already an inspection scheme for oil-fired burners. Boilers and heating systems have to be inspected on a regular basis. The inspections have to be carried out by a technical expert approved by the DEA. The experts have to fulfil certain requirements regarding education and skills, and pass an examination. It turned out that the implementation of the inspection scheme proceeded rather slowly, with few inspections carried through. Therefore, it was decided to revise the scheme in 2010. The revised inspection scheme is expected to come into force at the beginning of 2011.

For oil boilers, a yearly obligatory control measurement will take place. For gas boilers, no obligatory inspection scheme will take place. Instead, energy efficiency will be promoted by information campaigns etc. If an inspection of boilers and HVAC systems is made in combination with other works such as maintenance and service, the payment from the building owner must not exceed (all costs include VAT):

- 67 € for regular inspection of oil and solid fuel burners with a power ≤100 kW
- 134 € for one-time inspection of heating systems
- 30 € for cleaning an oil burner with a power ≤100 kW

If inspection is made independently of other works, payment must not exceed:

- 95 € for regular inspection of oil and solid fuel burners with a power ≤100 kW
- 163 € for one-time inspection of heating systems
- 58 € for cleaning an oil burner with a power ≤100 kW

Technical inspectors must pay a fee contributing to the operation of the scheme. Application for getting approval as an inspector costs a fee of 160 € for each category of inspection. Furthermore, the inspector must pay a fee of 1.3 € for every issued label.

Inspection of air conditioning and ventilation systems

An inspection scheme regarding A/C and ventilation systems came into force on the 1st of January 2008. The requirements (Article 9) are stated in Decree number 1104 of the 20th of September 2007. The A/C systems have to be inspected every fifth year. The scheme is being implemented gradually over five years, starting with plants installed in large buildings. The inspections are performed by certified companies. By October 2010, ten companies had been certified. The implementation of the scheme has been a bit slow. To speed up the process, an information campaign will be carried through in the spring of 2011.

4 > Qualified Experts

Since 2008, Denmark moved from a personal accreditation scheme to a company accreditation scheme for **building energy audits**. An accredited company must implement an ISO 9001 quality assurance scheme for its building energy certification system. Before 2009, Denmark had approx. 1000 individually certified experts. Two energy consultant appointments are available:

- Energy consultants covering single and two-family houses of less than 500 m^2,
- Energy consultants covering multifamily houses, public buildings and the trade and service sector.

It is possible to be accredited for both types of buildings. The energy consultants must be impartial. It is possible to be an individual certified consultant only until May 2011, when this form of consultancy ends. From April 2008, it became possible to accredit a company official to issue the certificates, thus permitting companies to appoint their own consultants. The companies carry out their own quality checks according to DS/EN ISO 9001. DEA carries out a market surveillance of the companies. These quality checks occur on a regular basis, but also when there are complaints from clients, out of range values etc.

The energy consultant for small houses must be an architect, engineer, construction designer or the like, and must have at least 2 years of documented, relevant experience on building technology and energy consultancy during the last 6 years. The qualifications for energy consultants for public buildings, the trade/service sector etc. must be a trained engineer or the like.

Label A to G, to be used when advertising for sale

Building energy certification experts in an accredited company must have the same qualifications as individual experts, but the company guarantees the quality of the certification. The company experts do not need to be individually accredited. A company can **inspect the ventilation and air-conditioning systems** only if the enterprise is accredited as an inspection company by the Danish Accreditation and Metrology Fund (DANAK), or an equivalent accreditation body. The company must be accredited for the inspection according to EN ISO 17020 on the general criteria for different types of bodies performing such inspections, and also according to DEA's guidelines for conducting inspections. DEA's guidelines are published on the agency website.

DEA approves the applications of technical experts to conduct **inspections of boilers and heating systems in buildings**. Recognition as a technical expert is personal and falls into the following categories:

- Technical expert in oil-fired boilers and solid fuel boilers
- Technical expert in gas-fired boiler
- Technical expert in oil-fired and solid fuel-fired heating systems
- Technical expert in gas-fired heating systems.

To be approved as a technical expert and operate in connection with servicing of boilers in buildings, the technical expert has to meet and document the following qualifications:

- For oil fired and solid fuel boilers, to be an approved oil burner installer or oil burner technician or qualified chimney sweeper or a plumbing engineer.
- For gas-fired boilers, to have obtained either an A gas certificate or an approval for commissioning and performance tests of large gas-fired installations or being a HVAC technician.

To be approved as a technical expert to conduct one-off inspections of heating systems in buildings not covered by the requirement of regular energy, in compliance with regulations on labelling of buildings, the technical expert has to meet and document the following qualifications:

- For oil fired and solid fuel boilers, to be an approved oil burner installer, or a burner or HVAC technician, or a personally appointed energy expert for residential buildings or an energy expert associated with a certified energy company.
- For gas-fired boilers, to have obtained either an A gas certificate or an approval for commissioning and performance tests of large gas-fired installations, or be a HVAC technician or a personally appointed energy expert in residential buildings or an energy expert associated with a certified energy company.

Furthermore, the technical expert must have completed training and must have passed the exam.

5 > National Information and Communication Campaigns

The web site of the Secretariat (www.seeb.dk) managing the daily operation of the EPC scheme offers general information about the scheme, as well as links in order to find a certified company to carry out a certification. Moreover, the site shows all relevant information about the legal documents, as well as case studies of good energy upgrading. Some brochures are available on the national websites.

Secretariat for the EPC scheme website: www.seeb.dk.

Inspection of boilers brochure

From the 1st of July 2010, any real estate agent putting a building up for sale has the responsibility to present the building's energy label in the announcement. This rule does not apply to private (person to person) sale or rent.

DEA hosts several websites containing information about energy savings and energy certification in general, for example the Climate & Energy Guide

(www.klimaogenergiguiden.dk).

The Knowledge Centre for Energy Savings in Buildings was established in 2009 and gathers expertise and best practices in the field of energy savings. Professionals of the building industry have free access to information, facts and advice about selecting the right material, technical solutions and construction methods for achieving energy savings.

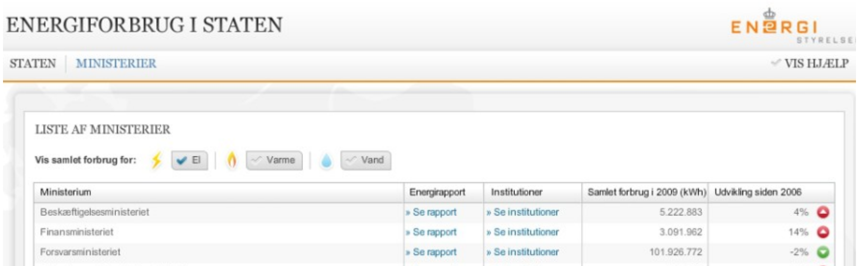
The Knowledge Centre strives to provide building professionals with the necessary know-how, qualifications and motivation to implement energy saving initiatives in housing and commercial development, and in the building stock.

Climate and Energy Guide (www.klimaogenergiguiden.dk);
Energy savings in buildings Knowledge Centre (www.byggeriogenergi.dk)
Energy Service (www.energitjenesten.dk)

Inspection of ventilation systems schemes brochure

The Danish Energy Saving Trust promotes energy savings in households, the public sector, and the commercial and industrial sectors for all forms of energy, other than transport. The website (*www.savingtrust.dk*) of the Trust deals with energy savings in general, but is also targeted on the EPC scheme. Information about thermal and electrical energy consumption, as well as water consumption, in state-owned buildings, including its trends since 2006, are shown in a publicly available website (see below). Each Ministry must make an action plan for their energy savings effort.

There is a plan to launch a new nation-wide campaign about energy efficient ventilation and energy efficient boilers in 2011.



Information about energy consumption in Danish ministries are shown at http://data.energibesparelseistaten.dk/StateEnergyConsumption.html.

6 > National incentives and subsidies

In Denmark, there are not many subsidies to carry out energy savings in buildings, and none directly connected to the building energy performance certification scheme. For the time being, only the scrapping scheme for replacing oil burners is available.

Oil burner scrapping scheme website: *www.skrotditoliefyr.dk*

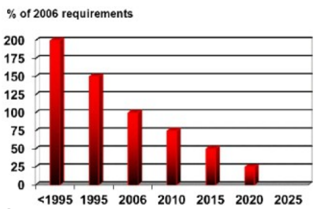
A total of 54 € million have been earmarked for subsidies for the replacement of inefficient oil-fired boilers with more energy efficient heating systems. In areas with district heating, the subsidies are only granted for the installation of district heating. Outside of district heating areas, there are three possibilities for subsidy: 1) efficient air-to-water heat pumps, 2) efficient liquid-to-water heat pumps or 3) solar heating installations. Via this scrapping scheme, subsidies can be granted for purchasing and installing approved heating systems to replace scrapped oil-fired boilers. The scheme covers all types of year-round domestic property, i.e., owner occupied houses and flats, housing association properties, rented property and holiday homes that have year-round status. The requirements for subsidy are that the oil-fired boiler is replaced either by a heat pump (geothermal or air-to-water), solar heating in combination with, for example, a new oil/natural gas/wood pellet boiler or a connection to district heating. The size of subsidy depends on the heating system installed: for single unit houses, 2,680 € for liquid-to-water heat pumps; 2,015 € for air–to-water heat pumps; 1,340 € for district heating units and 25% of investment costs for solar heating installations.

According to the political energy agreement of the 21st of February 2008, 4 € million were allocated for information campaigns, labelling of heat pumps, small subsidies schemes etc. The initiative targets consumers outside district heating areas and areas which are collectively supplied with natural gas. The efforts to promote the use of heat pumps are divided into three groups: product, consumer and market.

The following activities are respectively completed, ongoing or planned:

- Calculation method to calculate the energy efficiency of heat pumps, taking into account the Danish climate conditions - completed
- List of Energy-labelled heat pumps is established
- Measuring program for heat pumps – in practice
- Home Page with step by step guide for consumers
- Reference guide for installers of heat pumps (*Den lille blå om varmpepumper*)
- Survey to determine if professional advice has an effect on consumers' decision to select a heat pump
- Status of the heat pump market in Denmark
- Barrier Study on heat pump implementation (DEA)
- Project to study the use of heat pumps in smart grids
- Implementation of certification schemes for installers (as requested also in the RES-directive).

7 > Impact of the EPBD at national level



Primary energy requirements in Danish Building Regulations (2006=index 100)

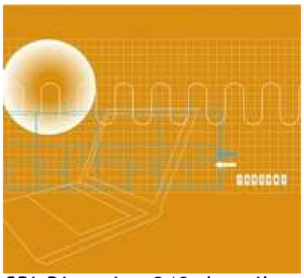
Energy requirements have been a topic in Danish Building Regulations since 1961, when the first nationwide Building Regulation came into force. Since then, the energy requirements have been stepwise tightened several times. The most recent tightening, from the 1st of January 2011, requires 25% better energy performance of all new buildings compared with the 2008 requirements. Targets for the next tightening (additionally 25%) in 2015 have already been defined in the Building Regulations, and there is an ongoing work to define the expected requirements for 2020. Details will be announced as soon as the definitions have been settled.

The EBPD enforced a shift from requirements for the final energy requirements for space heating (previous to 2006) to primary energy requirements for the gross energy consumption of buildings, including space heating, domestic hot water, cooling, electricity consumption for operating the building [i.e. fans, pumps, lighting (only in non-residential buildings)] and potential penalty for indoor temperatures > 26 °C.

Energy certification of new buildings secures a higher quality of the final building, ensuring that the design and the final building are identical, and that the efficiency of the boiler, the amount of pipe insulation etc. meet the requirements. For existing buildings, the EP certificates provide greater awareness on energy matters.

The public sector has demands for energy efficient purchase of appliances. Moreover, energy management and realisation of cost-effective energy savings in buildings, e.g., as indicated in the EP certificates, must also be implemented.

8 > Further information on new energy requirements for new and existing buildings


SBi-Direction 213 describes the Danish calculation procedure

New, tightened energy requirements for new and existing buildings were implemented on the 1st of January 2011.

New buildings

The energy frame is the maximum allowed primary energy demand for a building, which includes e.g. thermal bridges, solar gains, natural ventilation, heat recovery, cooling, lighting (non-residential buildings only), boiler and heat pump efficiency, electricity for operating the building, and sanctions for overheating.

The energy frames for the primary energy demand in new buildings have been tightened by 25% compared with the previous regulations. The new frames for 2011 are:

- 52.5 + 1,650 / A [kWh/m² per year] for residential buildings, and
- 71.3 + 1,650 / A [kWh/m² per year] for non-residential buildings

where A is the conditioned gross floor area.

Building Regulations 2008

Furthermore, new “low energy classes 2015” have been defined as:

- 30 + 1,000 / A [kWh/m² per year] for residential buildings, and
- 41 + 1,000 / A [kWh/m² per year] for non-residential buildings

In BR10, it is stated that these low energy classes are expected to become the minimum requirements for all new buildings in 2015.

In the previous Danish Building Regulations from 2008, two low energy classes were defined (expected to become minimum requirements by 2010 and by 2015 respectively), but this is not yet the case in BR10. However, a working group has been established to prepare a new “low energy class 2020”. This class will become the first attempt towards a Danish definition of “nearly zero energy buildings”. The new low energy classes will be announced as a supplement to BR10 as soon as they are ready.

Building Regulations 2010

The calculation procedure in the Danish Building Regulations has been updated according to the new requirements and is described in SBi Direction 213: Energy demand in buildings (In Danish at: *www.anvisninger.dk* - requires license for download). The procedure follows relevant CEN standards to a great extent. This publication also includes the updated PC calculation program Be10. The calculation core from this program is to be used by all other programs for compliance checks and for energy certification, to ensure identical calculation of the energy performance of buildings. Compared with the previous calculation procedure, Be06, the new procedure has been updated with respect to:

- New energy frames and energy requirements given in BR10
- Low energy class 2015 incl. a new district heating factor (conversion to primary energy)
- New energy frame for buildings heated to 5-15°C

- Multiple tanks for domestic hot water (DHW)
- Improved calculation of cooling demand
- Multiple heat pumps in same building/zone
- Multiple solar cell (photo voltaic) systems
- Calculation of electricity production by on-site wind turbines.

Existing buildings

In the previous Danish Building Regulations, BR08, energy upgrades were only mandatory in case of a major renovation – the 25% threshold rule of the EPBD. Then, all economically, technically and architecturally feasible measures needed to be implemented. This rule has kept some house owners from investing in energy savings, as the needed investments might outgrow their budget.

In the new Danish Building Regulation, BR10, the 25% threshold has been extended with requirements for most building components when they are renovated individually. However, the measures must be economically feasible, meaning that the annual savings multiplied by the expected lifetime of the measure divided by the investment, should be bigger than 1.33, or, put in another way, the measure must have a simple pay-back time less than 75% of the expected lifetime of the measure. In case of full replacement of a component (e.g. new roof, new window, new outer wall), the new component must meet the requirements, regardless of the economy.

Minimum requirements for replaced buildings components have been introduced as:

- External walls and basement walls must have a U-value less than 0.20 W/m²K
- Separations to unheated rooms or to rooms heated to a temperature 5°C lower must have a U-value less than 0.40 W/m²K
- Slab-on ground, basement ground floors, floors to air or to ventilated crawl spaces must have a U-value less than 0.12 W/m²K
- Roof constructions must have an U-value less than 0.15 W/m²K
- Doors, gates and double glazing must have a U-value less than 1.60 W/m²K
- Foundations must have a thermal bridge loss coefficient less than 0.12 W/mK
- Joints between external walls, windows, doors, gates, or hatches must have a thermal bridge loss coefficient less than 0.03 W/mK
- Joints between roof construction and roof windows or skylights must have a thermal bridge loss coefficient less than 0.10 W/mK
- When replacing a window, the energy gain during the heating season must not be less than –33 kWh/m² per year (-17 kWh/m² per year after 2015)
- When replacing a roof window, the energy gain during the heating season must not be less than –10 kWh/m² per year (-0 kWh/m² per year after 2015)
- When replacing a skylight, the U-value must be less than 1.60 W/m²K (1.4 W/m²K after 2015).

Installations

New, tightened requirements for installations defined in BR10 are:

- DHW systems equipped with a heat pump must have a COP (measured according to EN 255-3) not less than 3.1 for DHW production.
- Circulation pumps in heating, hot water, and cooling systems must have the energy label A or comply with similar requirements
- Mechanical ventilation systems must have a heat recovery unit with an efficiency not less than 70% (80% for single dwellings)
- Ventilation systems with a heat pump for heat recovery must have a COP not less than 3.6 in heating mode
- Mechanical ventilation systems must meet the following requirements for specific electricity consumption for air transportation:
    - 1,800 J/m³ in constant air volume (CAV) systems
    - 2,100 J/m³ a max air volume for variable air volume (VAV) systems
    - 800 J/m³ for exhaust ventilation systems
    - 1,000 J/m³ for ventilation systems for one dwelling
- Combined heat and power (CHP) systems must have a total efficiency (incl. heat production) ≥80% (Sterling or conventional engine, or fuel cells)

- Oil boilers must have an efficiency, according to CE-labelling scheme, not less than 93% at full load and 98% at part load
- Gas boilers must be condensing with an efficiency, according to CE-labelling scheme, not less than 96% at full load and 105% at part load
- In new buildings or in combination with renovation outside district heating areas with an expected DHW consumption exceeding 2,000 l per day, a solar collector must be installed to cover the normal DHW consumption
- In fluid/water heat pumps (ground heat systems) the norm effect factor (COP) for floor heating systems dependent on the power of the heat pump (0-3 kW: 3.0; 3-6 kW: 3.6; > 6 kW: 3.7)
- For heat pumps supplying radiators, the requirements are: (0-3 kW: 2.6; 3-6 kW: 2.8; > 6 kW: 3.0)
- Air-to-water heat pumps must have a norm effect factor (COP) ≥ 3.2 when supplying a floor heating system, and ≥2.7 when supplying a radiator system
- Air/air heat pumps must have an efficiency ≥3.6 in heating mode according to EN 14511 (corresponding to an energy label A in EU's energy certification of climate systems for domestic appliances).

9 > Conclusions and future planning

The EBPD has been implemented in Denmark to its full extent, resulting in better energy performance of the building stock. Work for implementation of the EBPD recast has already started. The tightenings of the energy requirements for new buildings in 2015 are already defined, and work has been initiated for defining the nearly zero energy buildings requirements for 2020 and beyond.

To meet the government's target for a CO_2-emission free country by 2050, existing buildings need to make their contribution. It will be a huge challenge to update the legislation and implement the changes in practice for the existing building stock. In this context, the EPC scheme will become a central element.

Draft layout of first page of new EP certificate

The Danish certification scheme is currently under revision (the new draft layout is shown on the left), and a new scheme will be launched in 2011. The new scheme will be more cost-effective, e.g. the age of the building will determine the level of detail for the certification. This will ensure that buildings with the highest potential for energy savings will get the most attention. In the new certification scheme, the validity of the certificates will be extended to 7 or 10 years, for buildings with a high or a low energy saving potential respectively. In the new scheme, energy certification of single family houses constructed less than 25-30 years before the certification can be carried out without physical inspection of the house. As something new, energy certification of selected buildings can be based on measured energy consumption. The validity of these certificates will be 5 years.

Management of the EPC database has shown many challenges. In the initial design, security to avoid the entrance of faulty data in the database was not a high priority. It was therefore decided to re-enter all information after a manual cleaning procedure. This task will certainly improve the data quality, but it requires a lot of manpower.

A major challenge is to raise the public awareness of their energy use. This, however, is slowly being promoted by the media's focus on energy consumption. There is still a strong need for official information campaigns to promote energy efficiency. Moreover, training should be mandatory for qualified experts, to improve their skills in energy audits and in giving advice regarding economical and technological building energy improvement solutions.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Estonia

Status in November 2010

Madis Laaniste

Ministry of Economic Affairs and Communications

Estonia

1 > Introduction

More efficient energy consumption in buildings has been one of the priorities of the governmental energy and housing policy in Estonia. Beside the implementation of the EPBD, a number of new measures have been recently adopted to ensure renovation of existing buildings and application of higher energy efficiency requirements for new buildings. Although the amendments of the Building Act transposing the main elements of the EPBD came into force in October 2006, the regulations transposing all the EPBD requirements were only finalised in January 2009.

The revision process of the current legislation is in the starting phase. An initiative for low-energy buildings has been launched; this foresees the development of standards for low-energy buildings, and the application of these standards in practice. The standard will be used as a starting point when the criteria for nearly zero energy buildings will be developed.

Despite of the significance of the EPBD and the newly implemented building energy certification practice, the national programmes for the energy auditing of buildings, as well as the renovation of apartment buildings and public buildings provide more visible results for the improvement of the energy efficiency of buildings. Actors in the private sector – building companies, building material and equipment providers, building energy certifiers and auditors, banks – turn their attention to new business opportunities related to the energy efficiency of buildings. In the following years, hundreds of million Euros will be invested in the renovation of existing buildings.

This report presents an overview of the current status of the implementation and of the plans for the evolution of the implementation of the EPBD in Estonia. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

National websites:

- *www.mkm.ee/hoonete-mn*
- *www.kredex.ee*
- *www.kena.ee*

2 > Certification

Certification of buildings

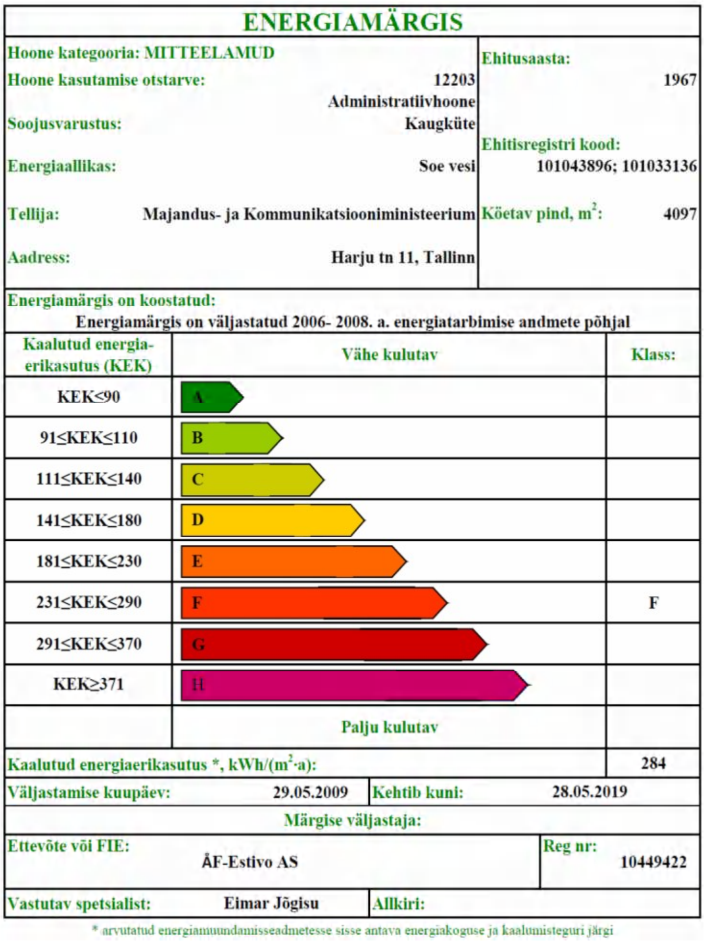
In Estonia, the implementation of the EPBD is the overall responsibility of the Ministry of the Economic Affairs and Communications. The Ministry has designed the legislation for the transposition of the EPBD in collaboration with the Tallinn University of Technology. Valuable contribution in this process was provided also by the Estonian Association of Heating and Ventilation Engineers. The regulation on the energy certification of buildings (“The template of energy certificate and issuing procedure”) was signed by the Minister of Economic Affairs and Communications on the 17th of December 2008, and it is published in the website of the State Gazette of the Republic of Estonia *https://www.riigiteataja.ee/akt/13094120*. The regulation sets a procedure for the determination of the energy rating of buildings, as well as the template of the energy certificate.

The first energy certificates were issued and registered in the National Building Register in January 2009. Today, the services of building energy certification and energy auditing are easily accessible to everyone.

The energy certification of buildings is a relatively simple service – it costs typically from 100 to 200 €, depending on the size of the building. For a more thorough analysis, an energy audit of the building should be conducted. However, national property market participants, such as building owners, buyers or renters, are not interested on paying for a detailed expertise on the building's condition.

The Energy Performance Certificate

In Estonia, there are standard templates for the energy performance certificates. The certificate provides information on the location of the building, its energy class, recommendations for energy efficiency improvements, the notes (particularly on the indoor climate of the building), as well as data regarding the person issuing the certificate. The validity of the energy performance certificate is 10 years. The template for a cover page of an energy certificate can be seen in Figure 1. The KEK parameter is a weighted average energy consumption (primary energy consumption).



ENERGIAMÄRGIS

Hoone kategooria: MITTEELAMUD		Ehitusaasta:	
Hoone kasutamise otstarve:	12203 Administratiivhoone		1967
Soojusvarustus:	Kaugküte		
Energiaallikas:	Soe vesi	Ehitisregistri kood:	101043896; 101033136
Tellija:	Majandus- ja Kommunikatsiooniministeerium	Köetav pind, m^2:	4097
Aadress:	Harju tn 11, Tallinn		

Energiamärgis on koostatud:
Energiamärgis on väljastatud 2006- 2008. a. energiatarbimise andmete põhjal

Kaalutud energia-erikasutus (KEK)	Vähe kulutav	Klass:
KEK≤90	A	
91≤KEK≤110	B	
111≤KEK≤140	C	
141≤KEK≤180	D	
181≤KEK≤230	E	
231≤KEK≤290	F	F
291≤KEK≤370	G	
KEK≥371	H	
	Palju kulutav	

Kaalutud energiaerikasutus *, kWh/(m^2·a):			284
Väljastamise kuupäev:	29.05.2009	Kehtib kuni:	28.05.2019
Märgise väljastaja:			
Ettevõte või FIE:	ÅF-Estivo AS	Reg nr:	10449422
Vastutav spetsialist:	Eimar Jõgisu	Allkiri:	

* arvutatud energiamuundamisseadmetesse sisse antava energiakoguse ja kaalumisteguri järgi

Figure 1 – Cover page of the energy performance certificate (existing office building).

There are 7 energy classes for residential buildings, ranging from A to G. There are 8 classes for non-residential buildings, ranging from A to H. The scale for the energy rating is different for:

1) Small residential buildings
2) Apartment buildings
3) Office buildings
4) Commercial buildings (hotels, restaurants, shops)
5) Public buildings
6) Schools, universities
7) Hospitals and other buildings serving medical purposes
8) Swimming pools
9) Other buildings (warehouses, rescue service buildings, custodial institutions, etc.)

Second page of the energy performance certificate

For new buildings, the energy certificate has only one page. For existing buildings, the certificate includes three additional pages. The second page of the energy certificate includes recommendations to the building owner, as well as notes by the qualified expert. The list of recommendations is almost predefined - service providers can provide a few specific additional recommendations on the template.

The recommendations to the building owner are typically only expert opinions; they are proposed without a more thorough cost-benefit analysis. A recommendation provided on the energy certificate can be, e.g., to conduct an energy audit of a building. If the expert observes an unusual indoor climate in the building, he/she should make a note on this in the second page of the energy certificate.

The third page of the energy certificate includes the data provided by the owner for the issuance of the energy certificate. The fourth page displays the calculations needed for the determination of the building's energy class.

Weighting factors of different energy carriers

Renewable energy	0.7
District heating	0.9
Fossil fuels	1.0
Electricity	1.5

For existing buildings, a typical energy certificate is based on an operational rating. The energy class of the building is determined according to the weighted average energy consumption of the building. The energy consumption of the building includes heat or fuel needs for heating, ventilation, domestic hot water and cooking purposes, and electricity consumption. The electricity consumption includes also the electricity consumption of cooling machines. The aim of using the weighted average energy consumption is to take into account different environmental impacts of using different energy sources. The methodology for the energy certification discourages the use of electricity and promotes the use of renewable energy: the weighting factor of electricity is 2 times higher than that of renewable energy.

For new buildings and major renovations, only asset rating is used for the issuance of the energy certificate. The methodology for proving compliance with the energy performance requirements and for calculating the energy performance number is published in the governmental regulation "Minimum energy performance requirements" (*https://www.riigiteataja.ee/akt/13217396*), and is in general agreement with the applicable CEN standards. The calculation methodology is relatively complex compared to the certification of existing buildings; software for the simulation of buildings' energy is required in order to calculate the energy performance value (see section 7.1). The energy class of a building is determined according to the energy performance number.

After the energy performance certificate is issued, it should be registered in the Building Register, where the date of issuance and the energy class of the building will be recorded. The registration is done through the internet; this service is free of charge.

In the national legislation, the meaning of public buildings is wider than that defined in the EPBD: public buildings requiring certification are all buildings accessible to the public, with a total floor area greater than 1,000 m^2. The certificates should be displayed on a place clearly visible to the visitors. The energy class of the building is also displayed in the Building Register.

The energy certificates can be issued by companies or self-employed physical persons. Three types of companies may issue energy certificates (see section 4.). For existing buildings, companies providing energy certification or energy auditing services may issue energy certificates. For new buildings and major renovations, only design contractors may issue energy certificates.

Registered companies are listed in the Register of Economic Activities

http://mtr.mkm.ee

The registration of companies is done by the Ministry of Economic Affairs and Communications. For the registration of a company, an application should be submitted to the Ministry; this should include information on the specialist in charge, as well as the documents proving their education or qualification. The data of registered companies are published in a special public register. After the registration, the company should annually confirm its compliance with the requirements in the legislation.

Quality assurance (QA)

In Estonia, the quality assurance procedures are conducted on three levels. Firstly, the building sector surveillance authority, the Technical Surveillance Authority, has the mandate to check if the energy performance certificate fulfils the requirements of the legal acts. Secondly, the Technical Surveillance Authority may issue precepts to the companies and decide according to its competence. After getting a precept, the company is obliged to fulfil the demands listed in it. Failure to meet the demands may result in fines or in cancelling the company's registration in the Register of Economic Activities. Finally, the Estonian Association of Heating and Ventilation Engineers, the body issuing the qualifications of energy auditors and energy certification experts, may cancel the qualification granted to them. If the qualification of an expert is cancelled, this expert does not fulfil the requirements for registration in the Register of Economic Activities, and the company where he/she is in charge will be deleted from the Register of Economic Activities.

Regular quality checks of energy certificates are not introduced in the national legislation. Usually, the outcomes of the energy certification are checked if the service has been subsidised. The Technical Surveillance Authority has received several complaints on the quality of energy certificates; some of them resulted in precepts or other legal actions to ensure compliance with the legislation.

3 > Inspections - Status of implementation

The role of on-site generation of heat in water-based heating systems is significantly smaller than that of heat supply from district heating. For boilers, Estonia has adopted option B of the Article 8 of the EPBD. The Building Act requires that sellers of boilers provide advice to consumers on demand whenever a new boiler is installed or an existing boiler is replaced. Provision of advice on demand may include on-site inspection of the system. If such an inspection is carried out, the inspection report should include information on options for the replacement of boilers, other modifications to the heating system, as well as on alternative solutions that would enable the energy efficient operation of the system.

When a boiler is sold, it should be registered, and the rated output, efficiency, type of its fuel, etc., must be recorded. The seller should forward to the Technical Surveillance Authority the information on the registered boilers annually. In 2010, data on less than 100 boilers were forwarded to the Technical Surveillance Authority. The registration of boilers started in 2008.

The use of air-conditioning is not widespread in buildings. Usually, small devices with rated output less than 12 kW are installed; larger systems with rated output greater than 12 kW are installed in large new buildings that are subject to energy certification. As the air-conditioning systems are relatively new (the majority of the systems were installed after 2000) and the summer period in Estonia is short, improvements in air-conditioning systems provide quite a small energy efficiency potential. The operation of air-conditioning systems is addressed when an optional energy audit is carried out.

4 > Independent experts and companies

There are three types of independent qualified experts who may be competent persons in a company issuing the energy certificates:

1) energy certifiers;
2) energy auditors;
3) building design engineers or architects.

An energy certifier may be a competent person in a company issuing only energy certificates. The qualifications for energy auditors are higher: they may be competent persons in a company conducting energy certification or energy auditing of existing buildings. For new buildings, building designing engineers or architects may be the competent persons in a design contractor company issuing energy certificates for new buildings.

The conditions for becoming an energy certifier are limited: higher education of the candidates is not required; In order to obtain the qualification of energy certifier, candidates have only to attend a small training course. The qualification will be obtained if the candidate passes the professional examination of the qualification provider (Estonian Association of Heating and Ventilation Engineers). By December 2010, 98 persons had obtained the qualification of energy certifier.

The requirements for becoming an energy auditing expert are more demanding: the candidates should have higher education (degree on mechanical or civil engineering or architecture) and attend a two-week course for energy auditors. After successfully attending the course, they may take the professional examination of the qualification provider. By December 2010, 66 persons had obtained the qualification of energy auditor.

National Information Campaign in 2009: "If your home feels cold, you will lose your money"

For energy auditors and energy certifiers, the qualification has to be renewed every fifth year. As of December 2010, there is only one course provider in Estonia: the Tallinn University of Technology. Participation in courses has been very active, but the number of persons attending the courses is higher than the number of experts who have actually taken the exam of the qualification provider.

To carry out energy certifications of new buildings, the competent person in the design contractor company only needs to have a higher education in civil engineering or architecture and adequate working experience (3 years). Additional qualification is not required.

As of the 31st of December 2010, the total number of companies having the right to issue energy certificates according to the Register of Economic Activities is the following:

1) energy certifiers – 154;
2) energy auditors – 86;
3) Design contractors – 2,437.

5 > National Information and Communication Campaigns

Logo of the national energy week "Saving is a smart action!" (2009)

The Estonian government is actively implementing policies to improve energy efficiency in existing buildings. The implementation of policies include promotional campaigns, most of them targeted at apartment buildings, as their share is roughly 70% of the total residential building stock. The campaigns have been arranged in an annual basis, to inform tenants of apartment buildings on energy saving measures, on the potential magnitude of the savings, as well as on getting the expert advice and support provided by the state. Several methods have been used in these campaigns: the information has been distributed through TV, radio, printed media, internet, advertisements in the streets, training courses for persons responsible for building maintenance, etc. The profile of the energy saving activities has grown by means of these campaigns. Now, building owners attach great importance to energy

Major renovation of an apartment building in Tallinn: before and after

efficiency when planning new investments. The campaigns do not directly inform the public about either the energy performance certificate or the advice on boilers under Article 8 option B.

6 > National incentives and subsidies

In Estonia, several mechanisms have been adopted for promoting the provision of advice to building owners or for supporting the implementation of energy efficiency investments, namely:

- Support for energy audits of apartment buildings started in 2005. 50% of the costs of the audit can be covered; the upper limit of the grant is 700 €. Probably more than 1,500 buildings have benefitted from this instrument.
- Support for the energy certification of buildings is provided by the City of Tallinn. The grant for an energy certificate is 96 €. The instrument was launched in 2009, and probably more than 1,500 buildings have benefitted from it.
- Loans with a low interest rate are provided for residential buildings. The interest rate is partly subsidised by structural funds. The total budget of this low-interest loan programme is more than 50 M€.
- In 2010, Estonia established a green investment scheme of 30 M€, funded by Luxemburg, that is targeted on supporting energy efficiency investments in apartment buildings.
- In the autumn of 2010, several green investment schemes having a total volume of 135 M€ targeted on energy efficiency improvements in state-owned public buildings were launched.
- A low-energy development initiative for public buildings was launched in 2010. Within this initiative, application of standards of low-energy buildings in 5 small public buildings is foreseen.
- Tax relief for interest paid for home renovation loans: this instrument is targeted to private persons. When private persons renovate their homes and take a loan from the bank, the interests paid to the bank may be deducted from the income declared in their income tax declaration. This instrument has helped to renew existing individual houses, and it has also supported the construction of new apartment buildings.
- Tax relief for reinvested profit in businesses: all businesses may deduct the reinvested profit from their income in their income tax declaration. The businesses may reinvest their profit in more energy efficient buildings.

7 > Impact of the EPBD at national level

Evolution of minimum energy performance requirements in building regulations

In Estonia, the minimum energy performance requirements are expressed as an energy performance number calculated for the building on its standardised use. Data for the standardised use include a description of load profiles and indoor climate.

In 2008, the minimum energy performance requirements were adopted for 6 different building types. Before then, there was not any specific legal obligation to insulate buildings or to design energy efficient technical systems in the buildings in Estonia. Minimum energy performance requirements are set as maximum allowable energy performance numbers. These numbers characterise the primary energy demand in the building. Maximum energy performance numbers are set as follows (for existing buildings, only for those undergoing a major renovation):

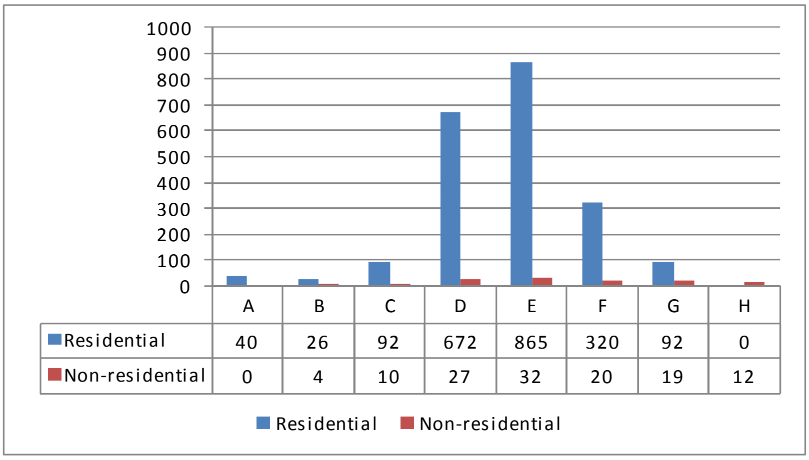
- Small houses [for new buildings the energy performance number should not exceed 180 kWh/(year·m^2); for existing buildings, 250 kWh/(year·m^2)].
- Apartment buildings [for new buildings, 150 kWh/(year·m^2); for existing buildings, 200 kWh/(year·m^2)].
- Office buildings [for new buildings, 220 kWh/(year·m^2); for existing buildings, 290 kWh/(year·m^2)].
- Public buildings [for new buildings, 300 kWh/(year·m^2); for existing buildings, 390 kWh/(year·m^2)].
- Medical buildings [for new buildings, 400 kWh/(year·m^2) for existing buildings, 520 kWh/(year·m^2)].
- Swimming pools [for new buildings, 800 kWh/(year·m^2); for existing buildings, 1,000 kWh/(year·m^2)].

Compliance with the minimum energy performance requirements should be proved through the energy calculation of the building. For smaller buildings (individual homes and row houses), it is allowed to demonstrate the compliance with the minimum energy performance requirements by the calculation of heat losses through the building envelope.

There are plans for the adoption of stricter energy performance requirements after 2013, but the existing legal acts do not foresee the application of more stringent requirements yet.

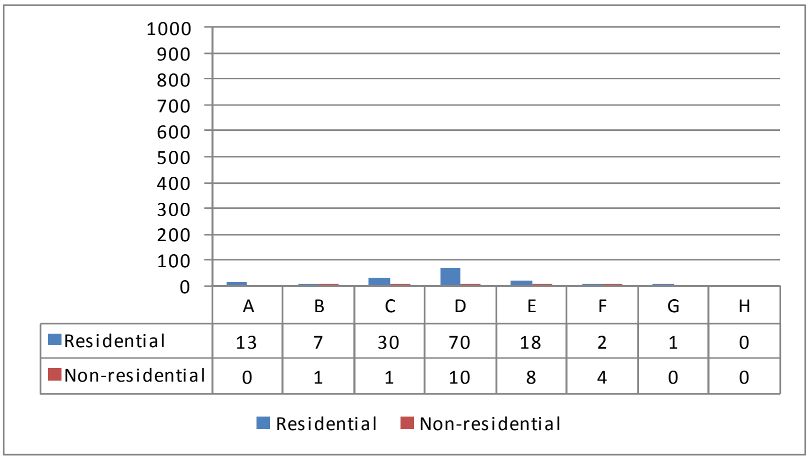
Other impacts

As of February 2010, approximately 2,500 energy certificates have been issued. The majority of them (2,200) were issued for existing buildings. The number of dwellings possessing energy certificates is significantly higher, because in a building with a communal heating system, only one certificate is registered for the whole building.



	A	B	C	D	E	F	G	H
Residential	40	26	92	672	865	320	92	0
Non-residential	0	4	10	27	32	20	19	12

Figure 2 - Number of certificates issued for existing buildings



	A	B	C	D	E	F	G	H
Residential	13	7	30	70	18	2	1	0
Non-residential	0	1	1	10	8	4	0	0

Figure 3 - Number of certificates issued for new buildings

Geographical coverage data show that the majority of the certificates are issued for buildings in towns. Relatively small numbers of energy certificates are partly caused by a recession in the economy. The activity and number of transactions in the real estate market in 2009-2010 have been significantly below the average.

There are no existing data on the number of public buildings possessing certificates yet.

8 > Conclusions and future planning

The EPBD has been fully transposed into the national legislation. While the development of energy certification continues satisfactorily, the adoption of new principles for setting and checking energy performance requirements needs a lot of additional work, particularly regarding the development of the professional skills of designers, architects and specialists working in the municipalities. Among many other policy instruments implemented in Estonia, the EPBD has motivated and streamlined the energy efficiency improvements of buildings.

The experiences from the implementation of the EPBD have outlined the following needs:

- The procedures for checking compliance with the minimum energy performance requirements should be more harmonised for typical buildings.
- The activities for improvement of the knowledge of designers, architects and specialists working in the municipalities on energy performance requirements should be continued.
- More efforts are needed regarding the energy certification of public buildings.
- Adequate technical and financial support is required to ensure energy efficiency improvements in residential buildings, because the energy auditing of buildings helps to determine the most promising energy saving options.
- It is essential to support the development of pilot low-energy and nearly zero energy buildings.

Implementation of the EPBD in Spain

Status in November 2010

Marcos González Álvarez

IDAE

Spain

National websites:

- *www.idae.es*
- *www.mityc.es*
- *www.mviv.es*

1 > Introduction

Since the publication of the last report, dated September 2008, Spain has kept working to implement the full transposition of the EPBD. The following Royal Decrees that transpose this Directive are still in force:

- Royal Decree 314/2006, of the 17th of March, approving the Technical Building Code.
- Royal Decree 47/2007, of the 19th of January, approving the basic procedure for the energy certification of new build.
- Royal Decree 1027/2007, of the 20th of July, approving the Thermal Building Regulations.

A fourth decree will be further added to these, to legislate the energy certification of existing buildings, and which will complete the transposition of the EPBD to the Spanish legal system. It is expected to be approved during early 2011. The approval of the latter needs a previous legal basis; works are being done to include this legal basis in the Sustainable Economy Law, to be published by the beginning of 2011. Law 26/1984, of the 19th of July, on the consumers' and user's defence, recast and published by the Legislative Royal Decree 1/2007, only regulates the relations between consumers and entrepreneurs, and the seller or leaser of a building or part of it cannot be awarded the condition of entrepreneur. On the other hand, Law 38/1999, of the 5th of November, on the Regulation of Construction, is solely applicable to new buildings.

Moreover, a revision process of the current regulations has begun, starting with the Technical Building Code, with its first revision envisaged for 2011. In parallel to these works, the roadmap to guide us towards the objectives established in the recast of the EPBD has started being defined - objectives such as the fact that all new buildings are to be "nearly zero-energy buildings" from the year 2020.

2 > Certification

Certification of buildings

The implementation of the EPBD is the responsibility of the Ministry of Industry, Tourism and Commerce, and of the Ministry of Housing in Spain or the Ministries with competences in building construction and energy. The Institute for Energy Diversification and Saving (IDAE) also contributes to this process. According to Royal

Legislation at the Ministry websites:

- *http://www.codigotecnico.org*
- *http://www.mityc.es/energia/desarrollos/EficienciaEnergetica/RITE/Paginas/InstalacionesTermicas.aspx*
- *http://www.mityc.es/energia/desarrollos/EficienciaEnergetica/CertificacionEnergetica/Paginas/certificacion.aspx*

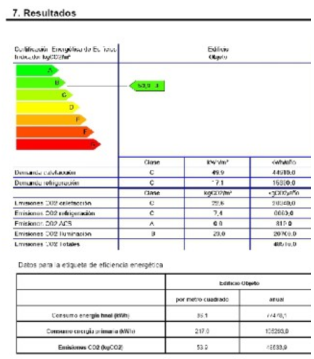
Decree 47/2007 on the Energy Certification of New Buildings, the Autonomous Communities are in charge of the registration, inspection and control of the energy efficiency certificates. All the legislation in force can be downloaded from the websites of the above-mentioned Ministries.

The new legislation was put in place between the years 2006 & 2007, with the exception of the new energy certification for the existing buildings, whose enforcement is envisaged for the year 2011.

The regulation for new buildings has been applicable to the new buildings whose building permits were dated after each of the applicable Royal Decrees came into force.

As regards the existing buildings, the draft Royal Decree being processed at the time of writing establishes a mandatory application schedule which depends on the heating and/or cooling capacity installed in the building and on the way it is used. According to the draft version of the Royal Decree, existing buildings with an installed capacity over 400kW will have to be rated, regardless of whether they will be sold or rented.

The same Royal Decree states that when a public or private building that provides public services with a net floor area larger than 1,000 m^2 has been certified, the EPC must be placed on a visible place to all the public visiting the building. This definition includes buildings with the following uses: administrative, health, education, commercial, culture (restaurants, theatres, sports halls, conference halls, etc., public residential and transport).



Report of the official software developed for residential and small and medium tertiary buildings

The energy performance certificate

The format of the energy performance certificate for new buildings is published in the Royal Decree 47/2007 and is shown in Fig 1. It displays the annual primary consumption of energy of the building and, apart from the energy rating achieved, its CO_2 global emissions (parameter C, described in the next page, left column).

Only the format of the label is standardised. As regards the software for energy rating, either the official ones or those to be acknowledged for further use, are issued with reports whose formats are not regulated at present. Nonetheless, these formats provide more information than the one shown on the label.

The energy rating scale in Spain ranges from A - very high performance, involving a high contribution of renewable energies in the building consumption - to G, which represents low performance. This global rating is assessed according to the building's global emissions, regardless of the existing partial ratings relative to the various consuming energy services, - both in terms of demand and final and primary energy consumption – and in terms of emissions.

Typically, a new building that strictly abides by the current regulations will be rated on the limit between C and D. The fact that energy rating A involves a very low demand along with the contribution of renewable energies in power supply could be seen as a good starting point to specify in a precise way what could be a "nearly zero-energy building" in each of the Spanish climate areas.

The energy certification procedures for existing buildings, which are at a very advanced development stage at present, should help the certifying technician to put forward ideas and recommendations to improve energy efficiency in the building.

$$C1=\frac{\left(\frac{I_O}{I_r}R\right)-1}{2(R-1)}+0.6$$

$$C2=\frac{\left(\frac{I_O}{I_s}R'\right)-1}{2(R'-1)}+0.5$$

I_O, CO_2 emissions of the building in question.

I_r, CO_2 emissions of a building that strictly meets the enforced regulation.

I_S, CO_2 average value of the building of the existing housing stock in 2006.

R, ratio between I_r and CO_2 emissions of the 10% percentile of the buildings strictly meeting the regulation.

R', ratio between I_S and CO_2 emissions of the 10% percentile of the existing housing stock in 2006

Label	Index
A	C1<0.15
B	0.15≤C1<0.50
C	0.50≤C1<1.00
D	1.00≤C1<1.75
E	C1≥1.75 y C2<1.00
F	C1≥1.75 y 1.00≤C2<1.50
G	C1≥1.75 y C2≥1.50

$$C=\frac{I_{objeto}}{I_{reference}}$$

I_{objeto}, CO_2 emissions of the building in question.

$I_{referencia}$, CO_2 emissions of the reference building.

Label	Index
A	C<0.40
B	0.40≤C<0.65
C	0.65≤C<1.00
D	1.00≤C<1.3
E	1.3≤C<1.6
F	1.6≤C<2
G	C≥2

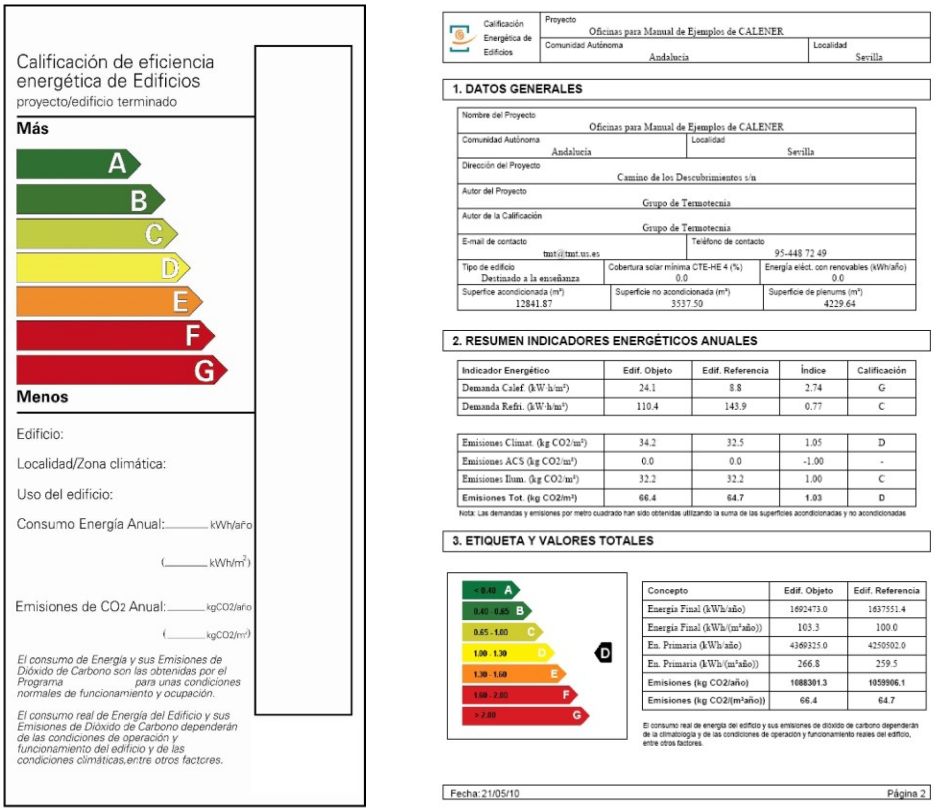


Figure 1 – Cover page of the EPC and first page of the report for the official software developed for large non-residential buildings

The recommendations could be based on actions focusing on the building energy demand, on actions that should improve the performance of thermal installations, actions on the lighting systems or on the integration of renewable energies in the building.

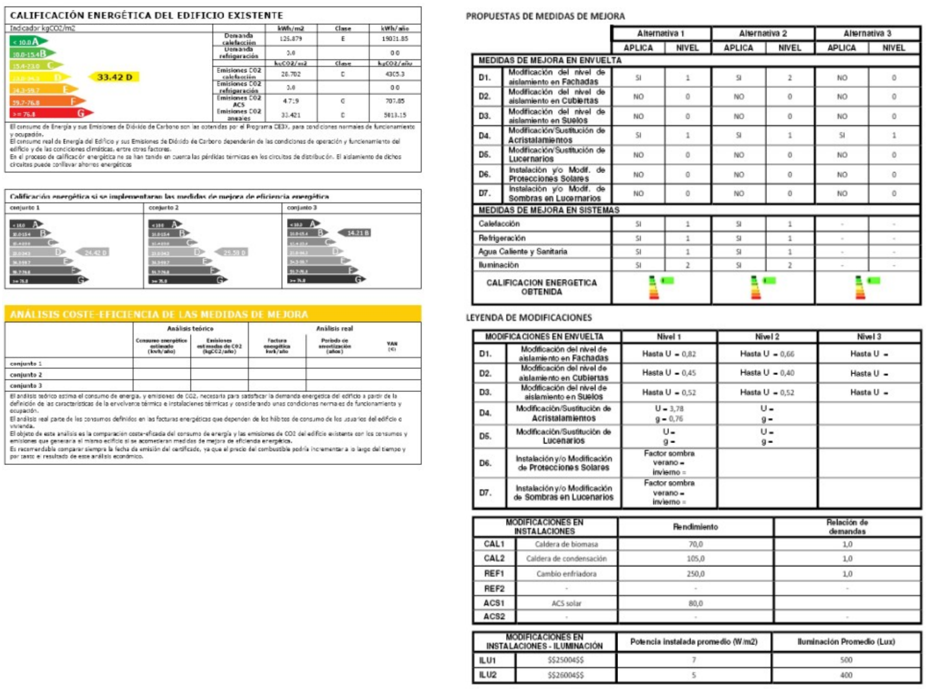
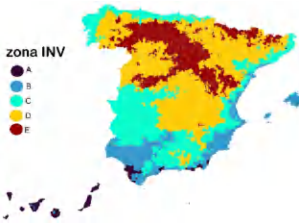


Figure 2 – Reports on the beta-version improvement measures of the energy certification procedures of existing buildings.

The drafts of the energy certification procedures of existing buildings, under development at the end of 2010, account for the assessment of these measures, both from a technical and economic point of view. This analysis is stated in the final report issued by software programmes.

The energy efficiency certificate of buildings is valid, in principle, for a maximum period of 10 years, which may be shortened by the Autonomous Community, but, so far, none has reduced it.

The calculation methodology



Spain winter climatologic zones

As stated, the global energy rating is assessed according to the CO_2 emitted per unit floor area per year, [$kgCO_2/m^2$.ear]. Moreover, there are partial ratings depending on the demand and energy consumption stated in terms of kWh/m^2.year of end-use and primary energy, and in $kgCO_2/m^2$.year for the various energy-consuming services (heating, cooling, sanitary hot water and lighting for tertiary buildings).

As for residential buildings, the calculated value is compared with a series of reference values that vary according to the climate area where the house is, both for new buildings and for the existing housing stock in the year 2007. For tertiary buildings, the energy rating is granted in accordance to the data of the building to be rated, as compared to a reference building abiding by the building energy regulations.

Spain summer climatologic zones

The twelve climate areas Spain has been divided into are shown on the left. The letter shows the winter climate severity index (SCI), where A stands for milder winters and E for cold winters. In summer, the number shows the summer climate severity index (SCV): 1 standing for milder summers and 4 for very hot summers. Both ratings are given on the basis of the Spanish climate.

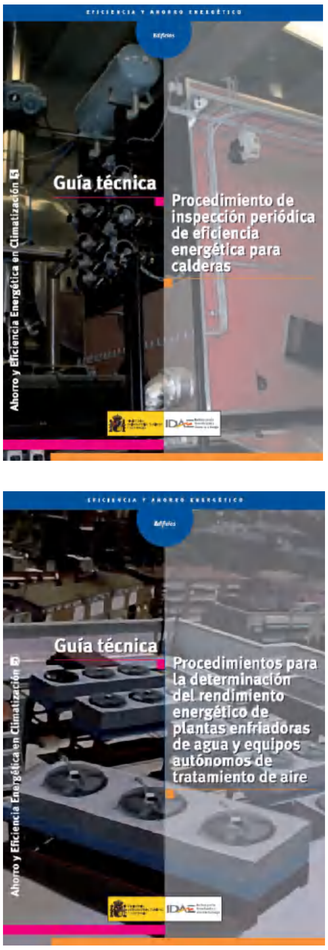
The new building energy certification procedure, called CALENER, was developed with IDAE's sponsorship. This procedure has two versions, one meant for the residential rating of buildings and the small tertiary ones, and the other meant for the large tertiary buildings. This procedure, as well as future versions of the software, follows CEN standards to a large extent.

Legislative situation of the building energy certification in the various Autonomous Communities.

The registration of these certificates falls within the competence of the Autonomous Communities, as well as the quality control to be applied on the certificates. Some communities (see left columns) have so far legislated on this issue, whereas others have legislation drafts to be enforced in the near future.

There is neither fixed cost nor administrative tax applied to certificates at national level, but Autonomous Communities can establish the said tax. For instance, Castile and León has done so in the regional Law 10/2009, of Financial measures, establishing a cost in terms of €/m^2 which depends on the size and type of the building (0.40 €/m^2 for residential blocks, 0.97 €/m^2 for single-family houses, 0.79 €/m^2 for small non-residential buildings, and 0.89 €/m^2 for big tertiary buildings), this administrative tax varies between a minimum amount of 150 € for single-family houses and a maximum amount of 1,200 € for big tertiary buildings. Extremadura also charges an administrative cost of 21.79 € per registered certificate.

> *http://www.mityc.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/ProgramaCalener/Paginas/DocumentosReconocidos.aspx*



Guides concerning efficiency inspections of heating and air-conditioning systems

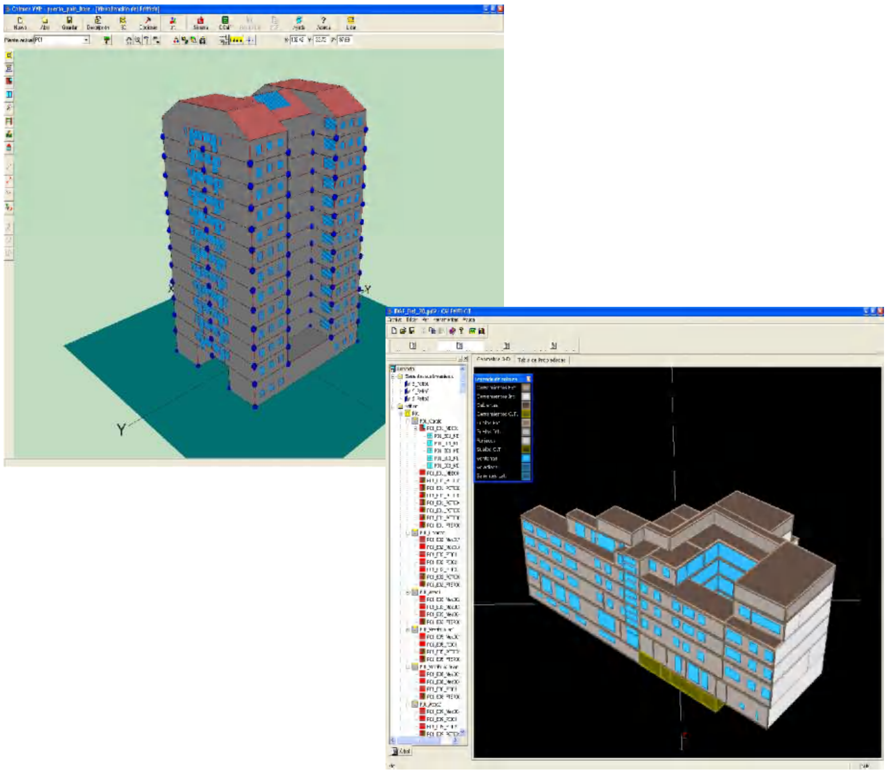


Figure 3 – Screens of CALENER VyP and CALENER-GT official certificate procedures.

The cost of the certificates is established by the market. For new projects, the cost is usually integrated in the price the designer and the project management will charge to the promoter of the building. For existing buildings, there is not yet experience of the cost of certification. Nevertheless, the estimates by the Administration show costs from 40 €/house for blocks of flats to 250 € for detached houses, and 0.5 €/m^2 for tertiary buildings. Nevertheless, these prices will be fixed by the market.

Quality assurance (QA)

The external control and the inspection of the energy certificates also fall within the competence of the Autonomous Communities, which can decide on the type of controls to apply and the penalties to be imposed in case of finding deficiencies.

For the external control, the Autonomous Communities can count on authorised agents - which may be accredited bodies or organisations for the building regulatory field and its thermal installations - or qualified independent technicians. The procedure to obtain this authorisation is to be defined by each Autonomous Community for its territorial scope. The Autonomous Communities that have regulated the external control make use of the so-called building quality control bodies, i.e., private companies that are hired by the administration to perform that task. The specific requirements can vary from one region to another, but usually they include a series of technical and economic reliability requirements (experience, civil responsibility insurance, sufficient human resources). Autonomous Communities such as Galicia, Extremadura or Castilie – La Mancha have regulated the requirements set to the external control bodies in great detail.

The external control carried out on the project certificates and on the finished building project includes a verification of the information included in the project, or really executed in the building works, and its comparison with the data introduced in the certificate. Apart from this control, the regional Administration is also entitled to an independent inspection of any certificate, should it deem it necessary.

Promotional material of the various courses relating to the building energy efficiency certification

As for infractions and sanctions, these are stated in Royal Decree 47/2007 to Law 26/1984, whose recast text is published in the Legislative Royal Decree 1/2007. They range from 3,005.06 € to 601,012.10 €. This Law is a very general Law on consumers' defence that was not designed to regulate infractions and sanctions concerning the Energy Performance Certification (the original Law was published in 1984). As a result, work is being done to develop a more detailed framework for penalties, where the sanctions are clearly stated as well as the amount of the applicable fines. This draft for the penalty framework classifies infractions into light, serious and very serious, with sanctions ranging from 300 € to 300,000 €. Examples of actions that could lead to a penalty are false information on the EPC, not giving the EPC to the buyer or tenant, not registering the EPC, advertising a false EPC, etc.

3 > Inspections - Status of implementation

Promotional diptych of the building energy certification

The energy efficiency inspection of cold and heat generators is regulated by the Regulation of Thermal Installations in Buildings, compulsory for all heat generators with a nominal thermal capacity over 20kW, and for all cold generators whose nominal capacity is over 12kW.

These inspections are intended to analyse and assess the performance of the installation. This regulation, to be applied nationwide, establishes minimum intervals for inspections of heat generators depending on the kind of fuel used and the nominal capacity of the installation. This periodicity may be increased if the Autonomous Community in charge of them chooses to do so, but all the Autonomous Communities are using the periodicity established in the national legislation.

Thermal Capacity [kW]	Fuel	Minimum periodicity
20≤P≤70	Gas and renewables	Each 5 years
	Other	Each 5 years
P>70	Gas and renewables	Each 4 years
	Other	Each 2 years

The periodicity of the inspections for cold generators is not the same nationwide and it is up to each regional administration to fix the periodicity of these inspections. Royal Decree 1027/2007 only establishes that this periodicity must depend on the rated output of the generators (between 12kW and 70kW, and more than 70kW). As an example, the periodicities set by the Autonomous Community of Navarre in Foral Order 242/2009 are:

Thermal Capacity [kW]	Minimum periodicity
12≤P≤70	Each 5 years
P>70	Each 3 years

Legislative situation of the energy efficiency inspections in the various Autonomous Communities.

Galicia has reduced the periodicity for cold generators with a capacity higher than 70kW to 2 years in an Order of the 24th of February 2010.

Concerning the inspection of the whole installation, it is to be done each 15 years according to the national regulations. The first inspection should be done at the same time as the first inspection of the heat or cold generator.

The figure on the left shows the different Autonomous Communities that have regulated the content of the energy efficiency inspections of the thermal installations.

Some Autonomous Communities have already regulated the detailed content of these inspections, taking into account the relevant CEN standards, which include the assessment of some aspects such as the document registration, the performance of the energy efficiency demands, the evaluation of the generators output, the safety conditions of the equipment and a report of the installation and a proposal of the improvement measures of the said safety.

IDAE, in collaboration with ATECYR (Spanish Technical Association of Air Conditioning and Refrigeration), published a collection of guides about Energy Saving and Efficiency in Buildings, including some on the energy efficiency inspection of heating and cooling installations.

4 > Qualified Experts

There are two kinds of energy efficiency certificates, the project energy efficiency certificate - which has to be signed by the designer of the building or the designer of its thermal installations and will be included in the execution project - and the finished building certificate, to be subscribed by the project management of the works and which will be included in the building book.

The technicians qualified to carry out this task are those qualified by Law 38/1999, of the 5th of November, on Building Regulation, i.e., architects, building surveyors, engineers and technical engineers. There is no obligation in Spain to follow any training syllabus or take an exam to be able to rate a building. It is only necessary to have a qualifying degree according to Law.

Nonetheless, dissemination conferences on the new regulation and courses on the use of the energy certification procedure have been held within Spain's Energy Saving and Efficiency Plan 2004-2012. Nearly 140 courses in relation to building energy certification were held in the year 2007 at the expense of the Work Plans of the Energy Saving and Efficiency Plan 2004-2008 and 2008-2012 in the various Autonomous Communities, with a total number of trainees of approximately 2,800. The overall approximate cost for these courses amounted to 1.6 M€ in 2007 & 2008. This measure has also been operational with a budget allocation of 2 M€ for the year 2008 and 2.9 M€ for the year 2009.

IDAE also developed a series of guides about energy certification to help experts understand and make a better use of the official software.

Figure 4 – Energy Performance Certification of Buildings guides

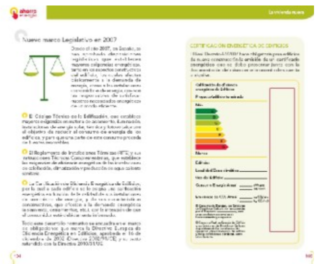
5 > National Information and Communication Campaigns

The need of informing citizens about certification

Some specific information campaigns have been made for citizens, regarding the building energy certification, meaning to explain the aims of the building energy rating and the rest of features related to the building energy certification.

Furthermore, various conferences on the introduction and dissemination of building energy certification have taken place in all the Autonomous Communities, addressed both to the professionals in the sector and to citizens. In like manner, IDAE takes part in many sectorial fairs, where it intends to promote the building energy certification, among other purposes.

IDAE's website, *www.idae.es* and the website of the Ministry of Industry, Tourism and Commerce, *www.mityc.es*, provide information on building energy certification, as well as on the basic rating procedures and the recognised energy certification documents.



ahorra energía

The publication called *"Guía Práctica de la Energía. Consumo eficiente y responsable"* (Practical Guideline on Efficient Energy Consumption) informs the citizen about building energy certification.

IDAE has published a collection of 12 guides called *"Calificación de Eficiencia Energética de Edificios"* (Building Energy Efficiency Rating), describing the basic certification procedures as well as the energy rating scale.

Apart from these specific campaigns, there are others of a more general nature to raise awareness on energy saving in Spain. At national level, the brand "save energy" was created, largely visible and with the sponsorship of the Spanish national football team or of events such as the *Vuelta Ciclista a España,* where the jersey of the race leader is also sponsored.

6 > National incentives and subsidies

The Energy Saving and Efficiency Plan (PAEE) 2008-2012 envisages a series of incentives to improve energy efficiency, and where several sectors are taken into account such as industry, transport, agriculture and also building. A Work Plan is defined every year between IDAE and each of the Autonomous Communities in Spain, establishing the availability of funds for a series of actions meant to improve energy efficiency in the country. A series of measures aimed at improving energy efficiency in existing buildings is included within the building sector, such as:

Promotional material of the subsidies related to the Spanish Energy Saving and Efficiency Plan developed by the Autonomous Communities.

- The thermal rehabilitation of the envelope of existing buildings;
- The improvement of the energy efficiency in thermal installations in existing buildings;
- The improvement of the energy efficiency in lighting installations in existing buildings.

These measures have been implemented by all the Autonomous Communities as they are considered a priority. Their aim is to cut back the energy consumption in a building by 20%, with a subsidy of 22% of the necessary investment to be made; this amount could be increased up to 27% of the investment if such action seeks an energy efficiency rating B for the building, or up to 35% if rating A is achieved.

Sometimes, these measures are incorporated in the so-called Renove Plans, either for windows, façades or boilers. These Renove Plans are meant to make measures even more noticeable and make them accessible for citizens.

There is also an optional measure within the Energy Saving and Efficiency Plan, i.e., it is not applied by all the Communities, and it is called "Construction of new buildings with high energy rating". The construction of A or B energy rating buildings is subsidised under the auspices of this measure. The amount of the subsidy varies in accordance with the kind of building (house, block of flats or tertiary) and of the achieved rating (A or B), ranging from 50 €/m^2 for a single-family house with rating A to 15 €/m^2 for tertiary buildings with energy rating B. The figure on the right shows which Autonomous Communities are applying this subsidy. The Autonomous Community of Navarre does not apply this measure under de PAEE 2008-2012 but, under its Anticrisis Autonomic plan, it subsidises the construction of social housing with high energy performance with 30 €/m^2 for A buildings, 20 €/m^2 for B buildings and 10 €/m^2 for C buildings.

Moreover, the Ministry of Housing subsidises, within the framework of the State's Housing and Rehabilitation Plan 2009-2012, the building of state subsidised dwellings with rating A, B or C, with the following fund allocation:

	Energy rating		
	A	**B**	**C**
Subsidy [€/home]	3,500	2,800	2,000

This subsidy is complemented in the region of Extremadura, through its Public Works Regional Office, with the following quantities per dwelling 1,500 € for A, 1,000 € for B, and 700 € for C.

Furthermore, Royal Decree-law 6/2010, of the 9th of April, on the measures to boost economic recovery and employment, among other features devoted to the overcoming of the economic crisis, includes a deduction on the Spanish Income Tax Revenue for improvement works on residential housing, and a reduction on the Spanish Value Added Tax for renewal and repair works of the main residence.

There are also fund lines directly managed by IDAE to integrate thermal renewable energies in buildings for biomass, geothermal and solar energy, called Biomcasa, Geotcasa and Solcasa, respectively. These lines are articulated through energy service companies (ESCO), qualified by IDAE. IDAE provides low-interest financing to the ESCOs that undertake investments within the scope of these programmes.

The interest rate and the money allocation of the programmes is listed in the following table:

Programme	Interest rate	Total budget
Biomcasa	EURIBOR + 1.5%	5 M€
Geotcasa	EURIBOR + 2.2%	3 M€
Solcasa	EURIBOR + 2.2%	5 M€

7 > Impact of the EPBD at national level

Evolution of Minimum quality requirements in building regulations

With the enforcement of the Technical Building Code in 2006, building energy efficiency received a large boost. This basic standard consists of a Basic Document, made up in time by 5 documents with a specific objective each.

- CTE DB HE1 – Limitation of energy demand
- CTE DB HE2 – Performance of thermal installations (RITE)
- CTE DB HE3 – Energy efficiency in lighting installations
- CTE DB HE4 – Minimum solar contribution for hot sanitary water
- CTE DB HE5 – Minimum photovoltaic contribution for electric power

Document CTE DB HE1 is meant to replace the former regulation, NEB-CT-79, on the thermal conditions of buildings, considerably toughening the requirements demanded for their building envelope. As an example, in the case of Madrid, the maximum thermal transmittance for the façade was cut back from 1.20 $W/m^2 \cdot K$ to 0.66 $W/m^2 \cdot K$.

The CTE DB HE2, despite being part of the TBC - for historical reasons it is usually dealt with as an independent document – the Regulation on Building Thermal Installations or RITE. As a result of the EPBD, this document was revised in the year 2007 as its former version dated back to 1998, introducing the concept of the periodic inspections on energy efficiency to be implemented by the Autonomous Communities.

This document has been modified by Royal Decree 1826/2009, of the 27th of November; in this modification winter and summer limit temperatures for indoor air have been set for administrative, commercial and public buildings when fossil energy is used to heat or cool the building. These temperature limits are 21ºC for winter and 26ºC for summer. It is also necessary to show these temperature values in a visible place on these buildings. This modification also introduced the obligation of using a mechanism to keep the doors of all building parts directly connected with the street closed when fossil energy is being used to condition the building.

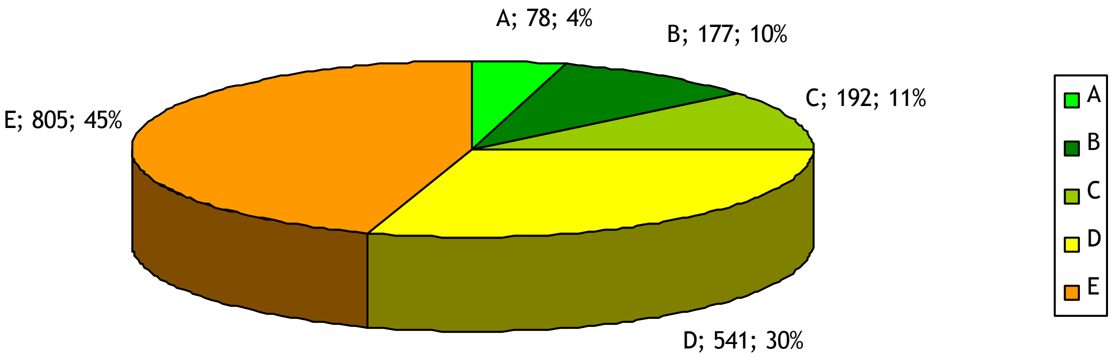
CTE DB HE3 comes to light with regard to lighting, limiting the minimum energy efficiency of the tertiary building lighting systems. For so doing, the concept of the Energy Efficiency Value of the Installation (VEEI) is introduced, and the minimum value of this factor is limited given the use of the various rooms in the building.

For the first time, the use of renewable energies becomes compulsory to meet part of the energy needs of buildings, either to produce sanitary hot water, as set forth in CTE DB HE4, or the use of renewable energies to produce electric power in tertiary buildings - CTE DB HE5. As this requirement is included under the Technical Building Code 2006, which is a national regulation, the use of renewable energies in new buildings is mandatory in the whole Spanish territory.

A reflection period has started, which should lead Spain to a revision of the TBC for the year 2011. This revision is the framework for the surveys being carried out to calculate the optimum level of demand from the point of view of costs. The first jump in terms of demand will take place in 2011, so as to advance in the way leading to “nearly zero-energy buildings” in the year 2020.

Other impacts

The number of registered buildings with a certificate in the Autonomous Communities where a certification scheme exists is still very low, basically because the regulation in force is only applicable to new buildings and because of the crisis in the building sector in Spain as a result of the financial crisis in the last years. Nevertheless, presently, data is available on the total number of registered buildings for four Autonomous Communities: Galicia, Navarre, Catalonia and Extremadura. Another four Communities, the Canary Islands, Andalusia, Valencian Community and Castilla – La Mancha also have a register in place but there is yet no data about the total number of certificates issued in their territory. The total number of certificates by the end of 2010 is 1,791, their distribution being shown in the chart below.



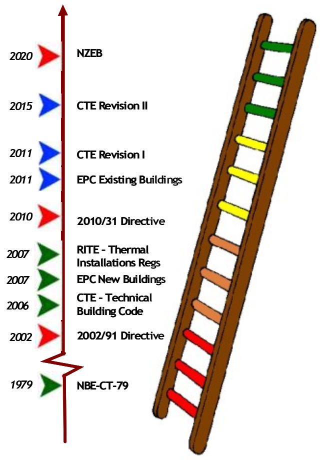
There are no certificates with the label F or G because the minimum qualification that a new building can achieve is E.

The number of issued certificates varies a lot from region to region, depending on the time the Autonomic legislation has been in force and the number of buildings that have been built lately.

8 > Conclusions and future planning

The adoption of the EPBD has significantly increased the number of requirements that buildings in Spain must meet. Nonetheless, the Royal Decree with the energy certification of existing buildings, to be published in a near future, is still necessary to fully transpose the EPBD. Once this Royal Decree has been published, which will endow the energy certification of existing buildings with a regulatory framework, the next logical step will be to combine the subsidies of the Energy Saving and Efficiency Plan to the improvement of the building energy rating.

In addition, given the compulsory consolidation of the recast EPBD, the requirements made to buildings will have to be toughened in order to meet the requirements set forth in the said Directive. This revision will have to toughen the compulsory requirements for the building thermal envelope and the performance of thermal installations, as well as the efficiency demanded for lighting systems. The demands regarding the integration of renewable energies should also be enlarged. A precise definition of a “nearly zero-energy building” will have to be developed for the different Spanish climatologic areas, taking into account the heating and cooling demands, use of the building, etc.



The evolution of the Spanish legislation regarding energy performance of buildings is shown on the figure on the left. As shown, the EPBD 2002/91/EC implied a reorganisation of all the legislation in Spain, the final step being the publication of the Royal Decree regulating the energy performance certification in 2011.

This process of revision of the regulations (RITE) and the EPC rules has already started. The Spanish normative will be tightened gradually to achieve the NZEB objective by 2020.

The legislation related to certificate registration and to external control will also be extended to all the Autonomous Communities, which are also working in coordination with one another as well within a work group created at the heart of the Counselling Commission to certify building energy efficiency.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Finland

Status in November 2010

Maarit Haakana

Ministry of the Environment

Finland

1 > Introduction

The implementation of the EPBD in Finland is based on laws and decrees published in 2007. Since the last report in August 2008, some amendments have been made to energy certification provisions and minimum energy performance requirements. At the moment, the implementation of the Recast of EPBD is under discussion.

In Finland, the implementation of the EPBD is the overall responsibility of the Ministry of the Environment. This report presents an overview of the current status of implementation and plans on how the implementation will unfold. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

National websites:

- *www.ymparisto.fi*
- *www.ymparisto.fi/energiatodistus*
- *www.motiva.fi/energiatodistus*

In Finland, the Ministry of the Environment is responsible for legislation and guidelines regarding energy performance certificates, energy performance certificate templates and other instructions concerning the issue of certificates. The Ministry of the Environment has designated two accreditation bodies to approve qualified experts. All material pertaining to energy performance certificates is available on the Ministry's website.

For all **new buildings**, certificates must be presented when applying for a building permit. The certification of new buildings began in early 2008. New buildings constructed in strict accordance with the requirements of the Building Regulations 2010 would typically fall into energy class C.

As of January 2009, **all existing buildings** must be certified when sold or rented. Energy certificates for existing buildings can be issued in three different ways. The building owner may choose which type of certificate will be used:

1) included in the property managers' certificate
2) issued through a so-called "separate energy certificate"
3) in connection with an energy audit.

The implementation timetable has been the same for all building types.

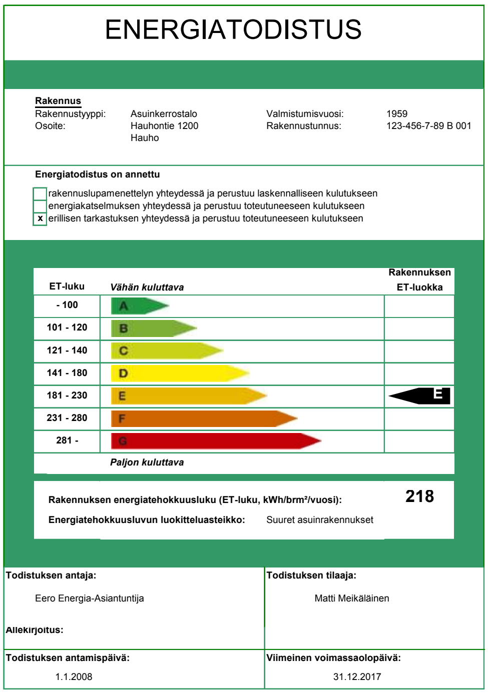
An energy certificate will be valid for 10 years for most buildings and for four years in the case of new apartment blocks and commercial buildings.

Certificates for new buildings will be provided by the principal designers of the buildings. For existing buildings, the energy certificate may be issued by a qualified expert, energy auditor or property manager. When a qualified expert issues an energy certificate, it is called a "separate energy certificate".

Premises of public authorities providing public services and with more than 1,000 m^2 will be required to display energy certificates. This requirement was set in the new law that will come into force in the beginning of March 2011.

The energy performance certificate

An energy certificate assigns an energy performance label to buildings and lists measures for improving their energy performance.



ENERGIATODISTUS

Rakennus
Rakennustyyppi: Asuinkerrostalo
Osoite: Hauhontie 1200, Hauho
Valmistumisvuosi: 1959
Rakennustunnus: 123-456-7-89 B 001

Energiatodistus on annettu

- [ ] rakennuslupamenettelyn yhteydessä ja perustuu laskennalliseen kulutukseen
- [ ] energiakatselmuksen yhteydessä ja perustuu toteutuneeseen kulutukseen
- [x] erillisen tarkastuksen yhteydessä ja perustuu toteutuneeseen kulutukseen

ET-luku	*Vähän kuluttava*	Rakennuksen ET-luokka
- 100	A	
101 - 120	B	
121 - 140	C	
141 - 180	D	
181 - 230	E	E
231 - 280	F	
281 -	G	
	Paljon kuluttava	

Rakennuksen energiatehokkuusluku (ET-luku, kWh/brm²/vuosi): 218
Energiatehokkuusluvun luokitteluasteikko: Suuret asuinrakennukset

Todistuksen antaja: Eero Energia-Asiantuntija
Allekirjoitus:
Todistuksen tilaaja: Matti Meikäläinen
Todistuksen antamispäivä: 1.1.2008
Viimeinen voimassaolopäivä: 31.12.2017

The energy label classifies buildings on an efficiency scale, ranging from A (high energy efficiency) to G (poor efficiency). Energy performance is based on the yearly net final energy demand of the building per m^2 of floor area (kWh/m^2.year). No primary energy factors or CO_2 factors are applied.

The energy label for new buildings is always based on calculated final energy consumption. The scale in the energy certificate is an absolute value (kWh/m^2.year). There are ten different scales for ten different building types.

In small residential buildings, the calculated energy consumption includes space and water heating, all electricity consumption and cooling energy. In large residential buildings, household electricity is not included in the energy consumption. The energy consumption of non-residential buildings includes heating (space and water), cooling energy, HVAC-electricity and built-in lighting.

The calculation methodology is described in the building regulations. It must be used for calculating energy consumption when issuing energy certificates for small residential buildings. When applying for a building permit or issuing energy certificates for other building types (new buildings), EN standards, other more detailed calculation methods and simulation tools can also be used. The calculation methodology described in the regulations follows the main principles of EN ISO 13790.

Existing buildings are rated according to their actual metered final energy consumption.

Recommendations are included only in "separate energy certificates" issued by qualified experts, for existing buildings only. In the case of other certificate types for existing buildings, recommendations are included in the energy audit report or the property managers' certificate.

A qualified expert must visit the building and assess the energy efficiency of its structure and technical systems (outdoor walls, doors, windows, heating and domestic hot water systems, ventilation systems, lighting and other electrical heating systems). After the audit, the qualified expert must suggest cost-effective energy-saving measures in the certificate. Because there are no general lists of recommended energy-saving measures, these recommendations depend on the expert's skills and knowledge. Savings must be calculated in detail for every building, reporting savings in kWh/year for each measure individually and for all of the proposed measures combined.

Responsibility for ensuring possession of such a certificate lies with the building owner. The cost of the certificate depends on the certificate type. The price of a "separate certificate" for an existing building begins from 500 € for a whole apartment building. If an energy certificate is based on an energy audit, the cost of an audit can rise to 2,000 €.

An energy certificate for a single-family house building permit costs close to 120 €. With several service providers issuing energy certificates, a certain "market price" has been struck in the Finnish market.

Quality assurance (QA)

The quality control procedure is not regulated by legislation. However, the current legislation does allow the Ministry of the Environment to gather relevant information on certificates and certificate prices from qualified experts. Qualified experts must keep a 15-year archive of any certificates they have issued. The local building supervision authority must also keep an archive of certificates issued for new buildings that have been issued with a building permit. The Ministry has the right to access these archives in order to conduct periodic checks of the certificates, but no control has been made so far.

A national, centralised database has been developed for energy certificates. This system was ready by the end of 2009. In the current phase, the database collects only statistical data on the number of certificates. The intention is for the database to operate on a temporary basis for a few years, until a centralised, quality control database is developed in connection with implementing the recast of the Energy Performance of Buildings Directive.

3 > Inspections - status of implementation

Finland chose option B (advice, voluntary inspections) instead of mandatory boiler inspections for the implementation of Article 8. The Ministry of Trade and Industry (now the Ministry of Employment and the Economy), the Ministry of the Environment and the Finnish oil sector established a co-operation programme (the HÖYLÄ energy efficiency agreement) in 1997, on furthering energy conservation in oil-heated properties. Since the beginning of 2003, Government subsidies have also been available for changing old heating systems in residential buildings by systems that utilise renewable energy sources. These existing instruments formed the basis for the voluntary approach.

The main objective of the voluntary approach is to promote energy efficient installations and operations, mainly by providing information and advice. As part of the implementation of the energy efficiency agreement, a magazine is distributed to all of Finland's 180,000 households with oil heating. The magazine informs end users on how to enhance the energy efficiency of buildings and oil heating systems. In addition, there are regular reviews of boilers and of solutions for their replacement. This magazine has been issued three or four times a year since 1985.

Figure 1. Information material for boiler owners

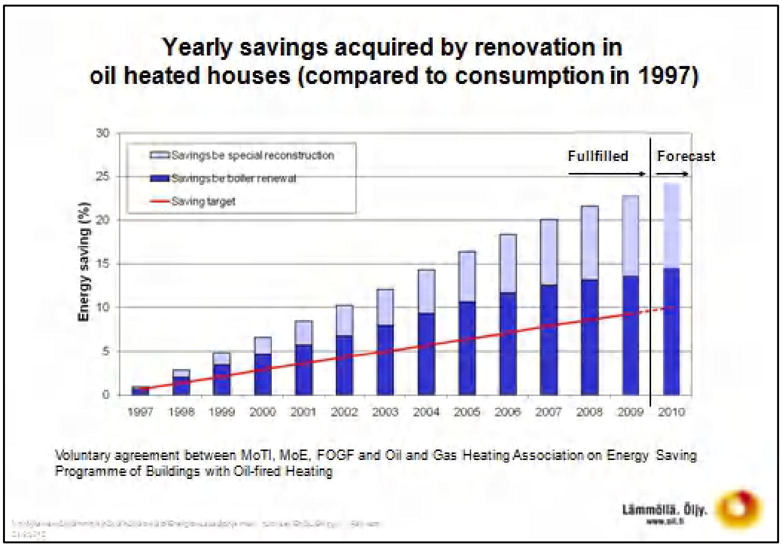


Figure 2. The Höylä-energy efficiency agreement; extensive savings in heating oil have been achieved by refurbishing ageing oil-heated properties.

Although boiler inspections are voluntary, a national inspection methodology was developed in 2004, before CEN-standards were available. Voluntary energy efficiency inspections of boilers have been conducted since early 2008. However, no major interest has been expressed in conducting energy efficiency inspections. The intention is therefore to include such inspections as part of ordinary, regular servicing in the future. A total of 50,000 such audits, with costs in the range of 100 - 200 €, are carried out per year, on average.

According to the Act on the Inspection of Air-conditioning Systems, inspections are compulsory for cooling equipment with a nominal cooling output of at least 12 kW. The national inspection methodology was developed in 2004, before CEN-standards were available. Inspections are only necessary where cooling systems are based on the use of compressors, i.e., district cooling systems are not included in the mandatory inspection scheme. Such equipment must be duly inspected at least once a decade. The new act came into force on the 1st of January 2008.

Sticker of voluntary boiler inspection (to be attached to a boiler).

A model report and guidelines exist on the content of inspection reports. The main parts of the report are as follows:

- description of the air-conditioning system
- measurements and inspections used
- assessment of saving potential
- recommendations for improvement

Until now, relatively few inspections of air-conditioning systems have been carried out. The first ten-yearly inspections of systems deployed in 2000 will fall due in 2010. Older systems must be inspected by the 1st of January 2013.

The Act on Inspection of Energy Efficiency of Air-conditioning Systems' Cooling Equipment has been amended in the autumn of 2010 in order to reduce the interval of periodic inspections from ten to five years. The amended act will come into force in the beginning of March 2011.

Figure 3. Information material on A/C inspections

Inspections are paid for by the owner of the building. Property owners have shown little interest in inspecting the energy efficiency of their air-conditioning systems. Despite being informed of the inspections and the related benefits, not all building owners are necessarily aware of the compulsory inspections in force. Some house owners consider a separate energy efficiency inspection unnecessary if a comprehensive air-conditioning system maintenance agreement has already been made for their building. In practice, they are confident that servicing will prove sufficient to ensure that the equipment functions as energy efficiently as possible. They therefore see no need for a separate inspection report. At the moment, there are no penalties for not having an inspection made.

4 > Qualified experts

Qualified Experts in certification have the authority to issue so-called Separate Certificates. Such experts must be architects, engineers or technicians with an educational background in building, HVAC or electrical engineering. A professional examination can be replaced by at least three years' experience in energy efficiency within the building sector. Furthermore, Qualified Experts must pass an exam arranged by an accreditation body. This exam tests their knowledge in certification legislation and in the certification system itself. Attendance of a training course is not mandatory.

Qualified Experts receive accreditation with a validity of 7 years. They can either operate on an individual basis or be integrated with public or private organisations. Two accreditation bodies have been authorised by the Ministry of the Environment to approve qualified experts: *FISE Oy* and *Kiinteistöalan Koulutuskeskus* (Kiinko). There are around 520 Qualified Experts in energy certification. If there is a compelling reason for doing so, the accreditation of a Qualified Expert can be withdrawn. Such reason may be for example reluctance to correct the false certificate after several notes of complaint. At the moment, there are no other penalties in use. So far, only two accreditations have been withdrawn.

Other professionals entitled to issue energy certificates (e.g. principal designers, property managers, chairpersons of housing company boards and energy auditors) do not require accreditation under the Act on Energy Certification of Buildings.

Training for experts engaged in voluntary boiler inspection was first arranged in April 2007. Some 300 experts have so far been trained. The majority of them comprise staff in oil heating installation and service businesses, and one third concerns chimney sweepers. Experts can apply for voluntary certification once they have completed the training. Approximately 130 of those trained have applied for, and been granted, certification. Organisations in the industry (Heating energy association/*Lämmitysenergia Yhdistys* and the Finnish Federation of Chimney-Sweeps/*Suomen Nuohousalan keskusliitto*) have arranged training. They also maintain a list of certified inspectors on their websites.

www.nuohoojat.fi
www.lammitysenergia.fi

Professionals authorised to carry out the inspection of leakages of certain fluorinated greenhouse gases from A/C systems, as referred to in Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006, can also act as qualified experts in air-conditioning inspection. The Safety Technology Authority (TUKES) accredits inspection companies and persons in charge of these inspections, while also maintaining a register of the accredited companies and persons. The Ministry of the Environment and the Finnish Refrigeration Enterprises Association (FREA) have developed further training for those in charge of inspecting the energy efficiency of air-conditioning systems. This is intended to ensure that inspections and reports are carried out to the appropriate extent. Training sessions have been arranged in four key locations in 2009 and 2010. These cover an estimated 80-90% of the key equipment base, at which inspections are being targeted for the time being. A total of 82 participants have attended training. Training sessions will continue as the need arises.

5 > National information and communication campaigns

energiaTODISTUS

Logo of the energy certification info campaign.

An information campaign was launched at the beginning of April 2008. The Ministry of the Environment mandated Motiva to coordinate this campaign. The main objective of the campaign is to inform the general public, professionals and other interest groups of the energy certificate.

The campaign's key information source is a web portal. It includes detailed information on certification procedures and provides answers to frequently asked questions. It also has links to lists of qualified experts and to official texts of the Ministry. The latter include, e.g., legislation, energy certificate templates and examples of the different types of certificate. These are available on the national website of the Ministry of the Environment (*www.ymparisto.fi*).

Campaign web portal:

www.motiva.fi/energiatodistus

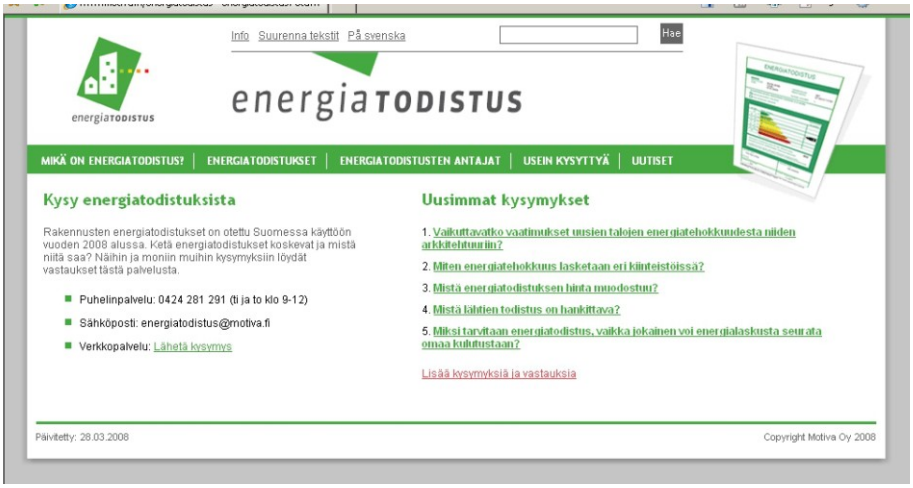


Figure 4. Web-portal

Motiva also maintains a helpdesk service centre, which can be contacted by telephone, e-mail or through the web portal. This web service attracts an average of 2,000 visitors per month. Both consumers and industry professionals seek advice and answers to questions.

A "pocket" leaflet has been published to promote the campaign. This leaflet has been distributed at major national housing fairs, seminars and other related events.

Figure 5. Leaflet of certification

Ministry representatives have visited regional events to inform municipal authorities of practices related to energy performance certificates. Representatives of Motiva and the Ministry have given presentations on energy certificates at a number of events arranged in various parts of the country. Organisations and enterprises in the industry have also arranged information and training events related to the certificates.

Energy certificates have been prominently displayed every year at the Housing Fair. In connection with the Housing Fair, and building fair events, seminars have been arranged informing consumers and building trade professionals of energy certificates. Once a year, the Ministry of the Environment and Motiva arrange a networking event for qualified experts in energy certification.

A campaign has been implemented involving the production of leaflets (in figures 1 and 5), news articles and press releases on energy certificates, voluntary boiler inspections and air-conditioning equipment inspections. The aim has been to enhance property owners' awareness of certificates and inspections and the benefits they confer.

Figure 6. Certificates on Housing Fair

6 > National incentives and subsidies

The state supports residential buildings in making energy efficiency improvements, low-CO_2 investments and engaging in the use of renewables with respect to heating systems, in four ways:

- subsidy for housing companies
- subsidy offsetting material costs for low income households
- tax deduction for households purchasing services
- subsidy for installing renewable energy sources

Since 2003, the State budget has been allocating subsidies to housing companies (10-15%) for the repair of buildings and specifically targeted energy renovation. For example, these include changing to more-energy-efficient windows, adding extra insulation to walls or ceilings, and switching from old heating systems to district heating, wood based boilers or ground-source heat pumps. The State also supports the low-income households with an optional subsidy of 25% covering the material costs of energy efficiency renovation.

The tax incentive for domestic employment of various service providers has been in effect since 2001. A household may deduct 30% of personnel salary costs or 60% of company-provided services (but not of materials) from personal taxation. This deduction is applicable to acquisitions of labour (services) for household purposes. Although the deduction can be applied to various works done within a household, in information concerning the tax deduction, the households have been encouraged to make improvements in the energy efficiency of their properties. At the moment, the annual maximum is 3,000 €/person.

A subsidy scheme entailing support for up to 20% of costs when a residential building introduces a ground source heat and air-to-water heat pump as its main heating system, or when it shifts to pellet heating and other wood-based fuels, will be introduced from the 1st of January 2011. The intention is to grant support for renovations of houses with electric or oil heating, but not for new buildings or old houses using district heating.

For the non-residential building stock, grants are provided for energy audits only.

7 > Impact of the EPBD at national level

Development of minimum requirements in building regulations

In its National Building Code, Finland has set minimum requirements for the thermal insulation and ventilation of new buildings since 1976. These requirements have been changed several times, in order to improve energy efficiency in buildings.

Changes were made in 2003, when the level of the requirements was tightened by 25-30%, and in 2007, when the requirements were changed due to the implementation of the EPBD. The latest tightening of the requirements (-30%) was given on December 2008 and came into force at the beginning of 2010.

Thermal losses from buildings have traditionally been controlled by the regulatory framework. The Minister of Housing has announced that, in 2012, Finland will introduce a regulation based on overall energy consumption, which will take account of the energy source (primary resource factor). Proposals for new energy efficiency requirements have been developed and a public consultation took place in October 2010. After this process is completed and the requirements are finalised, they will enter into force at the beginning of 2012.

Reference values for maximum heat loss	Year 1976	1978	1985	2003	2007	2010
Wall, U-value (W/m²,K)	0.40	0.29	0.28	0.25	0.24	0.17
Roof, U-value (W/m²,K)	0.35	0.23	0.22	0.16	0.15	0.09
Floor, U-value (W/m²,K)	0.40	0.40	0.36	0.25	0.24	0.16
Window, U-value (W/m²,K)	2.1	2.1	2.1	1.4	1.4	1.0
Door, U-value (W/m²,K)	0.7	0.7	0.7	1.4	1.4	1.0
Air-tightness, n50 (1/h)	6	6	6	4	4	2
The yearly exhaust air heat recovery efficiency	0 %	0 %	0 %	30 %	30 %	50 %
Thermal transmittance (W/K) [1]	***2017***	***1905***	***1879***	***1367***	***1353***	***917***
Change 1976 =100	*0 %*	*-6 %*	*-7 %*	*-32 %*	*-33 %*	*-55 %*
The EPDB-effect					*-1 %*	*-33 %*

[1]A typical 3-floor apartment house design in Finland

Other impacts

Since an energy certificate must be appended to a building permit application submitted to municipal building inspection authorities, in essence, energy certificates have been issued for all new buildings since early 2008.

The Ministry of the Environment maintains a monitoring system for energy certificates and has compiled information on these certificates from municipal building supervision authorities. Statistics indicate that new detached houses have significantly better energy efficiency than required by the building code. Over 50% of all detached houses built in 2009 were in energy class A or B, while a house in classes C or D would comply with the standards set in the building code.

Other new buildings were not as energy-efficient as detached houses. Instead, they mainly complied with building code standards: the vast majority fall into energy class C or D. Although construction complied with regulations in general, development projects increasing the share of passive houses and nearly-zero energy houses have become remarkably more common in recent years.

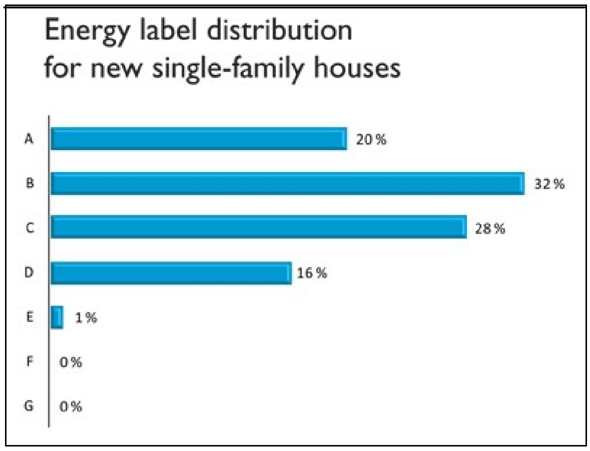


Figure 7. Energy class distribution for new single-family buildings, year 2009.

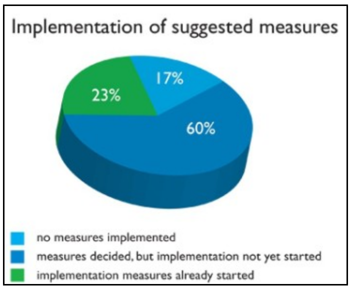


Fig. 8. Implementation of suggested measures

A survey of real estate sector professionals conducted in late 2009 revealed that the majority of them regarded the energy certificate as a clear and easily understandable tool for enhancing the energy efficiency of buildings. Moreover, the price of an energy certificate was considered reasonable. Although energy certificates had been compulsory for existing buildings for less than a year, proposals for energy saving measures have been well implemented in practice (Figure 8).

8 > Conclusions and future planning

Energy efficiency requirements for new buildings were strict in Finland, even before the implementation of the EPBD, which has rendered them even stricter. The major challenge for 2011 is to prepare operators in the sector for the change due in 2012, through which the emphasis of the building code will shift to overall energy consumption and the requirement to take account of the energy source.

The Ministry of the Environment has commenced the implementation of the recast of the EPBD. This will require new legislation, as well as a large number of reports, analyses and development projects. The further development of a building code applicable to new buildings, and nearly zero-energy buildings, will be promoted as a follow up to the building code reform now in progress.

The preparation of energy efficiency requirements for renovation has begun. Identifying well-functioning solutions for different buildings and various renovation projects will be challenging. Another major task lies in the development of energy certificates and a more extensive monitoring system.

Summing up, developing the measures required for recasting the EPBD into cost-efficient, attractive national procedures from the viewpoint of buildings' end-users, is challenging. In the future, more training and communication is required on new issues, both for consumers and building and real estate sector professionals.

Finland has still to implement a few legal reforms to enhance the short-term implementation of the former EPBD. Premises of public authorities providing public services and with more than 1,000 m^2 will be required to display energy certificates. The Act on Inspection of Energy Efficiency of Air-conditioning Systems' Cooling Equipment has been amended in order to reduce the interval between periodic inspections from ten to five years. These two new legal reforms have been approved by the Parliament and will take effect in the beginning of March 2011.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in France

Status in November 2010

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RÉPUBLIQUE FRANÇAISE

Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer

France

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1 > Introduction

The Energy Performance Certificate (EPC) aims at making people aware of economic and environmental issues with regard to energy saving in buildings. Most developments took place in France before the last report was published in March 2008. Concerning EPCs, minor modifications have been made in texts after March 2008. Furthermore, the new thermal regulation for major renovations (in buildings over 1,000 m²) was set out in June 2008. In addition, the TH-CE-ex calculation method for existing buildings was developed in August 2008. Labels for buildings renovated and a zero percent rate eco-loan have been established, in order to boost renovations that concern 75% of all existing buildings. On the 12th of July 2010, the revision of the current legislation (called *Grenelle II*) was signed to accommodate the requirements of the recast of the EPBD in 2010, and to improve the certification process, based on the experience from the last 3 years. Finally, France finished setting out the regulation on the inspection of boilers in October 2009, and on inspection of air conditioning systems in April 2010. In this way, France has completed the implementation of the first EPBD, and is already preparing the transposition of the recast.

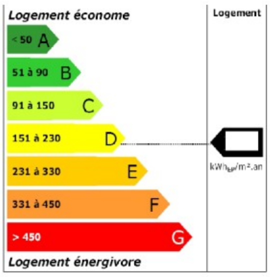
This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in France. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

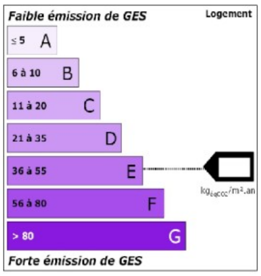
Certification of buildings

The implementation of the EPBD in France is the responsibility of the Ministry of Ecology, Energy, Sustainable Development and Sea. After the parliamentary vote, the French Government published the programme law defining the scope of the energy policy on the 13th of July 2005, regarding the main points for the transposition of the EPBD into French legislation. The execution orders are the responsibility of the Government.

The implementation of the certification activity has been transposed into French legislation through the Building Code (amended by laws in 2005 and an ordinance in 2006). The Certificate is called "*Diagnostic de Performance Energétique*" (DPE) in French.



Energy Label



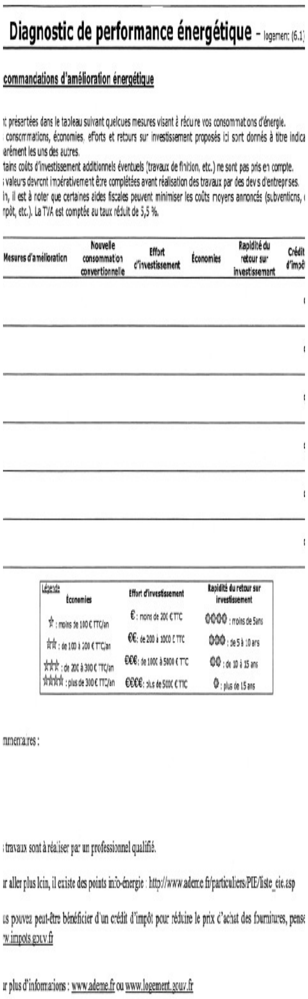


Figure 2. Recommendations for improving the energy performance of buildings.

Different texts define the scope of the Energy Performance Certificate

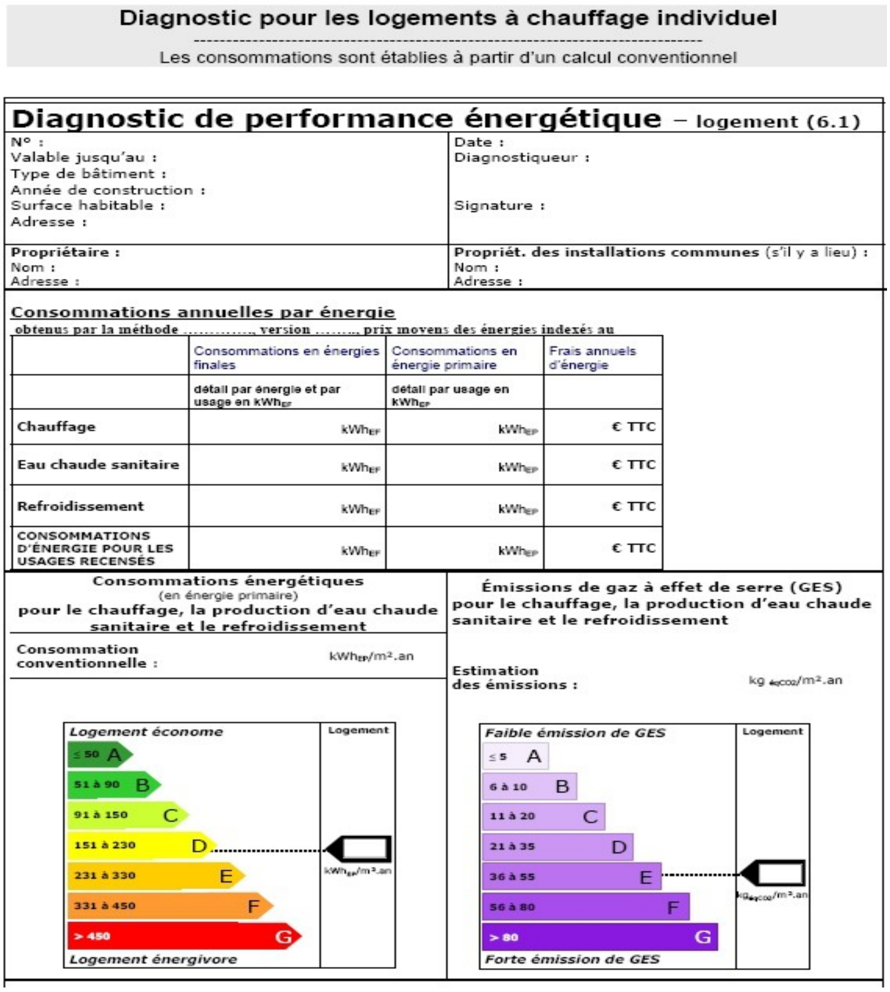
- existing buildings for sale, decree of the 15th of September 2006,
- housing for rent, decree of the 3rd of May 2007,
- new buildings built, decree of the 21st of September 2007,
- display of EPC in public buildings, decree of the 7th of December 2007.

The Energy Performance Certificate

This document defines the following aspects of a building:

- energy consumption of the dwelling or building,
- impact of this consumption on greenhouse effect.

Also, on the first page it shows the calculated or measured consumption of heating, cooling and domestic hot water, expressed in final and primary energy, and the corresponding annual costs.


Diagnostic pour les logements à chauffage individuel

Les consommations sont établies à partir d'un calcul conventionnel

Diagnostic de performance énergétique – logement (6.1)

N° : Valable jusqu'au : Type de bâtiment : Année de construction : Surface habitable : Adresse :	Date : Diagnostiqueur : Signature :
Propriétaire : Nom : Adresse :	Propriét. des installations communes (s'il y a lieu) : Nom : Adresse :

Consommations annuelles par énergie
obtenus par la méthode ...., version ...., prix moyens des énergies indexés au

	Consommations en énergies finales	Consommations en énergie primaire	Frais annuels d'énergie
	détail par énergie et par usage en kWh_{EF}	détail par usage en kWh_{EP}	
Chauffage	kWh_{EF}	kWh_{EP}	€ TTC
Eau chaude sanitaire	kWh_{EF}	kWh_{EP}	€ TTC
Refroidissement	kWh_{EF}	kWh_{EP}	€ TTC
CONSOMMATIONS D'ÉNERGIE POUR LES USAGES RECENSÉS	kWh_{EF}	kWh_{EP}	€ TTC

Consommations énergétiques (en énergie primaire) pour le chauffage, la production d'eau chaude sanitaire et le refroidissement	Émissions de gaz à effet de serre (GES) pour le chauffage, la production d'eau chaude sanitaire et le refroidissement
Consommation conventionnelle : $kWh_{EP}/m^2.an$	Estimation des émissions : kg $_{éqCO2}/m^2.an$

Figure 1. Cover page of the EPC.

The energy label classifies buildings on an energy consumption scale ranging from A (low energy consumption, high efficiency) to G (high energy consumption, poor efficiency).

The real benefit of Energy Performance Certification is in the recommendations given to the building owner. These are summarised on the last page (#4) of the certificate.

As shown in Fig. 2, suggested improvements include a short description, estimates of costs, savings and paybacks, and the impact on the energy rating, if all measures were to be implemented. The qualified expert makes recommendations after studying the case of the specific building.

The validity of energy certificates is 10 years.

The basic calculation methodology for the Energy Performance Certificate (EPC) is called 3CL (Conventional Consumption Calculation in Housing). For cases such as the certification of buildings built before 1948 or non-residential buildings, the certificate is produced based on measured consumption. It includes heating, cooling and DHW needs. This methodology is the minimum required, but experts also have the choice of using a dynamic calculation method, in order to get more accurate results.

The Ministry provides the 3CL method but, to be used, an interface has to be added to include all the conditions of legal texts. Developers have been invited to have their software assessed by a committee, in order to advertise software that is assessed as good quality.

Certificate for rented buildings

Since the 1st of July 2007, certification is compulsory when dwellings or buildings (only residential) are rented in France, except for the ones in overseas areas. From this date, the certificate has to be available to the owner, and provided by the owner to each prospective tenant, when the building or parts of the building are rented. The French Government published the corresponding regulations in May 2007.

Certificate for new buildings

Certification is obligatory for all new buildings with a building permit required after the 1st of July 2007. In December 2007, the French Government published regulations to define the implementation of the EPC. Energy consumption is calculated according to the new building regulation. The energy and climate scales are the same as those for the sale and rental of existing buildings. The table below summarises the method required in each case:

	Individual houses		Apartment buildings		
	Built before 1948	Built after 1948	Common heating source or hot water production	Individual heating source: Built before 1948	Individual heating source: Built after 1948
Sale	Invoices	Calculation	Invoices	Invoices	Calculation
Rental	Invoices	Calculation	Invoices	Invoices	Calculation

Certificate for public buildings

Since the 2nd of January 2008, certificates have to be displayed in public buildings over 1,000 m². In March 2007, the French Government published the decree and in December 2007 the order regulations, in order to define the implementation of the Energy Performance Certificate. For all public buildings, energy consumption is evaluated based on the energy use invoices of the last 3 years. The expert has to make recommendations for improvements, and also for better management of the building and its equipment. These recommendations are intended for the administrator of the building or for the occupants.

There are 3 different energy scales for public buildings, depending on the function performed therein and the body occupying the building: (1) administrative and educational buildings (2) buildings open 24 hours a day, e.g., hospitals, and (3) other buildings, for example museums, libraries, sports halls. In France, a public building is defined as a building occupied by a governmental body. Each public building larger than 1,000 m² is required to display an energy certificate at a conspicuous place. The occupant of the building is responsible for displaying the certificate.

The cost of a certificate, depending on the type of property to be assessed, is as follows:

Type	Studio/F1 F1bis	2 room apartment	4 room apartment	3 room house	5 room house
Mean price [€]	80 / 110	90 / 120	100 / 130	110 / 150	120 / 160

Quality assurance (QA)

The government has set up a mandatory QA scheme. It includes three stages, as shown in the following figure:

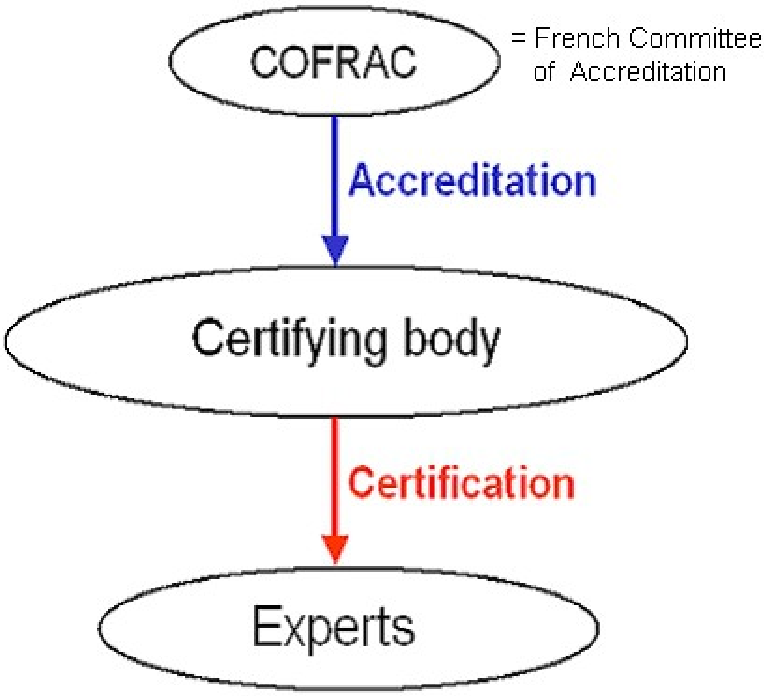


Figure 3. Quality assurance scheme.

To deliver Energy Performance Certificates, experts have to be certified by an accredited body. This body is accredited by the French committee of accreditation (COFRAC). It establishes the reference content that each certification expert has to respect. The training of experts is assessed in two exams: through a theoretical exam (multiple-choice questionnaire) and a practical exercise. No educational or experience background is required. Certification is valid for five years. Thus, every five years, the expert has to be re-certified. The certification body has to check at least ten reports, representative of the expert's work, during the first three years of the expert's activity. He/she must verify that each point of the regulation is respected. If some fields in the EPC are not correctly filled, the certification body can temporarily or permanently withdraw the expert's certification.

If someone who requests that an expert issues an EPC realises that the expert did not perform the work conscientiously, the certification body can be notified, which can then apply sanctions, if the complaint is justified.

A central archive for Certificates is under development. It will provide many statistics on the energy performance of the French building stock, which is an important step in running an efficient energy policy. Also, it will help certification bodies to check the proficiency of experts by reviewing the reports provided online and collecting complaints. For now, 4 million EPCs have been issued.

Decrees on boiler inspections:

- Décret n° 2009-649 du 9 Juin 2009 relatif à l'entretien annuel des chaudières dont la puissance nominale est comprise entre 4 et 400 kilowatts
- Arrêté du 15 Septembre 2009 relatif à l'entretien annuel des chaudières dont la puissance nominale est comprise entre 4 et 400 kilowatts
- Décret n° 2009-648 du 9 Juin 2009 relatif au contrôle des chaudières dont la puissance nominale est supérieure à 400 kilowatts et inférieure à 20 mégawatts
- Arrêté du 2 Octobre 2009 relatif au contrôle des chaudières dont la puissance nominale est supérieure à 400 kilowatts et inférieure à 20 mégawatts
- loi du 5 Juillet 1996 sur l'artisanat

Inspection of boilers

In 2008, the "*Grenelle de l'environnement*" included the new provision of advice to the users of small boilers, during the already required annual maintenance of boilers, and the strengthening of the maintenance procedure, instead of setting a periodic inspection of boilers, in addition to the annual maintenance.

Therefore, France has chosen option b) in implementing article 8 of the EPBD, with:

- Provision of advice during periodic inspections:
  - For boilers from 4 to 400 kW: advice to the users on the replacement of the boiler, other modifications to the heating system and on alternative solutions, given during the required annual maintenance of the boiler
  - For boilers from 400 kW to 20 MW: periodic control, every 2 years, and advice from ADEME on energy management
- Provision of advice on the most efficient heating systems, improvement of the energy performance of buildings, and financial incentives.

The French regulation on boilers has been **applied since the 31st of October 2009.**

	Annual maintenance	Periodic control
Power	From 4 to 400 kW	From 400 kW to 20 MW
Fuels	For all boilers (gas, oil, biomass, multi-combustibles)	For gas and oil boilers
Frequency	Every year	Every 2 years
Report	An attestation of maintenance, with advice to the users, must be delivered, within 15 days after the visit.	A report of control must be delivered, within 2 months after the visit.

The annual maintenance of boilers from 4 to 400 kW

To perform the maintenance, professionals must be qualified, according to the law of the 5th of July 1996 (see column on left). The decrees specify what the professional must do:

- Check the boiler and, if necessary, clean it and tune it
- ***Measure the concentration of carbon monoxide (CO)***
- ***Evaluate the energetic and environmental performance of the boiler***:
  - Evaluation of the energy efficiency of the boiler, which is compared to the energy efficiency of the best boilers available on the market today;
  - Evaluation of the polluting emissions of the boiler, which are compared to the emissions of the best boilers available on the market today (NO_x for gas and oil boilers, VOC and particulates for biomass boilers).
- ***Provide advice***: best use, improvement of the boiler and of the heating system in place and, if necessary, advice on the replacement of the installation.

A certificate of maintenance should be issued within 15 days after the visit. The certificate shall contain the results of the measurements and evaluations listed above, and include recommendations on best use and the improvement of the heating system in place and, if necessary, advice on the replacement of the installation. The reports are not collected in a central database.

The periodic control of boilers with output of 400 kW to 20 MW

To perform the control, the professional must be qualified according to ISO standard 17020 "General for the operation of various types of bodies performing inspection".

The professional must control the requirements applicable to boilers with output between 400 kW and 20 MW:

- Compliance with minimum efficiency values
- Control devices required in connection with boiler equipment
- The boiler room manual

An inspection report should be issued, within two months after the inspection. The reports are not collected in a central database.

ADEME provides advice to the users for the replacement of boilers, other modifications and alternative solutions: subvention for energy audit of heating systems.

Inspection of air conditioning systems

Decrees on AC inspections:

- Décret n° 2010-349 du 31 Mars 2010 relatif à l'inspection des systèmes de climatisation et des pompes à chaleur réversibles
- Arrêté du 16 Avril 2010 relatif à l'inspection périodique des systèmes de climatisation et des pompes à chaleur réversibles dont la puissance frigorifique est supérieure à 12 kilowatts
- Arrêté du 16 Avril 2010 définissant les critères de certification des compétences des personnes physiques réalisant l'inspection périodique des systèmes de climatisation et des pompes à chaleur réversibles dont la puissance frigorifique nominale est supérieure à 12 kilowatts et les critères d'accréditation des organismes de certification

The French regulation on air conditioning systems has been in application since the 16th of April 2010. France has chosen to implement article 9 of the EPBD by enforcing the following points:

- inspection of air conditioning systems and reversible heat pumps with an output of 12 kW or more
- every 5 years
- person responsible for the inspection: the owner or the manager of the building
- inspectors are certified
- at the end of the inspection, a report is issued, with the results of the inspection and advice on best use, improvement of the A/C system in place and, if necessary, advice on the replacement of the installation.

	Periodic control of A/C systems
Power	From 12 kW and above
Frequency	Every 5 years
Report	An inspection report must be delivered within 1 month after the inspection.

The inspection should include:

- an assessment of the documentation;
- an assessment of the air conditioning efficiency;
- an assessment of the air conditioning sizing, compared to the cooling requirements of the building.

Standard EN 15240 was used as a basis for the methodology, but the methodology of inspection is fully described in the decrees.

An inspection report should be issued within one month after the inspection. The report shall contain the results of the assessments listed above, and include recommendations on best use and improvement of the A/C system in place and, if necessary, advice on the replacement of the installation. The reports are not collected in a central database.

The first inspection of air conditioning systems and reversible heat pumps with output from 100 kW and above should be performed before the 1st of April 2012. The first inspection of air conditioning systems and reversible heat pumps with output from 12 kW to 100 kW should be performed before the 1st of April 2013.

4 > Qualified Experts

Energy Performance Certificates

Qualified Experts are the only persons authorised to issue EPCs. As already stated, no educational or experiential background is required. The qualification is first based on a theoretical exam comprising a multiple-choice questionnaire. The questions address technical systems in buildings (heating, cooling, ventilation), architecture, products of construction, regulations, renewables, winter and summer comfort, etc. The practical exam aims at simulating a real certification of a building with the use of software, and requires that the examinee gives recommendations adapted to the building being assessed. Certification bodies are free to elaborate questionnaires, provided they include all fields listed above.

Qualified experts can act on a freelance basis or be integrated in public or private organisations. When experts are qualified, they can certify every type of building. In the future, France has planned to divide certification into two levels: one for unsophisticated buildings, such as detached houses or apartments, and another for complex buildings, such as tertiary or housing buildings.

At the end of 2010, there are about 4,000 Qualified Experts for issuing EPCs.

Inspection of air conditioning systems

To perform an inspection of A/C systems, experts have to be certified according to ISO standard 17024 "General requirements for bodies operating certification of persons" by an accredited body. This body is accredited by the French committee of accreditation (COFRAC: see Fig. 3). It establishes the reference content that each certification body has to respect.

Two levels of certification exist:

- the "simple systems" level: for the inspection of A/C systems and reversible heat pumps with output from 12 kW to 100 kW;
- the "all systems" level: for the inspection of all such systems, large or small.

To be certified, the candidate should pass two tests: a theoretical test (most of the time, this is a multiple-choice questionnaire) and a practical test. Certification is valid for five years. During this period, the certification body has to:

- check at least two reports per year;
- accompany the certified inspector during at least one of his/her on-site inspections.

Several websites funded in part by the Ministry are available, in order to collect all the information needed:

- *www.developpement-durable.gouv.fr*
- *www.rt-batiment.fr*
- *www.ademe.fr*

The inspector must verify that each point of the regulation is adhered to. If not, the certification body can temporarily or permanently withdraw the certification of the expert. If someone who requests a certified inspector becomes aware of the fact that he/she did not perform the work conscientiously, the certification body can be notified, which in turn can then apply sanctions, if the complaint is justified.

At the end of 2010, the certification bodies were still in the process of accreditation. Therefore, no inspector is yet certified.

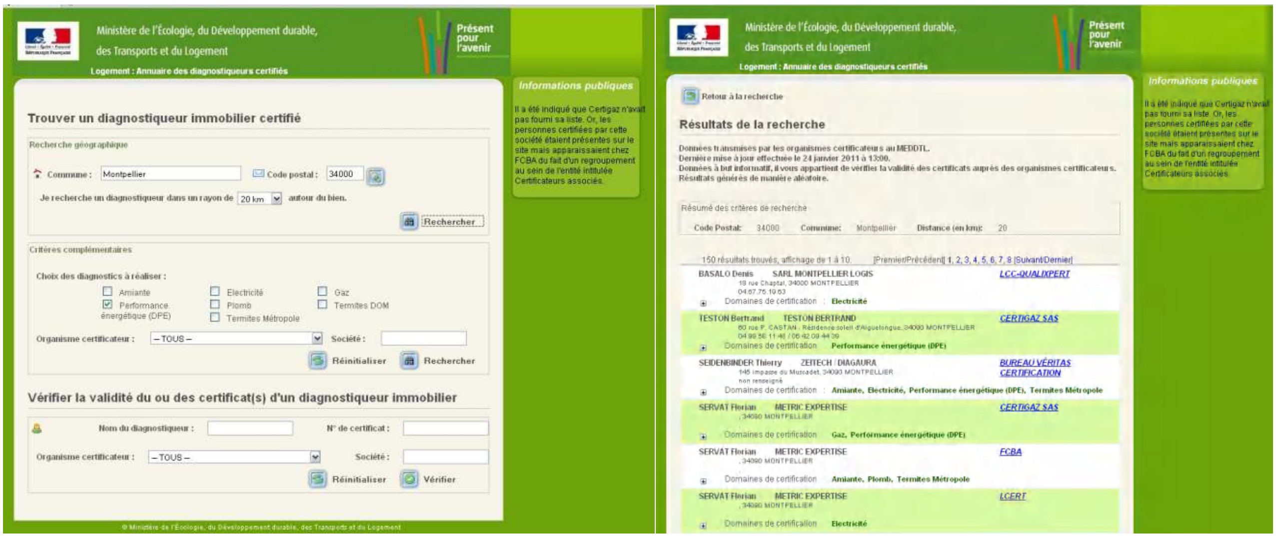
5 > National Information and Communication Campaigns

The need of informing citizens on certification

The Ministry has published guidebooks on several aspects of the regulations, such as Thermal regulation, EPC, financial incentives, and renovations, in order to make people aware of the link between the environment, energy and economy.

Two guidebooks for experts have been prepared to help them in preparing an EPC, in order to make the EPC more reliable: the first one is entitled "on-site inspection guide", and the second "recommendations". With the help of these two guides, experts are able to propose appropriate solutions for improving the energy performance of buildings.

A directory of persons certified to issue EPCs has been set up to make this information available to the public. In this way, it becomes very easy to find a certified person for someone who needs an EPC, and to have the validity of the certification checked.



Directory of experts
(diagnostiqueurs.application.developpement-durable.gouv.fr/index.action)

www.developpement-durable.gouv.fr

Communication on the new provisions regarding the annual maintenance of boilers

A guide for the public was prepared by the Ministry, together with the French energy agency (ADEME), in order to explain the new provisions regarding the annual maintenance of boilers. It can be downloaded, free of charge, from the Ministry's website. On the same website, in the section «Energy and Climate Change», there are articles dedicated to the new regulation, with links to the official texts, explaining the new provisions of the regulation.

A guide for professionals was prepared by the association «*Énergies et Avenir*», an association of professionals dedicated to the promotion of heating systems using hot water. It was presented to the press in December 2009. The associations and trade unions of professionals organised information meetings, in order to present the next regulation and the guide. Download is free of charge from the website *www.energies-avenir.fr*

National communication campaigns

The Ministry and ADEME disseminate information on:

- the most efficient boilers and on the financial incentives to improve or to replace the boiler or the heating system
- the improvement of the energy performance of buildings and
- financial incentives

Moreover, a national network to inform and advise individuals was organised and has been in operation since 2001 by ADEME and local authorities: «*Espaces Info Energies*». In 230 locations all around the country, around 400 trained advisers give information on energy efficiency and renewables sources at the local level.

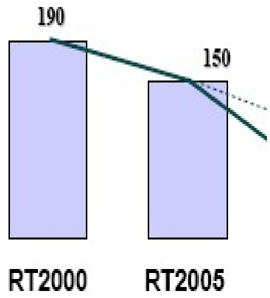
6 > National incentives and subsidies

In France, fiscal benefits were set up in 2005 to encourage people to build and renovate buildings, which take the environment and energy saving into account.

The sustainable development tax credit (*Crédit d'Impôt Développement Durable*) incites citizens to install very high energy performing equipment in new and existing buildings. A single person can be reimbursed an amount of 8,000 €, and a couple 16,000 €.

The zero percent eco-loan (*éco-prêt à taux zéro*) aims at financing energy renovation. If people order two types of work, they can receive a zero percent loan for 20,000 €, and 30,000 € for three types of work.

The Government has reduced the tax for energy renovation in existing buildings from 19.6% to 5.5%, in order to encourage renovations.



Evolution of mean final energy consumption of housing

Since 2006, France has implemented a white certificates scheme. For a given period, each energy supplier has an energy saving obligation corresponding to its market share. When an energy supplier implements energy saving measures for energy consumers, it receives a white certificate. Energy savings can be carried out by each energy supplier in all sectors (residential, tertiary, agriculture, industry, transports, etc.): in the first period (mid 2006 to mid 2009), 91% of energy savings were carried out in the residential and tertiary sectors (new boilers, insulation of buildings, etc.). At the end of the period, each energy supplier must demonstrate the fulfilment of its obligation, by providing the corresponding amount of white certificates: an energy supplier failing to do so receives a financial penalty. White certificates may be freely traded.

Energy providers propose a good return rate for the energy produced by the public and professionals installing renewable energy source harvesting equipment. This financial incentive aims at boosting the integration of renewables into buildings.

Other local financial incentives exist to allow people to gain access to low energy consumption buildings.

7 > Impact of the EPBD at national level

Evolution of Minimum performance requirements in building regulations

The new thermal regulation (RT2005), according to the EPBD 2002/91/EC, took into account:

- air conditioning installation;
- built-in lighting installation;
- active solar systems and other heating and electricity systems based on renewable energy sources;
- combination of heat and power;
- natural lighting.

The inclusion of the above elements and the reinforcement of other requirements brought about a 20% tightening of the regulatory requirements for new buildings between 2000 and 2005. Thermal regulations have also been set out for existing buildings, when they undergo renovation or extension.

Other impacts

The creation of EPC brought a step change to the market and created improved awareness of energy efficiency in the population.

8 > Thermal Regulation

Requirements for new buildings

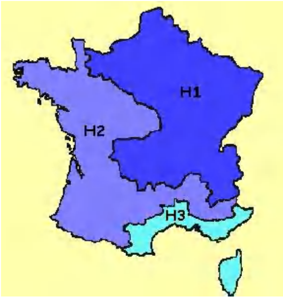
On the 24th of May 2006, the French Government adopted the minimum requirements for new buildings. The requirements came into force for building permits requested after the 1st of September 2006.

The type and level of requirements are governed by the function of the type of building (dwellings, office buildings, schools, etc.) and may cover:

- Maximum U-values for windows, walls, roofs and ceilings;
- Requirements on average insulation level;
- Maximum primary energy consumption per m^2 of floor area;
- Maximum interior temperature in the summer.

Maximum consumption expressed in primary energy for heating, cooling and production of sanitary hot water in new residential buildings

Type of heating	Climatic zone*	Maximum consumption
Fossil fuels	H1	130 kWh primary/m^2/year
	H2	110 kWh primary/m^2/year
	H3	80 kWh primary/m^2/year
Electric heating (including heat pumps)	H1	250 kWh primary/m^2/year
	H2	190 kWh primary/m^2/year
	H3	130 kWh primary/m^2/year



* the climatic zones are defined in the decree (H: North, to H3: Mediterranean zone)

In France, it is considered that:

- 1 kWh primary = 2.58 kWh final, for electric energy;
- 1 kWh primary = 1 kWh final, for other energy sources.

Specifically, the calculation procedure includes:

- Influence of climate;
- Position and orientation of building, including outdoor climate;
- Passive solar systems and solar protection;
- Indoor climate conditions, including the designed indoor climate;
- Active solar systems and other heating and electricity systems, based on renewable energy sources;
- Natural lighting.

The calculation method includes CEN standards. For example, the calculation of maximum losses in electric water with accumulation heaters has to respect European standards NF EN 60 338-1 and NF EN 60 335-2-21. Accumulators and gas water heaters must have thermal performance at least equal to European standards: EN 89 for gas accumulators, and EN 26 for water heaters with instantaneous production. Also, the reference power of combustion generators is taken from European standards.

The Energy Performance Certificate issued after completion of the building constitutes proof of compliance.

Requirements for existing buildings

The implementation of the requirements for existing buildings has been introduced into French legislation through the Building Code (amended by law in 2005 and decree in 2007).

In May 2007, the French Government adopted the minimum requirements for the installation of new building components, during building renovation, and for extensions to existing buildings, which came into force on the 1st of November 2007. In particular, they concern:

- Boilers fired by non-renewable liquid or solid fuel;
- Electric heating systems;
- Air conditioning systems;
- Hot water production systems;
- Windows and glazed walls (openable or non-openable);
- Energy production equipment using renewable energy sources;
- Insulation materials of opaque walls;
- Ventilation systems;
- Lighting systems.

In general, the minimum requirements are the same as those applying to new buildings.

Component	Climatic zone	Minimum requirement
Insulation materials of external opaque walls	H1, H2	R* = 2.3 m^2K/W
	H3	R* = 2 m^2K/W
Glazing	H1, H2, H3	U* = 2 W/m^2K For example : Double glazing with little emission or strengthened insulation
Boiler	H1, H2, H3	Minimal return from 89.0% to 90.9% for a nominal power from 20 to 400kW Minimal return over 90.9% for a nominal power over 400kW For example : low temperature boiler or condensing boiler

(* R : thermal resistance, U : coefficient of thermal transmission)

Table 1. Minimum requirements for some components.

Type of heating	Climatic zone	Maximum consumption
Fossil fuel, biomass, heat networks	H1	130 kWh primary/m^2/year
	H2	110 kWh primary/m^2/year
	H3	80 kWh primary/m^2/year

Table 2. Maximum consumption expressed in primary energy for heating, cooling and production of sanitary hot water in existing residential buildings

These requirements for fossil fuel heating are the same as those for new buildings. The required performance levels for electric heating are less demanding. During major renovations (or building units in new buildings or major renovations), buildings must achieve at least a B^- rating, to be approved at the planning stage before construction begins. This requirement started on the 1^{st} of July 2007 for renovated buildings larger than 1,000 m^2, and on the 1^{st} of July 2008 for every renovated building, large or small.

As of January 2009, all **existing** residential and non-residential **buildings** need to be certified when they are sold or rented. The owner must present a valid certificate to the buyer when the sale or rental contract is established. This involves a Qualified Expert visiting the property and assessing the building, in terms of the type of construction (walls, windows, insulation, thermal bridges, ventilation and air-tightness, etc.), and the type and quality of HVAC and hot water systems. The QE will then calculate the thermal efficiency of the building and issue the Certificate. There is no minimum requirement for an existing building, i.e., it can be labelled A through G.

If the building is larger than 1,000m^2, then the renovation has to respect an overall consumption, with minimum requirements on each piece of equipment.

9 > Conclusions and future planning

The EPBD requirements for new buildings and major renovations will certainly bring important energy savings in the near future, although new and renovated buildings only represent a small share of the entire building stock.

To achieve real energy savings in the building sector, significant incentives towards the improvement of existing buildings are needed, and certification can play a fundamental role. The recommendations made by the experts in the certificate are important guidelines that the owner of the building can make good use of, either in the context of a renovation, or as an individual cost-effective measure. Financial concerns about the investment cost in using energy efficient technologies are a major barrier, though.

Experts and the calculation method are now under criticism in France. The problem is that experts are not adequately qualified. The French Ministry had first thought, however, that if experts were highly qualified, the cost of an EPC would have been too high. Also, the calculation method is criticised because it includes too many conventional scenarios and is too simple and, thus, too far from reality. Therefore, the challenge is to increase the competence level of professionals and use a more reliable calculation method. To reach these goals, France is first of all launching a study to increase the number of data that the experts have to enter into the software from 30 to 60, and in this way decrease the number of default parameters. In this way, a higher level of competence will be required, in order to become an expert, in addition to a solid background in the building domain.

A decree has just been published to enforce the requirement of the EPC being displayed in all advertisements (in newspaper, on the Internet, and in the professional field).

The decree concerning the requirement of collecting all EPCs in a database is nearing completion. The statistics from these collective data will support the Government's energy policy. In addition, the texts on the EPC have to be reviewed, in order to be more widely understandable.

Moreover, a new thermal regulation, RT-2012, has recently been set out, regarding the energy performance and environmental quality of new buildings. It mandates that all new residential buildings must need less than 50 kWh of primary energy per m^2 per year. The text has to undergo some minor modifications before being put into effect on the 1st of January 2013. For non-residential buildings, the text is already in force.

In conclusion, France completed the implementation of the 2002 EPBD and is already at an advanced stage for transposing the recent recast EPBD.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Greece

Status in November 2010

G. Markogiannakis

G. Giannakidis

L. Lampropoulou

Centre for Renewable Energy Sources and Saving (CRES)

ΚΑΠΕ
CRES

Greece

National websites:

- *www.buildingcert.gr*
- *www.cres.gr*
- *www.ypeka.gr*

1 > Introduction

The implementation of the EPBD in Greece is the responsibility of the Ministry of Environment, Energy and Climate Change (MEECC). The law for the transposition of the EPBD was approved by the parliament in May 2008 (Law 3661 of the 19th of May 2008). A number of executing orders that were necessary for the implementation of the EPBD appeared as a Ministerial decision for the "Regulation of Energy Performance of Buildings" (KENAK) in April 2010 (Ministerial decision D6/B/5825 National Gazette 407/9th of April 2010). The Presidential decree necessary for the definition of the qualifications and training of energy auditors was published in the National Gazette in October 2010 (Presidential Decree 100/NG177/6th of October 2010). This was the last necessary legal document that had to be published in order to enable actual implementation of the EPBD in Greece.

The implementation and quality control of the scheme will be performed by the Energy Auditors Body, a public sector entity that was formed for this purpose.

This report presents the status of advancement of the implementation of the EPBD in Greece with respect to certification and inspection of systems, minimum requirements for new buildings, energy auditors' body, training, quality assurance, incentives and subsidies, and other related issues.

2 > Certification

Calculation procedures

The basis of the calculation procedure regulations according to the EPBD was set out in the Ministerial decision 407/April 2010. According to this, the reference building methodology is used. The reference building is defined as having the same geometry, orientation, use and operational characteristics as the building under consideration. Its difference is that it has a set of predefined thermal properties for the building shell, and a set of characteristics for the heating and cooling installations, hot water production and lighting (in the case of the tertiary sector).

The actual calculation procedure is based on the monthly methodology of EN13790, and a set of national parameters have been defined where necessary. The methodology covers heating, cooling, hot water for all buildings, plus lighting for commercial buildings. The assumptions and basic parameter calculations are described in a number of Technical Guidelines, published by the Technical Chamber of Greece in October 2010. These guidelines also include the climate files that should be used in the calculations, and thermal properties of building materials.

The classification of buildings in 9 classes is done according to the scale shown in Table 1. The category B corresponds to the minimum accepted category of new buildings and those undergoing major renovation. E.A. refers to the total primary energy consumption of the existing building and K.A. refers to the total primary energy consumption of the reference building. The reference building is defined as a building with the same geometrical characteristics as the building under consideration, which has specified characteristics for the U values of all the structural elements, as well as for the energy efficiency of heating, cooling and lighting installations.

Table 1 - Definition of energy classes

Category	Limits
A+	E.A. ≤ 0,33K.A.
A	0,33 K.A. < E.A. ≤ 0,50 K.A.
B+	0,50 K.A. < E.A. ≤ 0,75 K.A.
B	0,75 K.A. < E.A. ≤1,00 K.A.
Γ	1,00 K.A. < E.A. ≤ 1,41 K.A.
Δ	1,41 K.A. < E.A. ≤ 1,82 K.A.
E	1,82 K.A. < E.A. ≤ 2,27 K.A.
Z	2,27 K.A. < E.A. ≤ 2,73 K.A.
H	2,73K.A. < E.A.

E.A.: Primary Energy Consumption of the building under consideration
K.A.: Primary Energy Consumption of the Reference Building

Link to software download site:

http://portal.tee.gr/portal/page/portal/SCIENTIFIC_WORK/GR_ENERGEIAS/kenak/tee_kenak

A software tool was developed with funding from the Hellenic Technical Chamber. This can be used on its own and it is available to software companies, in order to integrate it into already existing tools. Any new software that comes into the market must be verified by the Department of Energy Audits, Ministry of Environment, Energy and Climate Change. The main criterion is that the software uses the computational engine developed by the Technical Chamber and produces the same results for a test case.

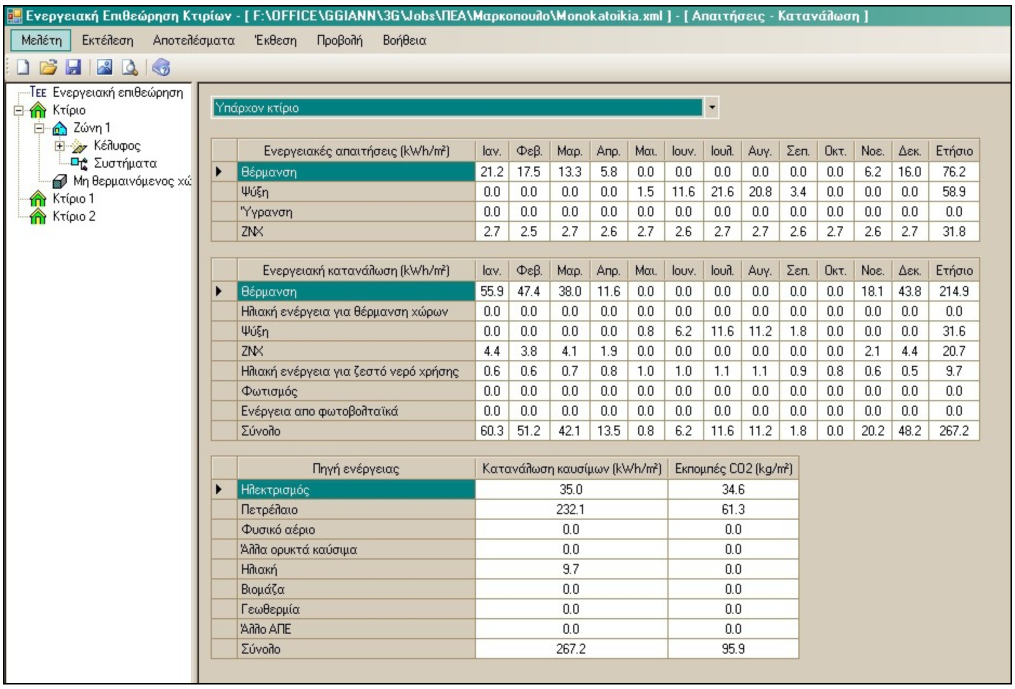
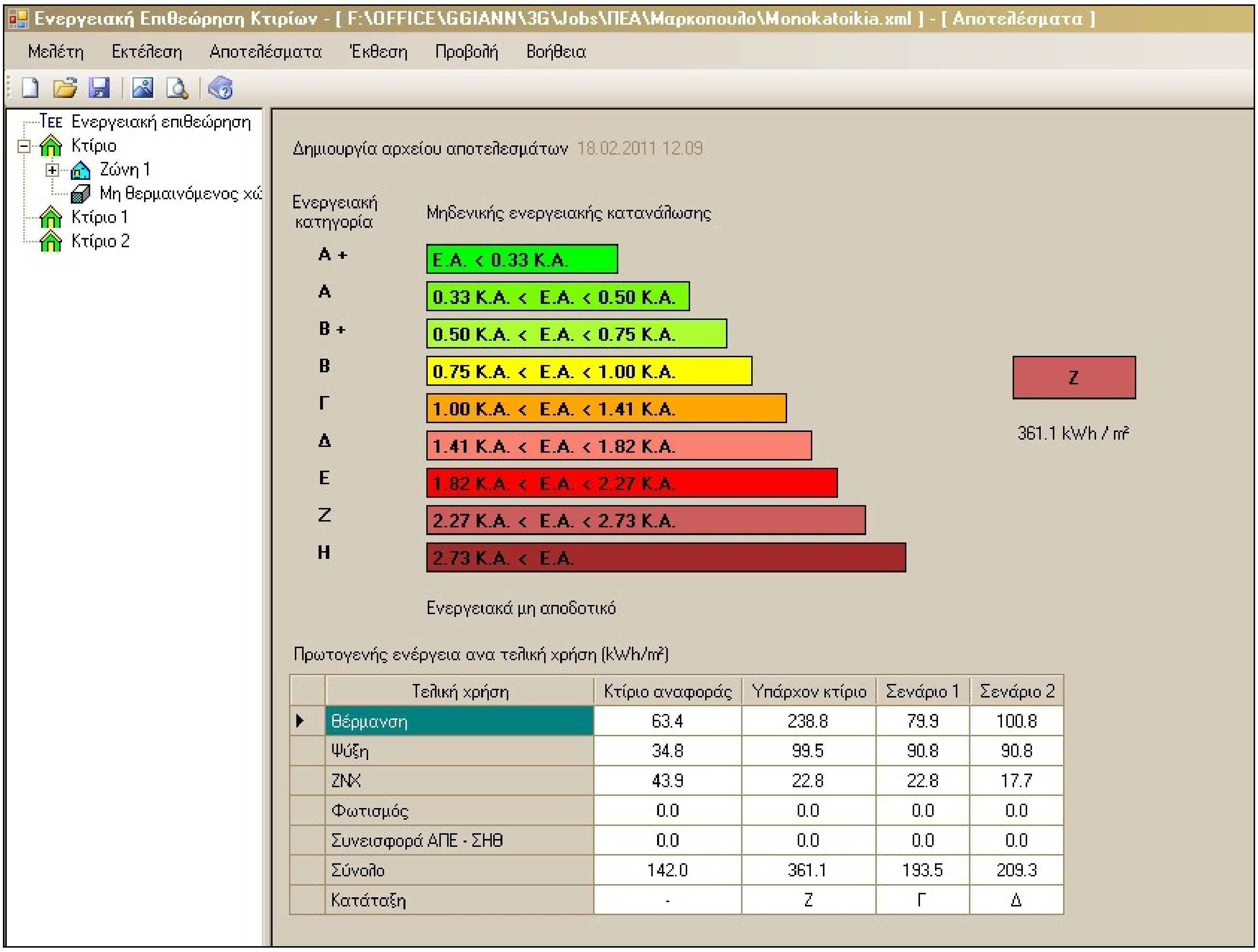


Figure 1 – Results presented in the software for the energy demand and consumption on a monthly basis.



Τελική χρήση	Κτίριο αναφοράς	Υπάρχον κτίριο	Σενάριο 1	Σενάριο 2
Θέρμανση	63.4	238.8	79.9	100.8
Ψύξη	34.8	99.5	90.8	90.8
ΖΝΧ	43.9	22.8	22.8	17.7
Φωτισμός	0.0	0.0	0.0	0.0
Συνεισφορά ΑΠΕ - ΣΗΘ	0.0	0.0	0.0	0.0
Σύνολο	142.0	361.1	193.5	209.3
Κατάταξη	-	Z	Γ	Δ

Figure 2 – Ranking results and primary energy consumption per use for the building.

Requirements for new buildings

According to the Regulation of the Energy Performance of Buildings, a set of minimum requirements are applied to new buildings. Therefore, all applications for building permits after the 1st of October 2010 must be accompanied by an Energy Study that proves that the building under planning is in compliance with these minimum requirements.

The type and level of requirements are a function of the type of building (dwellings, tertiary sector buildings) and cover:

- The design of the building, taking orientation, surrounding area, passive solar systems, natural ventilation, daylight etc., into account
- Maximum U-value for walls, windows, roofs etc., for each one of the four climatic zones in Greece. The main parameter used for the climatic zones is the annual heating degree-days
- Maximum value for the average U-value for the whole building
- At least 50% heat recovery in the central air-conditioning units
- Minimum levels of insulation of the heating and cooling distribution network
- At least 60% hot water production from solar panels.
- Minimum requirement for lighting installations in the tertiary sector buildings (55 lm/W).

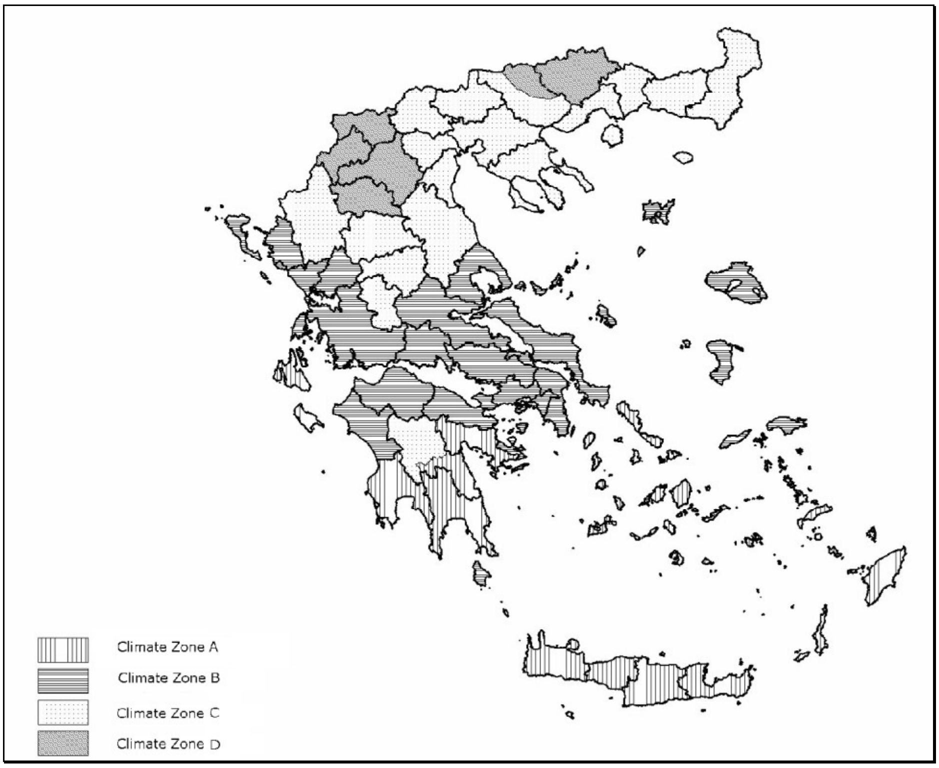


Figure 3 – Climatic Zones

The Energy study must prove that all new buildings are classified at least as B. After the completion of the construction, an energy audit is conducted and the energy certificate is issued. If the constructed building deviates from the design and is not classified at least as B, the owner must perform all necessary improvements within a year.

Requirements for existing buildings

Existing buildings undergoing major renovation should be upgraded in order to be classified at least as B.

Certification of buildings

The general certificate model to be used will be the A+ to H label. There are three categories above the B level, that is A+, A, and B+, in order to stimulate competition towards very efficient building designs in the future. On the first page of the certificate one can find:

- The basic data of the building (location, owner, building use, climatic zone, year of construction, total surface area, heated area).
- The classification which is done based on the primary energy consumption of the building compared to the primary energy consumption of a reference building.
- The calculated primary energy consumption of the building and of the reference building.
- The calculated CO2 emissions.
- The actual total energy consumption data and the consumption by energy carrier based on the bills available over the last three years, as well as the calculated CO2 emissions.
- An indication of the quality of thermal, visual and acoustic comfort and air quality.

On the second page of the certificate, there is space for presenting at least three recommendations specific to the building, for which the software calculates the energy savings, cost and payback period.

Figure 4 – Building Energy Certificate form

The certificate is issued by energy auditors, who are listed in the official registry of auditors (provisional for the time being), which is maintained by the Department of Energy Audits, Ministry of Environment, Energy and Climate Change. The database development and maintenance, together with the development and operation of the Energy Certificates database, is done by CRES.

The certificate is valid for ten years, unless the building undergoes major renovation, in which case a new certificate is required. All the certificates and the data used for the calculations are stored in a central electronic register, which is operated by CRES.

Certification is obligatory for **new buildings** with a building permit issued after the 1st of October 2010. The display of the certificate is compulsory for **public buildings** (public buildings are those used by public authorities, rented or owned).

The certificate is required as a legal document in the case of rental or sale of buildings after the 9th of January 2011.

3 > Inspection of boilers and air-conditioning

The new Energy Building Code and the Technical notes issued by the Hellenic Technical Chamber describe in detail the procedures for auditing boilers, heating systems and air-conditioning units. A considerable number of provisional Energy Auditors for the heating and cooling systems exist in the national registry. Audits can be performed at the moment using this procedure. However, it is not obligatory to perform these audits until July 2014. The details of the energy audit procedures are given below:

Boilers

Energy auditors should carry out audits of boilers using conventional fossil fuels as follows:

- - at least every five years for boilers with an effective nominal rated power between 20 kW and 100 kW;
- - at least every two years for boilers rated more than 100 kW for every fuel source, except natural gas (at least every four years).

Inspectors prepare a report assessing the thermal efficiency of the boiler and produce guidelines and recommendations to regulate, maintain, repair or replace, as necessary.

Boilers older than fifteen years and with a nominal power greater than 20 kW should be inspected once by an energy auditor together with the whole heating system, at a time and in accordance with the procedure defined in the regulation.

Inspectors draw a report assessing the efficiency of the boiler and its capacity in relation to the energy needs of the building, and give instructions and recommendations regarding the maintenance, replacement of the boiler system, and other alternatives.

Air-conditioning

Energy auditors should carry out audits of air-conditioning systems of buildings with a nominal power of more than 12 kW at least every five years. The inspectors shall report the efficiency and capacity of the installation of the air-conditioning system, in relation to the energy needs of the building, and provide appropriate guidelines and recommendations for improvement or replacement of the installation of the air-conditioning system.

The inspection reports for boilers and air-conditioning systems are submitted to the online central register of building certificates.

4 > Qualified Experts

The **Training of Experts** for Energy audits and the issue of EPCs is outlined in the new Regulation. The whole procedure foresees 120 hour training courses and exams, and is going to be organised by the Hellenic Technical Chamber, while training courses can also be carried out by other academic institutions, following the training programme elaborated and already defined by the Technical Chamber.

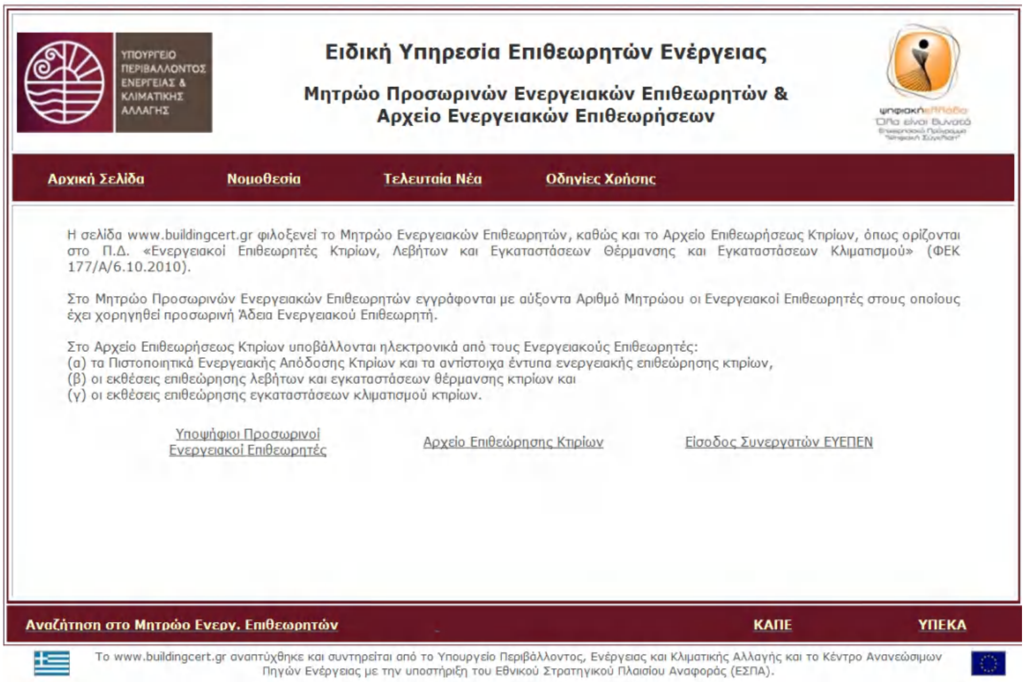
National registry for Energy Experts:

www.buildingcert.gr

After the exams, if successful, the experts will be registered in a National Registry for Energy Experts already developed by CRES. Qualified experts should be engineers and architects with at least 3 years of experience. Experts are distinguished in three categories of their own choice, i.e., for building inspections (60 hours of training), heating systems and/or A/C inspections (30 hours of training in each area). Depending on their academic background, they are also classified into two classes. Class A experts will be allowed to perform inspections and issue EPCs for buildings with heating and/or A/C installations up to 100 kW, while class B experts can perform inspections for all sizes of buildings and systems. Training courses will start at the end of 2010. The **Training of Trainers** is already under way since September 2010 and will be completed at the end of 2010.

In parallel, the National Database for EPCs and inspection reports has already been developed by CRES. The database will be operated by the Energy Auditors Body, created under the Ministry of Environment, Energy and Climate Change. Generation of EPCs and Quality check of EPCs will be done automatically by the system. Furthermore, random checks of EPCs will also be performed (approx. 2% of the total number of EPCs uploaded).

Inspectors responsible for incorrect inspections and EPCs will incur penalties, such as fines or temporary or even permanent suspension of their qualification, depending on the severity of error.



Link:

www.buildingcert.gr

Figure 5 - First page of the National Registry for Energy Auditors and Energy Audits

The initial page of the internet based platform for submitting EPCs can be seen above. This is the interface leading to the registry of auditors and the database of EPCs.

A Provisional Body of Experts is established in order for the EPC issuing procedure to start. This is also needed in the framework of a major National Programme, providing incentives for energy refurbishment of residential buildings (‘Energy Saving at Home’ - addressed to building stock constructed before 1980), which will be launched on the 1st of February 2011. These experts will be allowed to conduct energy audits for a limited time period of 18 months. Qualifications require an engineering or architecture degree and at least 10 years of experience, while no training or exams are required. A database for the registration of provisional experts is already developed by CRES (as mentioned above). Until the end of 2011, all the auditors in the provisional registry should undergo a training course and successfully pass exams.

5 > National Campaigns

The main campaign for the issue of EPCs is combined with the campaign of the ‘Energy Saving at Home’ programme, mentioned above. A number of radio and TV commercials, targeting the general public was launched from the Banks that are involved in the programme, providing information on the programme and presenting the Energy Performance Certificate.

The Ministry (MEECC) has produced a brochure which is shown in Figure 6, including general information on the energy efficiency of buildings, the Energy Certificate and the new Energy Building Code.

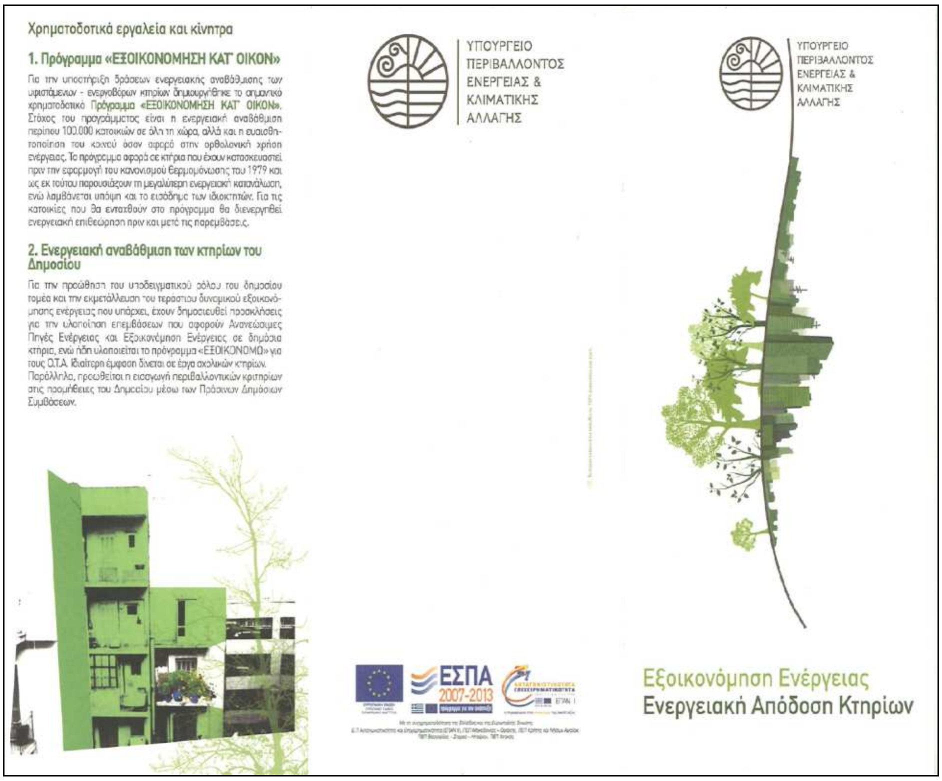


Figure 6 - Brochure for the initiatives of the Ministry (MEECC) on the Energy Efficiency of Buildings

6 > National incentives and subsidies

Links to the websites on the incentives:

http://exoikonomisi.ypeka.gr

Four major Energy Saving Programmes for buildings, providing incentives for implementation of energy efficient measures, have been prepared by the Ministry of Environment, Energy and Climate Change in relation to:

1 - Private houses
2 - Municipal Buildings
3 - Public Buildings
4 – Schools

Program "Saving at Home"

These four programmes require the issue of an EPC and/or audit procedures, according to the new Regulation.

'Energy Saving at Home', addressed to house/flat owners and providing direct subsidies (up to 30%) and low rate bank loans (covering the remaining share of the investment) for the renovation-Energy Performance improvement of existing buildings. An EPC is required before the implementation of measures and one after the implementation in order to prove that the EP rating was improved by two categories (i.e., a flat rated as H should be E after the implementation of measures).

'Save Energy' addressed to **Municipalities**, for buildings owned/used by municipal services, administration, schools and housing blocks (the process started in 2009, energy efficiency plans have been prepared and applied by Municipalities, the selection of the experts to evaluate the proposals has already been completed, and the evaluation of the plans is under way). An energy audit is required in the proposal submission phase and an EPC is required after the implementation of measures, in order to demonstrate the improvement of energy performance. The programme covers 100% of the expenses.

Energy Performance Improvement of Public Buildings. The Programme was launched in September 2010 – deadline for applications: March 2011. Audits according to the new Regulation are required for documenting the interventions. The programme covers 100% of the investment costs.

Energy Performance Improvement of School Buildings. The programme is under development. An EPC will be required after the implementation of measures. The programme covers 100% of the investment costs.

7 > Impact of the EPBD at national level

On the regulatory level, the requirements for issuing building permits, was updated, including the obligation of a Building Energy performance study.

The implementation of the EPBD added one more climatic zone to the three zones that were used before and changed the minimum requirements for the U-values according to the comparative table below.

As described in Section 2, the energy performance levels are expressed in relation to a reference building, which has prescribed characteristics. The U values prescribed are different for each climatic zone.

Minimum Requirements according to the new Regulation		U-value [W/m^2.K]			
		Climatic Zone			
		Α	Β	Γ	Δ
Roofs	U_{V_D}	0.50	0.45	0.40	0.35
External Walls	$U_{V\text{-}W}$	0.60	0.50	0.45	0.40
External Floors	U_{V_DL}	0.50	0.45	0.40	0.35
Floor over ground	U_{V_G}	1.20	0.90	0.75	0.70
External walls in contact with the ground	U_{V_WE}	1.50	1.00	0.80	0.70
Openings	U_{V_F}	3.20	3.00	2.80	2.60
Glass Facades	U_{V_GF}	2.20	2.00	1.80	1.80
Minimum Requirements according to the PREVIOUS Regulation		**U-value [W/m^2.K]**			
		Climatic Zone			
		Α	**Β**	**Γ**	
Roofs	U_{V_D}	0.50	0.50	0.50	
External Walls	$U_{V\text{-}W}$	0.70	0.70	0.70	
Floor over ground	U_{V_G}	3.00	1.90	0.70	
External walls in contact with the ground	U_{V_WE}	3.00	1.90	0.70	

8 > Conclusions and future planning

The full implementation of the EPBD started on the 9th of January 2011. Up to the end of 2010, the number of certificates issued exceeds 4,000, although for the time being an EPC is required only in case of new buildings or in the case of rental or sale of a whole building. The majority of certificates is issued for selling a property or for applying for the Programme 'Energy Saving at Home' (that offers incentives for energy refurbishment).

After the 9th of July 2011, issue of a certificate will be required also when renting part of a building (flats). This is expected to increase the number of issued certificates until the end of 2011 even more.

Law 3661/2008 has been modified according to the provisions of the EPBD recast, specifically:

- -the 1,000 m^2 limit has been removed,
- -60% of Domestic Hot Water production should be provided by Solar Thermal or Alternative Systems,
- -from 2020, all new buildings should cover their primary energy consumption using RES, CHP, District Heating or high efficiency Heat Pumps (for Public Buildings the provision is from 2015).

Programme "Building the Future":

http://www.cres.gr/kape/XTIZONTAS_TO_MELLON.pdf

A new, ambitious programme for the promotion of energy saving in buildings, called "Building the future" has been announced by the Ministry of Environment, Energy and Climate Change in November 2010 and is under development. The programme foresees specific interventions for refurbishing 154,000 buildings in total, until the end of 2014. The interventions in the households refer to replacing windows and glazing, installing insulation, replacing heating installations and installing solar thermal equipment. For the commercial sector buildings, the interventions focus on the installation of insulation, replacing of heating/cooling systems, improving the lighting systems, installing BEMS and improving building facades. The programme does not foresee financial incentives but is based on voluntary agreements for reduced prices, between the supply chain and the final consumers. The expected savings are estimated to be 14% of the energy consumption of the buildings that will participate in the programme.

Implementation of the EPBD in Croatia

Status in November 2010

Nada Marđetko Škoro

Ministry of Environmental Protection, Physical Planning and Construction

Croatia

National websites:

- *www.mzopu.hr*
- *www.mingorp.hr*

1 > Introduction

The Implementation of the EPBD in Croatia started in October 2008, with the publication of a revised regulation. Since the last report published in February 2009, many developments have taken place. In order to ensure that there are experts for the performance of energy certification of buildings, a tendering procedure was carried out. Based on this procedure, nine institutions were granted approval for carrying out training programmes. The Ministry has authorised more than 150 experts for the implementation of the energy certification in the period from April to November 2010. These authorised persons have also issued the first energy certificates.

A plan for the implementation of the recast of EPBD is under preparation. The revision process of the current legislation has been launched in order to accommodate its requirements and to improve the certification process based on the experience from 2010.

This report presents an overview of the current status of implementation and of the plans for the evolution of the implementation of the EPBD in Croatia. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

In Croatia, the implementation of the EPBD is the overall responsibility of the Ministry of Environmental Protection, Physical Planning and Construction (MEPPPC), together with the Ministry of Economy, Labour and Entrepreneurship.

The energy certificate, or the energy inspection of buildings for the purpose of issuing the energy certificate, may be prepared or carried out only by persons authorised by the MEPPPC. On the website of the MEPPPC, a list is available of authorised natural and legal persons, together with the authorisation's type and duration.

The Energy Performance Certificate

The Energy certification of buildings started in April 2010, with new residential and non-residential buildings.

The energy certificate contains general data on the building, data on the person issuing the energy certificate, the building's energy class, data on the thermal and technical systems of the building, data on climate conditions, data on energy demand, reference values, as well as a proposal on economically feasible measures for the improvement of the energy performance of the building, including a calculation of the period of return on the investment. For new buildings, recommendations are given on their use, with regard to the fulfilment of the essential requirements on energy efficiency, heat retention and energy performance of the building.

A proposal on measures for improving the energy performance of an existing building, or on recommendations regarding the use of a new building is developed for the specific building for which the certification is undertaken.

Energy certificates are valid for a period of 10 years. In the case of **new buildings,** one certificate is issued for the entire building, except in the case of a building with mixed designation, where a part of it is used for public purposes. In the case of buildings with several zones, energy certificates may be issued for the individual zones.

Energy certificates differ for residential buildings, non-residential buildings and non-residential buildings in which energy is used for achieving certain indoor conditions, but for which the designed indoor temperature does not exceed 18 °C in winter.

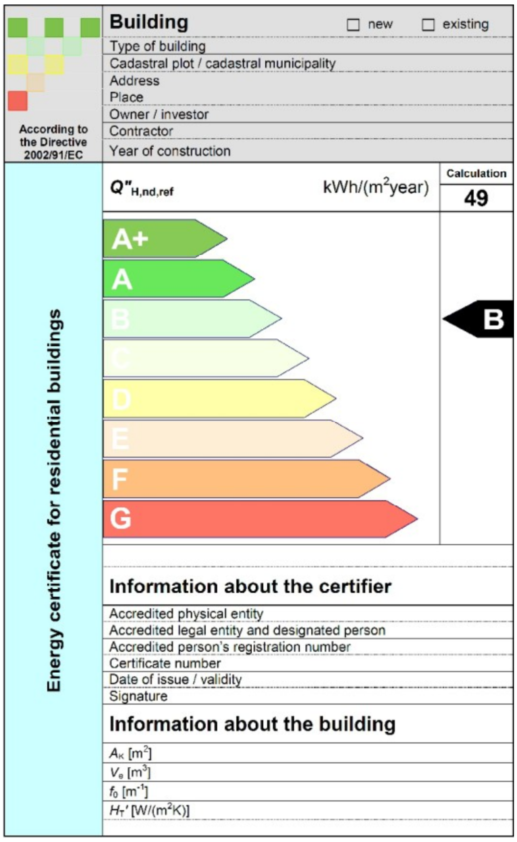


Fig. 1. Page one of the energy certificate for residential buildings

With regard to residential buildings and non-residential buildings, the energy label classifies the buildings on an efficiency scale ranging from A+ (high energy

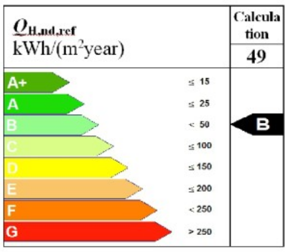


Fig. 2. Energy classes for residential buildings

Energy class	$Q_{H,nd,ref}$ – specific annual energy need for heating in kWh/(m²·year)
A+	≤ 15
A	≤ 25
B	≤ 50
C	≤ 100
D	≤ 150
E	≤ 200
F	≤ 250
G	> 250

Fig.3. Specific annual energy need for heating

efficiency) to G (poor efficiency). The energy class of the building is established on the basis of its calculated annual energy need for heating, based on reference climatic data calculated according to the HRN EN ISO 13790: 2008. For other non-residential buildings in which the designed indoor temperature does not exceed 18° C in winter, the energy class is not stated, but the heat transmission coefficients are indicated for those parts of the building which constitute its external envelope.

Residential buildings of the energy class A+ must have a specific annual energy consumption for heating under reference climate conditions smaller than or equal to 15 kWh/(m^2.year).

For all localities in the Republic of Croatia with 2,200 or more heating degree days per year, the annual energy demand is calculated on the basis of reference climate data for continental Croatia; for all localities in the Republic of Croatia with less than 2,200 heating degree days per year, the annual energy demand is calculated on the basis of reference climate data for littoral Croatia.

New buildings must achieve at least a C rating. New buildings applying for a construction permit after the 1st of April 2010 must have an energy certificate issued before the start of their use.

Existing buildings which are being sold or rented shall only be required to have an energy certificate on the day of Croatia's accession to full membership of the EU. However, if the existing building is undergoing a reconstruction with a significant effect on its energy performance, the owner may voluntarily require the issuance of an energy certificate before that date.

Public buildings having a total useful floor area exceeding 1,000 m^2 shall have an energy certificate issued and displayed within 36 months from the publication of the methodology for carrying out energy inspections of buildings (the methodology was published in June 2009). The public buildings are defined as non-residential buildings with a wide range of designations, and include: office buildings for administrative activities of legal and physical entities; buildings of administrative and other government bodies and local (district) government bodies; buildings of legal entities possessing public powers; courts of justice, prisons and barracks; buildings of international institutions, chambers and economic associations; banks, savings banks and other financial organisations; shops, restaurants and hotels; travel agencies, marinas and buildings for other service and tourist activities; buildings for railway, road, air and waterway transport, post offices, telecommunication centres, etc.; institutions of higher education and similar, schools, kindergartens, infant nurseries, student and pupil homes and similar, elderly homes and similar; buildings of sports associations and organisations, as well as sports facilities; buildings for cultural purposes: cinemas, theatres, museums, etc.; hospitals and other institutions for medical, social and rehabilitation purposes.

The public display of the first page of the energy certificate and of the page on which recommendations are listed is obligatory. It is recommended that these pages are enlarged to an A3 format. These pages must be displayed at a clearly visible place close to the main entrance of the building.

The energy class of a building is calculated on the basis of the carried out energy audit (in the case of an existing building), or on the basis of data from the main design (new buildings), respectively, and the following data are entered in the certificate:

- Type of building heating (local, by floors, central, remote heating sources)
- Energy source used for heating and production of sanitary hot water
- Type of cooling (local, by floors, central, remote sources)
- Energy source used for cooling
- Type of ventilation (natural, forced, with or without heat recovery)
- Type and manner of use of systems with renewable energy sources
- Percentage of renewable energy sources of the thermal energy necessary for heating
- Data on heat transmission coefficients of individual construction parts of the building.

Fig.4. Handbook for energy certification of buildings

<u>The calculation methodology</u> is described in the building regulations. The energy class of residential buildings is determined on the basis of the building's specific annual energy need for heating, with regard to reference climate data. In case of non-residential buildings, the energy class is determined on the basis of the relative annual energy need for heating, expressed in percentages as the ratio of the specific annual energy need for heating for reference climatic data and the allowed specific annual energy need for heating:

$$Q_{H,nd,rel} = Q'_{H,nd,ref} \;/\; Q'_{H,nd,dop} \;\times 100\ [\%]).$$

After the calculation of the energy rating, the authorised person sends the completed energy certificate in electronic format, as well as the Excel file containing the data required for the register to a designated e-mail address at the Ministry, where they are stored.

The obligation to provide an energy certificate lies with the investor in the case of new buildings, and with the owner in the case of existing buildings. Penalties for the investors or owners of buildings if they fail to provide the energy certificate, have not been prescribed so far.

By decision of the MEPPPC, the maximum price of energy certificates is prescribed. It depends on whether the certificate is issued for a new or an existing building, on the size of the building, and on its technical complexity.

MAXIMUM PRICES FOR CARRYING OUT ENERGY INSPECTIONS AND ISSUING ENERGY CERTIFICATES OF BUILDINGS																		
TYPES OF BUILDINGS		RESIDENTIAL BUILDINGS (INDIVIDUAL APARTMENTS AND BUILDINGS AS A WHOLE) AND NON-RESIDENTIAL BUILDINGS (BUSINESS, KINDERGARTENS, SCHOOLS, HOMES, HOTELS)										RESIDENTIAL BUILDINGS (EXTREMELY COMPLEX BUILDINGS WITH COMPLEX INSTALLATION SYSTEMS AND SEVERAL TEMPERATURE ZONES)						
		> 50 m²	≤ 250 m²	APARTMENT IN A BUILDING	≤ 400 m² and agricult. ≤ 600 m²	1.000 m²	5.000 m²	10.000 m²	20.000 m²	50.000 m²	> 50.000 m²	1.000 m²	5.000 m²	10.000 m²	15.000 m²	20.000 m²	50.000 m²	> 50.000 m²
NEW BUILDINGS	INSPECTION OF DOCUMENTATION AND (AS NEEDED) INSP. OF THE BUILDING AND ENERGY CERTIFICATE ISSUANCE	LUMP-SUM: 1.400 kn			LUMP-SUM: 1.750 kn	2.300 kn	6.200 kn	9.400 kn	14.300 kn	26.400 kn	LUMP-SUM: 31.700 kn	3.100	8.100 kn	12.200 kn	15.600 kn	18.500 kn	33.500	LUMP-SUM: 40.200 kn
EXISTING BUILDING	ENERGY INSPECTION	$0^{1,2}$ up to 3.300 kn		$0^{1,2}$ up to 1.500 kn	$0^{1,2}$ up to 5.000 kn	price for new buildings multiplied by the coefficient $0^{1,2,3}$ to 3,8												
	EVALUATION OF OPERATIONS OF EN. INSPECTION AND ENERGY CERTIFICATE ISSUANCE	LUMP-SUM: 1.450 kn		LUMP-SUM: 1.200 kn	LUMP-SUM: 2.400 kn	price for new buildings multiplied by the coefficient $1^{1,2}$ to 1,2												

Table1. Prices of certificates in Croatia

Energy certification of new buildings includes:

- determination of the energy class of the building, and
- issuance of the energy certificate, together with recommendations for the use of the building with regard to meeting the essential requirement of energy economy and heat retention, and meeting the energy performance requirement.

Energy certificates are issued on the basis of data from the main design relating to energy economy and heat retention, the final report of the supervising engineer on the construction of the building and the written statement of the contractor regarding the works carried out and the requirements of the building's maintenance.

The energy certification of existing buildings includes:

- energy inspection of the building,
- evaluation and rating of the building, and
- issuance of the energy certificate for the building, along with recommendations on cost-effective measures for improving the energy performance of the building.

Cooling and hot water preparation are not included in the calculations.

Fig.5. Programme “House in order”

Quality assurance (QA)

Supervision of the implementation of the energy certification of buildings is under the competence of the MEPPPC. Pursuant to regulations, the MEPPPC may carry out temporary controls on the accuracy of the issued energy certificates and request that all buildings subject to the obligation of energy certification have the prescribed energy certificate. For the time being, the control of the issued energy certificates covers only a rough examination relating to the verification of the completeness of energy certificates. In case of insufficiencies in the certificates, these certificates are returned to the authorised persons for correction. There are no penalties defined.

3 > Inspections - Status of implementation

Croatia adopted option A as referred to in the Article 8 of the EPBD, and laid down the legal obligation of regular controls of heating systems (including boilers) and air-conditioning systems. These requirements under the EPBD have been transposed by the *Act on Efficient Energy Use in Direct Consumption*, which was published in December 2008. The Act prescribes mandatory regular control inspections, and lays down that all other details would be stipulated in an Ordinance on energy inspections. Supervision of the inspection of heating boilers and air-conditioning systems is under the competence of the Ministry of Economy, Labour and Entrepreneurship.

The Ordinance on energy inspections, considering the existing CEN standards, is currently under preparation, and its adoption and entering into force is foreseen in early 2011. In the draft Ordinance, maximum utilisation of existing resources for carrying out regular control inspections is foreseen, meaning specifically the proposal that such inspections shall be performed by authorised service experts who shall attend a short course regarding the assessment of and reporting of the system efficiency, and then shall obtain authorisation from the competent ministry.

The objective of regular control inspections is to ensure the optimal performance of these systems, whereby the experts shall, as needed, provide advice to the users on the improvement or replacement of the system or parts thereof, in order to improve energy efficiency. The Ordinance shall also provide the format of the report to be compiled by the authorised persons upon completion of the inspections. The competent Ministry and the State Inspectorate shall supervise the compliance with this obligation by the owner of the system; the owners shall have the obligation to maintain the reports obtained from the authorised persons.

The frequency of regular control inspections shall depend on the nominal power of the system (for heating systems 20 kW<P<100 kW the proposal is 2 years, and for systems >100 kW, annually; for air-conditioning systems with 12 kW<P<100 kW the proposal is 2 years, and for systems with >100 kW, annually).

The Methodology for carrying out energy inspections of buildings (published on the website of the MEPPPC) includes the manner of obtaining input data and the procedure of activities carried out during the energy inspection.

4 > Qualified Experts

Issuance of energy certificates of buildings and energy inspections of buildings for purposes of issuing an energy certificate, as well as regular inspections of heating boilers and air-conditioning systems, shall be performed by authorised persons only. Authorisations may be obtained by both natural and legal persons meeting the prescribed requirements.

The MEPPPC shall revoke or reject to extend an accreditation granted to an authorised person in the case that this person fails to undertake the accredited functions in an expert way.

A natural person authorised to carry out energy certification of buildings shall meet the following requirements:

- He/she holds a university degree in architecture, civil engineering, mechanical or electrical engineering (diploma on university education lasting at least four years)
- He/she has at least five years of professional experience
- He/she attended the respective training programme and has successfully passed the examination
- He/she is insured against professional liability.

Fig.6. Institutions in Croatia running Education Programmes

A legal person applying for authorisation shall have at least one full-time employee with an unlimited employment contract meeting the same requirements as a natural person with regard to education, working experience and attendance of the training programme.

The training programme consists of two Modules, 1 and 2. Persons wishing to obtain authorisation for carrying out energy certifications of buildings with simple technical systems shall attend Module 1, with a duration of 40 hours, and shall pass the examination at the institution which carries out the training programme. Module 2 shall be attended by persons wishing to obtain authorisation for carrying out energy certification of buildings with complex technical systems, as well as by those wishing to obtain authorisation for carrying out energy certifications of buildings with complex technical systems, relating to the mechanical engineering part of the technical system of the building and to parts of automatic regulation and control of the building's technical system. The duration of this Module is 40 hours longer. On its completion, the attendees will undergo an examination.

The training programme covers the basic postulates and goals deriving from the EPBD and from other sources of European law relating to energy efficiency of buildings, regulations on heat retention systems, heating systems, cooling and air-conditioning systems, hot water production, remote heating and cooling systems, renewable energy sources. The programme also contains chapters on basic energy science and building physics, basics of buildings, systems for heating, cooling and ventilation, chapters on how to carry out energy audits of buildings, preparation of data for calculation, development of reports and proposal of measures for energy efficiency improvement.

Authorised persons have the obligation to attend annual programmes of skill upgrading. The duration of the skill upgrading programme is estimated to be 8 to 16 hours, depending on changes in regulations and on technological progress. The programme covers the following topics: technical regulations, reports on experiences with energy certification of buildings, experiences from supervisions of the work of authorised persons, existing and new methodology of carrying out energy certification, new materials, technical progress in heating and cooling systems, advanced techniques on renewable energy sources, new computer programmes.

Training programmes and programmes of skill upgrading are carried out by institutions which have obtained authorisation from the MEPPPC. The requirements for obtaining authorisation include availability of expert persons who will carry out training, i.e., recognised experts from the training programme, adequate premises for the programme implementation, technical equipment and administrative support. Authorisation was granted to a total of nine institutions, including faculties, institutes and professional organisations.

The training programme started in September 2009, and by the end of September 2010, 650 engineers have completed it. Authorisation began in April 2010, and by the end of 2010 ca., 150 authorisations were issued to natural and legal persons. Persons authorised for carrying out energy inspections and energy certification of buildings are assigned a registration number and are registered in a central register maintained by the MEPPPC.

5 > National Information and Communication Campaigns

Fig.7. Poster

An advertising campaign was developed within the programme "Promoting Energy Efficiency in Croatia".

The promotional campaign includes brochures, posters, video spots and manuals. The campaign is intended for the public, with the aim of raising awareness on energy efficiency and readiness for changes in behaviour with regard to the implementation of the available energy efficiency measures, in order to reduce daily and seasonal consumption of energy sources and, finally, to reduce emissions of noxious gases into the atmosphere. The promotion campaign is complemented by additional activities, such as lectures, seminars and forums, as well as by the dissemination of informational and educational posters and brochures.

The website *www.energetska-efikasnost.undp.hr* contains the following publications for anybody who wishes to be informed: brochures, manuals and guides, as well as advice with regard to energy economy in homes, typical measures to increase energy efficiency, a list of local information centres, and data on the national information centre.

Fig.8. 200 EE advices

6 > National incentives and subsidies

In April 2010, the Government adopted the National Energy Efficiency Programme of the Republic of Croatia for the period from 2008 to 2016, as well as the First National Plan on Energy Efficiency. The Programme is based on the *Act on Efficient Energy Use in Direct Consumption*, and its goal is to set a limit for the direct consumption of energy by each sector through the establishment of energy savings following a certain methodology, through implementation measures, the potential for savings and implementing agents. In technical and expert terms, the programme has been designed in accordance with the guidelines of the European Commission and the respective Directive 2006/32/EC on energy end-use efficiency and energy services. The action plan is based on the Energy Efficiency Programme; it is structured according to the template of the European Commission and contains a description of the measures for improving energy efficiency in Croatia, which are planned and implemented in order to achieve the programme's goals.

Fig. 9. Green office guide

In Croatia, the Environmental Protection and Energy Efficiency Fund (*www.fzoeu.hr*) was established in order to provide additional funds for financing projects, programmes and similar activities in the field of preservation, sustainable use and promotion of the environment, as well as in the field of energy efficiency and use of renewable energy. The Fund co-finances programmes and projects through medium-term and annual work programmes, pursuant to the Ordinance on requirements and manner of allocation of funds, and criteria and standards for evaluation of applications for fund allocation by the Fund (Official Gazette 18/09). In the field of sustainable building, financial resources from the Fund have been allocated to projects for the implementation of measures relating to energy efficiency improvement in buildings in the public sector, in households, in the industry sector and in the service sector, in order to increase the cost-effectiveness of the operation, to reduce energy consumption, to increase competitiveness, to reduce environmental pollution by emissions of noxious CO_2, NO_x and SO_2, and to directly or indirectly reduce environmental impacts.

In the period from 2004 to 2010, in the field of sustainable building, 22 projects were realised and 56 projects are underway. The projects relate to improving energy efficiency of buildings with regard to lighting and heating systems (including installation of control and measurement equipment in existing and new residential and business facilities, preparation of an energy-efficient system for sanitary hot water, and heating and cooling systems), construction of an energy-efficient building envelope and substitution of the primary energy source in boiler plants, as well as optimisation of the combustion system. From 2004 to 2010, a total of 23,606,054.64 kunas (ca. 3.2 M€) were disbursed for these projects.

Also, projects are implemented involving the establishment of a system for the education of state government employees and of the local or regional self-government, public information and education in Croatia, establishment of locations for the supervision of energy consumption, establishment of an information system for energy management, etc.

7 > Impact of the EPBD at national level

Evolution of minimum performance requirements in building regulations

a) In 2002, the HRN U.J5. 600/1987 standard came into force, together with the recognised technical rules to apply it. It prescribed the specific heat transmission losses of buildings (residential and non-residential), minimal losses due to natural or artificial ventilation of the building, and minimal thermal insulation of the building structures.

b) In the period 2006/2009, the Technical Regulation on Thermal Energy Saving and Heat Retention in Buildings (Official Gazette 79/05, 155/05, 74/06) came into force.

It prescribed the technical requirements with regard to thermal energy saving and heat retention which have to be fulfilled when designing new buildings, as well as when designing the reconstruction and conversion of existing buildings which are heated at an indoor temperature higher than 12°C This regulation also prescribed the content of the building design with regard to thermal energy saving and heat retention, the information on the building heating needs, as well as the building maintenance with regard to thermal energy saving and heat retention. The requirements varied depending on the designation of the building and the designed indoor temperature. For residential buildings heated at a temperature of 18°C or more, the maximum value of the annual energy need for heating was prescribed per m^2/useful floor area of the building, $Q''_{H,nd}$ [kWh/(m^2·year)]; depending on the factor of the building's shape, f_0, this was not allowed to exceed the following values:

- for f0 ≤ 0.20 — $Q''_{H,nd}$ ' = 51.31 kWh/(m^2·year)
- for 0.20 < f0 < 1.05 — $Q''_{H,nd}$ = (41.03 + 51.41·f0) kWh/(m^2·year)
- for f0 ≥ 1.05 — $Q''_{H,nd}$ = 95.01 kWh/(m^2·year).

For non-residential buildings heated at a temperature of 18°C or more, the maximum value of the annual energy need for heating was prescribed per unit of heated volume of the building, $Q'_{H,nd}$ [kWh/(m^3·a)], depending on the factor of the building's shape, f0; this was not allowed to exceed the following values:

- for f0 ≤ 0.20 — $Q'_{H,nd}$ = 16.42 kWh/(m^3·year)
- for 0.20 < f0 < 1.05 — $Q'_{H,nd}$ ' = (13.13 + 16.45·f0) kWh/(m^3·year)
- for f0 ≥ 1.05 — $Q'_{H,nd}$ = 30.40 kWh/(m^3·year).

Heat limitations did not apply to family houses with a floor area ≤400 m^2 and buildings of a volume ≤100 m^3, but the requirements relating to the prescribed heat transmission coefficients for individual structural parts had to be met.

The maximum heat transmission coefficients, U [W/(m^2·K)], were prescribed for structural parts with a weight exceeding 100 kg/m^2.

The information on the energy need for heating as an integral part of the documentation on maintenance and improvement of the essential requirements for the building is mandatory. The information included the indication of the heating needs, as well as a statement by the contractor on the works executed in compliance with the design prescribed in the regulation.

c) In 2010, the EPBD has been transposed by two acts: the *Physical Planning and Building Act* (Official Gazette 76/07 and 39/08) and the *Act on Efficient Energy Use in Direct Consumption* (Official Gazette 152/08). Subordinate acts directly transposing the Directive are the Technical Regulation on Thermal Energy Saving and Heat Retention in Buildings (Official Gazette 110/08 and 89/09), the Ordinance on Energy Certification of Buildings (Official Gazette 36/10), and the Ordinance on the Requirements and Criteria to be met by Energy Auditors and Energy Certifiers of Buildings (Official Gazette 113/08 and 89/09).

With regard to new buildings, they set requirements on the limitation of annual energy need for heating per m^2 of useful floor area (AK) of the building for residential buildings, and on the annual energy need for heating per unit of the volume of the heated part of buildings for non-residential buildings. The calculation is performed pursuant to the HRN EN ISO 13790:2008 standard, by a monthly calculation method. With regard to buildings for which cooling is foreseen, the annual cooling need are calculated on the basis of the same standard. The limitations set for the thermal energy consumption for heating are identical to those set by the regulation of 2005.

Requirements for buildings heated at a temperature of 18 ℃ or higher		
f_0	***Residential building***	***Non- residential building***
	Q_{Hnd}" [kWh/(m^{2}year)]	**Q_{Hnd}' [kWh/(m^{3}year)]**
$f_0 \leq 0.20$	Q_{Hnd}" = 51.31	Q_{Hnd}' = 16.42
$0{,}20 < f_0 < 1{,}05$	Q_{Hnd}" = $(41.03 + 51.41 \cdot f_0)$	Q_{Hnd}' = $(13.13 + 16.45 \cdot f_0)$
$f_0 \geq 1.05$	Q_{Hnd}" = 95.01	Q_{Hnd}' = 30.40

Table 2. Requirements for buildings heated at a temperature of 18°C or higher

Exemptions from the application of the minimal technical requirements with regard to annual energy needs for heating are determined pursuant to the allowed exemptions from the Directive. Also, the highest allowed values of heat transmission coefficients are prescribed for the structural parts of new buildings, small buildings (AK < 50 m^2), and upon rehabilitation of existing buildings (values have become stricter as compared to those previously prescribed in 2005).

No.	Structural part	U [W/(m²·K)]			
		Θi ≥ 18 °C		12°C < Θi < 18 °C	
		Θe,month, min >3 °C	Θe,month, min ≤3 °C	Θe,month, min >3 °C	Θe,month, min ≤3 °C
1.	External walls, walls to the garage, attic	0.60	0.45	0.75	0.75
2.	Windows, balcony doors, roof windows, transparent facade elements	1.80	1.80	3.00	3.00
3.	Flat and pitched roofs above heated rooms, ceilings to the attic	0.40	0.30	0.50	0.40
4.	Ceilings above external air, ceilings above garages	0.40	0.30	0.50	0.40
5.	Walls and ceilings to non-heated rooms and non-heated stairways at a temperature higher than 0°C	0.65	0.50	2.00	2.00
6.	Walls to the soil, floors on the soil	0.50	0.50	0.80	0.65
7.	External doors, doors to non-heated stairways, doors with non-transparent door wings	2.90	2.90	2.90	2.90
8.	Walls of the roller shutter box	0.80	0.80	0.80	0.80
9.	Ceilings between apartments, ceilings between heated working premises of various users	1.40	1.40	1.40	1.40

Table 3. Maximum U-values prescribed by the 2010 regulations

8 > Conclusions and future planning

The application of new technical requirements regarding the energy performance of buildings (as well as the future review of these requirements) for new buildings will certainly result in energy savings and reductions in greenhouse gas emissions. However, since in Croatia there are a total of around 2 million apartments, of which more than 45% were built before 1970, and the increase rate of the housing stock is ca. 1% per year, major energy savings should be expected from the application of suitable measures to the existing building stock. This is supported also by the provisions on application of energy efficiency requirements established for new buildings, for extensions of existing buildings, as well as in the case of certain reconstructions of the envelope of the heated part of the building.

In the legislative field, further development of existing requirements on the energy efficiency of buildings is planned, to set requirements on the consumption of primary energy, as well as the alignment with the new recast EPBD. The limitation of consumption of primary energy in residential and non-residential buildings will also imply changes in the energy certificate, in such a way that the energy class will be determined in relation to the consumption of primary energy.

A feasibility study with regard to alternative systems of energy supply is under preparation, according to which studies on the economic, technical and environmental feasibility of alternative systems would be developed; these studies would be part of the application for building permits or main design certificates in case of buildings with a useful floor area exceeding 1,000 m^2.

The development of an algorithm is planned for the calculation of energy performance pursuant to European standards, which would serve as a national guideline for the application of the standards.

In order to achieve better energy saving effects, in addition to the effective application of mechanisms for the implementation of existing regulations, activities aimed at the raising of the awareness of owners and users of buildings will also be needed, as well as activities of planning and implementation of incentive measures for improving the energy efficiency of buildings.

The education of experts carrying out energy certification of buildings and inspection of heating boilers and air-conditioning systems will be complemented with the education of other actors involved in energy efficiency, such as contractors, designers, etc.

Implementation of the EPBD in Hungary

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1 > Introduction

Hungary completed all preparatory steps in January 2006, setting the ground for the prompt implementation of the EPBD during early 2006. Although this advancement seemed promising, the Ministerial Decree TNM 7/2006, issued in May 2006, introduced a regulation only covering Articles 3, 4, 5 and 6 of the EPBD. The regulation has been in force since the 1st of September 2006. The issue of a regulation covering Articles 7-10 has been delayed, due to changes in the administration and to concerns relating to the cost of certification. As a result, certification of new buildings and the display campaign for public buildings only started in 2009, whilst the compulsory certification (in case of sale or rental) of existing buildings will only be launched on the 1st of January 2012. Nevertheless, voluntary certification of existing buildings has already started and certification became a precondition for receiving a subsidy already in 2008.

This report presents an overview of the current status of implementation of the EPBD in Hungary. It addresses regulations, training of Qualified Experts, the first steps in the implementation of the certification system, information campaigns, incentives and subsidies.

2 > Certification

In Hungary, prior to 2004, the Ministry of Interior was responsible for the implementation of the EPBD, through the National Office for Housing and Building. During this time, it cooperated with professional bodies in outlining a set of regulations and rules of certification, as well as creating relevant software, work that was completed in January 2006. The first Ministerial Order, which included the requirements, the design input data and the calculation method, was issued in May 2006 and has been in force since the 1st of September 2006. Since that date, the fulfillment of energy requirements is a precondition for acquiring a building permit. The software was developed on a commercial basis and became available in January 2006. As a result, the thermal performance of buildings improved considerably. In terms of building envelopes, it corresponds to 36%, 50% and 43% decreases of the U values of exposed walls, roofs and windows, respectively. The overall average U value of an envelope (including thermal bridge effects) ranges between 0.45 and 0.65 W/m^2 K, depending on the surface to volume ratio.

Although since then the administration system was reorganized several times, certification is now again the responsibility of the Ministry of Interior.

During 2007, intensive discussions took place between the different Ministries on the method of certification. Originally, the asset based method was developed, considering that, in this case, the same procedure can be applied in the design phase, for the certification of new and existing buildings, using design data, and easy to check real data and survey data, respectively. Furthermore, the asset based method offers the possibility of using a "standard user" in order to neutralize inhabitants' behaviour. Nevertheless, certification is not a free service that the general public can apply for, but must be paid for. Concerns about public reactions brought about the idea of introducing an operational method for existing buildings, based on energy bills. In the end, in the governmental order issued in 2008, both methods were included; the protocol for certification based on an operational method has been published and is the subject of conciliation in the Chamber of Engineers.

The same order postponed the deadlines for the initiation of the certification process: for new buildings, it started in January 2009, whilst compulsory certification of existing buildings will be launched in January 2012, although on a voluntary basis and in the case of subsidized energy conscious retrofit, it is already in effect since 2008.

Since the first year, 49,000 certificates have been issued for new buildings and about 4,000 for existing buildings; in the latter case, the reason for certification was that the owners intended to apply for subsidies for major renovations. Since 2008, energy saving programmes have existed (see in section 6), which offer considerable subsidies for energy conscious retrofits of existing buildings. Two of the preconditions for getting financial support are certification of the building in its existing state and identification of the label to be achieved after the retrofit.

The display of certificates in public buildings has already begun. In this case, an operational rating method is applied, since users of the building remain the same. Thus, both technical conditions and user behaviour can and should be evaluated.

The energy performance certificate

The Energy Certificate assigns an energy performance label to residential and non-residential buildings or building units and it lists cost-effective measures for improving their energy performance.

The energy label classifies the buildings on an efficiency scale ranging from A+ (high energy efficiency) to I (poor efficiency).

The practical benefit of energy performance certification is found in the recommendations that are provided to the building owner. These are summarised on page 2 of the certificate. The suggestions include a short description of improvements proposed and the impact on the energy rating, if all measures were to be implemented. How detailed the calculations are depends on whether the owners of existing buildings are applying for a subsidy. In that case, evidence of the expected outcome of the retrofit in energy terms must be provided and, therefore, a more accurate survey and calculation is necessary to guarantee that the subsidy conditions will be satisfied.

http://www.lakcimke.hu/kalkulator

Owners can estimate the rating of their buildings using the online calculator. They can create their own certification which, obviously, does not substitute an official one, issued by a licensed expert.

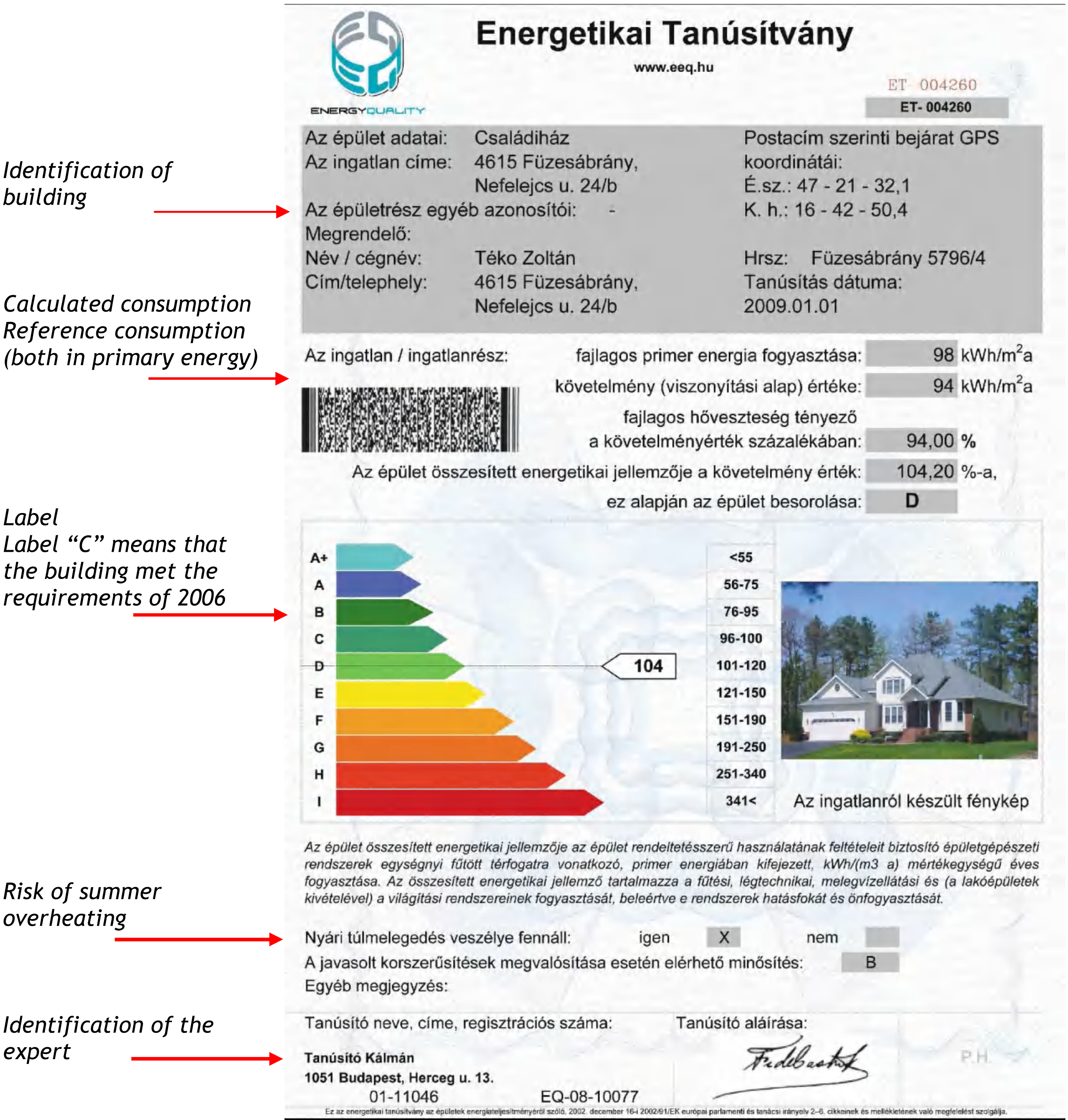


Fig. 1 - Cover page of the EPC

Energy certificates are valid for 10 years.

Starting from January 2012, all **existing residential and non-residential buildings** need to be certified, when sold or rented. The owner must present a valid certificate to the buyer, when the sale or rental contract is agreed upon. There is no minimum requirement for an existing building, i.e., it can be labelled from A+ to I, since, according to the EPBD, the aim of certification is *informative*.

New buildings must achieve at least a C label. The same rule applies in the case of a **major renovation** of buildings with over 1,000 m^2 floor area. If a new unit or wing is added to an existing building, there are two options: either the added unit, or the extended building as a whole, should meet the requirement. Such a retrofit or extension is subject to a building permit, which will be issued only if the aforementioned energy performance level can be demonstrated using the calculations.

The requirement system has three facets, as far as new buildings and major renovations are concerned. Maximum permitted values are set for the U values of elements and the specific heating energy need (W/m^{3}K), as a function of the surface to volume ratio. It is to be emphasized that applying elements of the allowed U

Building element	U W/m²K
Exposed wall	0.45
Flat roof	0.25
Attic floor slab	0.30
Heated attic	0.25
Floor slab over arcade	0.25
Floor slab over basement	0.50
Window, non metal frame	1.60
Window, metal frame	2.00
Non openable glazing	1.50
Toplit	2.50
Entrance door	3.00
Door	1.80
Partition wall heated-unheated	0.50
Partition wall heated-heated	1.50

Maximum U values of building elements from 2006.

values does not guarantee the fulfillment of the (W/m^{3}K) requirement: depending on the ratio of wall, window and roof area, often stricter insulation requirements must be applied. The losses from thermal bridges are also considered. Finally, the specific yearly primary energy need must not exceed the limit, which depends on the surface to volume ratio and the use of the building. Maximum permitted values are given for a few typical uses (residential, school, office), whilst, in case of mixed use, a reference building is to be considered. The primary energy needs include heating, domestic hot water, cooling and, for non-residential buildings, lighting needs.

The calculation methodology is described in the building regulations. Printed guidelines and software have been available since 2006. CEN standards, which became available in 2005, are considered, but are not directly referred to.

In Hungary, the definition of a **public building** includes every state-owned non-residential building. The larger ones, exceeding 1,000 m^2 floor area, are required to display their energy certificate, so that it is visible to the public. So far, 28 local authorities have joined the programme and over 100 public buildings have displayed their data. At the same time, the results of a former similar United Nations (UNDP) programme are being reviewed, in order to transpose those data into the present system and issue the corresponding energy certificates for public display.

Quality assurance (QA)

Certificates are collected by the VÁTI Hungarian Public Nonprofit Limited Liability Company for Regional Development and Town Planning, in an electronic central registry. The Hungarian Chamber of Engineers performs a quality control in case of a complaint. No check is performed if there is no complaint.

A voluntary initiative by the RAMSYS company on a commercial basis should be mentioned. The procedure is as follows. Certificates are uploaded online to the central server. During uploading, a syntactic and semantic check is carried out. Unclear data are sent back asking for a check (e.g., in the input data set, the façade area is x m^2, and the window in it x + 10, which is possible if the glazing is convex or concave, but this is to be confirmed - if not clarified, the document is rejected). The certificates and their copies are kept on the server, the printed certificates are issued a number, printed copies are available for sale, and the data are available for statistical purposes and for a detailed check, if necessary. A few experts have already joined this system. However, the delay in the implementation of the certification system, in addition to the lack of formal "official" support, does not provide favourable conditions for the widespread use of this system, at least for a while.

3 > Inspections - Status of implementation

The inspection of boilers and AC systems was the responsibility of the Ministry of Economy and Transport. In 2008, the Ministry was reorganized and continued this work as the Ministry of National Development and Economy, as is still the case in November 2010.

Hungary has adopted option a) on Article 8 of the EPBD, establishing a regular inspection of boilers. The inspection of boilers as well as air-conditioning systems is, however, still at an embryonic stage.

The legislative basis is the Governmental Decree 264/2008 (November 6th), "Governmental Decree on the inspection of heat generation equipment and air-conditioning systems", which has been in force since the 1st of January 2009. The deadlines that are to be adhered to are the following:

- 1st of January 2011 – inspection of all heating installations with boilers with an effective rated output of over 20 kW, which are older than 15 years
- 1st of January 2013 – first inspection of boilers and AC systems that were installed before the 1st of January 2007

- 1st of January 2015 – first inspection of boilers and A/C systems that were installed after the 1st of January 2007

Inspections can be carried out by:

- those experts who already have a license of expertise in HVAC systems or energy, issued by the Hungarian Chamber of Engineers
- engineers with at least one year of experience, who must take an exam at the Hungarian Chamber of Engineers
- technicians with at least five years of experience, who must take an exam at the Hungarian Chamber of Engineers

Up until now, only experts from the first group have carried out a few sporadic inspections, following their own protocol.

www.mmk.hu

The examination bodies have been established, the rules as well as the questions for the exam are available on the website, but to date *no one* has made use of this facility.

The same institute that collects the certificates (VATI) will also collect inspectors' reports, but, until now, no report has yet been received.

At present, the Quality Control system has not yet been organized. The Hungarian Chamber of Engineers performs a quality control only in the case of a complaint.

4 > Qualified Experts

Qualified Experts are the only persons authorized to issue Certificates. They must be authorized architects or engineers with at least eight (MSc) or ten (BSc) years of experience. In addition, qualified experts must pass an exam that evaluates their knowledge of the technical requirements of building regulations and the details of the certification system itself. Although attendance to a training course is not compulsory, most of the candidates have enrolled in a course. The Budapest University of Technology and Economics run the very first courses in January 2006. Later on, Debrecen University and Pécs University, which are the Hungarian universities that offer education for architects as well as mechanical engineers with specialization in HVAC systems, have run similar courses. Their cooperation through the reciprocal invitation of lecturers is worth mentioning. Locally run courses, organized by the regional bodies of the Chamber of Engineers and the Chamber of Architects, have followed these courses, inviting in most cases lecturers from the above universities. Between January 2006 and 2009, at least two courses were run in each regional centre.

Setting up the exams is the duty of the Chambers of Engineers and Architects. At present, the number of successful examinees at these chambers is 1,037 and 310, respectively.

http://lakcimke.hu/tanusitok
http://mmk.hu/nevjegyzek.php?no_cache=1

Qualified experts can act on a freelance basis or be integrated in public or private organizations. A list of licensed experts is available on the "*lakcimke*" website, registration, however, is voluntary. The website of the Chamber of Engineers provides a complete list of licensed experts.

5 > National Information and Communication Campaigns

In the early stages of implementation in 2006, the information campaign launched was very intensive. Several TV and radio interviews addressed the general public, while workshops and open forums were available to the professional community. A homepage and an electronic guide served the purpose of facilitating the correct interpretation of the Directive and national regulations. Printed guides for architects and engineers, in addition to popular pocket books for the housing associations, were published.

The homepage on the website of the Energy Club
http://www.energiaklub.hupont.hu/
http://www.lakcimke.hu/letoltheto
http://www.e-epites.hu/energetikai-tanusitas/modszertani-utmutatok
www.bm.gov.hu

Later on, the emphasis of the campaign shifted to providing information to the general public. The Energy Club (NGO) created a home page where the basic concepts, such as, renewable energy, sustainability, and certification, as well as everyday tips for energy saving, are presented in layperson language with many simple illustrations. A detailed booklet with many illustrations presents the features of “Passivhaus”. This campaign was and is still supported by the Ministry – to date with 200 million HUF (approx. 80,000 €). In cooperation with six other NGOs, 16 workshops for local authorities and housing associations were run in 2010, counting 510 participants, who represented the owners of 75,277 flats. 30,000 booklets, which can also be downloaded from the link on the left, have been distributed free of charge.

The Energy Club currently runs a consultancy service, The ECOHOUSE road show, carried out by the EMI Institute, in which 15 cities are involved. Each building authority was given a printed guide free of charge. On the Ministry’s homepage there are separate links for certification and display.

Similarly, the display programme is subsidised by the Ministry. Besides printed materials and workshops, the software is also available free of charge for local authorities that are responsible for public buildings. Moreover, a civil organisation helps in reviewing and evaluating energy bills.

Special attention is given to the younger generation. The display of certificates in school buildings is accompanied by many social events, raising the children’s awareness towards the environment.

The cover page of the display handbook for schools

6 > National incentives and subsidies (2008-2010)

National Energy Saving Programme (NEP)

The programme focused on traditional buildings (family houses and multi-residential buildings) built using masonry constructions. Individual renovations, such as thermal insulation of building elements, exchange of windows, and modernisation of heating systems or installation of RES systems, were supported with 15-30% non-refundable subsidies. The application procedure was very simple; even one flat owner in a multi-flat building could exchange his or her windows within the programme without involving an energy expert. As a consequence, the achieved energy saving was not registered and the owners were not motivated to choose the most efficient solutions. The investments made were not controlled at all. Most of the projects were small scale, one-flat or one family house projects. The yearly support was very modest, ranging between 1 and 2 billion HUF/year (3.5-7.0 M€/year), with the number of projects amounting to 1,000-5,000/year. The programme was ended in the middle of 2009 and was substituted by the GIS Climate Friendly Home Programme.

RES – poster for schools

Panel Programme

A separate programme was run for buildings built using industrialised technology. Only whole buildings could submit an application, and thus these projects were much larger scale. These buildings have 30-300 flats or even more. Requirements were much stricter. Since 2007, energy calculations were required according to the EPBD, and since 2008 a certificate was required. The support administered ranged between 33% and 66% of the costs, independent of the achieved energy saving. Although energy calculations were required, the achieved energy savings have not been analysed, therefore the feedback was rather limited. The Panel Programme supported around 500-2,000 projects yearly, and the grant was a maximum of 20 billion HUF/year (70 M€/year).

Childreen with the Display of their school (Nyíregyháza)

In the middle of 2009, the Panel Programme was restructured and brought under the umbrella of the GIS (Green Investment Scheme). The change mainly referred to the source of financing, but there were important modifications in the requirements as well. Every project thereafter needed an energy certification and the support administered was partly dependent on the achieved energy category. For a project achieving category D, the support was only 30%, whilst for category A+, 60% support was given. This action has definitely brought about a change in the efficiency level of projects, nevertheless, most projects targeted category B. Energy calculations had to be done by licensed energy experts, who had to use standardised calculation software specifically created for the GIS.

The programme was criticised by applicants, because of its complexity and the chaotic programme management, but it was the first step that involved using energy certification to motivate people towards more efficient projects. The programme lasted only half a year, there were 800 project applications submitted, which was not less than in previous years, and the Energy Efficiency level was much higher than before.

GIS Climate Friendly Home Programme

Similarly to the GIS Panel Programme, the GIS Climate Friendly Home Programme, subsidising traditional building types, was introduced in January 2010. The characteristics of the programme are analogous to the GIS Panel Programme, except for only a few small differences. A new element is the positive discrimination of projects applying KIVÉT products (KIVÉT – an abbreviation of a term in Hungarian, which refers to materials, elements, equipment of "Excellent Building Product" certification), but the method for their qualification is not completely elaborated. The programme, however, is still running.

A major problem with GIS is that project preparation costs (management, expert and design costs) are not eligible for subsidy and this strongly decreases the number of projects applied for, particularly well-designed ones.

Environment and Energy Operative Programme

The Environment and Energy Operative Programme is attractive due to the high percentage ratio of financial support. The programme gives 30-100% non-refundable grants for public and commercial buildings. Public buildings in underdeveloped regions can receive up to a 100% grant. In spite of that, the interest is not high enough, because of the complicated administrative procedure (a long 120 page application manual, controversial requirements, etc.). The success rate for receiving funding is only about 30%, therefore application is risky. Although energy calculations according to the EPBD are required, the achieved energy level doesn't influence the amount of the grant. An advantage is that preparation costs are eligible for subsidy and some project types are supported through automatic application mechanisms. In the second half of 2010, interest towards the programme rose; altogether, 831 projects were submitted, with a total grant request of 81 billion HUF during this period (approx. 290 M€).

Future plans

In late 2010, the new government announced its intention for a radical change in the energy efficiency action programmes in the building sector. A new Energy Efficient Construction Programme is under preparation. This ambitious programme plans to retrofit 50,000-100,000 flats yearly with an average energy saving of 60%. The expected development of the renovated buildings is presented in the following table.

year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	mean
traditional flat	20	30	40	50	60	60	60	60	60	60	50
panel	40	40	40	40	30	20	20	20	20	20	29
public building	5	6.5	7	6	3	2	1	1	0.5	0.5	3.25
new flat	10	10	15	15	20	25	30	30	30	40	22.5

* *"Panel" refers to blocks of flats built with prefabricated sandwich panels*

Table 1. – Planned development of yearly project numbers (thousand of flats, plan)

The programme will involve all building types, including public buildings and close to zero energy new buildings, Energy Efficiency and Renewable systems in the building sector under one umbrella.

It is planned that individual projects will be evaluated according to the achieved energy saving based on the EPBD energy certifications. Energy points will be given to the projects, as a function of the original and the targeted category, as table 2 presents for residential retrofit projects.

original state	renovated st.				
	C 100%	B 95%	A 75%	A+ 55%	A++ 45%
I	-	3.5p	5.0p	7.8p	12.0p
H	-	3.0p	4.5p	7.1p	11.0p
G	-	2.6p	4.0p	6.5p	10.0p
F	-	1.8	3.5p	5.0p	8.8p
E	-	1.0	3.0p	5.0p	7.5p
D	-	-	1.5p	3.0p	5.0p
C	-	-	1.0p	2.0p	4.0p
B	-	-	-	1.6p	3.5p
A	-	-	-	-	3.0p

Table 2 – Energy scores based on energy certifications (plan)

In addition to the energy points, the project can be awarded other bonus points, such as sustainability, quality or social impact.

This programme comes as a consequence of a study, which concluded that it was in the economic interest of the Hungarian state to start a renovation programme with communal buildings and family houses and to focus on the other building types afterwards.

7 > Impact of the EPBD at national level

Evolution of Minimum quality requirements in building regulations

In the past, building regulations were confined to setting a maximum acceptable limit for the U values of building elements. In Hungary, the first qualitative change in the definition of a building regulation dates back to 1991, when the regulation was ”extended” to include specific heating energy needs, as a function of the surface to volume ratio. The requirements seem to be stricter in the case of large and compact buildings. However, “translating” the specific volumetric requirement into the average U value of the envelope shows that more efficient thermal insulation must be applied, if the surface to volume ratio is higher. Fig. 2 shows two lines: the lower one represents continuous heating and the upper one intermittent heating (depending on the use of the building). This specific value has been kept in the new regulation, but the requirement became stricter as shown in Fig. 2. It can be seen that in the case of a typical single family house, if the requirement is “translated” into average U value of the envelope terms, this average U value of the envelope (including all elements: walls, roof, windows, entrance door, and taking the thermal bridge losses into account) should be 0.45-0.50 W/m^{2}K.

In the calculation of the specific volumetric value, the utilised passive solar gain can be taken into account, providing that solar access is demonstrated. The utilisation factor depends on the thermal mass of the building. The specific volumetric value includes all parameters of the building, which are closely related to the building: form, envelope, insulation, orientation, shadow factor, and solar access.

The new regulation covers the estimation of risk of summer overheating: internal and solar gains, position of openable windows and ventilators, possibility of night ventilation and thermal mass are taken into account in a simplified calculation.

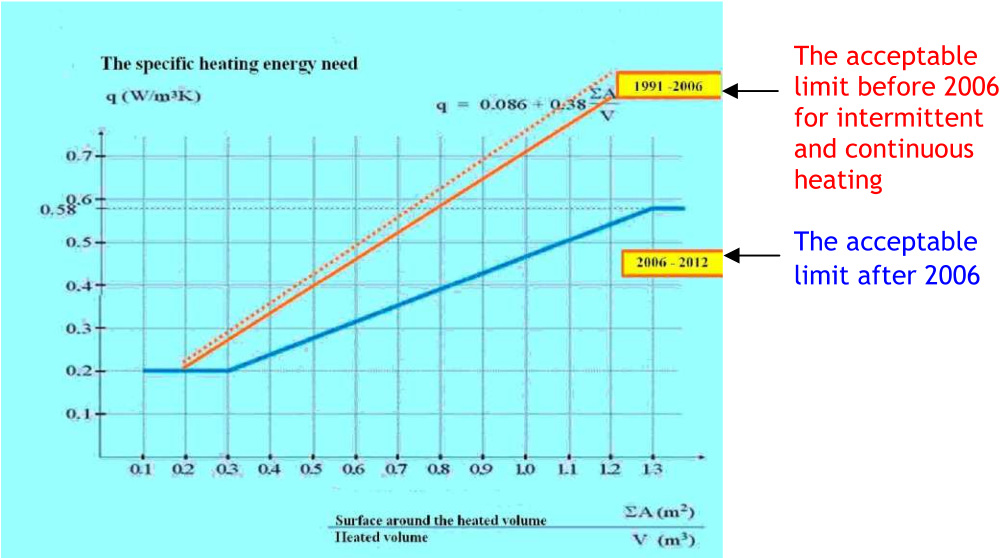
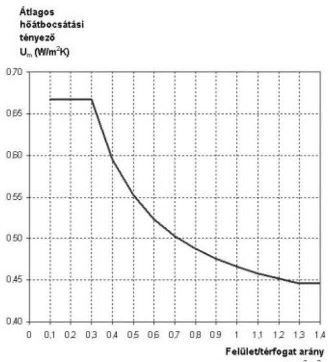


Fig. 2 The specific volumetric heating energy need before and after 2006. On the horizontal axis the surface to volume ratio



The overall average U value vs surface to volume ratio

www.bausoft.hu

The main feature of the new regulation, issued in 2006, is its three levels: setting a limit for the U value of building elements, the above presented specific volumetric value, and the specific yearly primary energy consumption, which includes heating, cooling, domestic hot water and, in the case of non-residential buildings, also lighting needs.

The requirement system will be strengthened in the near future, since it should be reviewed every five years. In Hungary, this will have to take place in 2011. The preparations are already in progress.

Considering the recast of the EPBD, a fundamental revision is expected in 2016: direct requirements regarding active solar and PV systems will emerge, and elements of the Life Cycle energy balance will be included, based on the most cost effective method.

The current software already allows for the calculation of the cost and the expected savings of different retrofit measures (building, mechanical systems). Several combinations can be compared in a few minutes, the results can be arranged according to payback time or investment costs, while one click is enough to show all combinations below a given investment cost or the payback time achieved with a given investment cost.

8 > Conclusions and future planning

The EPBD requirements for new buildings and major renovations will certainly bring important energy savings in the near future, although new and renovated buildings only represent a small share of the entire building stock in Hungary (around 4.3 million homes). Currently, less than 35,000 new buildings (with a hopefully one-off drop to under 13,000 in 2009) are built each year in Hungary and, despite the recent growth in the building market, major renovations still do not have a significant expression. Therefore, the impact of applying energy performance requirements to new and renovated buildings is obviously limited and will not lead, within a useful timeframe, to a relevant reduction in energy consumption in the building sector.

To achieve real energy savings in the building sector, significant incentives towards the improvement of existing buildings are needed and certification can play a fundamental role. The recommendations made by experts in the certificate are important guidelines that the owner of the building can make good use of, either in the context of a renovation, or as an individual cost-effective measure. Financial concerns about the investment costs of using energy efficient technologies are, however, a major obstacle. A breakthrough may take place in the field of subsidised projects, as the state administration has already adopted the methodology of offering subsidies, on the basis of energy certifications that motivate project developers to apply increasingly more efficient technologies.

A few months after the 2010 general elections, the secretary of state announced that by the end of the year 2010 the new energy policy, that will also address the building sector, will be published. A questionnaire is already circulating among stakeholders, universities and research institutes, in order to collect proposals for the identification of the best measures. In the meantime, the programmes listed in section 6 are still running.

The requirement system will be improved in the near future, since it is supposed to be reviewed every five years – in Hungary that will be in 2011. Its preparation is already in progress, and the following measures are planned:

The U value limits will be lowered by 15–20%, and for walls by 33%. In the case of small scale renovations, only elements meeting this improved quality can be used. The specific heating energy needs and integrated yearly primary energy consumption requirements will be corrected, by adjusting them to the new U value limits.

Minimum requirements will be introduced for some mechanical system elements, such as boiler efficiency, thermal insulation of storage tanks, and pipes.

The floor area limit for major renovations will be changed from 1,000 to 200 m^2, thus, in the case of smaller buildings the same requirements are to be met as for new buildings.

In the future, the way of thinking must change. Approaching near-zero or zero energy buildings, the yearly rate of embodied energy becomes comparable to the yearly operational energy consumption, thus, the Life Cycle energy balance is to be considered. On the one hand, the components of embodied energy are to be distinguished into: those pertaining to elements in direct relationship with operational energy consumption (envelope, mechanical systems) and others (basement, partition, stairs). On the other hand, the operational energy consumption has mostly building related (heating, cooling) and user dependent components. The rational balance of embodied energy of elements directly influencing the operational energy consumption and the mostly building related components of the operational energy consumption should be aimed at. Certainly, practical problems should also be discussed, first of all, the conventional life time of the building and its elements. Providing the cost of an investment is proportionate to the embodied energy (which would be normal), this approach is not far from the concept of cost effectiveness.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Ireland

Status in November 2010

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SUSTAINABLE ENERGY AUTHORITY OF IRELAND

National websites:

- *www.seai.ie*
- *www.environ.ie*

1 > Introduction

This report presents an overview of the current status and developments since the last country report of the EPBD implementation status in Ireland was published in 2008. The report covers updates to the legislation, certification programmes for domestic, non-domestic and public buildings, quality assurance, training and examinations for assessors, inspections, compliance and enforcement, information and communication campaigns, and incentives and subsidies.

2 > Certification

Updates to the legislation

In Ireland the implementation of the EPBD is the overall responsibility of the Department of the Environment, Heritage & Local Government (DEHLG) and the Department of Communications, Energy and Natural Resources (DCENR). DEHLG has direct responsibility for energy performance requirements for buildings. The Sustainable Energy Authority of Ireland (SEAI) is designated by legislation as the 'issuing authority' in relation to energy certification of buildings, on which it provides the tools, systems and training to enable implementation. The enforcement authorities for both energy performance requirements and energy certification are the Building Control Offices within the local authorities/ municipalities.

The key underpinning legislation remains the EC Energy Performance of Buildings Regulations 2006 (S.I. No. 666 of 2006) published in December 2006. It can be downloaded, along with other legislation at:
http://www.environ.ie/en/DevelopmentandHousing/BuildingStandards/

Since the last national summary report, legislative updates include:

- S.I. 229 of 2008 - enabled the introduction of certificates for non-residential buildings:
http://www.environ.ie/en/DevelopmentandHousing/BuildingStandards/RHLegislation/FileDownLoad,17763,en.pdf
- S.I. 591 of 2008 provided clarification in regard to certification of public buildings:
http://www.environ.ie/en/Legislation/DevelopmentandHousing/BuildingStandards/FileDownLoad,19185,en.pdf

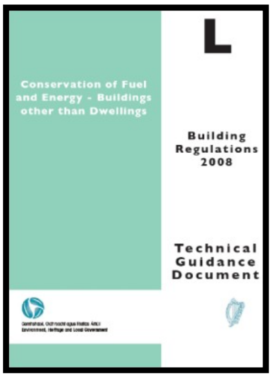

Figure 1: Guidance on Building Regulations Part L - Conservation of Fuel & Energy

Updates to the Building Regulations since the previous report include:

- SI 259 of 2008 Building Regulations (Part L Amendment). This includes designation of the national methodology for calculating energy performance of non-residential buildings.
- SI 556 of 2009 Building Regulations (Part F Amendment). This relates to the provision of appropriate ventilation in buildings.

These are in addition to the introduction of strengthened energy performance requirements for dwellings, introduced through the Building Regulations Part L and applying from 2008. The relevant Technical Guidance Document is shown in Fig. 1.

Building Energy Rating

Energy performance certification of buildings in Ireland is known as 'Building Energy Rating' (BER). The BER is in the form of an energy label that classifies buildings on a scale ranging from A (high energy efficiency) to G (poor efficiency). This scale is based on primary energy use under standard conditions for space heating and ventilation, water heating, lighting and associated pumps and fans. A secondary scale shows a CO_2 rating in relation to these same energy uses. Fig. 2 shows the format of the certificate for the case of dwellings.

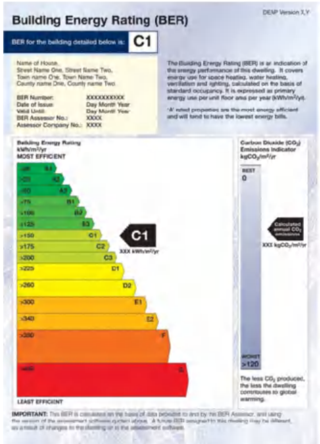

Figure 2. BER for dwellings

Mandatory BER was introduced in Ireland on a phased basis for the different classes of buildings, from the following dates:

- New dwellings - January 2007
- New non-residential buildings - July 2008
- Existing buildings offered for sale or rent - January 2009

For new buildings being offered for sale or rent before they are built, on the basis of plans or drawings, a provisional BER may also be issued which is valid for up to two years.

In addition, 'Display Energy Certificates', similar in format to BER but covering all operational energy usage, were introduced in public service buildings of over 1,000 m^2 from January 2009.

New and existing dwellings

New and existing residential buildings are assessed using a calculated/asset rating, conforming to EN ISO 13790. The methodology is the 'Dwellings Energy Assessment Procedure' (DEAP) which can be downloaded from: *http://www.seai.ie/DEAP/*

As of end November 2010:

- Number of BERs for new and existing dwellings: 148,695
- Number of active BER assessors (dwellings): 2,605

New and existing non-domestic buildings

New and existing non-domestic buildings are assessed using a calculated/asset rating. The framework methodology is known as the 'Non-Domestic Buildings Energy Assessment Procedure' (NEAP). Within this framework, the default method is the 'Simplified Building Energy Model' (SBEM). For more complex buildings, an approved dynamic simulation model can be used. The default calculation tool can be downloaded from *http://www.seai.ie/Your_Building/BER/Non_Domestic_buildings/Download_SBEM_Software/Download_SBEM_Software.html*

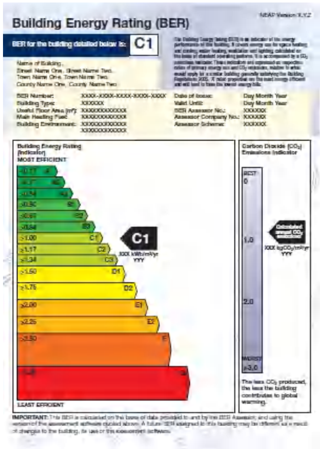

Figure 3. BER for non-residential buildings

Similar to the BER for dwellings, the BER certificate (Fig. 3) shows primary energy on the A-G scale, and CO_2 indicator on the right hand side. Unlike the case for dwellings where the scale and indicator are based on absolute energy and CO_2 calculated, the scales for non-domestic buildings are based on performance relative to a 'notional' building specified to approximately current Building Regulations standard.

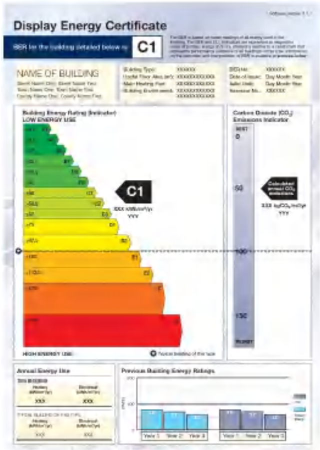

Figure 4. Display Energy Certificate for public buildings

As of end November 2010:

- Number of BERs for new and existing non-domestic buildings: 5,118
- Number of BER for assessors (non-domestic buildings): 370

Public buildings >1,000 m^2

The methodology is based on the UK methodology ORcalc and adapted into an Excel workbook. The benchmarks used are for 29 different building types – see CIBSE TM:46: 'Energy Benchmarks' at *www.cibse.org*.

The Display Energy Certificate (DEC) shows the primary energy on the A-G scale, and CO_2 indicator on the right hand side. It also shows the energy for space heating and the electrical energy and compares them to the benchmark values. Where information is available it shows previous year's ratings. The DEC is valid for one year from date of issue. The default calculation tool can be downloaded from: *http://www.seai.ie/Your_Building/BER/Download_Buildings/*

As of end November 2010:

- Number of current valid (in-date) certificates: 1,209
- Number of DEC assessors: 230

Figure 5. Print media advertisement for boiler inspection/ servicing

3 > Inspections

EPBD Article 9, in respect of air conditioning energy efficiency inspections, was transposed into national law by means of Statutory Instrument SI 346 of 2006. This sets out the obligations on system owners and on qualified technicians, commencing from the 1st of January 2008. The approach applied towards implementation has been a pragmatic one, encouraging inspection in conjunction with EU F gas regulations where feasible and in conjunction with routine system servicing. The legislation has been followed by publication in 2008 of an air-conditioning inspection manual which includes the procedures to be followed by qualified technicians.

Following the publication of the EPBD recast, the matter of air-conditioning inspections (Articles 15 and 16) and the manner in which this will be achieved is being reconsidered at present. There are discussions on-going and once a firm and detailed proposal is adopted this is likely to be published for public consultation in due course.

With regard to boiler inspections, Ireland has chosen Option B: Information campaign. A baseline study in 2005 had indicated that the vast majority of commercial oil and gas boilers were inspected/ serviced annually whereas just half of domestic boilers received such inspection/ servicing annually. SEAI also ran a survey on boiler maintenance habits of consumers. The main findings were:

- 48% have their boiler serviced once a year
- 18% every 2 years
- 11% over 5 years
- 15% never (until breakdown).

Motivating factors for servicing were, in order of preference:

- Safety
- Improved efficiency/cost savings
- Reliability
- Comfort

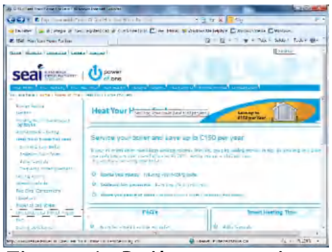

Figure 6. Boiler campaign website

The target audience for the information campaign has therefore been homeowners, and has used a combination of advertisements in newspapers and journals (Fig. 5), radio, television and internet. The messages were based on a combination of the above motivating factors. The advertising has directed readers and viewers to a portal home page (Fig. 6) reinforcing the key messages and linking to the specialist boiler maintenance services channelled through the oil, natural gas and LPG supplier communities.

Three such national campaigns have been run over the period 2009-2010. The following is an example of recent boiler campaign statistics (16 August - 12 September 2010):

- Daily newspapers: 1.873 million readers
- Sunday newspapers: 1.843 million readers
- Radio: 2.615 million listeners
- Online advertising: 786,000 visits, and 4,925,000 page impressions

The campaign led to an increase of over 350% in visits to the relevant web pages.

4 > Qualified Experts

Assessors (Dwellings)

http://www.seai.ie/Your_Building/BER/Training_Providers/BER_Training_Specification/

A prequalification requirement is a National Qualifications Authority of Ireland (NQAI) Level 6 Award (equating to technician diploma) in construction studies or equivalent. Training is required by a training provider registered with a national accreditation body. The training programme must meet SEAI's BER Training Specification in full.

The learner must achieve an examination mark of at least 70% in the training programme. To register, trained candidates must then pass SEAI's BER Examination. The national examination also acts as a test of Continuing Professional Development (CPD) which must be repeated every two years following initial registration.

Assessors (Non-domestic)

http://www.seai.ie/Your_Building/BER/Non_Domestic_buildings/

A prequalification requirement is a NQAI Level 7 or 8 Award (equating to ordinary or honours degree) in a building related discipline or equivalent, plus membership of a professional qualifying organisation at an appropriate grade listed for the assessor level. Further training is optional, but the candidate must pass the interim scheme qualifying iSBEM examination. SEAI will introduce a national qualifying and CPD examination by the start of 2011.

Figure 7. Mobile test centres for examinations

In addition, applicants wishing to register as non-domestic BER assessors using an approved software tool other than iSBEM are required to pass the approved qualifying examination from the relevant software provider.

Assessors (Large public buildings)

A prequalification requirement is a NQAI Level 7 Award (equating to ordinary or honours degree) in a building related discipline or equivalent. Training, as specified and delivered by SEAI, is mandatory.

Examinations

To ensure a consistent minimum standard across the community of BER assessors, SEAI developed a national examination. Delivery of this service is outsourced to a private company, which is a multinational service provider.

There is a total of 41 test centres in Ireland, comprising 16 fixed centres and 25 mobile centres (Fig. 7). Examinations are held Monday – Saturday. The contracted service includes: booking online or by phone, rescheduling, ID verification on arrival, photographing candidates (images will be used in future for ID cards), administering examinations, issuing results (immediately), dealing with complaints (complaints also come directly to SEAI), communicating results to SEAI, issuing VAT receipts for payments and making VAT returns.

Examination Statistics (May 2010):

- Total number of exams taken: 2,596
- Total number exams passed: 2,289 (pass mark = 70%)
- Total number of exams failed: 307
- Overall pass rate: 88.2%
- Average number of exams per week: 56


Qualifying Professional Organisations and Memberships/Titles

Assessor Levels 3, 4 and 5	
Chartered Institution of Building Services Engineers (CIBSE)	Fellow Grade (FCIBSE), Member Grade (MCIBSE), Associate Grade (ACIBSE), Graduate Member
Chartered Institute of Architectural Technologists (CIAT)	Chartered Architectural Technologist (MCIAT), Associate Member (ACIAT), Technician (Architectural Technician)
Chartered Institute of Building (CIOB)	Fellow CIOB, Member CIOB, Incorporated Member ICIOB, Associate Member ACIOB
Engineers Ireland (EI)	Fellow (CEng FIEI), Associate (AMIEI), Chartered Engineer (CEng MIEI), Ordinary Member (MIEI)
Irish Auctioneers & Valuers Institute (IAVI)	IAVI Member
Institute of Professional Auctioneers and Valuers (IPAV)	Full member IPAV
Royal Institute of the Architects of Ireland (RIAI)	Fellows (FRIAI), Member (MRIAI), Associate Member, Architectural Technician Member (RIAI Arch.Tech)
Society of Chartered Surveyors (SCS)	Chartered Quantity Surveyor, Chartered Building Surveyor

Figure 8 Qualifying organisations for non-domestic BER assessors

Quality assurance

Quality assurance of certificates is regarded as a vital reputational issue to give the market confidence in the certificates published, and is resourced accordingly. Three strategies underpin the QA system:

- Upstream: including assessor prequalification, training and the national examination;
- In-line: validation checking of ratings prior to publication;
- Downstream: QA auditing of published ratings and disciplinary procedure.

Auditing

Auditing is a key tool through which quality control of BER assessments is implemented. The aim of the audit programme is to identify technical, procedural or system faults in a timely manner and to feed the learnings back to assessors and/or to process and system revisions to minimise recurrence.

Breaches of the relevant BER technical methodology or Code of Practice that are detected through the audits are graded in terms of severity:

Severity 1: A non-compliance that has a high potential to compromise the fundamental integrity of the BER scheme, damage public confidence or otherwise negatively impact the reputation of the scheme. (3 penalty points).

Severity 2: A non-compliance that is significant but, while not acceptable, is unlikely on its own to affect the reputation of the BER scheme. (2 penalty points).

Severity 3: A non-compliance that is less significant and would not affect the reputation of the BER Scheme. (1 penalty point).

Each breach is associated with a number of 'penalty points', introduced on the 1st of May 2010. Penalty points are attached to the assessor's record (similar to the points system on a driver's licence). A suspension of 3 months will be invoked if a BER assessor's record shows 10 points or more accumulated within the previous 2 year period.

http://www.seai.ie/Your_Building/BER/BER_FAQ/FAQ_BER/Assessors/SEI_BER_Reports.html

The associated system improvement process includes:

- Technical bulletins issued regularly to provide QA and technical feedback to assessors.
- Update of the notices on the national BER administration system.
- Update of the BER calculation software and manual.

There are three different types of audits:

Data Review Audits are high volume audits, selected on both a random and targeted basis, in which audit requests are sent by email to BER assessors to check their compliance with a particular element of the Code of Practice and/or the relevant BER technical methodology.

Desk Review Audits involve the review of a set of BER assessments carried out by an individual BER assessor. Selection is on the basis of risk analysis which identifies potential errors within data files. Such audits may require provision of evidence/substantiation by a BER assessor in support of entries made in the BER data file for one or more BER assessments.

Documentation and Practice Audits are detailed audits, which review a BER assessor's compliance with both the relevant BER technical methodology and the

Code of Practice. Such a process will comprehensively audit all relevant aspects of a BER assessor's BER activities. A number of the BER assessor's assessments will normally be audited to determine if any error patterns exist.

Total quality auditing activity as of end September 2010:

- Data review audits 4,871
- Documentation & Practice/ Desk Review audits 253
- % of assessments audited 4.4%

Compliance and enforcement

Legislation (S.I. No. 666 of 2006) assigns responsibility for enforcement of compliance by building owners to Building Control within each local authority. The role of the local building control authority is to monitor and enforce the building control system. Building Control authorities are responsible for building standards, workmanship, conservation of fuel and energy, and access for people with disabilities. Building control officers are empowered to carry out inspections and undertake, where necessary, enforcement action in order to ensure compliance.

Penalties apply to a person offering a building for sale or rent or any agent acting on their behalf without presenting a valid certificate. Penalties include a fine of up to 5,000 €, or up to three months in prison, or both.

Fig. 9 shows the links in relation to BER assessors and trainers, with respective responsibilities residing with SEAI (as issuing authority) and national training awards bodies.

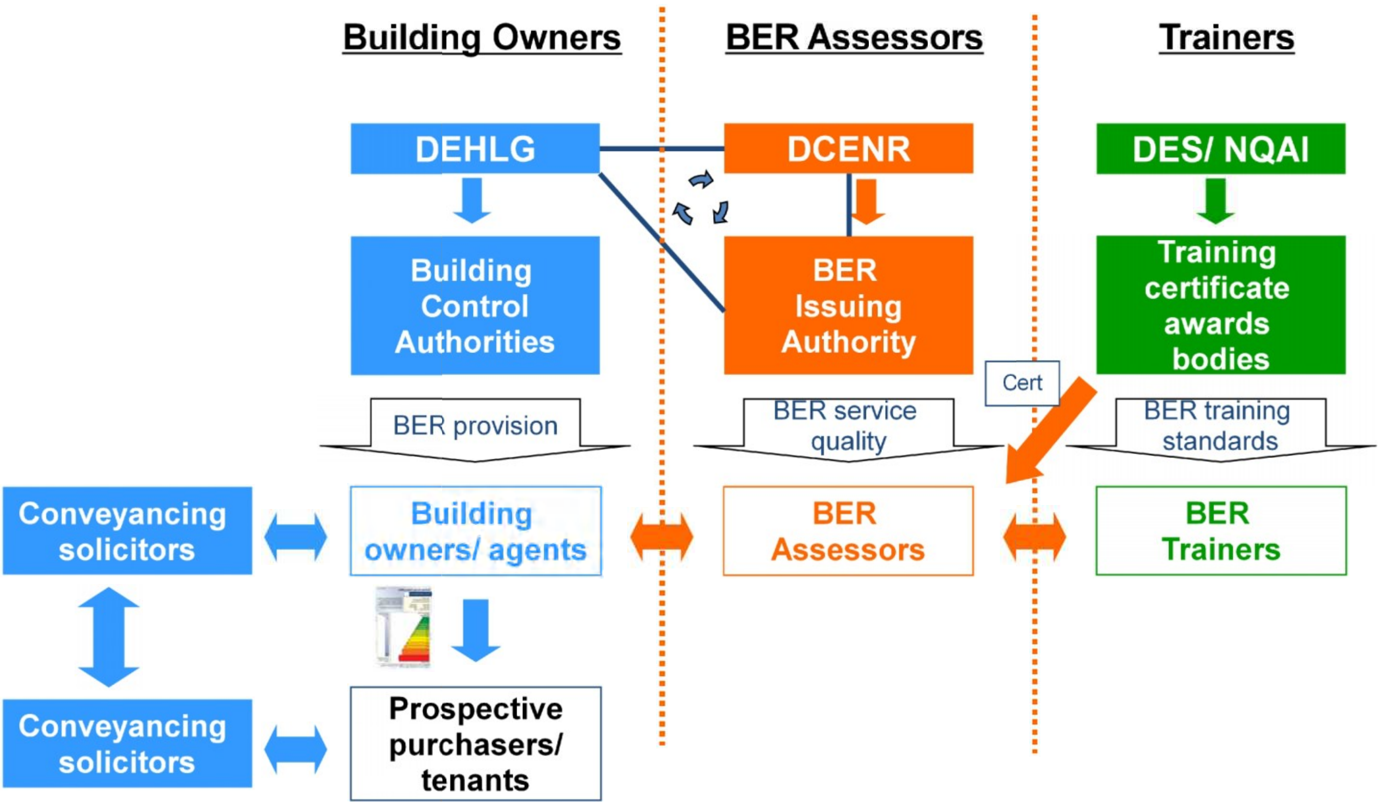

Figure 9. Enforcement responsibilities

Enforcement is complemented by a 'rights based' approach, whereby SEAI activities contribute to creating a compliance culture. Examples of such activities include:

- Major industry awareness campaign over four years: about 200 events, 22,000 attendees.

- Meetings with key industry players and professional bodies.
- Public awareness campaigns in 2008, 2009 and 2010.
- A Law Society Conveyancing (property transactions) Committee direction to members (solicitors or notaries) acting for an owner or prospective buyer/ tenant, giving a clear instruction on their legal obligations to their clients.
- Department of the Environment, Heritage & Local Government (DEHLG) directions to Building Control authorities emphasising their duties to ensure compliance by building owners within their jurisdictions.
- Building Control authorities direct notifications to estate agencies within their jurisdictions.
- SEAI liaison with Building Control authorities.
- SEAI monitoring of training standards.

Figure 10. BER information on SEAI website

5 > National Information and Communication Campaigns

Between autumn 2008 and autumn 2010 there have been four major public awareness campaigns delivered through advertising in print and trade press, on radio and television and on the internet, directed at establishing consumer awareness of BER.

Prior to the campaign in 2010, which placed greater emphasis on the rental sector, research was conducted by SEAI to ascertain:

1. Awareness of BER
2. Understanding of BER
3. Knowledge of where to go for BER information
4. Awareness of previous advertising campaigns
5. The main messages from previous campaigns.

Among the indicators from this consumer research were:

- 23% were aware of the correct definition of BER
- 26% understood ‘Energy Rating/Efficiency of a Property’ as the meaning of BER.

In addition, the following statements scored highly:

- BER is a certificate showing how energy efficient your home/ building is (84%).
- BER is a rating on how well insulated your home/ building is (80%).
- BER is a report on energy performance of your home/ building (72%).
- BER is an energy label for your home/ building (66%).

Communications have consistently included:

- Website: 40,000 visits per month, about 20,000 visitors
- Help Line: 300-400 enquiries per week
- TV, Press, radio, web advertising
- Queries and representations:
    - BER assessors – monthly technical bulletins, practice notes, BER association, responses to petitions
    - Media enquiries, e.g. national examination
    - Parliamentary Questions, e.g. pre-qualifications, numbers, costs
    - Industry representative groups, e.g. Irish Auctioneers and Valuers Institute

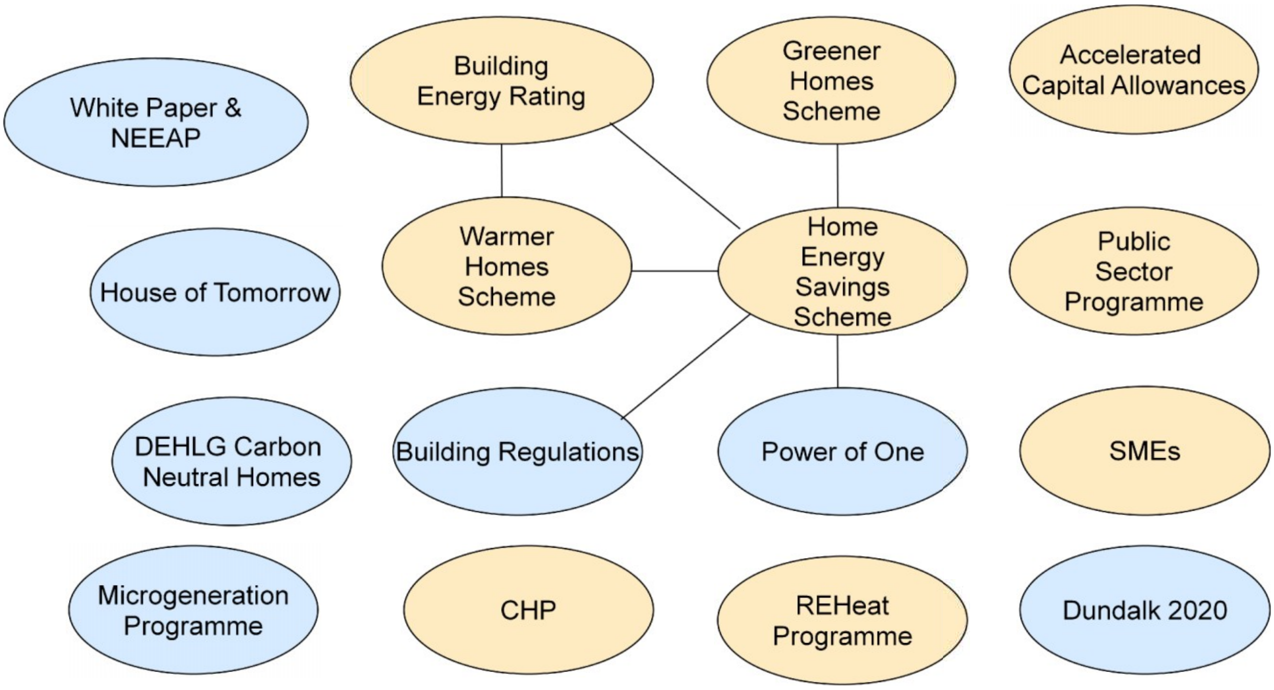

Figure 11. BER & other national programmes in the built environment

Consultation paper on the National retrofit programme: http://www.dcenr.gov.ie/Energy/Energy+Efficiency+and+Affordability+Division/Retrofit+Consultation.htm

Warmer Homes Scheme

This scheme aims to improve the energy efficiency and comfort conditions of homes occupied by vulnerable low-income households, and to establish the systems and grow the capacity in Ireland to install such measures. This approach is founded on a combined social employment and private contractor direct delivery model. It engages regional community based organisations to acquire and apply the skills to carry out the work – which includes attic insulation, draught proofing, lagging jackets, energy efficient lighting, cavity wall insulation and energy advice. This scheme provided energy efficiency services to 24,000 households in 2010, and has cumulatively provided such services to over 60,000 homes since year 2000. ***http://www.seai.ie/Grants/Warmer_Homes_Scheme/***

Figure 12. http://www.seai.ie/Grants/GreenerHomes/

Greener Homes Scheme

Established in 2006, the Greener Homes Scheme (Fig. 12) aims to increase the use of renewable energy technologies within Irish homes, by providing fixed grant assistance to homeowners who install a new renewable energy heating system for homes first occupied prior to the 30th of June 2008. This scheme provided grant assistance to almost 5,000 installations in 2010, bringing the total number of installations to 32,000 since its inception.

Figure 13. http://www.seai.ie/Grants/Home_Energy_Saving_Scheme/

Home Energy Saving scheme

Established in 2009, the Home Energy Saving scheme (Fig. 13) provides grants to homeowners for energy efficiency measures – including roof insulation, wall insulation and heating systems. The scheme is open to homes built before 2006. From the 8th of June 2010, under this scheme homeowners must undertake a BER on their home after grant aided works have been completed in order to receive the grant payment. SEAI has also developed a smart online Home Energy Self Survey to help homeowners decide which upgrade works might be most suitable for their home. Under this scheme a total of 46,000 homes was grant aided in 2010, which brings the total number of homes supported to 64,000 since its inception.

National retrofit programme

Announced in the Government's Infrastructural Investments 2010 – 2016, the national retrofit programme aims to deliver energy efficiency upgrades to one million residential, public and commercial buildings in Ireland. From 2011 onwards, this is planned to incorporate current grant programmes such as outlined above. To date these schemes have delivered energy saving upgrades to over 150,000 homes in Ireland.

Apart from programmes directly administered by SEAI, other incentives and programmes are provided via local authorities, energy utilities and government departments.

7 > Impact of the EPBD at national level

Evolution of minimum requirements in building regulations

For both dwellings and non-domestic buildings in Ireland, maximum permissible heat loss requirements have been progressively strengthened since first being introduced around 1980. However, overall energy performance targets were not introduced into Building Regulations until the implementation of the EPBD. For dwellings, a CO_2/primary energy target was first introduced in 2005, approximating to a maximum permissible primary energy requirement (for space heating and ventilation, hot water, lighting, pumps and fans) of around 156 kWh/m^2 for a typical 100 m^2 dwelling. Arising from national policy, this was subject to accelerated review in 2007 and improved by 40% from 2008 onwards, reflected in the revised document

http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownLoad,19069,en.pdf

A further review was undertaken in 2010, with proposals for a further strengthening by 60% relative to 2005 requirements during the year 2011. The overall progression in such energy performance standards, in both domestic and non-domestic buildings, historically and planned, is shown in Fig. 14.

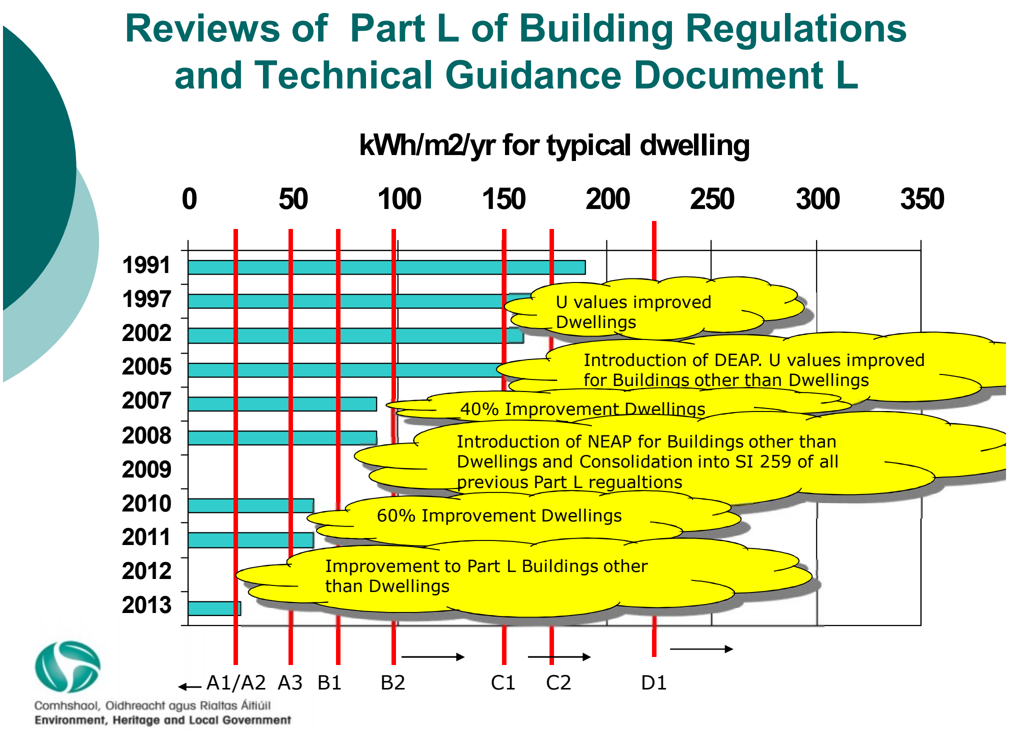

Figure 14. Progression in national energy performance requirements for buildings.

Dwellings

The 'Energy Performance Coefficient' (EPC) is defined as the ratio of calculated primary energy consumption for the proposed dwelling relative to that of a 'reference dwelling' incorporating energy features approximating to the standards of the Building Regulations 2005. The 'Carbon Performance Coefficient' (CPC) is defined as the ratio of calculated CO_2 emissions for the proposed dwelling relative to that of the same 'reference dwelling'. The strengthening of the requirements over time is reflected in the progressive improvement in the maximum permitted (MP) levels for the EPC and CPC, expressed as 'MPEPC' and 'MPCPC' and shown in the table below.

Year	2005	2008	2011
MPEPC	1	0.6	0.4
MPCPC	1	0.69	0.46

In addition from 2008, there is a minimum requirement of 10 kWh/m^2 of delivered energy to be supplied from renewable sources.

Supplementing these requirements, more stringent limits are set for building fabric U values (see tables below), thermal bridging details and an air-tightness sampling regime is required for developments of multiple housing units. Minimum acceptable boiler efficiency has been set at 86%.

Changes circulated for public consultation during 2010 with a view to introduction in 2011 include reduction of U-values, increase of boiler efficiency to 90%, and air-tightness threshold lowered to 7 m^3/hr/m^2.

Building Regulations 1997

	Overall Method	Elemental method	
	No elemental U-value criteria. Must comply with U_m=0.42+0.22V/A_t Also:	Not suitable for medium/large non-domestic buildings	
		New	**Alteration**
Exposed roof		0.25	0.35
Exposed wall		0.45	0.6
Exposed floor		0.45	0.6
Ground floor		0.45	No requirement
Semi-exposed roof		0.35	0.6
Semi-exposed wall		0.6	0.6
Semi-exposed floor		0.6	0.6
Exposed window, door, rooflight		3.3	
Vehicle access door		0.7	

Building Regulations 2006

	Overall Method	Elemental method	
	No elemental U-value criteria. Must comply with U_m=0.24+0.19V/A_t Also:-	Not suitable for medium/large non-domestic buildings	
		New	**Alteration**
Any roof	0.25		
Pitched roof, horizontal insulation		0.16	0.35
Pitched roof, sloped insulation		0.2	0.35
Flat roof		0.22	0.35
Exposed wall	0.37	0.27	0.6
Exposed floor	0.37	0.25	-
Ground floor	0.37	0.25	0.6
Exposed window, door, rooflight		2.2	2.2
Vehicle access door		1.5	-

http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownLoad,20322,en.pdf

Non-domestic buildings

This update in 2008 introduced the Maximum Permitted Energy Performance Coefficient (MPEPC), and the Maximum Permitted Carbon Performance Coefficient (MPCPC). Using the national methodology, these targets are broadly equivalent to a grade on the B/C boundary of the BER scale.

A review of these requirements is anticipated for 2011.

Other impacts of EPBD

National policy in Ireland is set on a path towards 'low/zero' carbon/ energy buildings. This is reflected in the progressive strengthening of Building Regulations Part L to overall primary energy performance standards which, in the case of housing, are already equivalent to those widely promoted as voluntary 'passive house' standards.

BER is making energy performance of buildings visible, potentially affecting pricing, and stimulating higher standards in new buildings as well as investment in the upgrading of existing buildings. The rate of new building construction in Ireland since 2008 has been very low but there has been a growing market response to the incentives for energy efficiency upgrading of existing dwellings.

We are confident that the Dwellings Energy Assessment Procedure (DEAP) and Non-domestic buildings Energy Assessment Procedure (NEAP) tools, which a have a dual role in enabling compliance with Building Regulations and in generating BERs, are helping to equip industry professionals with improved skills and insights into the determinants of the energy performance of buildings. This visibility of energy performance requirements and BER can in turn be expected to lead to market advantage to those with energy skills, superior products and specialist services such as air-leakage testing.

Overall therefore, the EPBD is seen as a significant lever to improve the energy, environmental and economic performance of Irish buildings.

8 > Conclusions and future planning

The main challenges and future developments of the EPBD team for the short and medium term are:

- Achieving robust compliance and enforcement in the property rental market
- Maintaining public awareness through campaigns and consumer advocacy
- Monitoring BER assessor numbers, prices and trainers
- Expansion of quality assurance activity: impact on assessors, disciplinary consequences of Penalty Points system
- Irish localisations of dynamic simulation models for non-domestic buildings
- Co-ordination with UK authorities on methodology management
- Strengthening functionality and guidance of advisory reports
- Continuous service functionalities and improvements of the ICT tools
- Planning and implementing the new requirements of the Recast EPBD
- Achieving growing market leverage towards energy efficiency upgrading investments, through informational, financial and institutional measures.

Implementation of the EPBD in Italy

Status in November 2010

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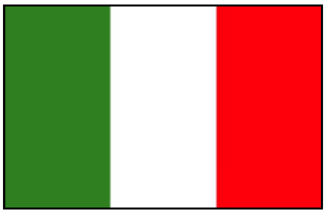


The official texts are available on the Ministry of Economic Development website www.sviluppoeconomico.gov.it

1 > Introduction

The implementation of the EPBD in Italy is a shared task between the State and the 21 Regions and Autonomous Provinces. Since the last report was published in June 2008, many developments have taken place and certification is now widespread in the building market, starting with the most active Regions. Implementation started in 2005, with a national transposition Decree, which established a transitional period during which:

i. the minimum requirements were tightened by about 30%, with respect to previous levels,

ii. methodologies for determining energy performance of buildings were confirmed, in reference to the already existing advanced regulations,

iii. Energy Certification of Buildings (ECB) was replaced by a declaration produced by a professional designer (assessor accreditation was not available yet), which was limited to new or renovated buildings, and then in 2006 was also extended to buildings on sale and rental,

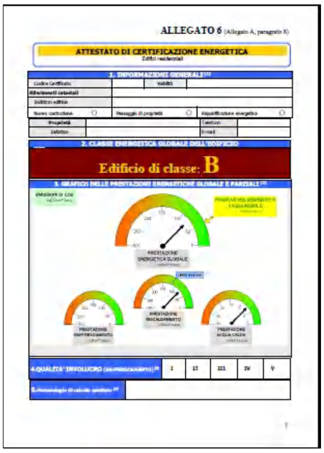
iv. boiler inspection procedures were slightly improved, in respect to the already existing regulation from 1993.

At the end of 2010, the revision process of the current legislation at the national level was completed (with the only exception being air conditioning inspections), and an initial group of 10 of the Regions implemented their transposition, according to the national model and guidelines, generally adding more demanding elements than in national regulations, while the national rules still apply in the Regions that have not yet published their legislation.

This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in Italy. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification of buildings

In Italy, the Ministry of Economic Development, in collaboration with the Ministry of Environment and the Ministry of Infrastructure, are in charge of the regulation on Energy Conservation of Buildings (ECB). Before it can be approved, the opinion of the Committee of Regions is required, obtained through the State-Regions Conference. According to the modification of the Italian Constitution, Part V,


ALLEGATO 6

ATTESTATO DI CERTIFICAZIONE ENERGETICA

Edificio di classe: B

Figure 1. Cover page of the EPC for residential buildings.

energy policy is partially delegated to the Regions and Autonomous Provinces, leaving the drafting of the general framework to the central government, while the Regions have the final power to adapt it to their individual requirements. The Regions are in charge of the entire certification system, which is based on regional registries and databases.

The most significant advancement in the new national regulations was made on the 25th of July 2009, when a new Ministerial Decree entered into force, adopting the National Guidelines on Energy Certification of Buildings. The guidelines specify the procedures, the performance classes and the basic elements for certification, which have legal value in all the Regions that have not yet produced their own legislation, or until the date of issue of new regional laws. The Regions that have already enforced regulations on building energy certification are required to adopt certain measures when their requirements are less strict or some aspect has been neglected, so that they gradually adapt their instruments to the national Guidelines.

The timetable for the implementation of the Energy Certification of Buildings (Table 1) in various building categories was graduated, and reached its full implementation on the 1st of July 2009, when all the required buildings were included in the certification system: new buildings, major renovations, public buildings and all buildings when sold. Each building or building unit, e.g., an apartment, is assigned an energy rating according to the label reported in Fig. 2.

Date	Type of building
1st of July 2007	Transfer of whole building > 1,000 m^2
1st of July 2008	Transfer of whole building < 1,000 m^2
1st of July 2009	Transfer of flats

Table 1. Timetable of implementation of ECB.

For apartment blocks, certification concerns the single flat: when multi-family buildings are concerned, it is possible to derive the flat certification from the EPC of the whole building, or from groups of similarly performing flats. When the boiler is centralised and there is no heat metering per single flat, the EPC for a single flat can be derived from the one of the whole building, simply by adapting it to the floor area of the flat concerned. It is also possible, for buildings of less than 1,000 m^2 for sale, to avoid certification, by declaring that the building has the minimum class G, due to high energy costs. Buildings without heating and domestic hot water systems are also obliged to have certification performed, with some simplifications in the procedure.

As of July 2009, all **existing** residential and non-residential **buildings** need to be certified when they are sold; there was no obligation for rented buildings at the national level, but the obligation exists in 8 Regions out of the 10 that have produced regional legislation. The Legislative Decree transposing the Directive 2009/28/EC, recently approved by the government, has corrected this item, requiring that both sale and rental contracts mention that the EPC was presented to the buyer or renter, even if for rental this is limited to cases where the EPC is already available, and has imposed the publication of EPC data in advertising of homes for sale. When registering a contract of sale, Italian notaries inform the parties involved of the obligation of having an EPC and check that there is an agreement between the parties concerning the issue of an EPC. In 2 Regions, the notary has to annex the EPC to the sale contract.

There is no national fee for EPC registration, but this is usually applied at regional level. There are fines foreseen for building owners refusing to deliver the certificate (see section 4), and in at least 2 Regions the notary refuses to register the contract of sale, if the certificate is not shown.

Certification is compulsory, in order to gain access to most public incentives for energy efficiency[1], like the 55% tax credit (see section 6), the contribution allowed when performing energy audits, and the increase of the self-produced PV electricity premium tariff, when at least 10% energy saving has been achieved.

[1] The EPC is not required for window substitution, boiler change and thermal solar systems installation.

The energy performance certificate

The Energy Performance Certificate (EPC) is the most visible aspect of the ECB. This document assigns an energy performance label to residential and non-residential buildings or building units, and it lists measures for improving their energy performance, sorted by cost-effectiveness. The energy label classifies the energy performance (EP) of buildings in kWh/m^2 (residential buildings) or kWh/m^3 (non-residential buildings) of primary energy, on an efficiency scale ranging from A+ (high energy efficiency) to G (poor efficiency). Performance is expressed for the whole energy used in the building, and separately for the single end uses: heating, hot water, cooling. For cooling, performance concerns the building summer load (system performance is not yet considered). Lighting will be considered, for non-residential buildings only, in a later phase.

The global EPgl is the sum of the partial EPs:

EPgl= EPi + EPacs + EPe + EPill

where:

EPi: is the EP for heating;

EPacs: is the EP for domestic hot water;

Epe: is the Ep for summer cooling;

EPill: is the EP for artificial lighting.

Table 2. Global classes (in relation to the minimum global requirements)

		Classe A_i+	<	0,25 EPi_L (2010)
0,25 EPi_L (2010)	$\leq$	Classe A_i	<	0,50 EPi_L (2010)
0,50 EPi_L (2010)	$\leq$	Classe B_i	<	0,75 EPi_L (2010)
0,75 EPi_L (2010)	$\leq$	Classe C_i	<	1,00 EPi_L (2010)
1,00 EPi_L (2010)	$\leq$	Classe D_i	<	1,25 EPi_L (2010)
1,25 EPi_L (2010)	$\leq$	Classe E_i	<	1,75 EPi_L (2010)
1,75 EPi_L (2010)	$\leq$	Classe F_i	<	2,50EPi_L (2010)
		Classe G_i	$\geq$	2,50 EPi_L (2010)

Table 3. Hot water classes (for DHW only) in kWh/m^2 per year primary energy

		Classe A_{acs}	<	9 kWh/m^2 anno
9 kWh/m^2 anno	$\leq$	Classe B_{acs}	<	12kWh/m^2 anno
12 kWh/m^2 anno	$\leq$	Classe C_{acs}	<	18 kWh/m^2 anno
18 kWh/m^2 anno	$\leq$	Classe D_{acs}	<	21 kWh/m^2 anno
21 kWh/m^2 anno	$\leq$	Classe E_{acs}	<	24 kWh/m^2 anno
24 kWh/m^2 anno	$\leq$	Classe F_{acs}	<	30 kWh/m^2 anno
		Classe G_{acs}	$\geq$	30 kWh/m^2 anno

Table 4. Cooling classes Building cooling load minimum requirements

End use	Climate zones A B C	Climate zones D E F
Residential kWh/m^2. year	40	30
Non-residential kWh/m^3. year	14	10

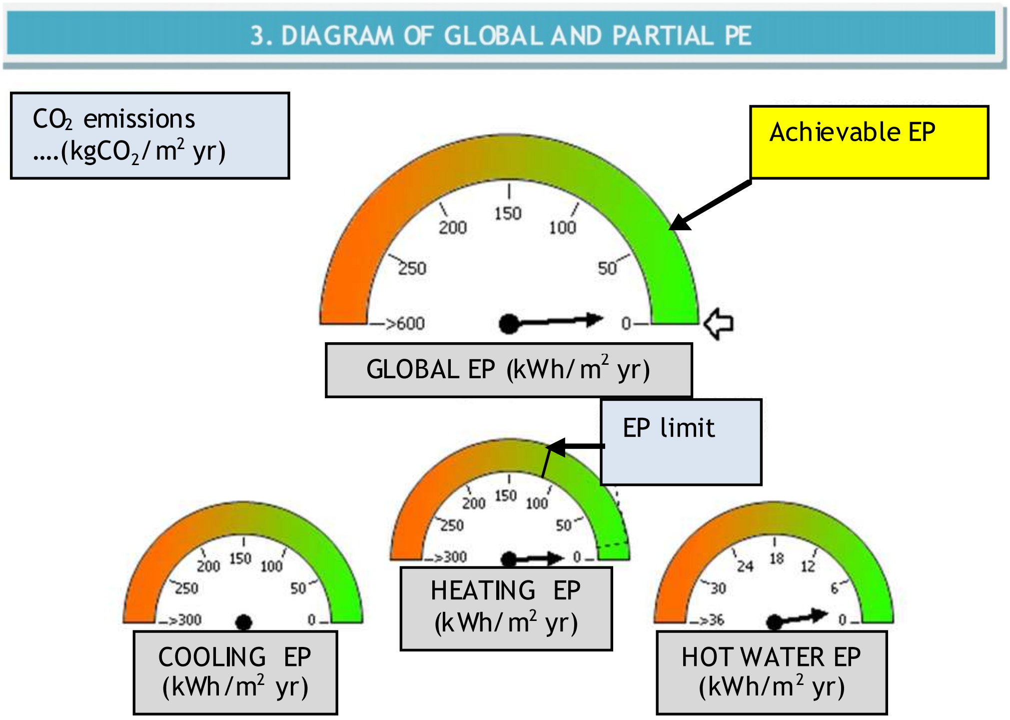


Figure 2. Energy Performance (EP) for each end use and overall performance are expressed graphically in the EPC using this format. The maximum allowed EP (EP limit) is displayed as a line in the heating EP diagram.

Validity of energy certificates is 10 years, but they have to be updated whenever the energy performance is modified by interventions on the envelope or on the system.

The real benefit of the EPC is in the recommendations given to the building owner. These are summarised on page 2 of the certificate, and are expressed as a list of actions, EP and class obtained after possible implementation, and payback time in years, as shown below.

6. RECOMMENDATIONS		
Measures	EP and Class after implementation	Payback time (years)
1)		
2)		
3)		
4)		
5)		
ACHIEVABLE NEW Energy Performance EP	……… kWh/m^2 year	…… years

Heating classes are defined with reference to the minimum energy performance (EP) requirements, which entered into force on the 1st of January 2010. The EP of a class varies with the climatic zone and with the shape factor of the building (ratio of envelope surface to heated volume). For **New buildings** or **major renovations** (or building units in new buildings or major renovations), the minimum EP corresponds to a C rating, to be approved at the planning stage, before construction begins.

As far as summer cooling is concerned, the thermal load of the new residential building (therefore excluding system performance) has to respect the following maximum levels:

For climatic zones A and B: 40 kWh/m^2 year.

For climatic zones C through F: 30 kWh/m^2 year.

And for all other new buildings the maximum level is:

For climatic zones A and B: 14 kWh/m^3 year.

For climatic zones C through F: 10 kWh/m^3 year.

Summer performance quality in the EPC can be evaluated on the basis of summer thermal load, so that classes of summer performance are obtained as shown in the following table.

EP e, thermal load (kWh/m^2 year)	Evaluation	Performance quality
EP e, thermal load < 10	Optimal	I
EP e, thermal load < 20	Good	II
EP e, thermal load < 30	Medium	III
EP e, thermal load < 40	Sufficient	IV
EP e, thermal load > 40	Poor	V

The calculation methodology is based on the national technical specifications of the series UNI TS 11300, which specify the mode of use of several CEN standards for Energy Conservation of Buildings in Italy. The selected method is monthly calculation of primary energy, including heating and cooling building load, domestic hot water, heating and cooling system, and renewable energies (still to be published). For non-residential buildings, lighting is also included in the calculation methodology, but the technical specification is not yet available.

EPC display in public buildings

Figure 3. The Lombardy Region official CENED software homepage.

In Italy, the definition of a **public building** includes:

Buildings owned by the State, regional, or local administrations, or other public organisations, irrespective of the activity performed therein, or any building not publicly owned, but used by a public body.

Every public building larger than 1,000 m^2 is required to **display the energy certificate** in a place easily visible to the public. However, no deadline or fine has been specified for non-compliance with this requirement.

All public buildings must have an EPC, when an operation and maintenance contract is signed for their management.

Figure 4. The first page of the CasaClima/ KlimaHaus EPC.

The regional system of ECB in Italy

The regionalisation of the ECB system has shown some positive and some potentially negative aspects. Among the positive aspects is the valorisation of local initiatives, which started before the existence of national guidelines; these initiatives have become examples of best practice for the whole country: the most famous example is the *CasaClima/KlimaHaus system* developed by the *Bolzano/Bozen* autonomous Province (*www.agenziacasaclima.it*).

On the other side, regionalisation produces a diversity of approaches moving from one area to another of the country (there are 21 Regions and Autonomous Provinces in Italy), creating obvious confusion in the identification of the final building class for the building designers, difficulties in the circulation of Qualified Experts from one Region to another, as well as uncertainty in the market on the real significance of a certain building class for buyers coming from other Regions. Until a Region produces its regional legislation, the national rules apply, but the Region has to organise training, accreditation, and so on. The main differences among the 10 issued regional systems are summarised below.

Region	EPBD Art. 3 Methodology	EPBD Art. 7 Certification	EPBD Art. 10 QEs
Valle d'Aosta	-	-	Assessors: training with examination or experience.
Piedmont	-	EPC is annexed to the sale and rental contract (+ fines). No class G declaration.	-
Lombardy	Slight deviations from UNI-TS 11300. Official SW tool.	EPC is annexed to the sale and rental contract (+ fines). No class G declaration.	Assessors: training with examination
Liguria	Official SW tool.	No class G declaration.	-
Aut. Pr. Bolzano	Official SW tool. Reference to EN 832. The classes are related to absolute EP values.	No class G declaration.	*CasaClima/KlimaHaus Agency* exercises control.
Aut. Pr. Trento		The national guidelines apply, therefore rental is excluded.	
Emilia Romagna	The classes are related to absolute EP values, not to minimum EP.	EPC is annexed to the sale and rental contract. No class G declaration. The notary has to annex the certificate to the sale act.	Assessors: training with examination or experience, but also registration in professional boards.
Tuscany	-	Class G if EPC is missing.	-
Apulia	-	EPC does not apply to sale and rental.	-
Friuli Venezia Giulia		An energy-environmental classification (VEA) is used for building certification.	Training courses started in 2010, certification is postponed to November 2011 (new) and January 2012 (sold and rented).

Impact of certification

As described in section 1, a first transitional period lasted from 2006 to 2009. During this period, the so-called "certificates of qualification" of buildings have been produced for new and sold buildings, and all existing buildings submitted to partial renovation. An estimate of more than 2 million certificates has been calculated, paving the way to the EPC.

EPC in the transitional phase	2006	2007	2008	2009	Total
New construction	110,000	315,000	295,000	255,000	975,000
Sales	-	60,000	240,000	640,000	940,000
Renovated flats (55% tax credit)	-	106,000	102,000	20,000	228,000
Renovated flats (FV Premium tariff)	-	650	1,200	1,650	3,500
					2,146,500*

*more than 8% of existing buildings

Concluding the transitional period, new EPCs have been issued in the Regions that had produced their own legislation, while other Regions lagged behind:

Region	Issued certificates	Months of certification
Bolzano Autonomous Province (September 2010)	2,358	45
Lombardy Region (October 2010)	365,000	26
Emilia Romagna Region (September 2010)	114,600	21
Liguria Region (September 2010)	26,133	16
Piedmont Region (October 2010)	101,566	12
Friuli Venezia Giulia, Tuscany, Apulia, Basilicata, Trento Autonomous Province.	...	Starting in 2011

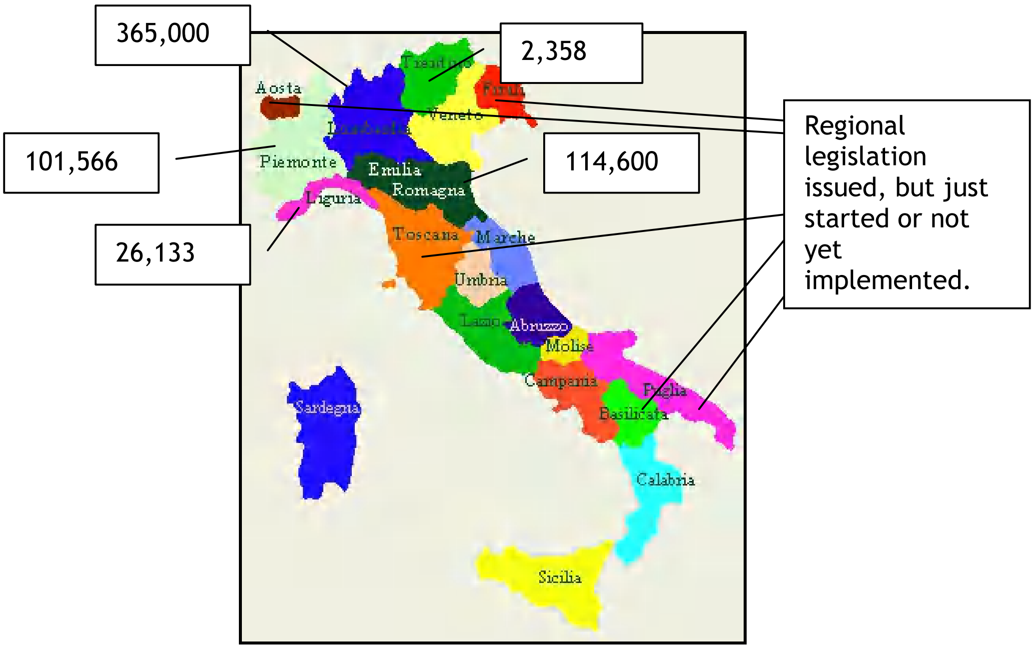


Figure 5. Number of EPCs issued in the first five Regions and Autonomous Provinces that organised their Energy Certification of Buildings (ECB) system, and indication of the other 5 Regions and Autonomous Provinces that have issued legislation, but not yet fully implemented a certification scheme.

Quality assurance (QA)

Figure 6. Quality assurance scheme.

The Regions have the responsibility for the management of the QA aspects of Energy Certification of Buildings. Typical stages are shown in the scheme in Fig. 6.

The training of experts is the first stage to guarantee a high quality level of the system. Specific regional training courses with high passing grades in the exam have started running in about 8 Regions and Autonomous Provinces out of 21. The second stage to guarantee EPC quality is an automatic system software[2] check of the data input, in order to avoid potential mistakes, before even issuing the certificate. A third QA stage is the control exerted by professional associations on their members, which is applied for example in case of a claim.

After the EPC is issued, there are usually two more stages, still at the regional level: first a simple QA check based on a visual verification of the form and the EPC, then a check of compliance on a random sample of the issued EPCs, delegated to an external institute, operative at present only in Lombardy and Bolzano/Bozen.

In order to guarantee independence in the evaluation procedure, the assessors have to declare, before signing a certificate:

a) In case of new buildings, the absence of any conflict of interest, namely expressed by the absence of direct or indirect involvement in the design or construction process, with the suppliers of the materials and components used, or with respect to advantages that the owner can obtain;

b) In case of existing buildings, the absence of any conflict of interest, namely expressed by the absence of direct or indirect involvement with the suppliers of the materials and components used, the administration of the building, or with respect to advantages that the owner can obtain.

This declaration is not necessary for assessors employed by public administrations or other public organisations dealing with energy and buildings. When a building is submitted to a simple boiler substitution, the renewal of the certificate can be issued by a technician of the boiler supplier or by the installer.

At present, there are recognised Qualified Experts in the following Regions and Autonomous Provinces, which have a QA system as presented above (even if not yet fully in operation):

Region	No. of assessors
Bolzano Autonomous Province (September 2010)	189
Lombardy Region (October 2010)	12,700
Emilia Romagna Region (November 2010)	21,546
Liguria Region (September 2010)	4,168
Piedmont Region (October 2010)	5,798
Trento Autonomous Province (September 2010)	171

3 > Inspections - Status of implementation

The inspection of boilers started in Italy a long time ago (1993), enforced by the Law n. 10/1991 and following implementation decrees. The inspection legislation has been finalised (Decree of the President of the Republic 59/2009), modifying some procedures, giving more responsibility to the Regions, and allowing for a longer maximum interval (up to 4 years, see table 5) for maintenance and control of small gas boilers. The procedures for inspection of air conditioning systems are still under discussion, and are now being prepared by a working group in the Ministry, under the new framework of the Recast transposition.

Liquid and solid fuel, gas >35 kW	Every year
Gas < 35 kW older than 9 years, and open system	Every 2 years
Gas < 35 kW, room sealed.	Every 4 years
Power > 350 kW	Twice per year

Table 5. Periodicity of inspections for energy efficiency purposes.

[2] A reference software has been produced by ENEA and CNR for small residential houses and for non-residential buildings (DOCET and DOCET PRO) accessible at *http://www.docet.itc.cnr.it/* and distributed at *https://europe.xclima.com/*

The principle of the Italian inspection system is the obligation of the owner/user to arrange regular boiler maintenance by the service staff, who fill out an inspection report and deliver it to the Local Administration, which is in charge of control of compliance. This control is exercised through checks on the received documents and on-site verifications on a sample of the systems. The inspection procedure is not limited to energy efficiency checks, but also involves safety aspects.

In their autonomy, the Regions and Autonomous Provinces have further detailed the national rules, and the local administrations have implemented databases of results.

The Qualified Experts, who make up the control staff, are trained by public and private organisations, according to a programme defined by ENEA (the national body for environment, energy and innovation) and have to pass an examination. The maintenance personnel are usually trained through entrepreneurial associations.

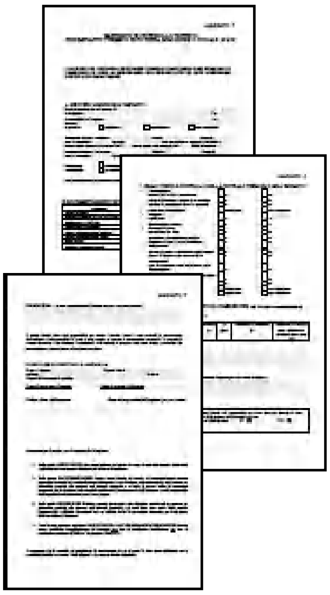


Figure 7. Structure of the inspection report.

Required information:

- System identification;
- Check of the compulsory technical documentation;
- Result of the visual inspection;
- Data obtained measuring combustion efficiency;
- Recommendations for safety and efficiency improvements;
- Authorisation for the safe operation of the boiler.

The measurement of combustion efficiency is carried out according to the relevant CEN standard. The inspection of boilers takes place every 1, 2, or 4 years depending on the fuel used, boiler nominal power, boiler age, or specific safety requirements (Table 5).

The long-term experience with the inspection system in Italy has shown that, in the first phases, the percentage of existing systems which are submitted to regular maintenance and efficiency control is 50-60%, rising to 80-90% after some years of implementation. The Local Administrations have difficulty in organising on-site controls, but there are positive examples, where up to 5% of the systems are checked every few years. Studies performed by some local administrations (City of Florence, as an example) indicate a potential saving as large as 6% of the overall heating consumption, obtainable through a carefully organised inspection scheme.

4 > Qualified Experts

Certificates can only be issued by Qualified Experts (QE). QEs may be architects, engineers, and technicians with a secondary school technical degree, duly qualified and recognised by their professional associations. When required, the QEs attend a training course provided by training organisations accredited by the Regions, and have to pass an examination. The list of accredited QEs is available to the public at the regional websites and is regularly updated.

Administrative penalties are foreseen for assessors' non compliance with the certification rules (30% of invoice), misconduct (70% of invoice and communication to the professional association), or falsification of the certificate (fine ranging from 500 € to 3,000 €); for the work supervisor, for omission of the compliance declaration (50% of invoice and communication to the professional association), or falsification of data (500 € or imprisonment of up to 6 months); and for end users, for not assuming the responsibility of producing and delivering the certificate (fine ranging from 500 € to 3,000 €).

5 > Information and Communication Campaigns

Figure 8. Campaign for Class A houses.

The need of informing citizens on certification

Some Regions have specific websites for information:

- Province of Milan: guidelines and certification tool SACERT *www.sacert.it*
- Province of Reggio Emilia, Municipality of Reggio Emilia and ACER (social housing company): ECOABITA certification system *www.ecoabita.it*
- Province of Vicenza: Ecodomus.vi, certification procedure *www.vienergia.it/a_22_IT_70_1.html*
- Emilia – Romagna Region: institutional website for ECB *www.regione.emilia-romagna.it/energia*
- Lombardy Region official website for certification *www.cened.it*
- Autonomous Province of Bolzano/Bozen: CasaClima/KlimaHouse agency official website *www.agenziacasaclima.it*

Among the initiatives recently launched for promoting Energy Certification of Buildings, ADICONSUM (*www.adiconsum.it*) provides a network of Qualified Experts to citizens asking for an energy audit with certification at their call centre (co-financed by the EIE project “ENFORCE”).

Finally, it is worth mentioning local initiatives of private companies, in collaboration with local administrations that provide free energy audits and certifications for multifamily buildings (condominiums), as a promotional tool for offering building/system renovation works[3].

Informing citizens on boiler inspections

Information and communication campaigns for boiler inspections have been organised by most provinces and cities, reminding the end users of their obligation of boiler maintenance and control, as well as the correct use of heating systems for safe and efficient operation.

6 > National incentives and subsidies

i) Tax credit programme

A 55% tax credit, to be distributed in ten fiscal years maximum, which was extended to 2010 by the Financial Law of 2008, is available for the following building efficiency measures:

- Electric, absorption cycle and geothermal heat pumps, condensing boilers, solar thermal collectors;
- Retrofitting of building envelope elements that satisfy the minimum Building renovations that globally satisfy building performance of less than 20% of the Energy Performance requirements in force.

Figure 9. Information campaign material for boiler inspections in the province of Ravenna

[3] One reference is the initiative of the consortium of installers “Domotecnica” in collaboration with Modena Municipality and the Modena Energy Agency (*www.domotecnica.it*), illustrated in figure 10.

Figure 10: The promotional campaign of Domotecnica for free energy audit and EPC in multifamily buildings in Modena.

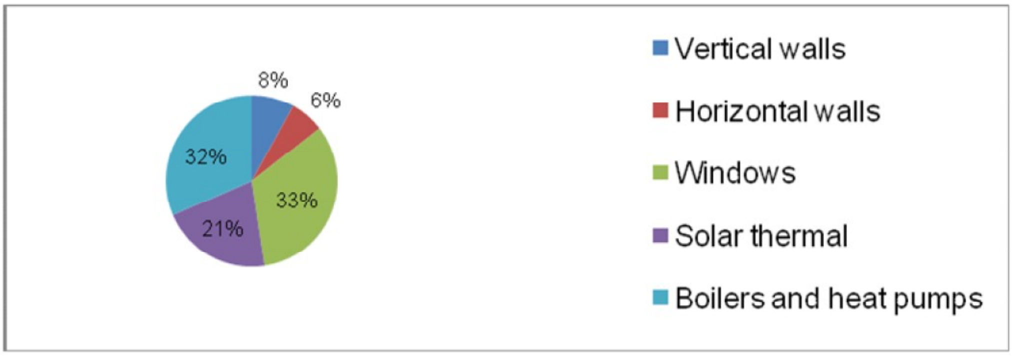


Figure 11. Breakdown of the results obtained through the 55% tax credit system in the two years 2007 and 2008.

The tax credit programme has been considered a great success, in terms of saved energy, induced investment, and benefit to SMEs and employment. In the whole period of application, since 2007 and including data from 2010, 840,000 interventions of energy renovation have been supported, involving 2 million flats (7.7 % of existing flats). The overall energy saving obtained was 6500 GWh/year, and 42,000 jobs created (average in the 4 years), with a peak of 56,000 in 2009. The annual data are reported below (2010 data are not yet complete).

	2007	2008	2009	Total
Number of interventions	106,000	247,000	236,000	589,000
Primary energy saved (MWh)	800,000	2,000,000	1,600,000	4,400,000
Net intervention costs (€)	1,500,000,000	3,500,000,000	2,800,000,000[4]	7,800,000,000
Income tax deduction (€)	825,000,000	1,925,000,000	1,540,000,000	4,290,000,000

ii) Photovoltaic production premium tariff

In the framework of the Photovoltaic premium tariff and net metering system, an increase of up to 30% of the tariff itself is available for buildings submitted to a renovation, leading to reduced energy consumption by at least 10%. EPC (heating performance and cooling load performance), before and after the renovation, is the necessary requirement and the way of demonstrating that the result has been achieved.

iii) Incentives for low energy buildings

A Decree of March 2010 offers a public grant of 83 €/m^2 and 116 €/m^2 for new residential buildings, in which family homes are housed, if the achieved Energy Performance is less than 30% and 50% respectively of the minimum requirements in force. This contribution could cover about 60% of the extra costs per m^2, but was limited to 5,000 € and 7,000 € respectively per intervention. Only a very small part of the available budget (10,000 flats initially estimated) has been used so far.

iv) Public buildings

Since December 2006, about 8 M€ has been budgeted for energy diagnosis and certification of public buildings, throughout the Regions.

v) Kyoto Fund

The Ministry of Environment has budgeted a revolving fund for sustainable energy investments, which will be managed by the Regions willing to assume responsibility for the organisation of the calls for projects.

[4] Estimate.

7 > Impact of the EPBD at national level

Evolution of Minimum quality requirements in building regulations

The evaluation of minimum quality requirements is difficult, due to the differentiation of climates and shape factors. Taking climatic zone E and a shape factor of 0.5 as an example, the first EP legal requirements on building energy performance stated in 1993, which can be assumed as approximately 120 kWh/m^2.year (final energy needs), have been reduced to 87.5 in 2006, to 80.5 in 2008 and to 71.2 in 2010 (Fig. 12).

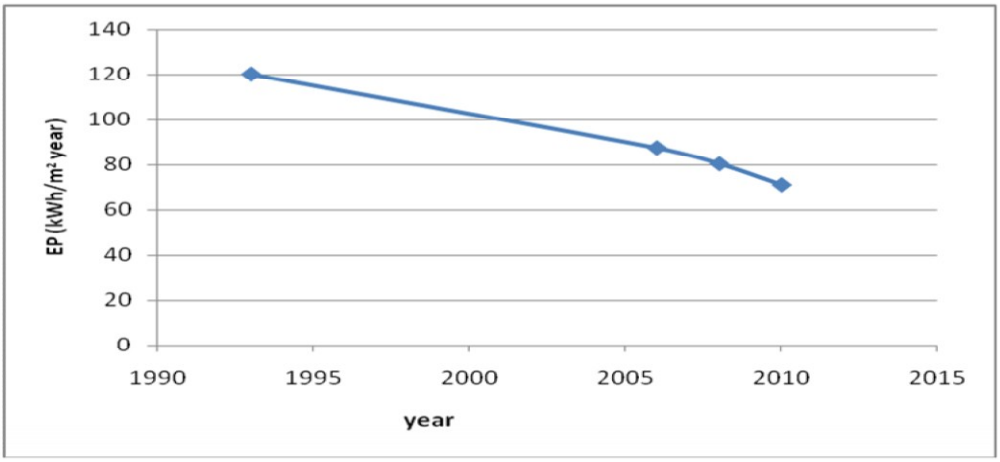


Figure 12. Decrease of the maximum legal EP with time.
(Final energy consumption, climatic zone E, shape factor 0.5)

Other impacts

The impact on employment is still difficult to assess, as the professionals dealing with energy certification of buildings are also involved in more conventional activities. Nevertheless, the training of Qualified Experts for this purpose has significantly increased the number and quality of architects, geometers, and technicians who deal with buildings, but until now had little familiarity with aspects of energy performance.

Companies are also specialising in low energy buildings, both for new constructions and for renovations: some clusters of enterprises are appearing on the market to provide a complete and skilled offer for major building renovations.

8 > Conclusions and future planning

The EPBD requirements for new buildings and major renovations will certainly bring important energy savings in the near future, although new and renovated buildings only represent a small share of the entire building stock in Italy (about 1% per year of the existing buildings). Therefore, the impact of applying energy performance requirements in new and renovated buildings is obviously limited and will not lead, in useful time, to a relevant reduction in energy consumption in the building sector.

To achieve real energy savings in the building sector, significant incentives regarding the improvement of existing buildings are needed, and certification can play a fundamental role. The recommendations made by the experts in the certificate are important guidelines that the owner of the building can make good use of, either in the context of a renovation, or as an individual cost-effective measure. Financial concerns about the investment cost in using energy efficient technologies are a major barrier, though.

A main challenge is to make the public aware of their real energy use. There still is a general lack of awareness on two fronts: 1) consumers are not aware of the amount of energy they are currently consuming in the building, which makes it difficult for them to understand the benefits of energy efficiency measures; 2) consumers are not well aware of the available energy efficiency measures and renewable technology opportunities. This, however, is slowly being overcome through the government's continued promotion of these technologies.

On the other hand, additional training should be offered for qualified experts, to improve their skills in energy audits and best economic and technologic building improvement solutions.

The main challenges and future developments of the certification system for the short and medium term, thus, are:

- To improve the regional IT platforms supporting the ECB, including online audit reports, data entry validation and automation of the QA process;
- To reinforce the QA Scheme, increasing the number of light checks on input data and some on-site random verifications;
- To provide additional training for system designers and installers, concerning efficient HVAC, domestic hot water and renewable energy systems, as well as more effective auditing techniques;
- To develop a simplified methodology for periodic inspections of air conditioning systems;
- To develop technical specifications for artificial lighting certification in tertiary sector buildings.
- To develop an efficient monitoring system of ECB at a national level, based on input from the Regions and Autonomous Provinces, in order to detect the level of homogeneity of operations, costs, and methodologies adopted in the different parts of the country.

The experience acquired until now will certainly be of great help to achieve these challenges, and also to reach the final goal of net zero energy new buildings by 2020.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Lithuania

Status in November 2010

Edita Meškauskienė

Ministry of Environment

Nina Česonienė

Ministry of Environment

Viktorija Aleksevičienė

Ministry of Energy

Robertas Encius

SPSC

Birutė Jagminienė

VEI

Lithuania

National websites:

- *www.am.lt*
- *www.enmin.lt*
- *www.spsc.lt*
- *www.ena.lt*
- *www.vei.lt*

1 > Introduction

The EPBD was fully transposed into Lithuanian law in 2006. All laws, regulations and administrative provisions necessary to bring this Directive into effect, pursuant to Article 15(1), came into force on the 4^{th} of January 2006. The implementation of the EPBD in Lithuania started in 2007. Since the last Report was published in May 2008, certification in Lithuania has become widespread in the building market.

Implementation of the EPBD is based on the Law on Construction, the Law on Energy, and on the Building Technical Regulation *STR 2.01.09:2005 "Energy Performance of Buildings; Certification of Energy Performance of Buildings"*, published in 2005 (http://www.am.lt/VI/en/VI/index.php#a/280). These legal acts remain unchanged so far. In the following year, taking the new items of the Directive 2010/31/EC into account, new steps are foreseen in the direction of the implementation.

The requirements that were set following the EPBD created the basis for The Lithuanian Housing Strategy (*http://www.am.lt/VI/en/VI/index.php#a/67*) and The Modernisation of Multifamily Buildings Programme, using the JESSICA[1] Financial Instrument. The 5 new legal acts were prepared to assist the implementation of these Programmes. Recently, the revision process of the current legislation has begun, in order to accommodate the requirements of the recast of the EPBD in 2010 and to improve the certification process, based on the experience gained over the last 3 years.

This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in Lithuania. It addresses the certification and inspection systems, including quality control mechanisms, training of qualified experts, information campaigns, incentives and subsidies.

The implementation of the EPBD in Lithuania was the overall responsibility of the Ministry of Environment and the Ministry of Economy. However, in 2009 the Ministry of Energy was appointed as responsible for the implementation of the EPBD, instead of the Ministry of Economy. At present, the Ministry of Environment and the Ministry of Energy are jointly responsible for the implementation of the EPBD in Lithuania.

[1] JESSICA – an initiative developed by the European Commission and the European Investment Bank, in collaboration with the Council of Europe Development Bank. Member States are given the option of using Structural Funds to make repayable investments on projects, forming part of an integrated plan for sustainable urban development.

2 > Certification

Logo of the Certification Centre of Building Products (SPSC)

In 2006, the certification body Certification Centre of Building Products (SPSC) was mandated to carry out the certification of experts of energy performance of buildings, and to manage the registry of certified experts and the central database of certified buildings. SPSC is also the body, which currently supervises the whole building certification process.

Two institutions were appointed as responsible for providing training to experts: the Architecture and Building Institute of Kaunas Technological University and the Quality Management Centre of Vilnius Gedimino Technical University.

In Lithuania, the EPBD was in practice first implemented in 2007, but the Lithuanian Housing Strategy (http://www.am.lt/VI/en/VI/index.php#a/67) and the Programme for the Refurbishment of Multifamily Buildings, both approved in 2004, created the connection between the EPBD and the existing housing stock. The main task of the Programme was to provide support to home owners of multifamily buildings with the implementation of energy efficiency measures.

In Lithuania, certification is mandatory for **new buildings** and **when existing buildings are rented or sold**. It is also required for multifamily buildings that are renovated, following The Rules of the Programme for Refurbishment.

The energy performance class of large buildings (or building parts) with a heated area of over 1,000 m^2 after major renovation must not be less than D.

The requirements regarding energy performance class are not obligatory for existing buildings (or building parts) that are for sale or rent, but the evaluation procedure became mandatory from the 1st of January 2009.

According to the Building Technical Regulation STR 2.01.09:2005, it is required that, in large buildings (public buildings) with a heated area of over 1,000 m^2, such as hotels, administrative, trade, services, restoration, transport, culture, education, health care and buildings destined for recreation, the valid energy performance certificate, less than 10 years old, is displayed at a prominent place, clearly visible to the public.

The energy performance certificate


PASTATO ENERGINIO NAUDINGUMO SERTIFIKATAS

Nr. KG-0183-0172

Unikalus pastato Nr.	2999-0006-3013
Pastato adresas:	K. Korsako g. 28, Šiauliai, Šiaulių m. sav.
Pastato paskirtis:	Kiti gyvenamieji pastatai
Pastato naudingasis plotas:	1607,91 m²

Pastatų energinio naudingumo klasifikavimas į klases*:

Pastato energinio naudingumo klasė:

A B C D E F G

D

Skaičiuojamosios suminės energijos sąnaudos vienam kvadratiniam metrui pastato naudingojo ploto:	282,86 kWh/(m²×metai)
Pagrindinis pastato šildymui naudojamas šilumos šaltinis:	Šilumos tinklai, automatinis reguliavimas
Sertifikato išdavimo data:	2009-12-08
Sertifikato galiojimo terminas:	2019-12-08

Sertifikatą išdavė pastatų energinio naudingumo sertifikavimo ekspertas: Andrius Mickus, atestato Nr.0183

UAB "MIESTO RENOVACIJA"

Andrius Mickus

07666

* A klasė nurodo labai energiškai efektyvų pastatą, G klasė nurodo energiškai neefektyvų pastatą

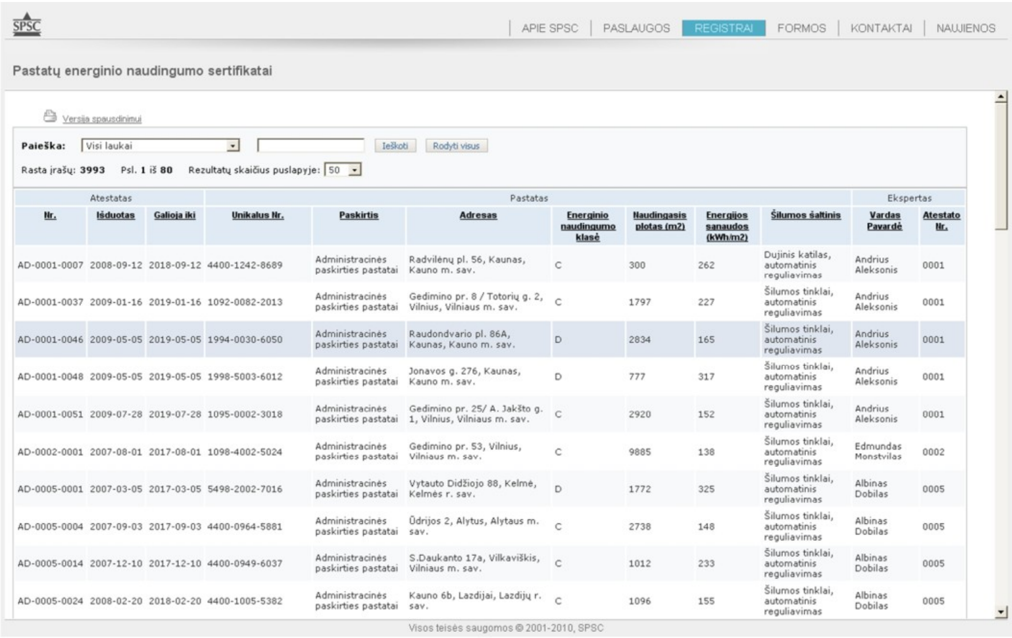
Fig. 1 – Cover page of the EPC

The certificates of energy performance of buildings can only be issued by the certified qualified experts of energy performance of buildings. The experts must conform to the requirements set in the rules, pass a training course and an exam, and obtain a certificate of qualification.

The register of certified experts and certificates of energy performance of buildings is continuously updated and always available to the public online at the SPSC website.

Link to the Central Database and Central Register of the certificates of energy performance

www.spsc.lt



SPSC | APIE SPSC | PASLAUGOS | REGISTRAI | FORMOS | KONTAKTAI | NAUJIENOS

Pastatų energinio naudingumo sertifikatai

Versija spausdinimui

Paieška: Visi laukai Ieškoti Rodyti visus

Rasta įrašų: **3993** Psl. **1** iš **80** Rezultatų skaičius puslapyje: 50

Atestatas			Pastatas							Ekspertas	
Nr.	Išduotas	Galioja iki	Unikalus Nr.	Paskirtis	Adresas	Energinio naudingumo klasė	Naudingasis plotas (m2)	Energijos sanaudos (kWh/m2)	Šilumos šaltinis	Vardas Pavardė	Atestato Nr.
AD-0001-0007	2008-09-12	2018-09-12	4400-1242-8689	Administracinės paskirties pastatai	Radvilėnų pl. 56, Kaunas, Kauno m. sav.	C	300	262	Dujinis katilas, automatinis reguliavimas	Andrius Aleksonis	0001
AD-0001-0037	2009-01-16	2019-01-16	1092-0082-2013	Administracinės paskirties pastatai	Gedimino pr. 8 / Totorių g. 2, Vilnius, Vilniaus m. sav.	C	1797	227	Šilumos tinklai, automatinis reguliavimas	Andrius Aleksonis	0001
AD-0001-0046	2009-05-05	2019-05-05	1994-0030-6050	Administracinės paskirties pastatai	Raudondvario pl. 86A, Kaunas, Kauno m. sav.	D	2834	165	Šilumos tinklai, automatinis reguliavimas	Andrius Aleksonis	0001
AD-0001-0048	2009-05-05	2019-05-05	1998-5003-6012	Administracinės paskirties pastatai	Jonavos g. 276, Kaunas, Kauno m. sav.	D	777	317	Šilumos tinklai, automatinis reguliavimas	Andrius Aleksonis	0001
AD-0001-0051	2009-07-28	2019-07-28	1095-0002-3018	Administracinės paskirties pastatai	Gedimino pr. 25/ A. Jakšto g. 1, Vilnius, Vilniaus m. sav.	C	2920	152	Šilumos tinklai, automatinis reguliavimas	Andrius Aleksonis	0001
AD-0002-0001	2007-08-01	2017-08-01	1098-4002-5024	Administracinės paskirties pastatai	Gedimino pr. 53, Vilnius, Vilniaus m. sav.	C	9885	138	Šilumos tinklai, automatinis reguliavimas	Edmundas Monstvilas	0002
AD-0005-0001	2007-03-05	2017-03-05	5498-2002-7016	Administracinės paskirties pastatai	Vytauto Didžiojo 88, Kelmė, Kelmės r. sav.	D	1772	325	Šilumos tinklai, automatinis reguliavimas	Albinas Dobilas	0005
AD-0005-0004	2007-09-03	2017-09-03	4400-0964-5881	Administracinės paskirties pastatai	Ūdrijos 2, Alytus, Alytaus m. sav.	C	2738	148	Šilumos tinklai, automatinis reguliavimas	Albinas Dobilas	0005
AD-0005-0014	2007-12-10	2017-12-10	4400-0949-6037	Administracinės paskirties pastatai	S.Daukanto 17a, Vilkaviškis, Vilniaus m. sav.	C	1012	233	Šilumos tinklai, automatinis reguliavimas	Albinas Dobilas	0005
AD-0005-0024	2008-02-20	2018-02-20	4400-1005-5382	Administracinės paskirties pastatai	Kauno 6b, Lazdijai, Lazdijų r. sav.	C	1096	155	Šilumos tinklai, automatinis reguliavimas	Albinas Dobilas	0005

Visos teisės saugomos © 2001-2010, SPSC

Fig.2. The Register of issued certificates of energy performance of buildings

The Certificate of a building (or its part, e.g., an apartment) must include the address of the building and the following data concerning the building or its part:

- purpose (typical use);
- energy performance class;
- calculated sum of final energy needs per m^2 of the useful area;
- data on the main source of heating and cooling;
- certificate number;
- issue date of the certificate;
- expiry date of the certificate;
- name and signature of the expert who issued the certificate.

Certificates of energy performance of buildings are usually valid for 10 years. Exceptions can only be made due to objective reasons, e.g., certification before and after the renovation of a building.

Buildings can be classified as belonging to one of 7 classes: A, B, C, D, E, F, or G. Class A is at the top and such a building is very energy efficient, with low energy consumption, while class G defines a building with poor energy efficiency. The building class assigned depends, among other factors, on the type of the building, primary and final energy needs, and CO_2 emissions.

The certificate includes recommendations given to the owner of the building, such as actions for improving the energy performance of the building and an estimation of the energy savings (kWh/(m^2 year), after the measures are implemented.

Link to the Central Register of Certified Buildings

At the moment, there are 4,000 certified buildings in Lithuania. Approx. 1,800 certificates were issued for non-residential buildings and 2,200 for residential buildings. All certificates of energy performance of buildings are collected in the central database and published in the central register at the SPSC website, *www.spsc.lt*.

A small registration fee for every issued certificate covers the cost of quality assurance of the certification process. There are no official data on certification costs, as they vary by expert and type of building, and range between 70 € and 2,500 € per building.

Requirements for new buildings

The main energy performance requirements for new buildings in relation to the EPBD (article 5) are described in the Building Technical Regulation *STR 2.01.09:2005 „Energy Performance of Buildings; Certification of Energy Performance of Buildings*". The energy performance class of new buildings (or building parts) must not be lower than C. This requirement is mandatory for all new buildings, for which the design parameters (references) were defined after the Regulation came into force, on the 4th of January 2006. Certification requirements for new buildings came into effect on the 1st of January 2007. The requirements for the certification of new buildings in Lithuania came into force on the 1st of January 2007.

Requirements for existing buildings

The requirements set for existing buildings differ from the requirements for new ones. The largest difference concerns the residential stock. The majority of Lithuanian residential multifamily houses, i.e., 60% of the building stock, were constructed between 1960 and 1990. Most of these are in very poor energy efficiency condition. The values defined in national regulations regarding new construction works, that are set according to the requirements of the EPBD under harmonised standards of thermal insulation products, cannot be achieved in existing buildings without major renovation.

The requirement of the mandatory certification of existing buildings that undergo major renovation came into effect on the 1st of January 2009. The energy performance class of large buildings (or building parts) with a heated area of over 1,000 m^2 after major renovation must not be lower than D.

The calculation methodology

Assessment of energy performance of a building.

Energy performance of a building must be assessed taking into consideration the value of the qualifying indicator C, calculated as follows:

if $\frac{Q_{sum}}{Q_{N.sum.}} \leq 1$,

$$C = \frac{Q_{sum}}{Q_{N.sum.}};$$

if $\frac{Q_{sum}}{Q_{R.sum.}} \geq 1$,

$$C = 1 + \frac{Q_{sum}}{Q_{R.sum.}};$$

The calculation procedure is based on methods described in the standards EN 15217:2005 „Energy performance of buildings. Methods for expressing energy performance and for energy certification of buildings", and EN 15203:2005 „Energy performance of buildings. Assessment of energy use and definition of ratings".

All buildings must be designed according to the requirements of the National Building Technical Regulations STR 2.05.01:2005 „Thermal Technique of Envelopes of Buildings", e.g., for residential buildings, the normative values must be as indicated in Fig.3.

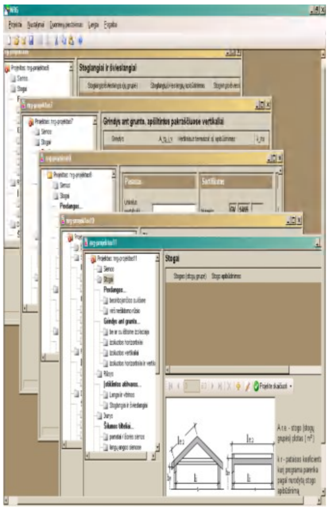
Building element	Normative U-value, W/(m^{2}K)
Roofs	$U_N \leq 0.16 \cdot \kappa$
Ceiling in contact with outdoor air	
Building elements in contact with ground	$U_N \leq 0.25 \cdot \kappa$
Ceilings over unheated basements and crawls	
External walls	$U_N \leq 0.20 \cdot \kappa$
Windows and transparent building elements	$U_N \leq 1.6 \cdot \kappa^{1)}$
Doors and gates	$U_N \leq 1.6 \cdot \kappa$
Linear thermal bridges	$\Psi_N \leq 0.18 \cdot \kappa$

1) If the total area of windows and other transparent building elements exceeds 25% of the total external wall area, the U-value of transparent elements should not exceed 1.3 W/(m^2·K).

2) $\kappa = 20/(\theta_i - \theta_e)$, - temperature correction factor, where θ_i - indoor air temperature, °C, θ_e - outdoor air temperature or design temperature of adjacent space, °C. Temperature of unheated spaces is determined separately. If indoor air temperature θ_i = 20 °C, and outdoor air θ_e = 0 °C, then κ = 1.

Fig.3. Normative requirements for thermal protection of residential building envelope

Example of the Software Tool application for the certification of energy performance of buildings



The energy consumption for heating is determined according to the default heat transmission coefficient values of each element in the building envelope:

- normative values are taken from the requirements of the National Building Technical Regulations STR 2.05.01:2005 „Thermal Technique of Envelopes of Buildings“;
- reference values are determined according to the requirements of the Building Codes and the construction guidelines from the corresponding construction period;
- calculated values are determined according to the design data for new buildings, and the standard data with respect to the construction year and the type of building elements for existing buildings;
- energy consumption for domestic hot water and electricity is determined according to the default values, without taking the usage of individual tenants into account.

The calculation can only be done using the legal calculation procedure presented in the National Building Technical Regulation STR 2.01.09:2005. The Energy Performance programme was prepared and approved by the Lithuanian Ministry of Environment. The calculation procedure is the same for new and existing buildings, as well as for residential and non-residential buildings. If any refurbishment is carried out in the building, the corresponding new values of heat transmission coefficients must be used in the calculation.

Energy consumption during the summer is only assessed for domestic hot water and electricity use. Ventilation related energy consumption is assessed only during the period of the year in which heating is used. The energy consumption of air-conditioning and cooling is not included in the calculation, as at present there are no normative values for building cooling and air-conditioning.

The calculation method does not set any requirements for primary energy consumption values in buildings. The energy performance efficiency of each building is evaluated solely using the reference building method, that is, a comparison between the normative, the reference and the calculated energy consumption value for each building.

Opening page of the Software Tool Guidance

Fig. 4. Software Tool Guidance

The certification of buildings in Lithuania is based on calculations and building audits, but not on the measurement of energy consumption. The input data required for the calculation of the energy consumption of a building are stated in the Building Technical Regulation STR 1.02.09:2005.

The energy performance of part of a building should be assessed using the same methodology as that for the whole building, the only difference being that the useful area of the respective part of the building is used, instead of the total useful area of the building.

Quality assurance (QA)

The Quality assurance scheme is the same for all types of buildings in Lithuania. Every certificate of energy performance of buildings is checked using specially designed software and by a person, in order for the data to be completed. Approximately 2% of all certificates issued every year, usually randomly selected, are carefully audited.

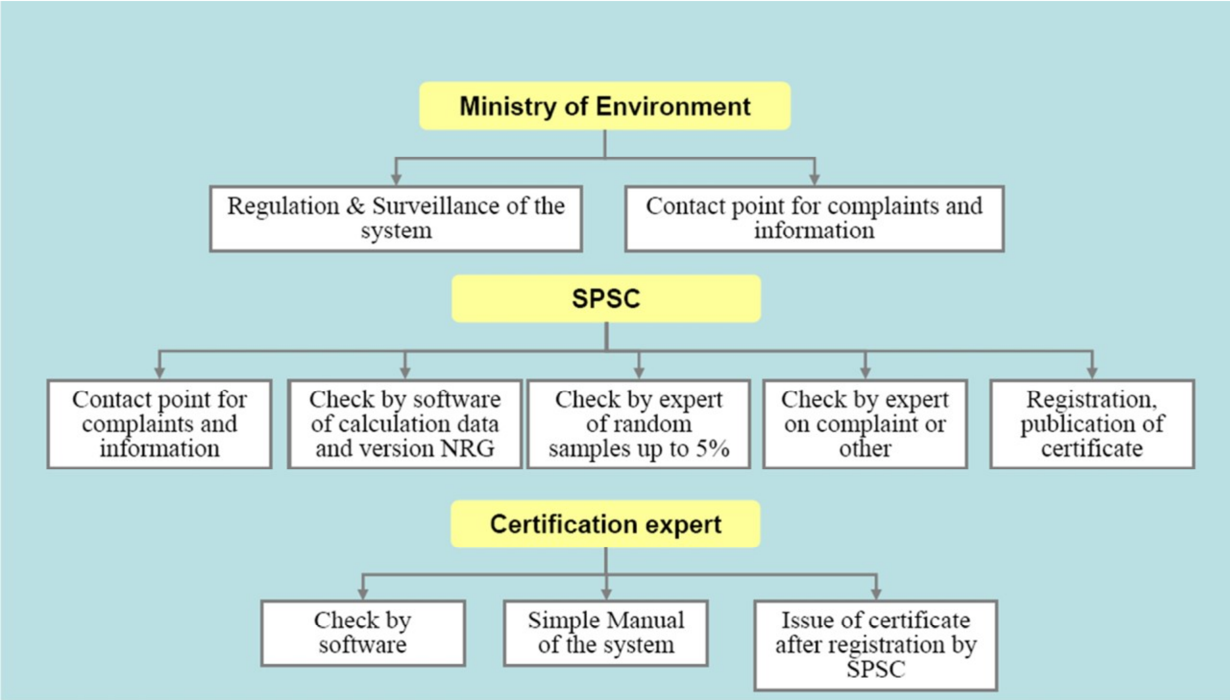


Fig.5. Quality assurance structure

The detailed check includes a review of the calculations and building documentation, as well as a building audit. A detailed audit is performed in the following cases: at random, following complaints of clients, or when the certificate data are outside a certain range. Approximately 150 certificates have undergone a simple or detailed check. In the preliminary stage, the process is more educational: the experts are informed about mistakes and they must issue new correct certificates free of charge. However, penalties are also foreseen for incorrectly issued certificates in the future.

3 > Inspection of Boilers, Heating Systems and Air-Conditioning Systems - Status of implementation

Example of the Report form of the boiler and air conditioning system inspection on the website:

http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=278977&p_query=&p_tr2=

The required legislation for the inspection of boilers, heating systems and air-conditioning systems was approved in Lithuania in 2006 and in 2008 (Regulations on the inspection of boilers, heating and air-conditioning systems and Methodologies). The main purpose of these Regulations is to reduce fuel consumption (i.e., save money) and limit carbon dioxide emissions. A regular inspection of boilers, working on non-renewable solid and liquid fuels, should be done every 2 or 3 years, depending on the boiler's installed capacity. Heating installations with boilers with a capacity exceeding 20 kW and older than 15 years should undergo a one-off inspection of the whole heating installation. Air-conditioning systems with a capacity of more than 12 kW should be inspected every 3 years. For residents, these inspections can be performed upon the owner's (or the consumer's) request. According to the Law on Energy, the Lithuanian Government assumes the responsibility of financing energy efficiency inspections. Residents are offered this service free of charge. The Special programme for financing theses inspections was established in 2008.

Inspection time interval, years		
Boiler fuel type	Capacity, kW	
	20-100	More than 100
non-renewable solid	3	2
liquid	3	2

Fig.6. Inspection time interval

Link to the central database of The Lithuanian State Energy Inspectorate:

www.vei.lt

The inspection of boilers as well as air-conditioning systems is, however, still at an early stage. The system's strengths and weaknesses will become apparent after a few years. One year after the implementation of the inspections scheme, the greatest difficulties are the Energy Companies' limited interest in inspections and the consumers' lack of information on inspections.

Inspections of boilers and air-conditioning systems are based on the assessment of energy efficiency under normal working conditions. Measurement methods and the procedure for the evaluation of boilers, heating systems and air-conditioning systems were established in the Methodologies of efficiency inspection. These methologies were prepared according to the Lithuanian standards and Regulations on the inspection of boilers, heating and air-conditioning systems, with minimum labour expenditures. The main steps involved in the inspection are as follows:

- Analysis of project and/or technical documentation;
- Visual inspection, evaluation of the system's state and assessment of its conformity with the Methodologies and Regulations on inspection;
- Measurements of and calculations using actual data;
- Inspection of equipment operation;
- Calculation of efficiency and other indicators;
- Report on the inspection (conclusions and recommendations).

Owners (or consumers) must keep the inspection report until the next inspection. Electronic copies of the inspection reports are also kept in the database of the Lithuanian State Energy Inspectorate.

4 > Qualified Experts

Qualified experts for the certification of energy performance of buildings

Example of the atestate of qualified expert

Qualified experts are persons who are authorized to issue certificates of energy performance of buildings. The main qualification requirements for qualified experts in Lithuania are the following:

- construction engineer diploma,
- three years of experience in the construction sector,
- specialised 32 hours training course,
- certification of three buildings as practical experience,
- successful completion of exam.

At the end of November 2010, there are 352 qualified experts in Lithuania. The experts are registered in the central database and at the SPSC, and the list is published on the *www.spsc.lt* website.

There are two training organisations in Lithuania: the Architecture and Building Institute of Kaunas Technological University (KTU ASI) and the Quality Management Centre of Vilnius Gedimino Technical University. These training organisations were appointed by the Ministry of Environment. The Certification Centre of Building Products (SPSC) was appointed to certify qualified experts. The training and certification of qualified experts started in Lithuania in November 2006.

The specialised 32 hours training programme for qualified experts was adopted by the Ministry of Environment in June 2006. It covers legal and general information, calculation methodology, calculation of energy consumption, organisational questions, and calculation software, and requires the certification of three buildings, as practical experience. After successful completion of the exam, the appointed committee grants the certificate of qualification.

Inspectors of boilers, heating and air-conditioning systems

Based on Lithuanian law, Inspectors are Energy Companies:

- Which have employees who acquired a certificate of competency from a specialised energy training centre. The training of employees is organised by the General Director of the Lithuanian Labour Market Training Authority under the Ministry of Social Security and Labour, through approved Training Programmes.
- Certified for the operation of electrical equipment by the State Energy Inspectorate (for the inspection of air-conditioners). These Certificates are valid for 2 or 5 years, depending on the qualification and experience of the employees of the Energy Company.
- Certified for the operation of heating equipment by the State Energy Inspectorate (for the inspection of boilers and heating systems). These Certificates are valid for 2 or 5 years, depending on the qualification and experience of the employees of the Energy Company.
- Holding a certificate of liability insurance.

There are over 200 energy companies for the inspection of boilers and heating systems, and 16 energy companies for the inspection of air-conditioners. Air-conditioning is not very popular in the Lithuanian climatic conditions. All certified Energy Companies are registered in the central database of the Lithuanian State Energy Inspectorate and published on the *www.vei.lt* website.

5 > National Information and Communication Campaigns

Logo of the Construction and Renovation exhibition in Lithuania, RESTA 2009:

RESTA 2009

Bendra informacija

Statyba ir remontas

LAIKAS STATYTI TAUPIAI

Promotional and informational seminars have been organised for institutions and organisations that were interested. In the first stage of the certification system, information campaigns focused essentially on municipalities, specialists and professionals of the building sector. The Ministry of Environment and the SPSC organised several conferences to present and explain the certification process to municipalities and other stakeholders.

One of the conferences arranged by the Ministry of Environment was the international conference on energy efficiency in buildings, during the annual Construction and Renovation exhibition in Lithuania, RESTA 2009. Presentations were made by speakers from the European Commission, The Netherlands, Poland, France, Spain, Norway, Austria, various Energy Associations and Lithuania.

In January 2009, a communication campaign was directed to the general public, when the last phase of the implementation of the EPBD was reached. This meant that all buildings were then included in the certification system: new, major renovations, public buildings and all buildings when sold or rented.

Over the last two years, the Ministry of Environment has organised several seminars and workshops disseminating the certification process and promoting awareness in citizens, regarding the added value of a building's certification, that were based on clear and reliable information on the thermal quality performance of houses. Several meetings took place at the Ministry of Environment with the key players involved in home buying and selling (notaries, real estate agencies, banks, etc.), in order to strengthen their knowledge of the new requirements and to support the process of certification. There were also numerous consultations with the professionals of the building sector, during the period in which the recast of the EPBD was prepared.

The Architecture and Building Institute of Kaunas Technological University and the Quality Management Centre of Vilnius Gedimino Technical University were significantly involved in the dissemination of the building energy certification, through lectures within the training programmes for the certification of professionals as qualified experts.

The Housing and Urban Development Agency provides support to municipalities, building administration and maintenance companies, and home owners. Subdivisions of Agency are located in Vilnius, Kaunas, Klaipėda, Šiauliai, Panevėžys, Alytus, Marijampolė, Telšiai and Utena.

www.bkagentura.lt

The Housing and Urban Development Agency organises seminars and training courses for persons holding a position of responsibility within the housing and energy sector. It seeks to ensure the proper implementation of the programmes and measures, in order to create and develop effective housing management and maintenance systems, promote effective use of energy, and encourage energy-efficient renovation of private and public buildings in Lithuania.

The Housing and Urban Development Agency website provides detailed information about the national and European projects on energy efficiency in buildings, to professionals of the sector, that is, property owners and developers, and also to the general public. Successfully implemented projects can be viewed on the same website.

Cover page of the brochure Inspection of Energy Eficiency of Boilers, Heating Systems and Air-Conditioning Systems

The Certification Centre of Construction Products (SPSC) provides detailed information on training courses, a list of qualified experts, and lists of valid certificates that can be partially viewed online, among other features that can be accessed by users. Detailed brochures, as well as official texts, are available on the national websites.

With the support of the Canadian International Development Agency a report, *The Lithuanian Housing Strategy: Monitoring & Implementation*, was prepared for the implementation of the housing monitoring system (not for issuing certificates, rather for the evaluation of the condition of a house). It has proven to be very useful, when it comes to the practical implementation.

People are now able to use the energy performance certification rating as an additional factor when making an investment decision: the purchase of a house. It is one of the few administrative processes that provide potentially useful information to the owner of the house, explaining what he/she can do to actually save money and improve thermal comfort.

In 2008, a brochure On the Energy Efficiency Inspection of Boilers, Heating Systems and Air-Conditioning Systems was prepared and printed.

Information on the regular Inspection of Boilers, Heating Systems and Air-Conditioning Systems was disseminated through the Territorial Divisions of the State Energy Inspectorate and the Association of Local Authorities in Lithuania. This information was presented on TV.

http://www.ena.lt/doc_atsi/Silumos_katilai.pdf

During the international exhibition on construction and renovation in Vilnius, RESTA 2010, many seminars were organized on energy efficient and passive houses, in addition to 5 excursions-seminars to the construction sites of such houses. Six publications on passive houses were presented in the media. Persons in position of responsibility and scientific collaborators have also participated in radio and television broadcasts, and have made presentations in several conferences, meetings and seminars. The promotional brochures on the certification of energy performance of buildings were produced and presented, during the international exhibition on construction and renovation RESTA 2010, to specialists of the construction field, responsible authorities, institutions, building owners, and to the general public.

Detailed brochures, as well as official texts, are available on the national websites.

6 > National incentives and subsidies

The National Energy Efficiency Programme for 2006-2010 is an inter-institutional programme providing for organisational, legal, economic, and technological improvement and introduction, applied research, public education and awareness raising measures, aimed at increasing the efficient use of energy resources and

Link to The National Energy Efficiency Programme:

http://www.ukmin.lt/en/energy/renew/doc/Neved_programa_angl.pdf

energy, as well as the monitoring of their implementation in the following sectors: buildings and their engineering systems, cogeneration, district heating, equipment in enterprises, establishments and households, transport, as well as indigenous, renewable and waste energy resources.

The Ministry of Environment prepared the Modernisation of Multifamily Buildings Programme, using the JESSICA financial instrument. Five new legal acts were prepared for the implementation of this Programme. The main one is The Law regarding State support for the acquisition or rent of housing and for the modernisation of multifamily buildings of the Republic of Lithuania (17th of July 2009). <u>The energy efficiency measures supported by the State are:</u> Modernisation of heating and hot water systems; replacement of windows and exterior doors; insulation of roofs; insulation of external walls; glazing of balconies; and installation of alternative energy sources (sun, wind, etc.).

The package of Financial Incentives of the Modernisation Programme comprises of two elements: (i) reimbursement of 50% of the expenses for the planning of a Renovation Project and the technical supervision of the construction, achieving an energy efficiency level of at least "D"; and (ii) reimbursement of 15% of the investment for the measures that increase energy efficiency, as defined by the investment plan, in accordance with the Programme for Renovation, achieving an energy efficiency level of at least "C" (the heating energy input is 80-115 kwh/m^2/year). The latter is an incentive designed to encourage potential investors to go beyond the minimum loan qualification threshold of "D".

Furthermore, according to the Law on Support for housing, the annual fixed interest rate on modernisation Loans granted to the Final Beneficiaries will not exceed 3% for the whole period until the Modernisation Loan is paid back. The state will compensate 100% of investment expenses for low-income households.

The Energy Efficiency Housing Pilot Project

The first action towards Energy savings in the housing sector dates from 1996: The Energy Efficiency Housing Pilot project, implemented by the Central Project Management Agency (*www.cpma.lt*). The Housing Agency provided the technical administration of this project through Advisory Centres. This project ended in 2004. The project aimed at supporting private initiatives for improving housing maintenance and investing in energy efficiency measures. During the implementation of the project (which received 30% of state support):

- energy efficiency measures were implemented in multi-apartment buildings, using technically and economically attractive energy packages,
- private energy consultants' services on housing renovation issues were developed, and
- a system was developed, through which assistance was provided by the Advisory Centres of the Housing Advisory Agency to customers, that is, multi-apartment building owners preparing and implementing projects.

More than 1,100 homeowners associations participated in the project and over 650 investment proposals were prepared. More than 580 loan agreements were signed. Over 500 Homeowners associations implemented renovation projects, with investments exceeding LTL 60 million (17.4 M€), in the context of the Energy Efficiency Housing Pilot project. Data on 100 multi-apartment buildings were collected after the renovation:

- average comfort adjusted savings of 24%;
- the average simple payback period for 100 monitored buildings amounted to 10.5 years;
- over 60% of 250 surveyed households indicated that loan repayment represents an insignificant or negligible burden on their families' budgets.

7 > Impact of the EPBD at national level

The first Passive House Project in Lithuania

The construction site of the first passive house

Over 4,000 certificates of energy performance of buildings have been issued in Lithuania up until November 2010. About 100-150 certificates are issued monthly. Figs. 7 through 9 show some statistics regarding certification in Lithuania. The central register of certified buildings can be found at *www.spsc.lt* website and is used by related institutions, specialists and individuals.

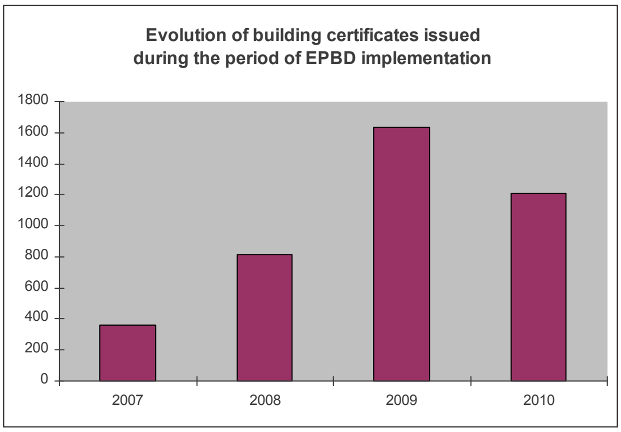


Fig. 7. Evolution of building certificates (2010 still partial)

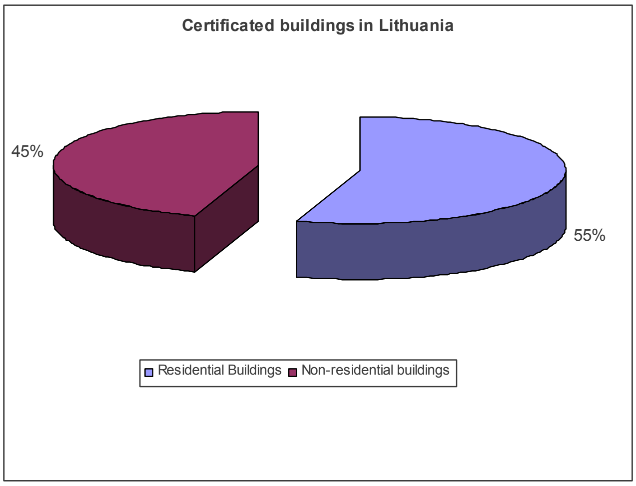


Fig. 8. Certified buildings

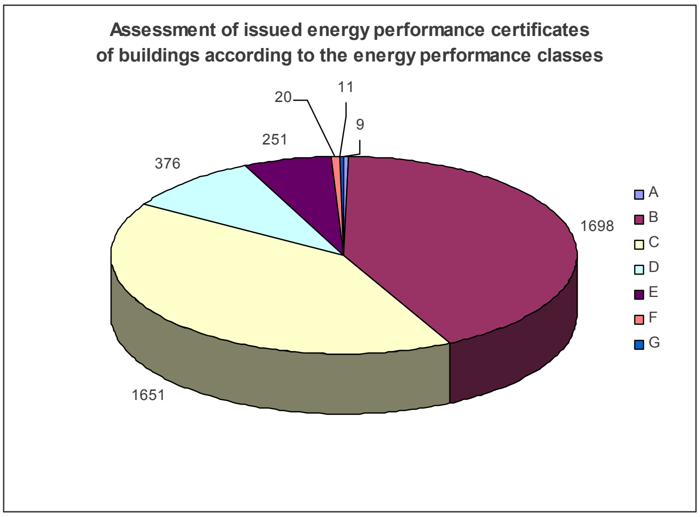


Fig. 9. Buildings according to energy performance class

8 > Conclusions and future planning

At present, Lithuania has started revising The Law on Construction and The Law on Energy, as well as a number of building technical regulations, in line with the requirements of the recast of the EPBD. At the end of 2012 all legal acts will be in place. The main aim is the transposition of the requirements of the recast of the EPBD and the creation of a control system with predefined penalties.

Nine Lithuanian companies and institutions involved in or closely related to construction, building materials, and real estate joined their endeavours in designing and constructing the first Lithuanian passive house. In November 2009, the construction of the energy efficient house was commissioned and completed in Lithuania. It was built in the Gulbinai Block of Houses, in Vilnius. Currently, the structure is undergoing monitoring and after some time the actual energy costs of this building will be reported with precision.

During the design and planning of technical solutions phase of the construction of the new generation house, it was calculated that the energy consumption of the Lithuanian passive house would not exceed 15 kWh/m^2 year. However, even better energy efficiency is now expected than what originally planned.

The Lithuanian passive house is quite simple, of minimalist architecture, with large south-oriented windows. A considerable amount of solar energy can enter the house through the windows, during the cold period of the year. During hot summer months, to avoid overheating, the owners of passive houses can install blinds, canopies, or pergolas with climbing plants over floor-to-ceiling windows.

According to the architect, an integrated assessment of the building and its systems in their entirety was of utmost importance, when designing and constructing the Lithuanian passive house.

Preparing for future challenges

The requirement that all new buildings must be nearly zero energy buildings by 2020, and buildings occupied by public authorities by 2018, sets a difficult task for the industry and builders to construct such buildings. Approaching “near-zero energy buildings” means an even greater challenge for builders than what expected until now.

On the one hand, in order to achieve real energy savings in the building sector, significant incentives in relation to the improvement of existing buildings are needed and certification can play a fundamental role. The recommendations made by the experts in the certificate are important guidelines that the building owner can make good use of, either in the context of a renovation, or as an individual cost-effective measure. Financial concerns about the investment cost of using energy efficient technologies are a major barrier, though.

On the other hand, additional training should be offered for qualified experts, in order to improve their skills in performing energy audits and regarding the best economic and technological building improvement solutions.

The National Energy Efficiency Programme for 2011–2016 is drafted and will be approved by the Government by the end of 2010.

It is foreseen to set a Regulation for the Lithuanian “passive” house. The practice of designing and constructing the first Lithuanian passive house was of major significance and helped in preparing this Regulation. The experience acquired until now will certainly be of great help in meeting these challenges and reaching the final goal of net zero energy new buildings by 2020.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

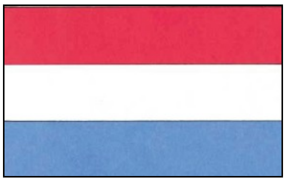
Implementation of the EPBD in Luxembourg

Status in November 2010

Tom Eischen

Ministry of Economy and Foreign trade

Luxembourg



National websites:

- *www.eco.public.lu*
- *http://www.developpement-durable-infrastructures.public.lu*
- *www.myenergy.lu*
- *www.guichet.lu*

1 > Introduction

The legislative implementation of the EPBD in Luxembourg has now been achieved. Since the last report was published in March 2008, certification has spread widely into the residential building market. Implementation for residential buildings started in 2007 and is based on the «*règlement grand-ducal modifié du 30 novembre 2007 concernant la performance énergétique des bâtiments d'habitation*». Recently, the legislative procedure of the «*règlement grand-ducal du 1^er^ août 2010 concernant la performance énergétique des bâtiments fonctionnels*» has been achieved and the regulation will enter into force on the 1st of January 2011. This new regulation contains a few minor changes concerning the residential sector, in order to improve the certification process for residential buildings, based on the experience from the last 3 years.

This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in Luxembourg. It addresses certification and inspection systems, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

In Luxembourg, the implementation of the EPBD is the overall responsibility of the Ministry of Economy and Foreign trade, together with the Ministry of Sustainable Development and Infrastructure for the periodic inspections of air conditioning systems. The Directorate of energy is the managing body and designed, developed and currently supports the entire certification system, with the help of external experts if needed.

The timeframe for the implementation of the new energy performance regulation for various types of buildings was divided into two major phases, until its full implementation in mid 2011, when all the required buildings shall be included in the certification system: new buildings, major renovations, non-residential buildings and all buildings when sold or rented.

The National System for Energy Performance Certification of Residential Buildings came into force on the 1st of January 2008 for new buildings. For existing buildings,

ENERGY EFFICIENT ENERGY EFFICIENT

the new legislation entered into force on the 1st of September 2008. This milestone started a new phase in the legislation on energy efficiency of buildings in Luxembourg, since it was published in the Memorial A-221 of the 14th of December 2007.

The Energy Performance Certification of non-residential buildings enters into force on the 1st of January 2011 for new buildings. For existing buildings, the new legislation will enter into force on the 1st of June 2011.

As Luxembourg had implemented the obligatory periodic control of heating systems and air conditioning years before the adoption of the EPBD, these rules only had to be adapted (one-off inspection after 15 years) to the EPBD requirements, in addition to the introduction of energy certification for buildings.

The different regulations are listed below:

Building certification:

«*Règlement grand-ducal modifié du 30 novembre 2007 concernant la performance énergétique des bâtiments d'habitation*»;

«*Règlement grand-ducal du 31 août 2010 concernant la performance énergétique des bâtiments fonctionnels*».

Periodic control:

«*Règlement grand-ducal du 27 février 2010 concernant les installations à gaz*»;

«*Règlement grand-ducal modifié du 23 décembre 1987 relatif aux installations de combustion alimentées en combustible liquide*»;

«*Règlement grand-ducal modifié du 18 avril 2004 relatif aux contrôles de fuites dans des équipements frigorifiques et climatiques et à l'inspection des installations de climatisation*».

Each building is assigned an energy performance rating according to the table below. Certificates can only be issued by Qualified Experts (QE). QEs are either architects or engineers, who are members of the «*Ordre des Architects et Ingénieurs-Conseils*», and experts holding an accreditation from the Ministry of Economy and Foreign trade with, however, some restrictions, concerning non-residential buildings (see further information in section 4).

	Building category	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
1	Multi family building	≤ 45	≤ 75	≤ 85	≤ 100	≤ 155	≤ 225	≤ 280	≤ 355	> 355
2	Single family building	≤ 45	≤ 95	≤ 125	≤ 145	≤ 210	≤ 295	≤ 395	≤ 530	> 530

Table 1: Classes for total primary energy performance (kWh/m^2.year) in residential buildings

	Building category	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
1	Multi family building	≤ 14	≤ 27	≤ 43	≤ 54	≤ 85	≤ 115	≤ 150	≤ 185	> 185
2	Single family building	≤ 22	≤ 43	≤ 69	≤ 86	≤ 130	≤ 170	≤ 230	≤ 295	> 295

Table 2: Classes for heating primary energy performance (kWh/m^2.year) in residential buildings

Energy performance class	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
Primary energy demand	≤ 55%	≤ 70%	≤ 85%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
CO_2 Emission performance figure	≤ 55%	≤ 70%	≤ 85%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
Heating energy demand	≤ 45%	≤ 60%	≤ 80%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
Heating primary energy demand	≤ 45%	≤ 60%	≤ 80%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
Cooling primary energy demand	≤ 45%	≤ 60%	≤ 80%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
Ventilation primary energy demand	≤ 65%	≤ 75%	≤ 85%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
Lighting primary energy demand	≤ 55%	≤ 70%	≤ 85%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%
Weighted final energy demand	≤ 55%	≤ 70%	≤ 85%	≤ 100%	≤ 150%	≤ 200%	≤ 300%	≤ 400%	> 400%

Table 3: Definition of the limits of the energy performance classes related to the reference building

The Energy Performance Certificate (EPC)

The EPC is the most visible aspect of the new regulation concerning the energy performance in buildings. This document assigns an energy performance label to residential and non-residential buildings or building units and lists, for existing buildings, cost-effective measures for improving their energy performance.

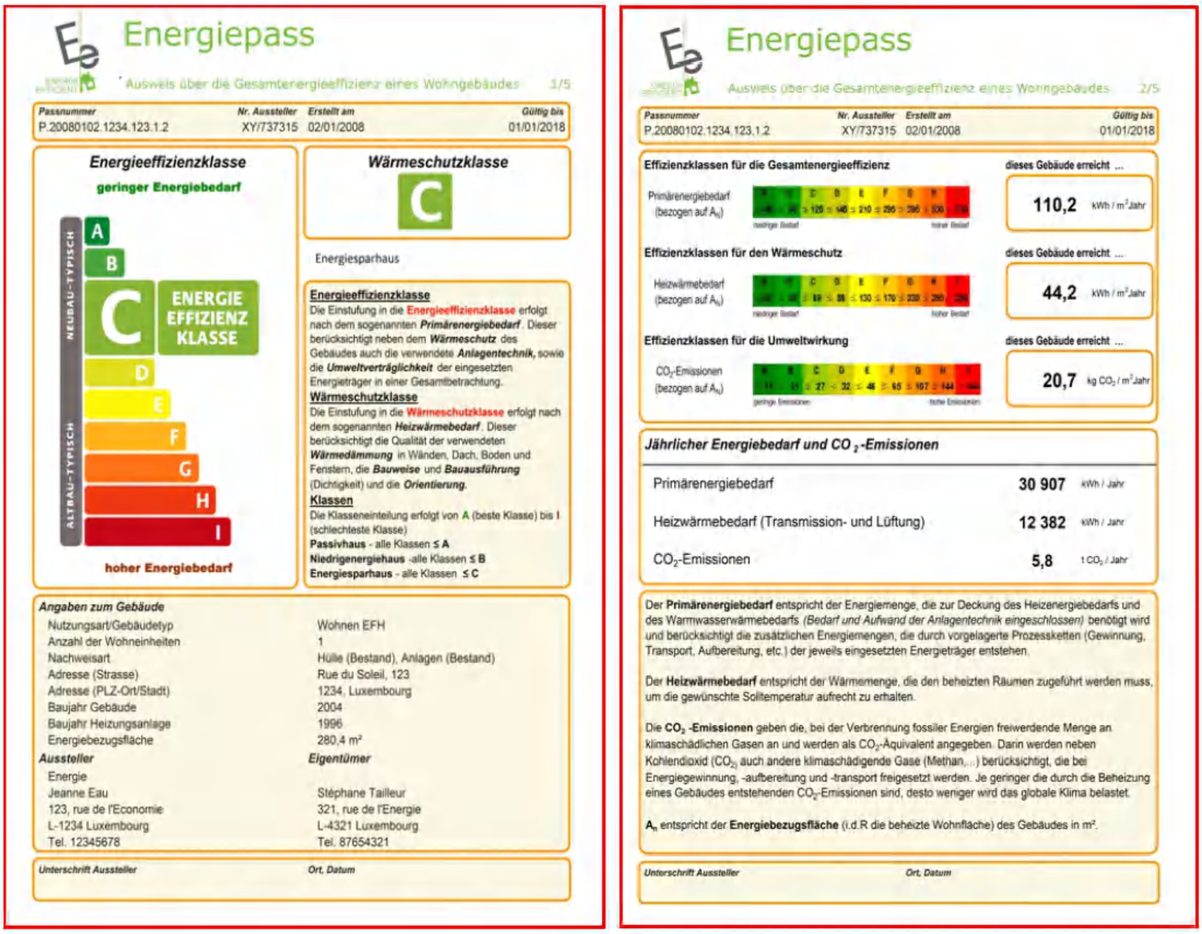
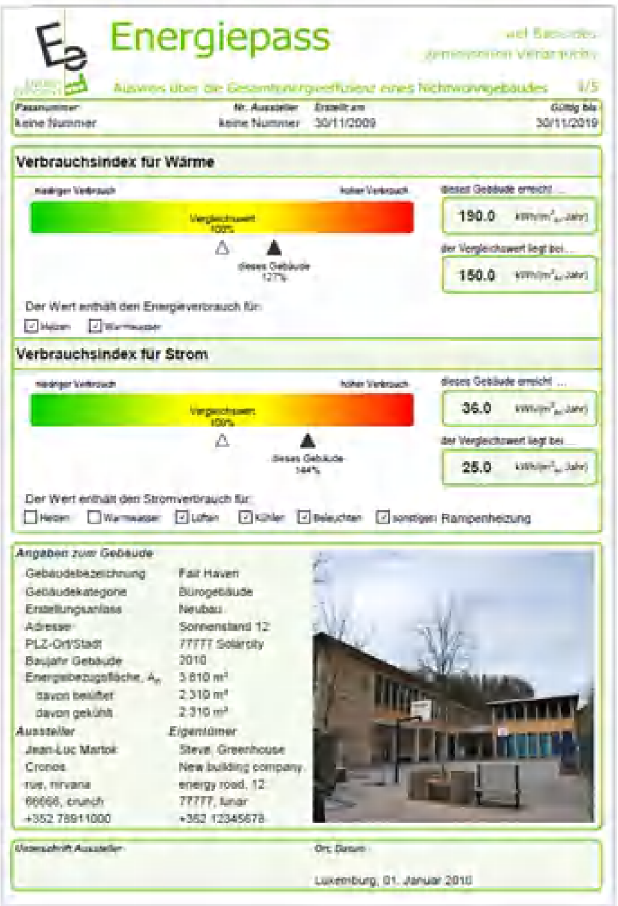


Fig. 1 – Cover page and 2nd page of the EPC for residential buildings


Energiepass
Ausweis über die Gesamtenergieeffizienz eines Nichtwohngebäudes 1/5
Passnummer: keine Nummer | Nr. Aussteller: keine Nummer | Erstellt am: 30/11/2009 | Gültig bis: 30/11/2019

Verbrauchsindex für Wärme

niedriger Verbrauch — hoher Verbrauch

Vergleichswert 100%

dieses Gebäude 127%

dieses Gebäude erreicht ... 150.0 kWh/(m²$_{An}$.Jahr)

der Vergleichswert liegt bei ... 150.0 kWh/(m²$_{An}$.Jahr)

Der Wert enthält den Energieverbrauch für: Heizen, Warmwasser

Verbrauchsindex für Strom

niedriger Verbrauch — hoher Verbrauch

Vergleichswert 100%

dieses Gebäude 144%

dieses Gebäude erreicht ... 36.0 kWh/(m²$_{An}$.Jahr)

der Vergleichswert liegt bei ... 25.0 kWh/(m²$_{An}$.Jahr)

Der Wert enthält den Stromverbrauch für: Heizen, Warmwasser, Lüften, Kühlen, Beleuchten, sonstigen: Rampenheizung

Angaben zum Gebäude

Gebäudebezeichnung	Fair Haven
Gebäudekategorie	Bürogebäude
Erstellungsanlass	Neubau
Adresse	Sonnenstand 12
PLZ-Ort/Stadt	77777 Solarcity
Baujahr Gebäude	2010
Energiebezugsfläche, A_n	3 810 m²
davon beheizt	2 310 m²
davon gekühlt	2 310 m²
Aussteller	**Eigentümer**
Jean-Luc Martok	Steve Greenhouse
Cronos	New building company
rue, nirvana	energy road, 12
66666, crunch	77777, lunar
+352 78911000	+352 12345678

Unterschrift Aussteller | Ort, Datum: Luxembourg, 01. Januar 2010

Figure 2 – Cover page of EPC for non-residential buildings


Einzelmaßnahmen zur energetischen Verbesserung des Gebäudes

Beschreibung der Einzelmaßnahme	geschätzte Endenergie-einsparung	in den nächsten 20 Jahren eingesparte	neue Energie-effizienzklasse
Kontrollierte Be- und Entlüftungsanlage mit WRG	4 891 kWh/a	4 402 €	C
Luftdichte Bauweise 1,0 1/h	2 516 kWh/a	2 264 €	B
Dreifachverglasung, U-Werte nach PH-Standard	6 809 kWh/a	6 128 €	A

Bewertung bei Realisierung aller Einzelmaßnahmen

derzeitiger mittlerer Energiepreis	0,045 €/kWh
gesamte Endenergieeinsparung	12 794 kWh/a
in den nächsten 20 Jahren eingesparte Kosten	11 515 €
neue Energieeffizienzklasse	A

Erläuterungen

In diesem Formular werden Maßnahmen zur energetischen Verbesserung / Sanierung des Gebäudes und dessen Anlagentechnik aufgeführt. Hierbei kann die gesamte Endenergieeinsparung kleiner als die Summe der einzelnen Endenergiebedarfe sein, da die Maßnahmen sich gegenseitig beeinflussen können. Bei der Ausweisung der gesamten Endenergieeinsparung sind die Einzelnaßnahmen in der Summe so zu betrachten, so dass ggf. Wechselwirkungen Rechnung getragen werden und die Gesamteinsparung möglichst realitätsnah ausgewiesen wird.

Unterschrift Aussteller | *Ort, Datum*

Figure 3 – Energy saving measures

The energy label classifies the buildings on an efficiency scale ranging from A (high energy efficiency) to I (poor efficiency) and is based on asset rating. The classification system takes primary energy needs, effective energy needs and CO_2-emissions into consideration.

The real benefit of the energy performance certification is in the recommendations given to the building owner. These are summarised on page 5 of the certificate. These recommendations should be the first step towards refurbishment of energy matters of the existing building.

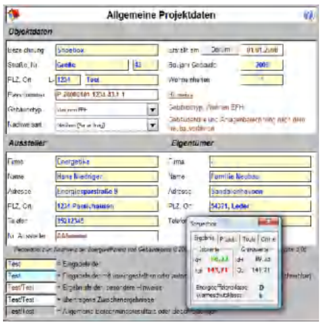
As shown below, suggested improvements include a short description, estimates of costs of each improvement measure, savings and paybacks, and the impact on the energy rating, if all measures were to be implemented. Recommendations made by the expert are the result of studying the case of the specific building.

The validity of EPCs is 10 years. As the energy certificate is offered on free market, the prices may vary from expert to expert. According to a short unofficial survey the range of prices for the energy performance certificate is between 500 € and 1300 € for a single family house and between 125 € and 250 € per dwelling for a residential building with 4 to 10 dwellings.

<u>New residential buildings or major renovations</u> (or building units in new buildings or major renovations), if a building license is required, must achieve at least a class D- rating to be approved at the planning stage, before construction begins. This requirement came into force on the 1st of January 2008 for new residential buildings.

Energy performance in buildings – requirements			
	Before 1.1.2008	After 1.1.2008	After 1.1.2011
Ee ENERGY EFFICIENT	RGD 22.11.1995	RGD 30.11.2007	RGD mod. 30.11.2007
	U-Values	* Minimum requirements ° U-Values ° Air tightness ° Insulation of pipes ° ventilation * Heating parameter * Primary energy parameter	
Ee ENERGY EFFICIENT	RGD 22.11.1995	RGD 30.11.2007	RGD 31.08.2010
	U-Values	U-Values	* Minimum requirements ° U-values ° Sunprotection ° Air tightness ° Thermal bridges ° Insulation of pipes/storage ° Ventilation ° Mesure/Control system * Heating parameter * Primary energy parameter

For new non-residential buildings, this requirement starts on the 1st of January 2011.



Software for issuing the energy label

Since the 1st of September 2008, all existing residential buildings need to be certified when they are sold or rented. The owner must present a valid EPC to the buyer, when the selling or renting contract is established. This involves a qualified expert visiting the property and assessing the building in terms of the type of construction (walls, windows, insulation, thermal bridges, ventilation and air-tightness, etc.) and the type and quality of HVAC and hot water systems. The qualified expert will then calculate the thermal efficiency of the building and issue the EPC. There is no minimum requirement for an existing building, i.e., they can be labelled A through G.

For all existing non-residential buildings the certification will become mandatory on the 1st of June 2011 in case of selling or renting. This EPC is based on measured energy consumption (operational rating) of the building.

The calculation methodology for new buildings is described in the energy performance regulations and includes heating, hot water, ventilation and auxiliary needs, expressed in terms of primary energy. For non-residential buildings, lighting and cooling consumption are also included in the calculation methodology. In addition, the heating energy needs and the CO_2 emissions are also evaluated in the EPC.

After the calculation of the energy rating and, in the case of existing buildings, the definition of required improvement measures, the expert compiles the EPC for delivery to the building's owners or support of the building license application, in case of a new building.

Energy performance certificate			
	Before 1.1.2008	after1.1. 2008	after 1.1.2011
Ee ENERGY EFFICIENT	No certificate	Certificate based on calculated energy needs	
Ee ENERGY EFFICIENT	No certificate	No certificate	New buildings Certificate based on calculated energy needs Existing buildings Certificate based on energy consumption

Every public building, or building in which public services are provided, larger than 1,000 m², is required to display an EPC at its main entrance.

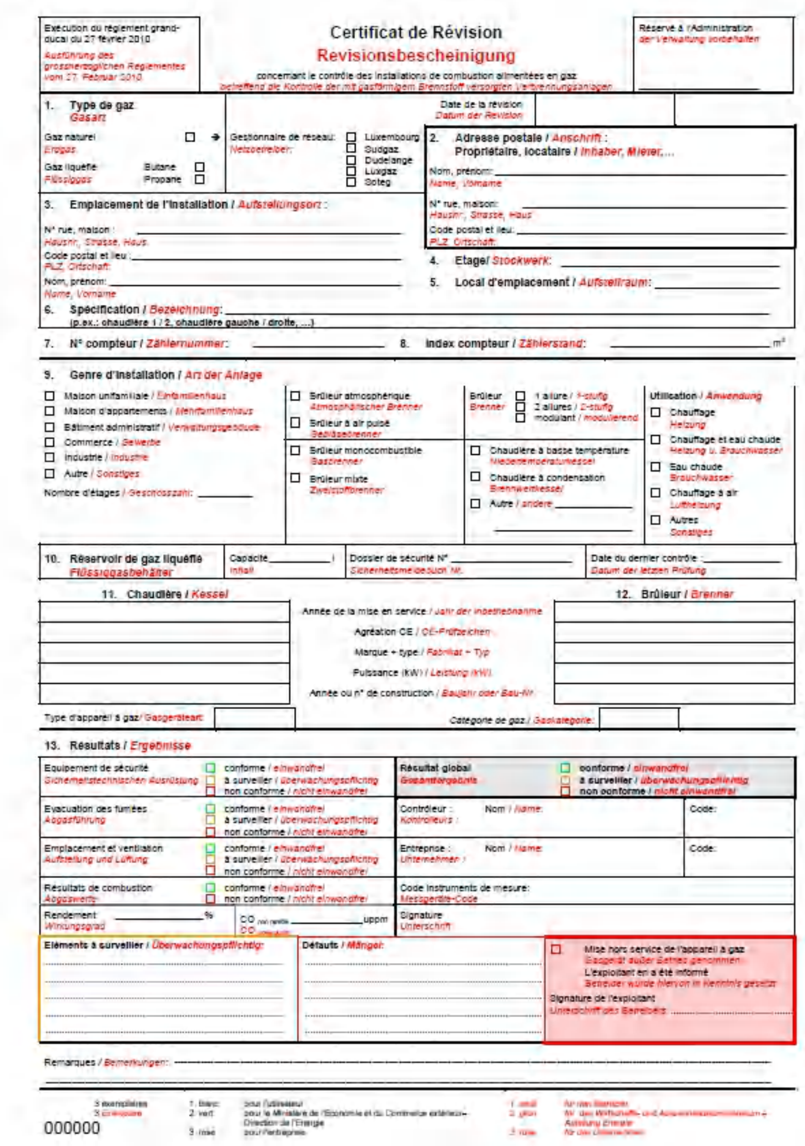
The responsibility of having an EPC always belongs to the building owner. An owner who fails to deliver the EPC to a buyer or tenant, or to display it in a public building, can incur a fine, according to the law on the rational use of energy.

Quality assurance (QA)

The government has set up non mandatory courses to ensure the quality of the issued EPCs. This topic is detailed in chapter 4.

The Ministry of Economy and Foreign trade can collect all the issued EPCs from the experts, in order to proceed to a quality control or to store them in a database. The experts have the obligation of keeping all data on calculation and issued EPCs for at least 10 years and making them available to the Ministry upon demand.

3 > Inspections - Status of implementation



Exécution du règlement grand-ducal du 27 février 2010
Ausführung des grossherzoglichen Reglementes vom 27. Februar 2010

Certificat de Révision
Revisionsbescheinigung
concernant le contrôle des installations de combustion alimentées en gaz
betreffend die Kontrolle der mit gasförmigem Brennstoff versorgten Verbrennungsanlagen

Réservé à l'Administration
der Verwaltung vorbehalten

1. Type de gaz / Gasart
Gaz naturel / Erdgas ☐ → Gestionnaire de réseau / Netzbetreiber: ☐ Luxembourg ☐ Sudgaz ☐ Dudelange ☐ Luxgaz ☐ Soteg
Gaz liquéfié / Flüssiggas: Butane ☐ Propane ☐
Date de la révision / Datum der Revision

2. Adresse postale / Anschrift : Propriétaire, locataire / Inhaber, Mieter,…
Nom, prénom / Name, Vorname:
N° rue, maison / Hausnr., Strasse, Haus:
Code postal et lieu / PLZ, Ortschaft:

3. Emplacement de l'installation / Aufstellungsort :
N° rue, maison / Hausnr., Strasse, Haus:
Code postal et lieu / PLZ, Ortschaft:
Nom, prénom / Name, Vorname:

4. Etage / Stockwerk:
5. Local d'emplacement / Aufstellraum:
6. Spécification / Bezeichnung: (p.ex.: chaudière 1 / 2, chaudière gauche / droite, …)
7. N° compteur / Zählernummer:
8. Index compteur / Zählerstand: m³

9. Genre d'installation / Art der Anlage
☐ Maison unifamiliale / Einfamilienhaus
☐ Maison d'appartements / Mehrfamilienhaus
☐ Bâtiment administratif / Verwaltungsgebäude
☐ Commerce / Gewerbe
☐ Industrie / Industrie
☐ Autre / Sonstiges
Nombre d'étages / Geschosszahl:
☐ Brûleur atmosphérique / Atmosphärischer Brenner
☐ Brûleur à air pulsé / Gebläsebrenner
☐ Brûleur monocombustible / Gasbrenner
☐ Brûleur mixte / Zweistoffbrenner
Brûleur / Brenner: ☐ 1 allure / 1-stufig ☐ 2 allures / 2-stufig ☐ modulant / modulierend
☐ Chaudière à basse température / Niedertemperaturkessel
☐ Chaudière à condensation / Brennwertkessel
☐ Autre / andere
Utilisation / Anwendung
☐ Chauffage / Heizung
☐ Chauffage et eau chaude / Heizung u. Brauchwasser
☐ Eau chaude / Brauchwasser
☐ Chauffage à air / Luftheizung
☐ Autres / Sonstiges

10. Réservoir de gaz liquéfié / Flüssiggasbehälter — Capacité / Inhalt: l — Dossier de sécurité N° / Sicherheitsmeldegesuch Nr. — Date du dernier contrôle / Datum der letzten Prüfung

11. Chaudière / Kessel — 12. Brûleur / Brenner
Année de la mise en service / Jahr der Inbetriebnahme
Agréation CE / CE-Prüfzeichen
Marque + type / Fabrikat + Typ
Puissance (kW) / Leistung (kW)
Année ou n° de construction / Baujahr oder Bau-Nr.
Type d'appareil à gaz / Gasgeräteart:
Catégorie de gaz / Gaskategorie:

13. Résultats / Ergebnisse
Equipement de sécurité / Sicherheitstechnischen Ausrüstung: ☐ conforme / einwandfrei ☐ à surveiller / überwachungspflichtig ☐ non conforme / nicht einwandfrei
Evacuation des fumées / Abgasführung: ☐ conforme / einwandfrei ☐ à surveiller / überwachungspflichtig ☐ non conforme / nicht einwandfrei
Emplacement et ventilation / Aufstellung und Lüftung: ☐ conforme / einwandfrei ☐ à surveiller / überwachungspflichtig ☐ non conforme / nicht einwandfrei
Résultats de combustion / Abgaswerte: ☐ conforme / einwandfrei ☐ non conforme / nicht einwandfrei
Rendement / Wirkungsgrad: % — CO: ppm
Résultat global / Gesamtergebnis: ☐ conforme / einwandfrei ☐ à surveiller / überwachungspflichtig ☐ non conforme / nicht einwandfrei
Contrôleur / Kontrolleurs: Nom / Name: Code:
Entreprise / Unternehmer: Nom / Name: Code:
Code instruments de mesure / Messgeräte-Code:
Signature / Unterschrift

Eléments à surveiller / Überwachungspflichtig:
Défauts / Mängel:
☐ Mise hors service de l'appareil à gaz / Gasgerät außer Betrieb genommen
L'exploitant en a été informé / Betreiber wurde hiervon in Kenntnis gesetzt
Signature de l'exploitant / Unterschrift des Betreibers

Remarques / Bemerkungen:

000000
3 exemplaires — 1. blanc pour l'utilisateur — 2. vert pour le Ministère de l'Economie et du Commerce extérieur – Direction de l'Energie — 3. rose pour l'entreprise

Inspection certificate of heating system

Luxembourg already established a mandatory acceptance procedure in new buildings and regular inspections of oil fired boilers in existing buildings in 1979. For gas fired boilers, this system became mandatory in 2000. The acceptance procedure and the regular inspection of air conditioning systems have been mandatory since 2009, in residential buildings as well as in non-residential buildings. The installers have the obligation to make the application for the acceptance procedure to the chamber of handcrafts, which acts for sections of this procedure under the mandate of the government, on the basis of a special agreement.

All new oil or gas fired heating systems in new buildings and existing buildings are submitted to an acceptance procedure. The results of these certifications are centralised in a database.

The certificate of oil fired heating systems includes, besides information on the user of the heating system and on the controller, the following information:

- Location of the boiler;
- Fuel-type;
- Nominal Power of the installation;
- Black carbon index and residual fuel in the exhaust gas;
- Carbon dioxide emissions;
- Temperature of exhaust gas;
- Combustion efficiency;
- Inspection result.

In the case of gas fired boilers, the certificate contains, in addition to the information mentioned above, a safety check of the installation, including the whole exhaust system and the location of the system inside the building.

Inspections of new air conditioning systems are mandatory and are certified by experts of the chamber of handcrafts. This certification includes the dimensioning and the overall efficiency of the air conditioning system.

In existing buildings, inspection of boilers takes place every 2 years, in case of an oil fired boiler, and every 4 years, in case of a gas fired boiler, while the inspection of air conditioning systems takes place every 5 years. Inspections are paid by the end user or by the owner of the building.

4 > Qualified Experts

EPC and calculation

Qualified experts are the only persons recognized to issue EPCs and perform calculations. They must be recognised architects or engineers and members of the «*Ordre des architectes et ingénieurs-conseils*» according to the «*Loi du 13 ème décembre 1989 portant organisation des professions d'architecte et d'ingénieur-conseil*».

In addition, the Minister of Economy and Foreign trade can authorise, under certain conditions, other qualified experts to perform the calculation and issue EPCs for new and existing residential buildings and for existing non-residential buildings. The accreditation has a validation limit of 3 years, after which it has to be renewed.

At this time, about 850 experts are authorised to issue the required documents. The government offers the experts a voluntary one day training course on the regulation on energy performance in residential buildings and a five day training course on the regulation on non-residential buildings.

Qualified experts act on a freelance basis or are integrated in private organisations.

In order to keep the certification process affordable to the citizens, the Ministry of Economy and Foreign trade has developed software tools, which allow qualified experts to issue EPCs, for residential as well as for non-residential buildings.

Inspections of heating and air conditioning systems

The inspection for the acceptance procedure of oil and gas fired boilers and for air conditioning systems is carried out by specialised experts of the chamber of handcrafts, mandated by the government. The acceptance procedure takes place in the presence of the installer of the system.

The regular controls are made by the installers who have successfully completed special training sessions and own the necessary tools that allow performance of the inspection in a professional and cost effective way. The authorisation to carry out the inspections has a validity of 5 years. It can only be renewed if a special continuing training course is completed.

5 > National Information and Communication Campaigns

The need of informing citizens on certification

When the new regulation on energy performance in residential buildings came into force in the beginning of 2008, the Ministry of Economy and Foreign trade initiated an information campaign about the new regulation and with particular emphasis on the new EPC. An information flyer was distributed to every household in the country.

In addition to this general information campaign, the Ministry of Economy and Foreign trade organised informational meetings with the syndicates of building owners, to raise the awareness of energy performance in buildings and to inform about the new procedure regarding the EPC.

Furthermore, the government has initiated the “energy efficient partner” project with the financial sector in Luxembourg, where a certain number of financial institutes are granting reduced interest rates to house builders, if the projected house satisfies the energy efficiency category A (passive house) or B (low energy house).

An advertising campaign was developed to launch the energy certification in existing buildings and was promoted on television, in the cinema, in the press and on the internet. The message of the campaign was to show that the EPC is promoting market transparency and that it is the first step towards undertaking energy saving measures.

www.energyefficient.lu

The Ministry of Economy and Foreign trade created a site providing detailed information on the EPC regulation and on the procedure to become an accredited expert. A list of all experts that have completed the training courses is published on this website. This website also offers the possibility to register online for the training courses.

www.myenergy.lu

Detailed information on energy efficiency in buildings and on the EPC is available at m*yenergy* website. During the last two years, myenergy, the national structure for the promotion of energy efficiency and renewable energy, was present in many events, fairs, seminars and workshops, disseminating information about the certification process and promoting awareness among citizens, regarding the added value of building energy performance certification that is based on clear and reliable information.

www.guichet.lu.

In addition to the activities of myenergy, the Ministry of Economy and Foreign trade organised several conferences to explain the certification process to municipalities and economical and institutional actors in the sectors concerned.

Furthermore, the government has created a virtual online desk where people may get all information on all kinds of procedures, etc. This desk includes a section with all the necessary information on building energy performance certification, authorised experts, energy performance and governmental subsidies in this domain.

6 > National incentives and subsidies

Regarding the promotion of energy efficiency and renewable energy in buildings, Luxembourg has implemented a system of subsidies to support investments undertaken by private persons. This programme supports all types of building energy efficiency measures, like insulation measures of the building envelope and energy efficient windows. Furthermore, renewable technologies, such as solar and wood heating systems, heat pumps, micro-cogeneration, and condensing boilers, are supported.

www.myenergy.lu/ subvention

The National Action Plan for Energy Efficiency (PNAEE), defined by the Luxembourg government under the Directive 2006/32/EC, has established the general framework for financial support for specific measures.

Detailed information on the financial support for energy efficiency measures and renewable energy technologies may be consulted under the internet link on the left.

7 > Impact of the EPBD at national level

Evolution of Minimum quality requirements in building regulations

The requirements for the thermal insulation of residential and non-residential buildings were implemented for the first time in 1995 by the «*règlement grand-ducal du 22 novembre 1995 concernant l'isolation thermique des immeubles*». This regulation set up requirements for new buildings and the refurbishment of existing building stock. The regulation fixed a maximum average U-value for buildings, taking into account several aspects, such as the volume/surface ratio and the inside temperature for buildings with a floor area greater than 200 m^2.

For smaller buildings, the average maximum U-values were determined for the different parts of the building (roof, external walls, windows, etc.).

2008 Building component	To outdoor air	To weakly heated spaces	To soil or unheated spaces
Wall and floor	0.32	0.5	0.40
Roof and ceiling	0.25	0.35	0.30
Window or balcony door including frame	1.50	2.00	2.00
Door including frame	2.00	2.50	2.50

1996 Building component	To outdoor air	To soil or unheated spaces
Outdoor walls	0.40	0.40
Windows and doors	2.00	0.30
Ridget/flat roof and attic	0.30	2.00
Foundation, Cellar	0.40	2.50

Maximum U-values for residential buildings in W/m^{2}K

Each time a building permit (new buildings and refurbishment of existing building) is required, a certificate proving that the building meets the requirements of the regulation had to be submitted with the application.

Revised requirements for new residential buildings and for the modification, extension and transformation of existing residential buildings came into force on the 1st of January 2008 and achieved an improvement of about 30% - 50% in comparison to the standards of 1996. These new requirements partly transposed (for residential buildings) the Energy Performance of Buildings Directive and include main requirements for primary energy needs and heating energy needs according in principle to class D and minimum requirements. The minimum requirements consist of maximum U-values of building elements (Table 1), building air tightness, insulation of hot water pipes and requirements for ventilation systems.

Concerning non-residential buildings, the regulation of 1995 continued to be in force, but with stricter U-values from the 1st of January 2008 on for all non-residential buildings, as the first step of the implementation of the EPBD concerned only residential buildings. In the meantime the second step of the implementation is nearly achieved and the «*règlement grand-ducal concernant la performance énergétique des bâtiments fonctionnels*» was published in the memorial A n°173 of 1st of October 2010 and the energy performance requirements will enter into force on 1st of January 2011.

Maximum U-Values U_{max} for non-residential buildings in $W/(m^2K)$			
Building component	To outdoor air	To weakly heated spaces [7)]	To soil or unheated spaces [9)]
Wall and floor	0.32	0.5	0.4
Roof and ceiling	0.25	0.35	0.3
Window or balcony door including frame	1.5	2	2
Domelights	2.7	2.7	2.7
Outer door including frame	2	2.5	2.5

Air tightness requirements:

Building type (only for new constructions)		Limit value n_{50} [1/h]
1	Buildings without ventilation equipment	≤ 3.0
2	Buildings with ventilation equipment	≤ 1.5
3	Energy efficient buildings without ventilation equipment	≤ 1.5
4	Low energy buildings with ventilation equipment and heat recovery	≤ 1.0
5	Passive houses with ventilation equipment and hest recovery	≤ 0.6

Other impacts

The obligation for certifying the energy performance of buildings had an important impact on the building and renting market. Real estate agencies have taken the EPC as a promotional instrument for energy efficient buildings.

8 > Conclusions and future planning

The EPBD requirements for new buildings will certainly bring important energy savings in the near future, although new buildings only represent a small share of the entire building stock. Currently, about 2,000 new single family house buildings are built each year in Luxembourg. The efforts concerning the renovation of existing buildings have yet to be increased, in order to achieve more savings in the existing building stock.

In order to accelerate the main goals of the EPBD, the government has implemented significant incentives for the improvement of existing buildings and the construction of low energy and passive buildings. Certification can play a fundamental role, especially in the refurbishment of existing buildings. The recommendations made by the experts in the EPC are important guidelines to the owner of the building, who can make good use of them, either in the context of a fundamental renovation, or as an individual cost-effective measure.

Additional training should be offered for qualified experts, to improve their skills in energy audits and the best economic and technologic building improvement solutions. The Government intends to work on these issues in the coming years, also in the context of the transposition of the EPBD recast into national law.

The main challenges and future developments of the certification system for the short and medium term are, thus, to:

- Provide additional training for qualified experts;
- Develop a simplified methodology for quality control of issued certificates;
- Control a percentage of already issued EPCs to gain experience in the field;
- Assess the possibilities for the creation of an EPC-Database.

The experience acquired until now will certainly be of great help for achieving these challenges and, also, for reaching the final goal of nearly zero-energy new buildings by 2020.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Latvia

Status in November 2010

Dzintars Grasmanis
Ministry of Economics

Andris Mālnieks
Ministry of Economics

Andris Jēkabsons
Ministry of Economics

Latvia

1 > Introduction

The implementation of the Energy Performance of Buildings Directive only started in 2009, when all the necessary laws and regulations for transposition of the EPBD were adopted and entered into force. However, energy performance of buildings was launched in Latvia in 2001, when substantially tighter requirements for building envelopes were implemented.

Since the last report was published in July 2008, the global economic crisis has strongly affected the Latvian economy and administrative structures. Therefore, unfortunately, the Building, Energy and Housing Agency, which was founded shortly before the onset of the crisis and had the practical implementation of energy performance for buildings and the promotion of related issues as one of its missions, ceased to exist.

This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in Latvia. It addresses certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

In Latvia, the implementation of the EPBD is the overall responsibility of the Ministry of Economics. Energy certification of buildings is regulated by the Law on The Energy Performance of Buildings and two Cabinet regulations:

- Regulation regarding Energy Certification of Buildings (No. 40 of the 13th of January 2009, recast No. 504 of the 8th of June 2010);
- Regulation regarding calculation of energy performance of buildings (No. 39 of the 13th of January 2009).

The energy performance certificate of a building is necessary when the building is being sold, rented or leased. These requirements do not apply to buildings that were put into service up until the 31st of December 2008, if the parties involved have agreed upon it.

National website:

- *www.em.gov.lv*

Latvijas Republikas
Ekonomikas ministrija

Laws and regulations referred to in this report are available on the portal of legislation acts at:

www.lv.lv

and

www.likumi.lv

For the certification of existing buildings, a calculated energy rating (asset rating) and measured energy rating (operational rating) must be determined. The energy performance certificate, valid for 10 years, must be issued by an energy auditor.

According to the Law on the Energy Performance of Buildings, if a State or local government institution or a public service provider is housed in a building, the total area of which is more than 1,000 m^2, the energy certificate of this building should be displayed in a place visible to visitors.

New and reconstructed buildings must be designed, according to the amendment Regulations (No. 299 of the 7th of April 2009) on the "General Construction Regulations" (No. 112 of the 1st of April 1997). These regulations introduced the requirement that the building design must include energy performance calculations.

For the certification of new buildings, a calculated energy rating (asset rating) must be determined and the temporary certificate, valid for 2 years, must be issued by an energy auditor or designer. Requirements for producing temporary certificates were included in the Regulations regarding the Acceptance of Structures for Service (Regulation No. 299, adopted on the 13th of April 2004, amendment Regulation No. 350, adopted on the 28th of April 2009).

All necessary legislations for the implementation of the EPBD have been adopted and are already in force. However, full implementation of the EPBD still requires more time and the investment of a lot of work from both the responsible authorities and professionals, in order to establish comprehensive understanding, not only by experts and professionals that are involved, but also by the public as a whole.

Previously, the evaluation of building energy efficiency-related public activities was mainly aimed at the multi-residential sector, and a separate group of public buildings. Given this, a legal building energy efficiency evaluation method was adopted in 2009. Assessment methods previously used by different public actors were typically borrowed from other countries. As they came from different contexts, ratings cannot be objectively compared and used for the energy certification of buildings. However, previous experience provides a comprehensive insight into the residential building sector assessment (Fig. 1).

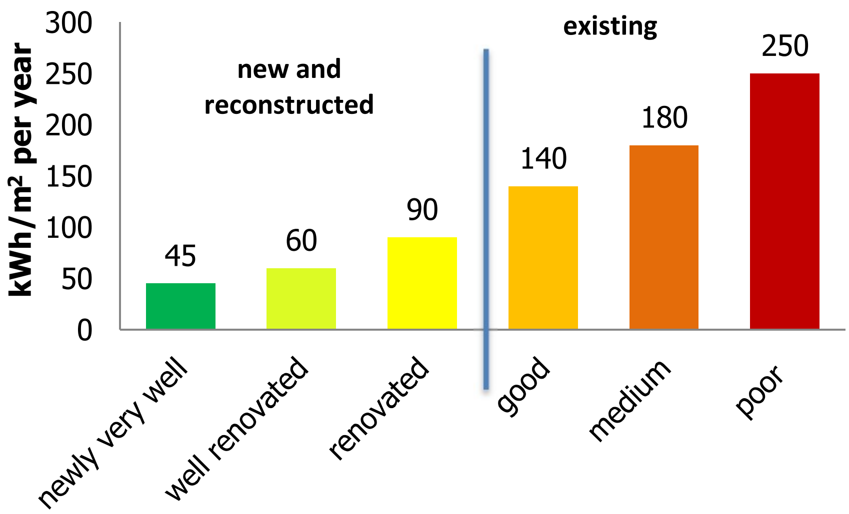


Figure 1. Final energy consumption for heating in apartment buildings.

The energy performance certificate

Energy performance certification of buildings is under development and still with only minor effect on the real estate market; however, the importance of certification will grow and energy certificates should, in the future, be one of the factors influencing the value of a building.

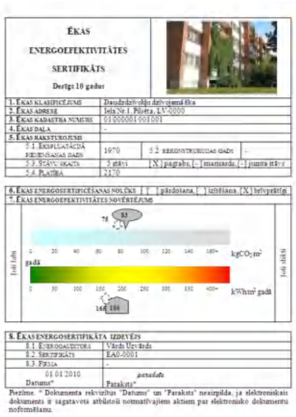
The result of an energy performance assessment is the energy performance certificate. For all building types, energy performance certificates have the same format, although there are two kinds of certificates:

- energy performance certificate for existing buildings and
- temporary energy performance certificate for new and reconstructed buildings.

Energy performance must be expressed using annual energy performance indicators:

- final energy consumption, in kWh/m^2 year,
- carbon dioxide emissions, in kgCO_2/m^2 year.

Energy performance indicators must be presented on an energy performance scale (Fig. 2), the one side of which is marked as “very good” and the other side as “very poor”.



Cover page of the EPC for existing buildings

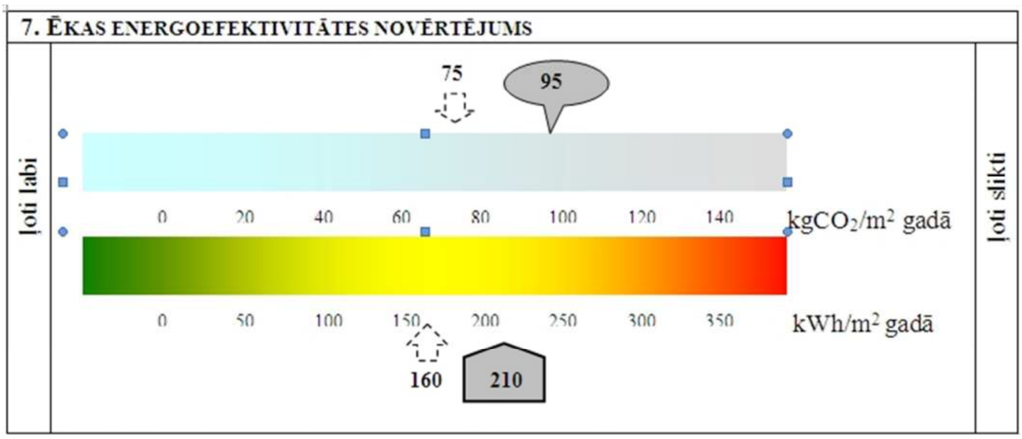
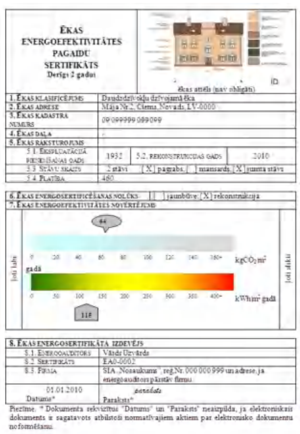
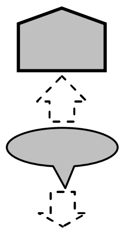


Figure 2. Building energy performance scale.



Cover page of the EPC for new and reconstructed buildings

Building energy performance indicators in the certificate (Fig. 2):



calculated energy rating (asset rating),

measured energy rating (operational rating),

calculated CO_2 emissions indicator,

measured CO_2 emissions indicator.

The energy performance certificate must contain information on total energy consumption (final energy – MWh/year) and the overall energy performance indicator (kWh/m^2 year) for:

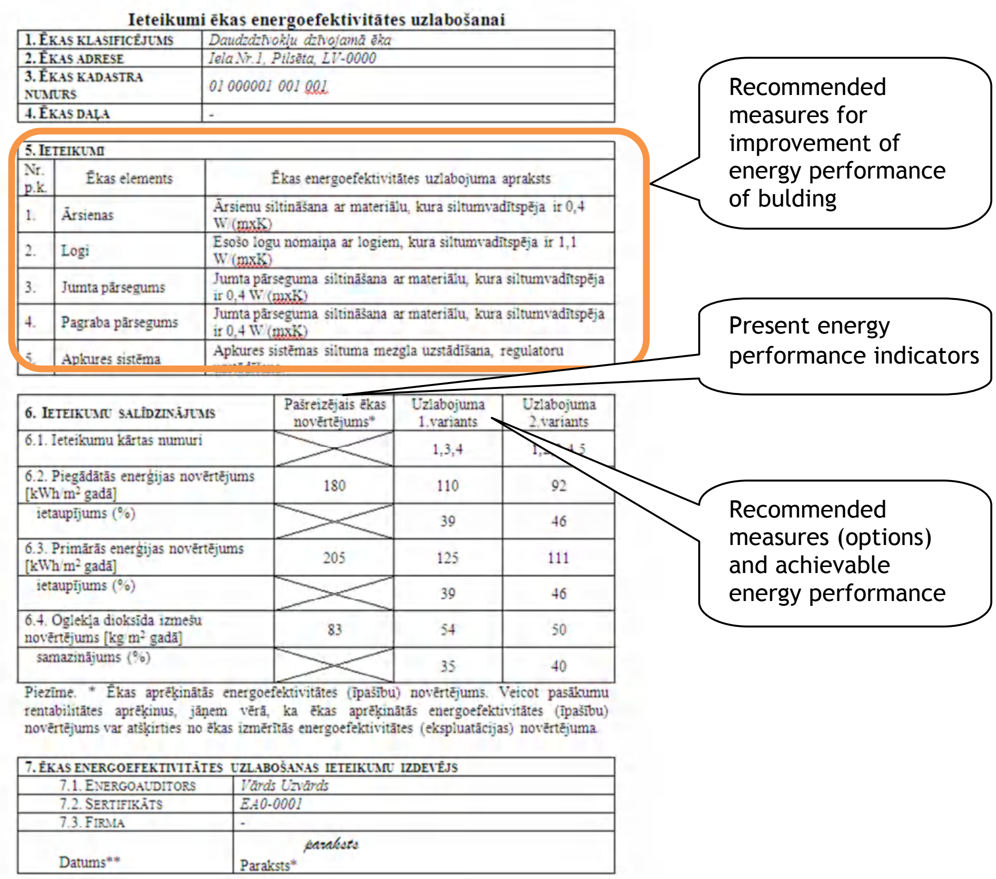
- heating,
- cooling,
- domestic hot water,
- lighting (optional for residential buildings),
- ventilation,
- other needs (must be indicated).

In addition, the energy performance certificate or temporary certificate must be appended with an annex, in which the values of the input data used for the calculations are indicated, specifying the method for the acquisition of the data and the data source:

- area of premises, zones, and the temperature therein;
- area of building envelopes, length of thermal bridges and their heat transmission coefficients;
- consumption of accounted energy and energy carriers;
- accepted values, in order to observe the factors affecting energy performance;
- coefficients used for the correction of calculations.

The inspection report of the boiler, the inspection report of the air-conditioning system, and recommendations for improvement of the energy performance of the building must be appended to the energy performance certificate.

Recommendations for improvement are made by the energy auditor, specifically prepared for each building. Recommendations include a comparative table with present and achievable energy performance indicators, if the recommendations were to be implemented. Evaluation of cost effectiveness of recommendations is not regulated. The energy auditor and the customer can optionally agree on the evaluation of the cost effectiveness of recommendations.



Ieteikumi ēkas energoefektivitātes uzlabošanai

1. ĒKAS KLASIFICĒJUMS	*Daudzdzīvokļu dzīvojamā ēka*
2. ĒKAS ADRESE	*Iela Nr.1, Pilsēta, LV-0000*
3. ĒKAS KADASTRA NUMURS	*01 000001 001 001*
4. ĒKAS DAĻA	-

5. IETEIKUMI		
Nr. p.k.	Ēkas elements	Ēkas energoefektivitātes uzlabojuma apraksts
1.	Ārsienas	Ārsienu siltināšana ar materiālu, kura siltumvadītspēja ir 0,4 W/(mxK)
2.	Logi	Esošo logu nomaiņa ar logiem, kura siltumvadītspēja ir 1,1 W/(mxK)
3.	Jumta pārsegums	Jumta pārseguma siltināšana ar materiālu, kura siltumvadītspēja ir 0,4 W/(mxK)
4.	Pagraba pārsegums	Jumta pārseguma siltināšana ar materiālu, kura siltumvadītspēja ir 0,4 W/(mxK)
5.	Apkures sistēma	Apkures sistēmas siltuma mezgla uzstādīšana, regulatoru [illegible]

6. IETEIKUMU SALĪDZINĀJUMS	Pašreizējais ēkas novērtējums*	Uzlabojuma 1.variants	Uzlabojuma 2.variants
6.1. Ieteikumu kārtas numuri		1,3,4	1,[illegible]4,5
6.2. Piegādātās enerģijas novērtējums [kWh/m² gadā]	180	110	92
ietaupījums (%)		39	46
6.3. Primārās enerģijas novērtējums [kWh/m² gadā]	205	125	111
ietaupījums (%)		39	46
6.4. Oglekļa dioksīda izmešu novērtējums [kg/m² gadā]	83	54	50
samazinājums (%)		35	40

Piezīme. * Ēkas aprēķinātās energoefektivitātes (īpašību) novērtējums. Veicot pasākumu rentabilitātes aprēķinus, jāņem vērā, ka ēkas aprēķinātās energoefektivitātes (īpašību) novērtējums var atšķirties no ēkas izmērītās energoefektivitātes (ekspluatācijas) novērtējuma.

7. ĒKAS ENERGOEFEKTIVITĀTES UZLABOŠANAS IETEIKUMU IZDEVĒJS	
7.1. ENERGOAUDITORS	*Vārds Uzvārds*
7.2. SERTIFIKĀTS	*EA0-0001*
7.3. FIRMA	-
Datums**	Paraksts* *paraksts*

Figure 3.Recommendations for improving the energy performance.

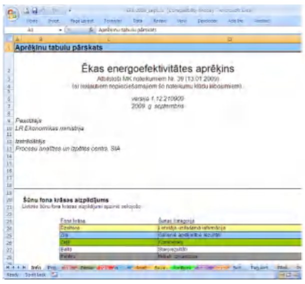
The legislation does not regulate the implementation of recommendations for the improvement of energy performance of buildings. However, if a building reconstruction is undertaken, the building must fulfil regulatory requirements relating to building envelopes.

The cost of the assessment of energy performance of buildings is also not regulated, and for typical apartment buildings (usually of a simple geometric shape, with district heating and natural ventilation), commonly it ranges between 300 € and 500 € for the whole building.

Requirements for new buildings and reconstructed buildings do not prescribe a specific energy performance level, but this results from prescriptive requirements for building envelopes that are set out in construction regulations, and microclimate requirements that are set out in the Latvian standards (LVS). Envelope requirements must be fulfilled for all types of buildings, and they are binding for all heated buildings or parts of buildings (spaces), with a set point temperature of over 8°C during the heating season.

Requirements for building envelopes are determined in the Latvian Building Code LBN 002-01 “Thermal requirements of building envelopes” (approved by the Cabinet of Ministers Regulation No. 495 of the 27th of November 2001, which was amended by No. 621 of the 27th of July 2004, No. 791 of the 26th of September 2006, and No. 1064 of the 23rd of November 2010).

The calculation methodology is described in the Cabinet regulations „Building energy performance calculation method” (No.30 of the 13th of January 2009) and it includes calculations for heating, cooling, DHW, and lighting using measured rating and calculated rating. For residential buildings, lighting consumption is not included in the calculation. The calculation methodology is based on the corresponding CEN Technical Report CEN/TR 15615 (Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) - Umbrella Document) and standard EN ISO 13790:2008 conditions, and includes references to the 14 other standards.



Title sheet from MS Excell software for calculation of the energy performance of buildings

In order to promote energy audits for improving the performance of buildings, the Ministry of Economics has developed a software-based calculation tool. The software runs on Microsoft Excel sheets and is available free of charge on the Ministry of Economics’ website (*www.em.gov.lv*). The programme is available for the evaluation of energy performance of buildings, and for issuing an energy performance certificate for existing buildings or a temporary energy performance certificate for designed buildings (new and reconstructed).Although the programme makes the work of the energy auditors and the construction designers substantially easier, its proper use requires knowledge of building construction, building materials, heating equipment, technical buildings systems, as well as the need to acquire the building energy performance calculation methodology. The programme use is limited - it can do the calculations for most existing buildings with no more than three heating zones, but it does not detail what is required for low-energy buildings or buildings needing complex solutions.

Quality assurance

The necessary elements for the quality assurance of energy certification of buildings and inspection of systems are:

- appropriate qualification of energy auditors,
- supervision of energy auditor’s activities, and
- monitoring of activities and results.

Requirements for energy auditors and their supervision are detailed in chapter 4.

Currently a building information system is under construction; it is planned to also integrate the necessary elements for the energy certification of buildings, that is, energy certification, quality control, and supervision of energy auditors. According to the current plans, the construction information system should be designed and implemented by 2012. Building energy performance certificates, temporary energy performance certificates, and boiler and air-conditioning inspection reports will be recorded in the Construction Information System.

3 > Inspections - Status of implementation

Inspections of boilers and air conditioning systems were implemented at the same time as certification of buildings. The inspection of boilers and air-conditioning systems is performed during the certification of the building or on a voluntary basis. The inspection includes an evaluation of effectiveness and recommendations. Energy auditors then make a report on the inspection of boilers and A/C systems.

The inspection of boilers must be done in accordance with standard LVS EN 15378:2007 “Energy performance of buildings: Inspection of boilers and heating systems”. The inspection of A/C must be performed in accordance with standard LVS EN 15240:2007 “Ventilation for Buildings - Energy performance of buildings: Guidelines for the inspection of air-conditioning systems”. Both standards have been nationally adapted from the appropriate CEN standards.

The format of inspection reports is prescribed in the legislation and follows a Standard prototype (Fig. 4).The report includes:

- reference to the building (address),
- technical information about the system (model, power, operating spaces),
- visual inspection assessment,
- details of the inspections and tests,
- system performance evaluation, and
- recommendations for future operation of the system.

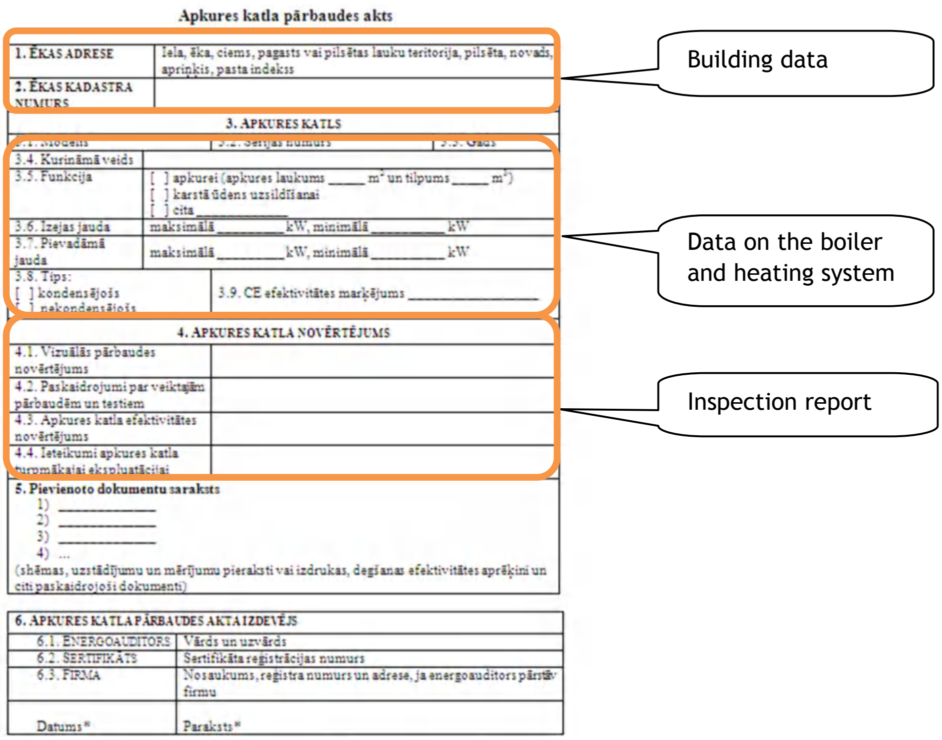


Figure 4. Boiler inspection report.

The majority of apartment buildings and large office buildings in Latvia are usually supplied by district heating systems. As 80% of heating for buildings is provided by district heating systems, and the number of buildings equipped with air-conditioning systems is very small, voluntary inspections of boilers and air-conditioning systems have received little interest from market participants. Currently, the collection of reports into a central registry has not yet started.

Certification Bodies of Energy Auditors

www.psi.lv
www.lsgutis.lv
www.abc.edu.lv

4 > Qualified Experts

The Energy Performance of Buildings Directive requires that the energy certification of buildings is done by an energy auditor. The requirements concerning energy auditors are provided in the Regulations of the Cabinet of Ministers (13th of January 2009, No. 26).

An energy auditor must have the required theoretical knowledge and practical experience, and also pass a proficiency exam. In accordance with the regulations, an energy auditor is certified for one or more of the following actions:

- energy performance certification of existing buildings;
- energy performance certification of new and reconstructed buildings (temporary certificates);
- inspection of boilers and air-conditioning systems.

An energy auditor is certified individually for one or more of the above mentioned actions. It is not necessary to be certified for all three.

In order to evaluate the energy performance of a building and to issue an energy performance certificate of a building or a temporary energy performance certificate of a building, theoretical knowledge is required in the following fields:

- thermal performance of building envelopes;
- technical systems of buildings (heating, ventilation, air-conditioning, water supply and lighting); and
- building climatology and indoor climate.

A temporary energy performance certificate for new buildings and for buildings to be reconstructed can also be issued by professionals who have received a Building Practice Certificate, in the field of structural design of buildings, in accordance with the procedures specified by regulatory enactments concerning construction.

In order to inspect boilers and air-conditioning systems, theoretical knowledge is required in the following fields: boilers and heating systems, air-conditioning equipment and systems, cooling equipment and systems, measurements, and adjustment of equipment.

The inspection of boilers and air-conditioning systems can also be performed by professionals who have received a Building Practice Certificate, in the field of heating and ventilation systems, in accordance with the procedures specified by regulatory enactments concerning construction.

The certification of energy auditors is performed by three accredited certification bodies.

- PSI Grupa Ltd. (*www.psi.lv*),
- Certification Body of The Latvian Association of Heat, Gas and Water Technologies Engineers (*Latvijas siltuma, gāzes un ūdens tehnoloģijas inženieru savienības Būvniecības speciālistu sertifikācijas centrs*) (*www.lsgutis.lv*).
- Certification Body of *„Mācību un konsultāciju centrs ABC Ltd"* (*www.abc.edu.lv*).

Energy auditors' online register offers information on certified energy auditors, certificate number, date and scope of certification.

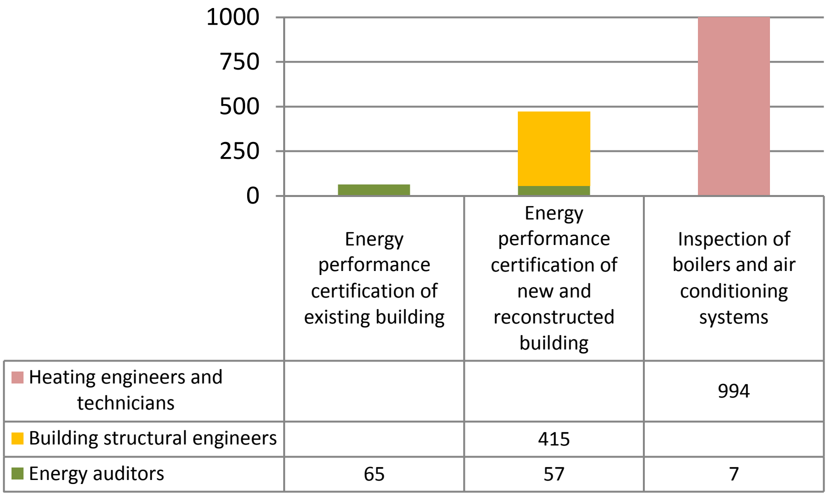


Figure 5.Qualified experts by category at the end of 2010.

Certification bodies perform the supervision of professional activities of the certified energy auditors.

Energy auditors' certificates issued by certification bodies must be registered in a central register maintained by the Ministry of Economics. The Ministry of Economics provides public access to the energy auditors' register (*www.em.gov.lv*).

Regulations prescribe the conditions in which an energy auditor's certificate is suspended or withdrawn.

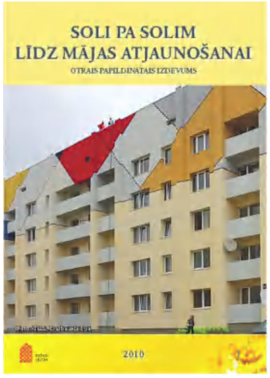
If violations of regulatory enactments in the field of the energy performance of buildings are detected in the professional activities of an energy auditor, a certification body makes a decision regarding the suspension of the certificate, until the energy auditor has eliminated the consequences caused by his/her activities, and specifies a deadline for elimination of the consequences.

A certification body makes a decision regarding the cancellation of an energy auditor's certificate:

- if after the certification body has made a decision regarding the suspension of the operation of a certificate, the energy auditor does not eliminate the consequences caused by his/her activities, within the deadline specified by the certification body;
- if it is proven that an energy auditor has deliberately violated regulatory enactments, in the field of evaluation of the energy performance of buildings.

Infringement cases are initiated, when violations have been detected. Usually violations are detected in state financed activities, in which cases the examination of documents is detailed. In 2009, the Ministry of Economics initiated seven cases on violations of energy auditors and, in one case, the certification body decided to suspend the certificate.

The Ministry of Economics is monitoring the certification system as a whole, and is considering appeals on the certification body decisions. In turn, the decision of the Ministry of Economics may be appealed against in court.



Step by step guide to home renovation


Leaflet of the renovation activity

DZĪVO SILTĀK

„Living warmer”

Up-to-date information on the campaign organised activities available on the social network Twitter: *http://twitter.com/siltinam*

5 > National Information and Communication Campaigns

Information on energy certification of buildings and other EPBD related issues for entrepreneurs, professionals and citizens are distributed through informative seminars, publications and the Internet. Information campaigns for building energy efficiency often take place at different levels, such as initiatives at the level of state and local government institutions, or private and non-governmental organisations. During the last two years, the Ministry of Economics was present in more than 20 events, meetings and workshops disseminating building insulation and renovation of technical systems of buildings.

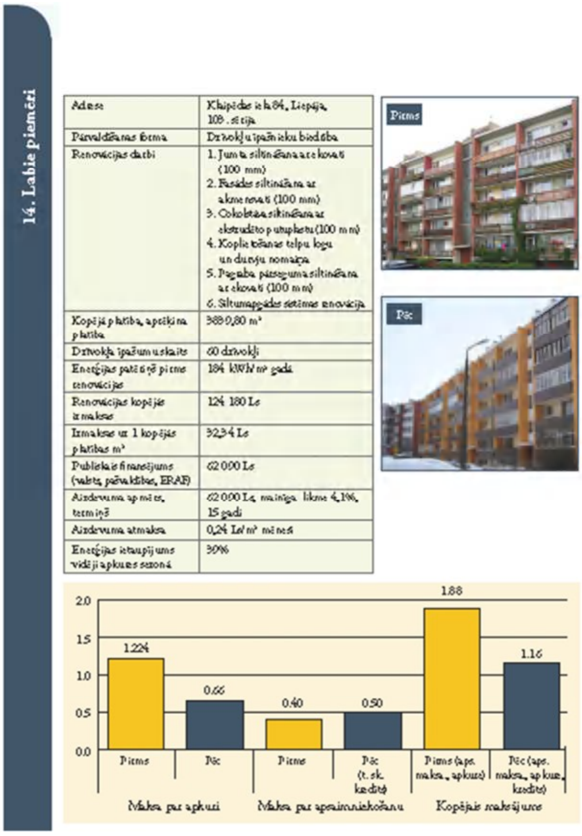


Figure 6. Building renovation example with comparison of economic indicators.

Currently, the campaign „Living warmer”, on the energy performance of buildings in Latvia, is running. The “Living warmer” campaign was launched on the 25th of

February 2010, when the Ministry of Economy, industry associations and business signed a cooperation memorandum at the conference "Housing renovation - Latvian investment in the future". Within the Memorandum of Cooperation, the parties agreed on joint cooperation in the housing renovation market.

The key objectives of the "Living warmer" campaign are to:

- activate apartment owners in making their home renovation using EU funds;
- inform and advise house managers, apartment owner associations and trustees on the EU funding programmes, conditions, and benefits;
- encourage construction companies, construction material manufacturers and traders to take the initiative of housing renovation;
- raise awareness of energy efficiency and reduce heat consumption.

6 > National incentives and subsidies

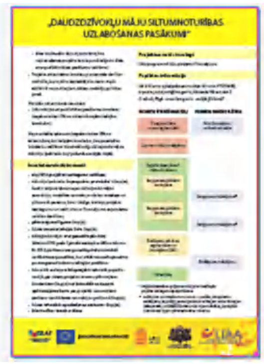
Special incentives directly addressing the energy certification of buildings do not exist in Latvia; indirectly, however, various programmes and funds promote energy efficiency in buildings. The major financial instruments for the promotion of energy efficiency in buildings in Latvia are EU Structural funds and the Financial Instruments on Climate Change (CCFI).

EU funds

The Latvian Investment and Development Agency currently has two on-going activities:

- - Thermal insulation Improvement of social housing;
- - Thermal insulation Improvement of multi-apartment Buildings.

The activity “Thermal insulation Improvement of Social housing” started in 2008. Within this activity, 56 buildings will be renovated, for a total of 9 M€. On-going work will be completed by the year 2012.



Leaflet of the renovation activity

The activity “Thermal insulation Improvement of Multi-Apartment Buildings” started in 2009 and the funding available amounts to 63 M€. The goal of the activity is the improvement of the energy efficiency of multi-apartment buildings, to ensure energy efficiency and sustainability of the housing stock. The programme will be available until all funds are spent.

After the renovation, thermal energy savings should not be less than 20%. Apartment owners can be reimbursed for 50% of the total eligible costs. The following costs are supported: technical survey of building, energy audit of building, building design, preparation of estimates, construction works (renovation), building inspection, and supervision.

Eligible multi-apartment houses can receive funds if:

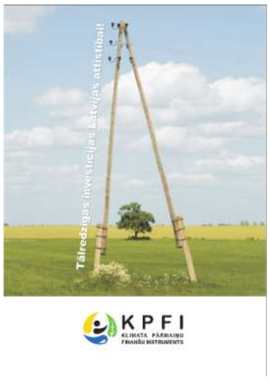
- the building was placed in service during the period from 1944 until 1993. (This period is characterised by low construction quality and building envelope low thermal resistance. Thermal requirements for building envelopes were substantially increased in1993).
- one owner owns no more than 20% of all the apartment;
- non-residential floor space does not exceed 25% of the total floor space.

Additional information is available on the Ministry of Economics' website (*www.em.gov.lv*) and LIDA (*www.liaa.gov.lv*).

KPFI
KLIMATA PĀRMAIŅU FINANŠU INSTRUMENTS

Climate Change Financial Instrument

The Climate change financial instrument (CCFI) is a Latvian governmental programme, run by the Ministry of Environment. CCFI aims to contribute to the fight against global climate change, adaptation to climate change impacts, and reduction of greenhouse gas emissions (for example, through measures for improving the energy efficiency of buildings in both the public and private sectors, technologies that use renewable energy development and deployment, and implementation of integrated solutions regarding greenhouse gas emissions).



CCFI - far-sighted investment in the development of Latvia

The CCFI is funded from sales of state-owned greenhouse gas emissions of assigned amount units (AAUs), by the international emissions trading under the Kyoto Protocol. It contributes to the Latvian economy with up to 50 M€ per year and will continue until 2012. The CCFI regulated Latvian international treaties concluded on an action regarding greenhouse gas emissions of AAUs sales, as well as legislation, including the "Law On Participation in the Flexible Mechanisms of the Kyoto Protocol", and the Cabinet of Ministers regulations No. 312 of the 28th of April 2009 "Statute on Advisory Council of Climate Change Financial Instrument.

CCFI completed or on-going projects aim to improve energy efficiency for public buildings, vocational training and higher education buildings, and industrial buildings. The CCFI framework for future projects is, among others:

- support for technology transition from fossil to renewable energy,
- transition to renewable energy, in order to reduce greenhouse gas emissions,
- pilot projects of low energy buildings.

Leaflet of the CCFI activity

Information on how CCFI funded the on-going projects and competitions, as well as long-term expectations, can be found on the CCFI website.

7 > Impact of the EPBD at national level

CCFI website:

http://www.vidm.gov.lv/lat/darbibas_veidi/KPFI/

Evolution of minimum performance requirements in building regulations

Requirements for maximum permissible transmission heat loss coefficient of external envelope structures of buildings, and requirements of maximum permissible heat loss of buildings apply, depending on the type of building. These requirements are included in Latvian Building code LBN 002-01 "Thermal requirements of the buildings envelopes", approved by the Cabinet of Ministers in the Regulation No.495 on the 27th of November 2001. By the amendment to LBN 002-01 from the 26th of September 2006, the requirement to indicate specific heat losses of the whole building and specific heat losses per m^2 of floor space were also included.

National legislation does not include exact energy performance values. Therefore, they can be calculated taking several factors into account:

- For residential houses, homes for the elderly, hospitals and kindergartens, the normative value H_{TR} may be determined in accordance with the formula $H_{TR} = h_A A$, where
  h_A–the calculated heat loss coefficient -W/(m^{2o}C),
  A - the sum of floor areas to be heated on all storeys (m^2) of a residential house.

Normative Values of Heat Transmittance Coefficients

Type of building / Heat transmission coefficients	Residential, homes for the elderly, hospitals and kindergardens	Public, excl. pensions, hospitals and kindergardens	Industrial
Envelope U_{RN}	W/(m^2°C)		
Roofs and external coverings	0.2 k	0.25 k	0.35 k
Floors on the grounds	0.25 k	0.35 k	0.5 k
Walls: - with mass less than 100 kg/m^2	0.25 k	0.35 k	0.45 k
- with mass 100 kg/m^2 or more	0.3 k	0.4 k	0.5 k
Windows, doors and glazed walls	1.8 k	2.2 k	2.4 k
Thermal bridges	W/(m x K)		
Ψ_{RN}	0.2 k	0.25 k	0.35 k

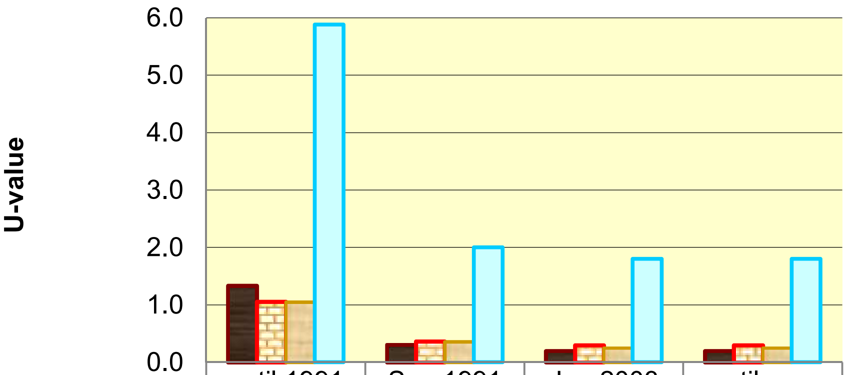
k - temperature factor. k=19/ΔT, where ΔT depends on the indoor and outdoor air normative values. (For residential buildings in different regions, k ranges from 0.95 to 1.09).

- For buildings which have parts with a different number of storeys, the value H_{TR} shall be determined for each part of the building separately.

For residential houses, homes for the elderly, hospitals and kindergartens, the specific heat consumption h_A per m^2 for one-storey and two-storey buildings shall be 1.10 (W/m^2°C), for three-storey and four-storey buildings 0.9 (W/m^2°C), and for five or more-storey buildings 0.7 (W/m^2°C).

The calculated heat loss coefficient H_T of a building must not exceed the normative value H_{TR}.

Regulatory requirements for building envelopes were approved in 2001 and came into force on the 1st of January 2003.



	until 1991	Sep.1991	Jan.2003	until now
Roofs	1.3	0.31	0.2	0.2
Walls (heavy)	1.1	0.36	0.3	0.3
Walls (light)	1.1	0.36	0.25	0.25
Windows	5.9	2.0	1.8	1.8

Figure 7. Normative U-values for residential houses.

With regard to building requirements, there is an active discussion and different opinions, but the conclusion is that for most of the existing buildings, i.e., with ventilation without heat recovery systems, requirements are quite optimal. Concerning low-energy buildings, it is clear that a different approach is required and Latvia is in the process of carrying out a detailed examination of the situation.

Other impacts

Starting with insulating the targeted buildings, it was concluded that, in the implementation of projects, a large proportion of activities is associated with construction design administration in official bodies and institutions. Analysis of the administrative framework for building envelope renovation processes leads to the conclusion that many required administrative procedures for numerous construction or reconstruction cases are formal or unnecessary with regard to building envelope renovation.

In order to facilitate building renovation, legislation to implement simplified construction administration procedures for building envelope renovation was drawn up, which reduces the required number of documents and usual administration time. Moreover, a simplified procedure was implemented by the Cabinet of Ministers (amendment regulation No. 299 of the 7th of April 2009 on the General Construction Regulation No. 112 of the 1st of April 1997) for the reconstruction and renovation of building technical systems.

8 > Conclusions and future planning

EPBD Implementation in Latvia has started, although not all features are working as it might have been wished. The necessary legal documents have been developed and accepted, but also a range of tasks needs to be undertaken, which will contribute to the activity of education institutions, professional actors and other non-governmental organisations. For better implementation, it is necessary to improve methods, to adapt standards for national conditions, to develop guidelines, etc.

According to provisional calculations, in order to achieve the EU and Latvian goal of 20% reduction in energy consumption in the buildings sector by 2020, in Latvia it will be necessary to renovate every third building, and the required investment is estimated at around 3,000 M€ in the next 10-year period. It is clear that this objective requires targeted policy in all building-related areas: the recast EPBD (2010/31/EU) shall be transposed and implemented, and the implications arising from the Directive on energy end-use efficiency and energy services (2006/32/EU) and the Directive on the promotion of the use of energy from renewable sources (2009/28/EU) must also be taken into account.

The short and medium term tasks in relation to the EPBD are as follows:

- transposition of the recast EPBD into construction and building energy performance legislation, including review of minimum requirements for buildings and their elements;
- development and implementation of construction information systems, including support tools for energy certification of buildings, as well as surveys, reports, publications, etc.;
- improvement of the supervision of energy auditors to ensure the quality of the energy certification of buildings and inspections;
- training programme development and increase of the skills of professionals.

Following the target set out in the recast EPBD to ensure that in 2020 all new buildings are nearly zero-energy buildings, measures should be taken in order to acquire an accurate understanding of the professional field and society, so as to plan such building developments in the future.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

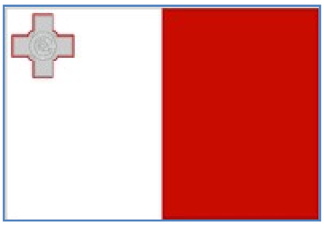
Implementation of the EPBD in Malta

Status in November 2010

Services Division

Ministry for Resources and Rural Affairs

Malta



National website:

› *mrra.gov.mt/epc*

1 > Introduction

Malta implemented the EPBD by means of Legal Notice 261 of 2008 (Malta Resources Authority Act - Chapter 423) Energy Performance of Buildings Regulations, 2008. This legislation supersedes Legal Notice 238 of 2006 but keeps the former technical guidelines on the “Minimum Requirements on the Energy Performance of Buildings”. The new legislation transposed all of the Directive’s clauses into national law. The process of revising the current minimum requirements and legislation will start in 2011 when Malta would have gained some experience from the current implementation.

This report describes the current status of implementation and discusses the effective way forward for the implementation of the EPBD in Malta. It addresses certification and the underlying development of the calculation, methodologies, inspection systems, the training of qualified energy performance assessors, including the logistics of quality control and auditing, information campaigns, incentives and subsidies.

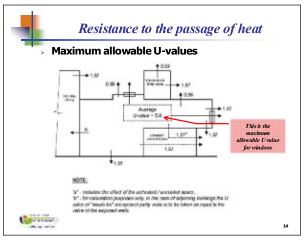
2 > Certification

Certification of buildings

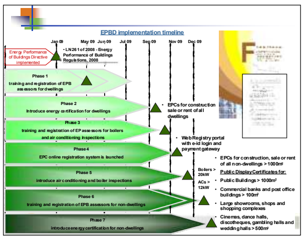
In Malta, the implementation of the EPBD is the overall responsibility of the Malta Resources Authority (MRA) under the Ministry for Resources and Rural Affairs (MRRA). The Building Regulation Office (BRO) is co-ordinating and managing this process. The BRO set up, designed and developed the certification system, which is based on a central national electronic registry and database.

Legal Notice 261 of 2008 on the Energy Performance of Buildings Regulations, 2008 was officially published on the 21st of October 2008 and then came into force on the 1st of January 2009. This law continued to build on the then current Legal Notice 238 of 2006 on the energy performance of buildings in Malta which was first published on the 6th of October 2006.

The first part of the current legislation reaffirms the regulation of the Minimum Requirements on the Energy Performance of Buildings, Technical Guidance Document F, notified in the Gazette by Government Notice No. 1002 of 2006. These regulations specified that all new buildings and existing large buildings that undergo major renovation or alteration, and whose building permit application was received by the Malta Environment and Planning Authority (MEPA) on or after the 2nd of



Minimum requirements in Document F – winter mode



EPBD implementation timeline

January 2007 had to comply with these regulations. Buildings that were subjected to a change of use and whose building permit application was received by MEPA on or after the 2nd of January 2009 have also been included.

Studies on the technical, environmental and economic feasibility of alternative energy systems also have to be carried out, according to this new legislation, in cases of large buildings which involve outline or full development permission applications received by MEPA on or after the 2nd of January 2009.

The second part of the current legislation sets three timeframes for owners, public entities and/or their respective agents, to commission and issue the Energy Performance Certificates (EPCs) of buildings - based on the design rating of the building if the building is not yet constructed and/or finished, or the asset rating, if the building is already constructed and finished.

Starting from the 2nd of January 2009, EPCs had to be issued for all residential buildings (dwellings) which had to be newly designed, sold or rented out.

As from the 1st of June 2009, EPCs had to be issued on all non-residential buildings that were being newly designed, sold or rented out.

Also starting from the 2nd of January 2009, persons or entities in charge of a number of categories of existing public buildings had to ensure that an EPC based on the asset rating of the building would be commissioned and displayed at all times in a prominent place which is clearly visible to the public by not later than the 2nd of January 2010. These categories include:

- Large buildings that are used by, or are providing services to, more than 500 persons daily.
- Commercial banks and post office buildings having a useful floor area of over 100 m^2, irrespective of the number of persons using or visiting such building.
- Showrooms, shops and shopping complexes having a useful floor area of over 1,000 m^2, irrespective of the number of persons using or visiting the building.
- Cinemas, dance halls, discotheques, gambling halls and wedding halls having a total useful floor area of over 500 m^2, irrespective of the number of persons using or visiting the building.

The EPC shows the calculated primary energy use and CO_2 (carbon dioxide) emissions. An example of an EPC for dwellings is shown below. Certificates can only be issued by qualified Energy Performance Assessors for Buildings (EPB Assessors). EPB Assessors have to be architects or engineers graduating at the University of Malta, or professionals with equivalent degrees (refer to section 4 for more information). The list of EPB Assessors is updated and available for viewing by the public on the Building Regulation Office web portal at *mrra.gov.mt/epc.*

The energy performance certificate

The EPCs are the end-product of the certification process. This document shows the calculated energy use rating for existing (asset rating) or designed (design rating) residential buildings and includes recommendations for improving their energy performance. The EPC is based on the design rating of the building if the building is not yet constructed and/or finished, or the asset rating, if the building is already constructed and finished.

The energy use or EPRDM rating scale ranges from 0 kWh/m^2.year (calculated low energy use due to high energy efficiency) to 280 kWh/m^2.year (calculated high energy use due to low energy efficiency). The dwelling's CO_2 emission rate (DCER) is also shown on a scale ranging from 0 kg/m^2.year to 70 kg/m^2.year beneath the main energy use scale.

Certificate Reference Number:
D 0999 00007 2807/2009

Malta Resources Authority | Ministry for Resources and Rural Affairs | Building Regulation Office Services Division

ENERGY PERFORMANCE CERTIFICATE OF DWELLINGS MALTA

Registration Date: 28 July 2009

Registered by the Malta Resources Authority in accordance with Legal Notice 261 of 2008

Rating type: Asset

Building Type: Flat / Apartment at Level 4

Energy Use: 125 kWh/m^2.yr

Carbon Dioxide Emissions: 31 kg/m^2.yr

Property Details

Locality:
Fgura
Street:
Triq il-Malel
Property Name or No:
No. 53, Flat 7
(Refer to site plan overleaf for property co-ordinates)
MEPA Application No:
Not Applicable
Year of Major Renovation (where applicable):
Not Applicable
Useful Floor Area (m^2):
85

Photograph of property façade

Assessor Name:
John Borg
Assessor Registration No:
00999
Assessor Signature & Stamp

Expiry Date of Certificate

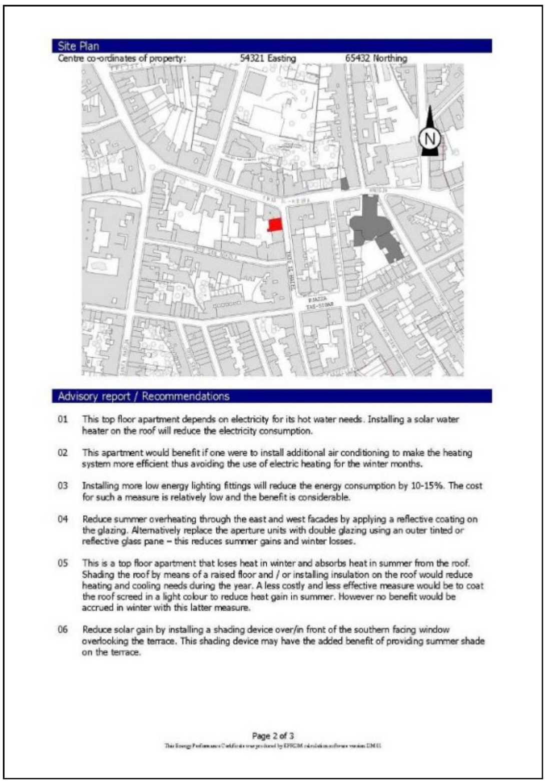
27 July 2019

This certificate is valid for a maximum period of 10 years from the date of registration provided there are no construction, fittings, or equipment changes in the building during this period.

Page 1 of 3

Fig. 1 – First page of the EPC: Asset rating certificate.

The real benefit of any EPC lies in the recommendations given to the building owner. These are included in page 2 of the certificate. As shown in Fig. 2, the suggested improvements include a short description of what can be done to reduce energy use. The EPB assessor may also include a cost estimate for implementing such measures, and the calculated energy savings and the impact on the energy rating if all measures were implemented. These recommendations are all tailored for the certified building and are not selected from a common database based on typical situations.



Site Plan
Centre co-ordinates of property: 54321 Easting 65432 Northing

Advisory report / Recommendations

01 This top floor apartment depends on electricity for its hot water needs. Installing a solar water heater on the roof will reduce the electricity consumption.

02 This apartment would benefit if one were to install additional air conditioning to make the heating system more efficient thus avoiding the use of electric heating for the winter months.

03 Installing more low energy lighting fittings will reduce the energy consumption by 10-15%. The cost for such a measure is relatively low and the benefit is considerable.

04 Reduce summer overheating through the east and west facades by applying a reflective coating on the glazing. Alternatively replace the aperture units with double glazing using an outer tinted or reflective glass pane – this reduces summer gains and winter losses.

05 This is a top floor apartment that loses heat in winter and absorbs heat in summer from the roof. Shading the roof by means of a raised floor and / or installing insulation on the roof would reduce heating and cooling needs during the year. A less costly and less effective measure would be to coat the roof screed in a light colour to reduce heat gain in summer. However no benefit would be accrued in winter with this latter measure.

06 Reduce solar gain by installing a shading device over/in front of the southern facing window overlooking the terrace. This shading device may have the added benefit of providing summer shade on the terrace.

Page 2 of 3

Fig. 2 – Second page of the EPC: Recommendations

The third page includes a detailed set of descriptions listing the materials, building fabric components, services installations and renewable energy sources that affect the EPRDM rating of the building.

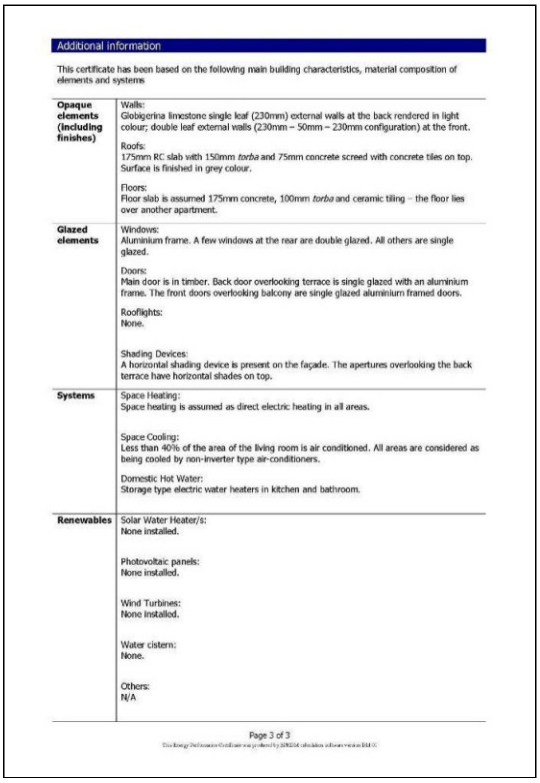
The EPC is valid for 10 years. Public display certificates will have to include the simultaneous display of the asset and operational ratings. The latter will have to be issued within a period not exceeding five years of the first display of the EPC, and updated every successive three years.

In cases where building permit applications were received by MEPA on or after the 2nd of January 2007, all new buildings and existing large buildings undergoing major renovation or alteration, have to comply with the Minimum Requirements.

As from the 2nd of January 2009, all residential buildings have to be certified when they are being newly designed, sold or rented. The owner is required by law to provide an EPC to the prospective buyer or tenant within the period of the promise of sale or at the time of signing of the sale agreement, or rent agreement.

As from the 1st of June 2009, all other buildings have to be certified when they are being newly designed, sold or rented.

In the case of buildings that are being sold or rented, the respective owners must engage a registered EPB Assessor who has to inspect the property and assess the building taking note of its volume, surface areas, and party wall perimeters, the type of construction used (walls, windows, roofs, floors, insulation, roof colour, external shading, etc.), any permanent air-conditioning or boiler installations, the lighting installation, the hot water system and any systems using renewable sources of energy including rainwater re-use. The EPB Assessor will then calculate the energy use rating of the building and issue a registered EPC. The same energy use rating scale is used for those buildings that were designed before the implementation of the minimum requirements for the energy performance of buildings.

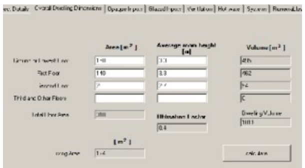

Additional information

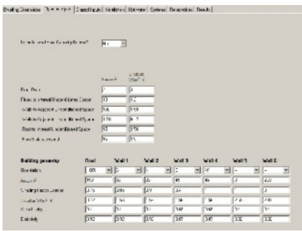
This certificate has been based on the following main building characteristics, material composition of elements and systems

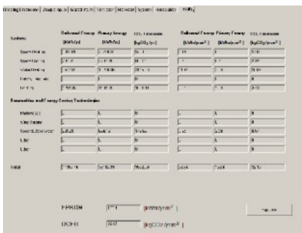
Opaque elements (including finishes)	Walls: Globigerina limestone single leaf (230mm) external walls at the back rendered in light colour; double leaf external walls (230mm – 50mm – 230mm configuration) at the front. Roofs: 175mm RC slab with 150mm *torba* and 75mm concrete screed with concrete tiles on top. Surface is finished in grey colour. Floors: Floor slab is assumed 175mm concrete, 100mm *torba* and ceramic tiling – the floor lies over another apartment.
Glazed elements	Windows: Aluminium frame. A few windows at the rear are double glazed. All others are single glazed. Doors: Main door is in timber. Back door overlooking terrace is single glazed with an aluminium frame. The front doors overlooking balcony are single glazed aluminium framed doors. Rooflights: None. Shading Devices: A horizontal shading device is present on the façade. The apertures overlooking the back terrace have horizontal shades on top.
Systems	Space Heating: Space heating is assumed as direct electric heating in all areas. Space Cooling: Less than 40% of the area of the living room is air conditioned. All areas are considered as being cooled by non-inverter type air-conditioners. Domestic Hot Water: Storage type electric water heaters in kitchen and bathroom.
Renewables	Solar Water Heater/s: None installed. Photovoltaic panels: None installed. Wind Turbines: None installed. Water cistern: None. Others: N/A

Page 3 of 3

Fig. 3 – Third page of the EPC: Detailed information.





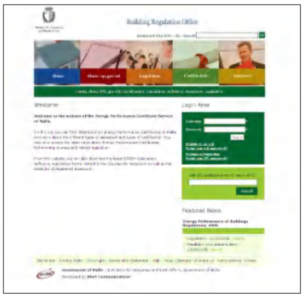


Screenshots from parts of the software used to calculate the Energy Performance Rating of Dwellings in Malta (EPRDM)

The calculation methodology for the Energy Performance of Residential Dwellings in Malta (EPRDM) is described in the manual accompanying the energy performance calculation software. The calculation procedure takes account of the weather climatology and net energy required for space heating and cooling, water heating, lighting, and ventilation, after subtracting any savings from energy generation technologies. It calculates the annual values of delivered energy consumption (energy use), primary energy consumption, and CO_2 (carbon dioxide) emissions, both as totals and per m^2 of total useful floor area of the dwelling per annum.

The procedure is designed to be compliant with the national transposition of the EU's Energy Performance of Buildings Directive (EPBD) and is based on the CEN standards, in particular, ISO EN 13790:2008 "Energy performance of buildings – energy use for space heating and cooling." It consists of a monthly calculation within a series of individual modules. The individual modules contain equations or algorithms representing the relationships between various factors which contribute to the annual energy demand of the dwelling.

The calculation methodology for non-residential buildings is being developed and will be based on the UK's Simplified Building Energy Model (SBEM) national calculation tool.



The EPC Portal Website with secure login through the electronic ID system

Once the energy use rating is calculated and the required improvement measures are identified, the EPB assessor has to perform a secure login on a web-based central registration system. Here, the assessor has to upload the XML file containing the input data, energy use rating and CO_2 emission calculation. This file is checked by the system for consistency and compatibility with the, then, current version of the methodology calculation software. A photograph of the outlined building façade (for asset rating certificates) or elevation drawing (for design rating certificates) and an image of the site location plan have to be uploaded as well. The recommendations and a description of the building envelope including the roofs, walls, windows, doors, HVAC systems and any renewable energy sources of energy are then entered online so that they get displayed in the final EPC. Before officially registering the EPC, the assessor may save the certificate in a temporary format online and access it later to change the recommendations and building description, if necessary, but not the XML data or image files. The system has been designed to handle the registration fee payment and certificate registration in real time. When the registration fee is paid, the contents of the EPC can no longer be modified and the certificate, in PDF form, is stored in a secure area accessible only to that particular EPB assessor. At this stage, the EPC is stored in the central database together with the accompanying XML file, the latter being made available to the department for verification and the auditing part of the process. This way, the assessor can print the certificate from his office as soon as the registration is made

Under Maltese legislation, the building owner is responsible for commissioning an EPC and will pay from 250 € to 450 € for a design rating residential EPC and between 400 € and 750 € for an asset rating residential EPC to cover professional fees. The MRA charges a 75 € registration fee for each certificate registration, which covers part of the expenses used to run and update the EPC web portal. An owner, who fails to produce the certificate to the authorities, when requested to do so, can incur a fine between 500 € and 1,500 €.

The EPC Portal backend - checks on EPCs through the certificate manager

QA through the Reports Manager – selection of certificates for checking and auditing purposes

Quality assurance (QA)

The quality of EPCs relies to a large degree on self regulation, which is reinforced by the training background of EPB assessors. The latter must have a professional degree in engineering or architecture and can only obtain their qualification after participating in an Assessor Training Programme for the Energy Assessment Procedure for Dwellings in Malta and obtaining a high grade in the final test. This topic is explained in more detail in chapter 4.

The first quality check is carried out on the EPC Web Portal, which automatically verifies the pattern in the uploaded XML data file and rejects it if found to be in a non-compliant format.

After the EPC is issued, it may be checked by internal auditors who would carry out a visual verification of the EPC, in a desk based review, including running a check on the XML data and the result it produces. However, it may undergo a deeper audit which would end up in detailed inspections where the assessor's data collected from the building, including all supporting documents such as drawings, sketches, notes, photos, and receipts of specific building materials are manually examined by an inspector. An on-site inspection of the building may also be carried out. Detailed audits, especially those involving complicated buildings, can also be outsourced to external independent auditors.

A number of certificates will be routinely inspected for quality assurance purposes. This will include a random sample of about 5% or more from all certificates, a check on at least one EPC per assessor per year, checks on EPCs that are repeatedly issued on the same property, checks on EPCs with out-of-range values and checks following complaints from clients.

Depending on the quality of work encountered and the degree of errors in the EPC being audited, the certificate may have to be revoked and the EPB Assessor may be required to re-issue the EPC at his or her expense. In cases where there are serious offences, the legislation provides the authorities with the necessary tools to issue fines or suspend the assessor's registration.

To date, no certificates have yet been registered officially, although a number of energy audits have been carried out. The different authorities involved, such as the Malta Resources Authority, the Malta Environment and Planning Authority, the Commissioner of Inland Revenue and the BRO are co-ordinating their efforts to provide enough information for the BRO to start enforcement measures. If these efforts do not give the desired results, there is a possibility that the legislation may have to be changed to make sure that EPCs are carried out on a more forceful level.

3 > Inspections - Status of implementation

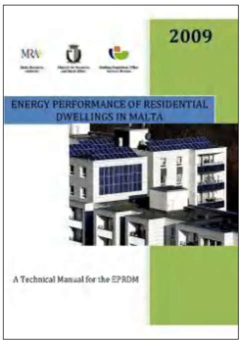
Inspections on boilers and air-conditioning systems are still in their early stages. The methodology for boilers has been based on the CEN standard MSA EN 15378:2007 "Heating systems in buildings - Inspection of boilers and heating systems", that for air-conditioning installations follows guidelines in TM44: 2007 "Inspection of Air Conditioning Systems" issued by the Chartered Institution of Building Services Engineers. The methodology, reporting and recommendation formats on how to carry out these inspections will be issued during 2011. The report will include the running condition, efficiency and design adequacy of the installations and the accompanying recommendations will include practical details on how to improve the overall system efficiency.

The inspection reports will be centrally registered on the EPC Web Portal which will allocate a unique authentication number for each inspection report. Audits will be carried out on the reports to check their quality and effectiveness.

EPRDM Courses – advert for courses 10, 11 and 12

4 > Qualified Experts

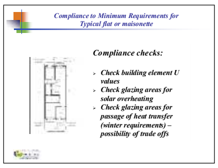
In Malta, prospective EPB assessors for dwellings must already have a professional degree in engineering or architecture, or be registered as an EPB assessor in another EU Member State. Those wishing to qualify as EPB assessors will have to successfully undertake a period of training approved by MRA on the assessment of the energy performance of buildings constructed in Malta. Successful participants will have to obtain an overall pass mark of at least 80% after having attended at least 80% of the course lectures.

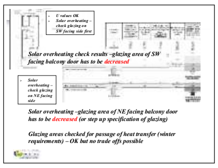


EPRDM Software manual

After undergoing the EPB assessors' training course sessions, the participants have to:

- Be well versed on the key objectives and background to the EPBD, the implementation in Malta including the legislation, minimum requirements and EPC registration and administration.
- Demonstrate the ability to accurately collect data from plans, specifications and physical surveys and to correctly calculate the energy demand of dwellings and the associated CO_2 emissions performance using





Slides from lectures presented to professional audiences explaining the application of minimum energy performance requirements.

the EPRDM software for both new and existing dwellings of varying complexity. The course participants have to be able to assess and apply lighting and internal loads, transmission of heat through the building fabric, ventilation, solar gains and energy use of permanent building installations in their calculations.

- Produce EPCs and Advisory Reports for residential buildings making recommendations to improve the energy performance of dwellings.
- Explain the significance of varying the specifications for dwellings.

The participants must undergo a test at the end of the course that will:

- Assess the participants' understanding of the EPRDM methodology, EPC policy, QA requirements, and surveying dwellings; and examine the participants' ability to recall, apply theory, define information and identify those products and systems in a dwelling that affect the EPC.
- Oblige learners to demonstrate their ability to use the EPRDM software during a practical supervised session - for a previously unseen dwelling – and to produce an EPC and Advisory Report. The practical test requires the candidates to apply all aspects of the EPRDM software.

The BRO has successfully organised twelve courses for Energy Performance Assessors of Buildings (Dwellings). Most of the course participants – about 97% - managed to qualify and register with the MRA as Energy Performance Assessors for Dwellings. At present there are 161 registered EPB Assessors.

Similar training procedures will also have to be undertaken by qualified professionals who wish to participate in an energy performance assessors' course for non-dwellings based on the respective methodology and calculation software.

5 > National Information and Communication Campaigns

Display Campaign Certificate for a government owned building

Lectures presented during an eco fair event in March 2010

The need of informing citizens on certification

The Building Regulation Office in co-ordination with the Ministry for Resources & Rural Affairs Public Relations Office has been actively involved in informing the public on the EPCs by taking part in several events such as:

- The promotion of the Display Campaign of certificates in public buildings and schools. The campaign will also help in paving the way for the implementation of the national obligations of the Directive.
- Weekly information sessions and programmes on Radio and Television broadcasts with live phone-ins from the public and video footage on energy efficient design principles in local buildings.
- Several seminars and presentations targeted towards different audiences such as the general public, architects and engineers, building contractors, estate agents, research bodies and students. Seminars have been sometimes organised as single events or as part of a larger trade fair venue or conference setting.
- Promoting energy efficiency themes with brochures and videos in various events through a supporting campaign called the Switch campaign.
- Preparing and delivering a series of lectures for an in-service course for teachers on Climate Change and Energy Efficiency in Buildings.
- Delivering lectures on the EPC and the centralised Web Portal during the EPRDM Energy Performance Assessors' courses for Dwellings.
- Co-ordinating summer courses for young students on energy efficiency of buildings & climate change.
- Contributing towards the creation of brochures and web information material with frequently asked questions on the EPC and tips on energy saving measures.

A brochure on energy efficiency in buildings

Fig. 4 - A brochure explaining the significance of the EPC

Advert on the provision of energy efficiency light bulbs to all Maltese families

The advertising campaigns will be intensified so as to increase public awareness and information available on EPCs. There are plans for video clips with a storyboard on energy efficiency in buildings and EPCs – these will be created, scripted, filmed and then transmitted on air on the major TV broadcasting stations during prime time hours probably during the second quarter of 2011.

6 > National incentives and subsidies

The government provided incentives mainly in the form of rebates/subsidies or grants on the purchase and installation of:

- Energy efficient light bulbs – free provision to every family in Malta
- Air-conditioners with a minimum Energy Efficiency Class A and an output equal to or less than 12kW
- Double glazing
- Solar water heaters
- Roof insulation
- PV panels
- Micro wind turbines.

Grants on solar water heaters and PV panels

Photovoltaic panels installed on a government-owned building

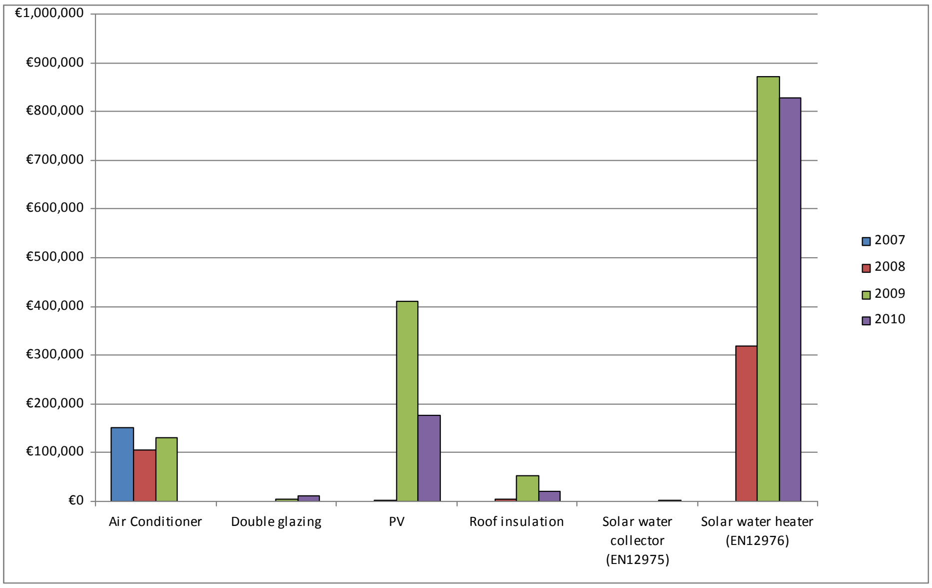


Fig. 5 - Government grants on installations, fixtures and renewable energy systems.

Advert promoting the use of solar energy to the industry.

The renewable energy source installations all have a positive effect on the EPRDM rating. Awareness on renewable technologies is progressively increasing by the government's continued promotion of these technologies.

There is scope to incentivise EPCs with lower energy use ratings, thereby making EPCs more popular with prospective buyers and property developers.

7 > Impact of the EPBD at national level

Evolution of Minimum performance requirements in building regulations

Before Legal Notice 261 of 2008 was introduced, there was no legislation regulating minimum energy performance requirements in buildings. The new legislation has introduced requirements for thermal insulation in roofs, limits on window sizes depending on solar gains, improved glazing, the imposition of power and timing regulating controls on heating and cooling systems, the conservation and re-use of rainwater in specially designed systems and increased awareness of the benefits obtained from renewable energy sources. The thermal efficiency of walls that was adopted reflects the local practice of building double walls with an inner and outer leaf constructed with stone blocks and separated by a cavity, which practice was being replaced in new constructions by the use of single leaf hollow concrete blockwork with lower thermal efficiency. These minimum values will in future be upgraded so as to be able to reach the targets that will be imposed by the *Recast* of the EPBD.

Other impacts

Not enough data on impacts is available, however large projects are being referred to the BRO for consultation before their planning permits are issued. Appropriate revisions to the building design and specifications are being requested in cases where the buildings do not meet the minimum requirements. There are cases where the project proposals now exceed the minimum requirements.

Local manufacturers of concrete blockwork are seeing a window of opportunity. They are now researching on ways of creating improved blocks with good structural and better thermal properties. The same thing is happening with local manufacturers of apertures who are seeking new suppliers of materials to introduce better insulated aperture frames and glazing. A considerable number of importers of domestic appliances are also taking up a market share by providing solar panels, solar water heaters and domestic wind turbines.

Slides, presented to the general public, illustrating how different construction practices affect energy performance in buildings.

8 > Conclusions and future planning

The impact of applying energy performance requirements in new and renovated buildings is limited at the moment. Significant reductions in energy consumption will probably be achieved when zero carbon footprint buildings are promoted and constructed on a wider scale by the building sector. Currently, less than 6,000 new buildings are built each year in Malta and, despite the recent growth in the rehabilitation market, major renovations still do not have a significant impact. Therefore, the EPBD requirements for new buildings and major renovations will certainly bring important energy savings in the near future, although new and renovated buildings only represent a small share of the entire building stock in Malta.

To achieve real energy savings in the building sector, significant incentives to the improvement of existing buildings are needed and certification can play its part. The recommendations made by the experts in the certificate are important guidelines that the owner of the building can make good use of, either in the context of a renovation, or an individual cost-effective measure. Financial concerns about the investment cost and applying the payback period for energy efficient technologies is still a major barrier, though.

The public may have been unaware of the real energy use in the past, however this trend is changing. There are changes in the daily patterns of energy use due to the recent heavy rise in energy tariffs. The increased costs have induced many to economise on heating and cooling, but this trend may be about to change as more buildings are constructed or refurbished with higher levels of energy performance qualities. This may lead consumers to once again increase their energy use, albeit in a controlled manner.

On the other hand, additional training has to be offered to architects, engineers and qualified experts, to improve their skills in energy audits and share best practices in economic and technological building improvement solutions.

Although there is considerable interest on the EPBD and certification from the building professions such as architects, engineers and estate agents, no EPCs have been officially registered yet. Buyers seem to prefer not to enforce their right to ask property sellers to provide EPCs because the perception is that the cost of the certificate will be added to the value of the property. The Government had drawn up the legislation on a *Self Regulatory basis* hoping that buyers would want to impose their right to have information on the quality of buildings they were buying or renting, however it seems that this pretext is not providing the desired results and the government is therefore looking for ways to better enforce the certification system.

The main challenges and future developments of the certification system for the short and medium term are, thus:

- Introduce new legislation to enforce the certification system.
- Continued improvement of the EPC Web Portal, including online audit reports, data entry validation and automation of the QA process.
- Reinforce the QA Scheme, increasing the number of input checks.
- Provide additional training for qualified experts on HVAC, DHW and renewable energy systems, as well as more effective auditing techniques.
- Take immediate steps to prepare new building regulations in line with the requirements of the new recast EPBD.
- Change from elemental requirements to maximum allowable energy footprints for the different building categories.
- Carry out more studies and gather more data on EPBD implementation in order to make the general public more aware of the benefits that can be derived out of the EPC schemes.

Malta is acquiring experience through the EPBD implementation and will use it to achieve the final goal of new nearly zero-energy buildings by 2020.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in The Netherlands

Status in November 2010

Nienke Betlem

Ministry of the Interior and Kingdom Relations

Hans van Eck

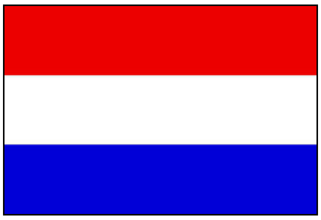
Raymond Beuken

Marjolein Heinemans

Leanne van Diggelen

NL Agency

The Netherlands



1 > Introduction

The implementation of the EPBD in The Netherlands has reached an almost full grown status. The date of implementation of the Directive as to the Energy Performance Certificate was January 1st 2008. For social housing companies this was one year later on the provision of certification of their complete building stock. The permanent certification for public buildings was mandatory as of January 1st 2009. In 2009, a revision of the Energy Performance Certification scheme started that led to improvements ranging from training and examination of assessors, to an updated methodology and software, to a new lay-out of the Energy Performance Certificate, and to a newly adopted quality assurance scheme, as of January 1st 2010.

For the implementation of the inspection of heating systems a voluntary scheme, according to 'option B', was adopted. Option B consists of non-mandatory tools and information campaigns and partly of existing Environmental law.

The inspection of air-conditioning systems is fully implemented in The Netherlands. Currently, the inspection of air-conditioning systems is dispersed amongst different parts of national law. Therefore, an improvement will be made to aggregate the inspection of air conditioning systems completely into Environmental law by July 1st 2011, also largely taking into account the provisions following the Recast of the EPBD.

This report presents an overview of the current status of implementation in The Netherlands. It addresses certification and inspection systems, quality control mechanisms, training of qualified assessors, information campaigns, incentives and subsidies.

National websites:

- *www.minbzk.nl*
- *www.rijksoverheid.nl/onderwerpen/energielabel-woning*
- *www.agentschapnl.nl*
- *www.energielabelgebouw.nl*

2 > Certification

Certification of buildings

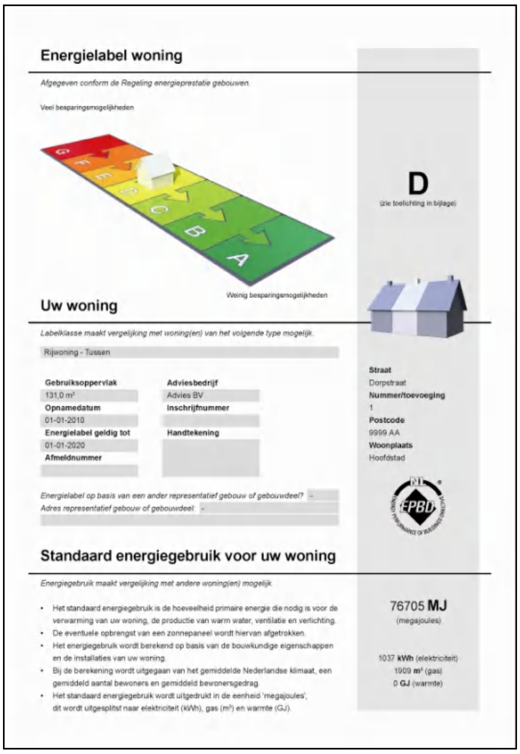
In The Netherlands the implementation of the EPBD is the overall responsibility of the Ministry of the Interior and Kingdom Relations. NL Agency, the Dutch energy agency is the executive body for the implementation process.

In December 2006 the 'Decree on Energy Performance of Buildings' (BEG) as well as the 'Regulation on Energy Performance of Buildings' (REG) were legally implemented in The Netherlands. This enabled The Netherlands to develop an

Energy Performance Certificate for existing buildings that first came into force on January 1st 2008. The certification of new buildings was already integrated into Dutch law by as early as 1995.

For each existing building or building unit, e.g., an apartment, an Energy-Index is calculated according to a fixed methodology. An energy certificate class is then assigned based on the Energy-Index and building type. Certificates can only be issued by qualified assessors. There are voluntary educations for assessors, but examination by a national board is mandatory. The list of qualified assessors is permanently updated and always available online for the public at the website of KBI, the Dutch quality assurance association (*www.kbi.nl*).

The energy performance certificate


Energielabel woning

Afgegeven conform de Regeling energieprestatie gebouwen.

Veel besparingsmogelijkheden

Weinig besparingsmogelijkheden

D
(zie toelichting in bijlage)

Uw woning

Labelklasse maakt vergelijking met woning(en) van het volgende type mogelijk.

Rijwoning - Tussen

Gebruiksoppervlak
131,0 m²
Opnamedatum
01-01-2010
Energielabel geldig tot
01-01-2020
Afmeldnummer

Adviesbedrijf
Advies BV
Inschrijfnummer

Handtekening

Straat
Dorpstraat
Nummer/toevoeging
1
Postcode
9999 AA
Woonplaats
Hoofdstad

Energielabel op basis van een ander representatief gebouw of gebouwdeel? -
Adres representatief gebouw of gebouwdeel: -

Standaard energiegebruik voor uw woning

Energiegebruik maakt vergelijking met andere woning(en) mogelijk.

- Het standaard energiegebruik is de hoeveelheid primaire energie die nodig is voor de verwarming van uw woning, de productie van warm water, ventilatie en verlichting.
- De eventuele opbrengst van een zonnepaneel wordt hiervan afgetrokken.
- Het energiegebruik wordt berekend op basis van de bouwkundige eigenschappen en de installaties van uw woning.
- Bij de berekening wordt uitgegaan van het gemiddelde Nederlandse klimaat, een gemiddeld aantal bewoners en gemiddeld bewonersgedrag.
- Het standaard energiegebruik wordt uitgedrukt in de eenheid 'megajoules', dit wordt uitgesplitst naar elektriciteit (kWh), gas (m^3) en warmte (GJ).

76705 **MJ**
(megajoules)

1037 **kWh** (elektriciteit)
1909 **m³** (gas)
0 **GJ** (warmte)

Figure 1 – Cover page of the EPC for residential buildings

The Energy Performance Certificate is the most visible aspect of the EPBD. This document assigns an energy performance rating to residential and non-residential buildings including building units and it lists individually tailored cost-effective measures for improving their energy performance.

The Energy Performance Certificate consists of 3 pages. On the first page, the energy certificate class of the building is indicated. The classes range from A (many energy saving measures taken) to G (many energy saving measures possible). The energy certificate class is determined by the calculated Energy-Index that can be found on page three of the Energy Performance Certificate. On the front page, furthermore, the standardised annual primary energy use in MJ is displayed including a sub-division into electricity (kWh), gas (m^3) and heat (GJ). The Energy Performance Certificate for non-residential buildings also displays the annual CO_2 emission. The first page also mentions the building type for which the energy certificate is issued, the assessor of the certificate and the date until when the certificate is valid (with a maximum of 10 years).

The energy saving measures that are advised for a specific building are described on page 2 of the certificate. As shown in Fig. 2, suggested improvements include a short general description for each energy-saving measure. Page 3 gives a description on how the Energy-Index is calculated, according to a standardised methodology.

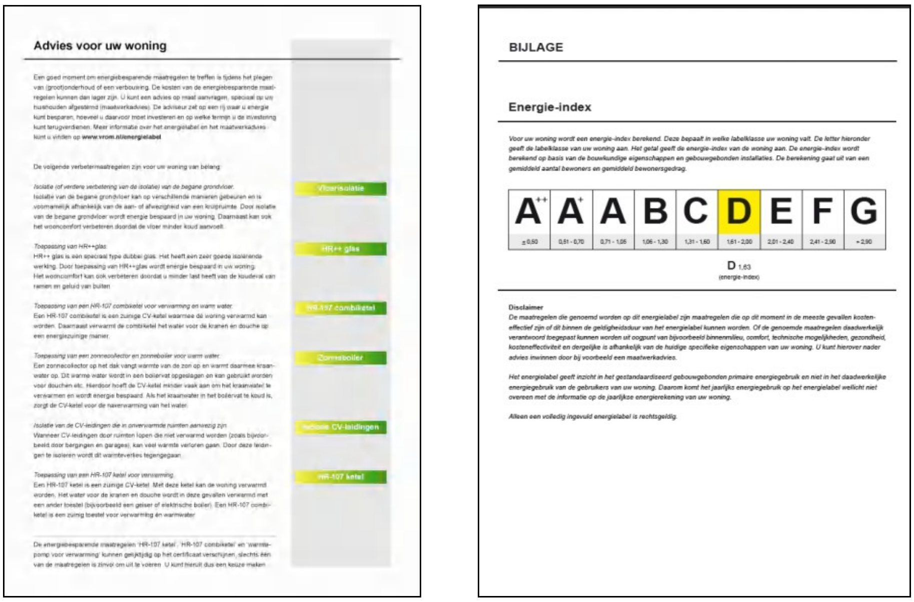


Figure 2 – page 2: Recommendations to improve the energy performance, page 3: Description on how the Energy Index is calculated.

For more information on accredited software please visit http://www.kbi.nl/zoek-een-certificaathouder/

(Only in Dutch)

Certification of existing residential and non-residential buildings started January 1st 2008, when a building or building unit is sold or rented out. The owner must present a valid Energy Performance Certificate at the moment of transaction. This involves a qualified assessor to visit the property and assess the building in terms of the type and quality of constructions and installations. The qualified assessor will then calculate the Energy-Index with an accredited software and issue the Energy Performance Certificate (Figure 1). This is done by sending an automated report to the central database that is hosted by NL Agency which returns a unique number for each certificate that can then be printed.

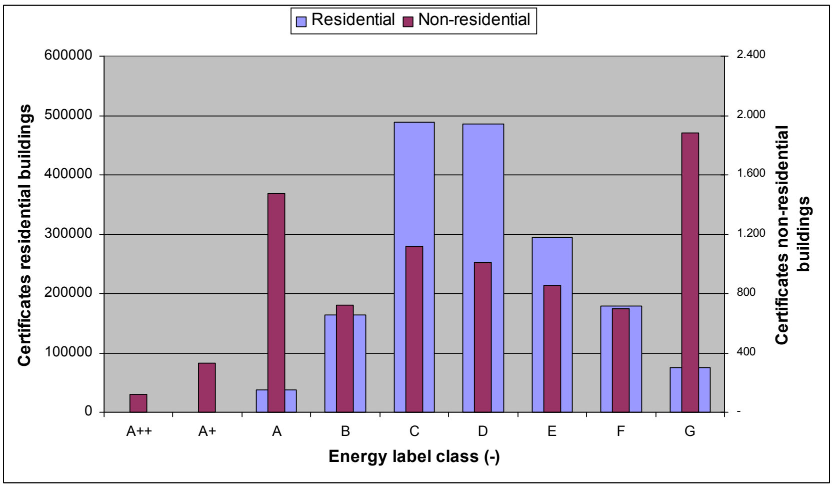


Figure 3 – Number of Energy Performance Certificates issued

Up to and including September 2010 (Figure 3), in The Netherlands 1,726,631 Energy Performance Certificates for residential buildings were issued (approx. 25% of the total residential building stock) and 8,207 for non-residential buildings, covering 24.5 million m^2 surface area.

New buildings

The existing Energy Performance Certificate applies to existing building and building units, both residential and non-residential, including public buildings. For new buildings, The Netherlands has had a methodology since 1995. The so-called Energy Performance Standard (EPN) sets requirements for the energy efficiency of new buildings and major renovations of existing buildings. This is expressed in an Energy Performance Coefficient. This coefficient is a dimensionless number to indicate the energy efficiency of a new building. The EPN sets an integral requirement for the whole building.

Year	*EPN - energy performance coefficient*
1995	*1.4*
1998	*1.2*
2000	*1.0*
2006	*0.8*
2011	*0.6*
2015	*0.4*
2020	*Zero energy*

Development of the EPN (EPC number) requirement for new residential buildings

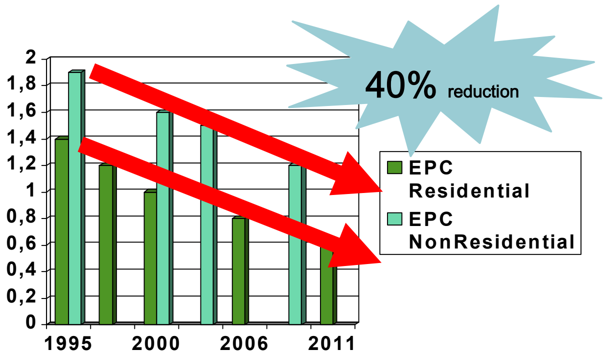


Figure 4 – Development of the Energy Performance Standard in the Netherlands

A general description of the methodology for new buildings can be found on www.agentschapnl.nl/epn

(only available in Dutch).

Dutch building legislation sets minimum requirement for building components. Each couple of years both sets of requirements are evaluated and if necessary adjusted (see figure 4). Dutch policy for new buildings hereby already fully incorporates all requirements following from the EPBD Recast towards nearly zero-energy buildings in 2020. See also the table next to the text.

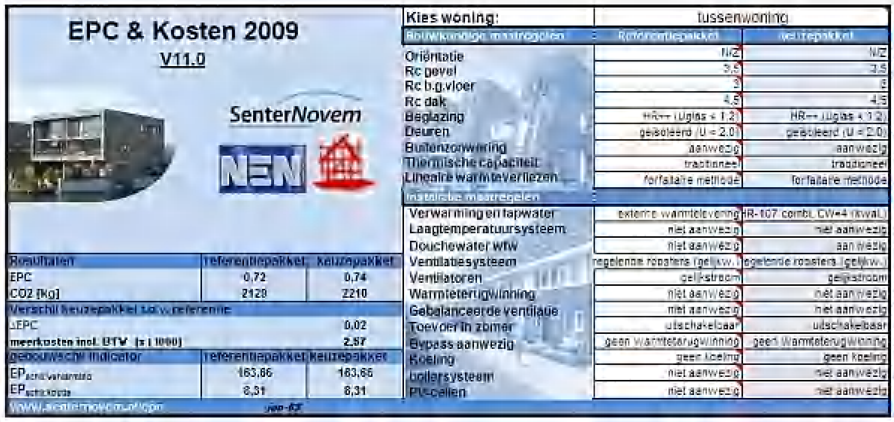


Figure 5 – Example of software for calculation cost effectiveness of EPN

The government decided to leave the solutions to achieve the EPN to the builders and/or architects. The builders can choose their own package of measures to meet the requirements. Important is the focus on the total energy performance of the building and not on stand-alone solutions. The same methodology applies to major renovations (new building envelope, HVAC and lighting) of existing buildings.

With regards to Public Buildings, The Netherlands has incorporated in national law the requirement that the owner of a building with a total useful floor area of more than 1.000 m^2 occupied by public authorities and by institutions providing public services to a large number of persons and therefore frequently visited by these persons must place an Energy Performance Certificate in a prominent place clearly visible to the public.

The calculation methodology

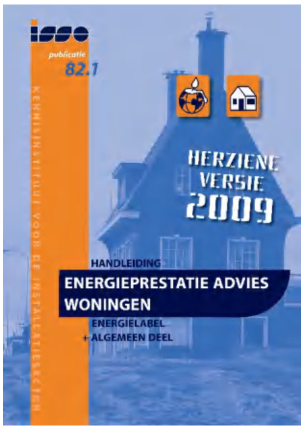
The calculation method for existing buildings is based on Energy Performance Advice (EPA) methodology. For existing buildings, the existing voluntary EPA methodology was simplified and enhanced and made mandatory for the calculation of an Energy Performance Certificate by publishing a Building Decree in 2006.

The methodology calculates the total annual primary energy use of a building for the components heating, hot water, ventilation and lighting (including renewable energy). Cooling is only considered for non-residential buildings. Each calculation is performed under average annual climate conditions, average number of occupants and occupant behavior. This method is currently being adapted to meet CEN standards.

It is expected that, during 2011, a new calculation methodology will be adopted in The Netherlands, the so-called Energy Performance of Buildings (EPG), combining a methodology for new and existing buildings, residential and non-residential buildings, into one package, taking into account existing CEN standards as much as possible. It is likely that this methodology will first be adapted to replace the current EPN methodology for new buildings.

As of the effectuation of the EPBD Recast starting from 2013, the new EPG methodology will be adapted for new and existing buildings, residential and non-residential buildings as the methodology to determine the Energy Performance Certificate.

Quality assurance (QA)



Through the Decree (BEG) and Regulation (REG) on the energy performance of buildings that were published in 2006, a quality assurance scheme was appointed. The quality assurance system is built on a national quality standard for energy consultants and qualified auditors: BRL9500 for quality assurance on the certification of buildings by qualified assessors and BRL9501 for quality assurance on accredited software. The methodology for non-residential buildings was published as ISSO 75 publication and the methodology for residential buildings was published as ISSO 82 publication. ISSO 54 publication covers the accreditation of software.

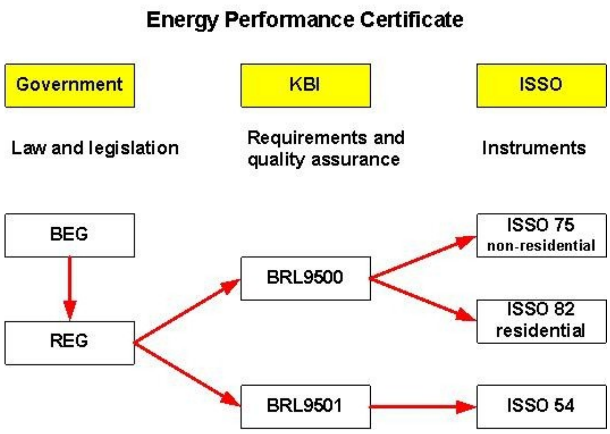


Figure 6 – Legal context energy certification

In order to issue an Energy Performance Certificate, the qualified assessor has to use accredited software. This software is developed by commercial companies but tested and accredited according to a software assessment guideline, BRL9501. All commercial software products communicate the same defined XML file to the central database which is operated by NL Agency. Only when an Energy Performance Certificate is composed by a qualified assessor and calculated with accredited software, can it be sent to the central database. And only under these circumstances a unique number is issued for the Energy Performance Certificate. Without this number the Energy Performance Certificate is not valid. When working under the BRL9500 guideline a qualified assessor is regularly checked by a certification institute which includes a full review of a certain number of Energy Performance Certificates issued. Such an audit involves checking all the supporting documentation prepared and used by the assessor (e.g. projects, drawings, reports, photos, etc.) and identification of eventual differences and mistakes incurred. Penalties may be applied when relevant faults occur. Penalties can include loss of licence.

For more information on the "verwarmingswijzer" please visit www.verwarmingswijzer.nl *(only in Dutch)*

Inspection of boilers

The system that The Netherlands has adopted will lead, with regard to the inspection provisions as laid down in the directive, to the intended result based on a voluntary inspection scheme and legislation, which is in accordance with Article 8.b of the EPBD 2002/91/EG. This system consists of three main paths.

1. Domestic buildings with an individual boiler

In The Netherlands small boilers (typically 15-35 kW) are inspected and maintained every year or every two years, depending on the type, size and age of the boiler. This is typically done by installation companies that provide various levels of service contracts, mainly to housing corporations, but to individual home owners as well. To stimulate the replacement of older boilers by a new energy efficient condensing boiler, a tool has been developed for consumers, the so-called '*verwarmingswijzer*'.

The tool gives consumers insight, based on the current installation and the current gas use, if a new and energy efficient heating system is economically viable.

2. Boilers larger than 100 kW

With regard to large boilers (> 100 kW), the Netherlands complies with current legislation in Environmental legislation. This means a mandatory regular inspection of the boiler according to a specified scheme. For gas-fired boilers, this requires an inspection at least once every 4 years. For non gas-fired boilers, the prescribed inspection frequency is at least once every 2 years.

The inspection focusses on safe functioning, optimum combustion control and energy efficiency of the boiler. The inspection furthermore includes inspecting the set-up of the combustion system, the system for fuel supply and the exhaustion of combustion gases. When an inspection shows that the heating or combustion plant needs maintenance, this should be done within two weeks of the original inspection. The owner must keep the last inspection report issued as well as the records of any maintenance job.

For more information on the "Installatie Performance Scan" please visit

www.installatieperformancescan.nl

(only in Dutch)

3. Inspection based advice on the heating system

For non-residential buildings and residential buildings with a collective boiler a tool has been developed to advice the owner and/or user of the building on possible measures to make the installation more energy efficient. With this tool, the '*Installatie Performance Scan*', the installer or advisor scans the existing installation of the building, heating as well as cooling, on energy efficiency. The tool is unique because it provides an integral check on the generation, controls, distribution etc. Altering the installations on the basis of the scan can lead to reduction of energy use and reduction on the chance of breakdown of the installation and higher comfort levels in the building.

Furthermore, for large heating systems in non-residential buildings a new law ('BEMS') was published in April 2010 that sets requirements for emission standards in new installations with an output ranging between 1 and 50 MW. This emission standards law prescribes inspection duty and if need be a maintenance obligation as follow up.

Inspection of air-conditioning systems

The article on the inspection of air-conditioning systems is implemented in The Netherlands, but this requirement is dispersed amongst different parts of national law. Therefore, an improvement will be made to aggregate the inspection of air-conditioning systems into one law by mid 2011. The inspection of air-conditioning systems will then be adapted and combined to the inspection on CFC-regulation.

4 > Qualified Assessors

The assessors who may issue an Energy Performance Certificate have to meet certain minimum qualifications, including the ability to assess the quality and condition of materials, building envelope and installations present in a building. The training of assessors is the first (voluntary) stage to guarantee high level quality Energy Performance Certificates. The second stage is a mandatory national exam that each individual assessor needs to pass. When the assessor has passed the exam, he/she will receive a NL-EPBD process certificate which enables him/her to issue Energy Performance Certificates in accordance with the BRL9500 assessment guideline (see also the paragraph on Quality Assurance and figure 6).

	Individuals	Companies
Residential	1.578	226
Non-residential	231	119

Number of qualified persons and companies to issue EPCs

Figure 7 – Qualified assessor professional license

By mid September 2010, about 1,800 individual assessors were qualified in The Netherlands to issue Energy Performance Certificates, divided over the residential sector (1,578 individuals) and non-residential sector (231 individuals), see also the table on the left.

Assessors of (large) boiler inspections have to meet certain qualifications as well. These qualifications are set out in a quality assurance scheme which includes a mandatory examination. These assessors need to prove their ability to perform maintenance and inspections on combustion systems.

5 > National Information and Communication Campaigns

Public awareness concerning the EPBD, and in particular the Energy Performance Certificate, in The Netherlands is the main responsibility of the Ministry of the Interior and Kingdom Relations. At the end of 2007, before the launch of the Energy Performance Certificate, the first national information campaign aired in The Netherlands. This campaign was repeated in the spring of 2008. The campaign focused on home-owners and consumers and informed the public on the Energy Performance Certificate with the slogan: *"An energy efficient house? Through the Energy Performance Certificate you will know!"*. The campaign consisted of short commercials on radio and television, items in housing programs, advertisements in national newspapers and a campaign site with guidelines to inform the broad public about the conditions under which an Energy Performance Certificate is required.

In 2009/2010 a more general campaign ran to raise public awareness on the topic of energy saving in the build environment.

Specific information for professionals is issued by NL Agency. NL Agency's website *www.energielabelgebouw.nl* (only in Dutch) provides detailed information about the EPBD and in particular the Energy Performance Certificate for professionals in the building sector: qualified assessors, commercial building owners and managers, installers and builders, real estate agents, notaries, municipalities and mortgage lenders.

6 > National incentives and subsidies

'More With Less' (*Meer Met Minder*)

'More with less' is a Dutch energy saving programme for existing buildings. It is an agreement between the Ministry of the Interior and Kingdom Relations, the Ministry of Economic Affairs, Agriculture and Innovation and private partners and organisations including utilities, installation sector, building constructors and social housing corporations. The goal of the programme is to create a substantial market for energy savings interventions to stimulate private and public home owners to make their buildings more energy efficient at low monthly costs. The Energy Performance Certificate plays a vital role in '*Meer Met Minder*', as it is used to measure energy improvement of buildings in order to fulfil the goals set in the agreement.

'*Meer Met Minder*' started in 2008. By the end of 2010, the implementing organisation is fully up and running and the initial target of improving the energy quality of 10,000 buildings has been met. Through the whole of The Netherlands, projects are running supported by installers, builders, housing corporations, municipalities and others not only aimed at improving the energy efficiency of the existing building stock, but also aimed at training the building workforce through educational programs.

For more information please visit www.meermetminder.nl

(only in Dutch)

'Energy subsidy guide' (*Energiesubsidiewijzer*)

By the end of 2010, many subsidies and other incentives are available to Dutch consumers and/or professional building owners, related to the Energy Performance Certificate, improvement of the current installation and energy saving measures in general. These subsidies include a grant of 200 € for a detailed Energy Performance Advice, which often includes an Energy Performance Certificate, a subsidy of 350 € or 750 € respectively when improving the energy performance of a dwelling in terms of 2 or 3 energy classes, and a higher mortgage sum when buying a 'green certificate' or 'A class' dwelling, bank guarantees for loans meant for energy saving measures, lower VAT rate for insulation of roof, wall and floor, incentive scheme for sustainable energy production and a subsidy scheme for sustainable heating.

For more information please visit www.energiesubsidiewijzer.nl

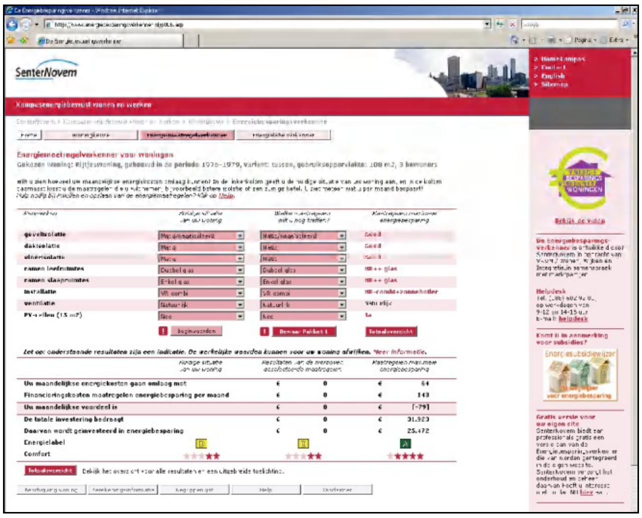
(only in Dutch)

A current overview of subsidies and incentives is available online through a subsidy tool that was developed by NL Agency for consumers and professionals, the '*Energiesubsidiewijzer*'. This internet tool gives an overview of financial instruments (such as subsidies, loans etc.) to stimulate energy saving measures in The Netherlands. The user of the tool can select his/her place of residence, select the type of 'user' he/she is (e.g. home owner, tenant of professional building owner) and, if desired, select a specific energy saving measure to get an overview of current financial instruments for their specific location. The '*Energiesubsidiewijzer*' contains subsidies, loans and other financial instruments on a national, regional and local level. The tool can help professional parties to communicate with consumers on the financial possibilities of energy saving measures.

'Energy Scout' (Energiebesparingsverkenner)

This is an interactive tool on the internet that gives insight into the possibilities of energy saving measures in existing houses and financial consequences. The tool gives information on the energy expenses and what the effect of energy saving measures is. Information is given on the expected improvement of the building energy performance, in terms of energy certificate classes, after taking measures, what the costs of the measures are and what the return of investment will be. This very useful instrument can be used by consumers organisations, housing associations, municipalities, building contractors etcetera to advise consumers professionally on the (financial) possibilities of energy saving.

For more information please visit www.energiebesparingsverkenner.nl (only in Dutch).



A more consumer friendly version is available via www.verbeteruwhuis.nl (only in Dutch).

Information for consumers can be found on www.milieucentraal.nl (only in Dutch)

7 > Impact of the EPBD at national level

Both for residential and non-residential buildings, The Netherlands already had minimum energy performance requirements in place since 1995. The Energy Performance Standard (EPN) sets requirements for the energy efficiency of new buildings and major renovations of existing buildings. This is expressed in an Energy Performance Coefficient (EPC). The EPN sets an integrated requirement for the whole building. Dutch building legislation further sets minimum requirement for building components. Each couple of years both sets of requirements are evaluated and if necessary adjusted.

Building function/ type	EPN - energy performance coefficient
Meeting	2.0
Detention	1.8
Health care, with beds	2.6
Health care, other	1.0
Office	1.1
Lodging	1.8
Educational	1.3
Sports	1.8
Shopping	2.6

Overview of current EPN requirements for new non-residential buildings

For new non-residential buildings, integrated requirements for buildings were introduced in 1995 and tightened in 2000, 2003, 2009 (see figure 4). Current levels are displayed in the table on the left for all nine buildings typologies in the non-residential sector. Further adjustments towards zero-energy of nearly zero-energy (new) buildings in 2020 are expected in 2017, with a 50% increase in energy efficiency levels compared to current requirements.

For new residential buildings, a similar development has occurred since 1995 when integrated building requirements were first published. These requirements were tightened in 1998, 2000 and 2006 (see figure 4). Further adjustment from the current requirement of 0.8 are expected in 2011 (25% efficiency increase to 0.6), 2015 (50% efficiency increase to 0.4) and 2020 (zero-energy or nearly zero-energy new residential buildings).

Year	*EPN - energy performance coefficient*	*Natural gas use in m^3*
1980		*3000*
1990	*Obligatory insulation*	*2000*
1995	*1.4*	*1400*
2000	*1.0*	*1000*
2007	*0.8*	*800*
2011	*0.6*	*600*
2015	*0.4*	*400*
Future	*Zero energy*	*0*

Figure 8 – overview of natural gas use in a typical Dutch dwelling over the years

For existing buildings that are retrofitted, minimum requirements currently apply to building envelope components. New developments are expected for retrofit situations to set minimum performance requirements for installations, following the implementation of the ECO-design guideline and EPBD Recast. Also future increases of energy performance requirements for building envelope components are expected following implementation of EPBD Recast.

8 > Conclusions and future planning

The Netherlands is well under way with the implementation of the EPBD and has started preparations for the implementation of the EPBD Recast in 2010. The Energy Performance Certificate for existing buildings was introduced in 2008, while new buildings already had to comply with minimum energy performance requirements since as early as 1995. Inspections of installations are largely based on existing laws, with added instruments to facilitate voluntary inspections and successive improvements. In 2011, existing dispersed inspections for air-conditioning systems will be brought together into one law.

Future Dutch energy policy already has some major issues covered that play a role in the EPBD Recast. Energy performance requirements for new buildings will be steadily tightened to zero-energy or nearly zero-energy level from 2020. For retrofitting existing buildings, requirements for building envelope components and installations will be increased and/or introduced within one or two years. Studies are currently under way to improve sanctioning and enforcement of EPBD in near future, in accordance with the EPBD Recast. Also preparatory work started on items like displaying the Energy Performance Certificate in public buildings with a useful floor area of 500 m^2 and in advertisements in commercial media. Concerted Action EPBD will remain of great value to The Netherlands in upcoming years to share best practices with other Member States and learn from each others experiences.

Useful links

- *www.minbzk.nl*
- *www.rijksoverheid.nl/onderwerpen/energielabel-woning*
- *www.agentschapnl.nl*
- *www.energielabelgebouw.nl*
- *www.energiebesparingsverkenner.nl*
- *www.energiesubsidiewijzer.nl*
- *www.meermetminder.nl*
- *www.milieucentraal.nl*
- *www.installatieperformancescan.nl*
- *www.verwarmingswijzer.nl*

Implementation of the EPBD in Norway

Status in November 2010

Olav Isachsen

NVE

Gunnar Grini

The National Office of BuildingTechnology and Administration

William Rode

NVE

Norway

National websites:

- *www.energimerking.no*
- *www.be.no*
- *www.standard.no*

1 > Introduction

The EPBD was fully implemented in Norway in 2010. Since the last report was published in June 2008, the transition period for implementing minimum requirements for new buildings is over, and the regulation for the certification of buildings and the inspection of boilers, heating systems, ventilation and cooling systems has been adopted and come into effect.

By the beginning of November 2010, approximately 40,000 energy certificates have been issued, mostly after the 1st of July 2010. During the coming months, one will be able to see how well the energy certificate is established in the building market. An evaluation of the present regulation will naturally take place along with considerations following the recast Directive.

This report presents an overview of the current status of implementation and of the further plans for the implementation of the EPBD in Norway. It addresses certification and inspection systems, including the status for quality control mechanisms, the status for qualified experts in the market, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

In Norway, the implementation of the EPBD is the overall responsibility of the Ministry of Petroleum and Energy, together with the Ministry of Local Government and Regional Development. The Norwegian Water Resources and Energy Directorate is the managing body for the certification and inspection schemes. The National Office of Building Technology and Administration manages the system of minimum requirements for new and renovated buildings. The two institutions naturally cooperate on issues such as the calculation methodology for energy performance of buildings.

The legislation was in place from the 1st of January 2010, but following input from the European Surveillance Authority, the regulation was revised as of the 1st of July 2010[1]. With the last revision, there is no transition period, but it will take some time before all buildings are certified. In particular, this refers to existing buildings over 1,000 m^2, which are not being sold or rented out.

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[1]Regulation for energy certification of buildings and inspection of boilers, heating systems, ventilation and A/C systems: *http://www.lovdata.no/cgi-wift/ldles?doc=/sf/sf/sf-20091218-1665.html*

Even if a number of buildings were certified in the first part of 2010, it was not until the summer that the process took off. As of the 1st of November 2010, more than 40,000 certificates have been issued. The estimated number of apartments and houses being sold annually is 100,000, indicating that a considerable share is already being certified. Approximately 3,100 certificates were issued by qualified experts whereas the rest were issued by home owners.

As of the 1st of July, the obligation of energy certification is in force for both residential and non-residential buildings. Certification of non-residential buildings will naturally take longer and cover smaller numbers of buildings. As of the 1st of November, approximately 300 certificates have been issued for non-residential buildings.

The energy performance certificate

The Energy Certificate is the legal document produced during energy certification. The regulation requires this document to be shown to potential buyers, etc. However, parts of the certificate, for instance the Energy Label, can be used as a short version.

The Energy Certificate (*Energiattesten*) has the following content:

Identity data. On top of the front page is the address and necessary data to identify the building or the apartment given, as well as the name of the person or organization responsible for issuing the certificate, normally the owner, as well as the person who has registered the data.

The Energy Label. This matrix presents the result of the calculation in two dimensions. Firstly, on the vertical axis, the grades A to G are called the Energy Grade and represent the *calculated delivered energy* need. Secondly, on the horizontal axis, the Heating Grade represents to what *extent heating of space and water can be done with renewable energy sources* - other than electricity and fossil fuels. The character represents the Energy Grade and the colour represents the Heating Grade. An explanation is given on the front page.

Measured energy consumption. An average of the energy use per energy carrier for the last three years is shown at the bottom of the front page. This is required for non-residential buildings, but for residential buildings it is only encouraged.

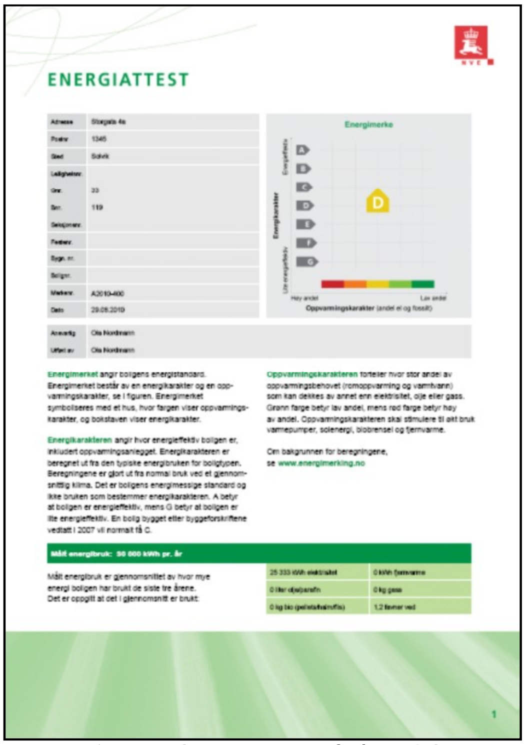


Fig. 1 – Cover page of the EPC

Fig. 2 -Recommendations for the improvement of energy performance

User influence. On page 2, a paragraph is devoted to general advice on energy use which can save energy, even if it does not affect the calculation of energy performance.

Recommendations. A summary of the recommendations. A more extensive description is given in an Appendix.

Central input data. On page 3, the most central input data given by the owner is reproduced, to allow the reader to check obvious data like building type, building year, etc.

Information and Help Desk. The last page is devoted to general information on Energy Certification and contact data for the Help Desk is provided.

A short version of the Energy Label is the profile of a building with the same combination of letter and colour as in the energy Label matrix, see left.

There are only small differences between certificates for residential and non-residential buildings. The differences are mostly on language and relevance of content.

The Norwegian scheme of certification is characterized by the option of "self-assessment" for the owners of existing apartments and residential buildings. This way, the Government wants to stimulate the individual owners' interest in their own energy use and possible efficiency efforts. When using the self-assessment option, the owner gives input data on the Internet to the Energy Certification System. The system allows the input of information regarding building year, room area, building type etc., finds corresponding typical values for the parameters needed for the calculation, and the certificate is instantly produced. The user can choose a "simple" version, which is the quickest and only suited for buildings with typical values, and detailed registration, where a certain amount of additional details is needed. A detailed registration is required to be able to get a recognition for enhancements or a building standard that is better than the norm for the year of construction. The list of recommendations following the self-assessment can only be a vague indication of the best efficiency measures for this building. However, when an expert performs the certification, he/she is responsible for all the input data, as well as the detailing of recommendations for improvement. This implies that certificates generated by a non-expert will be more general than those of an expert.

Validity of energy certificates is 10 years.

New buildings will normally achieve the energy grade C, although this depends on the efficiency of the heating system in place. A and B are normally reserved for buildings with better energy quality than required.

Certification of new buildings requires a qualified expert. The Energy Certification System is designed to import the result of the calculations from external energy calculation systems. This is beneficial in particular for developers of new buildings, who can use the same expert, the same software and, for the most part, the same input data as in the required calculation, to control compliance with minimum requirements. This way, the developer can easily take the energy character into consideration at an early stage of the project. The qualified expert will also be able to use data for technical installations that are not accessible to unqualified people doing self-assessment, e.g., efficiency of recovery units in ventilation, COP of heating and cooling installations.

The developer is obliged to present a certificate, when the building is on the market, and correct this later, if built different from the project plans. **Major renovations** require the same certification and requirements as new buildings in terms of the building regulation.

For **existing** residential buildings, there is a choice between expert certification and self-assessment. For **existing non-residential buildings,** an expert is always needed and he/she can choose between several options regarding the registration of data. For complex buildings, where the standard requires a dynamic calculation, the expert has to use one of the qualified external calculation systems.

The Directive includes special requirements for **public buildings**. The Government has decided that all non-residential buildings shall have the same obligation. This implies that all non-residential buildings over 1,000 m^2 shall have a valid energy certificate, and its summary has to be displayed to the public.

The calculation methodology

The calculation methodology used for the Energy Grade is defined by the standard NS 3031:2007. This standard has been developed to provide a framework for both minimum requirements and energy certification. It is based on CEN standard EN 13790, plus numerous other relevant CEN standards.

The Energy Grade is defined by calculated delivered energy to the building - irrespective of energy carrier, including all energy factors, as delivered to the building, if used under normal climatic and usage conditions. The result in kWh per m^2 produces the Energy Grade from a given table, below.

Building category	Delivered energy						
	A	B	C	D	E	F	G
	Lower or equal to	Lower or equal to	Lower or equal to	Lower or equal to	Lower or equal to	Lower or equal to	Lower or equal to
	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
Small buildings	79	118	158	231	305	458	No limit
Apartment blocks	67	100	134	184	235	353	No limit
Nursery schools	90	135	180	228	276	414	No limit
Offices	84	126	168	215	263	395	No limit
Schools	79	118	158	208	259	389	No limit
University buildings	95	143	191	240	289	434	No limit
Hospitals	179	268	358	416	475	713	No limit
Nursing homes	136	203	271	328	384	576	No limit
Hotels	135	202	269	321	373	560	No limit
Sports facilities	109	164	218	272	325	488	No limit
Trade service buildings	129	194	258	309	360	540	No limit
Cultural buildings	105	158	210	256	302	453	No limit
Industry and workshop buildings	106	159	212	270	329	494	No limit
			Based on minimum requirements (TEK 2007)				

The Heating Grade is calculated from a set of assumptions on what share of the heating demand each technology and source can realistically cover. For instance, an automatically driven system with biofuel is considered to cover up to 80 % of the demand, an air to air heat pump will normally cover only 30 %. For self-assessment, these figures are fixed but, with an expert, the exact data can be used.

Quality assurance (QA)

Quality assurance is of the highest importance in order for the market to have trust in energy certificates. The quality assurance has several main elements:

Control in the market. The general public, and the actors in the buildings and housing market, are informed about the duty of energy certification and that they can easily check the main data input given by the owner. Faulty input may give another grade than it should be, and may be considered a defect in the performance of a contract. This is the same mechanism which is actively used in the sales process of buildings and apartments.

Supervision of the process. NVE is responsible for the supervision of how well the market actors live up to the requirements of the regulation. From the first year of operation, NVE has been planning a systematic supervision covering issues such as: are certificates presented at sale, are certificates visible in the lobby of large non-residential buildings, does the data input represent the building object, does the expert meet the competence requirements, etc.? Supervision will be performed with the initiative of the NVE and as a follow up to information received about possible problems. Supervision is an instrument for improved design of the certification scheme and to uncover grave breaches in the duties.

Adequate preparation. NVE has, throughout the preparation phase, gone through a long series of actions to ensure that the certification is well planned. In the early stages, a large number of parties from research institutions, industry and non-governmental institutions have taken part in the discussion on the main design of the certification scheme. Important lessons are also taken from other countries' experiences during their preparations. Later, in the more detailed preparation, NVE has been responsible for the development of the IT system and the library of typical values. During the development phase, extensive testing took place to see that it meets the main user demands and that the calculation results are reasonable.

Data checks. Embedded in the IT system, a number of data checks are developed. This is important in particular for the self-assessment functionality. The checks of data validity cover both the format, but also the data range, which is allowed to be used. A continuous evaluation of these checks is needed to allow the necessary freedom of choice of parameters.

Penalties. The regulation includes a fine for the breach of duties. In the first phase, NVE has announced that information and guidance will be most important, and that fines will only be issued for serious breaches. No fines have been issued yet, as the regulation has only been in force for a few months.

The target of NVE is to have reviewed all the different types of actors, according to the regulation, within the first year: experts, sellers of apartments/houses, owners of non-residential buildings, estate agents.

3 > Inspections - Status of implementation

Articles 8 and 9 of the EPBD are implemented in the same regulation as energy certification. The requirements are also in force since the 1st of January 2010. It must however be noted that the practical implementation is slower. Up until the 1st of July 2010, the regulation provided for a transition period, and the change came as a surprise to building owners. Also, in the information given to the public up until now, the main emphasis has been on energy certification.

Norway has adopted option a) on Article 8 of the EPBD, establishing a regular inspection of boilers. On Article 9, the inspections must cover both air conditioning and ventilation systems. Rather than the EPBD's minimum size defined in effective rated output, the regulation sets the threshold in the size of the area served by the system. This is considered more practical for building owners. In addition it includes split units and enables the inspection of purely ventilation systems, without cooling devices. This is a fairly common way of heating and cooling in Norway.

The inspection requirements, thus, are:

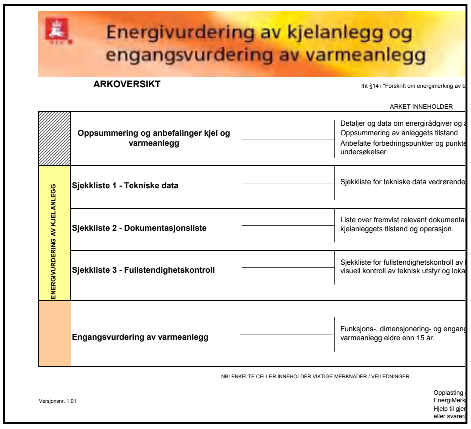
- Boilers using fossil fuels serving a heated area over 400 m^2 must be inspected every 4 years and every 2 years if over 2,000 m^2
- Heating systems using fossil fuels, serving a heated area over 400 m^2 and older than 15 years require a one-off inspection
- Air conditioning systems serving an area over 500 m^2 should be inspected every 4 years.

The CEN standards used as basis for the inspection schemes are NS-EN 15379 "Inspection of Ventilation" systems", NS – EN 15240 "Inspection of Air Conditioning Systems" and NS –EN15378 "Heating systems in buildings - Inspection of boilers and heating systems". The introduction of these inspection schemes is a new requirement for the building owner, and it is expected that it will take time for the market to adapt. For boilers, a voluntary inspection scheme is already widespread, but for heating and AC systems, the inspection will be a new routine.

It is the building owner's duty to arrange the inspection. The report from the inspection shall be uploaded onto the Energy Certification System at NVE, as well as being available on the premises. The content of the report is outlined in the regulation:

- Identification of building and system
- Description of system
- Summary of evaluation with any deviations from normal situation
- Registered data
- Recommendations
- Signature of the expert
- General information on the inspection report

NVE established a template form for each type of inspection. These forms can be downloaded in excel-format and used directly by the expert. Other formats and technical systems are allowed, as long as the data and evaluations are given on a level comparable with NVE's template. This template defines a large number of points to be checked and the data to be registered. These are considered necessary to fulfil the objectives of the inspection and give a reasonable return on the cost. For building owners who have good documentation of the systems and have regular maintenance in place, the task of inspection will not cause a large extra cost. It is allowed to use an expert who is already involved in maintenance, as long as he/she meets the requirements of competence. For building owners who neglect the continual need for maintenance, the task of inspection can be very substantial. The Government's first objective is to give an incentive for all owners of technical systems to establish good routines for service and maintenance.



Energivurdering av kjelanlegg og engangsvurdering av varmeanlegg

ARKOVERSIKT

Iht §14 i "Forskrift om energimerking av b

ARKET INNEHOLDER

	Oppsummering og anbefalinger kjel og varmeanlegg	Detaljer og data om energirådgiver og Oppsummering av anleggets tilstand Anbefalte forbedringspunkter og punkte undersøkelser
ENERGIVURDERING AV KJELANLEGG	Sjekkliste 1 - Tekniske data	Sjekkliste for tekniske data vedrørende
	Sjekkliste 2 - Dokumentasjonsliste	Liste over fremvist relevant dokumenta kjelanleggets tilstand og operasjon.
	Sjekkliste 3 - Fullstendighetskontroll	Sjekkliste for fullstendighetskontroll av visuell kontroll av teknisk utstyr og loka
	Engangsvurdering av varmeanlegg	Funksjons-, dimensjonering- og engang varmeanlegg eldre enn 15 år.

NB! ENKELTE CELLER INNEHOLDER VIKTIGE MERKNADER / VEILEDNINGER.

Versjonsnr. 1.01

Opplasting EnergiMerk Hjelp til gjer eller svarer

Fig. 3. First page of template form for inspection of boilers and heating systems

The duty of inspection is not connected to the duty of energy certification. However, there are obvious benefits in coordinating the tasks. Any inspection report will be of benefit to the certification expert. For an expert to inspect a heating system, it will be of benefit to lean on the calculations for energy performance of the building in question. And, for the owner, the whole process can be more effective, if done by a limited number of experts, and in cooperation.

4 > Qualified Experts

The regulation defines the level of competence needed to perform certification of new residential and non-residential buildings, as well as the inspection of technical systems. The requirements are set to ensure the needed competence and, at the same time, allowing the process to be coordinated with related processes, for instance during construction. Qualified experts are allowed to use the expert “entrances” to the Energy Certification System.

How does one become an expert?

The potential expert must ensure that he/she meets the requirements and be prepared to present documentation to the owner or to NVE, if requested. The requirements are largely defined according to general and predefined groups. For certification, the requirements are given in the next table:

Building type	Type of expertise	Required education	Required experience	Length of experience
Non-residential, existing buildings	Construction and energy	Bachelor	Energy performance calculation of buildings	2 years
New buildings, incl. apartments	Construction and energy	Corresponds to the role of “controller” in the buildings regulation		

For inspections, the requirements are given in the next table:

Type of system	Type of expertise	Required education	Required experience	Length of experience
Boilers, over 400 m^2	Combustion	None	Maintenance and service of boilers	2 years
Boilers, over 2,000 m^2	Combustion	None	Maintenance and service of large boilers	5 years
Heating systems, over 400 m^2 - Two alternatives	1. Construction and energy Combustion	Bachelor	Energy performance calculation of buildings. Maintenance and service of boilers	2 years 2 / 5 years
	2. Construction and energy Combustion	2 years licensed education.	Energy performance calculation of buildings Maintenance and service of boilers	2 years 2 / 5 years
Ventilation systems, over 500 m^2 - Two alternatives	1. Construction and energy.	Bachelor	Installation or inspection of ventilation systems	2 years
	2. Construction and energy.	2 years licensed education	Energy performance calculation of buildings.	2 years
Cooling systems, over 500 m^2 - Two alternatives	1. Construction and energy.	Bachelor	Installation or inspection of cooling systems	2 years
	2. Construction and energy.	2 years licensed education.	Energy performance calculation of buildings.	2 years

It is too early to see the effects of the expected demand for experts in the market. As the requirements correspond quite well to groups of expertise already on the market, the effort is rather on stimulating the existing systems of education, rather than to establish specialized training. Specialized courses are already offered in the market.

There is no regulation of the prices in the market, so some differentiation is to be expected according to competence, precision or time needed, combination with other tasks, as well as some regional differences. Typical costs cannot yet be established.

In the first months a couple hundred experts have been active. This number is expected to grow in the coming months.

5 > National Information and Communication Campaigns

The need of informing citizens on certification

With new duties and certificates introduced to the market, there is a strong need for information campaigns. Due to limited resources, the campaigns have been of very limited extent. However, during the phase of establishment, there has been a large interest in the news media to report on energy certification. For apartments and small houses, it seems that the duty of certification when marketing for sale is widely accepted, if not acclaimed. The challenges ahead will be:

- To reach the owners of non-residential buildings (certification and inspections)
- To reach owners of residential multi-storey buildings (inspections)
- To stimulate the demand for energy certificates (market pull)

The information strategy during 2010 has had the following main elements:

Updated information and proper guidance on *www.energimerking.no*

Two leaflets, directed to the public and owners of non-residential buildings

Editorial material to be used by magazines, newspapers, technical magazines etc.

A help desk was established in cooperation with Enova (National Energy Fund/Administration). Both the public and professional parties can get help on the content of the schemes, as well as user-related problems within the Energy Certification System.

6 > National incentives and subsidies

The Government gave high priority to letting energy certification for apartments and small houses be free of charge for those who accept a rather simple data input. Aside from that, there are no plans for any financial support towards owners to fulfil the duty of the new regulation.

For the time being there are no incentives regarding energy efficient buildings <u>directly</u> connected to energy certification or inspections. However, Enova is expected to make use of the Energy Label among their criteria for financial support.

Enova offers a wide number of support mechanisms to stimulate building developers to go beyond minimum requirements, as well as for owners to develop a good practice of maintenance and energy administration. A growing general interest for passive houses and low energy houses is generating a lot of information in the market, and political discussions on possible incentives for those who apply for these types of buildings.

Evolution of Minimum quality requirements in building regulations

Following the implementation of the EPBD, the energy requirements in the Norwegian building regulation were revised in 2007. In 2010, the requirements were further adjusted. In 2008, the political parties in the Norwegian Parliament, with one exception, agreed that all new buildings should be of passive standard by 2020.

The Ministry of Local Government and Regional Development has recently received a report from a commission on energy efficiency in buildings. The commission recommends that the passive standard should be implemented as a requirement in the building regulations by 2015. The same ministry is currently working on a white paper on building policy, where it is expected that future evolution of the energy requirements in the building regulations will be addressed.

The Norwegian building regulation contains specific energy limits for different building types. The requirements are set in kWh/m^2 final energy demand per year within the building envelope considering heat recovery from ventilation system, but without considering system losses and without considering energy export. There are also different component requirements for the building envelope, technical installations and solutions for an environmentally friendly energy supply. There are specific requirements for heat recovery of ventilation air in ventilation apparatus (yearly mean heat recovery rate), SFP factor (specific fan power), and equipment for shading or other precautions to avoid the use of cooling systems. Energy demand for lighting, hot water and all technical equipment are also considered, but so far only standard values are applied.

The Norwegian energy requirements are set with regard to 13 different building categories. An example of the development for some of the main properties necessary to fulfil the Norwegian minimum energy requirements for commercial buildings, single family houses, and apartment buildings can be seen in the table below. The requirements are the same for single family houses and apartments, listed below as dwellings.

Requirement	1997	2007	2010
Net energy demand (kWh/m^2 year)	-	Single family house: 125 + 1,600/m^2 heated floor area Apartment: 120 Commercial building: 165	Single family house: 120 + 1,600/m^2 heated floor area Apartment: 115 Commercial building: 150
Total area of glass/doors	20% of the heated floor area	20% of heated floor area	20% of heated floor area
U-value: exterior wall	0.22 W/(m^{2}K)	0.18 W/(m^{2}K)	0.18 W/(m^{2}K)
U-value: roof	0.15 W/(m^{2}K)	0.13 W/(m^{2}K)	0.13 W/(m^{2}K)
U-value: exposed floors	0.15 W/(m^{2}K)	0.15 W/(m^{2}K)	0.15 W/(m^{2}K)
U-value: glass/doors	1.6 W/(m^{2}K)	1.2 W/(m^{2}K)	1.2 W/(m^{2}K)
Thermal bridges	-	Single family house: 0.03/(m^{2}K) Other buildings: 0.06/(m^{2}K)	Single family house: 0.03/(m^{2}K) Other buildings: 0.06/(m^{2}K)
Heat recovery of ventilation air	60%	70%	Dwellings: 70% Commercial building: 80%
Air tightness	Single family house: 4.0	Single family house: 2.5	Single family house: 2.5
(Air changes/hour by 50 Pa pressure difference)	Other buildings (with more than two floors): 1.5	Other buildings (with more than two floors): 1.5	Other buildings (with more than two floors): 1.5
SFP factor	-	Dwellings: 2.5 kW/(m^3/s) Commercial building: 2.0 kW/(m^3/s)	Dwellings: 2.5 kW/(m^3/s) Commercial building: 2.0 kW/(m^3/s)
Screening factor for glass/window (gt)	-	-	0.15 (all buildings)

Other impacts

After only a few months of operation, it is still too early to evaluate any impacts other than the first-hand results in number of certificates.

One of the main objectives of the new regulation is to increase general attention towards good energy aspects in buildings, leading to good energy performance. It will be difficult, also in the future, to attribute any increased interest and attention to the new regulation alone. The results will also depend on other financial measures, information and the more general trend in the market for increased energy quality.

8 > Conclusions and future planning

With a very short period of practical experience, the certification of apartments and small houses should be considered a success. More emphasis is needed on the duties regarding non-residential buildings.

NVE has a long list of priorities for further development of the Energy Certification System. This includes an improved detailed registration, improved functionality for professional users etc. This practical approach is vital to improve users' experience of the system.

The regulation needs to be evaluated after some time. At present, this need seems to fit well with the need to evaluate the implications of the EPBD recast. NVE expects this activity to take place during 2011.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Poland

Status in November 2010

Jerzy Sowa

Warsaw University of Technology

Poland

1 > Introduction

Poland implemented the principles of the EPBD in 2007 and 2008. The changes to the Construction Act, approved by the Parliament on the 19th of September 2007, together with three Ministerial Ordinances published in November 2008, constitute the transposition of the EPBD into national law. The certification of buildings started in January 2009, and after the first experiences (in August 2009), the Parliament approved consecutive changes to the Construction Act. In December 2009, the Minister of Infrastructure signed a secondary legislation resulting from the changes to the Act. Currently, the Ministry is working on the analysis of the necessary changes resulting from both the recast of the EPBD and the negative opinions on the current system of certification. This report presents the current state of implementation of the EPBD in Poland (status in November 2010), as well as planned actions. The report addresses different aspects related to the EPBD, such as certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

The implementation of the EPBD in Poland is executed by the Ministry of Infrastructure, under the supervision of the Ministry of Economy.

The legal framework of implementation is based on a national act (the Construction Act) and secondary legislation (accompanying Ministerial Ordinances). The implementation started on the 19th of September 2007, when the Polish Parliament accepted the changes to the Construction Act. The changes defined rules for the creation of an energy assessment and certification system for buildings, and for the inspection of energy efficiency of building systems. Also, delegations were established in order to prepare the secondary legislation. In 2008, based on the work of these delegations, the following regulations were prepared:

- An ordinance on the training and examination of experts requesting to have the authority to issue energy performance certificates for buildings, apartments and building parts constituting separate technical/functional areas.
- An ordinance on the methodology of energy performance calculations for whole buildings, separate apartments or building parts constituting separate technical/functional areas, along with the scope of and a template for energy performance certificates.
- An ordinance on amendments to the Ordinance of the Ministry of Infrastructure dating from the 12th of April 2002, on the technical criteria to be met by the buildings and their location.
- An ordinance on amendments to the Ordinance of the Minister of Infrastructure, dating from the 3rd of July 2003, on the detailed scope and form of buildings' design.

On the 27th of August 2009, the Parliament approved additional changes to the Construction Act. The goal of the changes was to eliminate identified legal mistakes in the implementation of the EPBD, and to introduce the code for experts issuing energy certificates for buildings. Additionally, the legal circumstances for suspending the obligation for energy certification of individual apartments in multifamily buildings were defined (in multifamily buildings with centralised heating system, the certificate may from then onwards be issued for a defined apartment representative of a group of apartments).

The Energy Performance Certificate

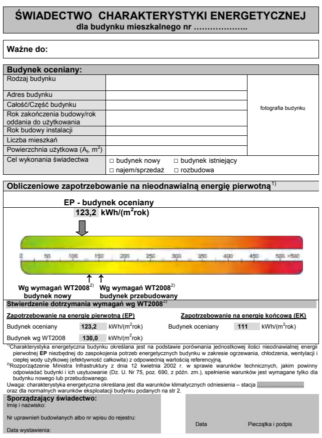
The Ordinance on the methodology of energy performance calculations and template of certificates defines the energy performance requirements (different for new and existing buildings) and the methodology for the energy assessment of buildings/apartments that quantifies the essential parameters needed for the preparation of the energy performance certificate, according to the results of a detailed assessment. Additionally, the Ordinance determines the scope of and a template for the energy performance certificate.

The Ordinance on the methodology of energy performance calculations for whole buildings, separate apartments or building parts constituting separate technical/ functional areas, along with the scope of and a template for energy performance certificates, defines 4 types of certificates:

- Certificate of energy performance for residential buildings.
- Certificate of energy performance for other buildings (non-residential).
- Certificate of energy performance for apartments.
- Certificate of energy performance for building parts constituting separate technical/functional areas (non- residential).

All types of certificates are similar in form and contain:

- Page 1: Basic information about the building; Calculated specific non-renewable primary energy use; Energy Performance with information on reference buildings; Information on the expert issuing the certificate.
- Page 2: Technical characteristics of the building and its system; Calculations of energy performance: primary energy use, end-use energy and non-renewable primary energy.
- Page 3: Recommendations for possible improvements in the energy performance of the assessed building or apartment (building envelope, energy source and installations, lighting, reduction of calculated specific non-renewable primary energy use).
- Page 4: Descriptions; Additional information.


ŚWIADECTWO CHARAKTERYSTYKI ENERGETYCZNEJ
dla budynku mieszkalnego nr ....

Ważne do:

Budynek oceniany:		
Rodzaj budynku		fotografia budynku
Adres budynku		
Całość/Część budynku		
Rok zakończenia budowy/rok oddania do użytkowania		
Rok budowy instalacji		
Liczba mieszkań		
Powierzchnia użytkowa (A_f, m^2)		
Cel wykonania świadectwa	☐ budynek nowy ☐ budynek istniejący ☐ najem/sprzedaż ☐ rozbudowa	

Obliczeniowe zapotrzebowanie na nieodnawialną energię pierwotną[1)]

EP - budynek oceniany
123,2 kWh/(m^2rok)

Wg wymagań WT2008[2)] **budynek nowy** **Wg wymagań WT2008**[2)] **budynek przebudowany**

Stwierdzenie dotrzymania wymagań wg WT2008[2)]

Zapotrzebowanie na energię pierwotną (EP)			Zapotrzebowanie na energię końcową (EK)		
Budynek oceniany	123,2	kWh/(m^2rok)	Budynek oceniany	111	kWh/(m^2rok)
Budynek wg WT2008	130,0	kWh/(m^2rok)			

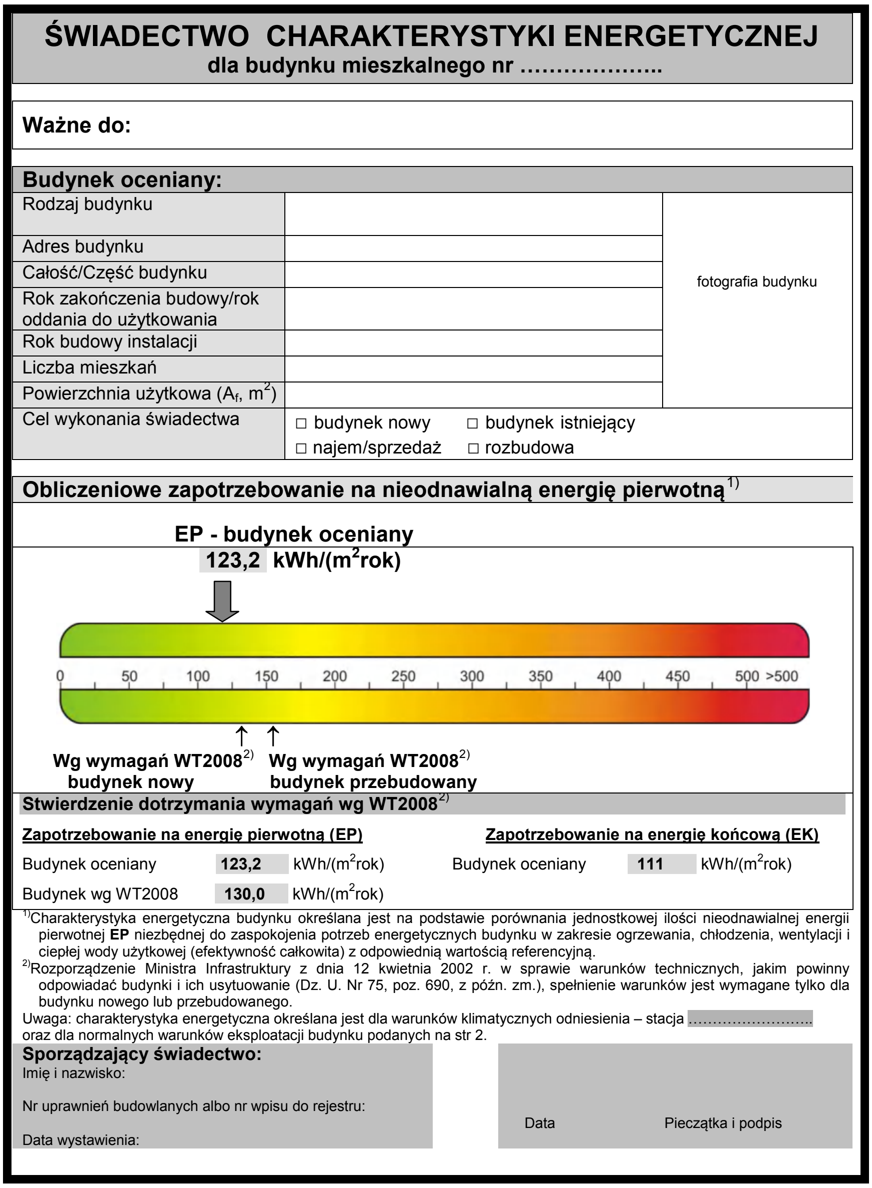
[1)]Charakterystyka energetyczna budynku określana jest na podstawie porównania jednostkowej ilości nieodnawialnej energii pierwotnej **EP** niezbędnej do zaspokojenia potrzeb energetycznych budynku w zakresie ogrzewania, chłodzenia, wentylacji i ciepłej wody użytkowej (efektywność całkowita) z odpowiednią wartością referencyjną.
[2)]Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 r. w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75, poz. 690, z późn. zm.), spełnienie warunków jest wymagane tylko dla budynku nowego lub przebudowanego.
Uwaga: charakterystyka energetyczna określana jest dla warunków klimatycznych odniesienia – stacja .... oraz dla normalnych warunków eksploatacji budynku podanych na str 2.

Sporządzający świadectwo:
Imię i nazwisko:
Nr uprawnień budowlanych albo nr wpisu do rejestru:
Data wystawienia:
Data Pieczątka i podpis

The assessment procedure does not use energy classes. The results of the assessments are presented on a linear analogue scale (Figure 1- upper arrow). Two additional arrows (below the scale) indicate the energy performance for a building similar to the one assessed, assuming that only the minimal requirements are met (case one for a newly constructed building, and case two for a renovated building).

The recommendation section contains only a short general description of potential improvements. As there is no standardised list of recommendations, the information provided in that section reflect the personal opinion of the expert issuing the certificate.

The validity of energy certificates is 10 years.



ŚWIADECTWO CHARAKTERYSTYKI ENERGETYCZNEJ
dla budynku mieszkalnego nr ....

Ważne do:

Budynek oceniany:

Rodzaj budynku		fotografia budynku
Adres budynku		
Całość/Część budynku		
Rok zakończenia budowy/rok oddania do użytkowania		
Rok budowy instalacji		
Liczba mieszkań		
Powierzchnia użytkowa (A_f, m^2)		
Cel wykonania świadectwa	□ budynek nowy □ budynek istniejący □ najem/sprzedaż □ rozbudowa	

Obliczeniowe zapotrzebowanie na nieodnawialną energię pierwotną [1)]

Stwierdzenie dotrzymania wymagań wg WT2008 [2)]

Zapotrzebowanie na energię pierwotną (EP)			**Zapotrzebowanie na energię końcową (EK)**		
Budynek oceniany	**123,2**	kWh/(m^2rok)	Budynek oceniany	**111**	kWh/(m^2rok)
Budynek wg WT2008	**130,0**	kWh/(m^2rok)			

[1)] Charakterystyka energetyczna budynku określana jest na podstawie porównania jednostkowej ilości nieodnawialnej energii pierwotnej **EP** niezbędnej do zaspokojenia potrzeb energetycznych budynku w zakresie ogrzewania, chłodzenia, wentylacji i ciepłej wody użytkowej (efektywność całkowita) z odpowiednią wartością referencyjną.
[2)] Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 r. w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75, poz. 690, z późn. zm.), spełnienie warunków jest wymagane tylko dla budynku nowego lub przebudowanego.
Uwaga: charakterystyka energetyczna określana jest dla warunków klimatycznych odniesienia – stacja .... oraz dla normalnych warunków eksploatacji budynku podanych na str 2.

Sporządzający świadectwo:
Imię i nazwisko:
Nr uprawnień budowlanych albo nr wpisu do rejestru:
Data wystawienia:

Data Pieczątka i podpis

Fig. 1 – Cover page of the energy performance certificate (for residential buildings)

New buildings and **major renovations** are subjected to a certification process on two stages:

- At the planning stage, where design assessment of buildings' conformity with technical regulations is required.
- At the start of operation of newly erected building, the energy certificate is required by local building authorities.

For **existing buildings**, the energy certificate is required in case of transaction (renting, selling). The responsibility of having a certificate lies always with the building owner but, in practice, due to the lack of control and penalties, certificates are issued only when demanded by at least one party.

In Poland, according to the article 63, paragraph 2, of the Construction Act, in **public buildings** dedicated to administration services or providing services for the general public, as e.g. railway stations, airports, museums, exhibition halls etc., the energy certificate should be placed where it is visible to the public.

The calculation methodology is described in the building regulations, and includes heating, cooling and DHW needs, expressed in terms of primary energy. For non-residential buildings, lighting and equipment consumption are also included in the calculation methodology.

The assessment methodology is based on the monthly balance method as described in PN-ISO-EN 13790. However, the methodology contains some mistakes that have not yet been corrected: the certificates issued strictly using the methodology described in the secondary ordinance provide results with a huge error, and the assessed buildings do not meet requirements. In practice, experts correct the mistakes on their own, but such behaviour raises legal questions regarding the validity of the certificate. The Ministry is currently collecting opinions and plans to introduce changes with the transposition of the Recast of the EPBD.

The cost of the certificate is set by the market. Observed prices started from ~ 50 € (simple single-family houses) to 750 € (public buildings).

Quality assurance (QA)

In Poland, no quality control procedures for energy performance certificates and energy experts were established.

All potential conflicts between qualified experts and building owners will be solved at Court. The Construction Act (art. 5, paragraph 6) clearly states that an energy certificate containing false information is a "physical failure of product", in the sense of Civil Law (Parliament Act dating from the 23rd of April 1964).

The changes made in Polish legislation in 2009 introduced obligatory insurance from civil liability for qualified experts issuing energy certificates for buildings. On the 28th of December 2009, the Minister of Finance, acting in concert with the Minister of Infrastructure, signed the corresponding Ordinance, defining:

- The detailed scope of obligatory insurance from legal liability related to issuing energy certificates for buildings.
- The date of the obligatory insurance (the day before the start of issuing energy certificates).
- The minimal sum insured (the minimal sum insured is 25,000 € per building).

Polish regulations do not provide for a national register of energy certificates for buildings. However, experts are obliged to archive copies of issued certificates for at least 10 years. So, there is no reliable information on the number of certificates issued so far.

The Construction Act additionally defined the procedure for the suspension of the authorisation to issue energy certificates, as well as the procedure for the revocation of the authorisation. The authorisation is automatically suspended or revoked when an expert:

- has been sentenced because of offences against property, documents, trade or economic credibility, etc.,
- has lost civil rights,
- has been wholly or partially incapacitated.

Authorisation can also be suspended or revoked after investigation (performed under the supervision of the Minister responsible for housing) proving that the expert did not pay enough attention to requirements (e.g. produced certificates with mistakes or false information, worked without insurance from legal liability or did not archive copies of issued certificates for at least 10 years).

3 > Inspections - Status of implementation

Poland decided to adopt option A of the Article 8 of the EPBD, establishing a regular inspection of boilers. The general requirements about the frequency and scope of different inspections of buildings are regulated in the Construction Act – Article 62. The implementation of the EPBD resulted in new obligations for:

- Periodical inspections of boilers, including an assessment of the energy efficiency of boilers and their sizing, compared to the heating needs
  - at least once every 2 years for boilers fired by non-renewable liquid or solid fuel of an effective rated output over 100 kW,
  - at least once every 4 years for boilers fired by non-renewable liquid or solid fuel of an effective rated output of 20 kW to 100 kW, and gas-fired boilers.
- Periodical inspections of air-conditioning systems of an effective rated output of more than 12 kW: this inspection shall include an assessment of the efficiency of the devices and their size, compared to the cooling needs.
- A one-off inspection of heating installations for boilers of an effective rated output of more than 20 kW which are older than 15 years: the inspection shall include an assessment of the boiler efficiency and sizing, compared to the heating requirements of the building envelope.

Inspections of boilers, heating installations and air-conditioning systems can be performed by engineers and technicians competent for supervising installation works.

In practice, energy efficiency and other parameters of inspections introduced by the EPBD are not performed, as secondary legislation describing procedures and methodologies for energy efficiency inspections has never been developed. Performed inspections of boilers, heating installations or A/C units take into account only safety aspects.

4 > Qualified Experts

Experts qualified for issuing energy performance certificates, according to the aforementioned Construction Act of the 19th of September 2007 (with changes dating from the 27th of August, 2009) are persons who fall into any one of the following three categories:

- Persons competent for performing the design or supervision of works within the specialisation of architecture, construction of buildings or installations (architects and engineers can acquire this competence after the required practice and after passing the exam conducted by the Chamber of Engineers: in case of competence for performing design, the minimal duration of practice is 2 years in a designing office, and 1 year on site; in case of competence for performing supervision of works, the minimal duration of practice is 2 years on site).
- Persons who have completed a specialised training course and passed the exam at the Ministry responsible for construction, spatial planning and housing,
- Persons who have completed at least one year of postgraduate studies in architecture, construction, environmental engineering, energy, or similar, e.g., within the scope of energy auditing for thermo-modernisation or energy certification purposes.

Irrespectively of the option, the basic requirement for a qualified expert is the completion of, at least, engineering studies in architecture, civil engineering or environmental engineering, or having a M.Sc. degree or equivalent in other disciplines.

Central register of engineers possessing competence for performing design or supervision of works who, as a result, can issue energy certificates of buildings, can be accessed at

http://www.piib.org.pl/index.php/lista-czsonkopmenu-45

In order to create the conditions for the setup of adequate training, on the 21st of January 2008, the Minister of Infrastructure signed the Ordinance on the scope of training and examination for experts wishing to be qualified to issue energy performance certificates for buildings, apartments and building parts constituting separate technical/functional areas. According to the Ordinance, there are no specific requirements for entities offering training courses. Conversely, the scope of training, the method of training, the form of certificate, together with training fees, are subject to regulation. The scope of training is described in detail in the annex to the Ordinance. Up to September 2010, 56 postgraduate courses for future energy experts have been launched at Technical Universities.

Between January 2009 and September 2010, over 7,000 persons were certified as qualified experts after passing the ministerial exams or completing postgraduate studies approved by the Ministry. These experts are included in a central register of experts (access possible through the webpage of the Ministry of Infrastructure, on page 1 of this report). At the same time, the number of engineers that acquired the permit to issue the energy certificates of buildings due to their competence for performing design or supervision of works is estimated at approximately 100,000. They are not included in the central register, but in registers operated by the Chamber of Engineers. No information about the percentage of engineers active in the field of certification is available.

5 > National Information and Communication Campaigns

An information campaign concerning the EPBD started in June 2005. The campaign, under the auspices of the Ministry of Infrastructure, was organised within the scope of the educational and information programme „*Dom przyjazny*" (Friendly house). The programme was aimed at facility managers and building owners. In the years 2005-2007, two information leaflets on the benefits and obligations deriving from the Directive's implementation have been prepared and published.

Publications can be downloaded from the site

www.domprzyjazny.org

Figure 2 – Brochures issued for the campaign "Dom przyjazny".

In 2008, the Ministry suspended the works on the promotion of the EPBD (preparation of brochures, posters, TV spots, www information platform, international conference, etc.). The Ministry also stopped supporting the "*Dom przyjazny*" programme.

Since September 2010, information about EPBD can be obtained from an information brochure addressed to those wishing to buy or rent a house or apartment, and to those interested in working as qualified experts. Additional information is placed on the Ministry webpage, where readers can find the following data:

- Central register of qualified experts
- Climatic data for Poland
- Examination procedure
- Frequently asked questions (FAQ).

The webpage of the Ministry contains the folder "*Świadectwa energetyczne*" (Energy certificates):

http://www.mi.gov.pl/2-48240e6fcf427.htm

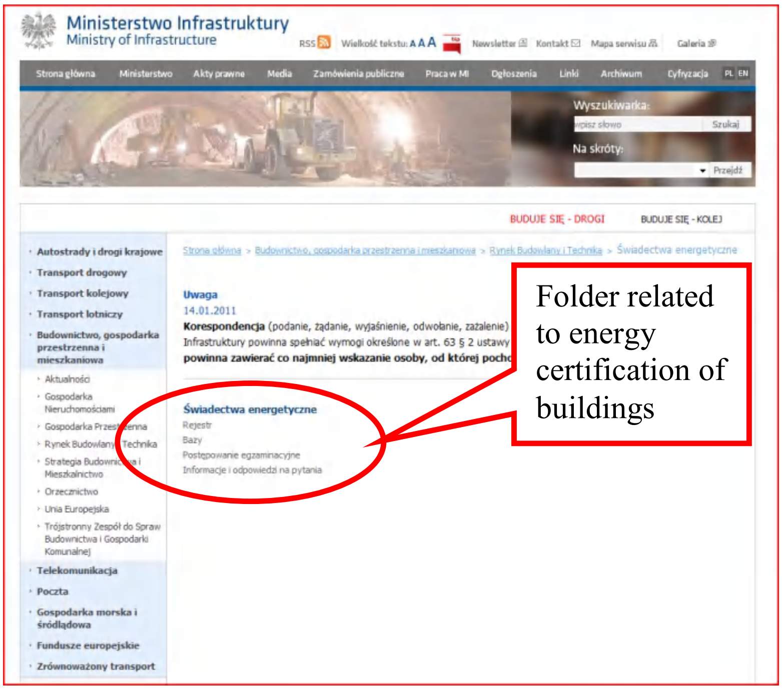


Figure 3 – The folder "Świadectwa energetyczne" (Energy certificates) at the Ministry of Infrastructure webpage.

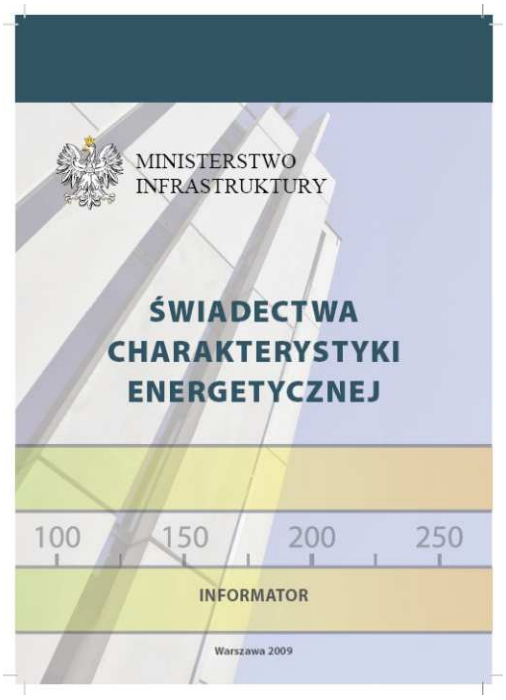


Figure 4 – The front page of the official brochure related to the EPBD, published by the Ministry of Infrastructure.

6 > National incentives and subsidies

Poland did not introduce any incentives or subsidies directly related to the implementation of the EPBD and the energy certification of buildings. However, owners of buildings desiring modernisation may apply for subsidies within the context of two programmes:

- Overhaul and Thermo-Modernisation Fund (from 1998).
- Thermo-modernisation of public buildings (from 2001).

The methodologies for the energy performance of buildings used in these programmes are different from the methodology used for the energy certification of buildings.

The Thermo-Modernisation Fund, created on the basis of provisions of the Thermo-Modernisation Act, dating from 1998 (full name: "Act on Support for Thermo-Modernisation Investment in Buildings"), covers the rules for providing investors (building owners or administrators) with financial support, in the form of a premium which can cover up to 25% of a credit loan granted for the realisation of thermal modernisation investments.

The premium is paid to the crediting bank directly from the premium fund, as a repayment of part of the credit instalment, just after all the modernisation work is completed. The replacement of a conventional heating system by another using renewable energy sources is also included in the scope of the investments described by the Law. The scheme is available to all investors, such as owners or administrators of buildings, local heat providers and local heat distribution networks. Support from the Thermo-Modernisation Fund has been available for public buildings from the 1st of January 2001. To be eligible, projects should fulfil technical (minimum energy savings in physical terms) and financial criteria. The thermo-modernisation investment projects should cause:

- Reduction of consumption of energy supplied for heating and domestic hot water purposes in all types of residential buildings, as well as in buildings used by municipal entities for purposes of public service (schools, kindergartens, hospitals, etc.).
- Reduction of heat losses in local distribution networks and local heat sources, with maximum capacity of 11.6 MW of thermal power, if efforts have been undertaken in order to reduce consumption of energy in the buildings supplied, or when those buildings meet the adequate energy efficiency requirements;
- Total or partial replacement of conventional energy sources with non-conventional ones, including renewable.

The eligible projects are as follows:

- Improvement resulting in the reduction of the annual energy consumption for heating and hot water purposes:
  - in buildings where only the heating system is modernised – by at least 10%
  - in buildings where the heating system has been already modernised – by at least 15%
  - in other buildings - by at least 25%
- Improvement resulting in the reduction of annual primary energy losses in local heat sources and local distribution networks - by at least 25%.
- Installation of technical couplings to the centralised heat sources in connection to bringing out of service the local source of heat, aimed at the reduction of costs of purchase of heat supplied to buildings - by at least 20% per annum.

The thermal-modernisation process is as follows:

- issuing an energy audit,
- loan application,
- approval of loan and obtaining the thermo-modernisation premium,
- designing,
- construction permit,
- performing,
- verification of the design conformity with the audit.

The energy audit is required to prove technical and economic evaluation. Submission of the energy audit is obligatory; it is also a basic condition in order to apply for a support (premium) from the Thermo-Modernisation Fund. The Act, through its ordinances, precisely describes the standard of the energy audit, and delivers calculation methods (Journal of Laws 2002, No 12, item 114, Decree on „Scope and form of energy audit”).

In particular, the energy audit report shall contain:

- Identifying data of the building, local heat source, local heat distribution network and its proprietor.
- An appraisal of the technical condition of the building, the local heat source and the local heat distribution network.
- Description of all possible options for the completion of the thermal-modernisation project.
- Economic analysis of possible measures.
- Identification of an optimum option and scope of the thermal-modernisation project.
- Detailed description of the optimum option.

All audits delivered to the commercial banks and then to the Bank of National Economy (BGK) as a basis for applying for the premium granting, are verified by independent institutions. The issue is determined by the Decree on “Verification of energy audit” (Journal of Laws 2002, No. 12, item 115)

Beside the two above mentioned financial instruments, there is a third one, introduced in 2010, granting a 40% non-refundable support for investment in solar collectors for hot water preparation, eligible for existing buildings.

7 > Impact of the EPBD at national level

Evolution of minimum quality requirements in building regulations

The new regulations introduced due to implementation of the EPBD are expressed in both a prescriptive (U – value) and a performance way (primary energy expressed in kWh/(m^2·year)). An expert can choose the way to prove that the building is fulfilling the requirements.

Unluckily, it is difficult to directly compare new requirements with requirements that have been set before the EPBD. Previously, performance requirements (used energy, not primary energy) were defined only for multi-residential buildings. Moreover, the performance requirements had been expressed in terms of kWh/(m^3·year). In older requirements, for both non-residential and single-family buildings, only the prescriptive requirements had been defined.

Table 1. Permissible values of heat transfer coefficients U from 2002 to present.

Year	External wall	Floor roof	Floors over unheated and closed under-floor spaces	Floor and floor-roofs under unheated attics	Windows	External Doors
2002 values (publication of the EPBD)	0.30 - 0.50	0.30	0.60	0.30	2.00 - 2.60	2.60
2008 values (transposition of the EPBD)	0.30	0.25	0.45	0.25	1.70 - 1.80	2.60

Thus, the comparative table presented above has been recalculated to a common basis. This shows the insignificant differences between the new and the old requirements.

Other impacts

The EPBD, as implemented in Poland, did not seriously affect the building market. However, it has generated some very important additional impacts. First of all, the EPBD has awakened awareness on energy efficiency issues among professionals.

During the last few years, many papers related to different aspects of energy efficiency were published in technical and scientific journals. Scientists prepared several proposals on the methodology for the energy assessment of buildings. Vital discussions on the variety of the proposed solutions activated research on that field in Poland.

Many Technical Universities introduced courses on energy efficiency in buildings to curricula of regular studies, and prepared additional postgraduate courses related to the energy certification of buildings.

8 > Conclusions and future planning

The regulations regarding the implementation of the EPBD in Poland have not been amended so far in terms of correction of mistakes in the original texts. The Ministry is currently collecting opinions and will introduce them along with the transposition of the Recast of EPBD. Moreover, the Recast is expected to be challenging, and a lot of effort will be needed for its implementation.

During the effort of transposition of the EPBD, different options of calculation were discussed countrywide. Therefore, in spite of the final decision about using the monthly balance method, adequate “infrastructure”/climate data have been prepared for accommodating a future implementation of the simplified hourly method, as described in PN-EN-ISO 13790.

As no decision has been made regarding the national calculation software, few companies provide tools for calculation and certification. One of them is using an internet engine, together with a database of issued certificates. They report that over 60,000 certificates were issued till the middle of 2010. Unfortunately, there is no validation procedure for the software. Concluding, such a situation provides great opportunities for future work towards the transposition of the EPBD Recast.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Portugal

Status in November 2010

Paulo Santos
ADENE

Pedro Mateus
ADENE

Eduardo Maldonado
University of Porto

Portugal

1 > Introduction

The implementation of the EPBD in Portugal is now a reality. Since the last report published in March 2008, many developments have taken place and certification is now widespread in the building market. Implementation started in 2007 and is based on the same three Decrees that were published in 2006, which remain unchanged. Recently, the revision process of the current legislation has been launched, in order to accommodate the requirements of the recast of the EPBD in 2010 and to improve the certification process, based on the experience gained over the last 3 years.

This report presents an overview of the current status of implementation and of the plans for the evolution of the implementation of the EPBD in Portugal. It addresses the certification and inspection systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies.

2 > Certification

Certification of buildings

Certificação Energética
e Ar Interior
EDIFÍCIOS

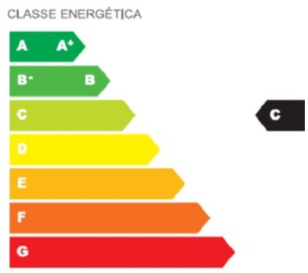
In Portugal, the implementation of the EPBD is the overall responsibility of the Ministry of Economy together with the Ministry of Environment. ADENE, the Portuguese Energy Agency, is the managing body for this process. ADENE designed, developed and currently supports the entire certification system, which is based on a central registry and database.

The National System for Energy and Indoor Air Quality Certification of Buildings (SCE) came into force on July 1st 2007. This milestone marked the beginning of a new phase in the current legislation on the energy efficiency of buildings in Portugal since its publication on April 4th 2006. All current legislation (in Portuguese) can be found at

http://www.adene.pt/ADENE/Canais/SubPortais/SCE/Legislacao/Nacional/.

National websites:

- *www.adene.pt*
- *www.dgge.pt*
- *www.apambiente.pt*
- *www.p3e-portugal.com*



Energy Label

Label	Reference Consumption
A+	≤ 25%
A	25 - 50%
B	50 - 75%
B-	75 - 100%
C	100 - 150%
D	150 - 200%
E	200 - 250%
F	250 - 300%
G	≥ 300%

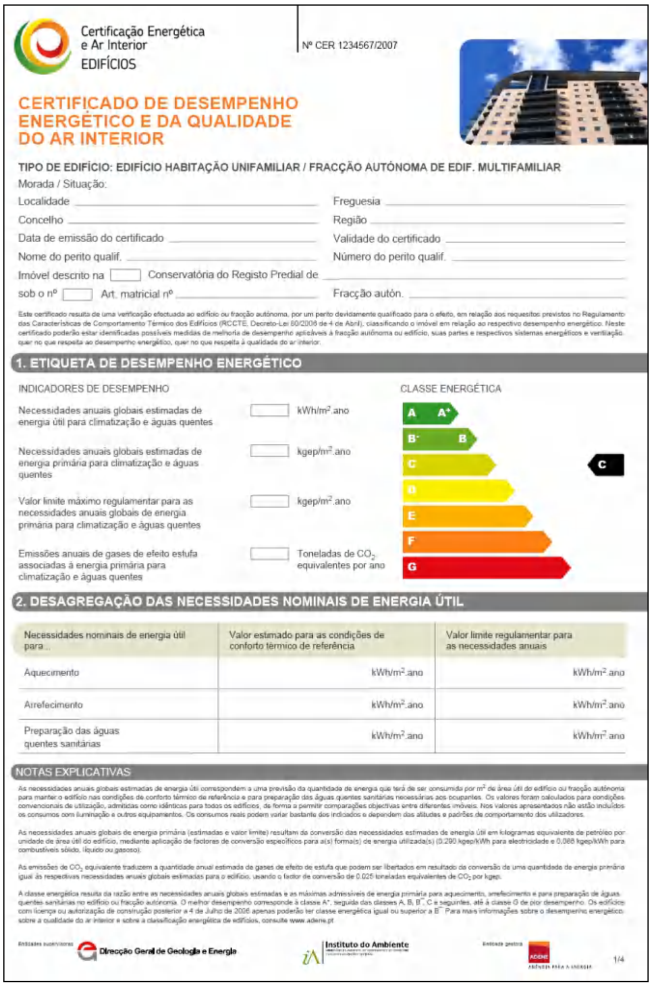
The timeframe for the implementation of the SCE in various types of buildings was divided into three phases that ended with its full implementation in January 2009, when all required buildings were included in the certification system: new buildings and major renovations, large non-residential buildings and all buildings when sold or rented. For each building or building unit, e.g., an apartment, an energy rating is assigned according to the table on the left. Certificates can only be issued by Qualified Experts, who are either architects or engineers, duly qualified and recognised by their professional associations (see further information in section 4). The list of Qualified Experts is continuously updated and always available to the public online at ADENE's website.

The energy performance certificate

The Energy Performance Certificate (EPC) is the most visible aspect of the SCE. This document assigns an energy performance label to residential and non-residential buildings or building units and it lists cost-effective measures for improving their energy performance.

The energy label classifies the buildings on an efficiency scale ranging from A+ (high energy efficiency) to G (poor efficiency) and is based on calculations in terms of primary energy. Nominal CO_2 emissions are also listed on the front page of the certificate.

The practical benefit of the Energy performance certification is found in the recommendations that are provided to the building owner. These are summarised on page 2 of the EPC.


Certificação Energética e Ar Interior
EDIFÍCIOS

Nº CER 1234567/2007

CERTIFICADO DE DESEMPENHO ENERGÉTICO E DA QUALIDADE DO AR INTERIOR

TIPO DE EDIFÍCIO: EDIFÍCIO HABITAÇÃO UNIFAMILIAR / FRACÇÃO AUTÓNOMA DE EDIF. MULTIFAMILIAR

Morada / Situação:

Localidade | Freguesia

Concelho | Região

Data de emissão do certificado | Validade do certificado

Nome do perito qualif. | Número do perito qualif.

Imóvel descrito na Conservatória do Registo Predial de

sob o nº Art. matricial nº | Fracção autón.

1. ETIQUETA DE DESEMPENHO ENERGÉTICO

INDICADORES DE DESEMPENHO | CLASSE ENERGÉTICA

Necessidades anuais globais estimadas de energia útil para climatização e águas quentes — kWh/m².ano

Necessidades anuais globais estimadas de energia primária para climatização e águas quentes — kgep/m².ano

Valor limite máximo regulamentar para as necessidades anuais globais de energia primária para climatização e águas quentes — kgep/m².ano

Emissões anuais de gases de efeito estufa associadas à energia primária para climatização e águas quentes — Toneladas de CO_2 equivalentes por ano

A A+ / B- B / C / D / E / F / G / C

2. DESAGREGAÇÃO DAS NECESSIDADES NOMINAIS DE ENERGIA ÚTIL

Necessidades nominais de energia útil para...	Valor estimado para as condições de conforto térmico de referência	Valor limite regulamentar para as necessidades anuais
Aquecimento	kWh/m².ano	kWh/m².ano
Arrefecimento	kWh/m².ano	kWh/m².ano
Preparação das águas quentes sanitárias	kWh/m².ano	kWh/m².ano

NOTAS EXPLICATIVAS

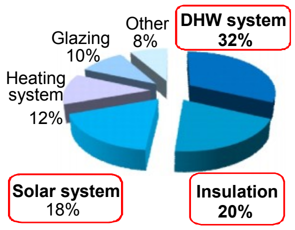
Direcção Geral de Geologia e Energia | Instituto do Ambiente | ADENE

1/4

Fig. 1 – Cover page of the EPC

As shown below, suggested improvements include a short description, estimates of costs, savings and paybacks, and the impact on the energy rating, if all measures were to be implemented. Recommendations should be made by the Qualified Experts following study of the individual measures for the specific building, rather than referring to a database of general measures for typical situations.

EPCs are valid for 10 years, with the exception of EPCs for public display (valid for 6 years).



Typical recommendations proposed by the experts

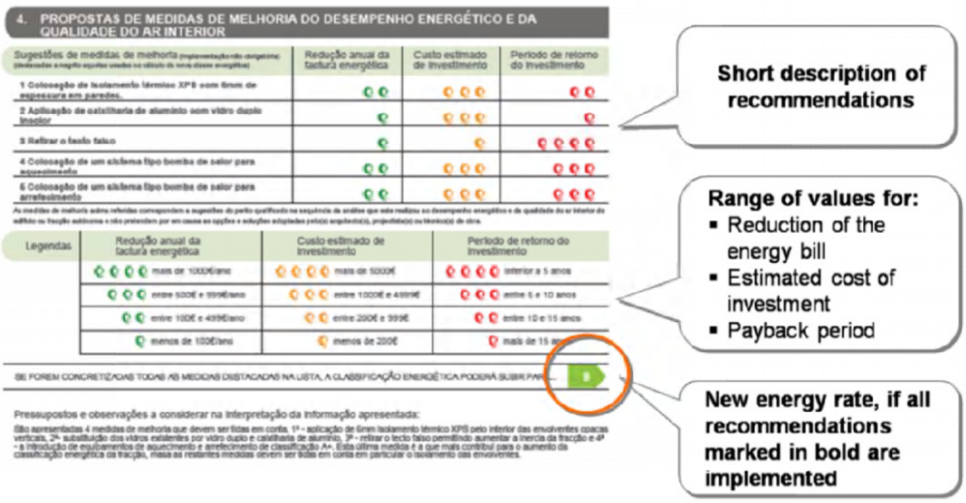


Figure 2 – Recommendations for improving energy performance

New buildings or major renovations (or building units in new buildings or major renovations) must achieve at least a B$^-$ rating to be approved at the planning stage, before construction begins. This requirement was put into force on July 1st 2007 for new buildings larger than 1,000 m^2 and on July 1st 2008 for every other new building.

As of January 2009, all **existing** residential and non-residential **buildings** need to be certified when they are sold or rented. The owner must present a valid EPC to the buyer when the selling or renting contract is established. This involves a Qualified Expert visiting the property and assessing the building in terms of the type of construction (walls, windows, insulation, thermal bridges, ventilation and air-tightness, etc.) and the type and quality (efficiency) of the HVAC and hot water systems. The Qualified Expert will then calculate the thermal efficiency of the building and issue the EPC. There is no minimum requirement for an existing building, i.e., it can be labelled A through G.

The calculation methodology is described in the building regulations and includes heating, cooling and DHW needs, expressed in terms of primary energy. For nonresidential buildings, lighting and equipment consumption are also included in the calculation methodology.

In the Portuguese legislation, European standards are considered as follows:

- The EPC design and contents are in full compliance with EN 15217;
- Energy needs are calculated based on EN ISO 13790 and EN 15603;
- Thermal bridge calculations can use default values or can be calculated more precisely using EN ISO 10211-1;
- Solar characteristics of glazing can use default values or can be calculated more precisely using EN 410;
- The thermal performance of building envelope elements are calculated based on EN ISO 6946 and EN ISO 13789;
- Heat transfer through the ground can use default values or can be calculated more precisely using EN ISO 13370;
- Airflow rates in dwellings can use default values or can be calculated more precisely using EN 13465;
- The input of solar domestic hot water systems is calculated according to EN 12975 or EN 12976;
- HVAC systems must comply with EN 378-1;

After the calculation of the energy rating and the definition of the required improvement measures, it is necessary to login into the online platform (web based central registration system) to fill out the form with the building description and energy rating indicators, and to describe the opaque envelope, windows, HVAC, DHW, ventilation, renewables and other energy systems. It is possible to import all data through an XML file and to access/consult/modify/copy the documents and print the Energy EPC online, for delivery to the building owners and public authorities.

In Portugal, the definition of a **public building** includes every non-residential building owned by private or government bodies. This definition is much wider than the strict interpretation of the EPBD requirements. Every non-residential building larger than 1,000 m^2 is required to **display an EPC** at the main entrance. Currently, there are more than 600 public buildings certified and many more in the process of being certified. However, the low figure of issued EPCs shows that this has been the building typology where most difficulties were found in the implementation of the EPBD requirements in Portugal.

The responsibility of having an EPC always rests with the building owner. The average market cost of an EPC is around 150-250 € for an apartment, small shop/office or single family building, but it can run up to several thousand € for large non-residential buildings. On top of the cost of the EPC, ADENE charges a registration fee for each EPC issued (45 € per household and 250 € per non-residential building, plus VAT), which is used to support the management and promotion of the EPC system. Most of the fee is put towards paying for the quality check of the experts' work (described in the next section). Owners who fail to deliver an EPC to a buyer or tenant, or to display one in a public building, will incur a fine between 250 € and 3,740 €.

Fig. 3 shows a simplified illustration of the process for the certification of new buildings, from design to first occupation, sale, or rental.

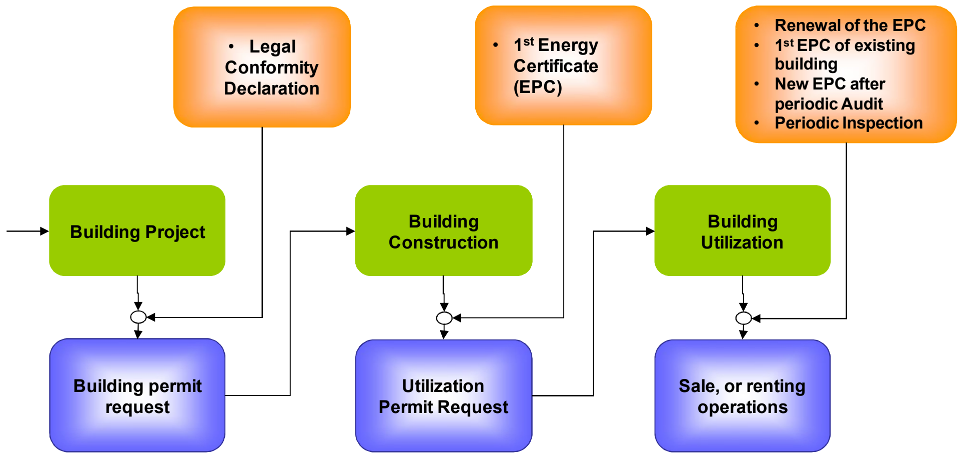


Figure 3 - Summary of qualified experts' work

Quality assurance (QA)

ADENE set up a mandatory QA scheme approved by the government. It includes four stages, as shown in Figure 4.

The training of experts is the first stage, in order to guarantee a high quality level of the system. A specific training course with high passing grades in the exam is the prerequisite for becoming a Qualified Expert. This topic is detailed later on in chapter 4. The second stage towards guaranteeing EPC quality is an automatic system software check of its data input in order to avoid potential mistakes before even issuing it.

After the EPC has been issued, there are another two stages: a simple QA check and a detailed QA check. The simple QA check is based on a straightforward visual verification of the form and the EPC, checking its accordance with the methodologies defined, without any complex calculations or additional information requests to qualified experts, performed on a random sample of 2% of the EPCs issued daily.

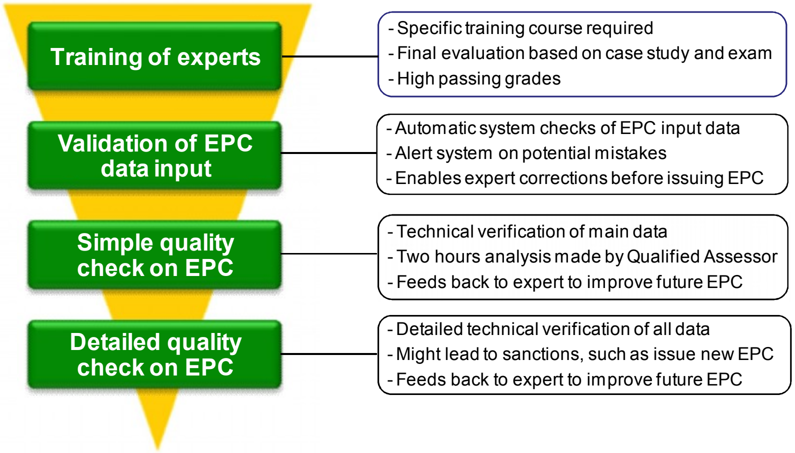


Figure 4 - Quality assurance scheme

The detailed QA check includes a full data review of calculations and a building audit, in order to check the accordance with the requirements and methodologies. Such an audit involves checking all the supporting documentation prepared and used by the expert (e.g., projects, drawings, reports, photos, etc.) and identification of eventual differences and mistakes that occurred. In the case of existing buildings, experts are requested to schedule a site visit and accompany the auditing team. The audit's conclusions are shared with the expert and penalties may be applied, when relevant faults occur. This is done for a random sample of 2% of the EPCs issued monthly, or whenever there is a complaint.

ADENE decides which EPCs to check based on several criteria, including first EPCs issued by the expert, any well supported complaint, buildings rated A or A+, new buildings without mandatory solar DHW systems and, of course, random selections from the database. Until now, around 5,000 detailed QA processes have been performed and legal procedures have already been issued, due to the incorrect application of thermal regulations and certification methodologies, to over 50 Qualified Experts, of which only one resulted in a fine. In this first phase of implementation, the process intends to be more educational than punitive. Moreover, as a direct result of the Quality Assurance process, more than 1,000 EPCs had to be reissued by Qualified Experts with mistakes duly corrected at their own cost.

The target is to audit, using simple and detailed checks, at least 8% of all the issued EPCs every year by 2011.

3 > Inspections - Status of implementation

Portugal has adopted option a) on Article 8 of the EPBD, establishing a regular inspection of boilers. The inspection of boilers as well as air-conditioning systems is still, however, at an early stage. Inspections only take place in existing buildings and they only entered the Certification System in January 2009.

In Portugal, the Qualified Expert is also responsible for carrying out inspections for boilers and air conditioning systems. However, as most of them are not properly trained to carry these out, they are normally performed by boiler and air conditioning technicians under the supervision of the Qualified Expert. The time interval between certification and inspections varies. However, each time a new EPC is issued, the Qualified Expert checks if the inspection report is valid and registers this information on the EPC, as well as the date for the next inspection and a short summary of the inspection results. In the near future, inspection reports shall also be stored in a central database.

Inspection time interval [years]			
Boiler	P - Power [kW]		
Fuel	20 < P ≤ 100	100 < P ≤ 500	P>500
Liquid Solid	6	2	1
Gas	-	3	2

Inspection time interval [years]		
	HVAC Power [kW]	
	12 < P ≤ 100	P>100
Liquid solid	3	1

Time interval between periodic inspections

There is no template report, but a common set of required minimum information is defined. The Qualified Expert must fill at least the following information in the EPC:

- date of inspection;
- methodology used;
- date of installation or age of equipment;
- source of recorded data;
- measurements and calculations;
- efficiency and regulation of the equipment;
- reference values considered.

Inspections of boilers and A/C systems are based on the assessment of efficiency under normal working conditions. Currently, inspections must simply follow the reference methodologies defined in the relevant CEN standards. A specific national methodology, also based on these standards but more precise, is currently under development.

The inspection of boilers takes place every 1, 2, 3 and 6 years, depending on the fuel used and on its power, while the inspection of AC systems takes place every 1 or 3 years depending mainly on the power of the system. Inspections are paid by the end user or by the owner of the building.

Almost two years after the implementation of the inspections scheme, the major difficulty is still the lack of properly trained technicians. There is a need to develop straightforward procedures, training sessions and tools that allow Qualified Experts and other technicians to perform the inspection in a cost effective way. Currently, a training scheme is being developed in partnership with equipment manufacturers and HVAC associations.

For non residential buildings, the law requires the implementation of the cost-effective measures recommended by the Qualified Expert following an inspection. Failure to implement the recommendations within a reasonable period of time may result in a fine to the building owner.

4 > Qualified Experts

Qualified Experts are the only persons recognized to issue EPCs and to carry out inspections of boilers and AC systems. They must be qualified architects or engineers with at least five years of experience, on the basis of peer-review analysis of their CVs, carried out by elected boards from their professional associations. In addition, qualified experts must attend recognized courses and pass a demanding national exam that evaluates their knowledge on the technical requirements of the building regulations and on the details of the certification system itself. Recognised courses are already offered by more than 40 universities or accredited training institutions.

ADENE coordinates the training of qualified experts and is responsible for the Energy Certification module in all courses. These courses are available in the three areas covered by the system and award different qualifications: RCCTE (residential and small non-residential) and RSECE (large non-residential). For the large non-residential buildings, experts can be qualified in one or two areas: Energy and Indoor Air Quality (RSECE-E and RSECE-QAI). Qualified Experts are issued a professional license, valid for 5 years, subject to renewal based on proof of continued training and absence of malpractice.

Qualified experts can act on a freelance basis or be integrated in public or private organizations. At the moment there are about 1,200 recognized Qualified Experts out of a pool of 2,314 candidates that started training, which displays a success rate of about 50%.

Figure 5 – Qualified experts' professional license

5 > National Information and Communication Campaigns

"One Day, all buildings shall be green" is the model for energy efficiency certification in Portuguese buildings

The need of informing citizens on certification

An advertising campaign was developed to launch the SCE. The campaign slogan, "Let's save energy to save Portugal", was promoted on television channels, in the press and on the Internet. The concept to be conveyed is that all residential or service buildings will have a color classification and, one day, they will all be "green", that is, economically efficient and environmentally friendly. This is represented using the image of a Rubik's cube in clear reference to the SCE's ultimate goal: to turn all of the cube's sides into the same colour, in this case green. The same image is promoted outdoors on building scaffolding during renovations at locations with high visibility.

ADENE's website, *www.adene.pt*, provides detailed information on the SCE to licensing authorities, professionals of the sector, property owners and developers, and also to the general public. It includes information about training courses, a list of qualified experts, and lists of valid EPCs that can be partially viewed on-line (see Fig. 6), among other features that can be accessed by users. Detailed brochures, as well as official texts, are available on the national websites.

Figure 6 – Online search for certified buildings

In the first stage of the certification system, information campaigns focused essentially on municipalities, specialists and professionals of the building sector. ADENE organized several conferences to explain the certification process to municipalities and other stakeholders. About 100 training meetings were organised for more than 1,500 technical members of staff from the municipalities. Progressively, the communication campaign was directed towards the general public, when the last phase of the EPBD implementation was reached (January 2009). That meant that all buildings were then included in the certification system: new, major renovations, public buildings and all buildings when sold or rented.

During the last two years, ADENE was present at over 200 events, fairs, seminars and workshops, disseminating the certification process and promoting awareness among

"Simplified software estimate the energy label"

citizens. The focus was on the added value of building certificates, offering clear and reliable information on the thermal quality performance of houses.

In order to bring the certification process closer to citizens, ADENE developed simplified software available online at *www.casamais.adene.pt*, which allows anyone with no technical knowledge to find an estimate of their house label. The software is based on a straightforward calculation methodology and simple questions about the building, but it is only meant for promotional use and can never replace the Qualified Expert's work.

In relation to the residential sector, ADENE engaged with the key players involved in home buying and selling (notaries, real estate agencies, banks, etc.) to ensure they were all aware of the new requirements and to get their involvement and support. These and other actions provided a suitable framework that allowed a fast and successful implementation of certification.

Finally, it is worth mentioning that universities in Portugal had a great involvement in the dissemination of the building energy certification, as they represent a considerable proportion of the group of entities promoting training actions for the recognition of professionals as qualified experts.

People are now able to use the energy performance certification rating as an additional factor when taking an investment decision, such as the purchase of a house. It is one of the few administrative processes that provide potentially useful information to the owner of the house, explaining what he or she can do to actually save money and improve thermal comfort.

6 > National incentives and subsidies

In Portugal, fiscal benefits were created in 2009 as incentives for the adoption of the energy certification system: a 10% increase in the deduction related to house loans in the Individual Income Tax for class A/A+ level homes. Regarding the promotion of building energy efficiency, there is also a tax deduction at the Individual Income Tax, corresponding to 30% for investments in renewable energies (2009) and insulating materials (2010), with a maximum of 803 € per building.

The municipality of Lisbon is also currently implementing a reduction of 25 to 50% of the Municipality Tax on properties for class A/A+ level homes. Other municipalities are reviewing the issue and may follow. The start date is yet unknown.

Link to a presentation on the National Action Plan for Energy Efficiency

http://www.adene.pt/NR/rdonlyres/A935A8EB-F0B0-4850-A3A1-3231A6BB9932/826/Portugal_EfficiencyPlan2015Summary.pdf

The National Action Plan for Energy Efficiency (PNAEE), defined by the Portuguese government under the Directive 2006/32/EC, has established the general framework for financial support towards specific measures (Fig. 7). The exact measures to be supported, as well as the detailed terms and conditions in order to access this support, are currently under study, taking into consideration the data already available on the database of the certification system. Building certification is part of Measure 5. Support towards energy efficiency measures in buildings will be available under Measures 4 and 6.

Until now, government support has been strongly oriented towards solar thermal energy for DHW, in both the residential and institutional sectors. Besides the tax deduction of 30% for the investment in renewable energies, Measure 6 of PNAEE – "Solar Programme" granted 50% non-refundable support towards investment in these systems during 2009 (residential sector) and 2010 (institutions). Consumers are able to purchase these systems directly in banks that take care of all necessary procedures and assure a professional installation of certified solar equipment.

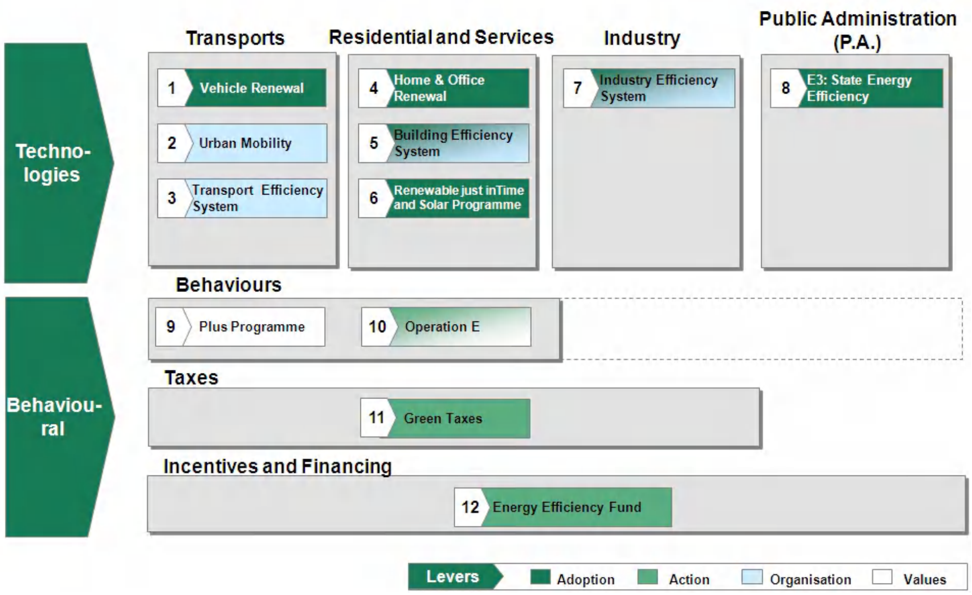


Figure 7 - Schematic summary of the 12 programmes that make up the National Action Plan for Energy Efficiency (PNAEE).

7 > Impact of the EPBD at the national level

Evolution of Minimum quality requirements in building regulations

The table below presents a summary of the evolution of minimum quality requirements in building regulations.

Time interval		Before 1990	1990-2006		2006-2010	
			Lisbon	Bragança	Lisbon	Bragança
U-value [W/(m2.K]	External **walls**	none	1.4	0.95	0.7	0.5
	External **roof/floor**		1.1	0.75	0.5	0.4
	External **window**		4.2	4.2	4.2	3.3
	Flat thermal bridges		none		2xU-value (closest element)	
Maximum energy needs kWh/(m2.year)	**heating***	no	64	135	52	117
	cooling*		18			
	DHW*		none		38.9	
Maximum window solar gain factor **g-value**			0.15 (light inertia) 0.56 (medium/heavy inertia)			
Renewable energy systems (RES)		no	no		RES mandatory	

* Values for an average size (120 m^2) building

Figure 8 - Evolution of minimum requirements for building components and final energy needs from 1990 to 2010.

The future requirements are not yet available, because the regulations to come into effect in 2012 (expected date) are still under development. Future requirements shall be defined using cost-optimum methodologies defined in the new recast EPBD.

Other impacts

Fig. 9 presents the distribution of EPCs across the Portuguese regions. Lisbon is the city with the highest number of EPCs issued.

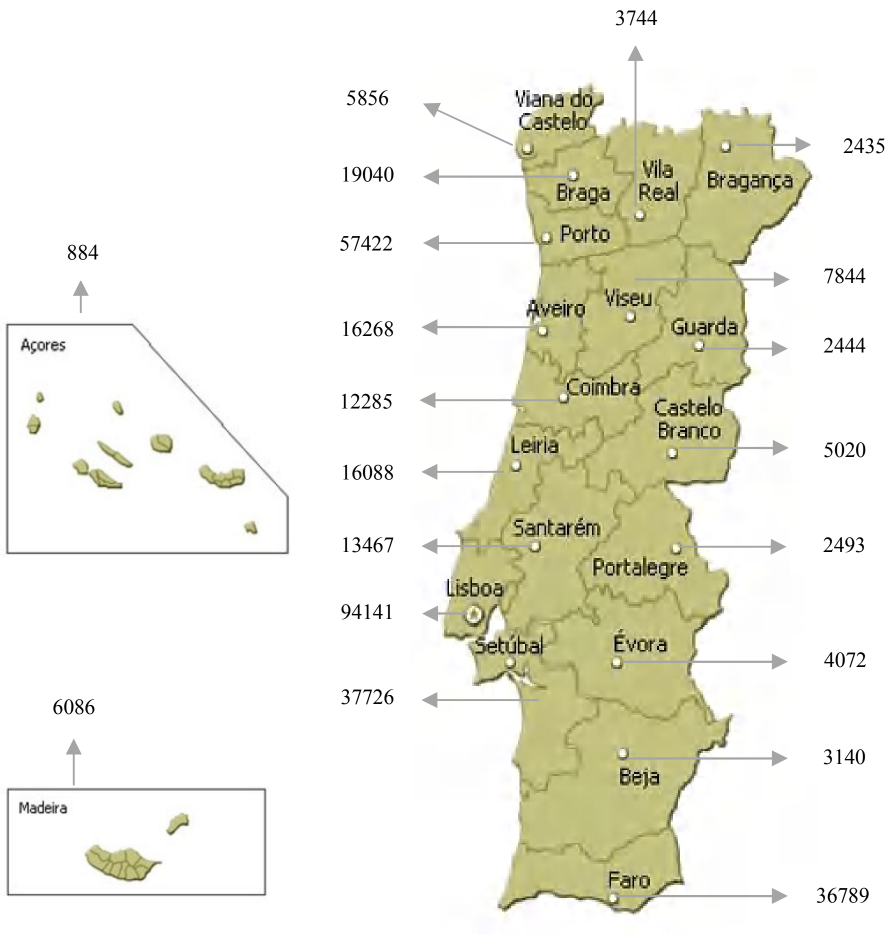


Figure 9 – Number of EPCs issued in each region

As of October 2010, more than 315,000 EPCs were issued since the scheme was launched in July 2007, in response to the requirements of the EU Energy Performance of Buildings Directive (EPBD). About 80% are for existing buildings upon sale or rent, issued since January 2009.

In 2010, around 3,000 EPCs for new buildings and 12,000 EPCs for existing buildings are being issued every month, covering nearly 90% of the licensing and selling processes that take place in the country. This way, a national database of certified buildings is being fed into with up to date information that will be useful to monitor the progress of different aspects of the implementation of the directive, from basic statistics, such as the number of certified buildings, to impact assessment, including estimated savings.

The database will also be used to produce information that is useful for the revision of the technical regulations, where a possible tightening of minimum requirements, as well as a change or optimization of some operational rules, is likely to take place during 2012. Figures 9 through 11 present some interesting information extracted from the database.

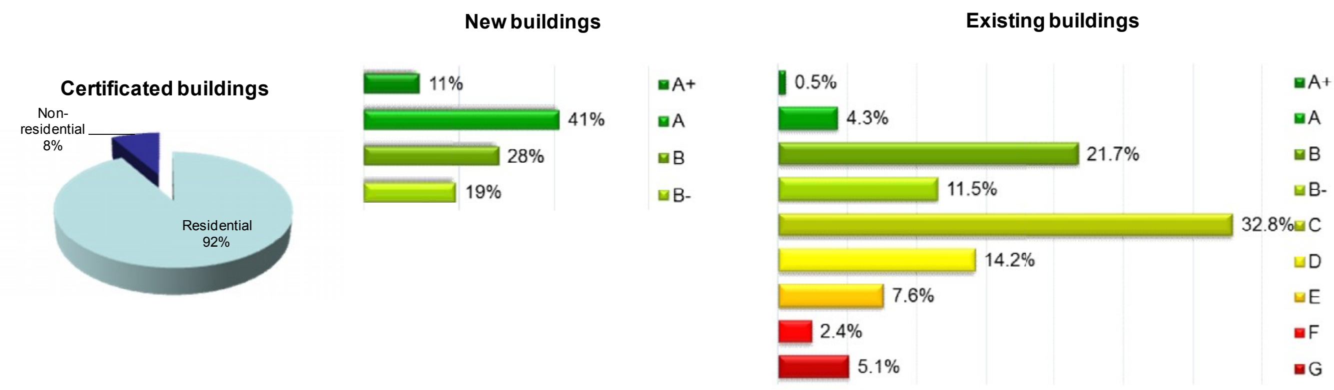


Figure 9 - Energy label distribution for new and existing buildings

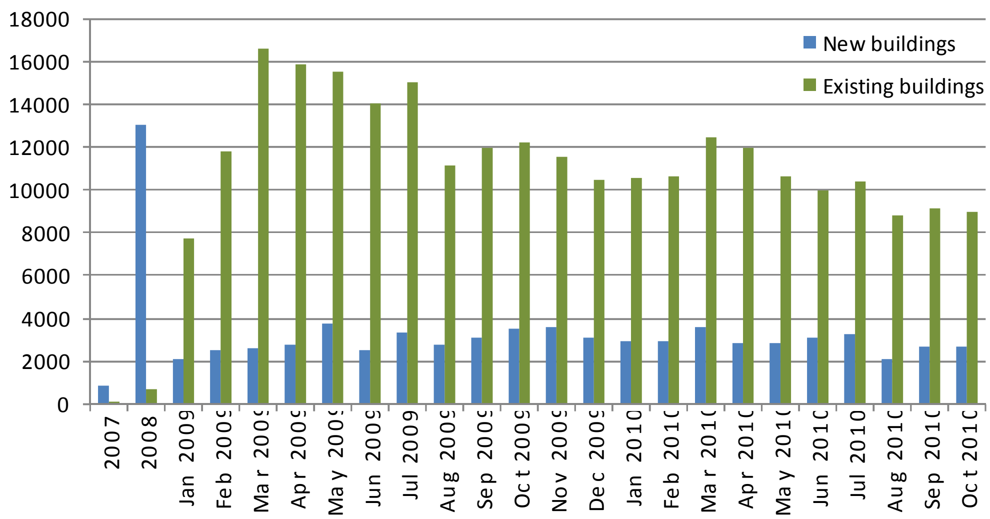


Figure 10 - Evolution of EPCs issued along the system implementation

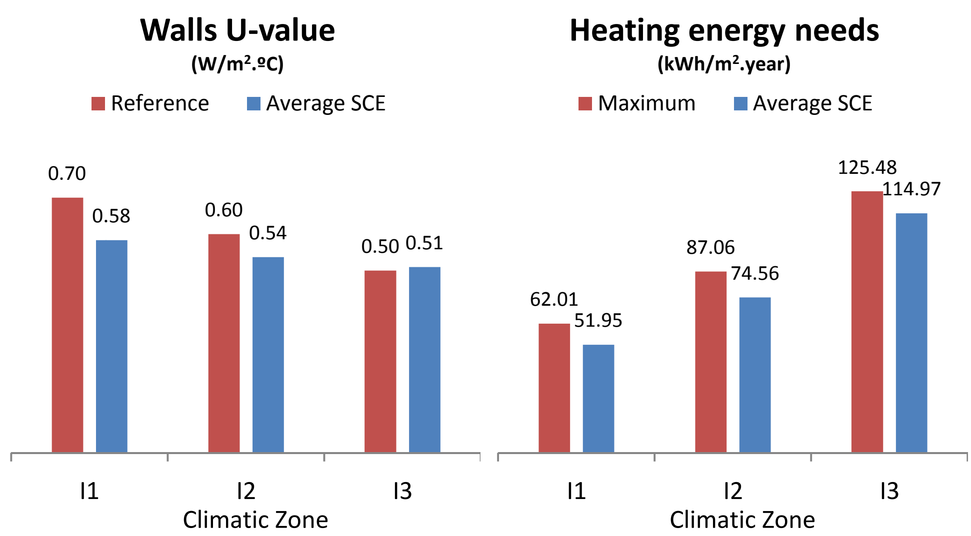
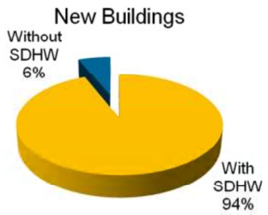
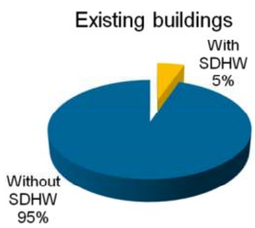


Figure 11 - Database reference and average values for U-values and heating needs (final energy), including new and existing buildings.

8 > Conclusions and future planning





Solar Domestic Hot Water (SDHW) statistics

The EPBD requirements for new buildings and major renovations will certainly bring important energy savings in the near future, although new and renovated buildings only represent a small share of the entire building stock in Portugal (around 5.5 million homes). Currently, less than 50,000 new buildings are built each year in Portugal and, despite the recent growth in the rehabilitation market, major renovations still do not have a significant expression. Therefore, the impact of applying energy performance requirements in new and renovated buildings is obviously limited and will not lead, within a useful timeframe, to a relevant reduction in energy consumption in the building sector.

To achieve real energy savings in the building sector, significant incentives for the improvement of existing buildings are needed and certification can play a fundamental role. The recommendations made by the experts in the EPCs are important guidelines that building owners can make good use of, either in the context of a renovation, or as an individual cost-effective measure. Financial concerns about the investment on energy efficient technologies are a major barrier.

A main challenge is training the public to be aware of their real energy use. Lack of awareness is generally reflected on two fronts: 1) consumers are not aware of the amount of energy they are currently using in the house. This makes it difficult for them to understand the benefits of renewable technologies and 2) consumers are not aware of the available and cost-effective renewable technologies. This is, however, slowly changing through the government's continued promotion of these technologies.

On the other hand, additional training should be offered for qualified experts, in order to improve their skills in performing energy audits and proposing optimum economic and technological building improvement solutions.

The main challenges and future developments of the certification system for the short and medium term, thus, are:

Example of a promotional advertisement used in the national campaign to promote solar energy.

- To continue improvements of the informatics platform that supports the SCE, including online audit reports, data entry validation and automation of the QA process;
- To reinforce the QA Scheme, increasing the number of simplified checks on the input of EPCs;
- To provide additional training for qualified experts in relation to HVAC, DHW and renewable energy systems, as well as in more effective auditing techniques;
- To develop a simplified methodology for periodic inspections of boilers and HVAC systems in smaller buildings;
- To complete the work of the committee that is preparing the revision of the building regulations, to come into effect by 2012 at the latest, in line with the requirements of the new recast EPBD (this committee reconvened in 2010 and its work is to be completed by summer 2011).

The experience acquired until now will certainly be of great help towards achieving these challenges and, also, towards reaching the final goal of net zero energy new buildings by 2020.

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in Romania

Status in November 2010

Aurelia Simion

Diana Dobrea

MDRT

Octavia Cocora

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Dan Constantinescu

Horia Petran

INCD "URBAN-INCERC"

Romania

National websites:

- *www.MDRT.ro*
- *www.norme.ro*

1 > Introduction

The implementation of the EPBD in Romania is the overall responsibility of the Ministry of Regional Development and Tourism (MDRT), and it has influenced regulations, building laws, governmental decisions, as well as the Government's determination to secure energy supplies for homes and businesses.

Romania has adopted appropriate measures to transpose the EPB Directive into the national law: on the 1st of January 2007, the Law 372/2005 on the transposition of the EPBD into national law came into force. Many other Orders and regulations were created in order to complete the issue of the energy performance of the building field.

2 > Certification

Certification of buildings

The energy consumption of buildings and the energy certification were subject of national regulation before the EPB Directive. Since 2000, Romania already had technical norms for energy consumption evaluation, building certification and building audit available before transposition of the EPBD on the 1st of January 2007.

In December 2005, the Parliament of Romania adopted the Law 372/2005 regarding the transposition of the EPBD into national law. It was published in the Official Monitor on the 19th of December 2005, and came into force on the 1st of January 2007, with the exception of the mandatory energy certificate for residential buildings when constructed, sold or rented, which should have been applied starting from the 1st of January 2010. In January 2010, the Government postponed the residential buildings' certification until the 1st of January 2011.

The methodological norms concerning the transposition of the Law 372/2005 were published on the 12th of October 2007 by Order 691/1459/288/2007. The execution orders are the responsibility of the Government and the local authorities. Law 372 defines the legal frame for the Calculation of energy performance of new and existing buildings, Certification of buildings, Inspection of boilers and air-conditioning systems, and independent expert Accreditation, i.e., articles 4, 5, 6, 7, 8, 9 & 10 of the EPBD.

On the 1st of February 2007, Order 157/2007 brought into force the new “Methodology of calculation of the energy performance of buildings - Mc 001/1,2,3 – 2006”, taking into account the EPBD standards, especially EN 13790 for heating and cooling, not available up till then. In Part II, Chapter 5 of the new Methodology, the alternative calculation methods for heating and hot water consumptions have been included, based on the previous Romanian research activity.

The Order 1071/2009 supplements and amends the Order 157/2007 with a calculation summary of the energy performance of buildings and apartments.

The Energy Performance Certificate

In Romania, the building certification activity started in 2005, on the base of national regulation. Starting on the 1st of January 2007, the building energy performance law 372/2005 and the calculation methodology Mc 001/2006 came into force for all new buildings, existing public buildings and major renovation works, except residential units when sold or rented.

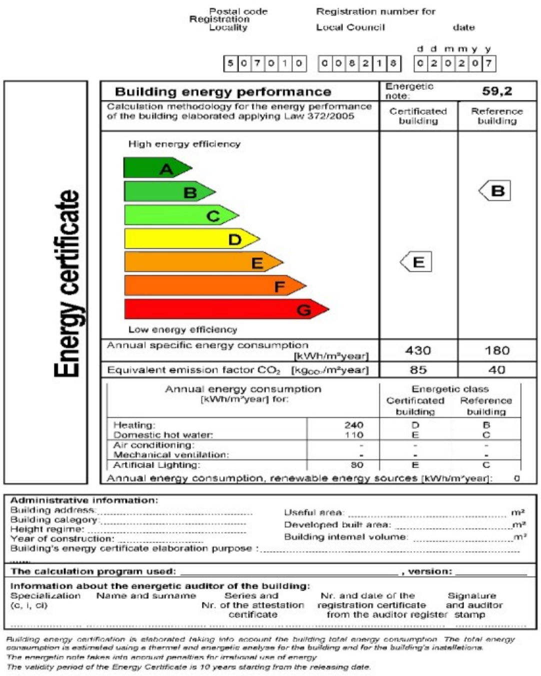


Fig. 1-Cover page of the EPC

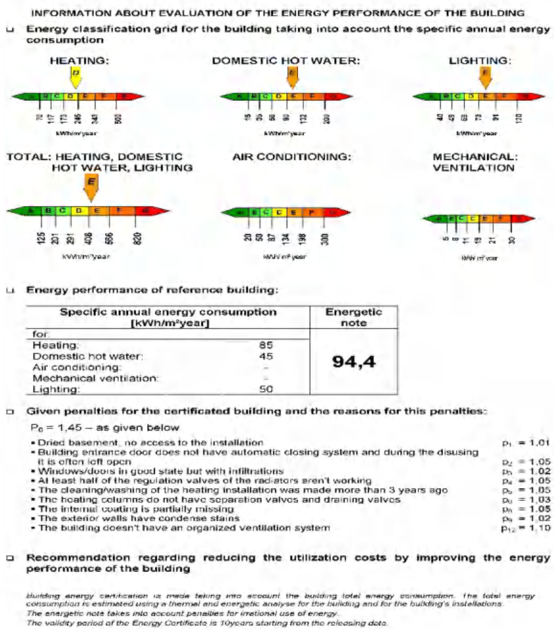


Fig. 2-Verso of the cover page of the EPC

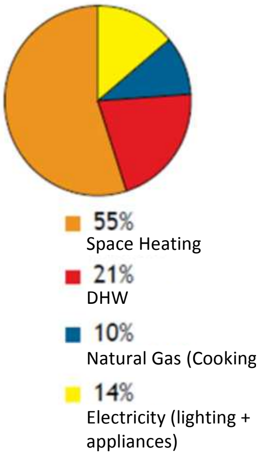
The Romanian Energy Performance Certificate (EPC) takes into account the final energy consumption of the actual building and the reference building; conversely, the apartment certificate refers only to the actual flat.

The energy certificate has two pages. The first page displays the characteristics of the building performance, such as: final annual specific energy consumption for heating, cooling, ventilation, hot water, lighting, total specific energy consumption and CO_2 emission. The energy class for the existing and the reference building, as well as the energy mark, are also included in the first page. The second page indicates the energy scale ranging from A to G for each type of installation, as well as information on the reference building. Energy performance is expressed by the final total specific annual assessed energy consumption [kWh/m^2.year], including all installations in use for normal building operation.

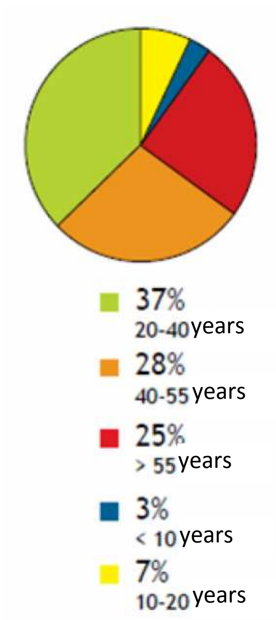
Every building and its reference building have an energy benchmark, calculated as a function of the total specific annual energy consumption and penalty, as following:

N = exp (-B1 • qT • po + B2) - for (qT • po) > qTm kWh/m^2.year

N =100 - for (qT • po) □ qTm kWh/m^2.year



Structure of energy consumption for a typical apartmant (block of flats built in the period 1950-1990)



Age structure of block-of-flats buildings

Where: qT is the specific final total calculated annual energy consumption for space heating, hot water, lighting and ventilation/air-conditioning, and po is the penalty coefficient taking into account the rational operation of the building and its installations:

1) For buildings with heating, hot water and lighting installations:

qTm = 125 [kWh/m^2.year] is the final specific energy consumption;

B1 = 0.001053, and B2 = 4.73724

2) For buildings with heating, ventilation/air-conditioning, hot water and lighting installations:

qTm =150 [kWh/m^2.year] is the final specific energy consumption;

B1 = 0.000742, and B2 = 4.71556

The penalty coefficient (p0) is the result of bad management of the existing building, and its use decreases the benchmark of the building. There are 12 penalty types (∏) for envelope and HVAC systems and equipment; p0 = ∏ pj. The penalty coefficient values vary between po=1 for a very good envelop without cracks and air and water infiltrations, and very efficient installation, up to po=2.22 for a building with a very low maintenance.

Requirements for new buildings, major renovations and existing buildings

For new buildings, the Order 2055/2005 concerning the revision of the thermal regulations for buildings C107 was approved on the 13th of December 2005. This regulation has been amended in October 2010 (C107/2010 annex 3) by improving thermal resistance values.

The type and level of requirements for new buildings depend on the type of building (dwellings, office buildings, schools, etc.) and the envelope of the buildings:

- Minimum thermal resistance corrected with thermal bridges R' - value.
- Maximum thermal transmittance corrected with thermal bridges U'-value.
- Maximum overall thermal coefficients G-values.

The proof of compliance must be made in two stages:

- When requesting for the building permit.
- After completion of the building (commissioning).

The control of the regulation is the responsibility of both the accredited experts registered in the Building Certification System, who verify the design, as well as the Municipality where the building is located.

For **existing buildings**, the actual building is compared with a reference building having the same shape and the U'_{max}-values provided in Table 1.

ENVELOPE UNITS	U'_{max} [W/(m^{2}K)] Maximum Thermal transmittances corrected with the influence of the thermal bridges C107/2010		U'_{max} [W/(m^{2}K)] Maximum Thermal transmittances corrected with the influence of the thermal bridges C107/1997
	Residential buildings		Residential buildings
	Newly built**	Existing to be renovated*	Newly built after 1998
External walls	0.57	0.71	0.71
External windows	1.30	2.50	2.00
Terraces	0.20	0.33	0.33
Floors of unheated basements	0.35	0.60	0.60
Ground floors (no basements)	0.22	0.33	0.22
Floors of heated basements	0.21	0.24	0.20
External walls of heated basements	0.35	0.50	0/41

Table 1 - Reference U'-values required for residential buildings (C 107)

*) values for the reference buildings
**) mandatory for new buildings, recommended for thermal rehabilitations

Rehabilitated block of flats

If upgrading of an existing building is performed, a combined technical and economical assessment is conducted. The values of energy performance and economic assessment are the result of the Romanian Methodology application. The final solution is based on investment cost, energy consumption reduction and payback time value, compared with the maximum accepted value of 10 years and the conventional lifetime of the technical solution.

Since the transposition of the EPBD into Romanian legislation by the Law 372/2005 and after the adoption of the design norms C107/1, 2-2005 regarding the minimum values for the thermal resistance of the envelope, the most important government decisions with important impact on the existing building stock are the following:

- The national programme for thermal rehabilitation of existing blocks of flats.
- The Order 174/2008 - consolidated version on special measures for the thermal rehabilitation of multi-storey residential buildings, including third-party financing through the thermal rehabilitation works.
- The Government Ordinance O.G. 18/2009 regarding thermal rehabilitation of blocks of flats built between 1950 and 1990.

The aim of the Government Ordinance 18/2009 is to increase the effect of the EPCs, to reduce the energy consumption for heating and to improve the esthetical aspect of the town. The O.G. 18/2009 has an important impact on the existing building stock, due to clear specification of financing and energy performance requirements. According to this ordinance, the costs of the EPC audit and technical project are supported by the Government. The execution works are supported as following: 50% by the Government, 30% by the local authorities and 20% by the owners.

According to the EP, the expert must propose the appropriate solutions for the thermal rehabilitation of the building's envelope, achieving a decreased heating consumption, below 100 kWh/m^2·year.

One of the strong points of the above mentioned Government Ordinance is that it specifies the minimum performance limit for a thermal rehabilitation. However, the Ordinance has a weak point: it does not specify actions for the energy rehabilitation of the building's indoor installations.

Following the implementation of the EPBD, the responsibility of Local Authorities and citizens was increased. Technical measures for better energy performance management of buildings were implemented, including individual metering of heating and hot water, and individual thermal regulation of heating.

Calculation procedures

The calculation procedures for energy performance indicators and energy consumption are defined in the "Thermal regulations" (C107) and in the "Methodology of calculation of the energy performance of buildings - Mc 001/Part 1,2,3,4 – 2006", available both for new and existing buildings, as well as for residential and non-residential buildings. National databases of typical annual hourly climatic data are to be prepared and published for every municipality in Romania. The software tools, created according to the Mc001-2006, are available on the market.

The Order 1071/2009 supplements the Order 1057/2007 with the procedure for validation of computer programmes used for the calculation of energy and developing energy performance certificates for blocks of flats.

A special theoretical and experimental validation research programme for new and existing calculation methods is currently being carried out, coordinated by the Ministry of Development (2008 – 2010). Within this research programme, a reference software (RS) will be developed. Based on this RS and on a special checklist of results, any alternative method and software product (Romanian or foreign) will be assessed. The intention is to use only certified software products in the design activity.

Present regulations for new buildings are limited to conventional buildings; some new and efficient solutions are omitted (e.g. solar passive systems, active solar systems, endothermic facades, phase change storage structures, etc.).

Quality assurance (QA)

The Quality assurance scheme is still under development, addressing training and examination of individual experts, validation and certification of software used for the processing of EPCs. EPCs are issued and registered in a central database, based on analysis of issued documents or possible in situ checks, as well as on calculation of the energy performance of buildings. For repeated errors, the auditor's license can be cancelled.

3 > Inspections - Status of implementation

Inspections are a substantial part of the energy audit of a building. The inspection of boilers and air-conditioning systems is, however, still at an early stage. The regulation for periodic inspections of boilers, heating systems and air-conditioning systems is being processed. A guide for each type of inspection will be available in early 2011.

The procedures for inspections will follow the European norms and specific national regulations. The implementing rules of the Law No. 372/2005 stipulate that energy inspections of boilers, thermal power plants and heating plants of buildings must be carried out by technical experts certified in heating and ventilation specialty.

4 > Qualified Assessors

Qualified experts are the only persons recognised to issue Certificates and carry out inspections. Energy auditors must have all the skills necessary for inspections and system improvement recommendations. They must be qualified engineers or architects with at least three years of experience in dwelling certification only, and five years of experience in certification and audit for all types of buildings.

In addition, qualified experts must attend recognised training courses (short courses of 80 hours or MSc university courses of 1 to 2 years), and pass a demanding national examination that evaluates their knowledge on the technical requirements of the building regulations, and on the details of the certification system itself. The examination has two parts: a theoretical examination and a practical exercise based on a simulation of audit activity (an existing building certification and an audit report for a detailed upgrading solution, combined with an economic efficiency assessment).

The Ministry of Regional Development and Tourism (MDRT) coordinates the training of qualified experts and is responsible for all aspects of the Energy Certification module. Qualified experts are given a professional license, valid for 5 years, which is subjected to renewal with proof of continued training and lack of malpractice. The demanding qualifications of the energy certification auditors is a guarantee of their correct professional attitude and increase the credibility of the certificates.

Qualified experts can act on an individual basis or be integrated in public or private organisations. Recognised courses are already offered by Technical Universities in Bucharest, Timisoara, Iasi and Cluj, accredited by MDRT. More than 1,000 candidates have been trained till September 2010.

In Romania, there are over 1,000 qualified experts in energy performance of buildings, certified to perform certification and energy audit on buildings. The Ministry keeps the list of authorised experts. This list is published in the Ministry's website www.mdrt.ro.

Figure 3 - Qualified expert professional license model

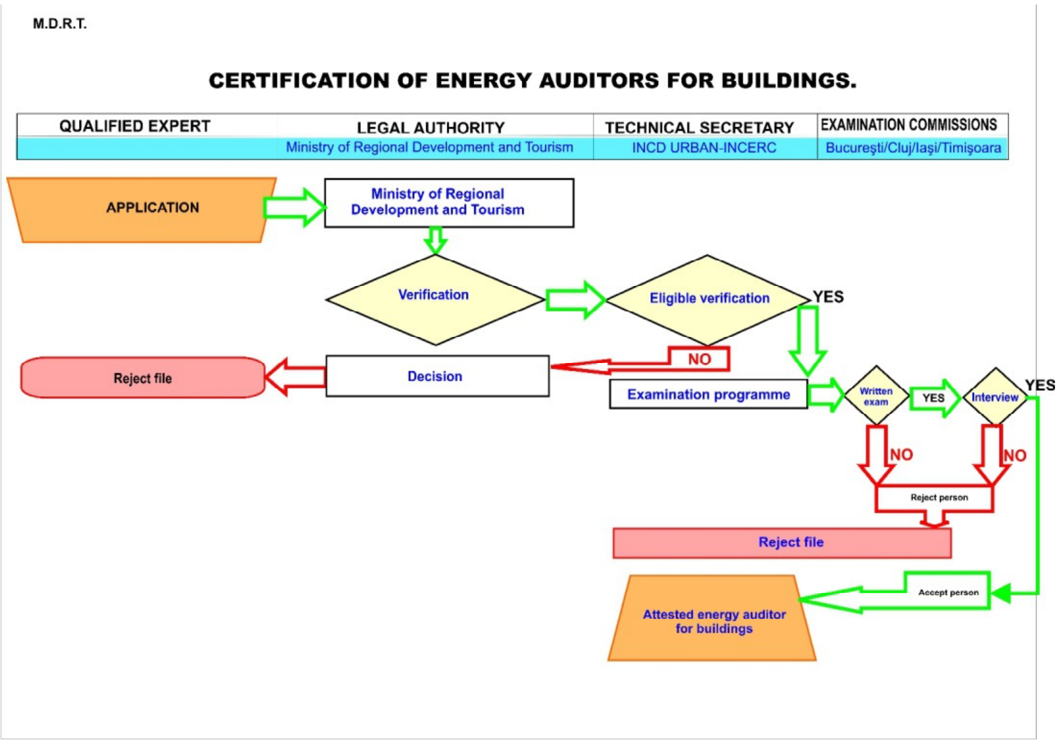


Figure 4 – Scheme for the certification of energy auditors for buildings

Quality control

Qualified experts are the only persons accredited to issue EPCs. According to the Norms of application of Law 372/2005, every auditor must keep the documents for each certificate in order, and keep a register for all EPCs.

As stated in the norms, a central registration of all EPCs and a national database must be organized by the National Building Research Institute (INCERC Bucharest).

The quality of the EPC is controlled by periodic checks conducted by a commission designated by the Ministry. At least once every 5 years, each expert will be examined by the commission for the evaluation of their correct use of methodologies and tools. About 10% of the certificates will be subjected to this quality check starting from 2011. In case of serious infringement of the EPC process, the control commission can propose to the Ministry the suspending of the license.

Any authority or owner can address the Ministry if there is a doubt concerning the certification compliance with the standards or the national regulation. There is not yet a clear regulation concerning this subject.

5 > National Information and Communication Campaigns

Communication is an essential component in all projects. Also, together with technology and policy, construction standards play a vital role in raising awareness on energy savings and renewable energies. Detailed brochures, as well as official texts, are available on the national websites. Since 2007, promotion and information seminars have been organised on a national basis.

The MDRT website (*www.mdrt.ro*) provides detailed information on training courses, information campaigns, legislation, technical regulation; it also provides a list of qualified experts. In the future, it will contain a list of valid certificates as well. This site includes the regularly updated national rehabilitation programme provided by the Ordinance 18/2009 – concerning blocks of flats.

The goal of the information campaigns, competitions, voluntary schemes and pilot activities is to promote market penetration of technologies and concepts that keep energy performance under legal requirements, as well as the implementation of the energy efficiency measures in both the private and the public sector.

Another issue is the access to finance - to assist all stakeholders in their projects. In order to raise awareness on the national thermal rehabilitation programme by government credit guarantee and interest subsidy, at the level of owners associations in blocks of flats and single-family building owners, the MDRT has developed an attractive brochure.

6 > National incentives and subsidies

In order to reduce energy consumption in residential buildings, the Government Emergency Ordinance No. 18/2009 was published in the Official Journal No. 155 of the 12th of March 2009. The normative act mainly sets the financing of the performance of works on the insulation of residential buildings constructed in the period 1950-1990, with high energy consumption for space heating:

- 50% from the state budget;
- 30% provided by local budgets;
- 20% from the repair fund of the association of owners and/or otherwise legally constituted entities.

Also, for this category of buildings, local authorities financed the implementation of energy audit and technical design.

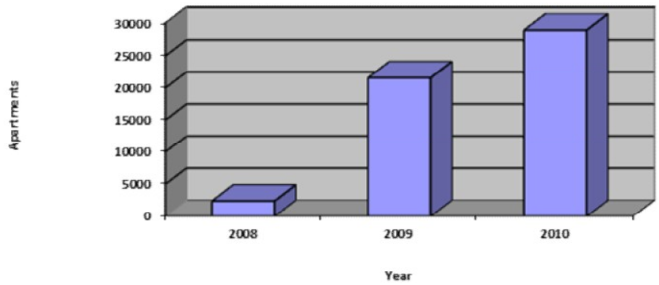
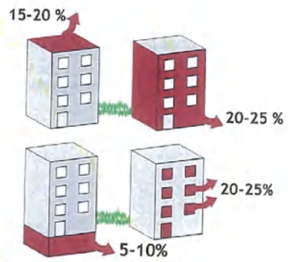


Figure 5 - Number of apartments in block-of-flats approved in the National Thermal Rehabilitation Programme



Following the above mentioned experience, and taking into account the provisions of art. 10 of 2010/31/UE Directive, MDRT identified new financial instruments for increasing the energy performance of buildings. In this regard, the Government issued Emergency Ordinance No. 69/2010, published in the Official Journal No. 443 of the 1st of July 2010, which provides directives for obtaining credit for carrying out rehabilitation of housing, with guarantee and full interest subsidy by the Government. With this legislation, credits can be accessed both by tenants' associations and by single-family building owners.

National Programme for Building Rehabilitation

7 > Impact of the EPBD at national level

The impact of the EPBD at the national level is:

- Effectiveness in promoting energy efficiency improvements.
- Reduction of cost-effectiveness for the end users.
- Influence on the national energy performance requirements of our country and development of new calculation procedures and harmonisation with the level of energy performance for new buildings and major renovations.

The results offered arguments in favour of the tightening of these requirements. Thus, the thermal requirements for new buildings according to the C107/2010 are more improved from those in the C107/2007, and the maximum heating consumption for major residential renovation is defined to 100 kWh/m^2.year.

- Measurements for energy performance for existing buildings and creation of a benchmarking system under the coordination of the MDRT; this system takes final energy into account and covers the overall result of the energy used for heating, hot water, cooling, ventilation and built-in lighting.
- The advantages of the implementation of the EPBD at national level will be felt also at environmental, economic and social level, and will lead to greater use of renewable energy.
- Less greenhouse gases.
- Less waste.
- Reduction of energy dependence.
- Promotion of green technologies.
- New opportunities for business.
- New jobs.

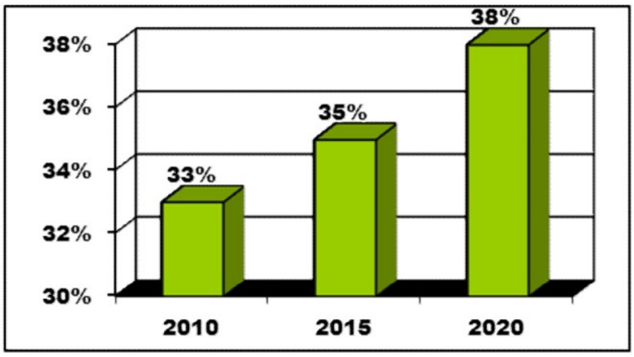


Figure 6 - Plans for Green Energy share in buildings

8 > Conclusions and future planning

The 2010/31/EU Directive (recast EPBD) and the National Energy Strategy for building planning in Romania are in full agreement, and, therefore, the recast EPBD is a useful legal tool for improving the energy performance of buildings in an effective way for short and medium term:

- Transposition and implementation of the new EPBD (recast).
- Increase of the number and quality of accredited experts.
- Development of a methodology for periodic inspections of boilers and HVAC systems in smaller buildings.
- Start of the supervision/quality control of the certificates issued by qualified experts on a regular basis during 2011.
- Reconvening of the committee that will prepare the revision of the minimum requirements, so that they come into effect 5 years after the publication of the current regulations.
- Start of the assessment and certification of the software products used for the energy assessment of new and existing buildings.
- Introduction of the individual residential buildings into the National Programme for thermal renovation of existing buildings.
- Development of the measurements of energy performance for existing buildings in benchmarking systems.
- Increase of the penetration of renewable energy in buildings.

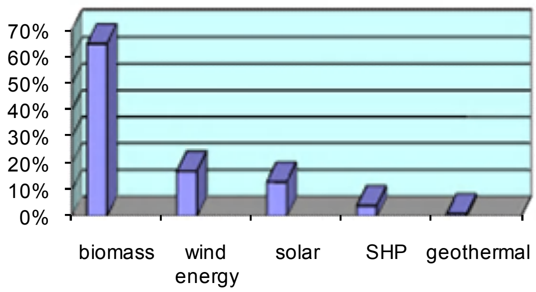


Figure 6 - Percentage distribution of renewable energies (estimated, 2010)

CEN produced a set of standards in support of the introduction of the EPBD, but they do not cover the whole challenge of the EPBD. Even through CEN standards are not directly implemented in the national energy performance procedures, Romania will continue to use CEN compatible approaches.

The 2010/31/UE Directive, together with construction standards, will ensure that Romanian homes and workplaces will be safe, confortable, healthy and non-polluting. There is a strong need for flexibility, cooperation, networking and involvement of market actors. The responsible attitude of the energy certification auditors will stimulate more extensive dissemination and credibility of the certificates.

The recast EPBD will further build on the guidance already set by the EPBD, therefore making it possible to meet the specific objectives and accelerate energy efficiency and national use of energy, including, among others, studies, events, training programmes, information campaigns, competitions, voluntary schemes, and pilot activities, in order to provide a fair field for a mature energy-efficiency market.

With every amendment of the energy requirements from the recast EPBD, the MDRT has to take the legal regulation into account, according to which all these requirements have to be economically feasible and create a system for all relevant components for new buildings and major renovations. Therefore, the impact of applying energy performance continues to improve the reduction in energy consumption in the building sector.

In order to progressively involve all existing buildings, energy certifications must be perceived by consumers as a useful tool for the improvement of the energy efficiency of buildings, and to increase transparency within the real estate market.

Implementation of the EPBD in Sweden

Status in November 2010

Hans-OK Hjorth

Boverket

Thomas Johansson

Boverket

Ola Svensson

Boverket

Sweden

National websites and other social media:

- *www.boverket.se*
- *www.energimyndigheten.se*
- *www.notisum.se*

(Swedish legislation available)

- *www.swedac.se*
- *www.omboende.se*

You can also find Boverket on face book:

- *http://www.facebook.com/pages/Boverket/397644582089*

and Twitter:

- *http://twitter.com/boverket*

1 > Introduction

In Sweden, the EPBD, 2002/91/EU, is in full action. Since the last status report was published in 2008, many new companies have been accredited to issue energy certificates, and certification has been accepted by the market.

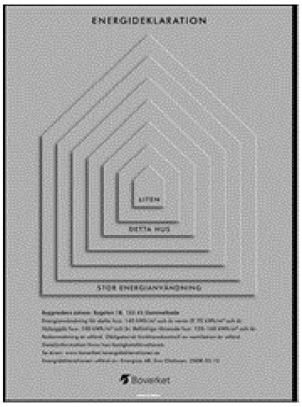
The energy requirements have also been revised once during this period. The *Ordinance (1994:1215)* was revised in 2008, followed by a revision of the building regulation later in the same year *(BFS 2008:20)*, where the energy requirements for electrical heated buildings were tightened. This revision went into full force on the 1st of January 2010, after an eleven month transposition period.

Implementation started in 2005 with the work on the revision of the Building Code (*BBR 12, BFS 2006;12*) method and minimum requirements and the regulation on energy certificates/energy declaration, based on the *Law (2006:985)* of June 2006 and the *Ordinance (2006:1592)* that was decided on in December 2006, that have remained unchanged so far. The revision towards the implementation of the recast of the EPBD has started, through a process in which the current legislation is scrutinised, in order to identify the impact of the recast of the EPBD, 2010/31/EU, on the old legislation. It is expected to result in a new law and a new ordinance in 2011, followed by new revised regulations before the deadline in 2012.

This report presents an overview of the current status of implementation and of the plans for the evolution of the implementation of the revised EPBD in Sweden. It addresses certification/declaration and inspection systems, including quality control mechanisms, Qualified Experts, information campaigns, incentives and subsidies.

In Sweden, the implementation of the EPBD is the overall responsibility of the Ministry of Enterprise, together with the Ministry of Environment. Boverket, the Swedish National Board of Housing Building and Planning, is the managing body for most of this process. Boverket manages the Building regulations and has designed, developed and currently supports the entire declaration system, which is based on a central registry and database, including a part concerning the inspection regime for A/C. The Swedish Energy Agency is responsible for the information campaign on boilers that comes as option b in article 8.

2 > Certification/Declaration



Energy Label/Summary of the declaration

Declaration of buildings

Starting with the law in October 2006 and the Government's ordinance in 2007, Boverket´s national regulations for Energy declaration and A/C inspection in Buildings *(BED, BFS 2007:4)* came into force on the 1st of March 2007. The first declaration was registered on the 10th of September 2007, after a short period, during which Independent Expert companies were accredited for the task. Boverket´s regulations have been revised twice, resulting in *BED 2* (in 2007) and *BED 3* (in 2010).

To be accredited, a company needs to have at least one person certified according to Boverket´s regulation on Energy experts (*CEX, BFS 2007:5*). This regulation has been revised once, *CEX 2* (in 2010).

The timetable for the implementation of the BED regulations in various types of buildings was divided into two phases, until its full implementation in January 2009, when all the required buildings were included in the certification system:

The first phase took place before the 1st of January 2009 concerning

- Official buildings larger than 1,000 m^3,
- Buildings that are rented, residential or non-residential.

The second phase continued from the 1st of January 2009 onwards with

- New buildings, and
- All buildings when sold.

The two first categories of buildings must always have an Energy declaration less than ten years old.

New buildings should have an energy declaration issued at the latest two years after the building is brought into use. This also serves as a check of the compliance with the minimum requirements of building regulations.

Buildings that are sold should have an energy declaration less than ten years old at the time of sale. Otherwise, the buyer can order a declaration at the sellers' expense within six months.

In Sweden, public buildings (Special Building/*Special byggnad*) are defined in the *taxation law* as owned by private or public bodies. Every Special building larger than 1,000 m^2 is required to always have a declaration less than ten years old, and display it, at an entrance often used by the public.

Currently, there are more than 30,000 non-residential buildings, including public buildings, declared and many more in the process of being declared. Also, Buildings that are rented out (multifamily residential and non-residential) have to have a valid declaration on display.

Each building is assigned an energy rating according to the table on the left.

Declarations can only be issued by an Independent Expert (IE) (juridical person). IEs are accredited companies duly qualified, through a person in a leading position, who is certified as an Energy expert, according to the CEX regulation, and is accredited by the Swedish Board for Accreditation and Conformity Assessment, SWEDAC, according to the international standard ISO 17020. The list of Independent Experts is continuously updated and always available to the public online at *SWEDAC's website*. At present it contains about 400 accredited companies.

Experts from other EU- or EES-Countries do not need to be accredited, but have to be approved as Energy experts in their own country. So far, there are three persons issuing Energy Declarations in Sweden under foreign approval, one Danish, one Finnish and one British expert.

Energy Label criteria (in kWh/m^2 of final energy consumption)

Inner small house,

< 50 kWh/m^2,

Second smallest,

50-100 $kWh/^2$

Third smallest

100-150 kWh/m^2

Fourth smallest

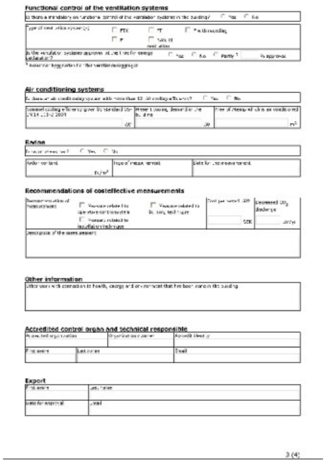
150-200 kWh/m^2

Fifth smallest

200-300 kWh/m^2

Sixth smallest

300-400 kWh/m^2



Page 3 with expandable fields for recommendations

Attic insulation, gains and risks

Tightening of windows and doors, gains and risks

The responsibility of having a declaration always rests with the building owner. There is no registration fee for the declarations issued, as Boverket manages the register, but it must be issued by an Independent Expert, who charges between about 500 and 2,000 € for this service. An owner who fails to deliver the declaration to a buyer can be forced to pay the cost of a declaration, if the buyer orders it within 6 months after the purchase. An owner, who fails to display the declaration in a special or rented building, can be fined.

Energy declarations are valid for 10 years.

The summary of the energy declaration

The summary of the energy declaration is the most visible aspect of the BED. This document assigns an energy performance label to the declared building and also shows whether indoor environment investigations, such as compulsory ventilation checks and radon measurements, have been carried out. It also gives information on where the reader can get more information about the energy declaration. A printed version of all energy declarations can be obtained from Boverket. Direct access to the National register "*Gripen/The Griffon*" can be obtained by the Building owners for them to see the declaration of their own building, as can the Independent Expert access it to view the declarations they have been involved in.

The performance of final energy [kWh/m^2 A_{temp}] is calculated using the measured values from heating and cooling energy, as well as energy used for the ventilation system, domestic hot water and for the property's energy, including for example pumps and lighting in public spaces; all this is divided by the area [A_{temp}] of the building that is intended to be heated to over 10 °C.

Additionally, energy performance is corrected for normal use, for example, the Independent Expert uses a correction factor in relation to size of family or if something extraordinary has happened during the year of measurement. Moreover, the on line formula that is used by the Independent Expert calculates the correction for the climate during the measured year, by degrees, days and/or Energy Index, so that it is compatible with other declarations made in different years.

The energy label classifies buildings on an efficiency scale ranging from low energy use to high energy use. This label is under revision and a Swedish classification standard is under development, based on the Swedish Building Code, so it will be able to give an energy performance indicator at a later stage.

The practical benefit of Energy Performance (EP) certification is found in the recommendations that are given to the building owner. These are provided in page 3[1] of the declaration, which also lists which measures have been taken since the last declaration. The Independent Expert also calculates the cost per saved kWh.

The suggested improvements include a short description and estimates of costs per saved kWh. Recommendations made by the Independent Expert should be the result of studying the case of the specific building, rather than general recommendations selected from a database, based on typical situations. The Independent Expert also calculates the impact on the building's release of CO_2, when measures are carried out.

[1] The pages can vary due to the dynamic format, offering the independent expert the opportunity to give more than one recommendation.

Energieffektiva åtgärder

2 Värmesystem

Möjligheter och risker

2:1 Komplettera med spiskassett i öppen spis

Complementary Cassette in the fireplace, gains and risks

Frequent recommendations	Building technique	Installation technique	Control and regulation
Total	21%	54%	25%
First most	Attic insulation 10%	Water saving measures 21%	Central temperature regulator 9%
Second most	Changing windows 8%	Changing radiator valves 8%	Adjustment of radiators 5%
Third most	Wall Insulation 2%	Conversion to heat pump 5% Ground + 4% Others	Temperature lowering 2%

Figure 1 Typical recommendations proposed by experts

Energieffektiva åtgärder

2 Värmesystem

Möjligheter och risker

2:2 Installera kamin eller kakelugn

Installation of stove or fireplace, gains and risks

Building category	Total final EP [TWh]	Saving potential [TWh]	Saving potential [%]
Single family buildings	1.9	0.4	20
Multi family buildings	15.2	2.1	14
Non residential	7.1	1.7	23
Total	24.2	4.2	17

Figure 2 – Recommendations to improve the energy performance

New buildings must achieve at least the minimum demands given in the Building regulations, verified by a calculation performed before the construction begins, and also validated by a measurement two years after the building comes into use. This requirement came into force on the 1st of July 2006, with a transitional period of one year. In Sweden, all renovated buildings should fulfil the minimum requirements that apply to new buildings, taking cultural values and the technical possibilities of the renovated building into account.

The calculation methodology is described in the building regulations and includes heating, cooling, domestic hot water and energy needs for communal areas of the building, expressed in terms of bought energy. The minimum requirement of the overall U-value is calculated according to the standard EN-ISO 13790.

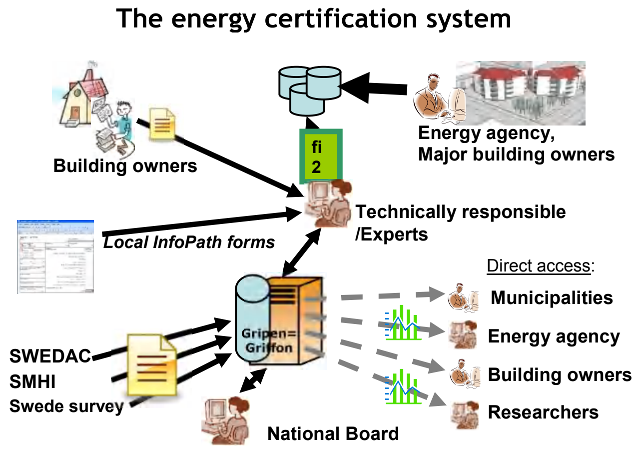


Figure 3 - Web based central registration system

The Independent Expert can make the declaration either directly online or save a file on a computer for later access to the central register. It is mandatory to send the declaration via the web based system; the Independent Expert can import data with an appropriate format from different systems owned by the building owner, and to access/ consult/ modify/ copy the documents and print the Energy Declaration online, for delivery to the building owner.

Quality assurance (QA)

In Sweden, Quality Assurance is taken into account within the Accreditation system, where ISO/IEC 17020 is the standard in use. According to this standard, the quality assurance system within the Independent Expert-company is the assurance of the quality of the work performed by the company.

CEX is found on
www.boverket.se

Swedish Energy Agency;
www.energimyndigheten.se

Information available in different languages

As accreditation of a company is based on a person in a leading position that is certified as an energy expert, according to the CEX regulations, the Quality assurance system of the company should certify that the other personnel have the same skills (training) as the certified person. The standard also sets the terms for dealing with complaints and handling documents and other tools that are needed to carry out the energy declaration of a building on different levels, depending what level the certified person is certified on (see section 4 below).

The requirement of expert skills is stated in the CEX (BFS 2007:5), see link above, and is the first stage in guaranteeing a high level of quality of the Independent Expert-company. Within CEX, the level of education, experience and suitability is graded into the three different levels below. Within the accreditation system, SWEDAC scrutinises all companies that intend to continue being accredited at least once a year, goes through their quality assurance programmes and other parts of their work, and also checks a specific number of the declarations issued by the company.

The check includes a full review of declarations, in order to ascertain accordance with the methodologies. If the company does not pass the examination of SWEDAC, its accreditation is withdrawn and it can no longer continue with its work. Furthermore, if the person certified as an energy expert leaves the company or the leading expert's personal certification is withdrawn, the company must stop issuing declarations, unless more than one certified person is employed in a leading position.

At the end of 2010, there are 371 registered companies. Three (3) companies have lost their accreditation due to malpractice. A further 38 companies have withdrawn their own accreditation, because this activity was not considered profitable, and for other reasons.

The target is to audit at least 8% of all the issued certificates every year by 2011, using simple and detailed checks.

3 > Inspections - Status of implementation

Regulations on "Compulsory ventilation check"

Sweden has adopted option b) on Article 8 of the EPBD, establishing a regular information campaign on boilers. The Swedish Energy Agency supports the regional and local energy offices with information material and they are currently holding informational meetings with building owners around the country.

The inspection of air conditioning systems in Sweden is included in the declaration system and is carried out at the same time and its records kept in the same register as the declaration. Inspections of air conditioning systems started together with the declaration system in 2007.

In Sweden, the Independent Expert is also responsible for carrying out inspections of air conditioning systems, if the certification of the leading person is at the Qualified or Air condition level (see section 4).

The set of required minimum information for the air condition inspections is defined in the Law (2006:985) on energy declaration for buildings. The Independent Expert must fill in at least the following information in the energy performance certificate:

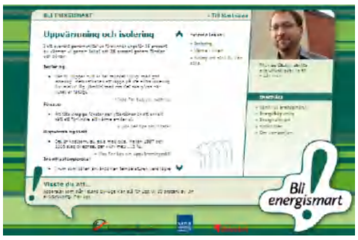
- the size of the installed system compared to the needs in the building, and
- whether a more energy efficient use can be obtained by altering either the whole system, change parts of or renovate the system.

Currently, air condition inspections follow the methodologies defined in EN14511-2 and EN15240.

The inspection of air conditioning systems takes place at least every 10th year or combined with every third (three years apart) compulsory ventilation check. If the inspection is coordinated, they are made every sixth or ninth year. Inspections are paid by the owner of the building.

At present, the system regarding air conditioning inspections collides with the compulsory ventilation checks but, with the new option in the recast of the EPBD, this conflict will be resolved. Currently, a certified ventilation controller does an inspection and his or her recommendation on energy efficiency improvements needs to be handed over to the Independent Expert, who in turn fills it into the inspection report of the air conditioning system.

4 > Qualified Experts



Examples of information sites from the campaign "Get Energy smart"

The experts issuing declarations must be employed in an accredited Independent Expert (company) with the competence stated in CEX. According to CEX, an energy expert must have passed a higher technical exam, and must have at least five years of experience, of which at least two years within the field of energy or indoor environment, in order to be deemed suitable. Experts can be certified on three different levels; Normal (for the simpler buildings), Qualified (for the more complex buildings) or Air-condition (for the buildings with only A/C checks) level.

Certification of energy experts.

In Sweden, four companies are accredited to certify energy experts. Certified energy experts can also work as specially acknowledged persons within the energy field, as sometimes it is prescribed by the municipality building board that they assist the person who is building or ordering a building to be built. Up until today, there are almost 1,000 registered energy experts on Boverket's website. Strangely enough, not all experts want to be registered.

Certified experts can act on a freelance basis, but not when it comes to the energy declaration of buildings. Then, they have to be part of an Independent Expert-organisation.

5 > National Information and Communication Campaigns

The need of informing citizens on energy and declaration

A campaign has been developed to increase public knowledge on energy efficiency. The campaign slogan, "*Bli energismart*!/Get Energy Smart!", was widely promoted in the press and on the Internet. The concept of energy declaration of buildings (BED) has also been promoted on TV and in appendices to the big national newspapers.

Boverket's website *www.boverket.se* provides detailed information about BED to supervising authorities, professionals of the sector, property owners and developers, and also to the general public. It includes information on qualified experts, the legislation and frequently asked questions. Detailed brochures as well as official texts are available on the national websites.

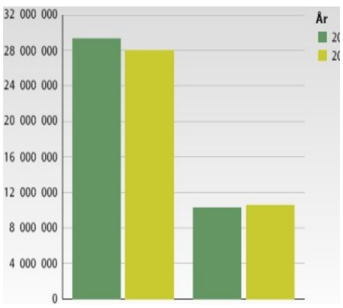
Progressively, the communication campaign was directed to the general public and owners of single family homes, as the last phase of EPBD implementation was reached (January 2009).

For the residential sector, Boverket has focused on real estate agencies and housing companies, to ensure that they were aware of the new requirements and to get their involvement and support.

www.omboende.se

People are now able to use the energy declaration as an additional factor, when making an investment decision, such as purchasing a house. Energy declaration is one of the few administrative processes that provide potentially useful information to the house owner, explaining what he or she can do to actually save money and improve thermal performance.

In Sweden, ordinary consumers also have a website launched by the National Board and the Consumers Agency, called *www.omboende.se*, (about living) which they can go to with questions concerning everything about their living conditions, in dwellings or privately owned houses.



Subsidies given to solar heat installations [SEK] left applied and right paid so far.

1 €~9SEK

6 > National incentives and subsidies

In Sweden, incentives and subsidies are administrated by Boverket and the statistics are published on *our website www.boverket.se*.

During the period 2008 to 2009, incentives and subsidies have been given towards different purposes, when it comes to using energy efficient systems. The yearly figures for 2010 are not yet ready at the time of publication of this report.

- For the installation of solar energy systems in private and public buildings 2.5 M€ in 2008 and 2.5 M€ in 2009 have been paid.
- For the change of windows in single family houses to windows of a U value better than 1.2 W/m2.K, a tax deduction of 4.8 M€ in 2008 and 5.9 M€ in 2009 has been made.
- During the years of 2008 and 2009, a tax deduction of 0.9 M€ in 2008 and 1.0 M€ in 2009 has been made for the installation of bio-fuel boilers in new single family homes.
- Subsidies for conversion to renewable energy projects in public buildings have been paid, amounting to 35.5 M€ in 2008 and 9 M€ in 2009.
- Subsidies of 1.8 M€ in 2008 have been paid for conversion to renewable energy projects in general.
- Subsidies for conversion from direct electric panels to another distribution system have been paid, amounting to 12.4 M€ 2008 and 9.8 M€ in 2009.
- Municipalities have been given support for planning purposes concerning wind power, of 2.6 M€ in 2008 and 2.1 M€ in 2009.

Presentation in Swedish of LÅGAN on

www.laganbygg.se

Further information on Swedish building industry

www.bygg.org

At the moment, a tax deduction of 50% is made to all building owners renovating their houses, amounting to up to 5,000 € annually/ building and owner.

The Energy Agency together with the Swedish building industry has launched a subsidy programme for low energy use, called "*LÅGAN*" (Low Energy Use/*LÅG energiANvändning*). This will hopefully provide further experience with the technique and its impact on other essential requirements.

The programme intends to

- encourage new construction of, and conversion to, energy-efficient buildings
- foster a national market for low energy use buildings, and
- assist the establishment of an existing national body of suppliers of products and services, and to create confidence in them.

7 > Impact of the EPBD at national level

Evolution of Minimum quality requirements in building regulations

The Minimum requirements for buildings have an old tradition in Sweden, as from the beginning of the 1950s there have been national requirements for buildings. Before then, there were already some local requirements.

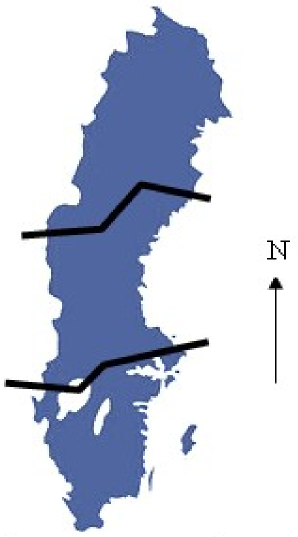
The biggest step towards the EPBD was taken in 2006, when the revised building code stated the maximum use of energy allowed in new buildings for the first time. With the legislation on the alteration or renovation of buildings, the regulations of 2006 also meant that there were to be demands on all buildings going through a renovation, irrespective of size.

Regulations regarding even more energy efficient buildings when heated with electricity were launched in 2009; the next step to be taken is to tighten the demands for all other buildings in 2011, with the aim of a revision in 2015 and 2018/2020 towards Nearly Zero Energy Buildings.

In 2002 the energy criterion was specified as a F_s-demand. The maximum specific energy F_s [W/m^2.°C] for residential buildings was $0.16+0.81*A_w/A_{env}$, where Aw is the area of windows and A_{env} is the inside area of the building envelope. For non-residential buildings, it was $0.22+0.81*A_w/A_{env}$, with a maximum measured area of windows of 18% of the heated area.

From 2006, maximum used energy and maximum U value have been set as requirements.

The building code is closely related to the energy declaration system, as the verification of compliance with the building code is done through an operational rating, taking place two years after the building is brought into use, just like the first declaration of the building in the energy declaration system. A less extensive verification can take place during the construction phase, where compliance can be checked using a calculated rating.



Approximate climatic zones

Requirements for residential buildings

	Residential buildings				Residential building electric heating[2]			
Climatic Zone	North	Middle	South	U $_{value}$	North	Middle	South	U $_{value}$
2006	130		110	0.5	95		75	0.5
2009	150	130	110	0.5	95	75	55	0.4
Proposed demands 2011	130	110	90	0.4	95	75	55	0.4

- Requirements in kWh/m^2 of final energy consumption
- U values in W/m^2.°C

Alternative validation in buildings smaller than 100 m^2

	Residential buildings		Residential building electric heating >50 m^2	
	2006	2009	2006[2]	2009
U $_{roof}$	0.13	0.13	0.08	0.08
U $_{wall}$	0.18	0.18	0.10	0.10
U $_{floor}$	0.15	0.15	0.10	0.10
U $_{Windows}$	1.3	1.3	1.1	1.1
U $_{doors}$	1.3	1.3	1.1	1.1
Air- Tightness	0.6 l/s. m^2		0.6 l/s. m^2	
Heat Recovery in ventilation[3]	70% temperature efficiency		70% temperature efficiency	

[2] Before 2009 only single family houses heated with electric panels
[3] In buildings between 60 and 100 m^2

Maximum installed electrical power for heating in residential buildings (kW)

Climate zone	North	Middle	South
Maximum installed Power [kW]	5.5	5.0	4.5
Addendum when A_{temp} > 130 m^2	0.035*(A_{temp}-130)	0.030*(A_{temp}-130)	0.025*(A_{temp}-130)

Requirements in non-residential Buildings

	Non- residential buildings				Non-residential building, electric heating[4]			
	North	Middle	South	U value	North	Middle	South	U value
2006	120		100	0.7				
2009	140	120	100	0.7	95	75	55	0.6
Addendum if q > 0.35 l/s.m^2 q_{max}=1.0	110*(<q>-0.35)	90*(<q>-0.35)	70*(<q>-0.35)	-	65*(<q>-0.35)	55*(<q>-0.35)	45*(<q>-0.35)	-
Proposed demands 2011	120	100	80	0.6	95	75	55	0.6

- Requirements in kWh/m^2 of final energy consumption
- U values in W/m^2.°C

Maximum installed electrical power for heating in non-residential buildings (kW)

Climate zone	North	Middle	South
Maximum installed Power [kW]	5.5	5.0	4.5
Addendum when q>0.35 l/sm^2	0.030*(<q>-0.35)*A_{temp}	0.026*(<q>-0.35)*A_{temp}	0.022*(<q>-0.35)*A_{temp}
Addendum when A_{temp} > 130 m^2	0.035*(A_{temp}-130)	0.030*(A_{temp}-130)	0.025*(A_{temp}-130)

After the proposed changes in 2011, the work towards Nearly Zero Energy Buildings continues. The first step is supposed to be launched in 2014 - 2015 and the second part will come into force in 2019 - 2021, depending on whether it concerns public buildings or others. The national environmental objectives stipulate energy savings of 20% by 2020 and 50% by 2050.

[4] Before 2009 only single family houses heated with electric panels

Other impacts

As of September 2010, over 280,000 certificates had been issued, since the scheme was launched in March 2007, in response to the requirements of the EU Energy Performance of Buildings Directive (EPBD).

In 2010, around 9,000 certificates for existing buildings are issued every month. The national database of declared buildings is growing and up to date information is added. The information will be useful in order to monitor progress of the implementation of the directive. Basic statistics, such as the number of certified buildings, including estimated savings, will be easier to obtain.

The database will also be used to produce information that is useful for the revision of the technical regulations, where a possible tightening of minimum requirements, as well as a change or optimisation of some operational rules, is possible.

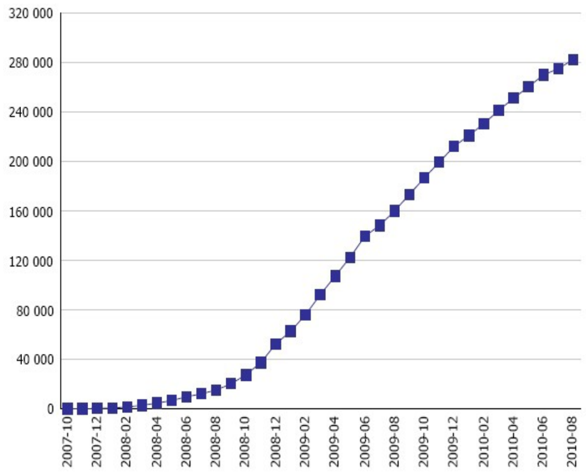


Figure 4 The accumulated amount of energy declarations in Sweden

Among the different categories included in the graph above, the three largest are approximately:

- 120,000 multifamily houses,
- 85,000 single family houses, and
- 30,000 non-residential buildings, public buildings included.

The average energy consumption per m^2 measured in these three categories was 146 kWh/m^2 in multifamily houses, 111 kWh/m^2 in single family houses, and 164 kWh/m^2 in non-residential buildings. The estimated savings potential in declared buildings is 15% in multifamily houses, 26% in single family houses and 15% in non-residential buildings.

8 > Conclusions and future planning

The EPBD requirements for new buildings and renovations will certainly bring important energy savings in the near future, although new and renovated buildings only represent a small share of the entire building stock in Sweden (around 4.5 million homes). Currently, less than 50,000 new apartments are built each year in Sweden. Therefore, the impact of applying energy performance requirements in new and renovated buildings is limited, within some years, however, renovation of the so called “one million dwellings program”[5] will start. Hopefully, it will have a significant impact on the reduction of energy consumption in the building sector.

[5] Between the end of the 1960s and the beginning of the 1970s, the so called one million dwellings programme took place, that is, one million new dwellings were built in ten years.

To achieve real energy savings in the building sector, the improvement of existing buildings is needed and declaration can play a fundamental role. The recommendations made by the experts in the declarations offer important help to building owners in making the right choices of measures for improving the energy efficiency of buildings. Concerns about the investment cost in using energy efficient technologies, though, can pose a major barrier.

On the one hand, a main challenge is training the public to be aware of its real energy use. Lack of awareness generally comes from two fronts: 1) consumers are not aware of the amount of energy they are currently consuming in their house. This makes it difficult for them to understand the benefits of sustainable technologies and 2) consumers are not aware of the sustainable technologies available.

On the other hand, additional training for qualified experts can improve their skills in making energy efficiency recommendations regarding the optimum financial and technological building improvement solutions.

The main challenges and future developments of the declaration system for the short and medium term, thus, are:

- Continued improvement of the informatics platforms that support the declaration system,
- Reinforcement of the quality of declarations, increasing energy efficient renovations,
- Continuous improvements of the compulsory ventilation check system,
- Encouragement towards the building of low energy buildings, so that the building regulations are evaluated and improved at four/five year intervals, in order to conform to the Zero Energy Buildings (NNE) system;
- Continued work on the implementation of the recast of the EPBD.

In the coming years, hopefully the new building code for buildings heated with other energy sources than electricity, as well as new regulations on the alteration or renovation of buildings will be decided. These proceedings are planned to start in October/November 2011 and an EU-notification is planned for spring/summer 2011. After that, the work towards Nearly Zero Energy Buildings will be increasingly stressed.

Sweden is launching a strategy in order to stimulate an investigation of the costs and impact on indoor and other essential requirements of buildings with lower energy use.

The Swedish standards organisation, SIS is also about to launch two new national standards on the classification of buildings, concerning installed power and energy use, SS 240 00-1 and SS 24000-2. In the future, these will be used to classify the declared building from A – G, in order to get an energy performance indicator and to set targets regarding the energy use of Nearly Zero Energy Buildings, in the next years.

Implementation of the EPBD in Slovenia

Status in November 2010

Marjana Sijanec Zavrl

GI ZRMK

Erik Potocar

MG

Slovenia

More Information Papers on other European activities can be found at:

www.buildup.eu

National websites:

http://www.mg.gov.si/

http://www.mop.gov.si/

EPBD related projects:

http://www.gi-zrmk.si

detailed methodology (2009):

http://www.mg.gov.si/si/zakonodaja_in_dokumenti/energetika/veljavni_predpisi/podzakonski_akti/sprejeti_podzakonski_akti_energetika/

1 > Introduction

In Slovenia, the EPBD has been transposed into national legislation by the Building Construction Act, the Environmental Protection Act, and by the amended Energy Act (17th of November 2006). The secondary regulation on new minimum requirements, calculation methodology, feasibility studies and regular inspection of A/C systems was promulgated in 2008, while the regulation on energy performance certification was accepted in 2009. The training and licences for independent experts working on building energy certification and inspection of A/C systems, as well as the protocols related to the registry of certificates, were defined in detail in the 2010 regulation. The regular inspection of boilers was implemented by an existing scheme and upgraded in November 2007.

Recently, the revision process of the current legislation has been launched, in order to accommodate some of the requirements of the recast of the EPBD in 2010. At the same time, Slovenia started the process of establishing and improving the certification process.

This report presents an overview of the current status of implementation and insight into the plans for further evolution of the EPBD implementation in Slovenia. It addresses certification and inspection systems, including quality control mechanisms, training of qualified experts, information campaigns, incentives and subsidies.

2 > Certification

In Slovenia, the energy performance certification of buildings is the responsibility of the Ministry of Energy, while the minimum requirements and calculation methodology are the responsibility of the Ministry of Environment and Spatial Planning, within the framework of design building codes.

The regulation on detailed methodology for the energy performance certification of buildings was promulgated in November 2009 (link at left), after a one year period of public consultation. It defines the certification protocols for new and existing buildings, methodology for residential and non-residential buildings in case of sale and rental, as well as the procedure for the public display of the certificate. The regulation determines when asset and operational ratings are to be applied. It also defines the electronic database of energy certificates and the responsibilities in relation to the database.

The regulation on the training, licensing and register of licenses of independent experts for energy performance certification of buildings was drafted in November 2008, and accepted in January 2010.

Certificates for new buildings and public buildings are obligatory since the 1st of January 2008. **Large public buildings** have to provide EPCs and publicly display the certificates, from January 2008 and by December 2010 at the latest.

An EPC can be issued either for part of the building (flat or residential and non-residential unit) or for a building as a whole.

According to the law, the EPC has a status of a public document, so it can only be issued by authorised organisations and elaborated by licensed experts. The validity of energy performance certificates is 10 years. A new certificate can be issued upon request of the building owner; i.e., this is recommended after the implementation of RES and RUE measures. According to the Energy Act, the maximum price of the energy performance certificate shall be defined by the ministry in the future.

An asset rating certificate is considered for all new buildings and for existing residential buildings. The calculation procedure is based on SIST EN ISO 13790 and defined in detail by the technical regulation. Operational rating certificates are foreseen for all the other buildings.

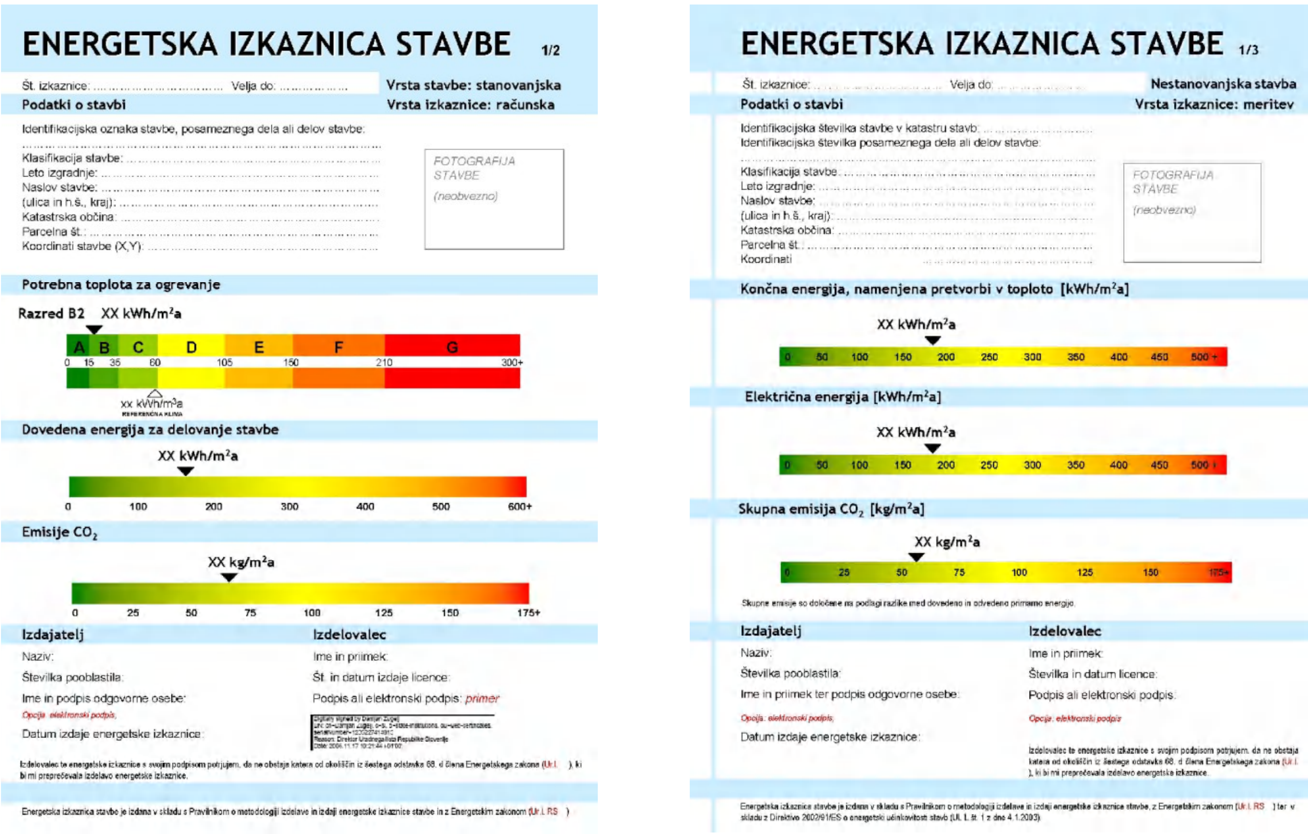


Figure 1. Energy performance certificate calculated indicators (left), and measured indicators (right).

Asset rating certificates contain three indicators of equal importance. The indicators reflect:

- building architectural concept and thermal quality of the envelope (energy needs for heating),
- final energy use (delivered) for HVAC systems and lighting, as well as
- related CO_2 emissions.

Classes are:

A1 – 0 to 15 kWh/m².year

A2 – 10 to 15 kWh/m².year

B1 – 15 to 25 kWh/m².year

B2 – 25 to 35 kWh/m².year

C - 35 to 60 kWh/m².year

D - 60 to 105 kWh/m².year

E - 105 to 150 kWh/m².year

F - 150 to 210 kWh/m².year

G - above 210 kWh/m².year

Energy efficiency classes are foreseen in asset rating, based on the first indicator, i.e., on energy needs for heating (kWh/m^2.year), where 7 classes from A-G are defined. Classes A and B are also split in two sub-classes.

The second indicator covers the final energy (kWh/m^2.year), delivered for space heating and cooling, hot water preparation, and operation of ventilation systems, (de)humidification and lighting.

The third indicator is a CO_2 indicator (kg/m^2.year), calculated from primary energy demand. All three indicators are presented on the front page of the certificate, in a coloured scale.

An operational rating certificate is considered for existing non-residential buildings (based on SIST EN 15603). The core indicators in operational rating are:

- final energy for heating (kWh/m^2.year),
- electricity consumption (kWh/m^2.year) and
- CO_2 indicator (kg/m^2.year).

The indicators are presented with the use of a sliding scale.

In the case of existing buildings planned for sale and public buildings, energy efficiency measures are required to be included in the certificate. Generic recommendations are acceptable.

Currently, there are no explicit requirements for energy class in the case of new buildings and major renovation. However, many Slovenian public and private investors tend to follow green (public) procurement guidelines and designs, or purchase B2, B1 or A class buildings. Together with the minimum requirements from July 2010 (PURES-2 2010), on the efficiency of systems and share of RES, these buildings may be considered as being in line with the EPBD Recast targets.

In the case of **new buildings**, if sold before construction works are completed, a summary of energy performance indicators is used as an energy performance certificate (i.e., design rating). This summary is a part of the design documentation submitted with a request for a building permit (in place since 2002). When the building is completed, the investor must replace the summary with the official certificate. An asset rating energy performance certificate must be issued for new buildings and submitted together with the rest of the documentation in the application for a usage permit.

All **existing residential and non-residential buildings** need to be certified when they are sold or rented. The owner must present a valid certificate to the buyer before the selling or renting contract is established. Certificates for residential buildings always use calculated energy ratings, while certificates for non-residential buildings use measured energy ratings, but calculated certification is also possible, in case of incomplete and unreliable measured data. This involves a qualified expert visiting the property and assessing the building, with the support of plans of the building as it is built (required along with the certificate) and of various additional energy related studies (i.e., energy audits, meter readings, IR thermography, blower door test, etc.). These studies are voluntary but, if existing, they must be submitted to the qualified expert. The QE will then either calculate the thermal efficiency of the building or analyse the measured energy consumption data and, finally, issue the certificate.

The typical cost of certificate for a single family house corresponds to one day of expert's work, i.e., between 300 € and 500 €. In general, the cost of certification is subject to the size and complexity of the building, as well as the quality of the available technical documentation.

The calculation methodology

In order to demonstrate compliance with the minimum requirements, the calculation of the energy performance of buildings was updated in July 2010 (replacing the 2008 regulation), through the promulgation of a new version of the Regulation on efficient use of energy in buildings (PURES-2 2010, from July 2010)

2010 regulations: PURES-2 2010

http://www.mop.gov.si/si/zakonodaja_in_dokumenti/veljavni_predpisi/zakon_o_graditvi_objektov/

and obligatory technical guidelines for construction TSG-1-004: 2010 Efficient use of energy. PURES-2 2010 has already covered some elements of the EPBD Recast transposition, i.e., the implementation of CEN EPBD standards in the calculation methodology and the setting of minimum requirements for very low energy new buildings and public buildings, respectively.

The calculation methodology is based on SIST EN ISO 13790 and the respective set of CEN EPBD standards, with some national adjustments. It includes the energy needs for space heating and cooling, hot water preparation, and energy for operation of ventilation systems, (de)humidification and lighting. The methodology calculates energy needs, expressed in terms of both delivered and primary energy, as well as CO_2 emissions.

The respective software has been developed by various market actors (currently three tools are finished, additional ones are in progress). The tools are available on the market free of charge. Frequent trainings for software users are on-going since 2009. Additional effort was put into the preparation of climatic data (climatic data available in a 1 km mesh since 2007), due to the considerable regional variety in climate.

http://www.geodetska-uprava.si/DHTML_HMZ/wm_ppp.htm

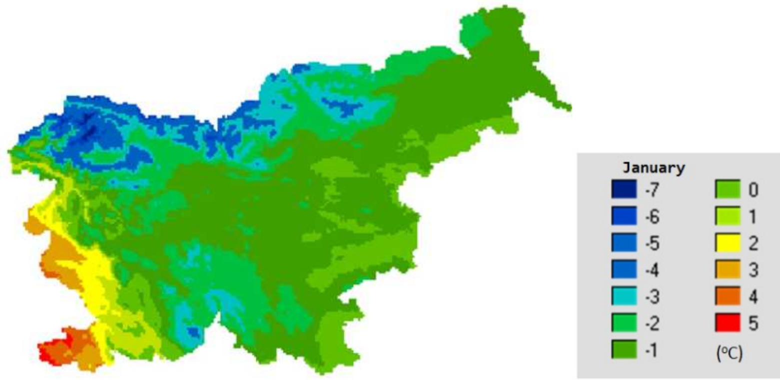


Figure 2. Average January temperature of air (°C) from 1971-2000

Minimum requirements

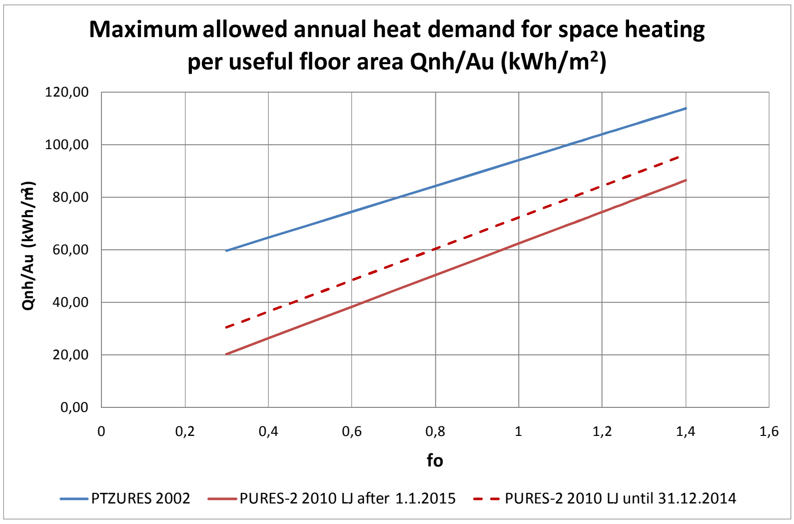
New buildings

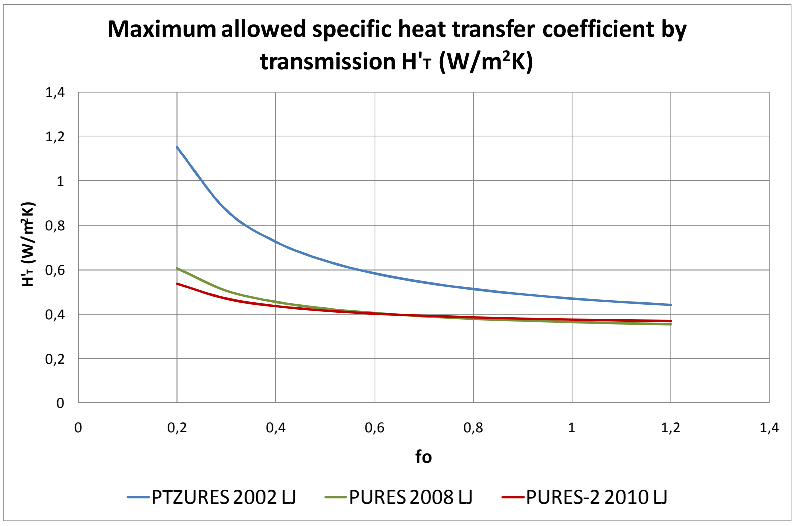
The definition of minimum requirements, in line with the EPBD Recast, was the aim of the revised Regulation on efficient use of energy in buildings (valid from July 2010, and fully in force after January 2011). Minimum requirements are expressed using performance based requirements, energy related requirements and detailed technical requirements for the building components and systems.

Performance based minimum requirements are focused on bioclimatic architectural concept, low energy envelope with high air-tightness, and treating thermal bridges by limitation of linear thermal transmission coefficients (therefore the simulation of thermal bridges is becoming a frequent design practice). A special set of minimum requirements refers to the energy efficiency of components and systems. As requested in the EPBD Recast, it is required that before the design of HVAC systems, the potential of shading, passive cooling and night ventilation is utilised. Mechanical ventilation with heat recovery is not a mandatory technology, but in practice it is needed for buildings with energy class B and above.

The compliance with the PURES – 2 2010 regulation is demonstrated by fulfilling the following energy related minimum requirements: maximum allowed specific transmission heat losses (Ht'), maximum annual heat demand for space heating and, for residential buildings, also for cooling (Qnh, Qnc), maximum primary energy for operation of the energy systems (HVAC and lighting) – for residential buildings, maximum U-values of the envelope elements. Public buildings must comply with 10% more severe requirements. Energy related minimum requirements (Qnh) are imposed in two steps: for the period from 2010 to 2014, and for the period beyond the year 2014 – see Fig. 3.

The use of RES is mandatory in all new buildings since 2008, i.e., min. 25% of total final energy use for operation of the energy systems in the building must be covered by RES. Alternatively, the RES requirement is considered to be fulfilled also if the share of RES used for space heating and cooling and DHW is obtained in one of the following ways: 25% from solar energy, 35% from gas biomass, 50% from solid biomass, 70% from geothermal energy, 50% from heat from the environment, 50% from CHP, 50% from energy efficient district heating/cooling; or if the building demonstrates at least 30% lower annual heat demand than defined in the minimum requirements; or by installation of solar collectors for hot water (min. 6 m^2/residential unit).





minimum requirements for the envelope:

walls	0.28 W/m^2K
floors between flats	0.90 W/m^2K
flat roofs	0.20 W/m^2K
windows	1.3 W/m^2K
glazing	1.1 W/m^2K
doors	1.6 W/m^2K

Figure 3. Minimum requirements for annual heat demand for space heating and specific heat transfer coefficient by transmission for new buildings from the PURES-2 2010 regulation, in comparison to the previous regulations.

Additional minimum requirements refer to maximum U-values of building envelope and windows and to the air-tightness of the envelope (n_{50} < 3.0 for natural ventilated buildings and n_{50} < 2 for buildings with mechanical ventilation with obligatory heat recovery).

A comprehensive list of requirements refers to energy efficiency characteristics of installations. Heat recovery in ventilation must be used due to the strict requirements for maximum allowed ventilation heat losses. The minimum required heat recovery in ventilation and/or A/C systems is 65%, and 75% in low energy buildings. Individual electrical heaters for domestic hot water are not acceptable, unless economically reasonable. Low temperature heating systems (max. 55^0C), as well as condensing gas boilers, are obligatory in new buildings. Heat and cold must be metered per individual unit. Additional requirements for cooling refer to obligatory shading of the envelope and to efficiency requirements for cooling systems.

The minimum requirement for lighting defines maximum allowed specific power of lighting devices per building category. Energy saving lamps are obligatory, and only a maximum of 20% of lighting may be covered by incandescent light bulbs.

At the design stage, it is obligatory to prepare a "summary of thermal characteristics of the building", where the main building and system characteristics and energy and CO_2 indicators are given. After the building is completed, the calculation and "summary" have to be repeated (by the designer, for the building as built), as this is the proof for final control of compliance with the regulation. Fulfillment of minimum requirements has to be demonstrated in the design in order to obtain a building permit, and when the building is built, when applying for a use permit for the building. This is the core technical documentation used in the next step by the independent expert preparing the energy performance certificate.

Building renovations

Minimum requirements apply to all new buildings, as well as to **major renovations**, i.e., if at least 25% of the surface of the building envelope is subject to major renovation. The minimum requirements for major renovations must be implemented regardless of the size of the building (the 1,000 m^2 EPBD limit is not used).

If a **renovation** (i.e., a building permit is needed) is limited to less than 25% of the thermal envelope surface, in case of investment maintenance works on the building envelope and in case of buildings smaller than 50 m^2, only the minimum requirements for U-values of the envelope must be considered (i.e., an additional insulation layer will be mandatory).

In case of major **renovation of the heating system** and in case of maintenance and replacement works, minimum requirements for the systems, subsystems and elements of the same level as required for new buildings are to be implemented.

Quality assurance (QA)

The training of experts is the first stage to guarantee the system's high level of quality. A specific training course with high passing grades in the exam is required. Training courses and exams for qualified experts for energy performance certification are run by authorised organisations. Obligatory training (of up to 30 hours in duration) covers the following topics: regulation on energy certification of buildings, special topics related to energy efficiency of building elements and systems, brief information on calculation and measurement rules, and evaluation of energy efficiency data for the certificate, recommended measures, certification protocols and issuing procedures. Basic knowledge about energy flows in buildings is not a subject of the training, as candidates are professionals with a university technical degree in architecture and engineering. The preparation of the training material is coordinated at the state level.

The second stage to guarantee the EPC's quality is an automatic system software check of the data input (feasibility check), in order to avoid potential mistakes before even issuing it.

After the EPC is issued, the ministry will establish QA checks, which will include a full data review of calculations and/or a building audit, in order to check the accordance with the requirements and methodologies.

The quality of the certificates will be assured by checking some 3% of the issued EPCs. The electronic database with EPCs' energy indicators, collected during issuing of certificates, will be used. The implementation of a comprehensive quality assurance system based on the electronic data base is planned for 2012.

3 > Inspections - Status of implementation

The regular inspection of boilers has already a long tradition in the existing scheme operated by chimney sweepers. The new scheme is covered by the Decree on the procedure, topic and conditions for the execution of obligatory state economy public services of performing measurements, inspection and cleaning of boilers, chimney ducts, and ventilation ducts, aiming at the protection of the environment and efficient use of energy (Official Journal, Nr. 105-5223/2007, 19th of November 2007). The decree defines the frequency of regular inspections of boilers, the extent of the service, the conditions for allocation of concession to chimney sweeping companies, together with the professional requirements for the experts implementing the service, and it defines the protocols for the service related database. 350,000 boilers per year are inspected under this scheme.

The regular inspection of A/C devices is defined in the regulation on obligatory inspection of air-conditioning devices (Official Journal, nr. 26/2008, from the 17th of March 2008). Regular inspection is needed every 5 years; phased implementation is planned for new A/C systems from the 25th of March 2008 and for existing A/C systems from the 1st of October 2009 to the 1st of October 2012, depending on the age of the A/C system and the available technical documentation (no documentation is a reason for inspection in the first term). The inspection of A/C devices is planned to begin by the end of 2011.

4 > Qualified Experts

According to the Energy Act, the energy performance certificates and inspections of A/C devices can only be done by qualified experts.

The Energy Act defines obligatory qualification for assessors working on energy performance certification; i.e., educational profile and degree; obligatory training course and exam are the preconditions for the state license for assessors. Regular additional training and exam (once every 5 years) is necessary to maintain the license.

The obligatory qualification of assessors for energy performance certification is an engineering degree in technical studies and/or architecture (5 years study and/or 3 years professional study and diploma in technical education - engineering or architecture). A minimum of 5 years of working experience in candidates' own professional area is a precondition required for the license. In addition, qualified experts must attend the obligatory training course and pass a demanding national exam that evaluates their knowledge on the technical requirements of the building regulations and the details of the certification system itself.

The Energy Act also defines the requirements for qualified experts for the inspection of A/C systems. The obligatory qualification of assessors is a professional degree in mechanical engineering or electrical engineering (5 years study and/or 3 years professional study and professional diploma in technical education - engineering or architecture); a minimum of 5 years of working experience in candidates' own professional area and successful completion of the obligatory training and exam are the other two preconditions required for the license.

The regulation on training, licensing and registry of independent experts for energy performance certification of buildings defines in detail the topics of obligatory national training for experts, while the Regulation on training, licensing and registry of independent experts for regular inspections of A/C systems defines the same protocols for A/C inspection. The process of selecting the authorised institutions that will organise trainings for a period of 3 years (one institution for each field) is in progress in 2010.

Energy certificates are to be elaborated by licensed independent experts and issued by authorised organisations. The licenses of the experts will be issued by the end of 2012. The database of licensed experts is to be part of the certification data base (planned for 2012).

Currently, as a part of phased implementation of certification, new buildings are covered with a document called "summary of thermal characteristics", which corresponds to a design rating. All authorized engineers issue such a document as a part of design documentation.

The Energy Act has also imposed a set of protocol requirements that contribute to the Quality Assurance:

- Independence of assessors: he/she shall refuse an order for certification in cases defined by the regulation, due to general administrative procedures: if he/she is employed by a customer or by the person placing the order for certification; if he/she performs payable services for the energy certification client.
- The assessor must issue a statement to the client, stating that he/she meets all the conditions to issue the energy certificate and has no legal impediments to do so.
- The ministry may withdraw the authorisation if an organisation issuing certificates does not fulfill the prescribed conditions.
- The ministry will have the possibility to withdraw an independent expert's license if he/she issues incorrect certificates, and does not respect the conditions regarding independence.

5 > National Information and Communication Campaigns

The need of informing citizens on certification

The Ministry of Economy provides detailed information about EPBD related activities to professionals of this sector, property owners and developers, and also to the general public through different promotion activities. Detailed brochures, as well as official texts, are available on the national websites.

Information campaigns on the certification system have primarily been focused on municipalities, technical experts and professionals in the building sector. In 2011, the ministry intends to organise training meetings for the technical staff of municipalities.

During the last two years, the EPBD was presented in more than 200 events, fairs, seminars and workshops where the certification process was disseminated and awareness among citizens, regarding the added value of buildings' certification that is based on clear and reliable information on the thermal quality performance of houses was promoted.

The aim of the promotion of energy performance certification is to influence the end users in decision-making, i.e., through better knowledge and understanding of the certificate. With the promotion of the certificate, the authorities would like people to be able to use the energy performance certification rating as an additional factor when taking an investment decision: the purchase of a house. It is one of the few administrative processes that provide potentially useful information to the owner of the house, explaining what he/she can do to actually save money and improve thermal comfort.

6 > National incentives and subsidies

Various programmes are in place in Slovenia, through which non-returnable funds are available to promote energy efficiency in buildings and installation of renewables.

The financial incentives currently available are defined in the Operational Programme for Developing Environmental and Transport Infrastructure. Sustainable use of energy is a development priority in Slovenia. The main priority areas for allocation of financial support are:

- energy refurbishment of existing buildings and sustainable new buildings in the public sector (low energy, passive buildings, energy efficient HVAC, decentralised RES based energy supply),
- efficient use of electricity in the industrial, public and tertiary sectors,
- innovative systems for local energy supply, large and medium district heating based on RES and CHP,
- demonstration projects, information, energy advisory service (in support towards the above targets).

Cohesion Fund financing is being used for the above priorities, in the form of non-returnable subsidies to promote district heating systems operating on wood biomass (solar collectors are also included as an eligible cost), as well as large wood biomass boilers in industry. The greatest share of subsidies for obtaining electricity from renewables will be used for biomass, which will also account for the highest share of long-term employment for operation and maintenance, including the jobs necessary for preparing fuel (wood biomass). Additional subsidies for the energy restoration of buildings and low energy new buildings, facilitating the EPBD Recast targets on RES and RUE in buildings, are in preparation – targeting **public buildings**: school buildings, buildings for research and homes for elderly people.

Eco fund – a Slovenian environmental public fund - gives subsidies and soft loans also for energy renovation of existing residential buildings and construction of very low energy new residential buildings. Most of the subsidies are given for building components and systems based on the technical data in the required EPCs. In 2010, the subsidies from the state budget were increased with financial contributions from energy distributors. Based on the ESD directive, utilities are obliged to allocate part of their income to financial instruments for improving energy efficiency.

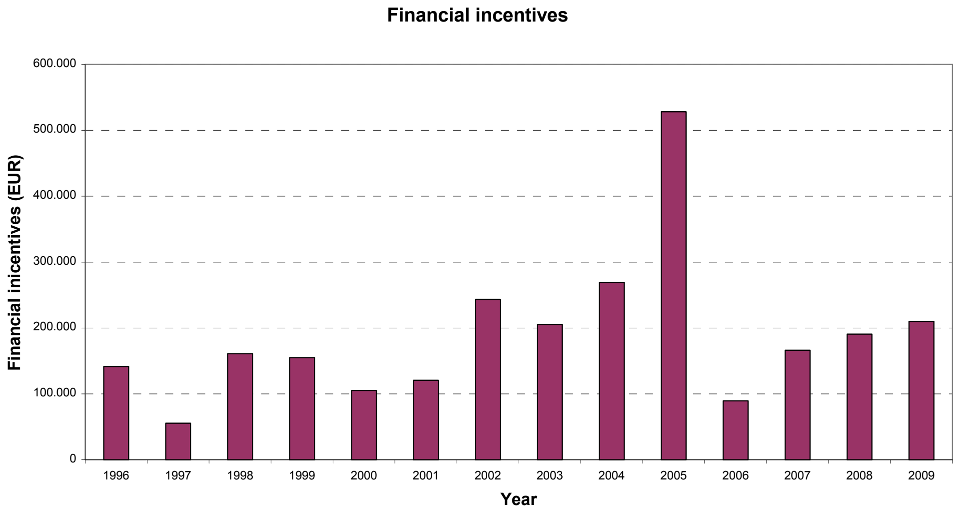


Figure 4. Annual state subsidies for households allocated for renovation measures (Source: National Eco fund: http://www.ekosklad.si/)

In 2011, subsidies for various new investments in RES and RUE in **family houses** and **apartment buildings** are available (budget of 12 M€ in the current call) – i.e., measures like solar systems for DHW, biomass heating system, heat pump for DHW and/or space heating, installation of central heating, if energy refurbished building is connected to RES based district heating, replacement of windows (wooden frames), thermal insulation of walls and roof, installation of mechanical ventilation with heat recovery, thermostatic valves and hydraulic balance, heat metering and billing, construction or purchase of a low energy and/or passive house (max. 125 €/m^2), buying of a flat in an apartment building built or retrofitted in passive house technology (max. 250 €/m^2 for the end user). The indicative level of the subsidy is 25% of eligible costs. A complete design documentation of the building is required for approval of eco fund subsidy.

7 > Impact of the EPBD at national level

The EPBD minimum requirements for new buildings and major renovations are certainly going to have a strong impact on energy savings in the near future in Slovenia. The impact of the EPBD at the national level will increase with the transposition and implementation of the EPBD Recast.

Some requirements of the EPBD have already influenced the Slovenian market of energy efficient buildings. The implementation process of energy performance certification has stimulated a much better understanding of the energy indicators of buildings. The well promoted process of transposition and implementation of the EPBD, the availability of state subsidies for energy refurbishment and construction of very low energy and passive buildings, and a series of EIE projects supporting the EPBD transposition, have stimulated the significant change in the building sector.

The pilot phase of energy performance certification (2002-2009) resulted in 130 pilot certificates issued, mostly for typical or sample buildings, with a total of over 2,000 flats. More recently, since the promulgation of the EPC regulation (2009), many Slovenian public and private investors decided to optimise the building energy performance, so as to reach B2, B1 or A class. With the economic and real-estate crisis, building energy efficiency and the integration of RES became a very important criterion for purchase. The general knowledge of end-users has been significantly improved during the EPBD transposition. The market of energy efficiency products and technologies is rapidly growing. However, additional effort is needed to upgrade the standard procurement protocols and traditional design, maintenance and renovation procedures using RES and RUE criteria.

8 > Conclusions and future planning

The following activities are planned for the short and medium term in relation to EPC:

- Intensive training of independent experts for energy performance certification and regular inspection of air-conditioning systems
- Establishment of the more comprehensive quality control system
- Development of electronic database and software support
- Establishment of database of energy indicators and, based on that, provision of feedback regarding the energy indicator ranking per different building types (as needed, in the case of complex and mixed use buildings)
- Validation of calculation tools

CONCERTED ACTION
ENERGY PERFORMANCE
OF BUILDINGS

Implementation of the EPBD in the Slovak Republic

Status in November 2010

Zuzana Sternová
TSÚS

Jana Bendžalová
TSÚS

Ján Magyar

Slovak Republic

National websites:

- *www.inforeg.sk*
- *www.tsus.sk*
- *www.build.gov.sk*
- *www.mhv.sk*
- *www.sksi.sk*

1 > Introduction

Since the last report was published in March 2008, many developments have taken place. The implementation of the EPBD started in 2006 with the Act N° 555/2005 Coll. on the Energy Performance of Buildings. It came into force on the 1st of January 2006. The execution order for this Act, which was published as a Decree of the Ministry of Construction and Regional Development of the Slovak Republic (MVRR) N° 625/2006 Coll., came fully into force on the 1st of January 2007. A design rating became from then onwards a requirement for obtaining the building permit. A new Decree of the MVRR came into effect on the 1st of October 2009 and the corresponding regulation was published in December 2009. The energy certificates became obligatory for the buildings sold and rented after the 1st of January 2008, and for new and renovated buildings, for which permits were issued after the 1st of January 2008.

Full responsibility for initiating the process of implementation of the EPBD for buildings was with the MVRR. On the 1st of July 2010, the MVRR SR merged with the Ministry of Economy, but from the 1st of November 2010 construction and regional development issues fall under the responsibility of the Ministry of Transport, Construction and Regional Development (MDVRR). In addition, the competence for the certification of the energy performance of buildings (as a new competence in the SR altogether) from the 1st of November 2010 belongs to this Ministry.

The Ministry of Economy is also responsible for the regular inspection of boilers and air-conditioning systems in buildings (further information is available in section 3).

The revision process of the current legislation should be launched in 2011, in order to accommodate the requirements of the recast of the EPBD and to improve the certification process, based on the experience from the last 3 years.

This report presents an overview of the current status of implementation and of the plans for evolution of the implementation of the EPBD in the Slovak Republic. It addresses energy certification and inspection of heating and air-conditioning systems, including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies. The institutional framework is shown in Fig. 1, together with all the interrelations and duties of participants in the process of energy certification of buildings.

2 > Certification of buildings

In the Slovak Republic, the implementation of the EPBD is the overall responsibility of the Ministry of Economy together with the Ministry of Transport, Construction and Regional Development (MDVRR). SIEA, the Slovak Innovation and Energy Agency, is designated for monitoring and reporting on the process of the improvement of energy efficiency. The MDVRR currently supports the entire certification system, which is based on a central registry of energy certificates. The database of buildings is maintained by the TSÚS (*Technicky a skusobny Ustav stavebny* - Building Testing and Research Institute, n.o.), an institute which is involved in research and prepares the documents on the energy performance of buildings.

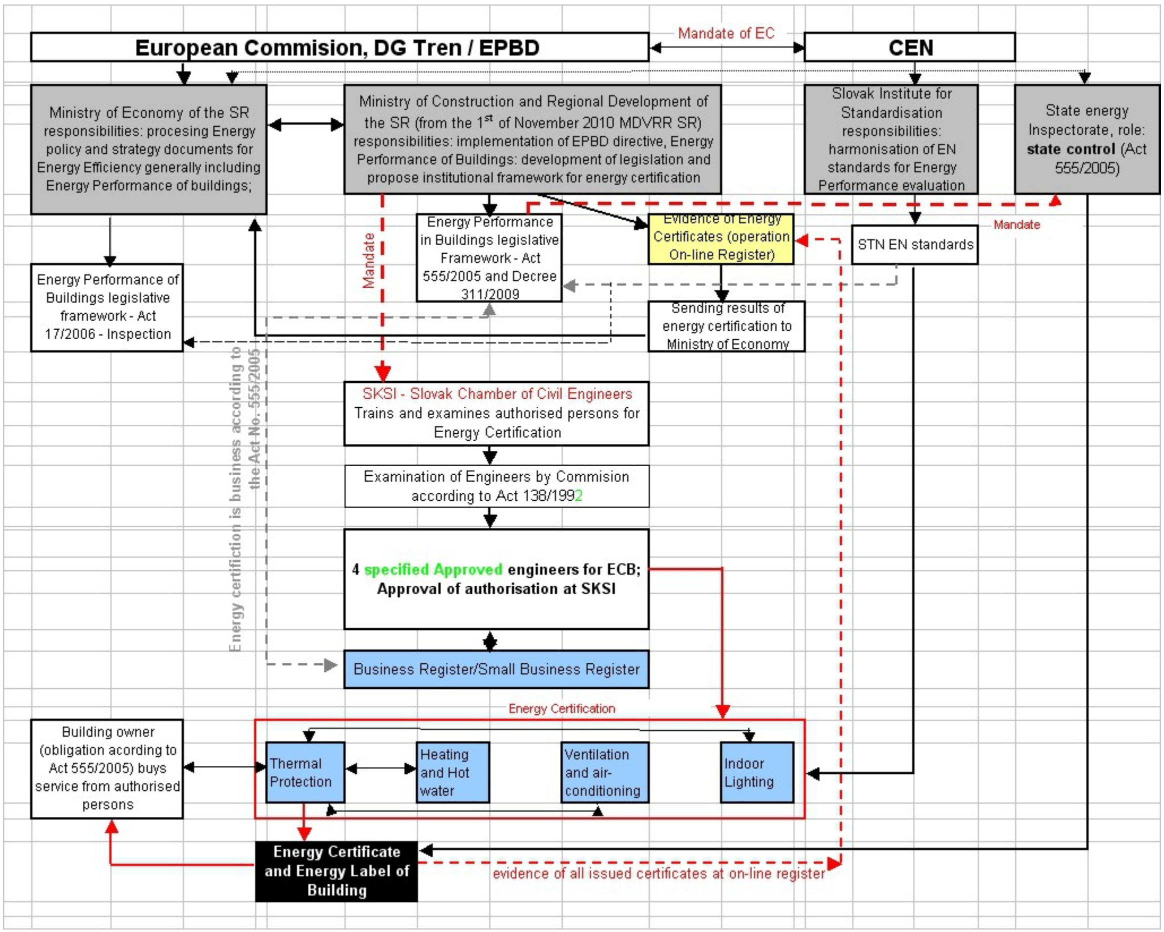


Fig. 1 - Institutional framework

The Energy Certification of Buildings (ECB) came into force on the 1st of January 2008. This milestone marked the beginning of a new phase in the current legislation on energy efficiency of buildings in the Slovak Republic, since the Act N°555/2005 Coll. was published on the 8th of November 2005.

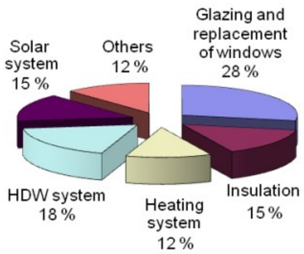
The implementation of Energy Certification of Buildings started for various categories of buildings (family houses, apartment buildings, office buildings, educational buildings, hospitals, hotels and restaurants, buildings for sport, buildings for trade and services, as well as mixed use buildings) at the same time, on the 1st of January 2008, for newly constructed, major renovated, and sold and rented buildings. On the same date, the requirement of labelling public buildings larger than 1,000 m^2 came into effect. Each building, except for those listed in the law (that is, constructed prior to the year 1947, monuments, buildings of historical and architectural heritage, buildings used less than 4 months per year, and with a total floor area of less than 50 m^2), is assigned an energy class according to its

Energy Class	Energy class boundaries
A	EP < 0.5 Rr
B	0.5 Rr□□□EP < Rr
C	Rr □□EP < 0.5 (Rr + Rs)
D	0.5 (Rr + Rs) □ EP < Rs
E	Rs□□□EP < 1.25 Rs
F	1.25 Rs □ EP < 1.5 Rs
G	1.5 Rs □□EP

Rr - requirement
Rs - average building stock
For Rs ≃ 2.Rr, current values:

Energy Class	Reference Consumption
A	< 50%
B	≥ 50 - 100%
C	≥ 100 - 150%
D	≥150 - 200%
E	≥ 200 - 250%
F	≥250 -300%
G	> 300%

Typical recommendations proposed by the experts



energy rating (in kWh/(m^2.a). The scale is set as shown in the table on the left, based on EN 15217. Reference values R_r and R_s are set for each building category and it is assumed that the average building stock energy consumption (R_s) is presently approximately twice of that according to the requirement (R_r). Certificates are issued by Qualified Experts (QE). QEs are engineers qualified and recognised by their professional association (see further information in section 4). The list of Qualified Experts is continuously updated and always available to the public online on the Slovak Chamber of Civil Engineers website.

The energy performance of buildings certificate

The Energy Certificate (EPC) is the most visible aspect of the Energy Certification of Buildings. The energy label is a copy of the first page of the EPC intended for display at a highly visible place in the building. This document assigns an energy performance to residential and non-residential buildings. The Energy Certificate consists of 8 pages. The energy rating is based on a calculated standardised energy rating or, after the ministerial decree, it is also possible to use the operational rating.

The energy rating includes all forms of energy consumption: energy use for heating, hot water, cooling, ventilation and lighting. The global indicator is the total delivered energy (energy use). The scale is based on the same principle for all building categories. The scale is also set separately for 4 consumption types (heating, HW, ventilation and cooling, and lighting), besides the main global indicator. Scales for the 4 energy consumption types are also reported in the certificate (see left part of the EPC in Fig. 2).

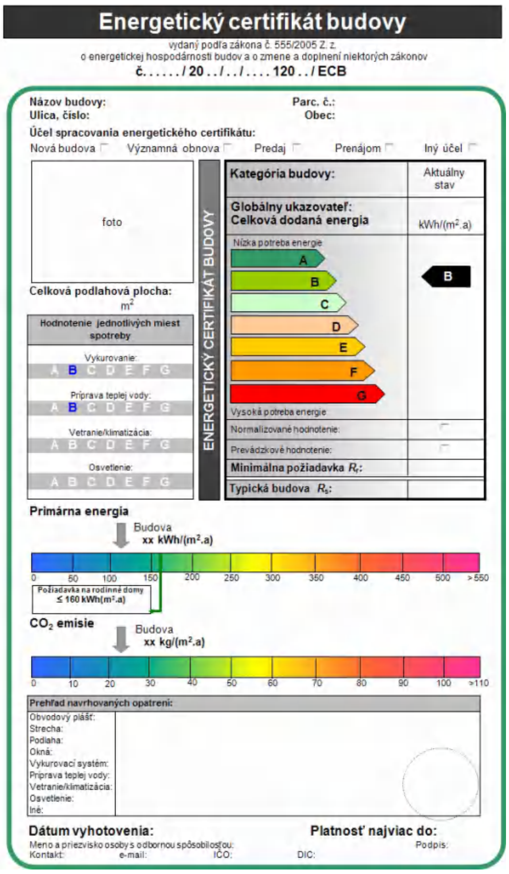


Fig. 2 - Cover page of the EPC

Additionally, primary energy and CO_2 emissions are calculated and the results are presented in the energy certificate. Family houses meet the requirement of energy performance, when the primary energy is ≤160 kWh/m^2 of the total floor area, ≤126 kWh/m^2 for apartment buildings and ≤240 kWh/m^2 for office buildings.

The energy certificate assigns buildings an energy class ranging from A (high energy efficiency) to G (poor efficiency).

Table 1 - Scales for Classes of Energy performance delivered energy in kWh/(m^2.year)

Building Category	Energy performance of building classes						
	A	B	C	D	E	F	G
Educational buildings	≤ 42	43-84	85-124	125-163	164-204	205-245	> 245
Hospitals	≤ 101	102-201	202-293	294-385	386-481	482-578	> 578
Hotels and Restaurants	≤ 94	95-187	188-275	276-363	364-454	455-545	> 545
Sports facilities	≤ 48	49-95	96-140	141-184	185-230	231-276	> 276
Buildings for trade and services	≤ 81	82-161	162-237	138-313	314-391	392-469	> 469

For family houses and apartment buildings, only the energy use for heating and domestic hot water are taken into account for calculating the energy rating.

The real benefit of the Energy performance certification is its influence on the decrease of energy consumption from the use of buildings, mainly due to heating (40 – 60%), and in the recommendations given to the building owner. These are summarized on page 1 of the energy certificate. Measures for the improvement of energy performance are proposed separately for thermal protection and for each type of energy consumption on pages 3 – 7 of the energy certificate (EPC), together with the results of a standardised calculation and energy rating. As shown below, some of the suggested improvements are included on the last page of the EPC with a short description, estimates of savings, also possible paybacks, and the impact on the energy rating if the proposed measures were to be implemented. The recommendations are specific recommendations proposed by the Qualified Expert in regard to the rated building.

Energy certificates are valid for a maximum of 10 years.

BUILDING ENERGY CERTIFICATE

Building:	Example building		
Street, N°:	Green 10	**City:**	Aloe
Building category:	Apartment building		

Calculation method: monthly

Potential for energy saving after realisation of proposed measures

Construction / system	Energy need/use Actual state kWh/(m^2.a)	Energy need/use After realisation of proposed measures kWh/(m^2.a)	Energy savings kWh/(m^2.a)	Energy savings %
Energy need for heating	**87.7**	**68.6**	19.0	**21.7%**
Energy use:				
space heating	**105.6**	**79.2**	26.3	**25.0%**
domestic hot water	**37.1**	**37.1**		
Total delivered energy kWh/(m^2.a):	**143**	**116**	26.3	**18.5%**
Primary energy kWh/(m^2.a):	**219**	**166**	53.1	**24.3%**
CO_2 emissions kg/(m^2.a):	**43.7**	**32.8**	10.8	**24.8%**

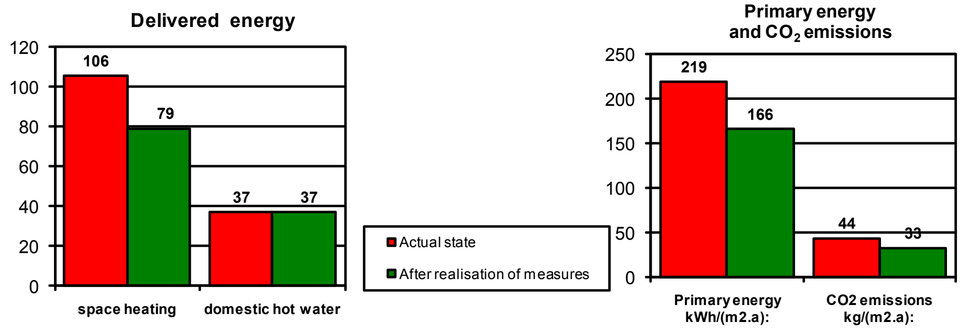
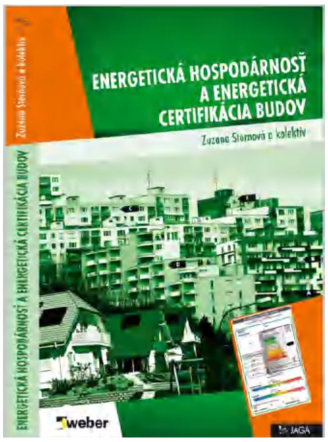


Fig. 3 – Recommendations for improving energy performance

For new and majorly renovated buildings, the designer (authorised engineer) is obliged to achieve the required minimum energy performance following the technical standards, in order to get the building permit. This requirement came into force on the 1st of January 2007. New buildings and majorly renovated buildings are approved after being constructed and certified. New buildings must achieve at least a class B^- to be approved. Majorly renovated buildings are also required to achieve class B, if this is functionally, technically and economically possible.

From the 1st of January 2008, all existing residential and non-residential buildings need to be certified, when they are sold or rented. The owner must hand a valid certificate to the buyer, or a verified copy upon renting the building. There is no minimum requirement for an existing building, i.e., it can be rated as falling into any energy class from A to G.

An energy certificate and report (as an annex to the EPC) is composed by 4 Qualified Experts (for thermal protection, heating and DHW, cooling and ventilation, and lighting) – see section 4. The qualified experts are required to visit the certified building and assess it in terms of: its construction (walls, windows, insulation, thermal bridges, ventilation and air-tightness, etc.), the type and quality of HVAC and hot water systems, as well as the type and quality of lighting. The Qualified Experts then calculate the energy performance of the building and issue the energy certificate.



The calculation methodology

The calculation methodology is described in the regulations (Ministerial Decree N° 311/2009 Coll.) and includes heating (incl. thermal protection heat need), cooling, ventilation, DHW and lighting energy use, expressed in terms of delivered energy (total energy use) and primary energy, as well as CO_2 emissions. Cooling, ventilation and lighting are included in the calculation methodology for non-residential buildings only. The calculation methodology is based on the full implementation of CEN standards. A national amendment to STN EN ISO 13790 was issued, in which default data on climate conditions, building structures and material properties are worked out, following EN standards (EN IS0 15927).

For family houses and apartment buildings, the seasonal method is used (3,422 K.days for heating with an average external temperature of 3.89 °C and 212 heating days). For non-residential buildings, the monthly method must be used.

After the calculation of energy use in kWh/(m^2.a), the building is assigned an energy class, according to the energy rating and the definition of required improvement measures. It is necessary to login into the online platform (central registration system) to get the registration number of the energy certificate and to fill it into the EPC form with the building description, energy rating indicators, description of the opaque envelope, windows, HVAC, DHW, ventilation, renewable and other energy systems, assigned energy class, proposed measures, etc., and to print the energy certificate.

www.inforeg.sk

Fig. 4 – The home page of the certification system

In Slovakia, the definition of a public building includes every non-residential building with a large number of visitors, which houses a governmental or non-governmental body. Every non-residential building larger than 1,000 m^2 is required to display an energy label at the main entrance.

The responsibility of having a certificate always lies with the building owner. There are no fixed prices for an energy certificate. The Qualified Expert does not need to pay a fee to put the certificate on the central register. The prices for an energy certificate range from approx. 250 € for a family house, up to thousands of Euros for large non-residential buildings.

Quality assurance (QA)

The mandatory QA scheme is outlined in the law. It starts with the training of experts. A specific training course offered by the Slovak Chamber of Civil Engineers with high passing grades in the exam is required. The training is specialised for the following groups of Qualified Experts: thermal protection, heating and DHW, cooling and ventilation, and lighting.

After the EPC is issued by a Qualified Expert for thermal protection, the Energy Inspection is authorised by the law to check the energy certificate.

3 > Inspections - Status of implementation

Slovakia has adopted option a) on Article 8 of the EPBD. The Ministry of Economy is responsible for the regular inspection of boilers and air-conditioning systems in buildings, and the assessment of the heating installations, in which the boilers are over 15 years old. The legal basis consists of Act N^o. 17/2007, which fully came into force on the 1st of January 2008, and two decrees. Decree N^o. 548/2008 sets out the requirement of regular inspection of boilers, individual one-off inspection of heating systems, and regular inspection of air-conditioning systems. And Decree N^o. 195/2008 defines the details of the examination procedure that qualified experts need to follow, in order to carry out the regular inspection of boilers and air-conditioning systems. Regular inspections became mandatory on the 1st of January 2008.

There is a common set of required minimum information in the inspection reports and a report template is provided by the SIEA. The Qualified Expert must fill in at least the following information in the inspection report:

- Identification data of boiler manufacturer;
- Type of equipment and manufacture year of boiler;
- Nominal heat output of equipment for every kind of fuel used;
- Kind, type and characteristics of fuel used;
- Inspection methodology and calculations used;
- Inspection results, including recommendations;
- Identification data of inspection, Qualified Expert and signature.

In Slovakia, only companies and professionals licensed for the regular inspection of boilers and air-conditioning systems are allowed to carry out inspections.

Once a year, in January, Qualified Experts are required to send electronically as well as one paper copy of all inspection reports done in the previous year to the national energy agency, the Slovak Innovation and Energy Agency (SIEA), for monitoring.

Inspections of boilers and air conditioning systems are based on the assessment of efficiency under defined normal working conditions. Currently, inspections must follow the reference methodologies, partially based on standards EN 15378 and EN 15240. A detailed national methodology is defined in Decree No. 548/2008.

The regular intervals of inspection depend on the thermal output of the heating system, the type of fuel and type of building (residential/non-residential), or on the cooling output of the inspected A/C-system. When the boiler inspected is more than 15 years old, then its regular inspection should be carried out together with a one-off inspection of the heating system, according to Decree No. 548/2008. Inspections are ordered and paid by the owner of the building or the contractual administrator of the building or the equipment. Building owners (or administrators) are required to:

- keep the inspection report for three years after the next periodic inspection;
- during the sale of a building, the owner should submit the report from the last inspection to the new owner;
- the owner of a building or facility that is rented should provide a certified copy of the report from the last inspection to the tenant.

The owner or administrator of a building or equipment may be fined, if he/she does not arrange for an inspection before a set date, does not submit a report from the last inspection to a new owner, or does not provide a certified copy of the report from the last inspection to a tenant. Owners, however, are not fined for a negative inspection result.

Table 3 - Intervals of regular inspection of A/C-systems

Nominal cooling output of AC-system [kW]	Interval of regular inspection [years]
In the range of 12 (incl.) to 50	8
In the range of 50 (incl.) to 250	6
In the range of 250 (incl.) to 1000	4
from 1,000 (incl.)	2 (first inspection at the latest on 31.12.2009)

Table 4 - Intervals of regular inspection of boilers.

Nominal thermal output of boiler [kW]	Fuel	Interval of regular inspection [years] Single family houses and residential houses	Other buildings
In the range of 20 (incl.) to 30	Fossil solid, liquid and gaseous fuels, except natural gas	10	7
	Natural gas	15 (first inspection at the latest on 31.12.2022)	12 (first inspection at the latest on 31.12.2019)
	Biomass, biogas	15	15
In the range of 30 (incl.) to 100	Fossil solid, liquid and gaseous fuels, except natural gas	4	4
	Natural gas	6	6
	Biomass, biogas	10	10
From 100 (incl.)	Fossil solid, liquid and gaseous fuels, except natural gas	2 (first inspection at the latest on 31.12.2009)	2 (first inspection at the latest on 31.12.2009)
	Natural gas	3 (first inspection at the latest on 31.12.2010)	3 (first inspection at the latest on 31.12.2010)
	Biomass, biogas	6	6

By the end of 2010, the SIEA has received 172 inspection reports for 185 boilers (broken down by fuel: 182 using natural gas, 2 using black coal, 1 using wood), and no inspection report for air-conditioning. The next inspection reports will be delivered by the 31st of January 2011. The impact on energy consumption is not possible as yet, as safety rules can stand in the way, since the inspection of a boiler can only be performed if the device is capable of reliable and safe operation.

The owner (or administrator) is in no way required to implement the recommendations that the Qualified Expert includes in the inspection report.

4 > Qualified Experts

Qualified Experts are the only persons certified for standardised and operational ratings and to issue Certificates. There are four qualifications for the different specialisations of qualified experts, who then work together on evaluating (calculating) heat need, energy use for heating and hot water, for ventilation and cooling, and for lighting. The Qualified Expert for thermal protection is responsible for completing the calculation, and issuing and registering the energy certificate. To prepare an EPC for family house and for apartment building, there are two experts involved. Four experts are involved only in the case when the building has a cooling system.


Slovenská komora stavebných inžinierov

OSVEDČENIE

prof. PhD.

Professional Certificate

Energy certification is a professional activity requiring specific skills. A qualified person is a professional with a Master´s degree in construction, architecture, engineering or electro technical studies on lighting, or who has a minimum of three years of experience after completing the university studies in an area of building design. Qualification is tested in an exam.

The Slovak Chamber of Civil Engineers is responsible for training qualified experts and for the Energy Certification module in all courses. The lecturers, training modules and members of the examination boards are approved by the Ministry. Qualified Experts receive a professional certification. Enrolling in a training course is not obligatory. At the end of 2010, the list of qualified persons (available at *www.sksi.sk*), includes 166 persons for thermal protection, 117 for heating and DHW, 13 persons for ventilation and cooling, and 34 persons for lighting. Altogether, there are 330 qualified experts. Qualified experts can act on a freelance basis or can be integrated in a public or private organisation.

Energy Inspection (a state institution) is responsible for controlling the quality of energy certificates. The Inspection is authorised to request that the Qualified Expert corrects any mistakes, to impose financial penalties, and to propose an examination of the Qualified Expert. All penalties are given in Act N°. 555/2005 Coll.

The regular inspections of boilers, heating systems and air-conditioning systems can only be carried out by a company or entrepreneur who is authorized under a special regulation (Act No. 455/1991 on business). A license is issued by SIEA upon request, for inspection of boilers and heating systems, inspection of air-conditioning systems or both. The Qualified Expert (QE) must be a person with secondary level or university level of education of technical direction or natural science on mathematics, physics or chemistry.

QEs must pass a professional examination or have a valid document proving his qualification to perform inspections issued in another Member State of the European Union, recognized under a special regulation. Trainings are not mandatory. For regular inspection of boilers and heating systems, they are organized by National Energy Company, NES, while for inspection of air-conditioning systems they are organized by Slovak Association of Refrigeration and Air-conditioning Technology. The professional examination is organized at least once a year by SIEA. A list of QEs is available at the SIEA website. At the end of 2010, there are 152 recognised Qualified Experts for inspections.

5 > National Information and Communication Campaigns

The need of informing citizens on certification

In the Slovak Republic, there has been no officially organised campaign or advertisement of the energy certification of buildings. Despite this, special events, conferences and lectures have been organised for owners and tenants of buildings:

- In the last years, the International Construction Fair CONECO focused on energy saving. The slogan of the 2010 fair was “Energy beyond Gold”.
- Additional events have been organised within the framework of the “Academy of Energy Saving”.
- Lastly, building products with high energy efficiency are awarded each year.

6 > National incentives and subsidies

The National Action Plan for Energy Efficiency, defined by the Government of the Slovak Republic under the Directive 2006/32/EC, has established the general framework to support specific measures.

The Energy Efficiency Action Plan sets out measures for achieving energy savings on the total energy consumption, amounting to 4,135 TJ/year. In order to achieve the required objectives, the following measures must be taken:

- For buildings, there is a requirement for an energy saving of approximately 1,365 TJ, from the total demand for energy saving.
- CO_2 emission should be decreased by 0.2365 kg/kWh (natural gas district heating).
- When 10,000 major renovated flats per year are taken into account, with an average total floor area of 71.43 m^3 each and a saving of 53 kWh/(m^2.a), then the CO_2 emission decrease is equal to 8,954 t/year (in the first year of renovation).

The building sector represents an approx. 26% share of the total energy consumption in the Slovak Republic. A major part of the consumption is due to energy use for heating, DHW preparation and lighting.

Measures for achieving improved energy efficiency in buildings are oriented towards:

- a decrease of the energy consumption for heating (by means of changes in the thermal protection of buildings), when providing optimal thermal comfort,
- a decrease of the heat need for DHW preparation.

Existing and new measures in the building sector shall represent an 11% share of the total energy saving. The implemented measures shall correspond to an energy saving of 455 TJ per year in the building sector.

All these measures are still being planned and no subsidies/incentives are available at the end of 2010.

7 > Impact of the EPBD at national level

Evolution of Minimum quality requirements in building regulations

In 2002, the last change in thermal protection requirements was made in relation to renovated and new buildings. The transposition of the EPBD exerted an influence by diminishing energy use through the decrease of heating needs. Buildings achieving only the minimum requirements (energy class B) have an energy use lower by 28.6%, when compared to requirements prior to the transposition of the EPBD.

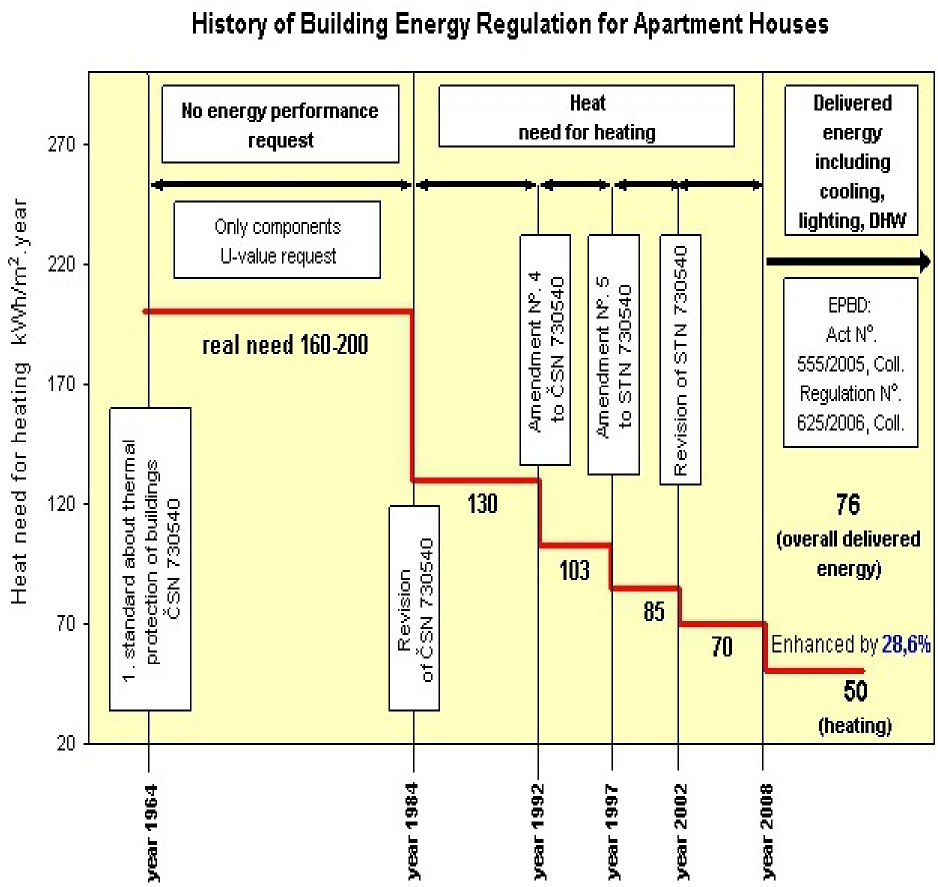


Fig. 5 - Evolution of building requirements in the Slovak Republic

Work on implementing the requirements after the recast of the EPBD (Directive N° 2010/31/EU) into the national law are planned for 2011. Until the end of 2011, the requirements regarding building structures should be changed by revising the national standard STN 73 0540, taking the energy buildings characteristics law into account, as well as the requirements on passive and NZE buildings.

Other impacts

The registration of energy certificates only started from the 1st of January 2010. The energy certificates issued before were not registered. So far, the number of registered certificates has reached 9,342: 8,138 were issued for residential buildings and 1,204 for non-residential buildings. When taking energy class into account, there are 5,291 buildings in class B and 315 buildings in class A

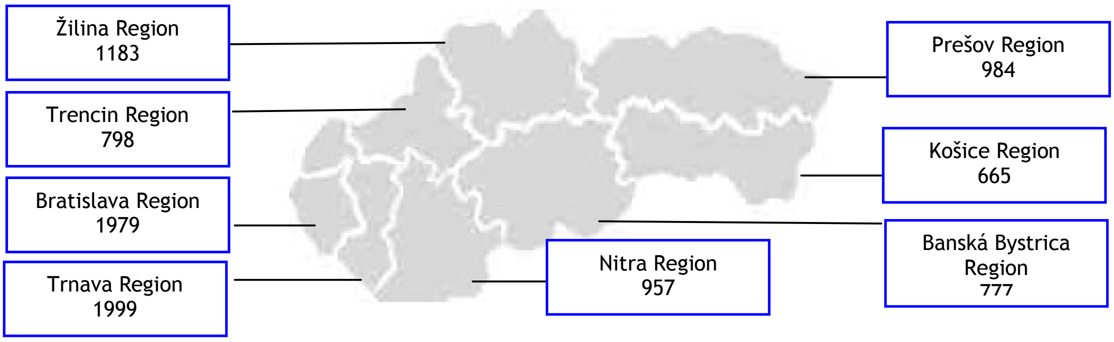


Fig. 6 – Number of issued energy certificates in each region (year 2010)

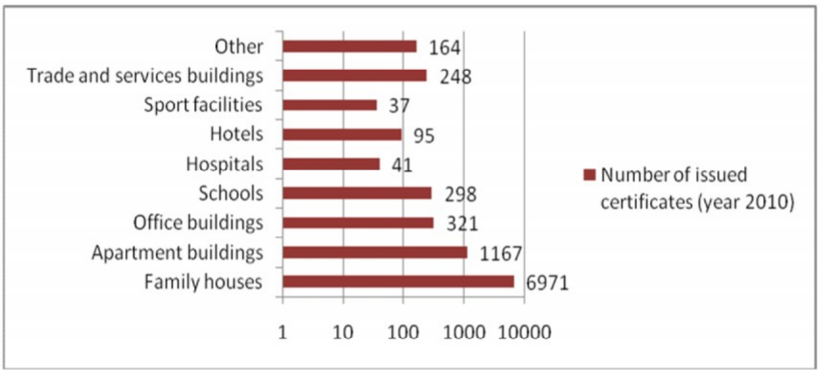


Fig. 7 - Issued certificates according to building certificates by energy class

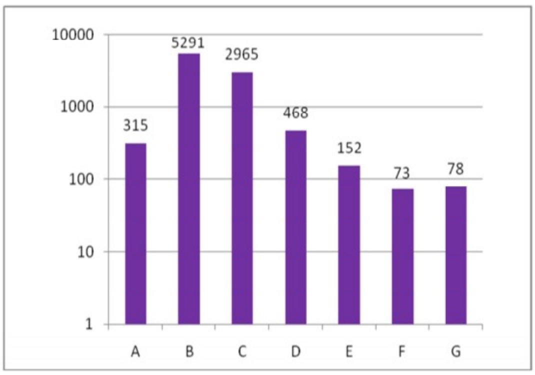


Fig. 8 - Number of energy categories

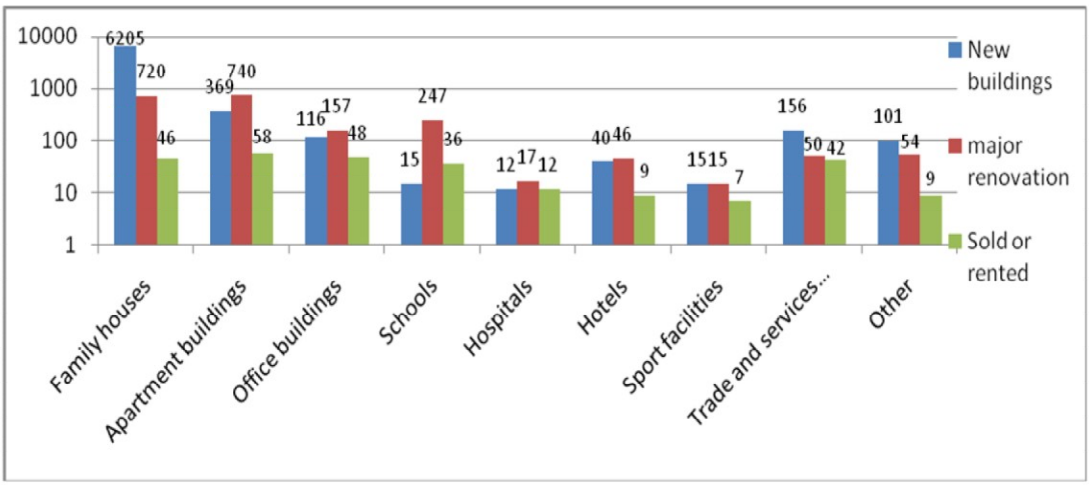


Fig.9 - Distribution of energy certificates (new and majorly renovated buildings)

8 > Conclusions and future planning

The EPBD requirements on new buildings and majorly renovated buildings will be a very important issue. At the end of 2010, the Action plan for energy efficiency for the period 2011-2013 is in preparation. Implementation of the recast EPBD is scheduled until the end of the year 2011. In addition, the new Ministerial Decree should be based on tightening thermal protection requirements also given for low energy, passive and Nearly-Zero Energy buildings. The revised national standard STN 73 0540 should come into force at the latest in March 2012. New requirements for buildings and building components will have to be decided upon.

Additional training must be organised for qualified experts. A significant challenge will be training the public in order to raise its awareness of its real energy use.

The monitoring of energy certificates and inspection reports should be fully in function starting in 2011.

In order to achieve real energy savings in the building sector, significant conditions, tools and subsidies for the improvement of existing buildings are needed. Energy certification plays a very important role.

Implementation of the EPBD in England and Wales, Scotland and Northern Ireland

Status in November 2010

Paul Woods

AECOM Ltd

United Kingdom

National websites where official info can be found:

- *http://www.communities.gov.uk/planningandbuilding/sustainability/*
- *http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/profinfo/epcintro*
- *http://www.dfpni.gov.uk/index/buildings-energy-efficiency-buildings/energy-performance-of-buildings.htm*

1 > Introduction

This report provides information about the Directive implementation process in England and Wales, Scotland and Northern Ireland updating the earlier report dated October 2008. In October 2010, revisions to the Building Regulations in England and Wales were introduced, the first update for 10 years (Statutory Instrument 2010/2214[1]). There is also a new regulation relating to Approved Inspectors (S.I. 2010/2215). The Building Regulations 2010 consolidate the Building Regulations 2000 (S.I. 2000/2531) and subsequent amending Regulations, and the Building (Approved Inspectors etc.) Regulations 2010 consolidate the Building (Approved Inspectors etc.) Regulations 2000 (S.I. 2000/2532) and subsequent amendments. These are two separate but related consolidations. All the amending instruments made since each of the 2000 Regulations came into effect are incorporated into the instruments. The relevant changes within Part L are outlined below.

In Scotland, The Building (Scotland) Amendment Regulations 2010 came into force on the 1st of October 2010[2]. This has resulted in changes to mandatory standards and associated guidance, and the publication of new documents (see also Methods of demonstrating compliance with Standard 6.1 for new dwellings, 2010, and Improvement to the performance of fixed building services for existing non-domestic building, 2010).

In Northern Ireland, the governing legislation is The Building (Amendment) Regulations (Northern Ireland) 2006[3] and The Energy Performance of Buildings (Certificates and Inspections) Regulations (Northern Ireland) 2008

This report also addresses certification and inspection systems including quality control mechanisms, training of Qualified Experts, information campaigns, incentives and subsidies. For more details please visit the referenced web sites or contact the responsible institutions.

Legal context

England & Wales

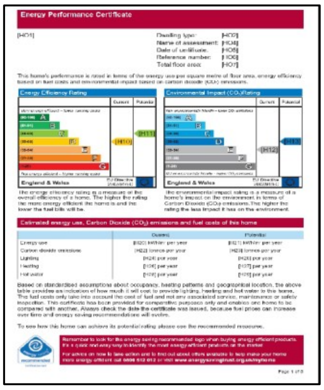
The implementation of the EPBD in England and Wales is the responsibility of the Department for Communities and Local Government (CLG), supported by the Department for the Environment, Food and Rural Affairs (Defra) and the Department of Energy and Climate Change (DECC). Implementation in Scotland and Northern Ireland is the responsibility of the devolved administrations.

[1] *http://www.legislation.gov.uk/uksi/2010/2214/contents/made*
[2] *http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/tech2010changes*
[3] *http://www.legislation.gov.uk/nisr/2006/355/contents/made*

In March 2006, regulations were laid before Parliament to implement Articles 3-6 of the EPBD. Regulations were laid before Parliament to implement Articles 7, 9 and 10 of the EPBD in 2007 (March, June and November) and 2008 (March and September). Article 8 did not require legislation as the Advice route has been selected for the whole of the UK.

The 2010 Building Regulations incorporate Articles 3 – 6 and 7, 9 and 10.

Scotland

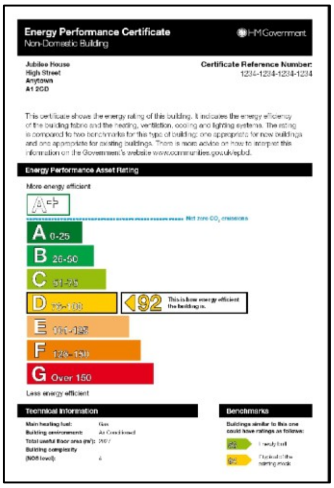


In Scotland, the implementation of the EPBD is the responsibility of the Building Standards Division, which is part of the Directorate for the Built Environment.

Articles 3-7, 9 & 10 of the Directive are implemented through The Building (Scotland) Act 2003, the Building (Scotland) Regulations 2004 (amended in 2006, 2007 and 2008), the Building (Procedure) (Scotland) Regulations 2007, the Building (Forms) (Scotland) Regulations 2007 and Energy Performance of Buildings Regulations 2008. As noted above, The Building (Scotland) Amendment Regulations 2010 have also been introduced.

Northern Ireland

The implementation of the EPBD in Northern Ireland is the responsibility of the Department of Finance and Personnel (DFPNI), supported by the Department for Social Development (DSDNI).



Articles 3-6 were implemented by "The Building (Amendment) Regulations (Northern Ireland) 2006". This is a Statutory Rule - 2006 No 355. The regulations were made on the 31st of August 2006 and came into operation on the 30th of November 2006. These regulations were subsequently amended by "The Building (Amendment No 2) Regulations (Northern Ireland) 2006" SR 2006 No 440, which were made on the 9th of November 2006 and came into operation on the 30th of November 2006. An additional amendment "The Building (Amendment No 2) Regulations (Northern Ireland) 2010" SR 2010 No 382, was made on the 24th of November 2010 and came into operation on the 31st of December 2006. The regulations were supported by two Technical Booklets: F1 dealing with dwellings and F2 which addresses buildings other than dwellings.

Articles 7-10 were implemented by “The Energy Performance of Buildings (Certificates and Inspections) Regulations (Northern Ireland) 2008”. This is Statutory Rule 2008 No 170. The regulations were made on the 10th of April 2008 and came into operation from the 30th of June 2008 with a phased approach. The regulations were subsequently modified by a correction sheet (to correct minor errors) prior to coming into operation. The regulations were subsequently amended by “The Energy Performance of Buildings (Certificates and Inspections) (Amendments) Regulations (Northern Ireland) 2009” SR 2009 No 369 made on the 12th of November 2009 and came into operation on the 3rd of December 2009.

2 > Certification of buildings: Implementation of Article 7

England and Wales

The requirements regarding the certification of buildings were implemented progressively between August 2007 and October 2008. Example domestic and nondomestic EPCs are shown here. EPCs are produced for buildings on construction, sale and rent. Domestic and non domestic EPCs are valid for ten years.

For new buildings, the change to the Building Regulations means that the developer must submit a design stage assessment demonstrating compliance. The as-built data, which includes test results (actual or sample) for mechanical ventilation and air-tightness is used for the final Building Regulations submission and the EPC.

http://www.epcregister.com/

A central electronic register has been established for the storage of all EPCs and DECs produced. By December 31st 2010, 5.7 million domestic EPCs, 210,000 non-domestic and 72,000 DECs had been lodged.

Domestic EPC content

The EPC provides a rating of the overall energy efficiency of the building on a scale from A to G, where A is very efficient and G is the least efficient. This is an asset based rating, based on the characteristics of the building itself and its services and a standardised occupancy profile. Domestic EPCs also contain an environmental impact rating, which is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions - the higher the rating, the less impact it has on the environment. In addition, the EPC indicates the potential energy efficiency and environmental impact ratings if all cost-effective measures were installed. An average existing property is referred to as having an energy efficiency rating E. This contrasts with an average new house which will have at least a rating of B.

The certificate is accompanied by a report which includes cost-effective recommendations to improve the energy ratings specific to the dwelling. In the case of domestic properties, measures are categorised as:

- ***Lower cost*** - typically up to £500 capital cost
- ***Higher cost*** - typically over £500 capital cost

In England and Wales, estate agents who are providing written sale particulars for a property being marketed for sale, will need to include the graphics showing the energy efficiency rating and the environmental impact rating for the property, or attach the EPC (but not the Recommendation Report) to the particulars. Estate Agents need to verify that an EPC has been commissioned before accepting an appointment.

Non Domestic EPC Content

Energy performance is shown as a single CO_2 based index, again based on a scale of A to G and an asset rating calculation. The non-domestic EPC also provides two benchmarks, but in this case these are the energy rating if the property were newly built and the energy rating if it were typical of the existing stock of similar properties. Cost effective recommendations for non-domestic properties are categorised as:

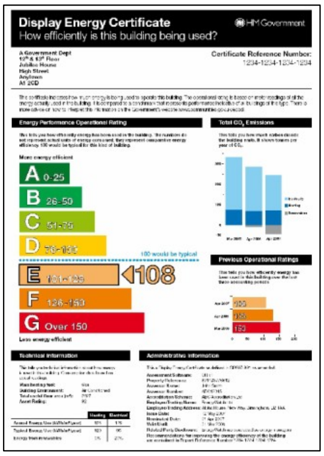
- ***Short term*** - payback less than three years
- ***Medium term*** - payback between three and seven years
- ***Long term*** - payback more than seven years

Other recommendations based on the assessor's knowledge

Other Information Content (Domestic and Non-Domestic EPCs)

Other key pieces of information are conveyed on EPCs, such as:

- ***Reference information*** – this includes the unique certificate reference number (as stored in the central register), and the date of issue of the certificate
- ***Energy assessor details*** – this includes the assessor's name, accreditation number, employer's name (or any trading name if self-employed) and accreditation scheme
- ***Information on how to complain or how to confirm that the certificate is genuine*** – the certificate provides information on how to register a complaint about an unsatisfactory EPC and how to check the certificate is authentic.



Display Energy Certificates

Display Energy Certificates (DECs) are produced by public authorities and institutions providing public services to large numbers of persons where they occupy buildings with floor areas greater than 1,000 m^2.

DECs show the energy performance of a building based on actual energy consumption for the current year, i.e. in the form of an operational rating (OR). Information on performance recorded over the previous three years is also shown on the DEC when available. The presence of historic data reveals whether or not there has been an improvement in a building's performance. The OR gives a numerical indicator of a building's CO_2 emissions on a scale of A to G, with A being the best performance. An asset rating may also be shown if an EPC is available for the building.

The building's performance is compared to a hypothetical building with performance equal to one typical of its type (the benchmark). Typical performance for that type of building would have an OR of 100. A building that resulted in zero CO_2 emissions would have an OR of zero, and a building that resulted in twice the typical CO_2 emissions would have an operational rating of 200. If the building is a net energy generator, it is still given an operational rating of zero.

http://www.communities.gov.uk/publications/planningandbuilding/displayenergycertificate

DECs are updated annually, with the advisory report which lists cost-effective recommendations updated on a seven year basis. Recommendations are categorised by payback in the same way as non-domestic EPCs.

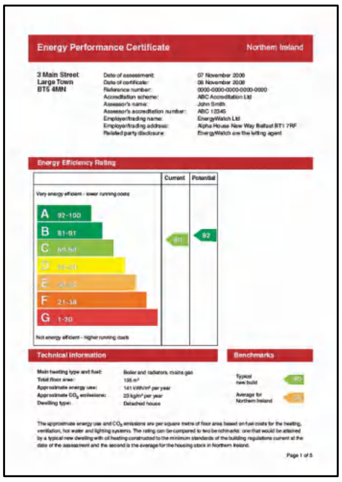
Scotland

Domestic EPC design and cost-effective recommendations reports are similar to those for England and Wales. Non-domestic EPC design is also similar but the benchmarks differ from those on the E & W certificates. In Scotland, the benchmarks shown are for a building of a similar type built to Building Regulations and for the building if the cost effective measures were to be installed. A key difference is the requirement for the EPCs to be affixed to both domestic and non-domestic properties. In addition to listing cost effective improvements, the option to provide additional information on more expensive improvements can be requested by the person commissioning the EPC.

EPCs for dwellings are held in the electronic Home Energy Efficiency Database.

There are no Display Energy Certificates in Scotland. Instead, the Energy Performance Certificate (Asset rating) is displayed for public buildings.

The validity of the EPC does not exceed 10 years. EPCs have needed to be displayed in a prominent place in all public buildings greater than 1,000 m^2 from the 4th of January 2009. For all non-domestic buildings, ratings range from 'Carbon Neutral' through to poor performance on an A-G scale.



Northern Ireland

EPCs for existing dwellings on sale are required from the 30th of June 2008. All newly completed buildings require EPCs from the 30th of September 2008. A requirement for EPCs on all rentals and sales of non-domestic properties was introduced on the 30th of December 2008. A sample certificate is shown at left for domestic properties, for non-domestic properties the certificate is similar to that for England and Wales.

In Northern Ireland, the EPC must be made available at the earliest opportunity before the conveyancing process commences and, as a constituent document in this process, it must be provided as part of the completion of the sale.

The energy performance rating, potential rating, accompanying recommendation report and registration of data are the same as for England and Wales. Details of the certificate content can be found at *www.dfpni.gov.uk/energy-performance-of-buildings*.

EPCs are maintained on two central registers: the domestic register is *www.epbniregister.com* and the non-domestic register will be at *www.epbnindregister.com*.

The requirement for DECs to be displayed in all public buildings greater than 1,000 m^2 came into effect from December 2008. The requirement to produce a DEC, its content, lifespan, requirement for an advisory report and registration of data are the same as for England and Wales. Details of the certificate content can be found at *www.dfpni.gov.uk/energy-performance-of-buildings*.

Costs of Certificates

Domestic EPCs for existing dwellings typically cost between £50 and £100 plus VAT.

The cost of EPCs for non-domestic buildings and DECs vary greatly depending on the size of the building and the complexity of the building services.

Calculation procedures: Implementation of Article 3

http://www.communities.gov.uk/publications/planningandbuilding/ncmmodellingguide

The procedures for a national calculation methodology (NCM) have been established. For dwellings, the NCM is called SAP. An updated version (SAP2009) was released in March 2010 (see below) with further revisions in October 2010 to align with revisions to the Building Regulations (a revision to the Northern Ireland Building Regulations will be made later in 2011). For non-domestic buildings, the core calculation is SBEM, and the interface is iSBEM. SBEM was updated in June 2010. Further details for buildings other than dwellings are provided within the NCM Modelling Guide for England and Wales and Northern Ireland.

Compliance with the NCM for determining building energy performance in a standardised way is achieved via the application of one of a suite of software tools approved for the purposes of production of Energy Performance Certificates (EPC) and Display Energy Certificates (DECs). Software tools (SBEM, SAP and ORCalc) have been developed by Government, however other software packages, dynamic simulation models and interfaces can be used instead provided these are approved by Government.

www.communities.gov.uk/publications/planningandbuilding/noticeapproval

In England and Wales, the Notice of Approval document sets out the approved:

methods of calculation of the energy performance of buildings, including methods for calculating the target emission rate, building emission rate, asset rating and operational rating;

ways of expressing the energy performance of buildings as calculated, in accordance with the methodology.

These tools and procedures are available for England and Wales and the devolved administrations in the UK (i.e. Northern Ireland and Scotland) to adopt to suit their implementation strategy. Northern Ireland applies these tools and procedures.

In Scotland, the asset based methodology has been adopted (for all EPCs including those for public buildings) and is incorporated in the software packages approved for use in Scotland.

Approved packages include:

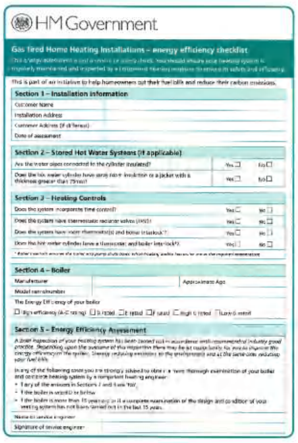
- the Government's Standard Assessment Procedure for the Energy Rating of Dwellings (SAP2009)[4] *www.bre.co.uk/sap2009*;
- approved software applications of SAP2009 and RdSAP2005[5] (a reduced data application of SAP2009 for use in the energy assessment of existing dwellings) *www.bre.co.uk/sap2009 and www.bre.co.uk/sap2005* respectively*;*

[4] For the time being Energy Performance Certificates for new dwellings are produced using SAP 2005. This will be switched to SAP 2009 in March 2011

[5] It is proposed that RdSAP 2009 software will be available and should be used instead of RdSAP 2005 from March 2011 for EPCs for existing dwellings

- the Government's Simplified Building Energy Model (SBEM) *http://www.ncm.bre.co.uk*;
- approved software interfaces to SBEM *http://www.ncm.bre.co.uk*;
- approved proprietary Dynamic Simulation Model software packages (DSMs);
- the Government's Software for Calculating Operational Ratings of buildings (ORCalc) (except Scotland)
- Approved proprietary software applications of ORCalc (except Scotland).

3 > Inspections and Advice - Implementation of Articles 8 and 9


HM Government

Gas fired Home Heating Installations – energy efficiency checklist

This is part of an initiative to help homeowners cut their fuel bills and reduce their carbon emissions.

Section 1 – Installation information

Customer Name	
Installation Address	
Customer Address (if different)	
Date of assessment	

Section 2 – Stored Hot Water Systems (if applicable)

Are the water pipes connected to the cylinder insulated?	Yes ☐	No ☐
Does the hot water cylinder have spray foam insulation or a jacket with a thickness greater than 75mm?	Yes ☐	No ☐

Section 3 – Heating Controls

Does the system incorporate time control?	Yes ☐	No ☐
Does the system have thermostatic radiator valves (TRV)?	Yes ☐	No ☐
Does the system have room thermostat(s) and boiler interlock*?	Yes ☐	No ☐
Does the hot water cylinder have a thermostat and boiler interlock*?	Yes ☐	No ☐

Section 4 – Boiler

Manufacturer		Approximate Age
Model name/number		

The Energy Efficiency of your boiler

Section 5 – Energy Efficiency Assessment

Name of service engineer

Signature of service engineer

Energy Efficiency Checklists at:

- *www.energysavingtrust.org.uk*
- *www.carbontrust.org.uk*

http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/profinfo/techguide/inspectaircon

http://www.communities.gov.uk/documents/planningandbuilding/pdf/889248.pdf

http://www.dfpni.gov.uk/energy-performance-of-buildings

http://www.cibse.org/index.cfm?go=publications.view&item=372

The UK has decided to pursue the option of provision of advice on boilers rather than inspection, continuing the extensive programme of information, grant schemes and regulation it has been following for a number of years. An equivalence report was issued to the Commission in January 2008, and an updated report to include the period 2008-2009 was prepared. Examples of implementation can be seen in the amendments to the Building Regulations energy efficiency requirements, the heating installation energy efficiency checklists, and guidance available to purchasers via the websites of: the National Governments, the Energy Saving Trust (domestic customers) and the Carbon Trust (non-domestic customers).

The reference documents in support of the 2006 and 2010 amendments to Part L included a Domestic Building Services Compliance Guide (*http://www.planningportal.gov.uk/uploads/br/domestic_building_compliance_guide_2010.pdf*) and a Non-Domestic Building Services Compliance Guide (*http://www.planningportal.gov.uk/uploads/br/non-domestic_building_compliance_guide_2010.pdf*).

The scope of these documents is England, Wales, Scotland and Northern Ireland.

In England and Wales, the inspections of air-conditioning equipment has been phased in from January 2009 for all systems >250KW installed after January 2008, and from January 2011 for all systems >12kW. Installations must be inspected every five years.

Scottish legislation for the introduction of inspections for air-conditioning systems was introduced on the 1st May of 2007. For existing buildings, inspections were phased in as follows:

- For all new systems, from the 1st of May 2007;
- For existing systems with an effective rated output of more than 250 kW, from the 4th of January 2009 with first inspections completed by the 4th of January 2011;
- For existing systems with an effective rated output of more than 12 kW from the 4th of January 2011 with first inspections completed by the 4th of January 2013.

A guidance leaflet on various aspects of the inspection process has also been produced.

In Northern Ireland, there has also been a phased introduction of the requirement for air-conditioning. New installations will be inspected every 5 years. Systems over 250kW will be inspected by the 4th of January 2010 and those over 12kW by the 4th of January 2011. Guidance on the scope and implementation of the Regulations is available from the sites at left.

The approved survey approach in all cases is the Technical Memorandum No. 44 (TM 44) Inspection of Air Conditioning Systems published by the Chartered Institution of Building Services Engineers. A version of TM44 has been produced to meet the needs of the Scottish regulatory system.

4 > Independent experts: Implementation of Article 10

England and Wales

An energy assessor must be a member of a specialist Accreditation Scheme approved by the Government. Each Accreditation Scheme is responsible for ensuring that energy assessors are suitably qualified to conduct energy assessments and for ensuring the quality of the assessments and any certificates or reports produced (including their independence).

At present, there are a number of categories of assessor (numbers registered given in brackets):

- On Construction Domestic Energy Assessor - OCDEA (1,386)
- Domestic Energy Assessor (for existing dwellings) - DEA (11,565)
- Commercial Energy Assessor or Non-Domestic Energy Assessors – CEA or NDEA (6,686)[6]
- Public Building Energy Assessor for Display Energy Certificates - PBEA (1,423)
- Air-Conditioning Energy Assessor – ACEA (809)

A list of Schemes approved by the Government to accredit assessors, either by the Qualification or the APEL (approved prior experiential learning) routes can be found at:

http://www.communities.gov.uk/documents/planningandbuilding/pdf/1097804.pdf

To become accredited, each assessor must demonstrate evidence of their qualification and competence to meet the National Occupational Standards.

Details of the minimum requirements that assessors must satisfy can be found at the location indicated at left. Accreditation Schemes will be responsible for maintaining and demonstrating quality assurance procedures. The CLG has arranged for independent quality audits to be carried out for each Accreditation Scheme. The quality control regime has resulted in some assessors being suspended or their accreditation removed. The proportion of assessors in these categories is 0.4% for OCDEA, 5% for DEAs, 1.7% for CEA/NDEA, 1% for PBEA and 0% for ACEA

Scotland

For existing buildings, EPCs must be produced by a member of a professional body with whom the Scottish Government has entered into protocol. Each approved organisation is responsible for ensuring that their members are suitably qualified to conduct energy assessments and for ensuring the quality of the assessments and any certificates or reports produced (including their independence). A similar approach has been adopted for experts to carry out the air-conditioning inspections.

Northern Ireland

Northern Ireland has adopted a similar approach to that in England and Wales. Details of approved Accreditation Schemes can be found at:

http://www.dfpni.gov.uk/index/buildings-energy-efficiency-buildings/energy-performance-of-buildings/content_-_energy_performance_of_buildings-energy_assessors_schemes.htm.

Enforcement

In England and Wales, the enforcement of the regulations is the responsibility of a Building Control Body (BCB) – either a Local Authority BCB or an Approved Inspector. Enforcement of EPCs and DECs is via Local Authority Trading Standards Officers in the Local Authority/District Council area where the building is located.

[6] An individual can be a Commercial Energy Assessor level 3, level 4 or level 5, which determines the scope of the EPCs they can produce. Level 5 assessors are required to produce EPCs for the most complex buildings including air-conditioning where a higher level of technical knowledge is needed.

In Scotland, responsibility for enforcement lies with the Local Authority. If compliance is not achieved, the local authority can take action which may include serving notice, carrying out the work and recovering costs. Failure to comply with a notice is a criminal offence and the matter may be referred to the procurator fiscal. In the case of existing buildings, the enforcement authority may choose to issue a penalty charge notice.

In Northern Ireland enforcement is currently undertaken by district councils, except in relation to council buildings where the Department of Finance and Personnel undertakes the enforcement role, although the intention is to pass this role to staff within the District Councils.

5 > National Information and Communication Campaigns

Major publicity campaigns have taken place in all parts of the UK through a range of media: TV, press, radio, the internet and guidance documentation for householders and other stakeholders. The regional governments have worked with Professional Bodies, Trade Associations and Accreditation Schemes to ensure a smooth implementation process.

6 > National Incentives and subsidies

Dwellings constructed to achieve net carbon emissions of zero over the year are exempt from stamp duty tax.

http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/feedin_tariff/fits_grant/fits_grant.aspx

In England and Wales, feed-in tariffs (FiTs) have been introduced from April 2010 for electricity generated on site from small-scale renewable electricity generating systems (<5MWe), see link at left. The Government has indicated that a similar Renewable Heat Incentive (RHI) will be introduced from June 2011.

The Government will introduce changes to EPCs through the addition of a new RHI section to the recommendations report which accompanies the EPC, displaying these figures. The RHI section will be added to new EPCs produced in England, Scotland and Wales from April 2011. Householders who wish to receive RHI payments will need to obtain an EPC displaying these figures before the installation can be accredited. While this will place some additional cost on entry to the RHI the Government believes that any cost will be recompensed by the long-term benefit of RHI payments.

7 > Impact of the EPBD

Requirements for new buildings: Implementation of Articles 4 and 5

http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partl/approved

England and Wales

The revised requirements for new buildings came into force in October 2010 – see Approved Documents ADL1A (dwellings) and ADL2A (buildings other than dwellings).

For a property to comply it must satisfy 5 key criteria:

Criterion 1

The property's calculated emission rate of CO_2 emissions must be below the Target Emission Rate (TER), both are measured in kg CO_2/m^2 of floor area per year.

England and Wales

Dwellings: Limiting U-values (new build)

Element	Limiting U-Value
Wall	0.30 W/m^{2}K
Floor	0.25 W/m^{2}K
Roof	0.20 W/m^{2}K
Windows, roof windows, roof lights and doors	2.00 W/m^{2}K

Non Dwellings: Limiting U-values (new build)

Element	Limiting U-Value
Wall	0.35 W/m^{2}K
Floor	0.25 W/m^{2}K
Roof	0.25 W/m^{2}K
Windows, roof windows, roof lights and curtain walling	2.20 W/m^{2}K
Pedestrian doors	2.20 W/m^{2}K
Vehicle access and similar large doors	1.50 W/m^{2}K
High usage entrance doors	3.5 W/m^{2}K
Roof ventilators (including smoke vents)	3.5 W/m^{2}K

A reasonable limit for design air-permeability for both dwellings and non-dwellings is set at 10m^3/h.m^2 @ 50Pa

For dwellings, the TER is calculated by determining the emissions from a notional dwelling of the same size and shape as the actual dwelling constructed to the reference values set out in Appendix R of SAP 2009, and applying the proposed fuel. The heat loss through party walls is now also taken into account, and where a swimming pool is constructed as part of a new dwelling, reasonable provision should be made to limit heat loss from the pool basin (minimum U value 0.25 W/m^{2}K). The 25% reduction in carbon emissions for dwellings is based on a “flat” rather than “aggregate” approach.

For non-domestic buildings, the TER is set at the emissions of a notional building of the same size and shape as the actual building but constructed to a series of reference values for a property that would meet the requirements of the 2010 National Calculation Methodology modelling guide. Overall, there is a 25% reduction in CO_2 emissions across the new-build mix, the “aggregate” approach. Some building types are required to achieve a greater than 25% reduction, and others a lesser reduction, but they should all achieve the required level of improvement at approximately the same cost of compliance.

In the case of dwellings, the software assumes the provision of heating, hot water, ventilation and internal fixed lighting for a standardised household. In the case of non-dwellings, the software calculates the energy and emissions for the provision of heating, cooling, ventilation and lighting. This approach provides maximum flexibility to the designer but focuses attention on energy efficiency to reduce CO_2 emissions as the main compliance target.

Criterion 2

The performance of the building fabric (U-values and permeability) should be no worse than the given design limits – see left. Similarly, the performance of fixed building services (heating and hot water, pipework insulation, mechanical ventilation, mechanical cooling, fixed internal and external lighting) should be met using energy efficient fixed building services with efficient controls and no worse than given design limits.

Criterion 3

There should be appropriate passive control measures to limit unwanted summer solar gains, whilst maintaining adequate levels of day lighting. For non-domestic buildings, there is an emphasis on limiting solar gain through the building fabric.

Criterion 4

The performance of the building as built must be consistent with the design intent. This is considered through continuity of insulation, air-permeability and pressure testing standards and evidence of satisfactory commissioning of fixed building services.

Criterion 5

Adequate information on operation and maintenance of the building services must be provided.

Scotland

http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/pubtech

The revised energy standards in the building regulations came into force in October 2010. Technical Handbooks provide guidance on achieving the standards for Domestic buildings and for Non-domestic buildings. The current 2010 edition applies from the 1st of October 2010.

The standards and guidance provided in these documents are intended to achieve an improvement on the previous standards of around 23-28% fewer emissions for non-domestic buildings and 18-25% fewer emissions for domestic buildings. For new buildings, a carbon dioxide emissions standard was introduced supported by guidance that sets out a target maximum carbon dioxide emissions level by use of a methodology that incorporates a range of parameters which influence energy use. Design and construction methods which improve the dwelling/building emission rate and which make greater use of Low and Zero Carbon Technologies are encouraged.

In addition to compliance with new carbon dioxide emissions standard, all new buildings must be provided with an Energy Performance Certificate (EPC) as part of the building completion certificate process.

Northern Ireland

http://www.dfpni.gov.uk/index/laws-and-regulations/building-regulations

Technical standards for new buildings came into effect on the 30th of November 2006. These are set out in Technical Booklet F1 for dwellings and Technical Booklet F2 for all other buildings and can be downloaded from the site at left.

The building complies with the regulations if it satisfies criteria very similar to those listed for England and Wales above. Proposals are being drafted to upgrade the thermal requirements, fixed building services etc. to the equivalent of the England and Wales October 2010 standards are being drafted with the intention to come into operation in late 2011.

Requirements for existing buildings: Implementation of Articles 4 and 6

England and Wales

http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partl/approved

The updated requirements for existing buildings came into force in October 2010 – see Approved Documents ADL1B and ADL2B.

When work is carried out on existing buildings, all such work is expected to meet minimum energy efficiency standards defined at the elemental level.

Standards are prescribed for newly constructed thermal elements; for walls, roofs, roof windows and rooflights; and for improvements to fabric elements that are to become thermal elements. Standards are also prescribed for heating and lighting in the extension.

Where an existing thermal element is part of a building subject to a material change of use, or an existing element is to become part of the thermal envelope where previously it was not (e.g. conversion of a garage to a heated space), it is expected that if the current performance is below the threshold value, it should be upgraded to achieve the corresponding improved value (see table below) providing this is technically, functionally and economically feasible.

The standards for new thermal elements and for controlled fittings for dwellings can be found here:

http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf

The standards for new thermal elements and controlled fittings in non-domestic buildings can be found here:

http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partl/approved#ApprovedDocumentL2B:ConservationoffuelandpowerExistingbuildingsotherthandwellings2010edition

Dwellings: Upgrading retained thermal elements (assumes 15 year cost effectiveness)

Element[7]	Threshold U-value	Improved U-value
Cavity wall	0.70 W/m^{2}K	0.55 W/m^{2}K
Wall – external or internal insulation	0.70 W/m^{2}K	0.30 W/m^{2}K
Floor	0.70 W/m^{2}K	0.25 W/m^{2}K
Pitched roof - insulation at ceiling level	0.35 W/m^{2}K	0.16 W/m^{2}K
Pitched roof - insulation between rafters	0.35 W/m^{2}K	0.18 W/m^{2}K
Flat roof or roof with integral insulation	0.35 W/m^{2}K	0.18 W/m^{2}K

[7] *http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf*
It is important to read the accompanying notes regarding exceptions

For certain types of major improvement works in buildings with floor areas over 1,000 m^2 where the work has the potential to increase energy intensity (e.g. extending the building or installing air-conditioning), there is a further requirement for additional improvements to make the existing building more energy efficiency, provided these are technically, functionally and economically feasible. These are known as consequential improvements.

Non dwellings: Upgrading retained thermal elements

Element[8]	Threshold U-value	Improved U-value
Cavity wall	0.70 W/m^2K	0.55 W/m^2K
Wall - external or internal insulation	0.70 W/m^2K	0.30 W/m^2K
Floor	0.70 W/m^2K	0.25 W/m^2K
Pitched roof - insulation at ceiling level	0.35 W/m^2K	0.16 W/m^2K
Pitched roof - insulation between rafters	0.35 W/m^2K	0.18 W/m^2K
Flat roof or roof with integral insulation	0.35 W/m^2K	0.18 W/m^2K

Scotland

Work to existing buildings, including conversions, extensions and alterations, is not required to comply with the new carbon dioxide emissions standard. However, the new components installed as a result of the work must meet all other energy standards. There is no threshold set for floor areas of buildings to which this applies. The guidance supporting these standards sets out minimum levels, or robust back-stops, including maximum U-values and minimum efficiencies of heating and hot water systems.

Northern Ireland

The technical standards, which came into effect on the 30th of November 2006, also set requirements for conversions and for work to existing buildings, such as extensions and alterations. For certain types of major improvement works in buildings with floor areas over 1,000 m^2 where the work has the potential to increase energy intensity (e.g. extending the building or installing air-conditioning), there is a requirement for additional improvements to energy efficiency, provided these are technically, functionally and economically feasible.

The standards for thermal elements and controlled fittings in buildings can be found at:

- *http://www.dfpni.gov.uk/tb_f1_mp_v6.pdf*
- *http://www.dfpni.gov.uk/tb_f2_v15-2.pdf*
- *http://www.dfpni.gov.uk/amd_4_amendments_booklet.pdf*
- *http://www.dfpni.gov.uk/amd5_website_version.pdf*

Proposals to upgrade the thermal requirements, fixed building services etc. to the equivalent of the England and Wales October 2010 standards are being drafted with the intention to come into operation in late 2011.

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[8] *http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL1B_2010.pdf*
It is important to read the accompanying notes regarding exceptions

8 > Conclusions and Future Planning

The implementation of EPBD and the realised benefits will be kept under review by the devolved administrations as part of their programmes for achieving national goals for energy efficiency and carbon emissions reduction. Changes will be made in the implementing instruments where these will improve effectiveness.

A review of the Display Energy Certificates (DEC) lodged on the central register has been conducted to inform the development of the DEC calculation methodology. It is expected that further reviews of the data held on the central register will help formulate future policy making.

The effectiveness of the processes transposing the Directive is being assessed for England & Wales. Early findings indicate that the processes implemented are delivering their intended objectives.

The individual reports of this publication
can be downloaded from

www.epbd-ca.eu

and also from

www.buildup.eu

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